SERVICE MANUAL

F4HGE615C F4HGE615C*V001, F4HGE615D F4HGE615D*V001, N67TEVP N67TEVP01.00, N67TEVP N67TEVP02.00, N67TEVP N67TEVP05.00 , N67TEVP N67TEVP06.00, N67TEVP N67TEVP09.00, N67TEVP N67TEVP10.00

P4D32N1009_EN 26/05/2023

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INTRODUCTION

(*) See content for specific models

Foreword - General information

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N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

This publication provides the data, characteristics, instructions, and procedures for the repairs to be carried out on the vehicle and its components and is in any case, intended for specialised and qualified personnel. Service network personnel FPT as well as all FPT authorised points of assistance are specifically qualified and equipped to perform the repair interventions that are indicated in this document. Before performing any intervention, check that the document relating to the vehicle model on which the intervention is being performed is available as well as all accident prevention devices, including but not limited to, goggles, helmet, gloves, shoes, work equipment, lifting and transport equipment, etc. Furthermore, make sure that the vehicle conditions are such that the interventions can be carried out safely. Making interventions strictly observing the indications given here, as well as using specific equipment indicated, assures a correct repair intervention, execution timing observance and operators' safety. Each repair intervention must be finalised to the recovery of functionality, efficiency and safety conditions that are provided by FPT. Each intervention on the vehicle which serves a modification, alteration or any other action which has not been authorised by FPT, involves the exclusion of any liability by FPT, and, in particular, where the vehicle is covered by a warranty, will cause the immediate invalidation of the warranty. FPT declines any liability for repair work. FPT is available to provide any information necessary for the implementation of the interventions and to provide instructions for any cases and situations not covered in this publication.

The data and information contained in this publication may not be updated as a result of amendments made by FPT, at any time, for technical or commercial reasons or for the need to adapt the vehicle to the legal requirements of different countries. In the event of discordance between the information in this manual and the actual vehicle, please contact the FPT network before performing any interventions.

Manuals for repairs are split into Sections, each one of which is marked by a numeral; the contents of these sections are indicated in the general table of contents.

Each section is generally dedicated to a main Unit (e.g.: engine, gearbox, electrical system, etc.).

Sections with mechanical contents include technical data, tightening torque collections, tool lists, connections - disconnections of units to/from the vehicle, overhauls at the bench and relative troubleshooting.

On the electric/electronic system section there are the descriptions of the electric network and vehicle electronic systems, wiring diagrams, electric characteristics of components, component codes and troubleshooting relative to the control units specific to the electric system.

The connectors are viewed from the cable side. Connector views contained in the manual for repairs are representative of cable side. For fuse identification and rating, comply with the indications present in the vehicle, since their identification or rating may be subject to changes.

The manual uses proper symbols in its descriptions; the purpose of these symbols is to classify information. In particular, a set of symbols has been defined to classify warnings, while another set has been specified for service operations.

International symbols

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

SYMBOLS - WARNINGS

	Danger for persons Failure to comply with these prescriptions can result in the risk of serious injury.
	Risk of serious damage to the vehicle Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle and can sometimes result in the guarantee being voided.
	General danger Includes the dangers of both above described signals.
	Environmental protection Indicates correct behaviour in order that vehicle use is as environmentally friendly as possible.
NOTE	Indicates an additional explanation for a piece of information.

Grouped Safety Message

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.

Risk of injury:
Use designated PPE (gloves, safety shoes, glasses, etc.)
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of injury:
Use suitable clothing, preferably tight-fitting; do not wear chains, rings, etc.
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of intoxication or poisoning
Make sure that no combustible vapours or gasses are present in the area in which the engine is to operate.
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of intoxication or poisoning
Do not breathe fumes from liquids, fluids and solvents. Do not breathe in engine exhaust fumes.
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of burns
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.
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of injury:
Avoid contact with liquids and fluids when the engine is hot: risk of burns.
Failure to comply with these prescriptions can result in the risk of serious injury

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Risk of injury:
All flammable fluids and liquids must be handled with care according to the product safety data sheets.
In case of accidental contact, consult product safety data sheets.
Store fluids and liquids in containers that comply with regulations.
Failure to comply with these prescriptions can result in the risk of serious injury

Risk of injury:
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.
Failure to comply with these prescriptions can result in the risk of serious injury

Fire risk
Pay close attention to glowing parts and guards with warning pictograms.
Failure to comply with these prescriptions can result in the risk of serious injury

Fire risk!
Fire hazard: pay careful attention to flammable liquids, dusts and vapours.
Failure to comply could result in death or serious injury.

Risk of explosion
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.
Failure to comply could result in death or serious injury.

Risk of injury:
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)
Failure to comply with these prescriptions can result in the risk of serious injury

Risk of injury:
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:
- disconnect the pipes with the engine running;
- reuse the disassembled pipes.

Failure to comply with these prescriptions can result in the risk of serious injury

Risk of injury:
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.
Failure to comply with these prescriptions can result in the risk of serious injury

Risk of injury when lifting and carrying heavy loads!
Use suitable lifting equipment and load securing devices.
Failure to comply could result in death or serious injury.

Risk of injury and accidents in the case of improper use!
Observe the maintenance instructions. If in any doubt, contact the Service Network before proceeding.
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
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.
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
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.
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
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.
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
Worn, damaged or consumable parts must be replaced with original FPT parts.
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
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.
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
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.
Failure to observe the indications provided could cause damage to the engine.

General prescriptions
Do not start the engine with quick charger power packs.
Disconnect the battery from the electrical system before charging.
Failure to observe the indications provided could cause damage to the engine.

General prescriptions
Do not utilize fast screw tightening tools.
Failure to observe the indications provided could cause damage to the engine.

General prescriptions
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.
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
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.
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
Replace the auxiliary belt if abrasions, cracks or tears, oil or fuel soiling can be seen
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
Make sure that the oil dipstick is fully inserted and that the oil filler cap is fully tightened in a clockwise direction.
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!
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.
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
If the installation of mechanical or electromechanical optionals is required, always refer to the "FPT Installation Guide" documents.
Failure to observe the indications provided could cause damage to the engine and its electrical architecture.

General risk, general prescriptions
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.
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
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.
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
Engines must only be used for the applications declared by the manufacturer
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

General prescriptions
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.
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.

General risk, general prescriptions
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.
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!
Observe the maintenance instructions. If in any doubt, contact the Service Network before proceeding.
Failure to comply could result in death or serious injury.

General prescriptions
Any intervention on the systems and any maintenance operations must be carried out by authorized technicians.
The equipment and tools used for fine-tuning, maintenance or repair work must be approved by the manufacturer.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

General prescriptions
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
Failure to observe this indication could lead to serious personal injury and damage to the engine.

General prescriptions
All flammable fluids and liquids must be handled with care according to the product safety data sheets.
Store fluids and liquids in containers that comply with regulations.
Failure to observe this indication could lead to serious personal injury and damage to the engine.

Fire risk
Do not smoke or light open flames near batteries, flammable liquids and fluids.
Failure to observe this indication could lead to serious personal injury and damage to the engine.

General prescriptions
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.
Failure to observe this indication could lead to serious personal injury and damage to the engine.

⚠	General prescriptions 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 Failure to observe this indication could lead to serious risks to health and damage to the engine - component.
⚠	General specifications (handling of components «> 25kg») 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General specifications (engine lifting accessories) 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 Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General prescriptions Use only the specific equipment listed in the repair manual and standard equipment that complies with regulations. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General specifications – engine stop 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General prescriptions 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	Risk of injury: Make sure that the guards of moving parts are correctly positioned and pay attention to the warning pictograms on the engine. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General prescriptions Pay close attention to the adhesive safety labels on the engine. Failure to observe this indication could lead to serious personal injury and damage to the engine.
⚠	General prescriptions 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.

⚠	General prescriptions Maintenance procedures requiring engine start-up, for example during the forced regeneration procedure of ATS systems. The guards present on moving parts must be properly secured; wear sound-proof headphones. Failure to observe this indication could lead to serious personal injury and damage to the engine.

⚠	General risk, general prescriptions Always keep the engine clean; remove oil, fuel and coolant stains. Failure to observe this indication could lead to serious personal injury and damage to the engine.

⚠	General risk, general prescriptions Do not leave external objects on the engine. 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 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.

⚠	Risk of injury: Always operate with a cold engine in order to prevent electromechanical engine components from activating suddenly due to the temperatures reached by the engine. Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

⚠	General risk, general prescriptions 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. Failure to observe this indication could lead to serious personal injury and damage to the engine.

Gen-set applications - Warnings - specific instructions

General prescriptions
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
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.

Disposal of liquids
Arrange containers to recover the coolant, diesel and oil from the power steering and fan control hydraulic systems.
Correct behavior will ensure that vehicle is used as environmentally friendly as possible

General risk, general prescriptions
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.
Correct behavior will ensure that vehicle is used as environmentally friendly as possible

General prescriptions
Rags soaked in flammable liquids must be replaced in containers which are suitable and comply with current legislation.
Correct behavior will ensure that vehicle is used as environmentally friendly as possible

Scheduled maintenance

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Introduction

To ensure best operating conditions, the checks, tests and adjustments which are to be carried out on the different parts at the established time are provided on the following pages.

The frequencies of the maintenance operations are indicative since the engine use and its characteristics are essential to evaluate replacements and checks.

Not only it is permitted, but it is recommended that the staff in charge of maintenance should also perform those checking and maintenance operations which are not included in the list below, but are recommended by good-practices and particular conditions of use of the engine.

Checks (during the period of use)	Frequency
ENGINE OIL FILTER CARTRIDGE - Visual inspection (54.30)	Daily
WATER COOLING - Check (54.32)	Daily
RADIATOR - Cleaning (50.60)	Daily
ENGINE - Visual inspection (54.01)	**50 h**
AIR CLEANER CARTRIDGE - Cleaning (50.51) (*)	Monthly **(1)**
WATER PUMP DRIVE BELT - Check (54.34)	**300 h**
ENGINE BREATHER - Check (54.04)	Every six months
EXHAUST PIPES - Check (50.71)	Every six months

Periodic maintenance	Frequency
FUEL PRE-FILTER - Drain fluid (77.31) (*)	**150 h (4)**
FUEL TANK - Drain fluid (50.72) (*)	**150 h (4)**
Visual check of the engine parts, the exhaust gas treatment system (ATS) and the accessory connections	**600 h**
AD-BLUE SYSTEM - Service instruction (50.74)	**600 h (**)**
ENGINE OIL FILTER CARTRIDGE - Change fluid (54.30)	**600 h (2) (3)**
ENGINE OIL FILTER CARTRIDGE - Replace (54.30)	**600 h (7)**
FILTER ASSEMBLY - Replace (54.20)	**600 h (4) (8)**
FUEL PRE-FILTER - Replace (77.31)	**600 h (4) (9)**
ENGINE SUPPLY AIR FILTER - Replace (50.51) (*)	**1200 h (5)**
ENGINE BREATHER - Replace (54.04)	**1200 h (3)**

Unscheduled maintenance	Frequency
TURBO CHARGER - Visual inspection (54.24)	**1200 h**
WATER PUMP DRIVE BELT - Replace (54.34)	**1200 h**
RADIATOR - Cleaning (50.60)	**1200 h**
ROCKER ARM ASSY - Adjust (54.12)	**2400 h**
RADIATOR - Change fluid (50.60)	**3000 h (7)**

(*)Component(s) not supplied by FPT

(**) To be carried out by the Service Network. Carry out the forced regeneration before changing the oil.

(1) In any case, every time the indicator is red.

(2) Must be performed annually, even if the required number of working hours has not been reached.

(3) For the oil specifications, refer to the table of the oils (**General specification ()**).

(4) Maximum period relating to the use of high-quality fuel (ASTM D975 or EN 590 specifications); this is reduced based on fuel contamination and alarm signals caused by the clogging of the filter and/or the presence of water in the pre-filter. The filter clogging signal indicates it needs to be replaced. If the signal that detects the presence of water in the pre-filter does not turn off after draining, the filter must be replaced.

(5) Interval to be halved for environmental conditions characterised by a high concentration of dust.

(6) Coolant compliant with specifications ASTM D 6210; mixed **50%** with water in the case of concentrated products.

(7) Only use oil filters with the following specifications:

- degree of filtering < **12 µm**
- filtering efficiency **99.5%** (ß > 200).

(8) Only use fuel filters with the following specifications:

- filtering efficiency: **95%** at **4 µm**; **99.5%** at **6 µm**
- maximum flow rate: **380 L/hour**
- operating temperature from **-30 °C** to **100 °C**
- breaking pressure: **1000 kPa**

(9) Only use fuel pre-filters with the following characteristics:

- degree of filtering: **25 µm** > **70%**, **40 µm** > **90%**
- nominal flow rate: **100 L/hour**
- operating temperature from **-25 °C** to **90 °C**
- burst pressure: > **3 bar**

NOTE: *Cold startability is strongly related to the quality of the diesel.*

NOTE: *The maintenance operations are valid only if the setter fully complies with all the installation prescriptions provided by FPT.*

Scheduled maintenance

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Introduction

To ensure best operating conditions, the checks, tests and adjustments which are to be carried out on the different parts at the established time are provided on the following pages.

The frequencies of the maintenance operations are indicative since the engine use and its characteristics are essential to evaluate replacements and checks.

Not only it is permitted, but it is recommended that the staff in charge of maintenance should also perform those checking and maintenance operations which are not included in the list below, but are recommended by good-practices and particular conditions of use of the engine.

Checks (during the period of use)	Frequency
ENGINE OIL FILTER CARTRIDGE - Visual inspection (54.30)	Daily
WATER COOLING - Check (54.32)	Daily
RADIATOR - Cleaning (50.60)	Daily
ENGINE - Visual inspection (54.01)	**50 h**
AIR CLEANER CARTRIDGE - Cleaning (50.51)	Monthly **(1)**
WATER PUMP DRIVE BELT - Check (54.34)	**300 h**
BATTERY - Visual inspection (76.20)	Every six months
BATTERY - Check (76.20)	Every six months
ENGINE BREATHER - Check (54.04)	Every six months
EXHAUST PIPES - Check (50.71)	Every six months

Periodic maintenance	Frequency
FUEL PRE-FILTER - Drain fluid (77.31) (*)	**150 h (4)**
FUEL TANK - Drain fluid (50.72) (*)	**150 h (4)**
Visual check of the engine parts, the exhaust gas treatment system (ATS) and the accessory connections	**600 h**
AD-BLUE SYSTEM - Service instruction (50.74)	**600 h (**)**
ENGINE OIL FILTER CARTRIDGE - Change fluid (54.30)	**600 h (2) (3)**
ENGINE OIL FILTER CARTRIDGE - Replace (54.30)	**600 h (7)**
FILTER ASSEMBLY - Replace (54.20)	**600 h (4) (8)**
FUEL PRE-FILTER - Replace (77.31)	**600 h (4) (9)**
ENGINE SUPPLY AIR FILTER - Replace (50.51)	**1200 h (5)**
ENGINE BREATHER - Replace (54.04)	**1200 h (3)**

Unscheduled maintenance	Frequency
TURBO CHARGER - Visual inspection (54.24)	**1200 h**
WATER PUMP DRIVE BELT - Replace (54.34)	**1200 h**
RADIATOR - Cleaning (50.60)	**1200 h**
ROCKER ARM ASSY - Adjust (54.12)	**2400 h**
RADIATOR - Change fluid (50.60)	**3000 h (7)**

(*)Component(s) not supplied by FPT

(**) To be carried out by the Service Network. Carry out the forced regeneration before changing the oil.

(1) In any case, every time the indicator is red.

(2) Must be performed annually, even if the required number of working hours has not been reached.

(3) For the oil specifications, refer to the table of the oils (**General specification ()**).

(4) Maximum period relating to the use of high-quality fuel (ASTM D975 or EN 590 specifications); this is reduced based on fuel contamination and alarm signals caused by the clogging of the filter and/or the presence of water in the pre-filter. The filter clogging signal indicates it needs to be replaced. If the signal that detects the presence of water in the pre-filter does not turn off after draining, the filter must be replaced.

(5) Interval to be halved for environmental conditions characterised by a high concentration of dust.

(6) Coolant compliant with specifications ASTM D 6210; mixed **50%** with water in the case of concentrated products.

(7) Only use oil filters with the following specifications:

- degree of filtering < **12 µm**
- filtering efficiency **99.5%** (ß > 200).

(8) Only use fuel filters with the following specifications:

- filtering efficiency: **95%** at **4 µm**; **99.5%** at **6 µm**
- maximum flow rate: **380 L/hour**
- operating temperature from **-30 °C** to **100 °C**
- breaking pressure: **1000 kPa**

(9) Only use fuel pre-filters with the following characteristics:

- degree of filtering: **25 µm** > **70%**, **40 µm** > **90%**
- nominal flow rate: **100 L/hour**
- operating temperature from **-25 °C** to **90 °C**
- burst pressure: > **3 bar**

NOTE: *Cold startability is strongly related to the quality of the diesel.*

NOTE: *The maintenance operations are valid only if the setter fully complies with all the installation prescriptions provided by FPT.*

Scheduled maintenance ATS system

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Below are indicated the checks, tests and adjustments which are to be carried out on the components of the ATS system at the established time interval.

The frequency of the operations is just an indication since the use of the engine is the main characteristic to determine and evaluate replacement parts.

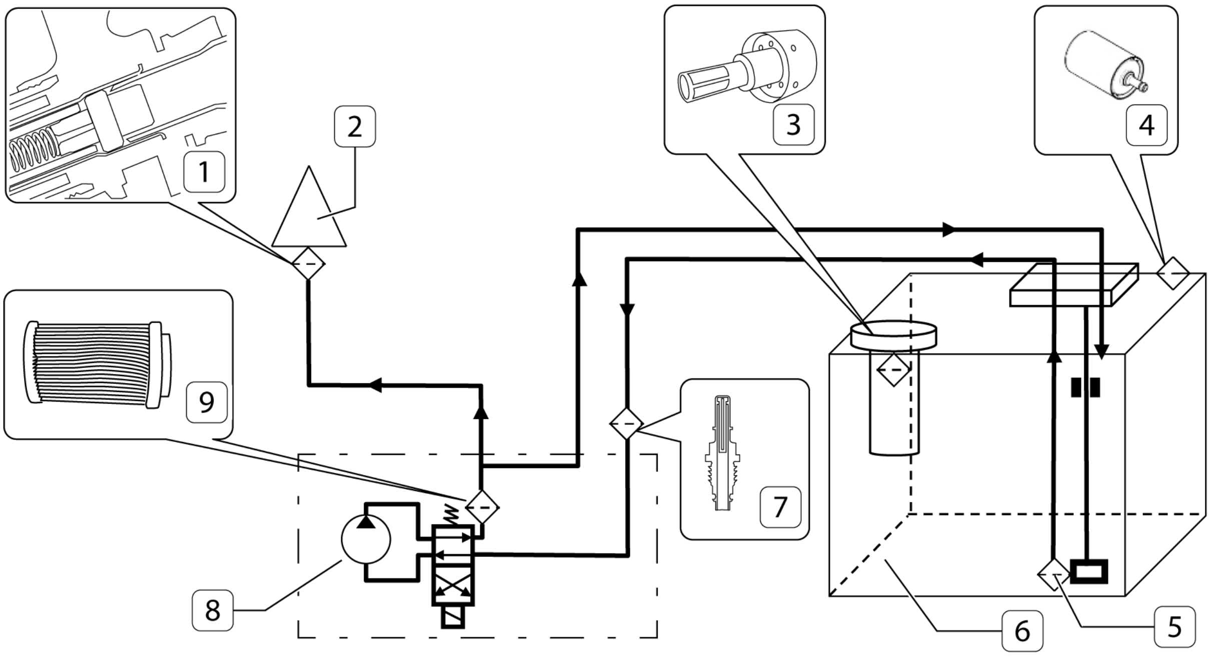
Not only it is permitted, but it is also recommended that the staff in charge of maintenance also perform those checking and maintenance operations which may not be included in the list below but which are recommended by good-practices and particular conditions of use of the engine.

In the case of evident system malfunction, immediately intervene in order to find the cause.

We wish to remind operators that maintenance operations, even the most simple, must be performed in compliance with the accident prevention standards for the safety of maintenance personnel.

Item	Function	Maintenance
Tank filler filter (**100 μm***)	Protects the tank during refilling phases	No maintenance anticipated (clean if necessary)
Tank ventilation filter (**5/10 μm** *)	Protects the tank, allows ventilation	No maintenance anticipated (clean if necessary)
MFU filter in tank (**40 μm***)	Protects the supply module from dirt coming from the tank	No regular service scheduled (replace if necessary)
Supply module intake filter (**100 μm**)	Protects the Supply Module during first start-up	No maintenance anticipated (clean if necessary)
Supply module main filter	Protects the supply module	Change every **3000 h** or every 2 years (whichever occurs first)
Supply module backflow filter (**100 μm**)	Protects from impurities introduced while changing the main filter	No maintenance anticipated (clean if necessary)
Dosing module filter (**36 μm**)	Protects the Dosing Module during first start-up	Maintenance not possible

ATS System filter location



268020 1

1. Dosing valve filter (**36 µm**)
2. Dosing module
3. Tank filler filter (**100 µm***)
4. Tank ventilation filter (**5 – 10 µm** *)
5. MFU filter in tank (**40 µm***)
6. AdBlue Tank
7. Supply module intake filter (**100 µm**)
8. Supply Module
9. Supply module main filter

Conversion factors

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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

Power

1 kW = 1,36 CV

1 kW = 1,34 Hp

1 CV = 0,736 kW

1 CV = 0,986 Hp

1 Hp = 0,746 kW

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

1 bar = 100 kPa

Unless there is a specific need for accuracy:

- The unit Nm is converted into kgm for simplicity according to a ratio of 10:1
  1 kgm = 10 N·m
- The unit bar is converted into kg/cm2 for simplicity according to a ratio of 1:1
  1 Kg/cm² = 1 bar

Temperature

0 °C = 32 °F

1 °C = (1x1,8+32) °F

Main characteristics of oil

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Oil Specifications (*)	International specifications
359	**10W-40 API CJ-4 / API CK-4 ACEA E9 (FPI9.LUBR001-TLS CK4) (STD.) 10W-40 API CK-4 /ACEA E9 (FPI9.LUBR001-TLS CK4) (STD.) 0W-40 API CK-4 (FPI9.LUBR001-TLS CC) (COLD CLIM. PREM.)**

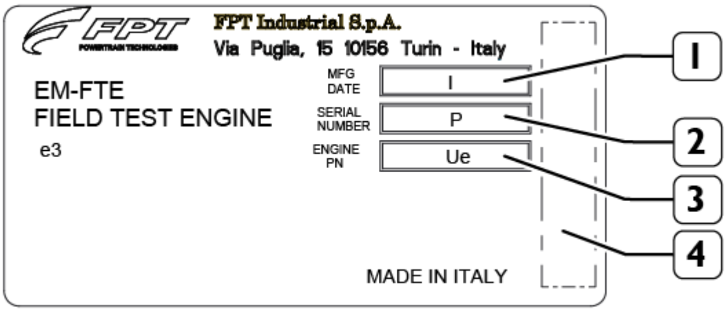
(*) For the oil specifications, please refer to https://www.fptindustrial.com/global/en/service/fluids/oils-and-coolants

288935 1

Product identification

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Engine identification label



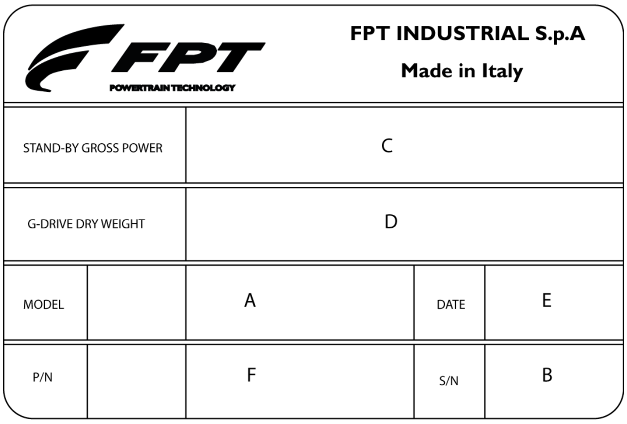
260743 1

1. Month and year of manufacture
2. Engine serial No.
3. Engine part number
4. Area reserved for the bar code

Product identification

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

IDENTIFICATION NAMEPLATE



258628 1

A. Model
B. s/n
C. Gross stand-by power (**1500 – 1800 RPM**)
D. G-drive weight
E. Data
F. P/N

Product identification - correspondence between technical codes and commercial codes

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Technical codes	Commercial Codes
F4HGE615C*V001	N67 TE VP
F4HGE615D*V001	

Product identification - Technical coding

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The technical code is assigned during production; it is used to identify the main characteristics, characterise the application and the corresponding level of power output.

F4HGE615C*V001 / F4HGE615D*V001

- **(F4)** HGE615C*V001 - ENGINE FAMILY IDENTIFICATION
- F4 **(H)** GE615C*V001 - EVOLUTION OF THE NON-STRUCTURAL OFF-ROAD PROJECT
- F4H **(G)** E615C*V001 - ENGINE DESIGNED FOR TIER 4 FULL / STAGE V
- F4HG **(E)** 615C*V001 - CYLINDER CONFIGURATION (E = 4-stroke vertical with after-treatment device)
- F4HGE **(6)** 135C*V001 - NUMBER OF CYLINDERS
- F4HGE6 **(1)** 5C*V001 - MAIN ENGINE CHARACTERISTICS (1 = Supercharged diesel with intercooled direct injection)
- F4HGE61 **(5)** C*V001 - APPLICATION (5 = Genset)
- F4HGE615 **(C)** *V001 - TORQUE LEVEL OR ENGINE POWER
- F4HGE615C* **(V)** 001 - EMISSION LEVEL (V=TIER 4 FULL / STAGE V)
- F4HGE615C*V **(003)** - VARIANTS TO THE BASIC ENGINE WITHIN BILL OF MATERIALS

Product identification - Commercial coding

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The purpose of the commercial name is to make the information regarding engine characteristics easy to understand, by joining engines from different families, origins and applications for which they are intended. The commercial code cannot be used for technical purposes in order to completely identify the parts that make up the engine, referring to the "serial number" otherwise indicated as "ENGINE S/N", as the identification.

N67 TE VP

- **(N)** 67 TE VP - ENGINE FAMILY IDENTIFICATION (N = NEF)
- N **(67)** TE VP - DISPLACEMENT – 67 = 6700 c.c. NOMINAL
- N67 **(T)** E V P - SUPERCHARGED WITH AIR/AIR INTERCOOLER
- N67 T **(E)** V P - ELECTRONIC WITH ECU
- N67 TE **(V)** P- EMISSION LEVEL: V = TIER 4 FULL / STAGE V
- N67 TE V **(P)** - ENGINE MANAGEMENT CONTROL UNIT: P = MD1CE101

Contents

ENGINE - 54

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

[54.34] FAN AND COOLING CONTROL 54.12

SERVICE

WATER PUMP DRIVE BELT

FAN

[54.37] EXHAUST BRAKE + CONTROLS 54.13

FUNCTIONAL DATA

BUTTERFLY VALVE

(*) See content for specific models

540110 ENGINE - Torque

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Type	Quantity	Step	Value
Cylinder liner lubrication nozzles		6 screws M8 x 1.25 x 20		**15 +/- 3 N·m**
Crankshaft caps		12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
			Phase 2 Angle tightening	**90°**
Connecting rod caps		12 screws M10x1.25 x52	Phase 1 Tighten	**50 +/- 2 N·m**
			Phase 2 Angle tightening	**60°**
Camshaft longitudinal retaining plate		2 screws M8 x 1.25		**24 +/- 4 N·m**
Rear gear case			1 screw M12 x 1.75	**77 +/- 12 N·m**
			4 screwsM8 x 1.25	**24 +/- 4 N·m**
			5 screws M10 x 1.5	**47 +/- 5 N·m**
Camshaft gear		6 screws M8 x 1.25		**36 +/- 2 N·m**
Engine flywheel housing			8 screws M12 x 1.75	**85 +/- 10 N·m**
			12 screws M10 x 1.5	**49 +/- 5 N·m**
			2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**
Engine flywheel		8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
			Phase 2 Angle tightening	**60°**
Oil pump		4 screwsM8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
			Phase 2 Tighten	**24 +/- 4 N·m**
Front gear case			7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
			6 screws M8 x 1.25	**24 +/- 4 N·m**
Timing gearbox			5 screws M10 x 1.5	**47 +/- 5 N·m**
			4 screwsM8 x 1.25	**24 +/- 4 N·m**
			1 screw M12 x 1.75	**77 +/- 12 N·m**
Crankcase stiffening plate		4 screwsM10x1.5x25		**43 +/- 5 N·m**
Oil suction strainer pipe		2 screws M8 x 20		**25 +/- 2,5 N·m**
Suction strainer retainer			2 screws M8 X 20	**25 N·m**
			2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe bracket		1 screw M10 x 1.5 x 20		**45 N·m**
Oil sump			14 screws M8 x 1.25 x 40	**27 – 30 N·m**
			4 screwsM8 x 1.25 x 45	**27 – 30 N·m**
Oil sump plug		1 plug M22 x 1.5		**40 +/- 10 N·m**
Oil filter bracket and heat exchanger		15 screws M8 x 1.25 x 35		**26 +/- 4 N·m**
Oil filter		1 adapter M27 x 2		**18 +/- 2 N·m**
Oil filler pipe			2 screws M12x1.75x25	**80 +/- 4 N·m**
Brackets for lifting engine			4 screwsM8 x 1.25 x 25	**36 +/- 5 N·m**

Description	Type	Quantity	Step	Value
			2 screws M12x1.75x25	**77 +/- 12 N·m**
Cylinder head		12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
			Phase 3 Angle tightening	**90°**
Cylinder head		14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
			Phase 3 Angle tightening	**90°**
Electro-injectors		12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
			Phase 2 Angle tightening	**25°**
			Phase 3 Angle tightening	**25°**
			Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head		6 nuts M22x1.5x9.5		**55 +/- 5 N·m**
Rocker assembly bracket			5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Valve clearance adjustment		12 nuts M8 x 1.25		**24 +/- 4 N·m**
Injector wiring mount		7 screws M8 x 1.25		**24 +/- 4 N·m**
Wiring on each electro-injector		12 nuts M4		**1,5 +/- 0,25 N·m**
Engine cable connector on injector wiring mount		3 screws M6 x 1 x 16		**5 +/- 1 N·m**
Tappet cover			6 nuts M8 x 1.25	**20 +/- 2 N·m**
Intake manifold			7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
			3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Pre-heating grid-heater resistor		6 screws M6 x 1 x 16		**10 +/- 2 N·m**
Common rail		4 screwsM8 x1.25x125		**36 +/- 5 N·m**
Overpressure valve DBV4		M20 x 1.5		**100 +/- 5 N·m**
High-pressure fuel delivery pipe from rail to injector		12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
			Phase 2 Angle tightening	**55°**
Power take-off cover		2 screws M12x1.75x25		**80 +/- 5 N·m**
High-pressure pump gear		1 nut M8 x 1.5		**105 +/- 5 N·m**
High-pressure pump			3 nuts M8x8	**24 +/- 4 N·m**
			3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**
Fuel pipe from high pressure pump to Common Rail		2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
			Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail		1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**
Fuel suction pump crankcase cover		2 screws M8 x 1.25 x 20		**24 +/- 4 N·m**
Blow-by breather plate		1 screw M6 x 1		**10 +/- 2 N·m**
Blow-by breather pipe		2 fittings M12 x 1.5		**20 +/- 4 N·m**

Description	Type	Quantity	Step	Value
Blow-by filter		3 screws M6 x 1		**10 +/- 2 N·m**
Exhaust manifold		12 screws M10x1.5x65		**55 +/- 3 N·m**
Turbo charger			4 nuts M10 x 1.5	**45 +/- 2 N·m**
			4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger air outlet to intercooler		1 screw M6 x 1 x 55		**10 +/- 25 N·m**
Turbocharger exhaust outlet to throttle valve		1 screw M6 x 1 x 50		**6 +/- 1 N·m**
Motorized throttle valve water pipes			2 fittings M10 x 1	**20 N·m**
			3 nuts M12 x 1.5	**45 N·m**
			2 screws M8 x 20	**23 +/- 2,3 N·m**
			1 fitting M10 x 1	**25 N·m**
			1 screw M8 x 16	**23 +/- 2,3 N·m**
Bracket fixing motorized throttle valve to exhaust manifold		4 screwsM8 x 1.25 x 25		**25 N·m**
Turbocharger lubrication oil pipes			2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
			2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
			2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**
Engine coolant inlet			2 screws M10x1.5x130	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Engine coolant outlet / thermostat cover		3 screws M6 x 1 x 12		**13,5 +/- 1,5 N·m**
Water pump		2 screws M8 x 1.25 x 35		**24 +/- 4 N·m**
Crankshaft pulley with damper pulley		6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
Fan pulley mount		4 screwsM8 x 1.25 x 45		**24 +/- 4 N·m**
Fan control pulley		4 screwsM10 x 1.25		**68 +/- 7 N·m**
Idler pulley		1 screw M10 x 1.5		**43 +/- 6 N·m**
Automatic belt tensioner support		2 screws M8 x 1.25 x 30		**24 +/- 4 N·m**
Automatic belt tensioner		1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Fuel filter bracket		2 screws M1 2x1.75x30		**80 +/- 8 N·m**
Fuel filter		1 adapter M20 x 1.5		**20 +/- 2 N·m**
Engine Controller Module			3 screws M8 x 1.25 x 45	**14 N·m**
Camshaft timing sensor		1 nut with stud M6 x 1		**12 N·m**
Crankshaft RPM sensor		1 screw M6 x 1 x 20		**10 +/- 2 N·m**
Coolant temperature sensor		M14 x 1.5 x 12		**24 +/- 4 N·m**
Oil temperature and pressure sensor		2 screws M6 x 1 x 20		**10 +/- 2 N·m**
Rail pressure sensor		M18 x 1.5		**70 +/- 5 N·m**
Fuel temperature sensor		M14 x 1.5		**24 +/- 4 N·m**
Boost pressure and air temperature sensor		1 screw M6 x 1 x 20		**10 +/- 2 N·m**
Oil level sensor	**M12 x 1.5**			**10 +/- 2 N·m**
Oil level dipstick retainer	**M8 x 1.25**			**24 +/- 4 N·m**
Alternator			1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

Description	Type	Quantity	Step	Value
Thermostat		3 screws M6 x 1 x 12		**13,5 +/- 1,5 N·m**
Electric starter motor			3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
			3 nuts M10 x 1.5	**43 +/- 6 N·m**
AdBlue filter plug				**20 +/- 5 N·m**
A/C compressor			1 screw M12 x 1.75 x 130	**75 +/- 5 N·m**
			1 screw M8 x 1.25 x 20	**24 +/- 2 N·m**
A/C compressor support			3 screws M10 x 1.5 x 50	**45 +/- 5 N·m**
			1 screw M6 x 1 x 40	**9 +/- 1 N·m**
Oil filler		2 screws M12 x 1.75 x 25		**69 +/- 5 N·m**
Engine air intake		4 screwsM8 x 1.25 x 30		**23 +/- 2 N·m**

540110 ENGINE - Torque

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Type	Quantity	Step	Value
Cylinder liner lubrication nozzles		6 screws M8 x 1.25 x 20		**15 +/- 3 N·m**
Crankshaft caps		12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
			Phase 2 Angle tightening	**90°**
Connecting rod caps		12 screws M10x1.25 x52	Phase 1 Tighten	**50 +/- 2 N·m**
			Phase 2 Angle tightening	**60°**
Camshaft longitudinal retaining plate		2 screws M8 x 1.25		**24 +/- 4 N·m**
Rear gear case			1 screw M12 x 1.75	**77 +/- 12 N·m**
			4 screws M8 x 1.25	**24 +/- 4 N·m**
			5 screws M10 x 1.5	**47 +/- 5 N·m**
Camshaft gear		6 screws M8 x 1.25		**36 +/- 2 N·m**
Flywheel housing			8 screws M12 x 1.75	**85 +/- 10 N·m**
			12 screws M10 x 1.5	**49 +/- 5 N·m**
			2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**
Engine flywheel		8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
			Phase 2 Angle tightening	**60°**
Oil pump		4 screws M8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
			Phase 2 Tighten	**24 +/- 4 N·m**
Front gear case			7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
			6 screws M8 x 1.25	**24 +/- 4 N·m**
Timing gears case			5 screws M10 x 1.5	**47 +/- 5 N·m**
			4 screws M8 x 1.25	**24 +/- 4 N·m**
			1 screw M12 x 1.75	**77 +/- 12 N·m**
Crankcase stiffening plate		4 screws M10x1.5x25		**43 +/- 5 N·m**

Description	Type	Quantity	Step	Value
Oil suction strainer pipe		2 screws M8 x 20		**25 +/- 2,5 N·m**
Suction strainer retainer			2 screws M8 X 20	**25 N·m**
			2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe bracket		1 screw M10 x 1.5 x 20		**45 N·m**
Oil sump			14 screws M8 x 1.25 x 40	**27 – 30 N·m**
			4 screws M8 x 1.25 x 45	**27 – 30 N·m**
Oil sump plug		1 plug M22 x 1.5		**40 +/- 10 N·m**
Oil filter bracket and heat exchanger		15 screws M8 x 1.25 x 35		**26 +/- 4 N·m**
Oil filter		1 adapter M27 x 2		**18 +/- 2 N·m**
Oil filler pipe			2 screws M12x1.75x25	**80 +/- 4 N·m**
Brackets for lifting engine			4 screws M8 x 1.25 x 25	**36 +/- 5 N·m**
			2 screws M12x1.75x25	**77 +/- 12 N·m**
Cylinder head		12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
			Step 3 Angle tightening	**90°**
Cylinder head		14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
			Step 3 Angle tightening	**90°**
Electro-injectors		12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
			Phase 2 Angle tightening	**25°**
			Step 3 Angle tightening	**25°**
			Step 4 Angle tightening	**25°**
Fuel manifolds on cylinder head		6 nuts M22x1.5x9.5		**55 +/- 5 N·m**
Rocker assembly bracket			5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Valve clearance adjustment		12 nuts M8 x 1.25		**24 +/- 4 N·m**
Injector wiring support		7 screws M8 x 1.25		**24 +/- 4 N·m**
Wiring on each electro-injector		12 nuts M4		**1,5 +/- 0,25 N·m**
Engine cable connector on electro-injectors wiring mount		3 screws M6 x 1 x 16		**5 +/- 1 N·m**
Tappet cover			6 nuts M8 x 1.25	**20 +/- 2 N·m**
Intake manifold			7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
			3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Pre-heating grid-heater resistor		6 screws M6 x 1 x 16		**10 +/- 2 N·m**
Common rail		4 screws M8 x1.25x125		**36 +/- 5 N·m**
Overpressure valve DBV4		M20 x 1.5		**100 +/- 5 N·m**
High-pressure fuel delivery pipe from rail to injector		12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**

Description	Type	Quantity	Step	Value
			Phase 2 Angle tightening	**55°**
Power take-off cover		2 screws M12x1.75x25		**80 +/- 5 N·m**
High-pressure pump gear		1 nut M8 x 1.5		**105 +/- 5 N·m**
High-pressure pump			3 nuts M8x8	**24 +/- 4 N·m**
			3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**
Fuel pipe from high pressure pump to Common Rail		2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
			Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail		1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**
Fuel suction pump crankcase cover		2 screws M8 x 1.25 x 20		**24 +/- 4 N·m**
Blow-by breather plate		1 screw M6 x 1		**10 +/- 2 N·m**
Blow-by breather pipe		2 fittings M12 x 1.5		**20 +/- 4 N·m**
Blow-by filter		3 screws M6 x 1		**10 +/- 2 N·m**
Exhaust manifold		12 screws M10x1.5x65		**55 +/- 3 N·m**
Turbocharger			4 nuts M10 x 1.5	**45 +/- 2 N·m**
			4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger air outlet to intercooler		1 screw M6 x 1 x 55		**10 +/- 25 N·m**
Turbocharger exhaust outlet to throttle valve		1 screw M6 x 1 x 50		**6 +/- 1 N·m**
Motorized throttle valve water pipes			2 fittings M10 x 1	**20 N·m**
			3 nuts M12 x 1.5	**45 N·m**
			2 screws M8 x 20	**23 +/- 2,3 N·m**
			1 fitting M10 x 1	**25 N·m**
			1 screw M8 x 16	**23 +/- 2,3 N·m**
Bracket fixing motorized throttle valve to exhaust manifold		4 screws M8 x 1.25 x 25		**25 N·m**
Turbocharger lubrication oil pipes			2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
			2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
			2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**
Engine coolant inlet			2 screws M10x1.5x130	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
			2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Engine coolant outlet / thermostat cover		3 screws M6 x 1 x 12		**13,5 +/- 1,5 N·m**
Water pump		2 screws M8 x 1.25 x 35		**24 +/- 4 N·m**
Crankshaft pulley with damper pulley		6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
			Phase 2 Angle tightening	**90°**
Fan pulley mount		4 screws M8 x 1.25 x 45		**24 +/- 4 N·m**
Fan control pulley		4 screws M10 x 1.25		**68 +/- 7 N·m**
Idler pulley		1 screw M10 x 1.5		**43 +/- 6 N·m**
Automatic belt tensioner support		2 screws M8 x 1.25 x 30		**24 +/- 4 N·m**
Automatic belt tensioner		1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Fuel filter bracket		2 screws M12x1.75x30		**80 +/- 8 N·m**

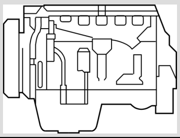
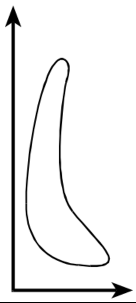
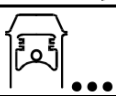
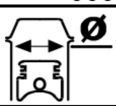
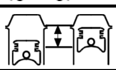
Description	Type	Quantity	Step	Value
Fuel filter		1 adapter M20 x 1.5		**20 +/- 2 N·m**
Engine controller			3 screws M8 x 1.25 x 45	**14 N·m**
Camshaft timing sensor		1 nut with stud M6 x 1		**12 N·m**
Engine crankshaft rpm sensor		1 screw M6 x 1 x 20		**10 +/- 2 N·m**
Coolant temperature sensor		M14 x 1.5 x 12		**24 +/- 4 N·m**
Oil temperature and pressure sensor		2 screws M6 x 1 x 20		**10 +/- 2 N·m**
Rail pressure sensor		M18 x 1.5		**70 +/- 5 N·m**
Fuel temperature sensor		M14 x 1.5		**24 +/- 4 N·m**
Air temperature and boost pressure sensor		1 screw M6 x 1 x 20		**10 +/- 2 N·m**
Oil level sensor	**M12 x 1.5**			**10 +/- 2 N·m**
Oil level dipstick retainer	**M8 x 1.25**			**24 +/- 4 N·m**
Alternator			1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
			1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**
Thermostat		3 screws M6 x 1 x 12		**13,5 +/- 1,5 N·m**
Electric starter motor			3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
			3 nuts M10 x 1.5	**43 +/- 6 N·m**
AdBlue filter plug				**20 +/- 5 N·m**
NOx sensor			1 fitting M20x1.5	**50 +/- 10 N·m**
Exhaust gas temperature sensor			1 fitting M10	**45 +/- 4.5 N·m**
Bracket for pressure inlet hose clip		4 screws M6 x 1 x 16		**13.5 +/- 1.5 N·m**
Differential pressure sensor		1 screw M6 x 1 x 16		**9 +/- 1 N·m**
Upper Diesel Oxidation Catalyst bracket (DOC)		4 screws M6 x 1 x 12		**13.5 +/- 1.5 N·m**
AdBlue dosing module		3 screws M6x1x35		**13.5 +/- 1.5 N·m**
Exhaust gas pipe hose clip between DOC and SCRoF		4 screws M8 x 1.25 x 35		**22.5 +/- 2.5 N·m**
Exhaust gas pipe bracket between DOC and SCRoF		4 screws M8 x 1.25 x 16		**22.5 +/- 2.5 N·m**
Diesel oxidation catalyst bracket (DOC)		4 screws M10 x 1.5 x 60		**66.5 +/- 6.5 N·m**
Diesel oxidation catalyst (DOC)		4 screws M10x1.5x25		**66.5 +/- 6.5 N·m**
Bracket for exhaust gas outlet pipe from SCRoF to the ATS frame		2 screws M12x1.75x30		**80 +/- 8 N·m**
Bracket for exhaust gas outlet pipe from SCRoF		2 screws M12x1.75x25		**80 +/- 8 N·m**
Selective catalytic reduction (SCRoF)		4 nuts M12 x 1.75		**80 +/- 8 N·m**
NOx sensor control unit			2 screws M8 x 1.25 x 55	**22.5 +/- 2.5 N·m**
			2 screws M8 x 1.25 x 20	**22.5 +/- 2.5 N·m**
Air pipe collar		1 screw		**6,05 +/- 0,45 N·m**
Breather pipe collar on radiator		1 screw		**2,25 +/- 0,25 N·m**
Engine water inlet pipe collar		1 screw M8 x 1.25 x 25		**24,5 +/- 2,5 N·m**
Air pipe on intake manifold		4 screws M8 x 1.25 x 25		**24,5 +/- 2,5 N·m**
Protective grille		12 screws M8 x 1.25 x 20		**23 +/- 2 N·m**
Radiator mount		4 nuts M14 x 2		**114,5 +/- 11,5 N·m**
Fan		6 screws M10x1.5x130		**24 +/- 4 N·m**
Air filter bracket		2 screws M6 x 1 x 14		**0 +/- 0 N·m**

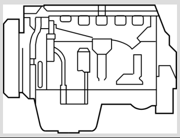
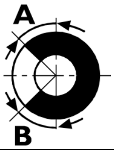
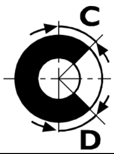
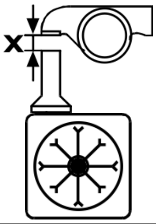
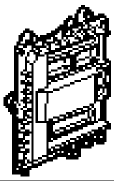
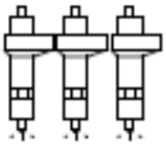
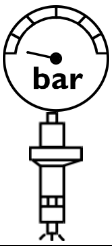
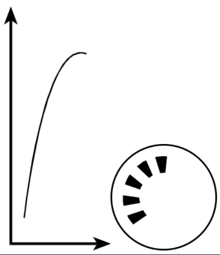
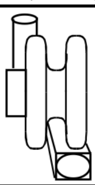
Description	Type	Quantity	Step	Value
Bracket supporting air filter on flywheel housing			1 screw M10 x 1.5 x 20	**0 +/- 0 N·m**
			2 screws M12x1.75x25	**0 +/- 0 N·m**
Interface box			8 nuts M6 x 1	**9 +/- 1 N·m**
			2 screws M12x1.75x25	**80 +/- 8 N·m**
Throttle valve water pipe			1 connection M10 x 1	**20 +/- 2 N·m**
			1 fitting M12 x 1.5	**45 +/- 5 N·m**
Throttle valve supporting bracket		4 screws M8 x 1.25 x 25		**25 +/- 3 N·m**
Pipe between blow-by and air filter		1 screw M20 x 35		**3,25 +/- 0,25 N·m**
Screw for belt tensioner 4898548		1 x M10 x 1.5		**43 +/- 6 N·m**
Cylinder head fastening screws			Phase 1 M12 x 1.75 x 130	**35 +/- 5 N·m**
			Phase 2 M12 x 1.75 x 130	**90°**
			Phase 3 M12 x 1.75 x 130	**90°**
			Phase 1 M12 x 1.75 x 150	**55 +/- 5 N·m**
			Phase 2 M12 x 1.75 x 150	**90°**
			Phase 3 M12 x 1.75 x 150	**90°**

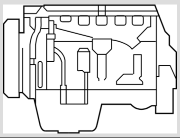
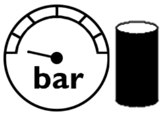
540110 ENGINE - Technical Data

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

GENERAL CHARACTERISTICS

	**Type**	**F4HGE615**	
		C*V001	**V*V001**
	Cycle	Four-stroke diesel engine	
	Fuel system	Supercharged with air/air aftercooler	
	Injection	Direct	
	Number of cylinders	6, in line	
	Bore	**104 mm**	
	Stroke	**132 mm**	
	Total displacement	**6728 cm³**	

	Type	F4HGE615	
		C*V001	**V*V001**
	DISTRIBUTION		
	start before TDC		A = **18,5°**
	end after BDC		B = **29,5°**
	start before BDC		D= **67°**
	end after TDC		C = **35°**
	X		**0,20 – 0,30 mm**
			**0,46 – 0,56 mm**
	FUEL SYSTEM		
	Injection type	High-pressure pump, common rail, MD1CE101 Control unit	
	Pump type	BOSCH CP3.3	
	Injector	CRIN2	
	Injection sequence	1 - 5 - 3 - 6 - 2 - 4	
	Injection pressure	**250 – 1600 bar**	
ϱ	compression ratio	17 : 1	
	Performance [gross] **(*)**	**149 kWm** at **1500 RPM** **167 kWm** at **1800 RPM**	**196 kWm** at **1500 RPM** **223 kWm** at **1800 RPM**
	TURBOCHARGING	Turbocharged - with Intercooler	
	Turbocharger type	BORG WARNER TIER4B WG	

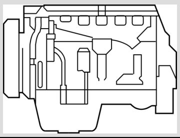
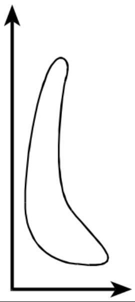
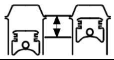
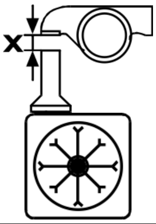
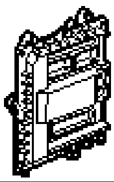
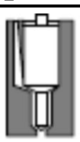
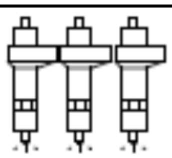
	Type	F4HGE615	
		C*V001	**V*V001**
	LUBRICATION Oil pressure (engine hot) - at idle speed - at max speed	Forced by gear pump, pressure relief valve, oil filter **0,6 bar** **3,5 bar**	
	COOLING Check water pump - opening start - max. opening	Liquid Belt driven **79 °C ± 2 °C** **96 °C**	
	REFILLING		
	Cooling circuit **(1)**	**11 L**	
	Lubricating system **(2)** Total capacity API CJ-4; ACEA E6/E9; SAE 10W-40 **(3)** Periodic replacement: oil sump at min level oil sump at max level	**18 L** (**16,2 kg**) **7 L** (**6.3 kg**) **14 L** (**12,6 kg**)	
	Fuel tank **(4)**	—	
	Urea tank **(5)**	Optional	
	Electric system	**24 V**	
	Accumulator/s - capacity - discharge current	**1300 A·h** or above **500 A**	
	Electric starter motor - Maximum power rating	**4 kW**	
	Alternator Capacity	**70 A**	

(*) Power at the flywheel in compliance with directive 97/68 CE (without fan), after **50 h** of operation, tolerance ± **3%**, fuel EN590;
Test in compliance with standard ISO 3046/1, turbocharger inlet air temperature **25 °C**, atmospheric pressure **100 kPa**, humidity **30%** - Also in compliance with specifications DIN 6271, BS 5514, SAE J1349.
All the data are based on engine operation with fuel system, water pump, lubricant oil pump and intake and exhaust restriction within or below, the limits indicated in the "data sheet".
Additional loads estimated at **20 N·m** from idle speed to nominal speed.
(1) The quantities refer to the standard engine configuration. Use coolant with ORGANIC ACID TECHNOLOGY (Ethylene glycol/Propylene glycol) compliant with standard ASTM D-6210.
(2) Use SEMI-SYNTHETIC lubricants that comply with the international standards: API CJ-4; ACEA E6/E9; SAE 10W-40. SYNTHETIC lubricants that comply with SAE 5W-30 must be used in cold environmental conditions. FPT recommends using original PETRONAS products.
(3) The amounts indicated refer only to the first fill of the engine, oil sump and filter.
(4) Use STANDARD fuel in compliance with standards ASTM D975 or EN 590. The indications regarding the capacity of the fuel tank are the responsibility of the vehicle/equipment manufacturer as it is subject to variations depending on the different vehicle/equipment configurations.
(5) Only use AdBlue® / DEF (mixed **32.5%** with water) in compliance with specification ISO 22241.

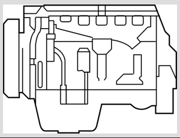
540110 ENGINE - Technical Data

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

GENERAL CHARACTERISTICS

	**Type**	**N67 TE**	
		VP02.00 – VP06.00	**VP01.00 – VP05.00**
	Cycle	Four-stroke diesel engine	
	Fuel system	Supercharged with air/air aftercooler	
	Injection	Direct	
	Number of cylinders	6, in line	
	Bore	**104 mm**	
	Stroke	**132 mm**	
	Total displacement	**6728 cm³**	
	TIMING GEAR		
	start before T.D.C.		A = **18,5°**
	end after BDC		B = **29,5°**
	start before B.D.C.		D = **67°**
	end after T.D.C.		C = **35°**
	X		**0,20 – 0,30 mm**
			**0,46 – 0,56 mm**
	FUEL SYSTEM		
	Injection type	High-pressure pump, common rail, MD1CE101 Control unit	
	Pump type	BOSCH CP3.3	
	Injector	CRIN2	
	Injection sequence	1 - 5 - 3 - 6 - 2 - 4	

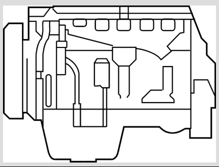
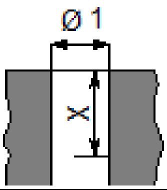
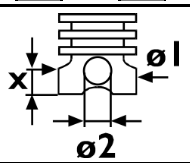
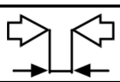
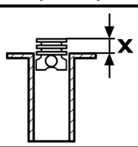
	Type	N67 TE	
		VP02.00 – VP06.00	**VP01.00 – VP05.00**
	Injection pressure	**250 – 1600 bar**	
ϱ	compression ratio	17 : 1	
	Performance [gross] **(*)**	**167 kWm** at **1800 RPM** **149 kWm** at **1500 RPM**	**223 kWm** at **1800 RPM** **196 kWm** at **1500 RPM**
	SUPERCHARGING	Turbocharged with intercooler	
	Turbocharger type	BORG WARNER TIER4B WG	
	LUBRICATION Oil pressure (engine hot) - at idle speed - at max speed	Forced by gear pump, pressure relief valve, oil filter **0,6 bar** **3,5 bar**	
	COOLING Check water pump - opening start - max. opening	Liquid Belt driven **79 °C ± 2 °C** **96 °C**	
	REFILLING		
	Cooling circuit **(1)** – oil **(5)**	**15 L**	
	Cooling circuit **(1)** – G-Drive **(6)**	—	
	Lubricating system **(2)** Total capacity **(3)** Periodical replacement: oil sump at min level oil sump at max level	 **28 L** (**25,2 kg**) **12,5 L** (**11,25 kg**) **23 L** (**20,7 kg**)	
	Fuel tank **(4)**	—	
	Electric System	**24 V**	
	Accumulator/s - capacity - discharge current	 **1300 A·h** or above **500 A**	
	Electric starter motor - Maximum power rating	 **4 kW**	
	Alternator Capacity	**70 A**	

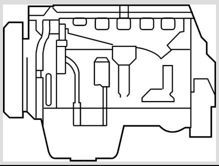
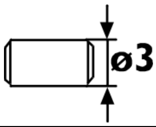
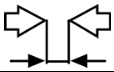
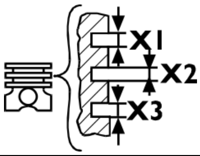
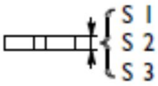
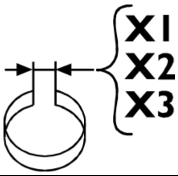
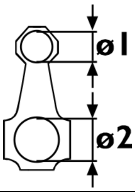
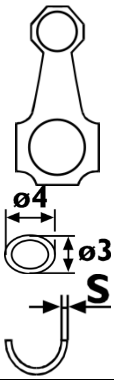
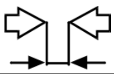
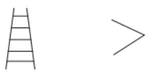
	Type	N67 TE	
		VP02.00 – VP06.00	VP01.00 – VP05.00

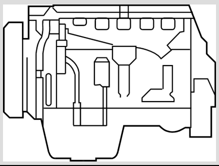
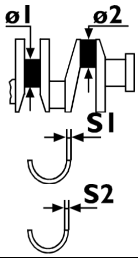
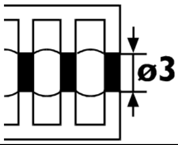
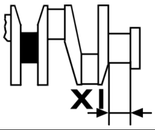
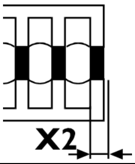
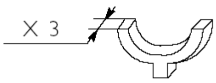
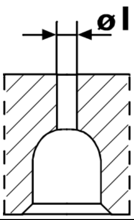
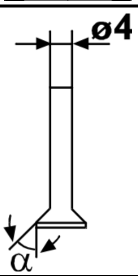
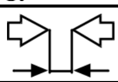
(*) Power at the flywheel in compliance with directive 97/68 CE (without fan), after **50 h** of operation, tolerance ± **3%**, fuel EN590;
Test in compliance with standard ISO 3046/1, turbocharger inlet air temperature **25 °C**, atmospheric pressure **100 kPa**, humidity **30%** - Also in compliance with specifications DIN 6271, BS 5514, SAE J1349.
All data is based on engine operation with fuel system, water pump, lubricant oil pump and intake and exhaust restriction within or below the limits indicated in the "data sheet".
Additional loads estimated at **20 N·m** from idle to nominal engine speed.
(1) The quantities refer to the standard engine configuration. Use coolant compliant with standard ASTM D-6210. Concentrated coolants must be used as a **50%** solution in water.
(2) For the oil specifications, refer to the table of the oils (**General specification ()**).
(3) The amounts indicated refer only to the first fill of the engine, engine sump and filter.
(4) Fuel tank not supplied by FPT.
Refer to the data provided by the manufacturer of the genset. Only use fuel that meets the requirements of international standards ASTM D975 or EN 590.
The manufacturer of the generator set is responsible for the information on fuel tank capacity since it may vary depending on the different configurations of the generator set.
(5) The quantities indicated only refer to the engine in its standard configuration.
(6) The quantities indicated refer to the total capacity of the G-Drive including the capacity of the engine, radiator and pipes.

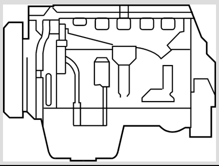
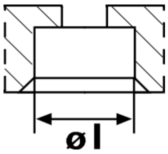
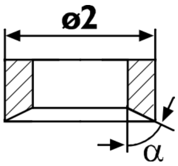
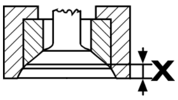
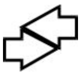
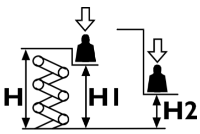
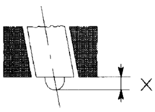
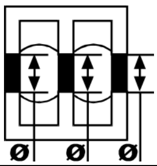
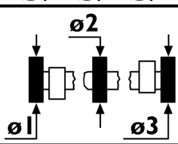
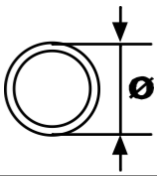
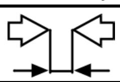
540110 ENGINE - Technical Data and assembly clearances

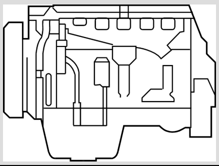
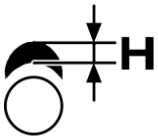
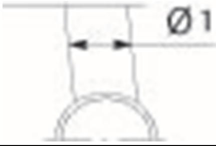
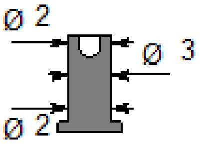
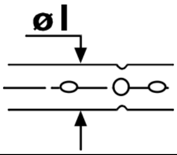
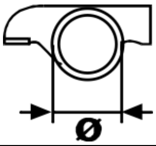
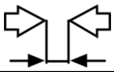
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

	Type		F4HGE615	
			C*V001	V*V001
CYLINDER ASSEMBLY AND CRANK MEMBERS				
 	Cylinder liners	X	144,000 – 144,024 mm	
		> Ø 1	0,4 – 0,8 mm	
 	Pistons: measurement distance	X	34 mm	
	outer diameter	Ø 1	103,739 – 103,757 mm	
	pin seat	Ø 2	40,015 – 40,021 mm	
	Piston diameter	Ø 1	0,4 – 0,8 mm	
	Piston - cylinder liners		0,243 – 0,285 mm	
 	Piston position from crankcase	X	0,28 – 0,52 mm	

	Type		F4HGE615	
			C*V001	V*V001
	Piston pin	Ø 3	39,994 – 40,000 mm	
	Piston pin - pin seat		0,010 – 0,022 mm	
	Grooving for cut piston rings	X1 X2 X3	2,722 – 2,752* mm 2,030 – 2,05 mm 3,03 – 3050 mm	
	(*) measured on Ø of **101 mm**			
	Piston rings	S1 S2 S3	2,563 – 2,597 mm 1,97 – 1.995 mm 3,970 – 3,990 mm	
	Piston rings - slots		0,108 – 0,172 mm 0,040 – 0,090 mm 0,040 – 0,080 mm	
	Piston rings		0,4 – 0,8 mm	
	Piston ring end gap in cylinder liner:	X 1 X 2 X 3	0,30 – 0,40 mm 0,60 – 0,80 mm 0,30 – 0,55 mm	
	Connecting rod small end bush seat	Ø 1	42,987 – 43,013 mm	
	Connecting rod small end bush seat	Ø 2	73,987 – 74,013 mm	
	Small end bushing diameter Internal	Ø 3	40,019 – 40,033 mm	
	Big end half-bearings	S	1,958 – 1,968 mm	
	Piston pin - bushing		0,019 – 0,039 mm	
	Big end half-bearings		0,250 – 0,500 mm	

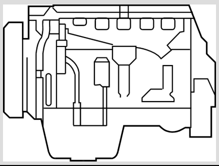
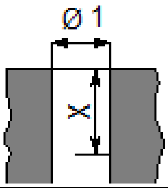
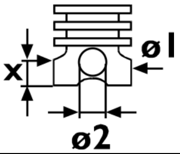
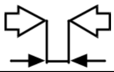
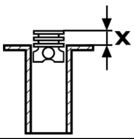
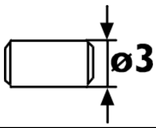
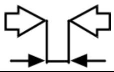
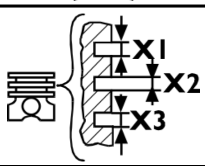
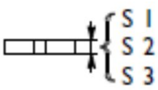
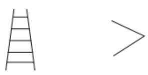
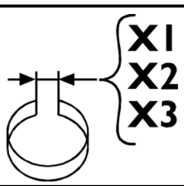
	Type		F4HGE615	
			C*V001	V*V001
	Main journals Crankpins Main half-bearings Big end half-bearings	Ø 1 Ø 2 S1 S2	82,990 – 83,010 mm 69,987 – 70,013 mm 2,464 – 2,472 mm 1,958 – 1,968 mm	
	Main bearings No. 1 - 7 No. 2 - 3 - 4 - 5 - 6	 Ø 3 Ø 3	 87,982 – 88,008 mm 87,977 – 88,013 mm	
	Half bearings – Main journals No. 1 - 7 No. 2 - 3 - 4 - 5 - 6 Half bearings - crankpins	 Ø 3 Ø 3	 0,028 – 0,090 mm 0,023 – 0,095 mm 0,038 – 0,110 mm	
	Main half-bearings Big end half-bearings		0,250 – 0,500 mm	
	Thrust pin	X1	37,475 – 37,545 mm	
	Thrust main bearing	X2	32,180 – 32,280 mm	
	Shoulder half-rings	X3	37,28 – 37,38 mm	
	Main journal and shoulder half-rings		0,095 – 0,265 mm	
CYLINDER HEAD - TIMING SYSTEM				
	Valve guide seat on cylinder head	Ø 1	7,042 – 7,062 mm	
	Valves:  	Ø 4 α Ø 4 α	6,970 – 6,990 mm 60‘± 0,15‘ 6,970 – 6,990 mm 45‘± 0,25‘	
	Valve stem and relative guide		0,032 – 0,072 mm	

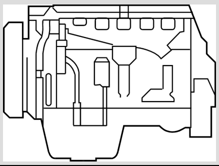
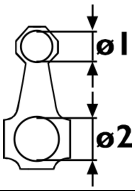
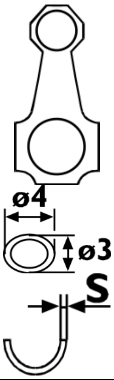
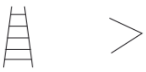
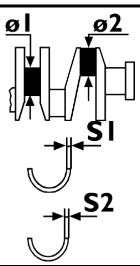
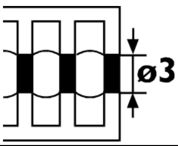
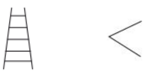
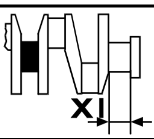
	Type	F4HGE615 C*V001	F4HGE615 V*V001
	Housing on head for valve seat: Ø 1 Ø 1	34.837 – 34,863 mm 34,837 – 34,863 mm	
	Valve housing outer diameter; valve housing inclination on cylinder head: Ø 2 α Ø 2 α	34,917 – 34,931 mm 60° 34,917 – 34,931 mm 45°	
	Sinking X	0,59 – 1,11 mm 0,96 – 1,48 mm	
	Between valve seat and cylinder head	0,054 – 0,094 mm 0,054 – 0,094 mm	
	Valve seats	–	
	Valve spring height: free spring H under a load equal to: **339,8 +/- 19 N** H1 **741 +/- 39 N** H2	47,75 mm 35,33 mm 25,2 mm	
	Injector protrusion X	—	
	Camshaft bush housings No. 1 (flywheel side) Camshaft pin seats No. 2-3-4-5-6-7 Ø	59,222 – 59,248 mm 54,089 – 54,139 mm	
	Camshaft support journals Ø 1 → 7	53,995 – 54,045 mm	
	Internal bush diameter Ø	54,083 – 54,147 mm	
	Bushings and	0,038 – 0,152 mm	

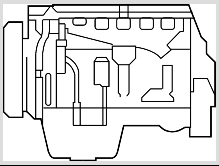
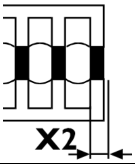
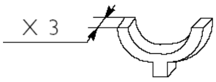
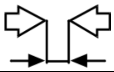
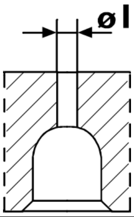
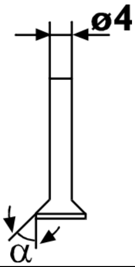
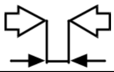
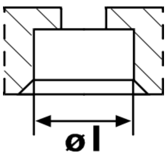
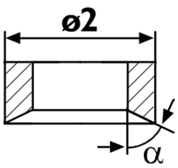
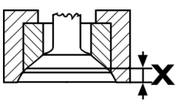
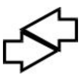
	Type	F4HGE615	
		C*V001	V*V001
	Cam lift:  H 	**6,045 mm** **7,582 mm**	
	Tappet cap housing on block Ø 1	**16,000 – 16,030 mm**	
	Tappet cap outside diameter: Ø 2 Ø 3	**15,924 – 15,954 mm** **15,960 – 15,975 mm**	
	Between tappets and seats	**0,025 – 0,070 mm**	
	Tappets	—	
	Rocker arm shaft Ø 1	**21,965 – 21,977 mm**	
	Rocker arm Ø Ø	**22,001 – 22,027 mm**	
	Between rockers and shaft	**0,024 – 0,062 mm**	

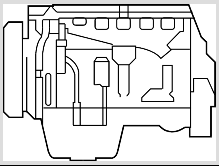
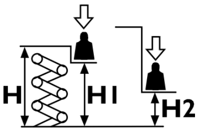
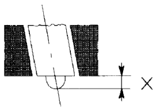
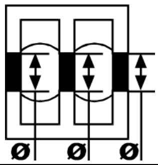
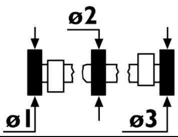
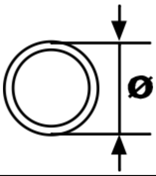
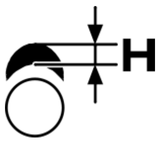
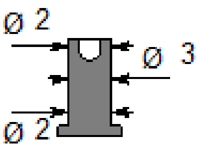
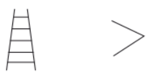
540110 ENGINE - Technical Data and assembly clearances

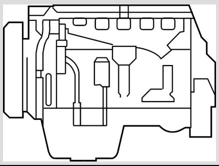
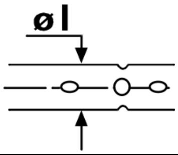
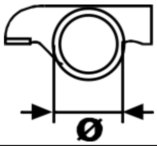
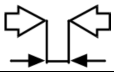
Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

	Type	N67 TE VP
	CRANK GEAR ELEMENTS AND CYLINDER ASSEMBLY	
	Cylinder liners X > Ø 1	**144,000 – 144,024 mm** **0,4 – 0,8 mm**
	Pistons: measuring dimension X outer diameter Ø 1 pin seat Ø 2	**34 mm** **103,739 – 103,757 mm** **40,015 – 40,021 mm**
	Piston diameter Ø 1	**0,4 – 0,8 mm**
	Piston - cylinder liners	**0,243 – 0,285 mm**
	Piston position from crankcase X	**0,28 – 0,52 mm**
	Piston pin Ø 3	**39,994 – 40,000 mm**
	Gudgeon pin - pin housing	**0,010 – 0,022 mm**
	Split ring slots X1 X2 X3	**2,722 – 2,752* mm** **2,030 – 2,05 mm** **3,03 – 3050 mm**
	(*) measured on Ø of **101 mm**	
	Circlips S1 S2 S3	**2,563 – 2,597 mm** **1,97 – 1.995 mm** **3,970 – 3,990 mm**
	Piston rings - slots	**0,108 – 0,172 mm** **0,040 – 0,090 mm** **0,040 – 0,080 mm**
	Circlips	**0,4 – 0,8 mm**
	Circlip end opening in cylinder liner: X 1 X 2 X 3	**0,30 – 0,40 mm** **0,60 – 0,80 mm** **0,30 – 0,55 mm**

	Type	N67 TE VP
	Connecting rod small end bush seat Ø 1 Connecting rod small end bush seat Ø 2	**42,987 – 43,013 mm** **73,987 – 74,013 mm**
	Diameter of connecting rod small end bush Inner Ø 3 Big end half-bearings S	**40,019 – 40,033 mm** **1,958 – 1,968 mm**
	Piston pin - bush	**0,019 – 0,039 mm**
	Big end half-bearings	**0,250 – 0,500 mm**
	Main journals Ø 1 Crankpins Ø 2 Main half-bearings S1 Big end half-bearings S2	**82,990 – 83,010 mm** **69,987 – 70,013 mm** **2,464 – 2,472 mm** **1,958 – 1,968 mm**
	Main bearings No. 1 - 7 Ø 3 No. 2 - 3 - 4 - 5 - 6 Ø 3	 **87,982 – 88,008 mm** **87,977 – 88,013 mm**
	Half bearings – Main journals No. 1 - 7 Ø 3 No. 2 - 3 - 4 - 5 - 6 Ø 3 Half bearings - crankpins	 **0,028 – 0,090 mm** **0,023 – 0,095 mm** **0,038 – 0,110 mm**
	Main half-bearings Big end half-bearings	**0,250 – 0,500 mm**
	Main journal for shoulder X1	**37,475 – 37,545 mm**

	Type	N67 TE VP
	Main bearings for shoulder X2	**32,180 – 32,280 mm**
	Shoulder half-rings X3	**37,28 – 37,38 mm**
	Main journal and shoulder half rings	**0,095 – 0,265 mm**
CYLINDER HEAD - TIMING GEAR		
	Valve guide seats on the cylinder head Ø 1	**7,042 – 7,062 mm**
	Valves: Ø 4 α Ø 4 α	**6,970 – 6,990 mm** **60‘± 0,15‘** **6,970 – 6,990 mm** **45‘± 0,25‘**
	Valve stem and relative guide	**0,032 – 0,072 mm**
	Housing on head for valve seat: Ø 1 Ø 1	**34.837 – 34,863 mm** **34,837 – 34,863 mm**
	Valve housing outer diameter; valve housing inclination on cylinder head: Ø 2 α Ø 2 α	**34,917 – 34,931 mm** **60°** **34,917 – 34,931 mm** **45°**
	Recess X	**0,59 – 1,11 mm** **0,96 – 1,48 mm**
	Between valve seat and head	**0,054 – 0,094 mm** **0,054 – 0,094 mm**

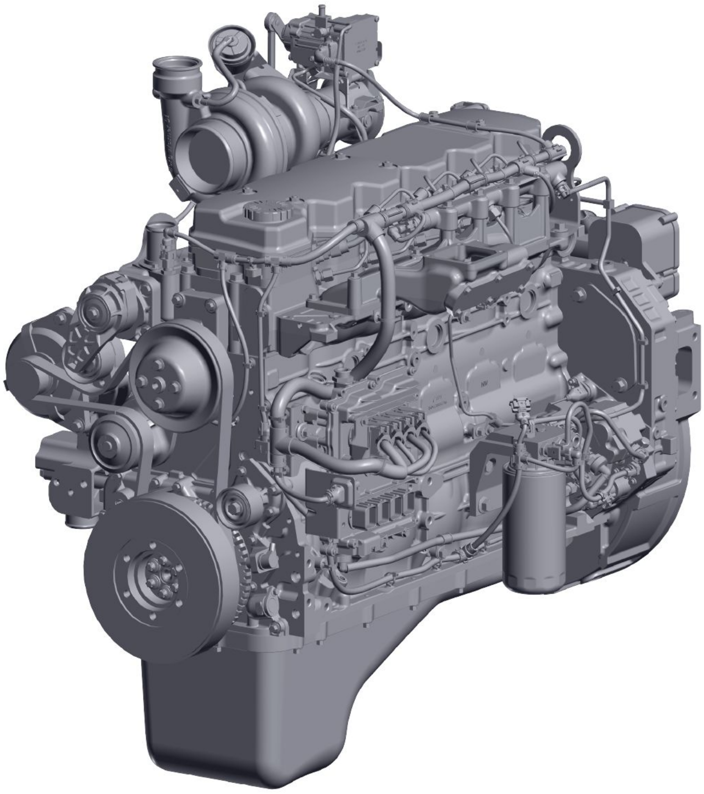
	Type	N67 TE VP
	Valve seats	—
	Valve spring height: Free spring H Under a load equal to: **339,8 +/- 19 N** H1 **741 +/- 39 N** H2	**47,75 mm** **35,33 mm** **25,2 mm**
	Injector protrusion X	—
	Camshaft bush housings No. 1 (flywheel side) Camshaft pin seats No. 2-3-4-5-6-7 Ø	**59,222 – 59,248 mm** **54,089 – 54,139 mm**
	Camshaft support journals Ø 1 → 7	**53,995 – 54,045 mm**
	Bushing inside diameter Ø	**54,083 – 54,147 mm**
	Bushings and journals	**0,038 – 0,152 mm**
	Useful cam lift: H 	**6,045 mm** **7,582 mm**
	Tappet cap housing on crankcase Ø 1	**16,000 – 16,030 mm**
	Tappet cap outside diameter: Ø 2 Ø 3	**15,924 – 15,954 mm** **15,960 – 15,975 mm**
	Between tappets and seats	**0,025 – 0,070 mm**
	Tappets	—

	Type	N67 TE VP
	Rocker arm shaft Ø 1	**21,965 – 21,977 mm**
	Rocker arm Ø Ø	**22,001 – 22,027 mm**
	Between rocker arms and shaft	**0,024 – 0,062 mm**

540110 ENGINE - External view

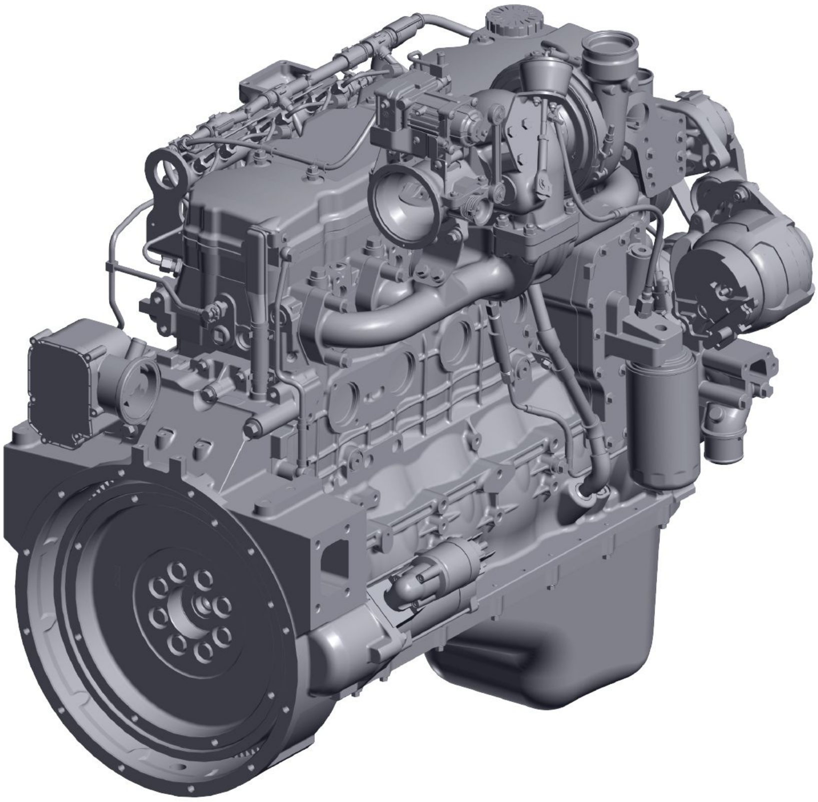
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

FRONT LEFT VIEW



265731 1

REAR RIGHT VIEW



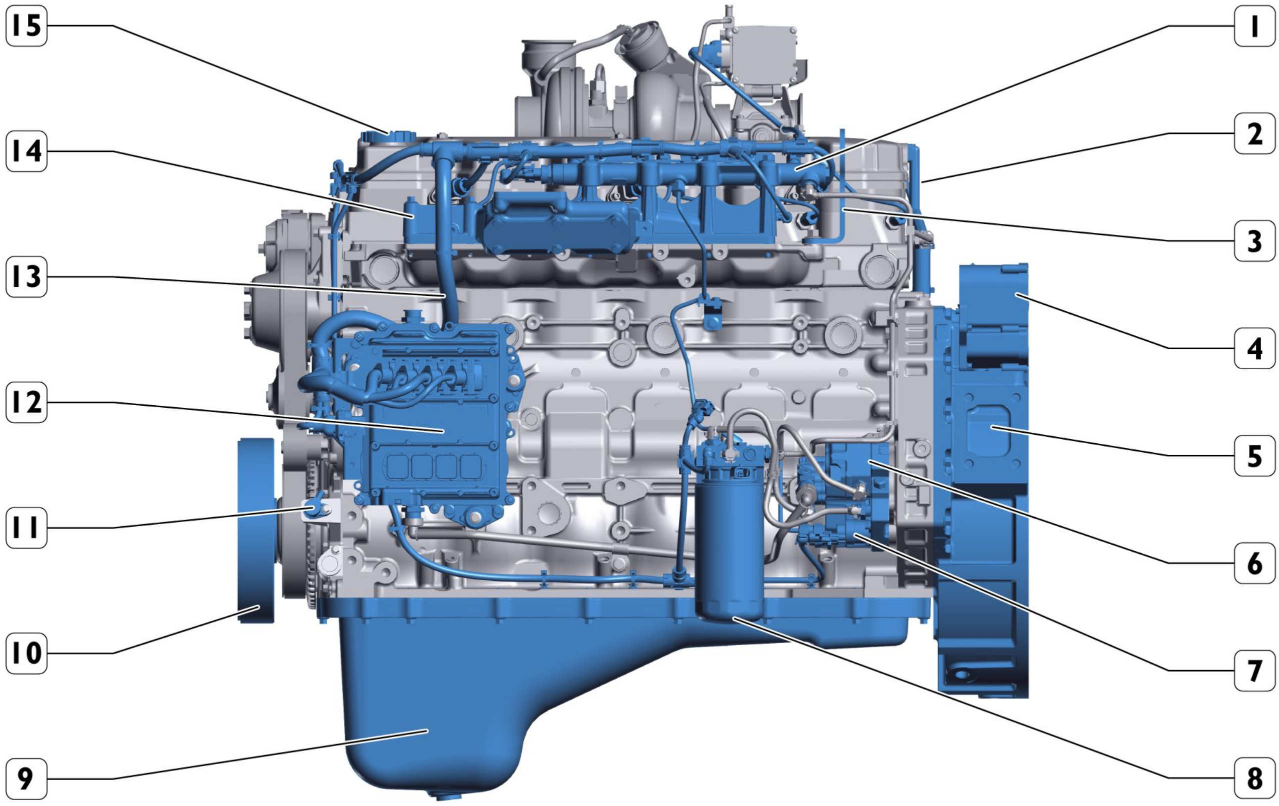
265730 2

F4HFE615 is an in-line 6-cylinder turbo engine with intercooler and 4 valves per cylinder; it belongs to the NEF series and operates according to a 4-stroke diesel cycle.

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

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

LEFT SIDE VIEW



265725 3

(1) Common rail

(2) Blow-by breather pipe

(3) Lifting U-bolt

(4) Blow-by filter

(5) Flywheel housing

(6) High-pressure pump

(7) Flow rate modulator

(8) Fuel filter

(9) Oil sump

(10) Damper flywheel

(11) Engine crankshaft speed sensor

(12) MD1 control unit

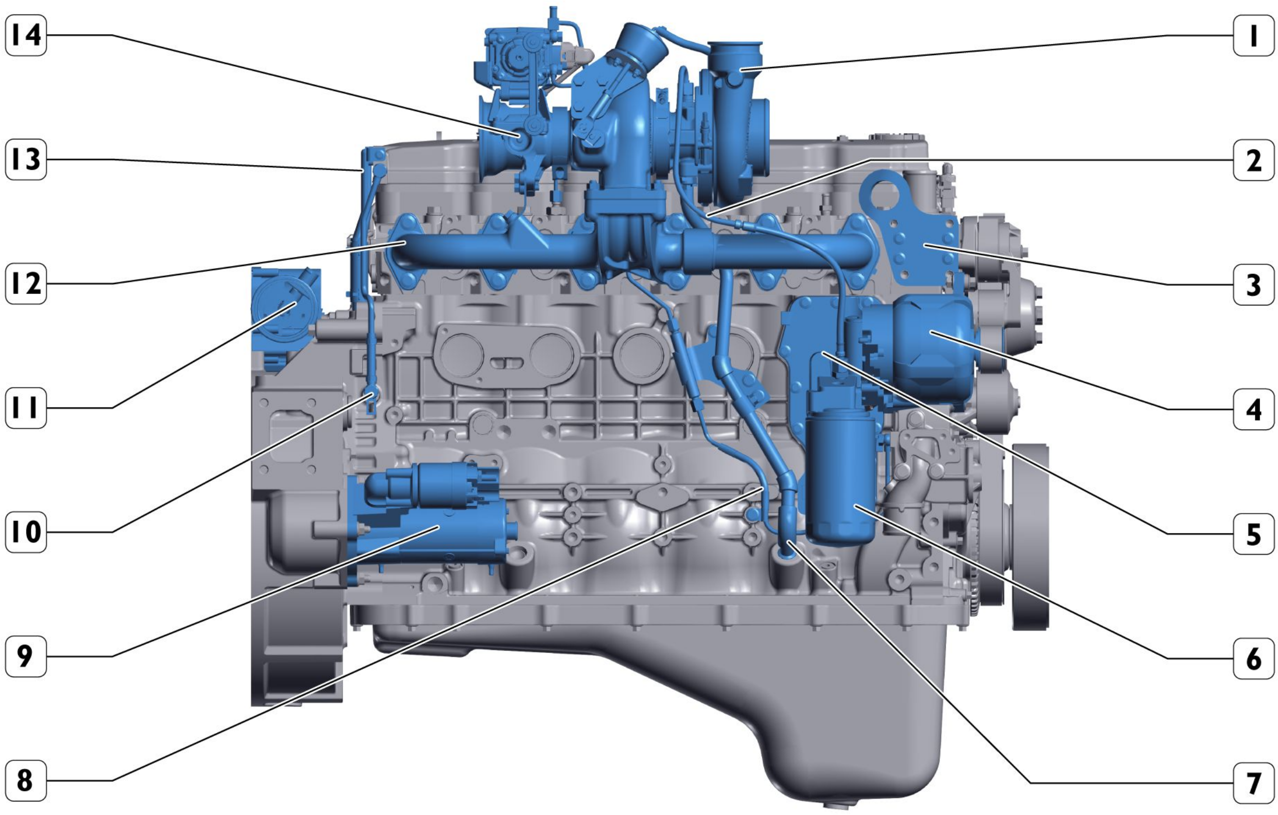
(13) Engine cable

(14) Intake manifold

(15) Oil filler cap

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

RIGHT SIDE VIEW



265726 4

(1) Turbocharger with wastegate

(2) Turbocharger lubricant oil delivery pipe

(3) Lifting U-bolt

(4) Alternator

(5) Lubricant heat exchanger

(6) Oil filter

(7) Lubricant oil return pipe from turbocharger

(8) Flap valve cooling delivery pipe

(9) Starter motor

(10) Condensate oil return pipe

(11) Blow-by filter

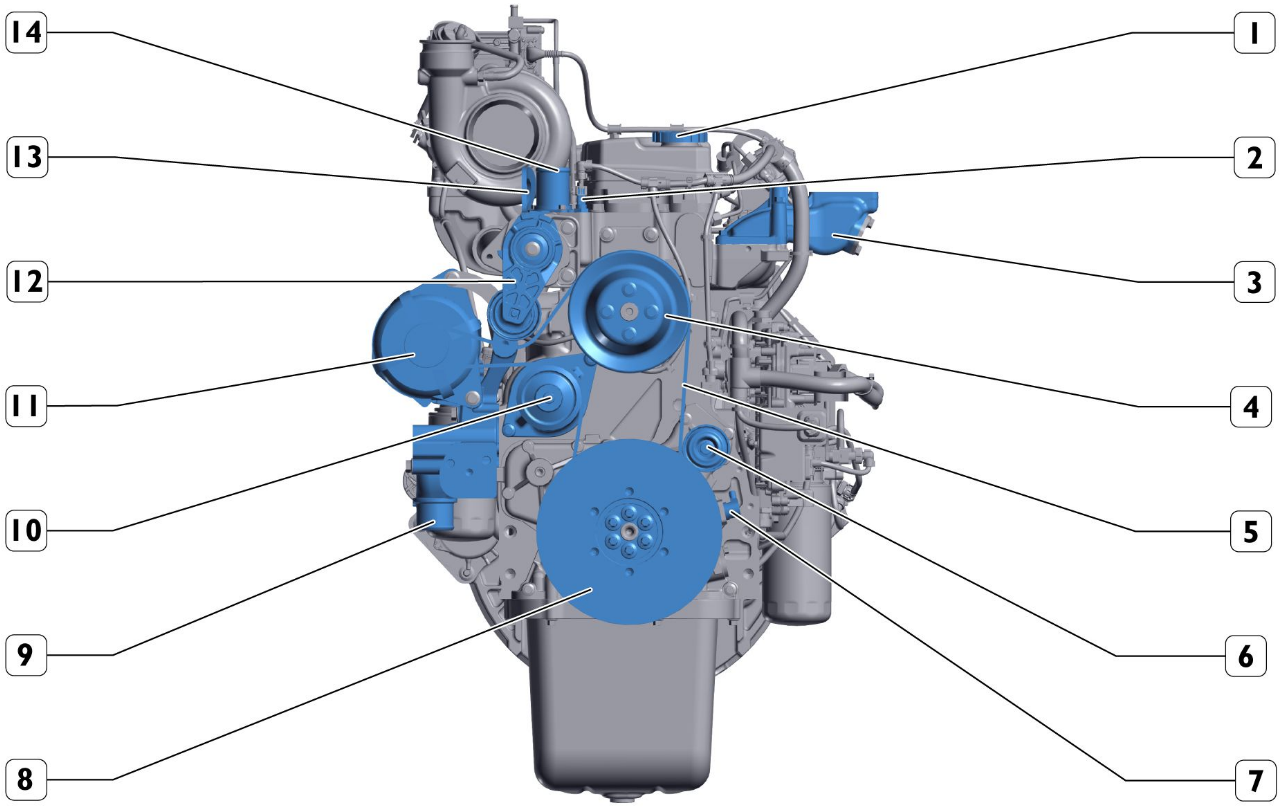
(12) Exhaust manifold

(13) Blow-by breather pipe

(14) Flap valve

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

FRONT SIDE VIEW



265727 5

(1) Oil filler cap

(2) Coolant temperature sensor

(3) Intake manifold

(4) Fan pulley

(5) Auxiliary members' belt

(6) Fixed belt tensioner

(7) Engine crankshaft speed sensor

(8) Damper flywheel

(9) Coolant inlet pipe from radiator

(10) Water pump

(11) Alternator

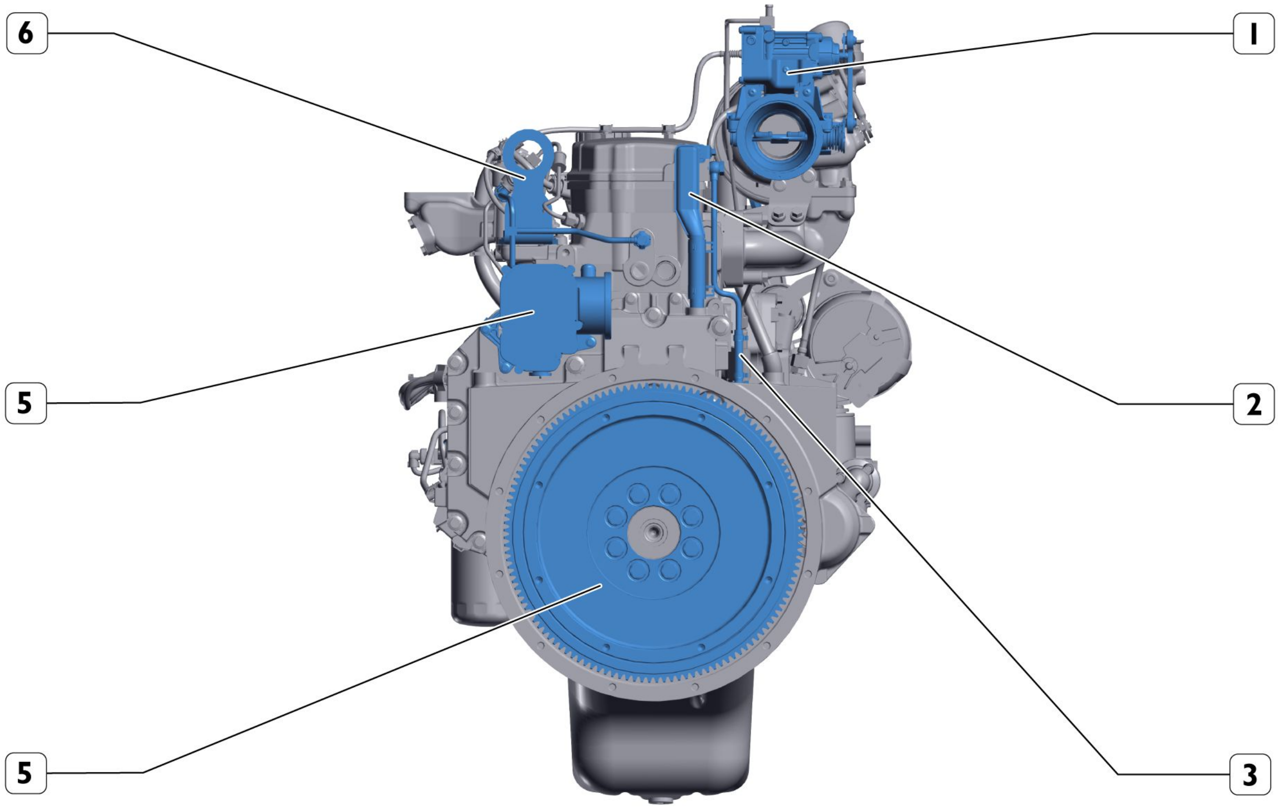
(12) Automatic belt tensioner

(13) Lifting U-bolt

(14) Thermostat cover

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

REAR VIEW



265728 6

(1) Flap valve

(2) Blow-by breather pipe

(3) Condensate oil return pipe

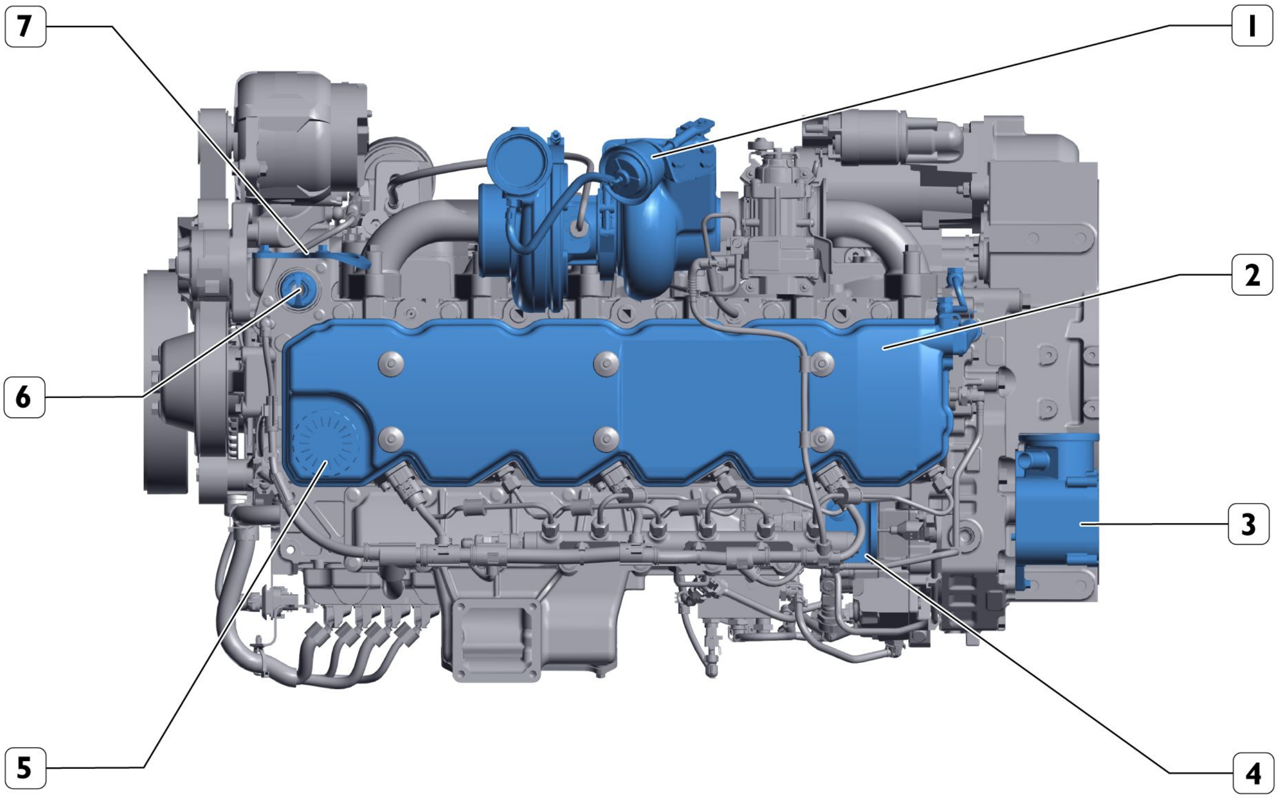
(4) Engine flywheel

(5) Blow-by filter

(6) Lifting U-bolt

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

TOP VIEW



265729 7

(1) Turbocharger with wastegate

(2) Tappet cover

(3) Blow-by filter

(4) Lifting U-bolt

(5) Oil filler cap

(6) Thermostat

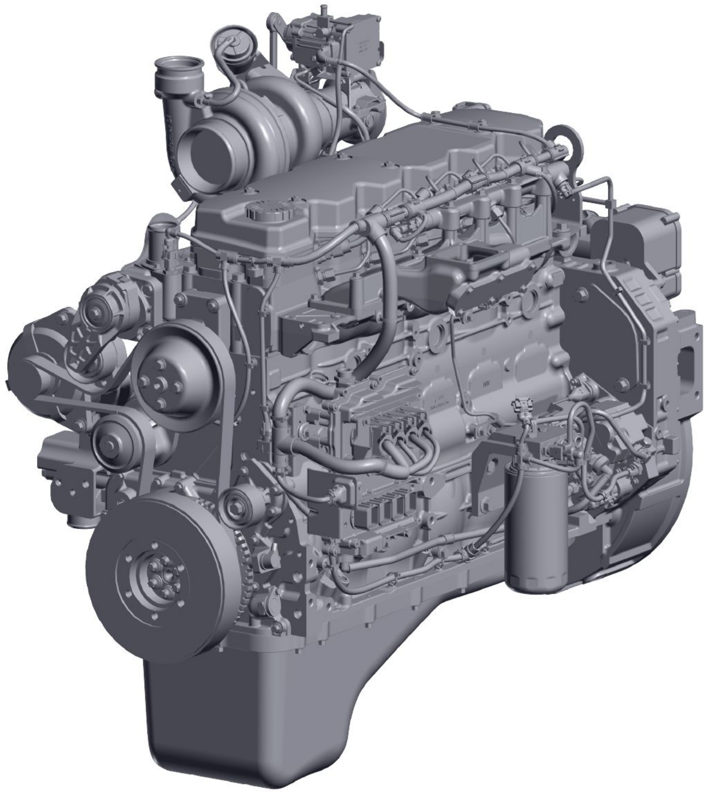
(7) Lifting U-bolt

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

540110 ENGINE - Overview

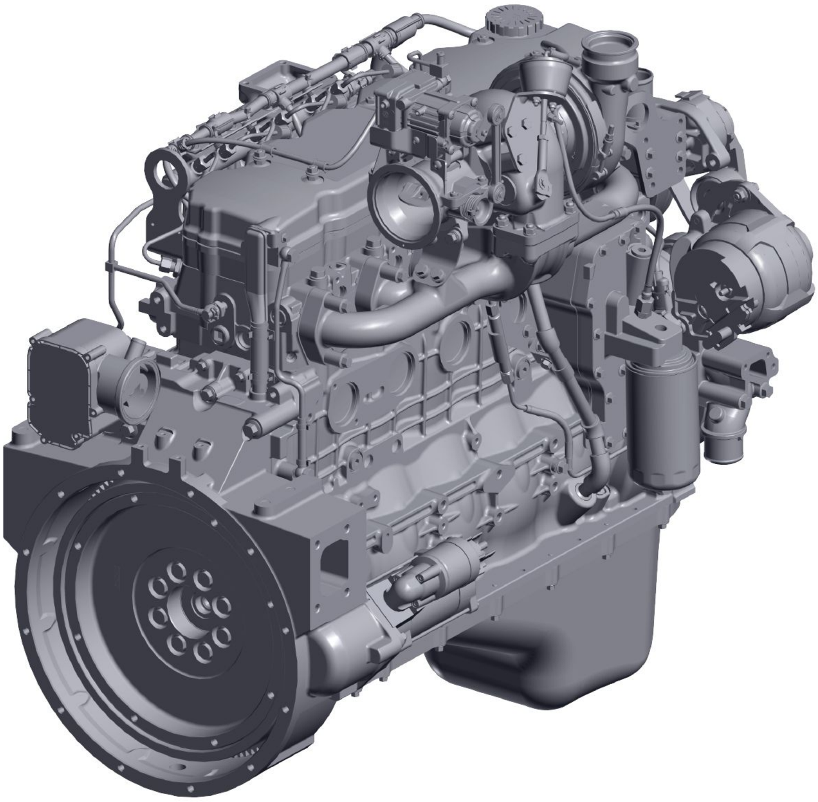
Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

FRONT LEFT VIEW



265731 1

REAR RIGHT VIEW



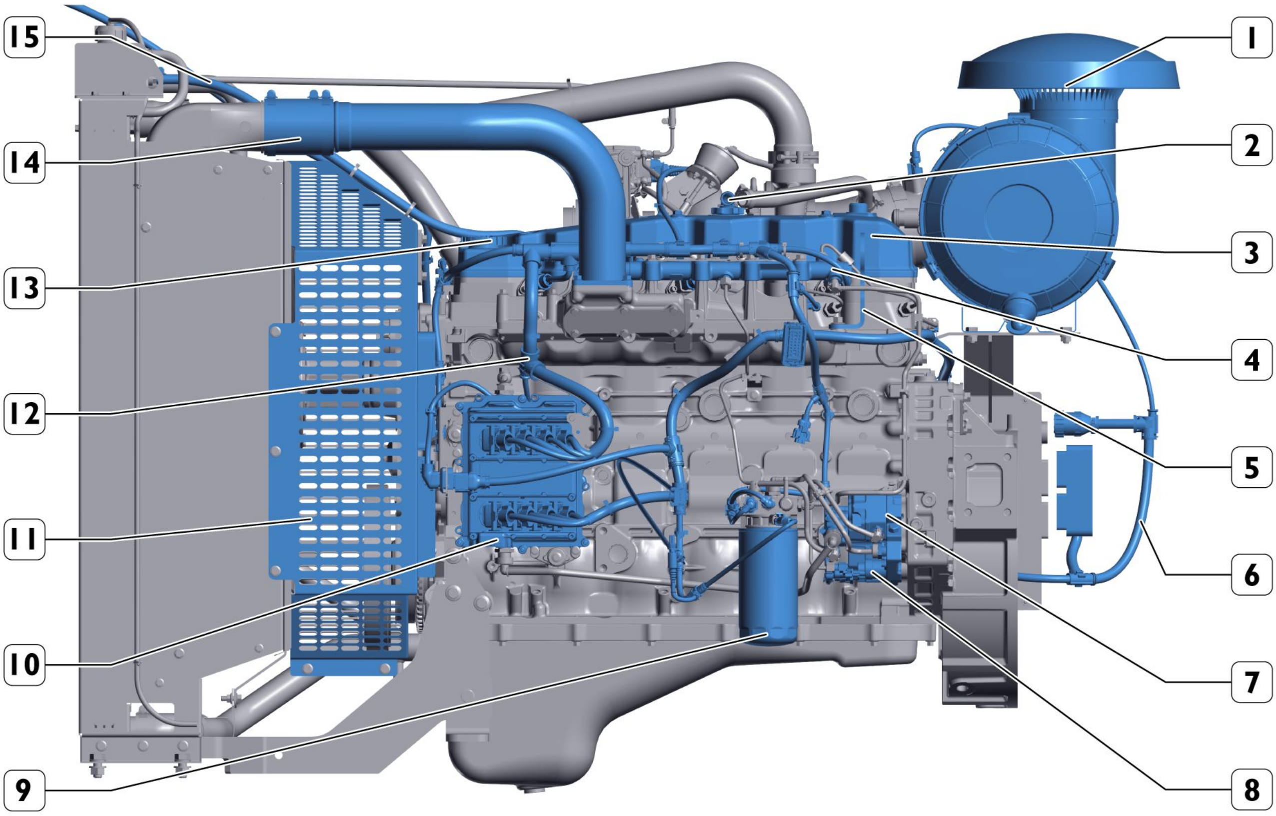
265730 2

They are characterised by a 4 stroke diesel cycle, sucked in or supercharged with 6 cylinders with 4 valves per cylinder.

They are powered with the high-pressure pump .

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

LEFT SIDE VIEW



267982 3

(1) Air filter

(2) Oil vapour breather from blow-by

(3) Tappet cover

(4) Common rail

(5) Lifting U-bolt

(6) Interconnection cable

(7) High-pressure pump

(8) Pressure regulator

(9) Fuel filter

(10) MD1 control unit

(11) Protective grille

(12) Engine cable

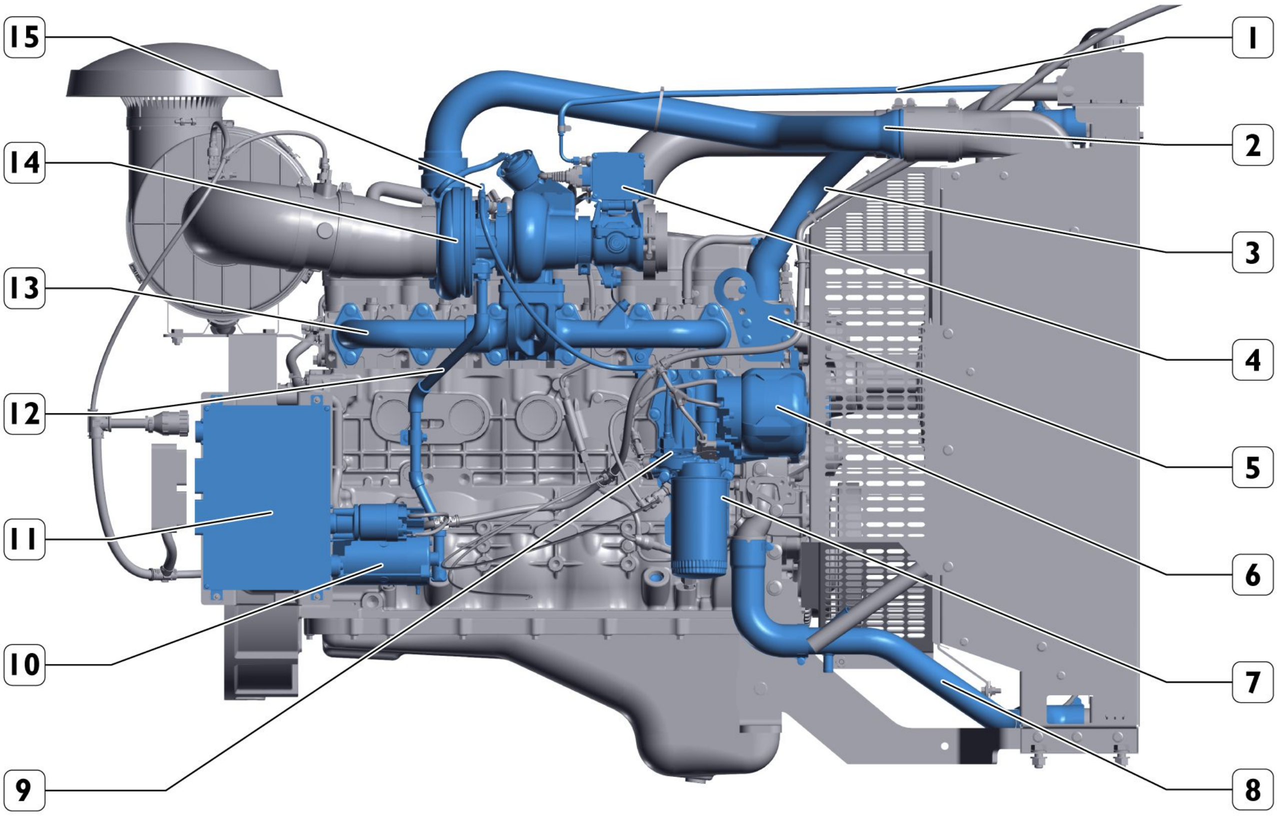
(13) Oil filler cap

(14) Cooled air inlet pipe to intake manifold

(15) Engine breather pipe on radiator

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

RIGHT SIDE VIEW



267983 4

(1) Breather pipe to radiator

(2) Compressed air inlet pipe to radiator

(3) Coolant inlet pipe to radiator

(4) Exhaust Flap valve

(5) Lifting U-bolt

(6) Alternator

(7) Oil filter

(8) Coolant outlet pipe from radiator

(9) Heat exchanger

(10) Electric starter motor

(11) Interface housing

(12) Lubricant oil return pipe from turbocharger

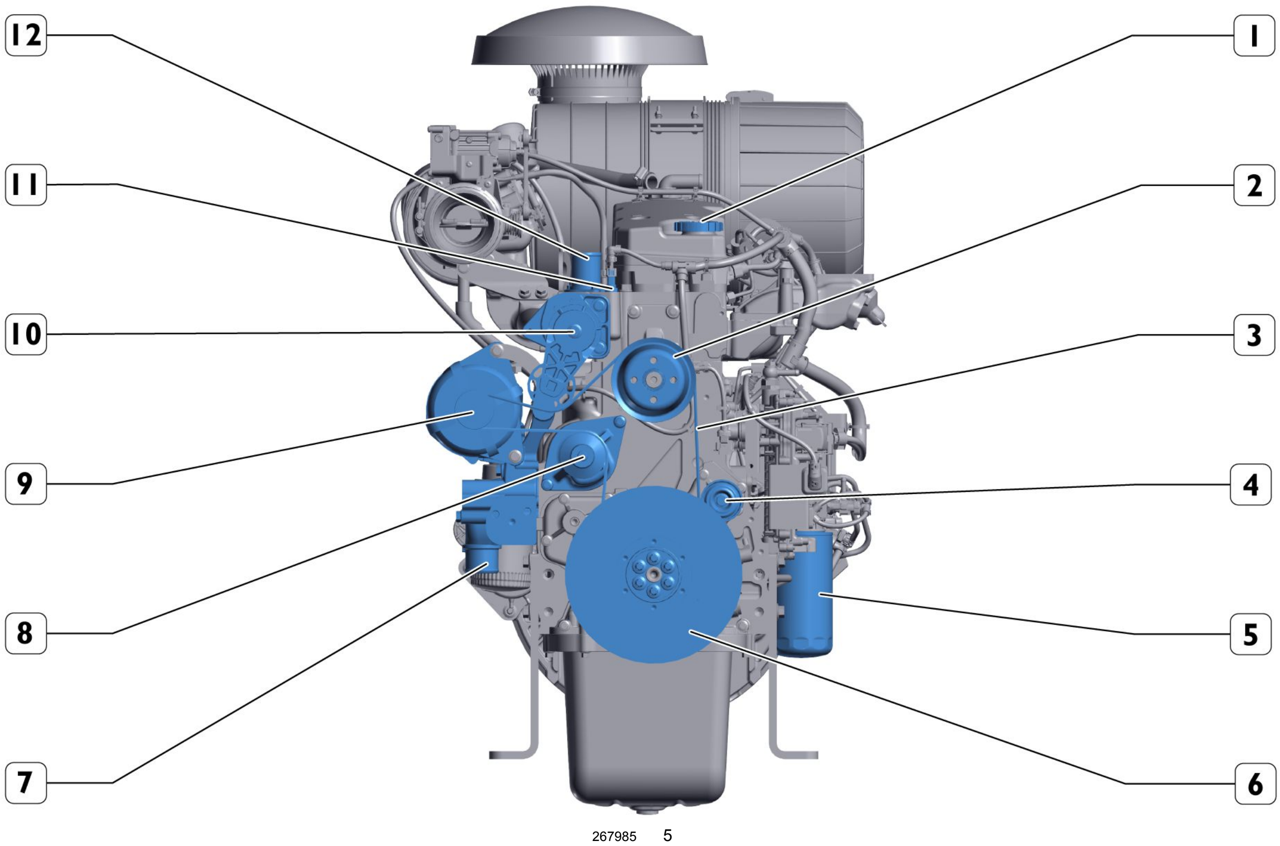
(13) Exhaust manifold

(14) Turbocharger

(15) Turbocharger lubricant oil delivery pipe

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

FRONT SIDE VIEW



(1) Oil filler cap

(2) Fan pulley

(3) Auxiliary members' belt

(4) Idler pulley

(5) Fuel filter

(6) Damper flywheel

(7) Engine coolant inlet

(8) Water pump

(9) Alternator

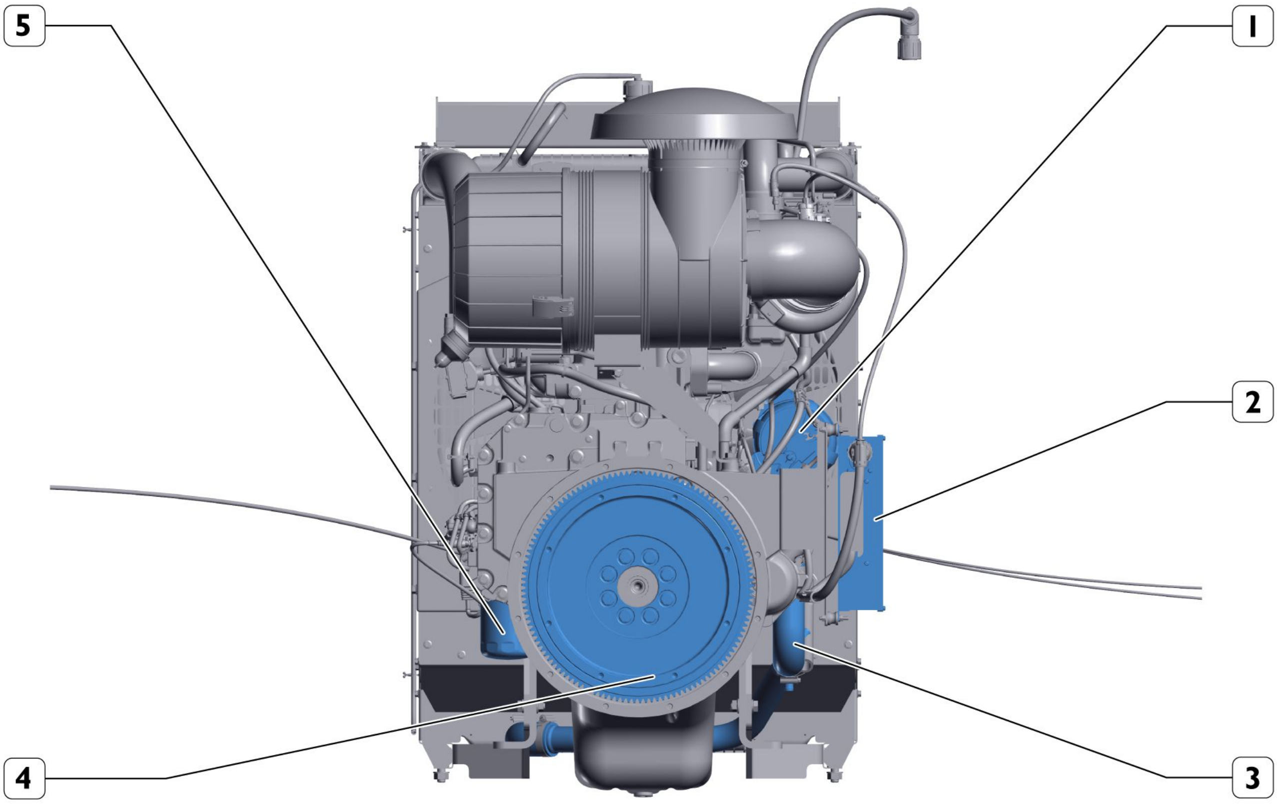
(10) Automatic belt tensioner

(11) Coolant temperature sensor

(12) Thermostat pipe

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

REAR VIEW



267984 6

(1) Alternator

(2) Interface housing

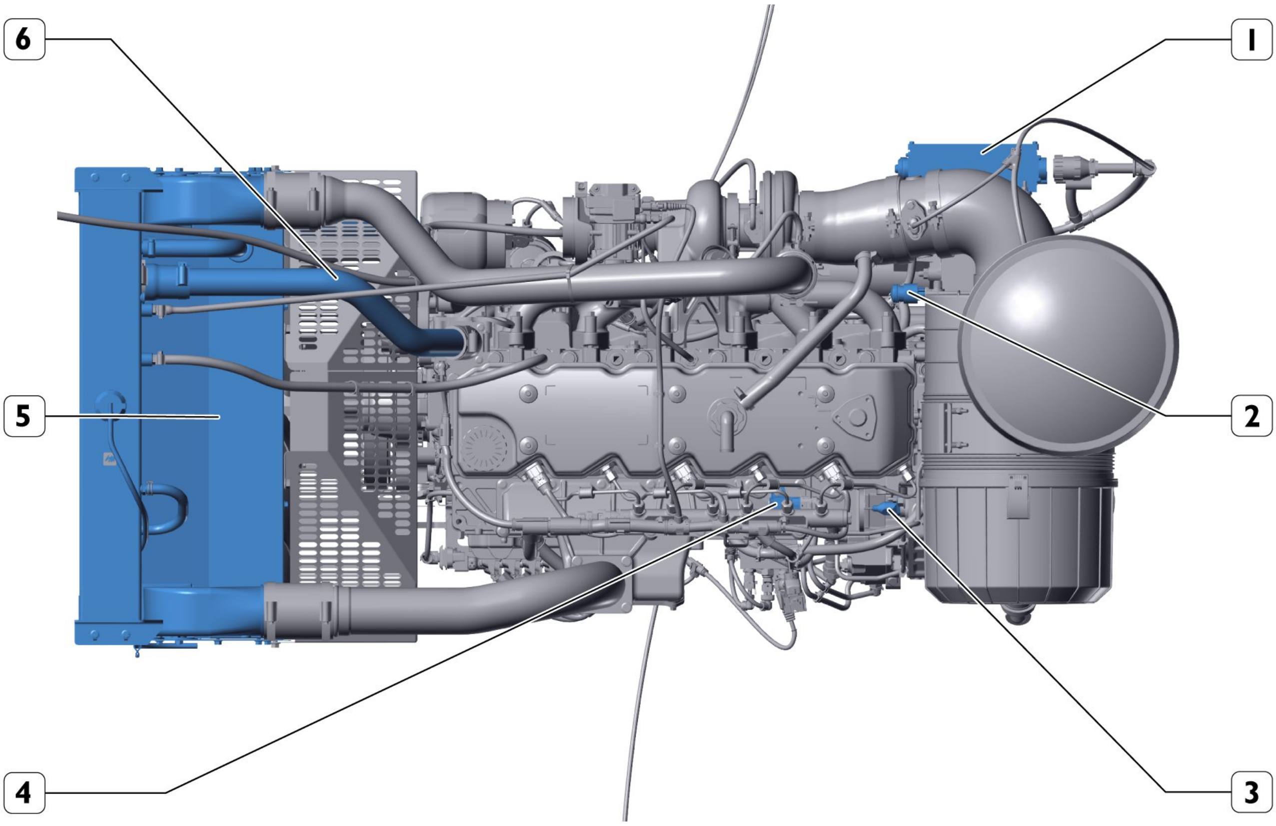
(3) Coolant outlet pipe from radiator

(4) Engine flywheel

(5) Fuel filter

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

TOP VIEW



267986 7

(1) Interface housing

(2) Air filter clogged sensor

(3) Engine speed sensor

(4) Air temperature and pressure sensor

(5) Radiator

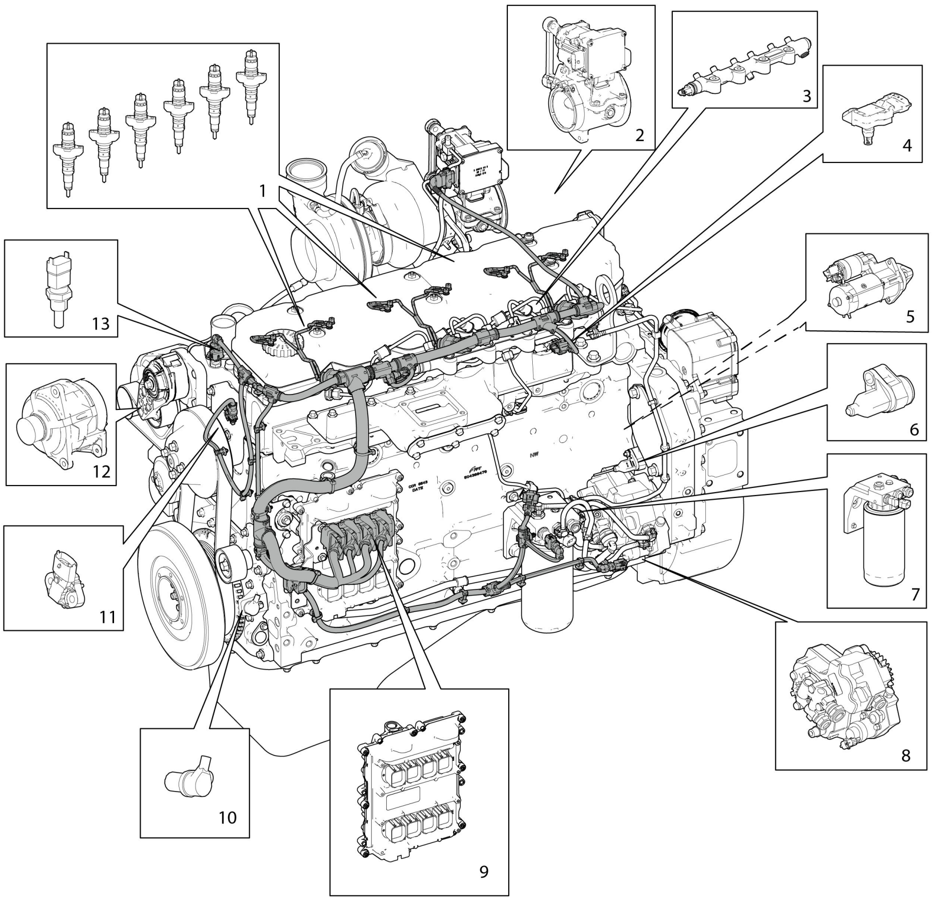
(6) Coolant inlet pipe to radiator

NOTE: *The engine lifting hooks are sized to move the engine only. It is strictly prohibited to use these hooks to lift the engine together with other parts which make up the genset, for example single-phase/three-phase electric machines, lower crankcase etc.*

540110 ENGINE - Component localisation diagrams

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Location of electrical components



265937 1

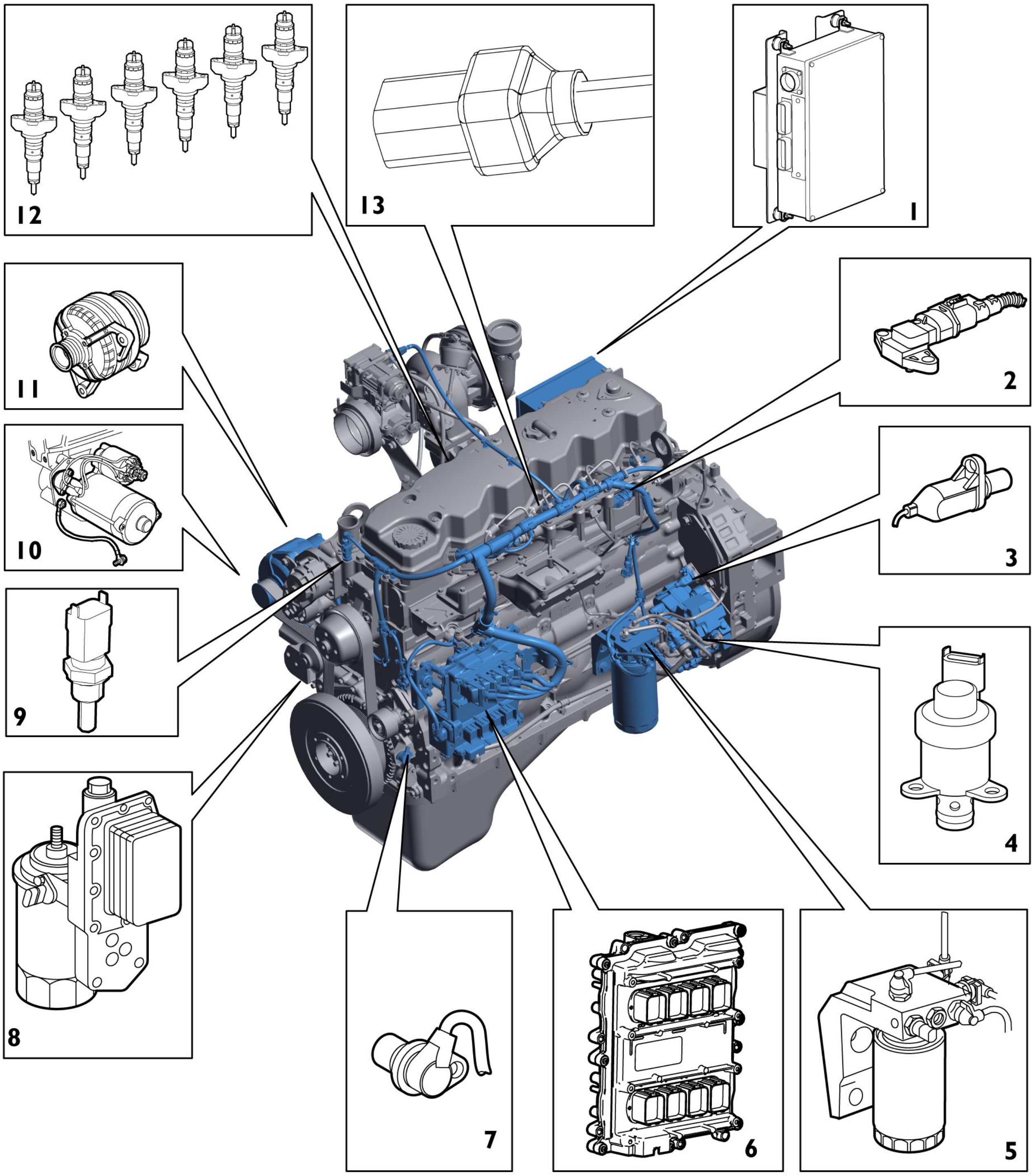
(1) Injectors - (2) Motorised throttle valve connector (exhaust valve) - (3) Rail pressure sensor - (4) Air temperature and pressure sensor - (5) Electric starter motor - (6) Camshaft segmental timing speed sensor - (7) Fuel temperature sensor - (8) High-pressure fuel dosing unit - (9) MD1CE101 engine control unit - (10) Crankshaft incremental speed sensor - (11) Engine oil pressure and temperature sensor - (12) Alternator - (13) Coolant temperature sensor

540110 ENGINE - Component localisation

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The NEF TE engines are fully controlled by the electronic control unit. This is mounted directly onto the engine via a heat exchanger that allows it to cool, using rubber blocks that reduce the vibrations transmitted by the engine.

The ECU allows checking of correct engine operation.



267990 1

1. Interface housing **CONNECTION UNIT - Overview (76.61)**
2. Air temperature / pressure sensor **AIR PRESSURE SENSOR - Overview (77.26)**
3. Timing gear timing sensor **TIMING GEAR SPEED SENDER - Overview (76.42)**
4. Pressure regulator **HIGH PRESSURE ADJ UNIT - Overview (77.10)**
5. Fuel heater; fuel temperature sensor and clogged sensor **FUEL TEMPERATURE SENSOR - Overview (77.26)**
6. MD1 control unit **ENGINE CONTROL UNIT - Overview (76.61)**
7. Engine speed sensor **REV.COUNTER SENDER - Overview (76.42)**
8. Engine oil pressure and temperature sensor **ENGINE OIL PRESSURE GAUGE SENDER - Overview (76.42)**
9. Engine coolant temperature sensor **ENGINE WATER TEMPERATURE SWITCH - Overview (76.42)**
10. Starter motor **COMPLETE STARTER MOTOR - Overview (76.08)**
11. Alternator **ALTERNATOR ASSEMBLY - Overview (76.03)**
12. Injectors **INJECTOR - Overview (77.50)**
13. Connections for electro-injectors

540110 ENGINE - Visual inspection

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. After starting the engine and with the engine running, perform the following checks and inspections:
2. Check for any leaks from the fuel, coolant and lubricant circuits.
3. Make sure that there are no unusual noises or clinks while the engine is running.
4. Check the vehicle's pressure and temperature, along with other parameters, using its devices.
5. Visually check the exhaust smoke (colour of the exhaust emissions).
6. Visually check the level of the coolant in the expansion tank.

540110 ENGINE - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205
Brackets fixing engine to revolving stand 99322205	99361037
Crankshaft lifting tackle	99360500
Flywheel restrainer	99360351
Remover,cartridge filter	99360076
Rocking sling for removing/installing engine	99360595
Tool for removing gaskets	99363204
Tool to remove crankshaft front gasket	99340055
Tool to remove crankshaft rear gasket	99340056
Tool to remove injectors	99342101

The following description refers to the general mechanical overhaul operations starting with the engine removed from the vehicle.

NOTE: *Please refer to the specific publication for indications on removing the engine from the vehicle. Engine removal and general mechanical overhaul operations must be performed by qualified personnel with the specific tools.*

This Section includes:

1. the operations to be carried out to fit the engine onto the rotating stand,
2. the sequence of removal operations of the main components,
3. the actual overhaul of the crankcase and the cylinder head,
4. the sequence of installation operations of the main components,
5. the engine completion operations after having removed it from the rotating stand,
6. final checks and verifications.

Some of the operations described in this section can be performed directly on the engine still fitted in the vehicle, depending on the accessibility of the engine compartment and the vehicle version. These are listed in the section Removal - installation of the main components of the engine.

FITTING THE ENGINE ON THE ROTATING STAND

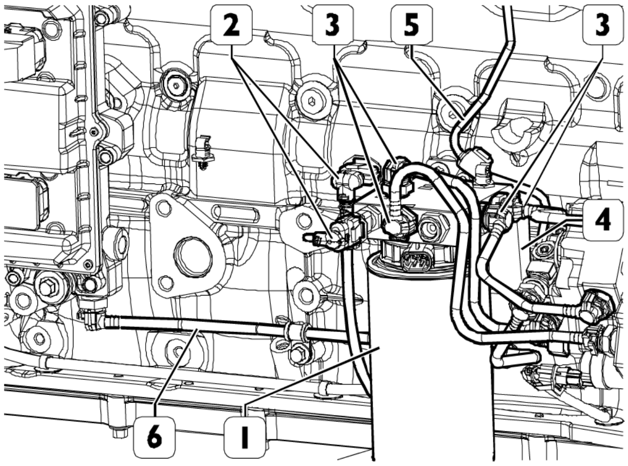
1. To apply to the crankcase the brackets for fastening the engine to the overhaul stand, proceed as follows working from the left side of the engine:

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037

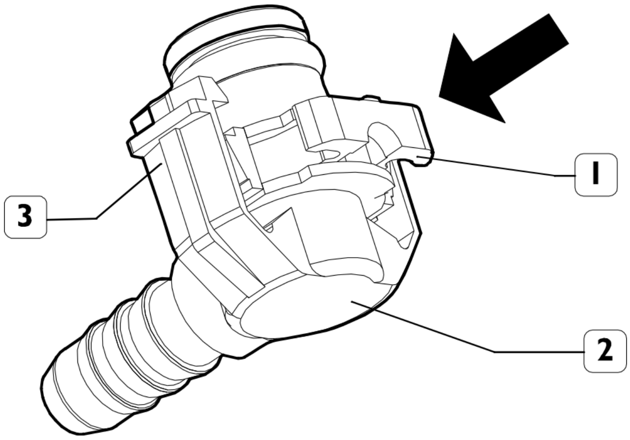
2. Position a suitable container to collect any fuel which may leak out.
3. Using the tool, remove the fuel filter **(1)** from its support.

Tool / Material	
Remover,cartridge filter	99360076

4. Disconnect the fuel temperature sensor and the camshaft timing sensor electrical connection **(2)**.
5. Disconnect the low-pressure fuel pipes **(3)** from the filter support.
6. Unscrew the fastening screws and remove the filter support **(4)** complete with the bracket, if fitted, from the engine block.
7. To disconnect a low-pressure fuel pipe from the relevant connection fitting, hold and press the clip **(1)** and extract the quick-release coupling **(2)**.



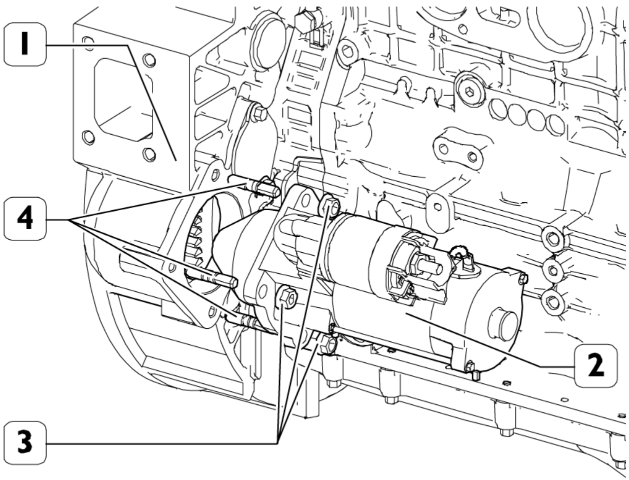
166072 1



116237 2

8. Ensure that the electric starter motor **(2)** is suitably supported.
9. Unscrew the fastening nuts **(3)** and remove the electric starter motor **(2)**.
10. Unscrew the studs **(4)** from the flywheel housing **(1)**.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**

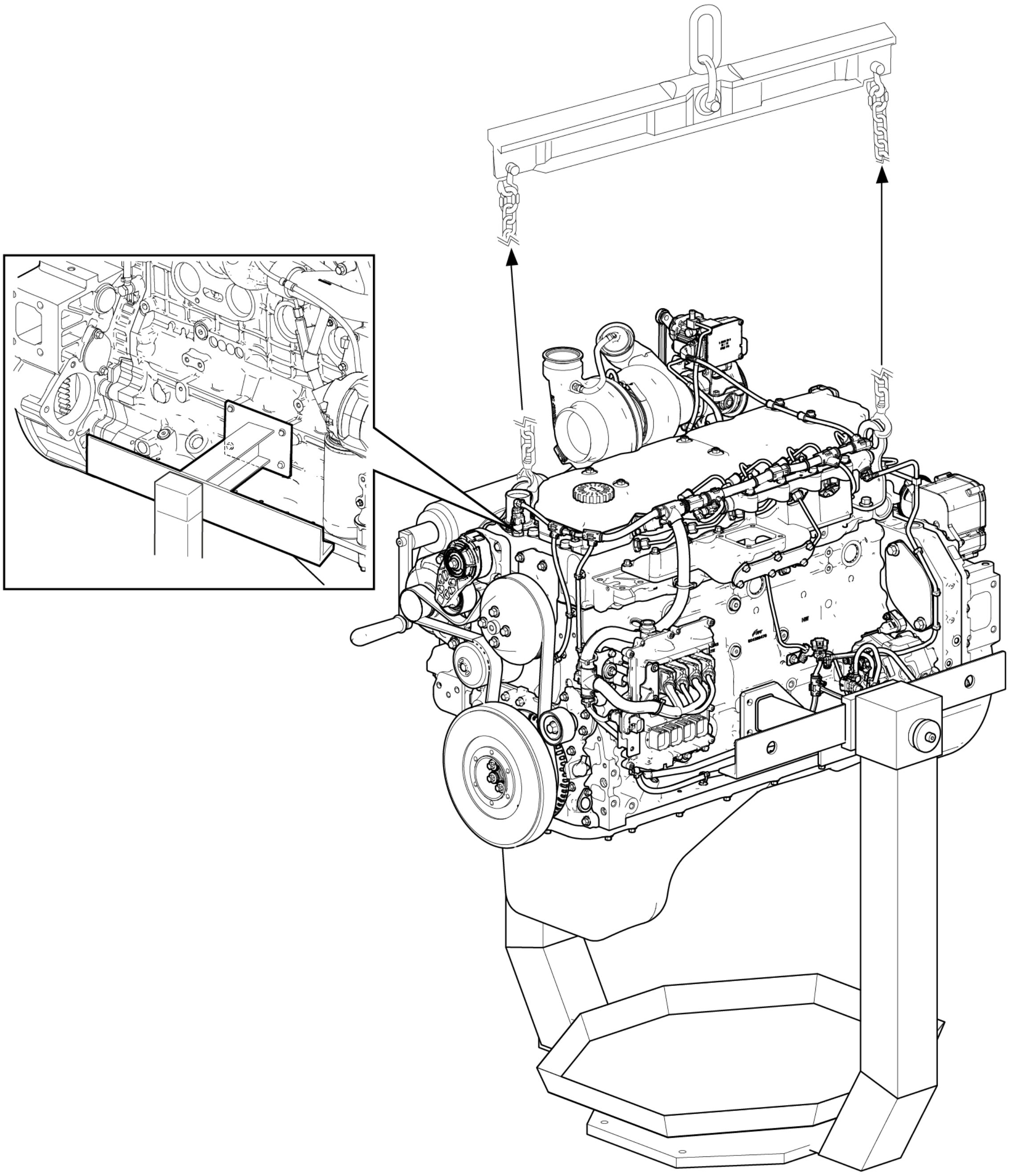


215015 3

11. Fit the brackets to the crankcase and use these to secure the engine to the rotating stand. Drain the engine oil by removing the plug from the sump.

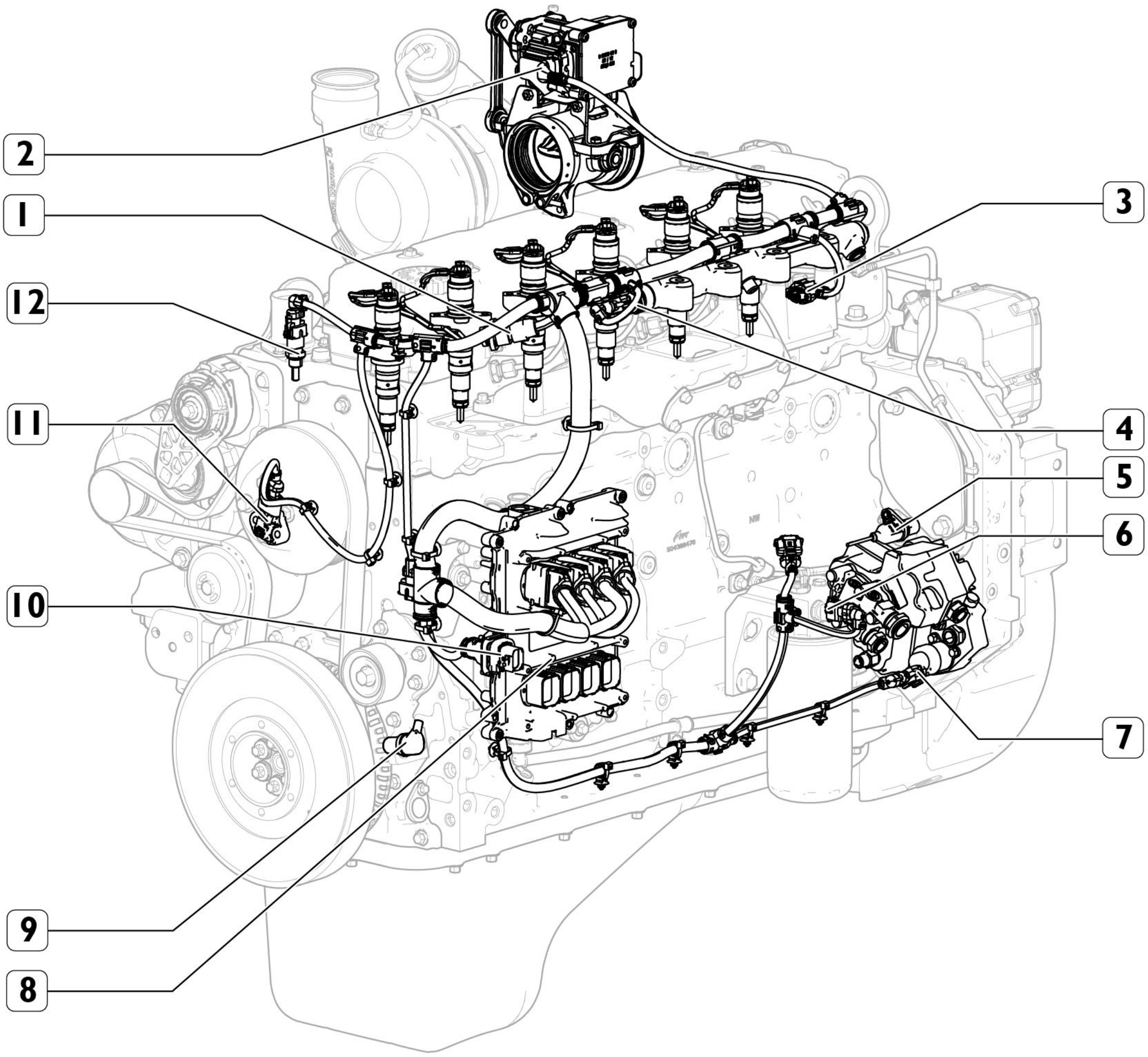
NOTICE: *Dispose of the oil according to applicable laws.*

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205



265938 4

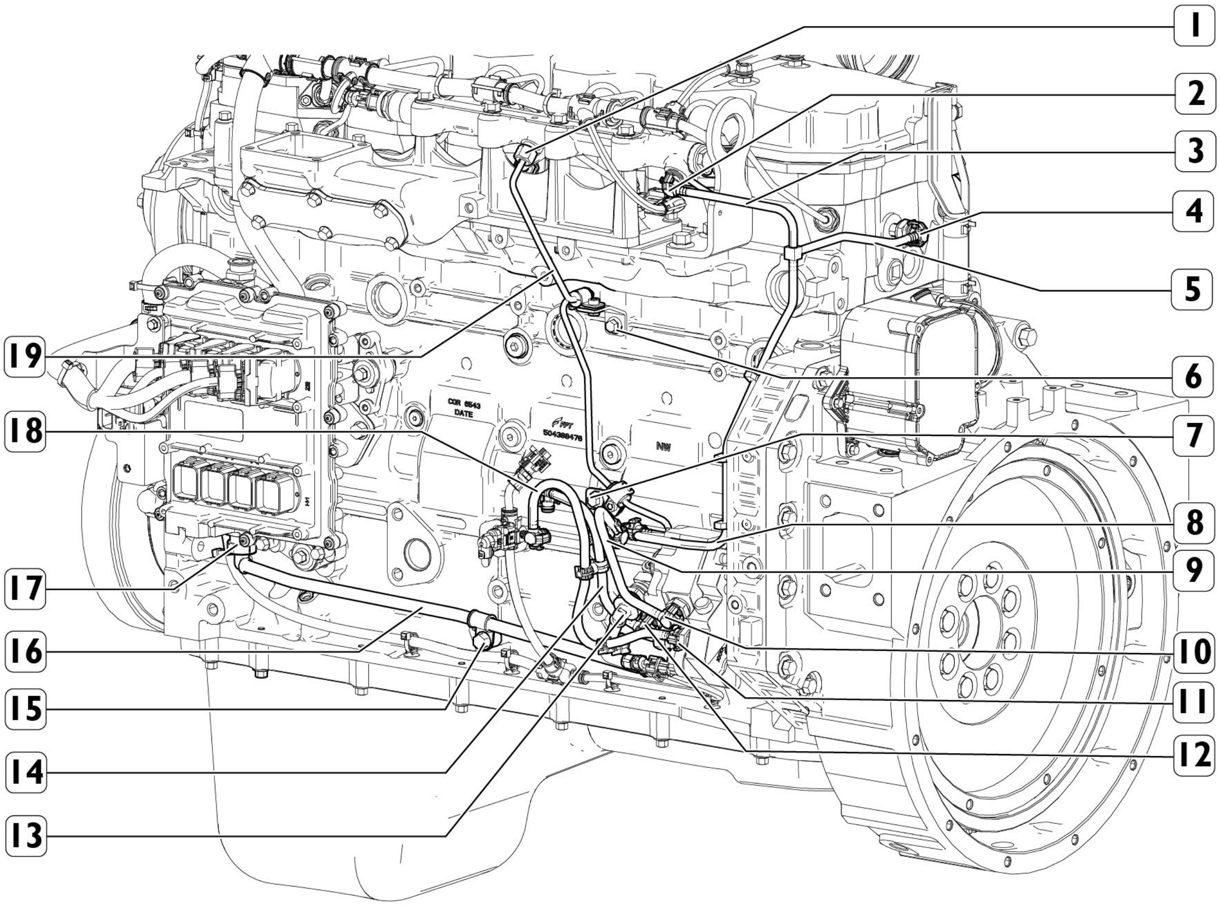
REMOVAL - INSTALLATION OF MAIN COMPONENTS



265939 5

(1) Injector connections - (2) Motorised throttle valve actuator connector (Exhaust valve) - (3) Boost pressure and air temperature sensor - (4) Rail pressure sensor - (5) Camshaft timing segment speed sensor - (6) Fuel temperature sensor - (7) Fuel high pressure pump dosing unit - (8) Engine control unit - (9) Crankshaft rpm incremental speed sensor - (10) On-line connector - (11) Engine oil temperature and pressure sensor - (12) Coolant temperature sensor

12. Remove the engine cable by unplugging it from the control unit **(8)**, from the motorised throttle valve actuator connector **(2)**, and from all the sensors and transmitters to which it is connected.
13. Open the clips fastening the engine cable to the crankcase and remove the cable.



265940 6

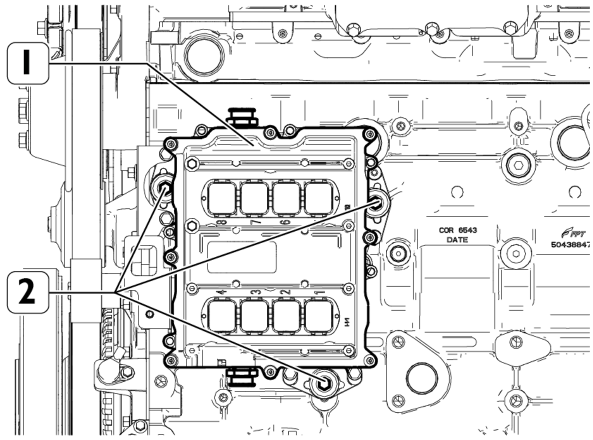
14. Position a suitable container to catch any fuel.
15. Disconnect the retainer **(11)** and remove the low-pressure fuel pipe **(18)** from the fuel filter to the high-pressure pump.
16. Disconnect the retainers **(13)** and **(17)**, unscrew the screw **(15)** and remove the low-pressure fuel pipe **(16)** from the engine control unit heat exchanger to the mechanical pump.
17. Disconnect the retainer **(12)** and remove the low-pressure fuel pipe **(14)** from the mechanical pump to the fuel filter.
18. Disconnect the retainer **(10)** and remove the fuel return pipe **(9)** from the high pressure pump to the fuel filter support.
19. Disconnect the retainers **(2)** and **(4)** and remove the fuel return pipes **(3)**, **(5)** and **(8)** from the common rail and electro-injectors to the fuel filter support.
20. Unscrew the hose couplings **(1)** of the high-pressure fuel pipe **(19)** from the high-pressure pump to the common rail;

21. Unscrew the screws **(6)** and **(7)** fastening the pipe **(19)** to the engine block and remove it.

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**

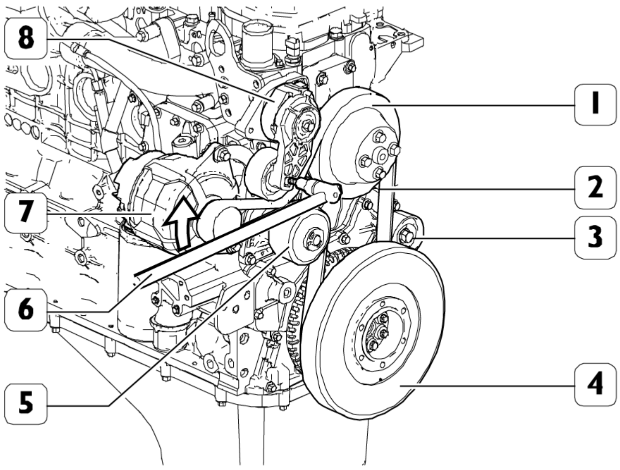
22. Position a suitable container to catch any fuel.
23. Disconnect the retainer and remove the low-pressure fuel pipe that connects the fuel pre-filter to the heat exchanger of the engine management control unit.
24. Unscrew the supporting screws **(2)** and remove the ECU **(1)** together with the heat exchanger.

Description	Step	Value
Engine Controller Module	3 screws M8 x 1.25 x 45	**14 N·m**



265941 7

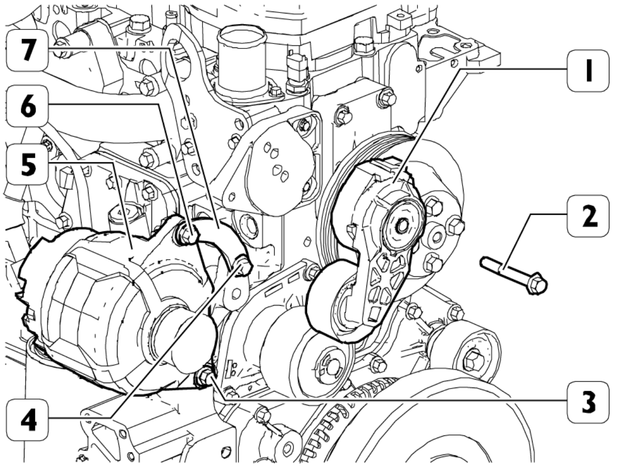
25. Remove the belt **(2)** by acting on the automatic belt tensioner **(8)** with the appropriate tool **(6)** from alternator **(7)**, water pump **(5)**, fan control pulley **(1)**, crankshaft pulley with damper **(4)** and fixed guide roller **(3)**.



215030 8

26. Unscrew the fastening screw **(2)** and remove the automatic belt tensioner **(1)**.
27. Unscrew the fastening screws **(3)**, **(4)** and **(6)** and remove the alternator **(5)** and its bracket **(7)**.

Description	Quantity	Step	Value
Automatic belt tensioner	1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Alternator		1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

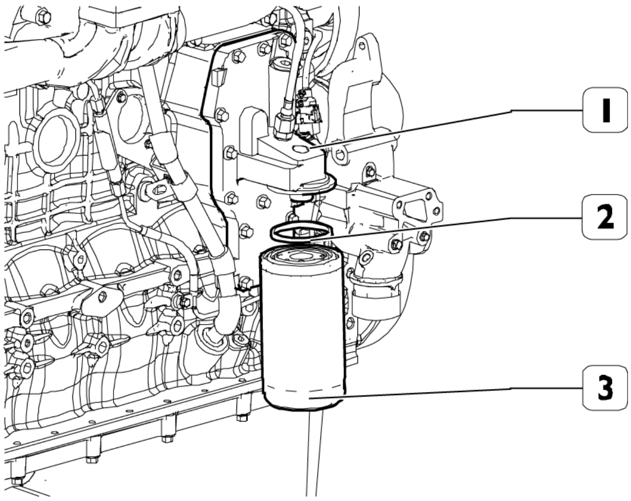


215031 9

28. Position a container to collect the used oil below the filter mount **(1)**.
29. Unscrew and remove the oil filter **(3)** from its relative support **(1)** using the tool.

Tool / Material	
Remover,cartridge filter	99360076

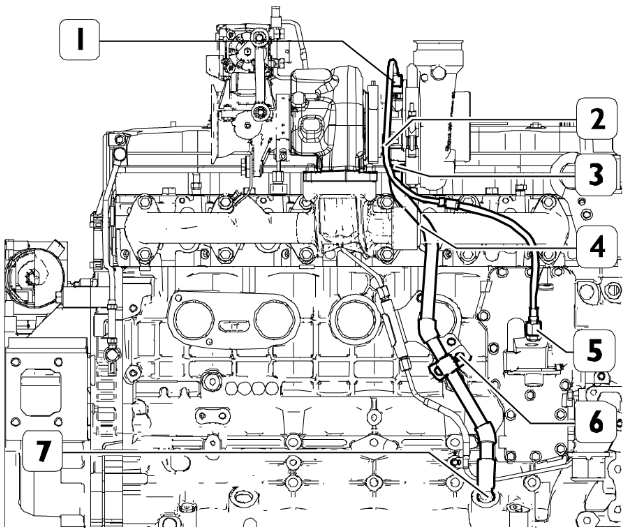
Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**



209220 10

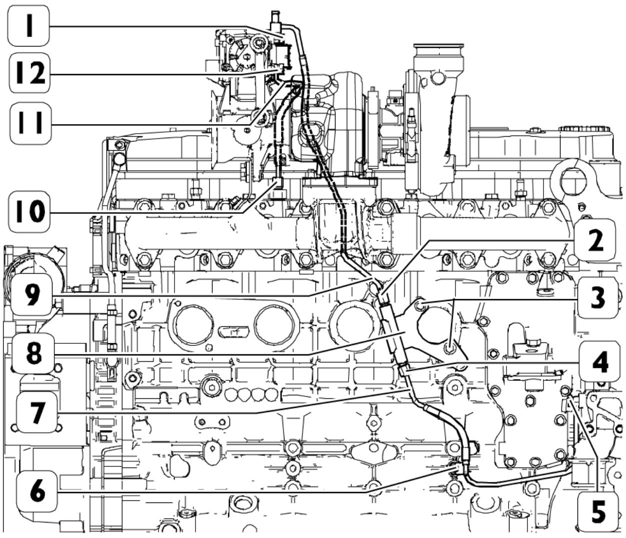
30. Position a suitable container to collect the oil.
31. Unscrew the hose couplings **(1)** and **(5)** and remove the lubricating oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger.
32. Remove the lubricant oil drain pipe **(4)** from the turbocharger, proceeding as follows:
33. unscrew the mounting screws **(3)** on the lower part of the turbocharger, recovering the relative gasket.
34. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
35. unscrew the coupling **(7)** from the crankcase.

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**



215034 11

36. Position a suitable container to collect the coolant.
37. Remove the motorised throttle valve water inlet and outlet pipe proceeding as follows, unscrewing the fastening nut **(2)** and the fitting **(1)** and remove the top part of the water return pipe **(9)**.
38. Unscrew the fastening nut **(4)**, the connector **(5)** and the screw **(6)** and remove the lower section water return pipe **(7)**.
39. Unscrew the fastening screws **(3)** and remove the water return pipe union **(8)**.
40. Unscrew the fastening nut **(10)** and the connector **(12)** and remove the water delivery pipe **(11)**.

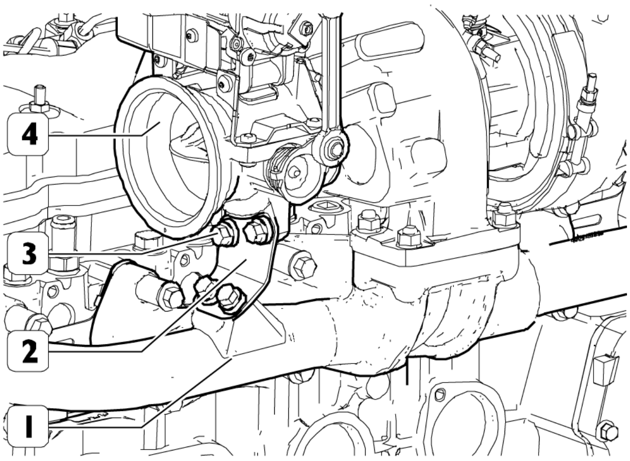


215035 12

Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**

41. Unscrew the fastening screws **(3)** and remove the bracket **(2)** fixing the motorized throttle valve **(4)** to the exhaust manifold **(1)**.

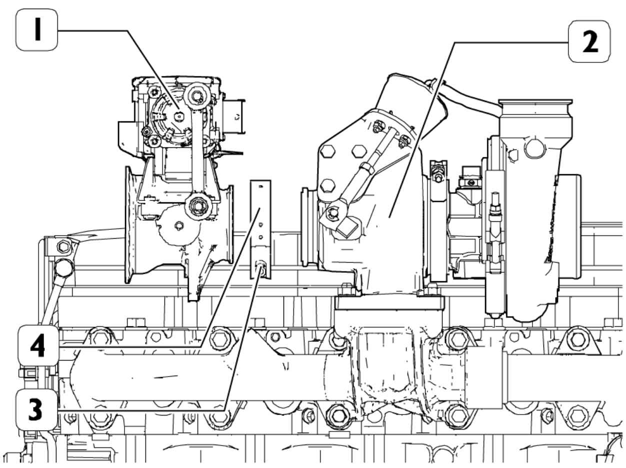
Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	**25 N·m**



215026 13

42. Unscrew the screw **(3)** and loosen the V-clamping collar **(4)** to remove the motorized throttle valve **(1)** from the turbocharger **(2)**.

Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**

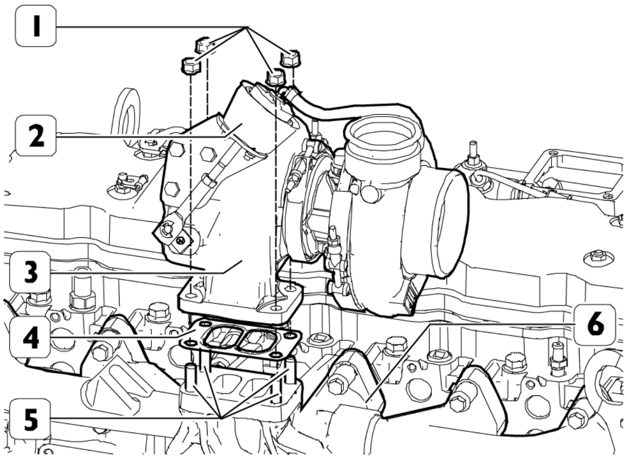


215022 14

43. Unscrew the fastening nuts **(1)** and remove the turbocharger **(3)** together with the waste-gate valve **(2)**, recovering the relevant gasket **(4)**.

44. Unscrew the studs **(5)** from the exhaust manifold **(6)**.

Description	Step	Value
Turbo charger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



214768 15

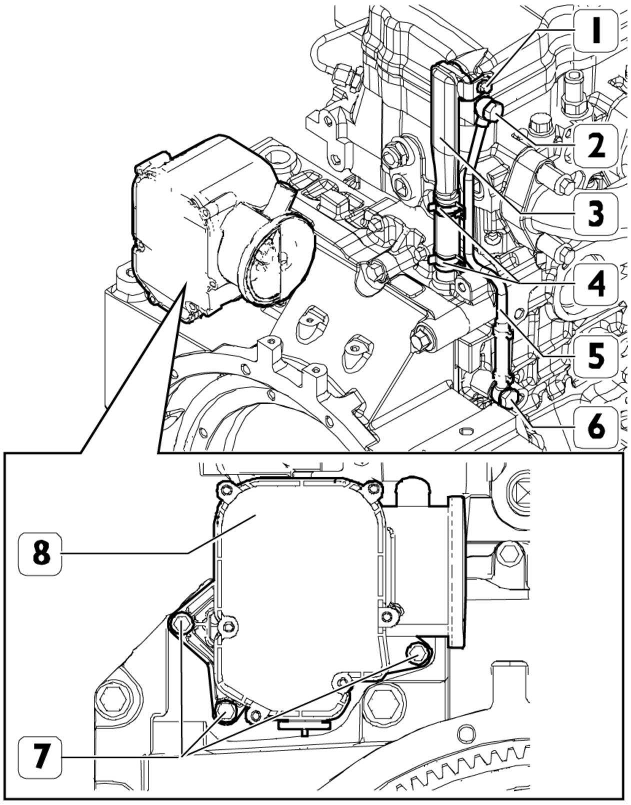
45. Position a suitable container to collect the oil.

46. Unscrew the fastening screw **(1)**, loosen the retaining clamps **(4)** and remove the blow-by breather pipe **(3)**.

47. Unscrew the connectors **(2)** and **(6)** and remove the oil return pipe **(5)**.

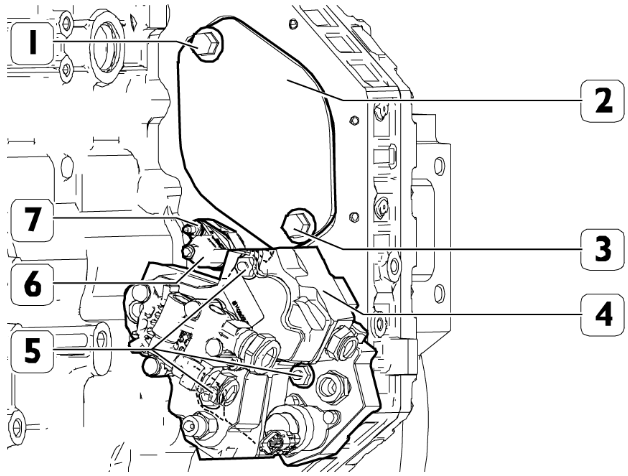
48. Unscrew the fastening screws **(7)** and remove the blow-by filter **(8)**.

Description	Quantity	Value
Blow-by breather plate	1 screw M6 x 1	**10 +/- 2 N·m**
Blow-by breather pipe	2 fittings M12 x 1.5	**20 +/- 4 N·m**
Blow-by filter	3 screws M6 x 1	**10 +/- 2 N·m**



212828 16

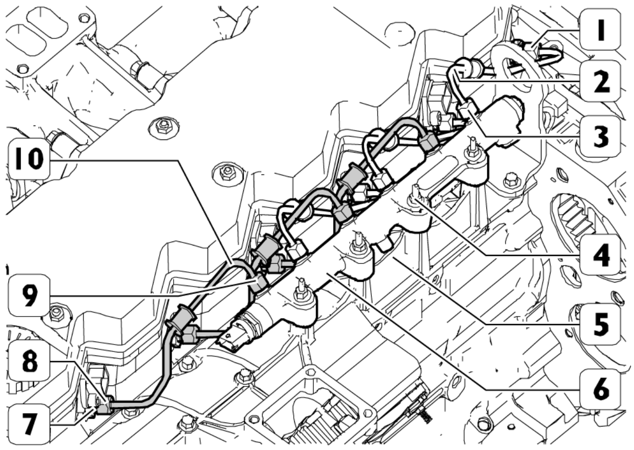
49. Unscrew the fastening screws **(1)** and **(3)** and remove the cover **(2)**, recovering the gasket.
50. If present, remove the flange and the gear of the power take-off **(PTO)**.
51. Unscrew the fastening nut **(7)** and remove the camshaft timing segment speed sensor **(6)**.
52. Make sure that the high-pressure fuel pump **(4)** is suitably supported.
53. Unscrew the fastening nuts **(5)** and remove the high-pressure pump **(4)** complete with the mechanical pump, the flange and the gear.
54. Unscrew the studs **(5)**.



212829 17

Description	Quantity	Step	Value
Power take-off cover	2 screws M12x1.75x25		**80 +/- 5 N·m**
High-pressure pump		3 nuts M8x8	**24 +/- 4 N·m**
		3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**
Camshaft timing sensor	1 nut with stud M6 x 1		**12 N·m**

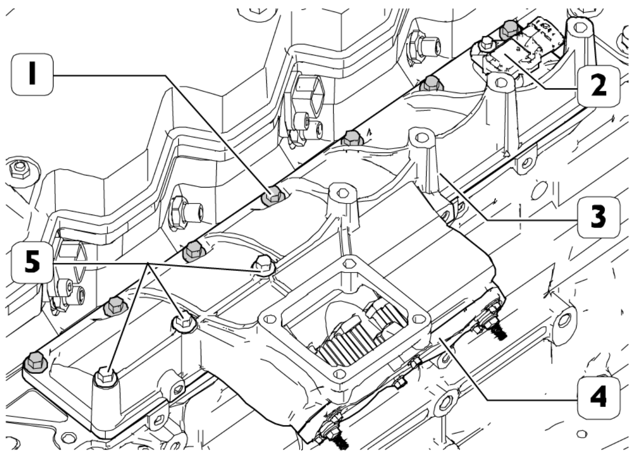
55. Unscrew the hose couplings **(1)**, **(3)**, **(8)** and **(9)** from the common rail **(6)** and the injector manifolds **(7)** and remove the high-pressure fuel delivery pipes **(2)** and **(10)**.
56. Screw the dual threaded shank screws **(4)** and remove the common rail **(6)** from the intake manifold **(5)**.



212830 18

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screwsM8x1.25x125		**36 +/- 5 N·m**

57. Unscrew the screws **(1)** and **(5)** and remove the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)**.

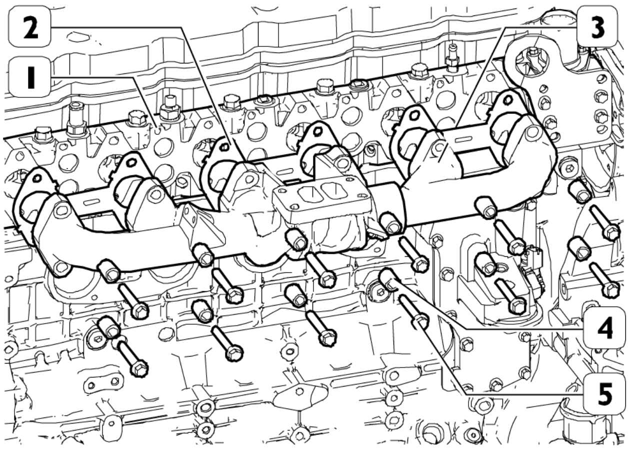


212831 19

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**

58. Unscrew the screws **(5)** together with the spacers **(4)** and remove the exhaust manifold **(3)** together with the relative gaskets **(2)** from the cylinder head **(1)**.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**

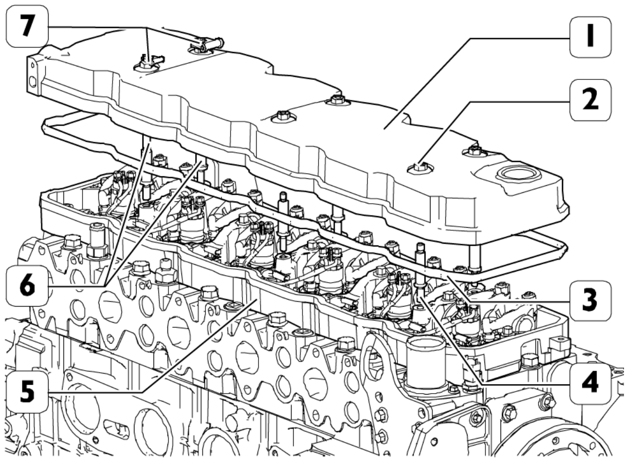


214769 20

59. Unscrew the fastening nuts **(2)** and **(7)** and remove the tappet cover **(1)** from the wiring support **(5)**, retrieving the relative gasket **(3)**.

60. Unscrew the threaded double-shank screws **(4)** and **(6)** from the wiring support **(5)**.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**

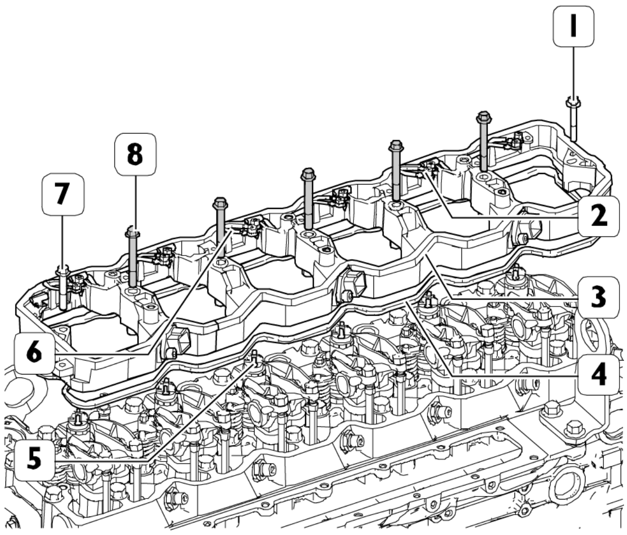


212832 21

61. Remove the nuts **(2)** and disconnect the electrical cables **(6)** from the electro-injectors **(5)**.

62. Unscrew the screws **(1)**, **(7)** and **(8)** and remove the electro-injector wiring support **(3)** complete with gasket **(4)**.

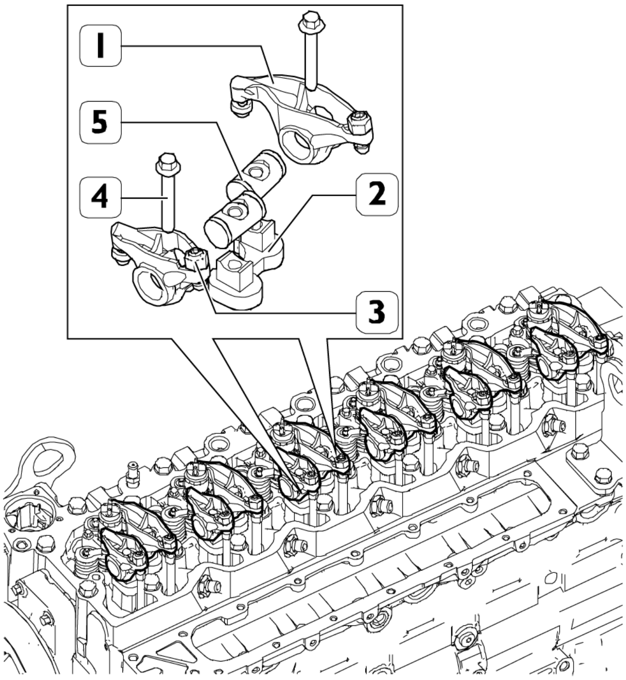
Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**



212833 22

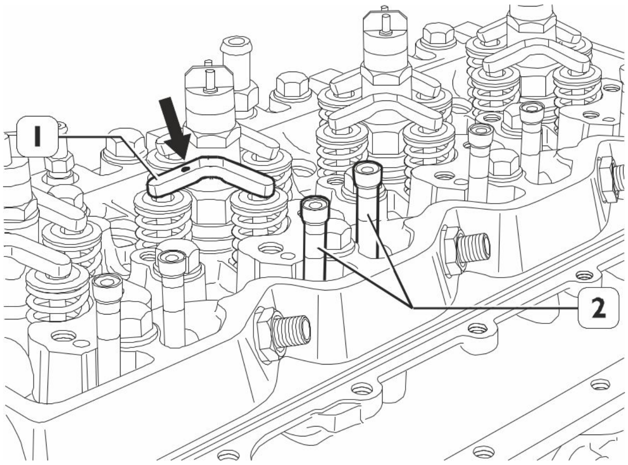
63. Loosen the tappet adjuster retaining nuts **(3)** and unscrew the tappet adjuster screws.
64. Unscrew the fastening screws **(4)** and remove the rocker unit from the cylinder head, including support **(2)**, rockers **(1)** and shafts **(5)**.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 23

65. Remove the bridges **(1)** from the valves and the push rods **(2)** from the cylinder head and crankcase.

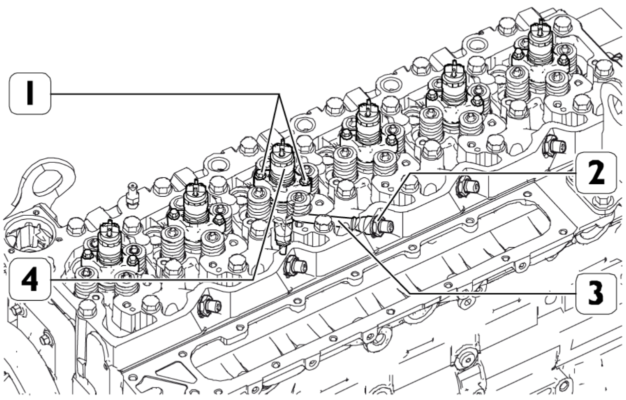


70345 24

66. Unscrew the fastening nuts **(2)** and remove the fuel manifolds **(3)**.
67. Unscrew the electro-injector **(1)** fastening screws **(4)**.

NOTE: *Disassembled fuel manifolds* ***(2)*** *must not be used again, but replaced with new ones.*

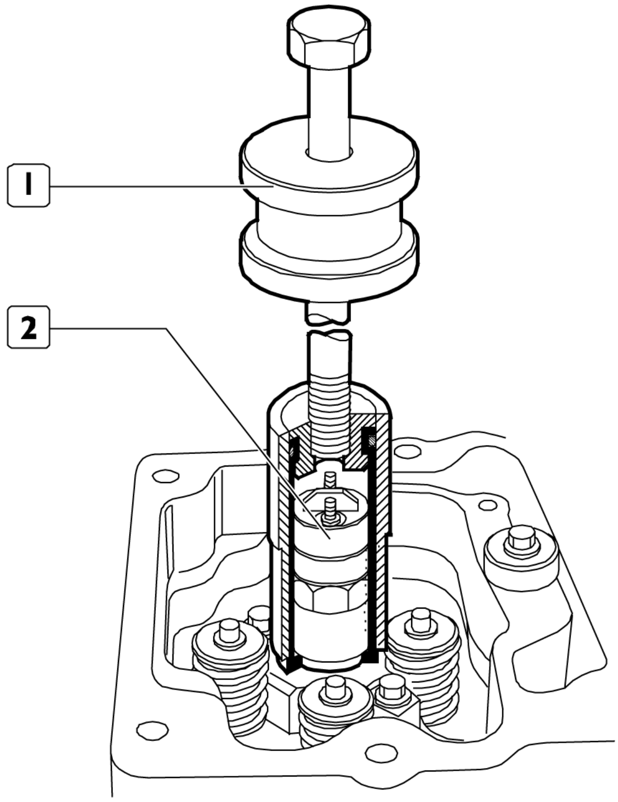
Description	Quantity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Phase 3 Angle tightening	**25°**
		Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**



212835 25

68. Remove injector fastening screws and use the tool **(1)** to remove the injectors **(2)** from the cylinder head.

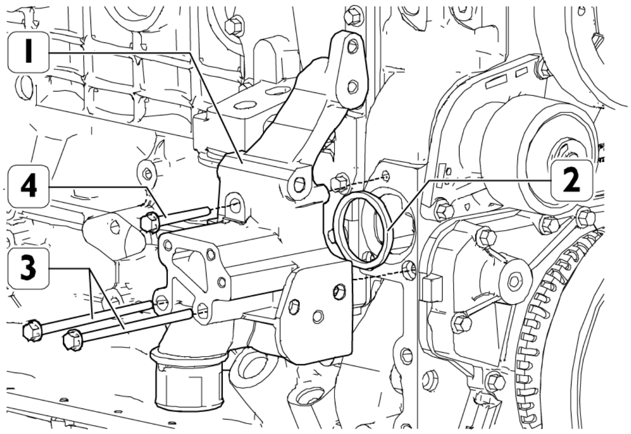
Tool / Material	
Tool to remove injectors	99342101



181861 26

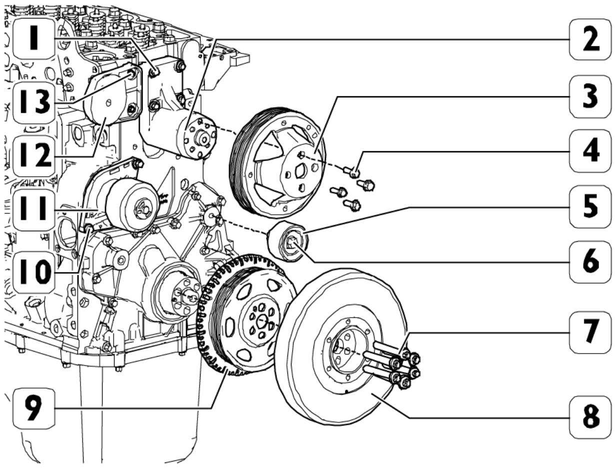
69. Unscrew the fastening screws **(3)** and **(4)** and remove the engine coolant inlet **(1)**, recovering the gasket **(2)**.

Description	Step	Value
Engine coolant inlet	2 screws M10x1.5x130	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212836 27

70. Unscrew the fastening screws **(4)** and remove the fan control pulley **(3)**.
71. Unscrew the fastening screws **(1)** and remove the fan pulley mount **(2)**.
72. Unscrew the fastening screw **(13)** and remove the automatic belt tensioner mount **(12)**.
73. Unscrew the fastening screws **(6)** and remove the idler pulley **(5)**.
74. Unscrew the fastening screws **(7)** and remove the damper pulley **(8)** together with the crankshaft pulley **(9)**.
75. Unscrew the fastening screws **(10)** and remove the water pump **(11)**.



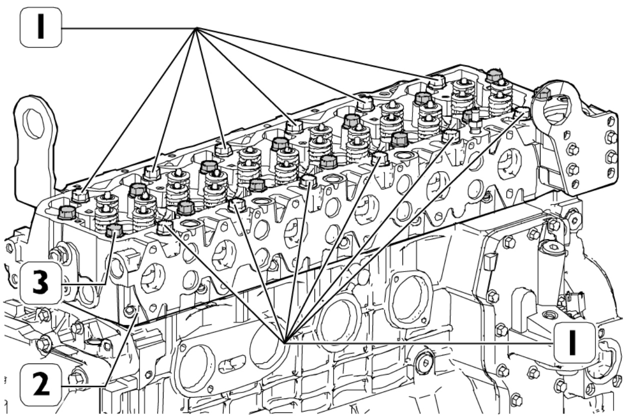
28

NOTE: *The flywheel blocking device can aid the removal of the damper pulley **(8)** fitted onto the crankshaft pulley **(9)**.*

Description	Quantity	Step	Value
Fan pulley mount	4 screwsM8 x 1.25 x 45		**24 +/- 4 N·m**
Fan control pulley	4 screwsM10 x 1.25		**68 +/- 7 N·m**
Idler pulley	1 screw M10 x 1.5		**43 +/- 6 N·m**
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
Water pump	2 screws M8 x 1.25 x 35		**24 +/- 4 N·m**
Automatic belt tensioner support	2 screws M8 x 1.25 x 30		**24 +/- 4 N·m**

76. Unscrew the screws **(1)** and **(3)** fixing the cylinder head **(2)** to the crankcase.

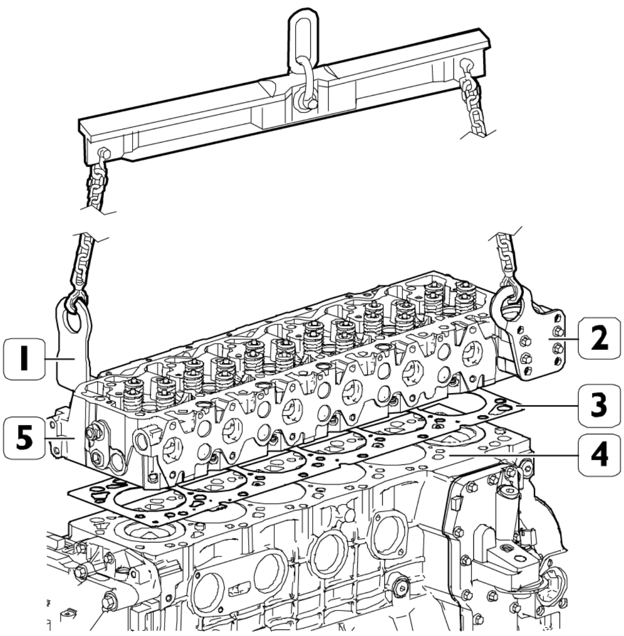
Description	Quantity	Step	Value
Cylinder head	12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**



212838 29

77. Use suitable lifting hooks **(1)** and **(2)** in order to lift and remove the cylinder head **(5)** together with the gasket **(3)** from the engine block **(4)** by using a hoist with the tool.

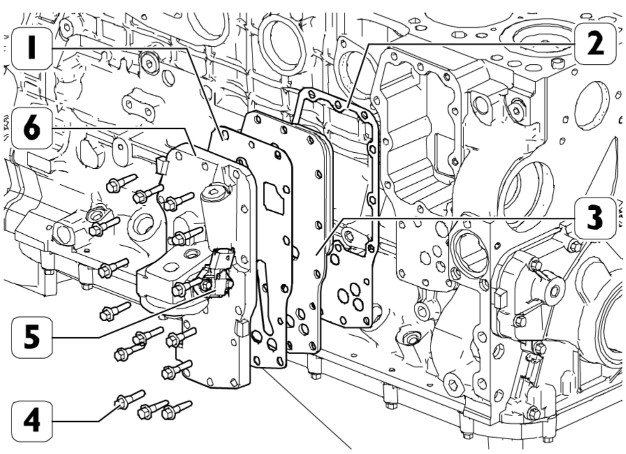
Tool / Material	
Rocking sling for removing/installing engine	99360595



212839 30

78. Unscrew the fastening screws **(4)** and remove the oil filter / heat exchanger together with oil pressure and temperature sensor **(5)**, including the oil filter support **(6)**, heat exchanger plate **(3)** and the relative gaskets **(1)** and **(2)**.

Description	Quantity	Value
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35	**26 +/- 4 N·m**

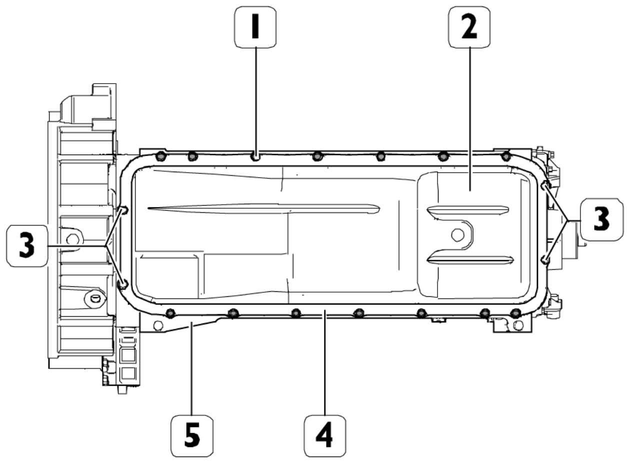


212840 31

79. Overturn the engine.

80. Unscrew the fastening screws **(1)** and **(3)** and remove the oil sump **(2)** from the crankcase **(5)**, recovering the relevant gasket **(4)**.

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screwsM8 x 1.25 x 45	**27 – 30 N·m**



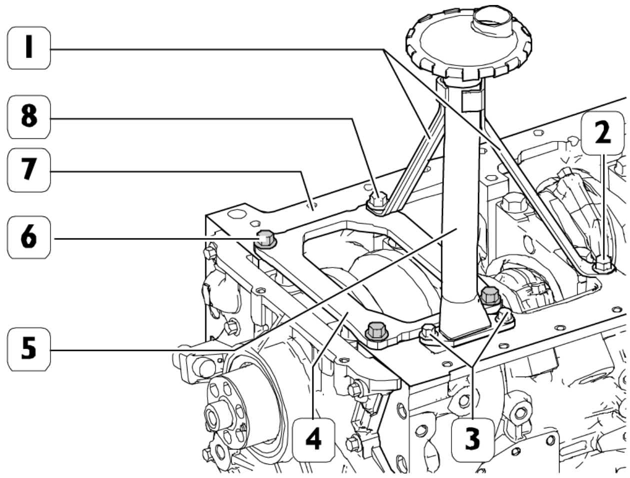
212841 32

81. Unscrew the fastening screws **(2)** and **(8)** and remove the oil suction strainer pipe brackets **(1)**.

82. Unscrew the fastening screws **(3)** and remove the oil suction strainer pipe **(5)** recovering the relevant gasket from the crankcase **(7)**.

83. Unscrew the fastening screws **(6)** and remove the stiffening plate **(4)** from the crankcase **(7)**.

Description	Quantity	Step	Value
Suction strainer retainer		2 screws M8 X 20	**25 N·m**
		2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe	2 screws M8 x 20		**25 +/- 2,5 N·m**
Crankcase stiffening plate	4 screwsM10x1.5x25		**43 +/- 5 N·m**

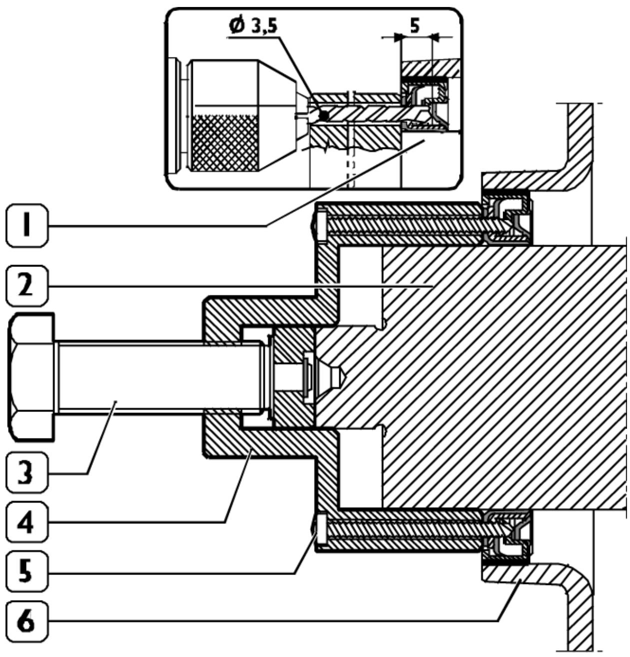


212842 33

84. Take out the crankshaft seal ring from the front cover.

85. Apply the special tool **(4)** to the front crankshaft tang **(2)** and through the tool guiding holes, drill the internal seal ring **(1)** with a drill (ø **3,5 mm**) to a depth of **5 mm**.

Tool / Material	
Tool to remove crankshaft front gasket	99340055



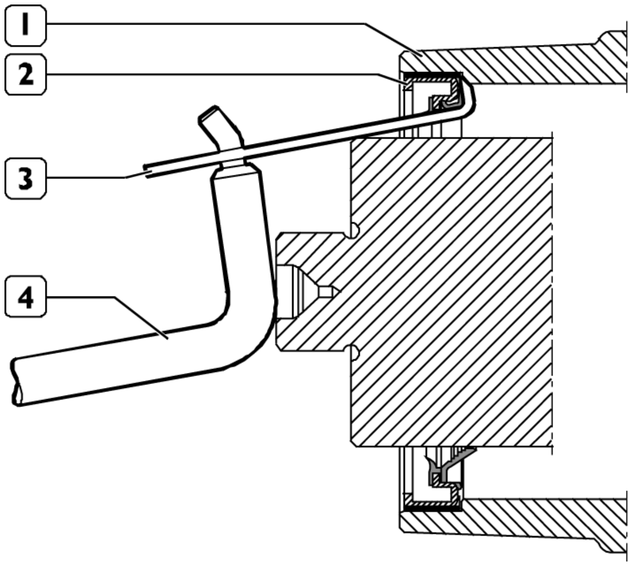
00900T 34

86. Secure the tool to the ring screwing in the 6 screws supplied.

87. Then extract the ring **(1)** by screwing in the screw **(3)**.

88. Fit the appropriate tie-rod **(3)** of the tool onto the external seal **(2)** and using the lever **(4)**, extract it from the front cover **(1)**.

Tool / Material	
Tool for removing gaskets	99363204

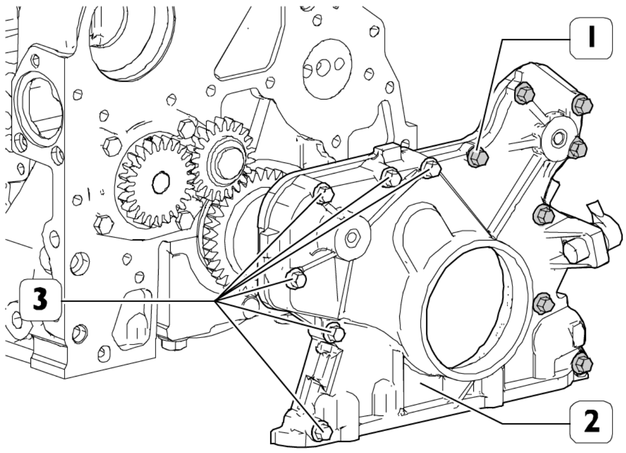


00904T 35

89. Unscrew the fastening screws **(1)** and **(3)** and remove the front cover **(2)** together with the crankshaft rpm increment speed sensor.

NOTE: *Take note of the assembly position of screw* ***(1)*** *and* ***(3)****, since the screws have different length.*

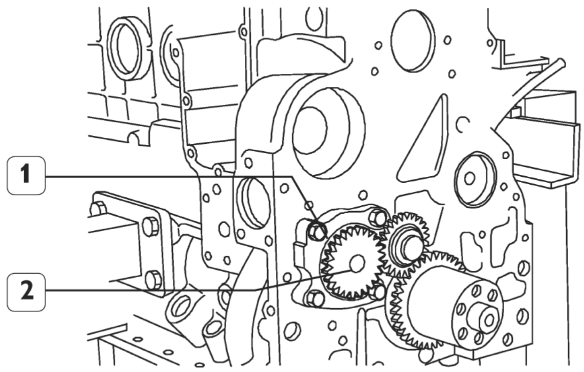
Description	Step	Value
Front gear case	7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
	6 screws M8 x 1.25	**24 +/- 4 N·m**



212843 36

90. Remove the screws **(1)** and disconnect the oil pump **(2)**.

Description	Quantity	Step	Value
Oil pump	4 screwsM8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
		Phase 2 Tighten	**24 +/- 4 N·m**

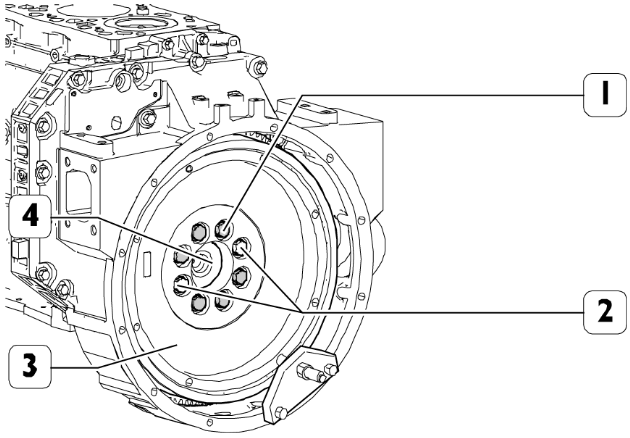


75811 37

91. Apply the tool on the flywheel housing in block the engine flywheel **(3)** rotation.

Tool / Material	
Flywheel restrainer	99360351

92. Unscrew the two opposite **(2)** screws fixing the engine flywheel **(3)** to the crankshaft **(4)**.
93. Introduce two withdrawal pins in the ports (see the following picture).
94. Rotate the engine vertically (with the flywheel at the top) acting on the crank of the rotating support.
95. Loosen the remaining screws **(1)** fixing the engine flywheel **(3)** to the crankshaft **(4)** and remove the flywheel blocking tool.



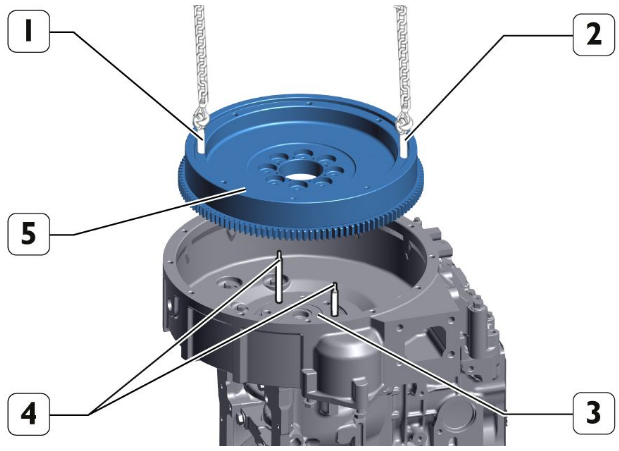
212844 38

Tool / Material	
Flywheel restrainer	99360351

Description	Quantity	Step	Value
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
		Phase 2 Angle tightening	**60°**

96. Screw in two medium length screws in the ports **(2)** to sling the engine flywheel **(3)**.
97. Rotate the engine again horizontally (main bearing caps facing down) using the crank of the rotating support
98. Through the two guide pins **(4)** that were previously screwed into the crankshaft ports **(1)**, control the extraction of the flywheel **(3)** by means of a hoist with a tool.

Tool / Material	
Rocking sling for removing/installing engine	99360595



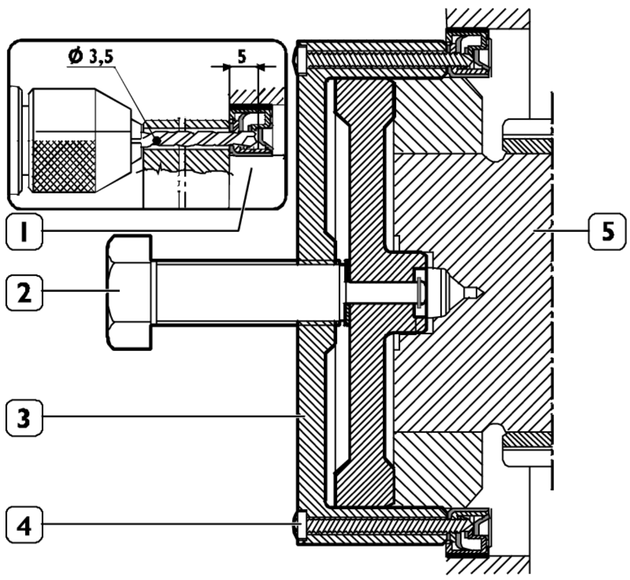
249902 39

99. Extract the flywheel housing seal ring by fitting the tool **(3)** on the rear shank **(5)** of the crankshaft.

Tool / Material	
Tool to remove crankshaft rear gasket	99340056

100. Through the guiding holes of the tool itself, drill the internal seal ring with a bit (Ø 3.5 mm) to a depth of 5 mm.
101. Fix tool 99340056 **(3)** to the ring **(1)** by screwing in the 6 screws (4) provided.
102. Then extract the ring **(1)** by screwing in the screw **(2)**.
103. Fit the appropriate tie-rod of the tool onto the flywheel housing external seal and extract it using the lever

Tool / Material	
Tool for removing gaskets	99363204

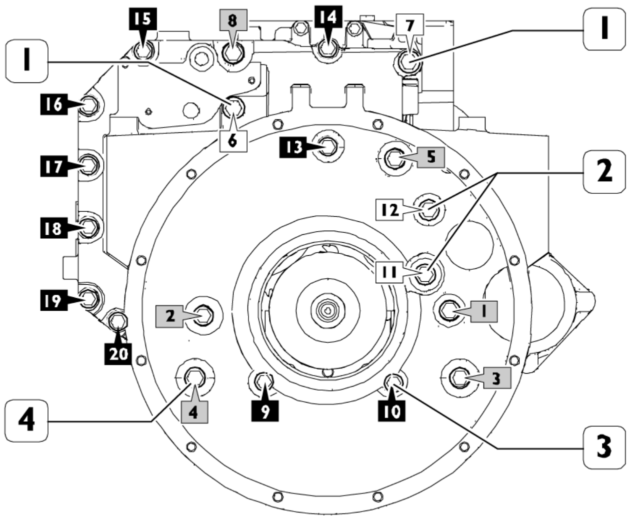


00903T 40

104. Unscrew the fastening screws **(1)**, **(2)**, **(3)** and **(4)** and remove the flywheel housing.

NOTE: *Note down the installation positions of the screws since they are of different sizes.*

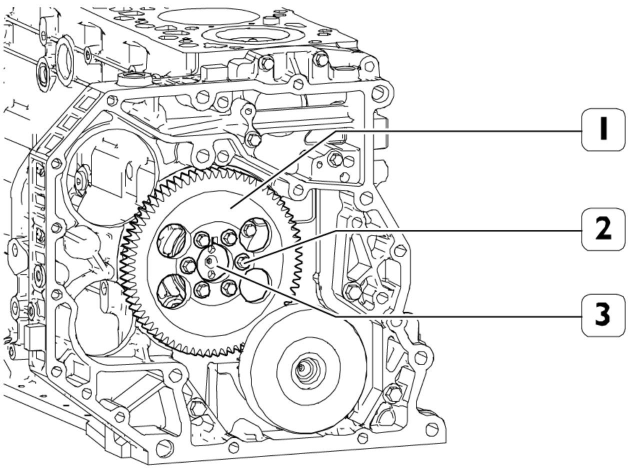
Description	Step	Value
Engine flywheel housing	8 screws M12 x 1.75	**85 +/- 10 N·m**
	12 screws M10 x 1.5	**49 +/- 5 N·m**
	2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**



212846 41

105. Unscrew the fastening screws **(2)** and remove the timing gear **(1)** from the camshaft.

Description	Quantity	Value
Camshaft gear	6 screws M8 x 1.25	**36 +/- 2 N·m**

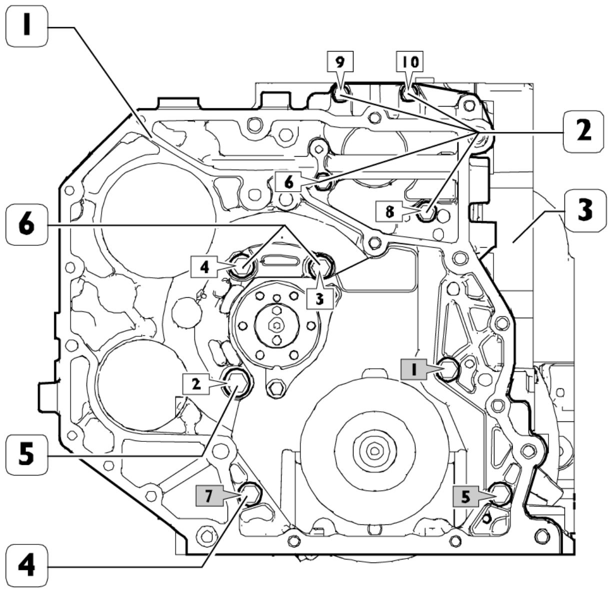


212847 42

106. Unscrew the fastening screws **(2)**, **(4)**, **(5)** and **(6)** and remove the timing gear case **(1)** from the crankcase **(3)**.

NOTE: *Note down the installation positions of the screws since they are of different sizes.*

Description	Step	Value
Rear gear case	1 screw M12 x 1.75	**77 +/- 12 N·m**
	4 screwsM8 x 1.25	**24 +/- 4 N·m**
	5 screws M10 x 1.5	**47 +/- 5 N·m**



212849 43

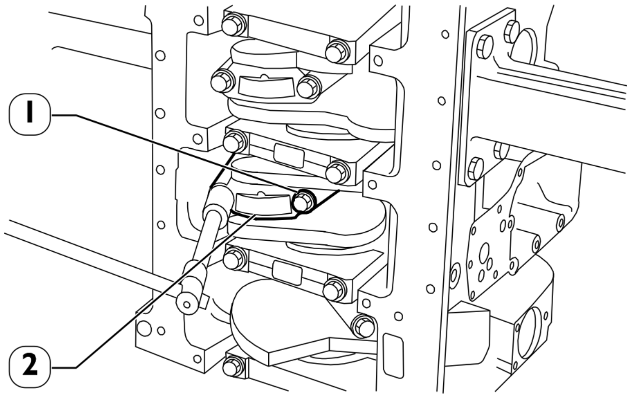
REMOVING THE ENGINE CRANKCASE AT THE BENCH

107. Remove the fastening screws **(1)** from the connecting rod caps **(2)** and remove them.

108. 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.*

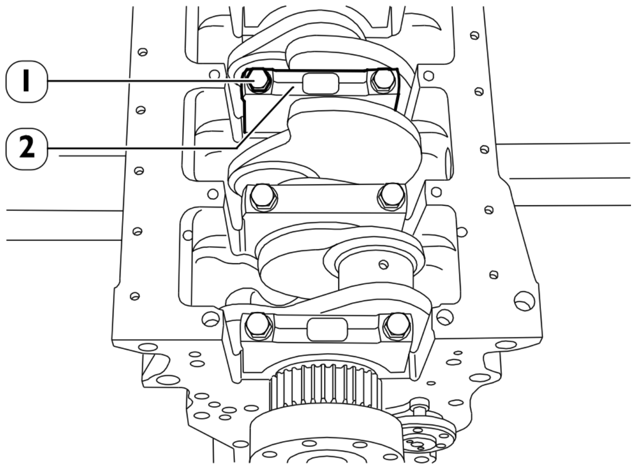
Description	Quantity	Step	Value
Connecting rod caps	12 screws M10x1.25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**



70158 44

109. Remove the screws **(1)** and disassemble the main bearing caps **(2)**.

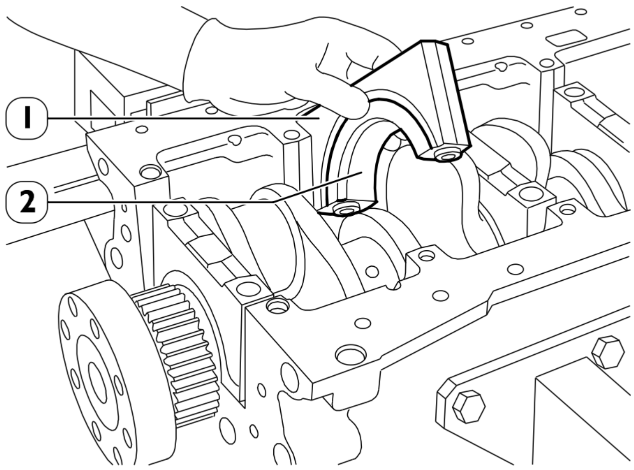
Description	Quantity	Step	Value
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**



70159 45

110. The second last main bearing cap **(1)** and the relevant support are fitted with shoulder half-bearing **(2)**.

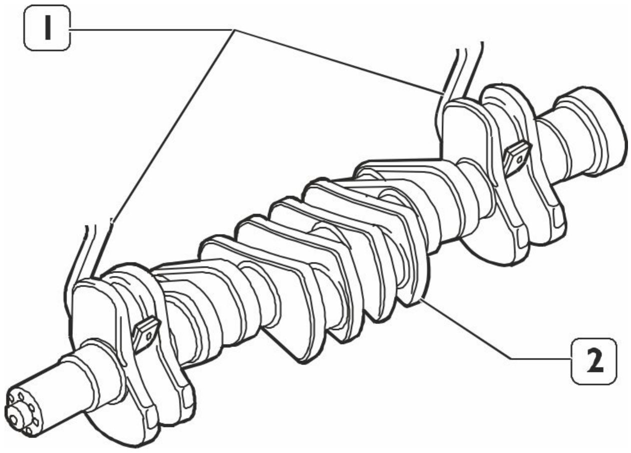
NOTE: *Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.*



70160 46

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

Tool / Material	
Crankshaft lifting tackle	99360500

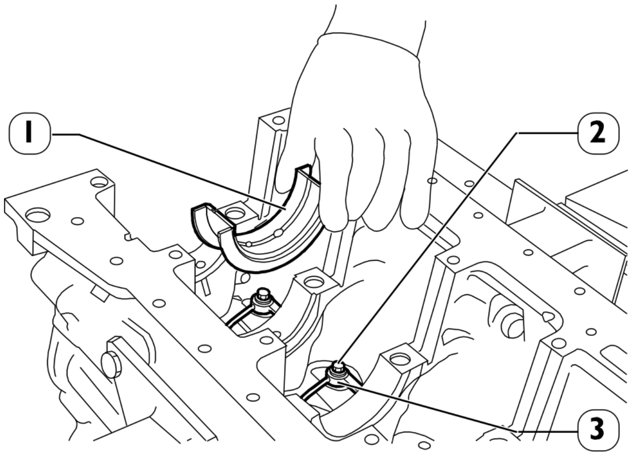


74774 47

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

113. Remove the screws **(2)** and disassemble the oil injectors **(3)**.

Description	Quantity	Value
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20	**15 +/- 3 N·m**

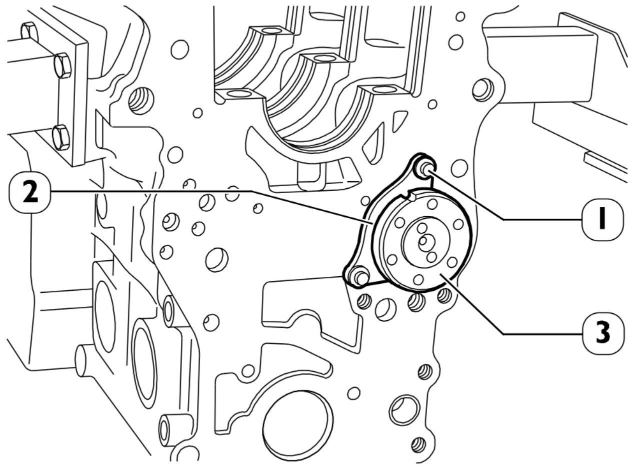


70162 48

114. Remove the screws **(1)** and disassemble the camshaft **(3)** retaining plate **(2)**.

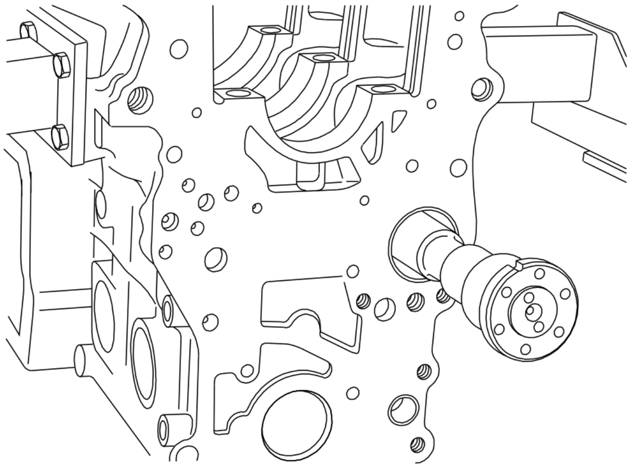
NOTE: *Take note of the plate assembly position* ***(2)****.*

Description	Quantity	Value
Camshaft longitudinal retaining plate	2 screws M8 x 1.25	**24 +/- 4 N·m**



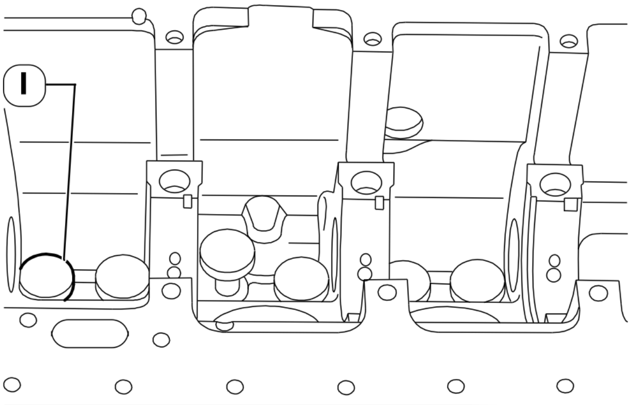
70163 49

115. Carefully withdraw the camshaft **(1)** from the crankcase.



70164 50

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



70165 51

540110 ENGINE - Disassemble

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Camshaft longitudinal retaining plate	2 screws M8 x 1.25		**24 +/- 4 N·m**
Connecting rod caps	12 screws M10x1.25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20		**15 +/- 3 N·m**
Throttle valve water pipe		1 connection M10 x 1	**20 +/- 2 N·m**
		1 fitting M12 x 1.5	**45 +/- 5 N·m**

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205
Brackets fixing engine to revolving stand 99322205	99361037
Crankshaft lifting tackle	99360500
Flywheel restrainer	99360351
Remover,cartridge filter	99360076
Rocking sling for removing/installing engine	99360595
Tool for removing gaskets	99363204
Tool to remove crankshaft front gasket	99340055
Tool to remove crankshaft rear gasket	99340056
Tool to remove injectors	99342101

The following description refers to the general mechanical overhaul operations starting with the engine removed from the vehicle.

NOTE: *Please refer to the specific publication for indications on removing the engine from the vehicle. Engine removal and general mechanical overhaul operations must be performed by qualified personnel with the specific tools.*

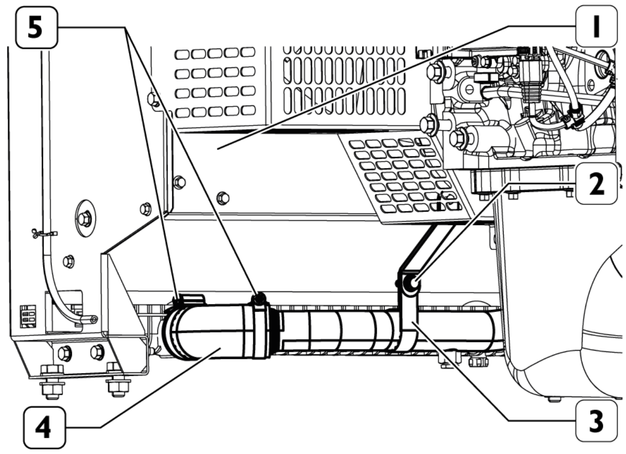
This Section includes:

1. the operations to be carried out to fit the engine onto the rotating stand,
2. the sequence of removal operations of the main components,
3. the actual overhaul of the crankcase and the cylinder head,
4. the sequence of installation operations of the main components,
5. the engine completion operations after having removed it from the rotating stand,
6. final checks and verifications.

DISASSEMBLY OF THE RADIATOR UNIT ON

1. Position a suitable container under the pipe **(4)** to recover the coolant. Disconnect the pipe **(4)** acting on the relative collars **(5)**.
2. Undo the screw **(2)**.

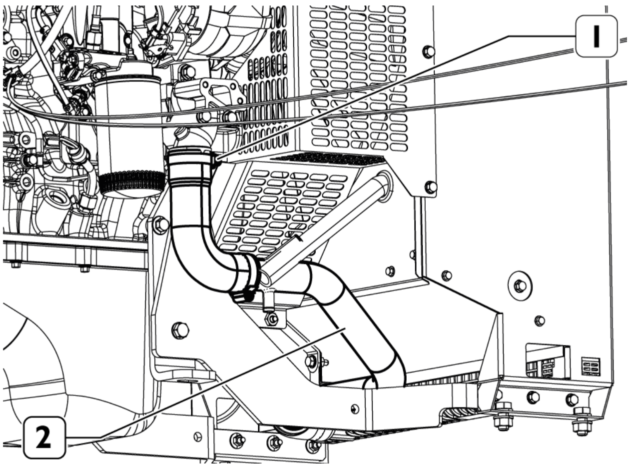
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267999 1

3. Unscrew the screw **(1)** of the V-collar.
4. Remove the pipe **(2)**.

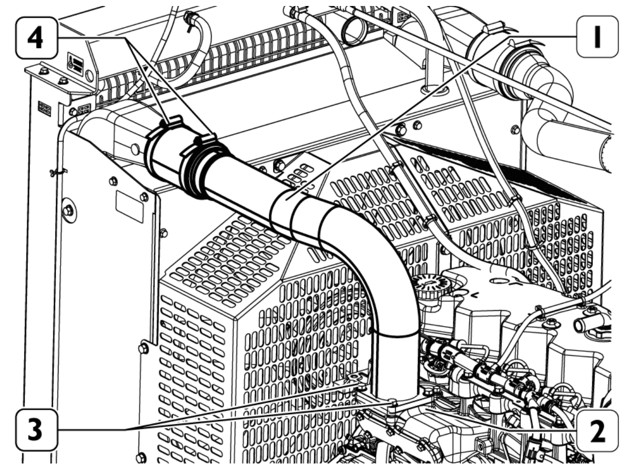
Description	Quantity	Value
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267998 2

5. Disconnect the pipe **(1)** acting on the relative clamps **(4)**.
6. Unscrew the screws **(3)** and remove the pipe **(1)** from the intake manifold **(2)**.

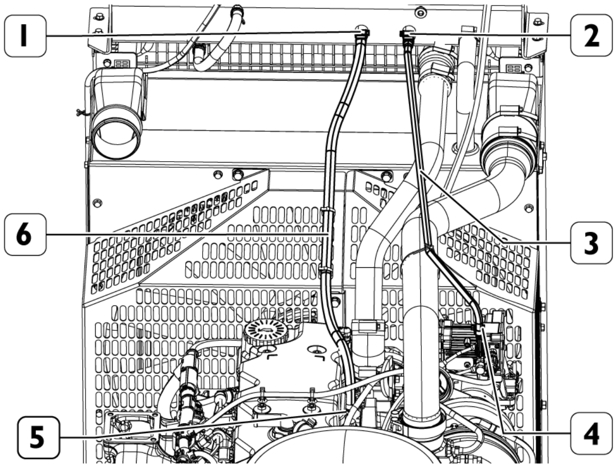
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



268000 3

7. Unscrew the screws on the collars **(1)** and **(5)**.
8. Disconnect the water pipe **(6)** from the radiator unit.
9. Unscrew the screws on the collars **(2)** and **(4)**.
10. Disconnect the water pipe **(3)** from the radiator unit.

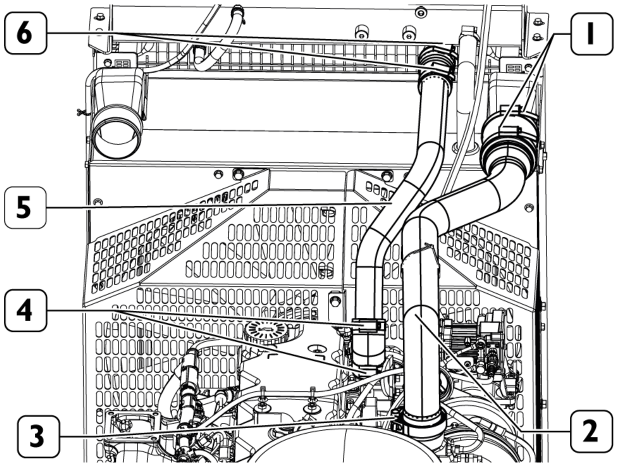
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267994 4

11. Unscrew the screws on the collars **(6)** and **(4)**.
12. Disconnect and remove the water outlet pipe **(5)** from the thermostat.
13. Unscrew the screws on the collar **(1)** and unscrew the screw **(3)** of the V-collar.
14. Disconnect and remove the air inlet pipe **(2)** to the radiator.

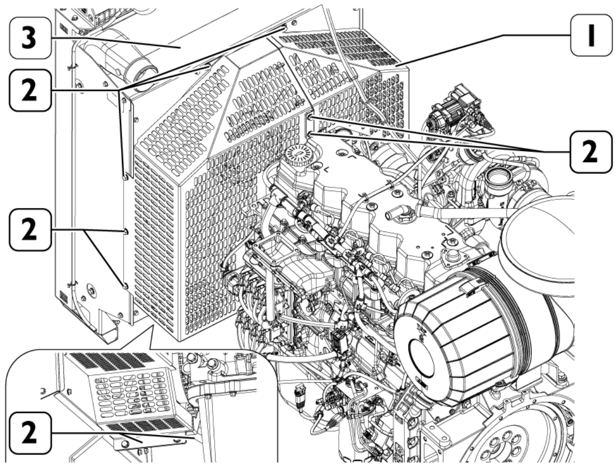
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267995 5

15. Unscrew the screws **(2)** and remove the protective grille **(1)** from the radiator unit **(3)**.

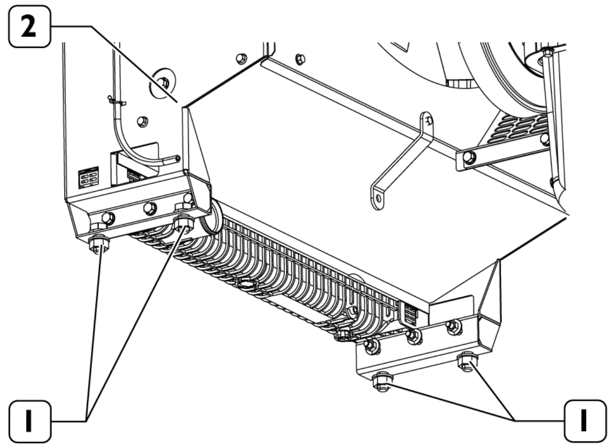
Description	Quantity	Value
Protective grille	12 screws M8 x 1.25 x 20	**23 +/- 2 N·m**



268002 6

16. Unscrew the nuts **(1)** and remove the radiator unit **(2)**.

Description	Quantity	Value
Radiator mount	4 nuts M14 x 2	**114,5 +/- 11,5 N·m**



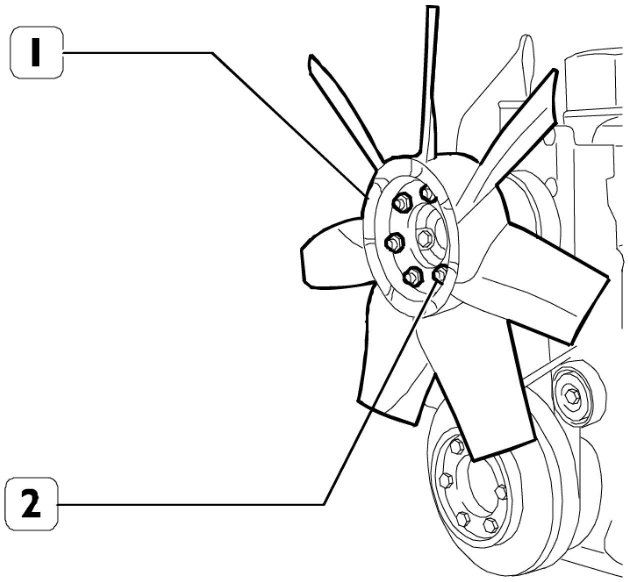
268003 7

17. Unscrew the screws **(2)**.

Description	Quantity	Value
Fan	6 screws M10x1.5 x130	**24 +/- 4 N·m**

18. Remove the fan **(1)** with the spacer.

NOTE: *The shape and size of the fan vary depending on engine use.*
The relative illustrations provide a general outline of the work to be carried out.
However the procedures described are applicable anyway.



129297 8

FITTING THE ENGINE ON THE ROTATING STAND

19. To apply to the crankcase the brackets for fastening the engine to the overhaul stand, proceed as follows working from the left side of the engine:

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037

20. Position a suitable container to collect any fuel which may leak out.

21. Using the tool, remove the fuel filter **(1)** from its support.

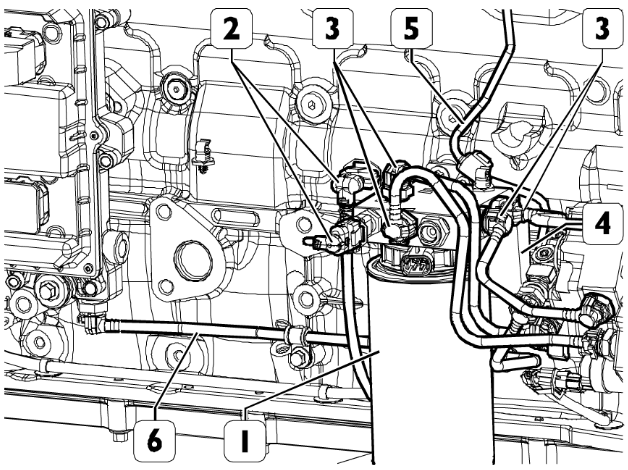
Tool / Material	
Remover,cartridge filter	99360076

22. Disconnect the fuel temperature sensor and the camshaft timing sensor electrical connection **(2)**.

23. Disconnect the low-pressure fuel pipes **(3)** from the filter support.

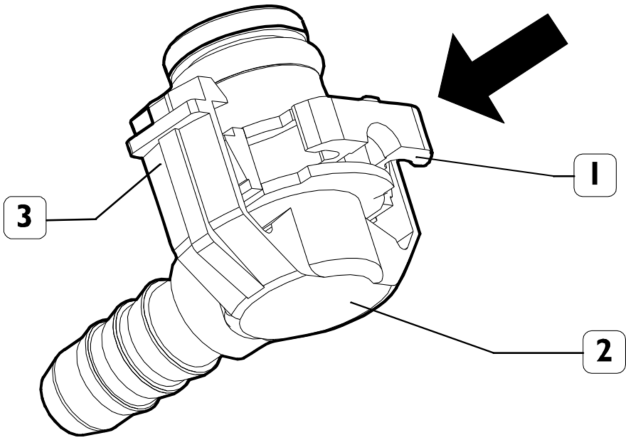
24. Unscrew the fastening screws and remove the filter support **(4)** complete with the bracket, if fitted, from the engine block.

25. Remove the pipes **(5)** and **(6)**.



166072 9

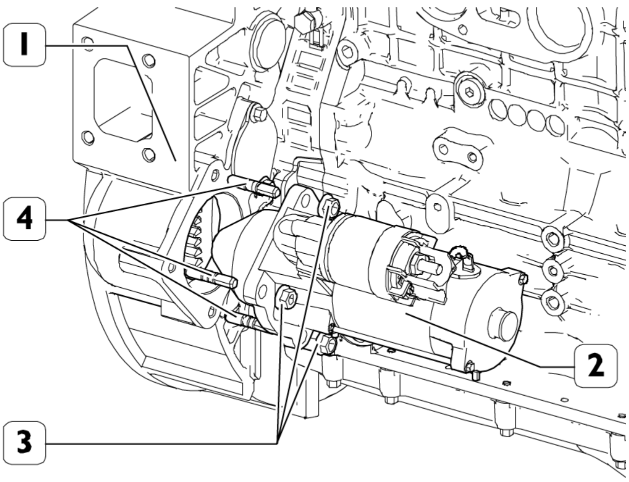
26. To disconnect a low-pressure fuel pipe from the relevant connection fitting, hold and press the clip **(1)** and extract the quick-release coupling **(2)**.



116237 10

27. Ensure that the electric starter motor **(2)** is suitably supported.
28. Unscrew the fastening nuts **(3)** and remove the electric starter motor **(2)**.
29. Unscrew the studs **(4)** from the flywheel housing **(1)**.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**

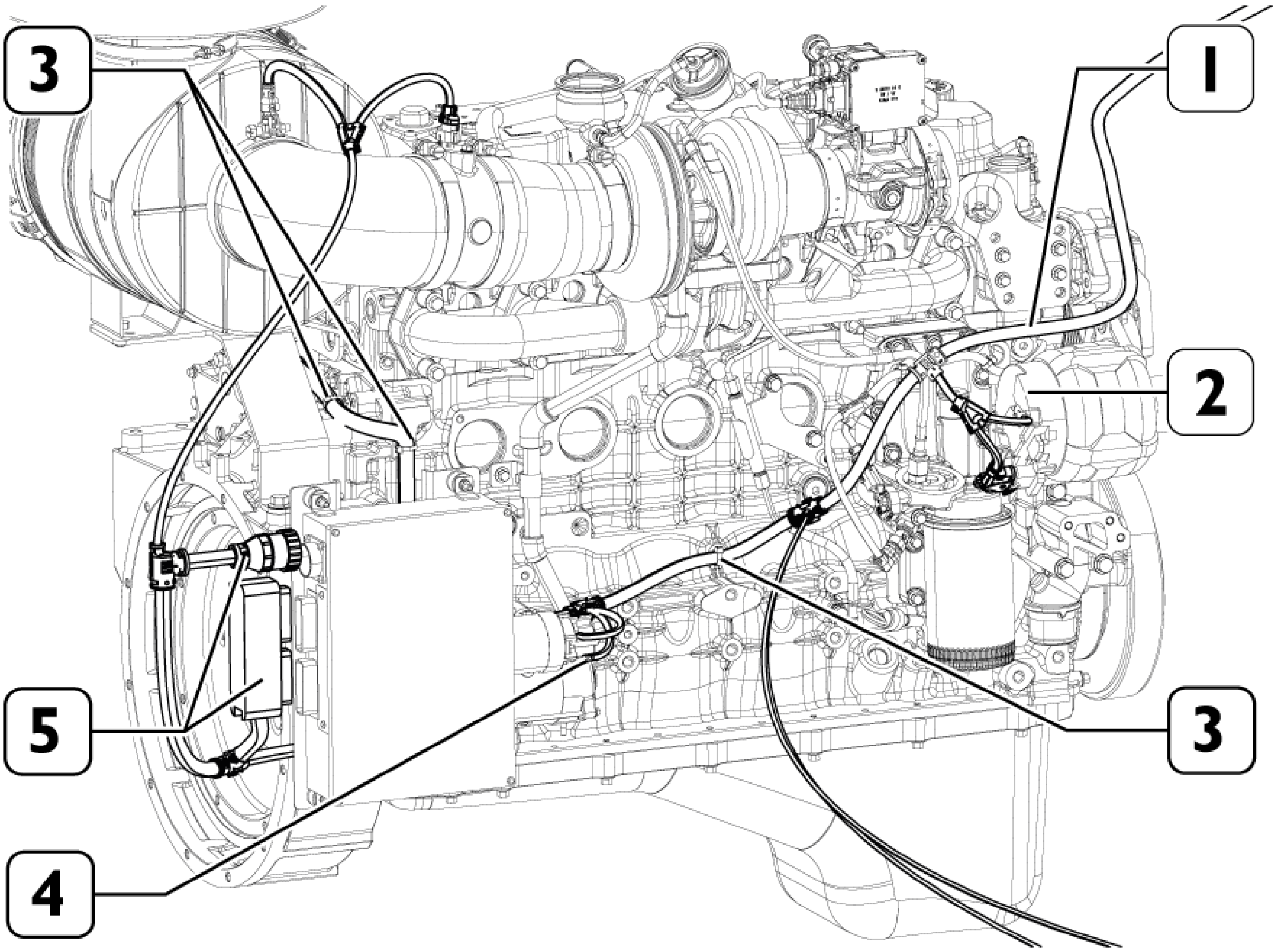


215015 11

30. Fit the brackets to the crankcase and use these to secure the engine to the rotating stand. Drain the engine oil by removing the plug from the sump.

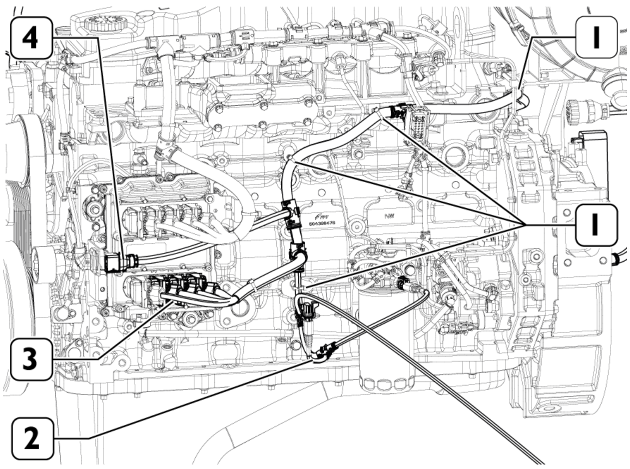
NOTICE: *Dispose of the oil according to applicable laws.*

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205



267996 12

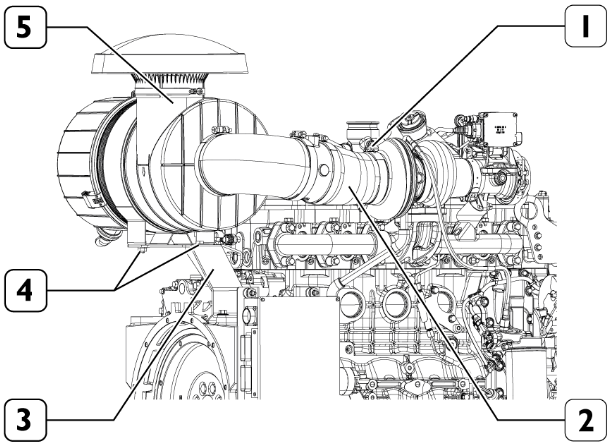
31. Disconnect connectors J1 and J2 **(5)** from the interface control unit.
32. Disconnect all the connectors between the interface cable and sensors.
33. Remove the connections between the interface cable and the starter motor **(4)** and the alternator **(2)**.
34. Remove the interface cable removing the 7 anchoring plugs **(3)**.
35. Disconnect the connector **(4)** of the ATS system.
36. Disconnect the connectors **(3)** between the interface cable **(2)** and the MD1 control unit.
37. Remove the interface cable **(2)** by removing the 7 anchoring plugs **(1)**.



267997 13

38. Unscrew the screw collar **(1)** from the air pipe **(2)**.
39. Unscrew the nuts **(4)** and remove the air filter **(5)** from the supporting bracket **(3)**.

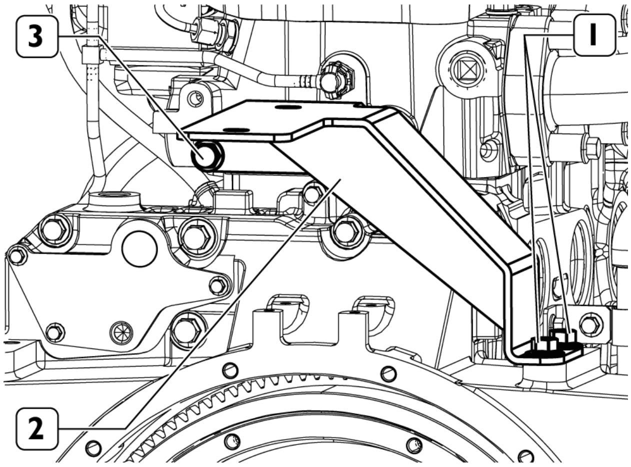
Description	Quantity	Value
Air filter bracket	2 screws M6 x 1 x 14	**0 +/- 0 N·m**



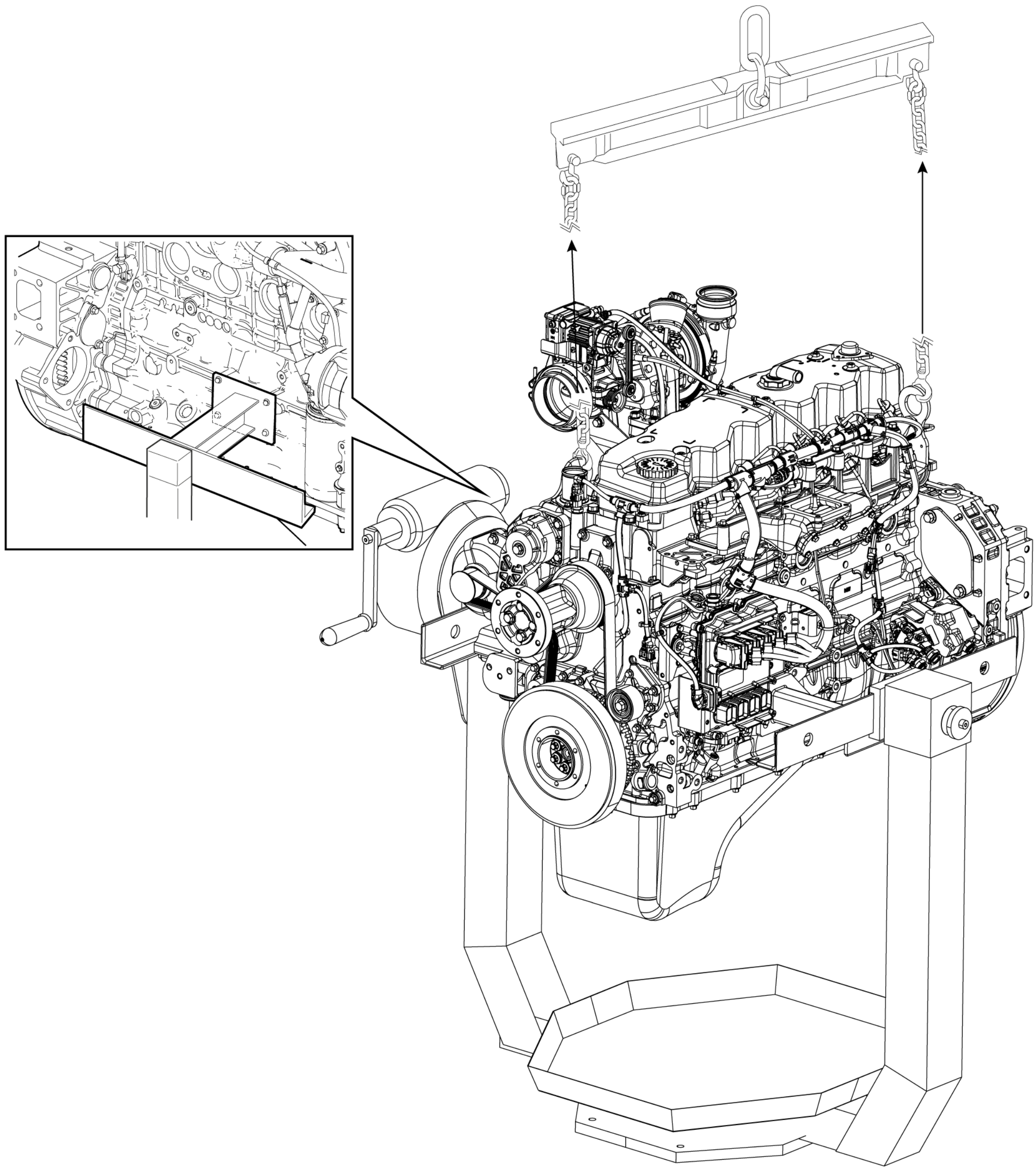
268004 14

40. Unscrew the screws **(1)** and **(3)**.
41. Remove the support bracket **(2)**.

Description	Step	Value
Bracket supporting air filter on flywheel housing	1 screw M10 x 1.5 x 20	**0 +/- 0 N·m**
	2 screws M12x1.75x25	**0 +/- 0 N·m**

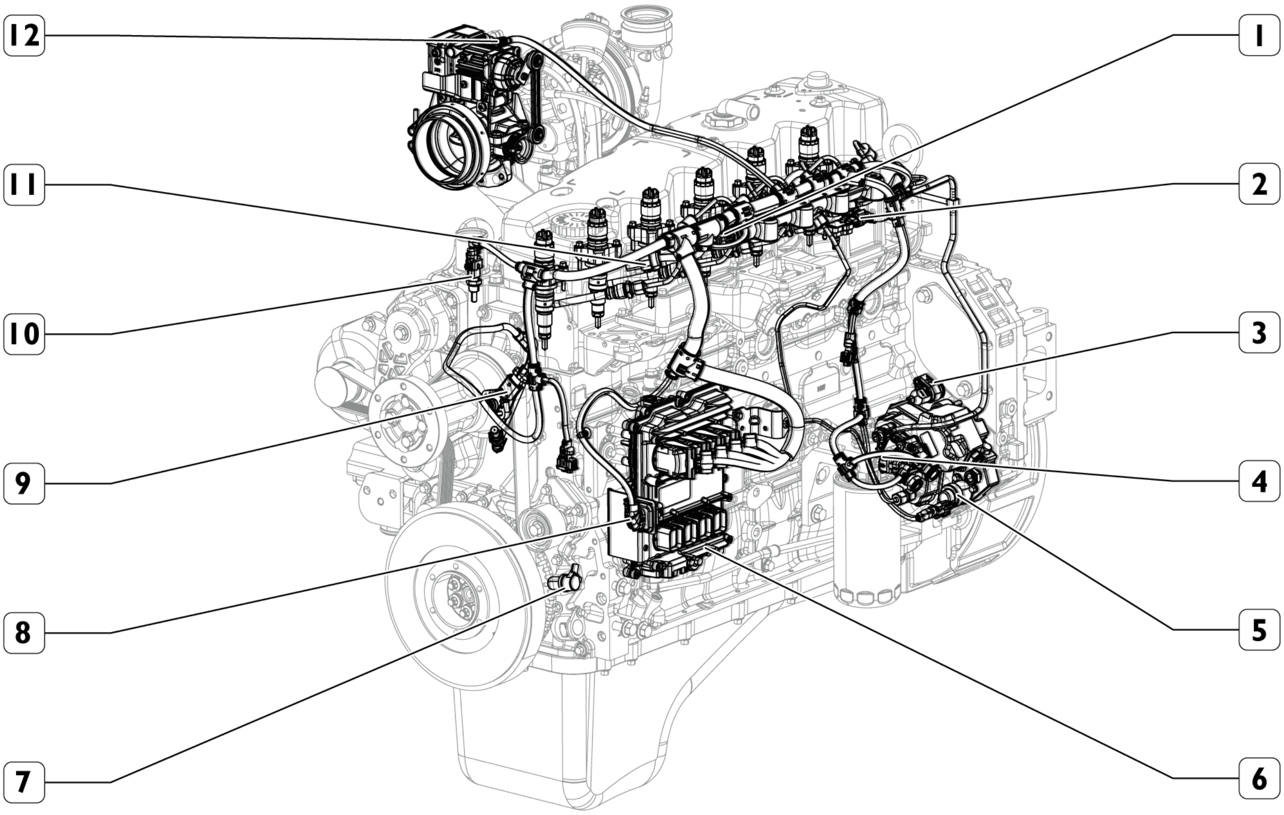


268005 15



268006 16

REMOVAL - INSTALLATION OF MAIN COMPONENTS

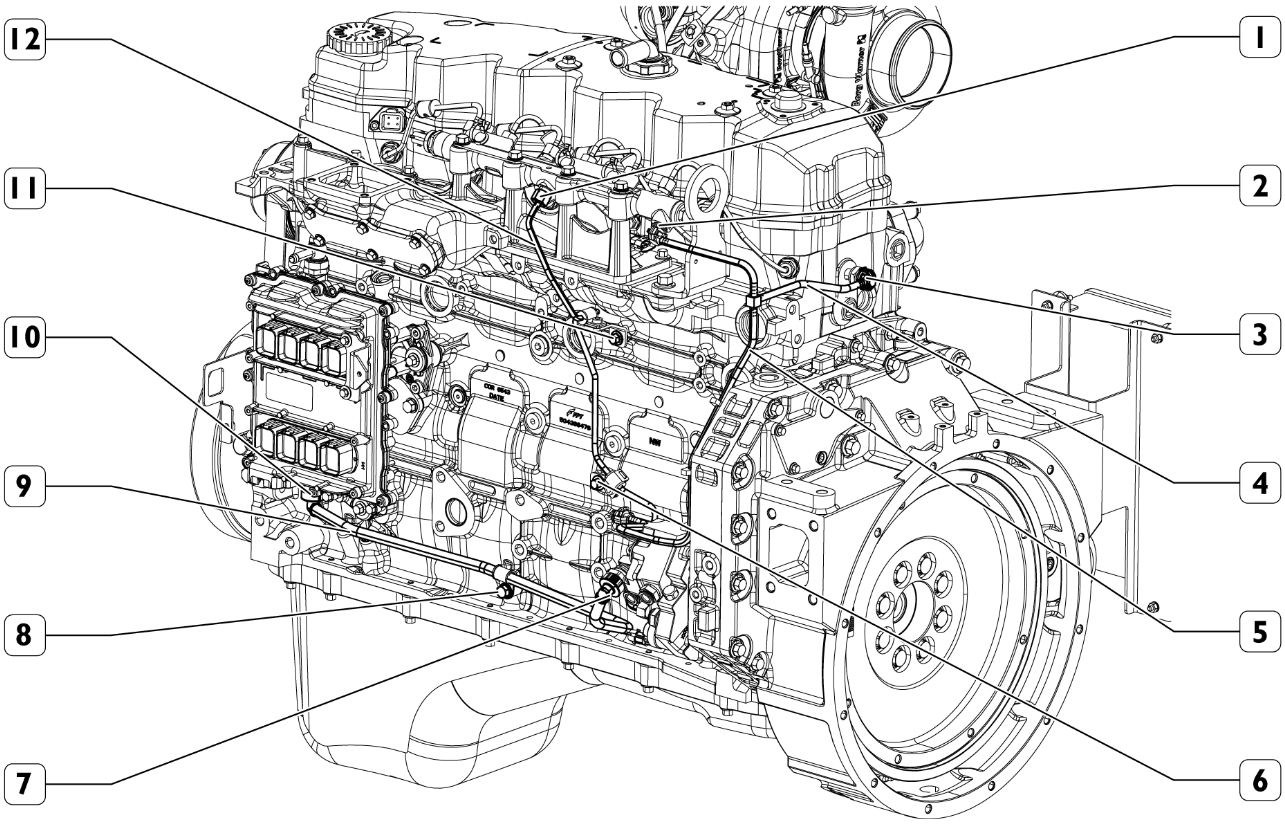


268007 17

(1) Rail pressure sensor — (2) Air temperature and boost pressure sensor — (3) Camshaft timing segment speed sensor — (4) Fuel temperature sensor — (5) High-pressure pump dosing unit — (6) Engine control unit — (7) Crankshaft incremental speed sensor — (8) In-line connector — (9) Engine oil pressure and temperature sensor — (10) Coolant temperature sensor — (11) Injector connections — (12) Motorised throttle valve connector (Exhaust valve)

42. Remove the engine cable by unplugging it from the control unit **(6)**, from the motorised throttle valve actuator connector **(12)**, and from all the sensors and transmitters to which it is connected.

43. Open the clips fastening the engine cable to the crankcase and remove the cable.



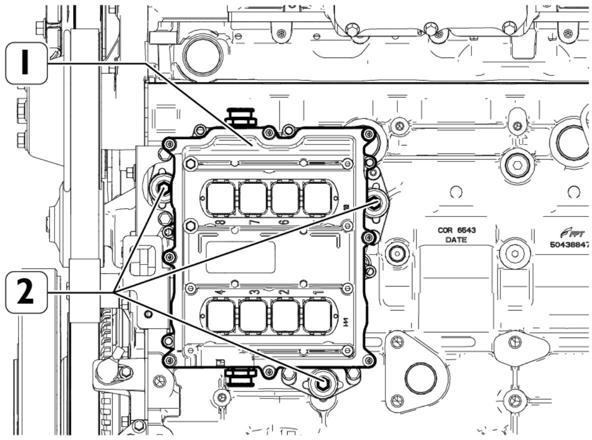
268008 18

44. Position a suitable container to catch any fuel.
45. Disconnect the retainers **(2)** and **(3)** and remove the fuel return pipes **(4)** and **(5)** which connect the common rail and injectors to the fuel filter bracket.
46. Unscrew the hose couplings **(1)** of the high-pressure fuel pipe **(12)** from the high-pressure pump to the common rail;
47. Unscrew the screws **(6)** and **(11)** fastening the pipe **(12)** to the engine block and remove it.

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**

48. Position a suitable container to catch any fuel.
49. Disconnect the retainer and remove the low-pressure fuel pipe that connects the fuel pre-filter to the heat exchanger of the engine management control unit.
50. Unscrew the supporting screws **(2)** and remove the ECU **(1)** together with the heat exchanger.

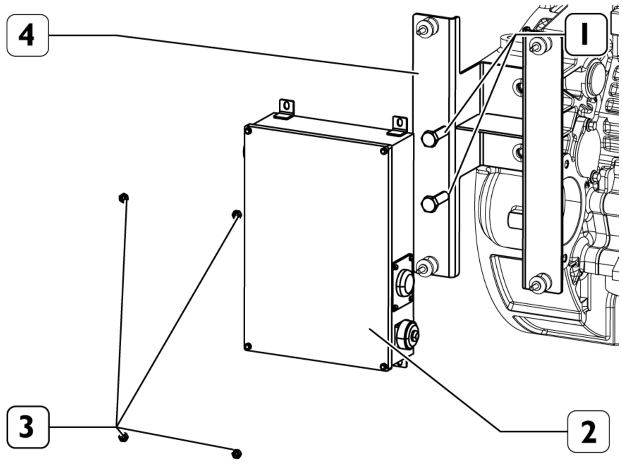
Description	Step	Value
Engine controller	3 screws M8 x 1.25 x 45	**14 N·m**



265941 19

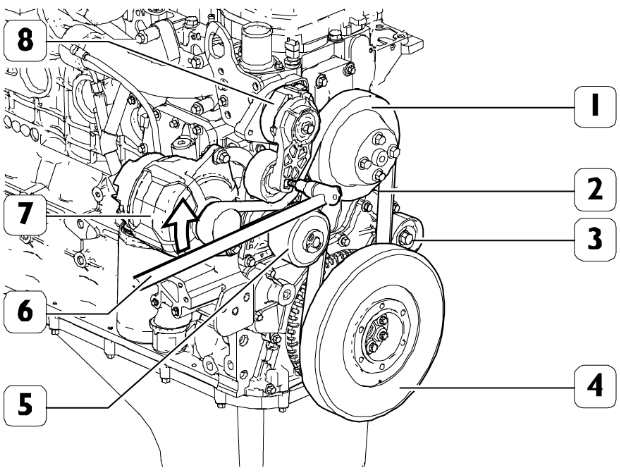
51. Unscrew the nuts **(3)** and remove the connection unit **(2)**.
52. Unscrew the screws **(1)** and remove the supporting bracket **(4)**.

Description	Step	Value
Interface box	8 nuts M6 x 1	**9 +/- 1 N·m**
	2 screws M12x1.75x25	**80 +/- 8 N·m**



268010 20

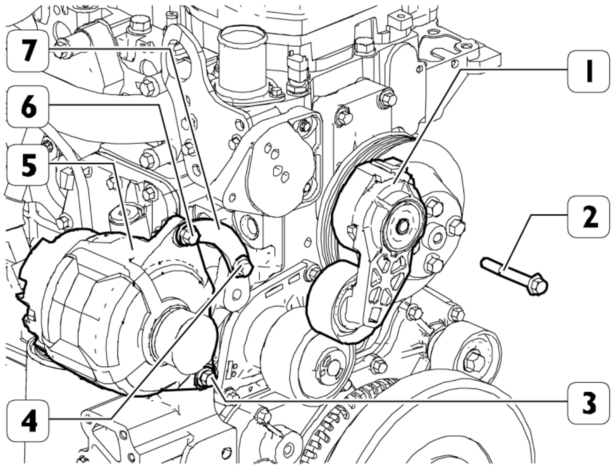
53. Remove the belt **(2)** by acting on the automatic belt tensioner **(8)** with the appropriate tool **(6)** from alternator **(7)**, water pump **(5)**, fan control pulley **(1)**, crankshaft pulley with damper **(4)** and fixed guide roller **(3)**.



215030 21

54. Unscrew the fastening screw **(2)** and remove the automatic belt tensioner **(1)**.
55. Unscrew the fastening screws **(3)**, **(4)** and **(6)** and remove the alternator **(5)** and its bracket **(7)**.

Description	Quantity	Step	Value
Automatic belt tensioner	1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Alternator		1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

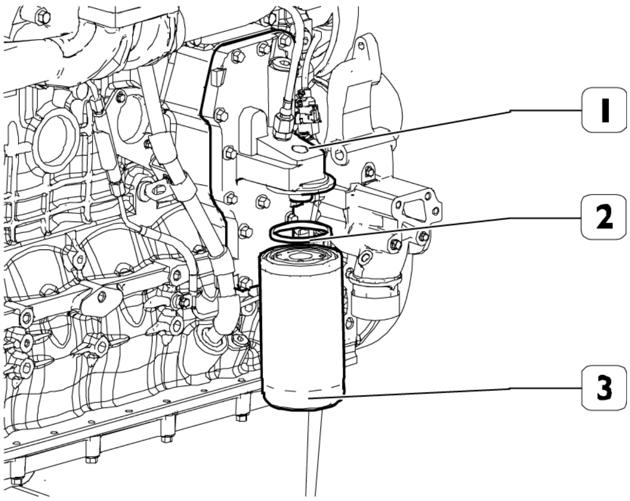


215031 22

56. Position a container to collect the used oil below the filter mount **(1)**.
57. Unscrew and remove the oil filter **(3)** from its relative support **(1)** using the tool.

Tool / Material	
Remover,cartridge filter	99360076

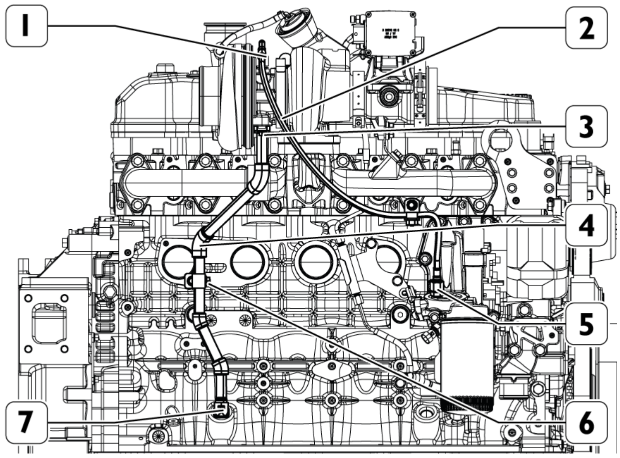
Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**



209220 23

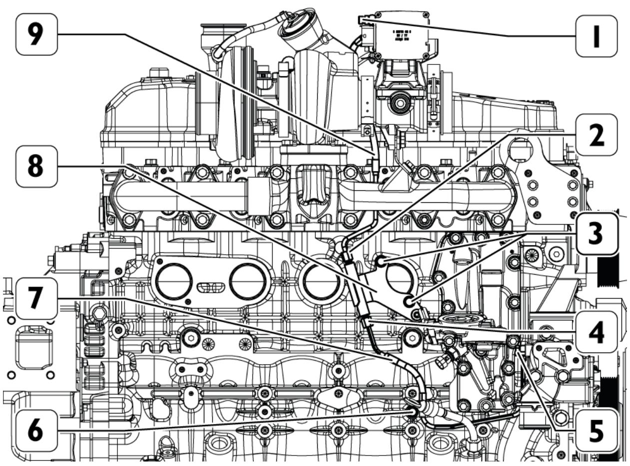
58. Position a suitable container to collect the oil.
59. Unscrew the hose couplings **(1)** and **(5)** and remove the lubricating oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger.
60. Remove the lubricant oil drain pipe **(4)** from the turbocharger, proceeding as follows:
61. unscrew the mounting screws **(3)** on the lower part of the turbocharger, recovering the relative gasket.
62. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
63. unscrew the coupling **(7)** from the crankcase.

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**



268009 24

64. Position a suitable container to collect the coolant.
65. Remove the motorised throttle valve water inlet and outlet pipe proceeding as follows, unscrewing the fastening nut **(2)** and the fitting **(1)** and remove the top part of the water return pipe **(9)**.
66. Unscrew the fastening nut **(4)**, the connector **(5)** and the screw **(6)** and remove the lower section water return pipe **(7)**.
67. Unscrew the fastening screws **(3)** and remove the water return pipe union **(8)**.



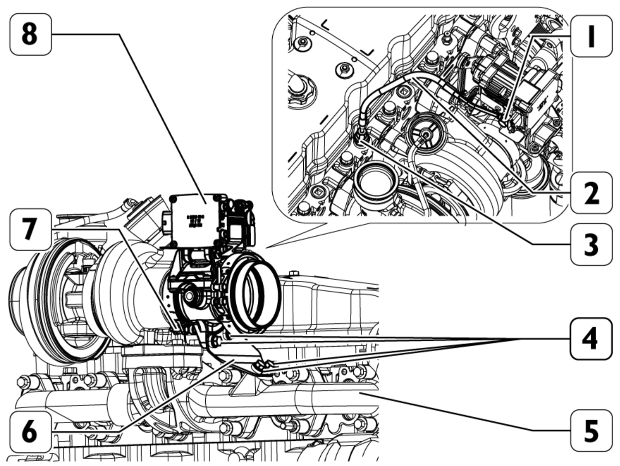
268011 25

Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**

68. Unscrew the fastening screws **(4)** and remove the bracket **(6)** fixing the motorised throttle valve **(8)** to the exhaust manifold **(5)**.

Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25	**25 N·m**

69. Unscrew the connection **(1)** and the fitting **(3)** and remove the water delivery pipe **(2)** to the valve.



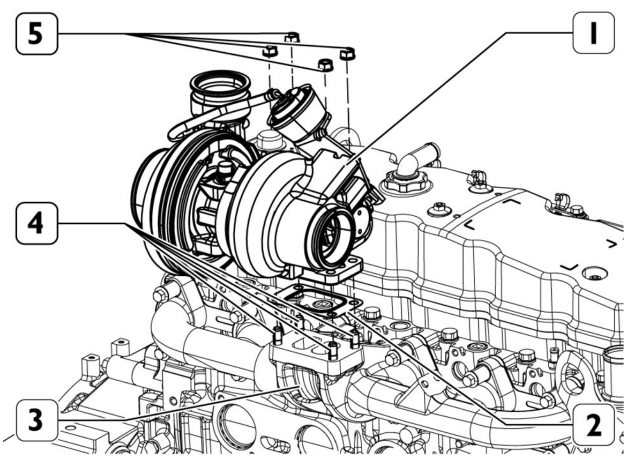
268012 26

Description	Step	Value
Throttle valve water pipe	1 connection M10 x 1	**20 +/- 2 N·m**
	1 fitting M12 x 1.5	**45 +/- 5 N·m**

70. Unscrew the screw **(7)** and loosen the V-clamping collar to remove the motorized throttle valve **(8)** from the turbocharger .

Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**

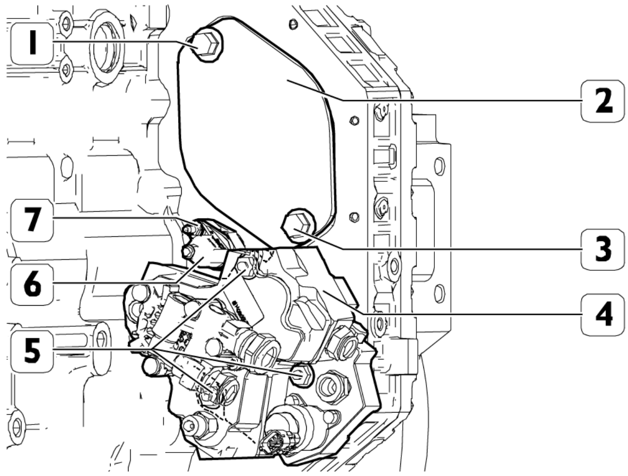
71. Unscrew the fastening nuts **(5)** and remove the turbocharger **(1)**, recovering the relevant gasket **(2)**.
72. Unscrew the studs **(4)** from the exhaust manifold **(3)**.



268013 27

Description	Step	Value
Turbocharger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**

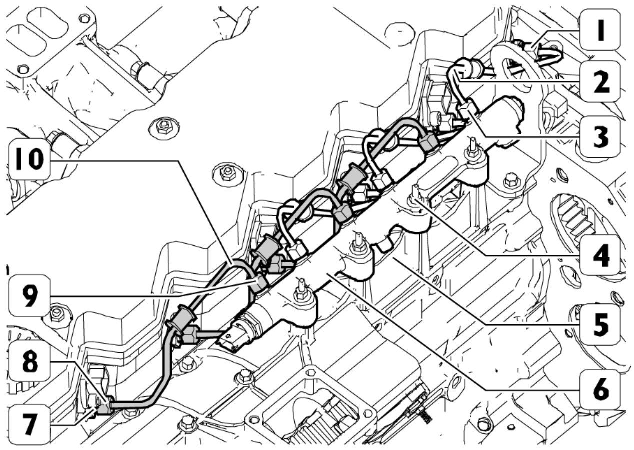
73. Unscrew the fastening screws **(1)** and **(3)** and remove the cover **(2)**, recovering the gasket.
74. If present, remove the flange and the gear of the power take-off **(PTO)**.
75. Unscrew the fastening nut **(7)** and remove the camshaft timing segment speed sensor **(6)**.
76. Make sure that the high-pressure fuel pump **(4)** is suitably supported.
77. Unscrew the fastening nuts **(5)** and remove the high-pressure pump **(4)** complete with the mechanical pump, the flange and the gear.
78. Unscrew the studs **(5)**.



212829 28

Description	Quantity	Step	Value
Power take-off cover	2 screws M12x1.75x25		**80 +/- 5 N·m**
High-pressure pump		3 nuts M8x8	**24 +/- 4 N·m**
		3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**
Camshaft timing sensor	1 nut with stud M6 x 1		**12 N·m**

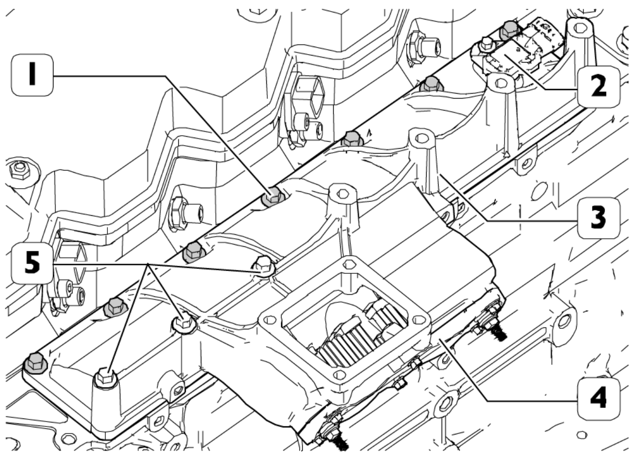
79. Unscrew the hose couplings **(1)**, **(3)**, **(8)** and **(9)** from the common rail **(6)** and the injector manifolds **(7)** and remove the high-pressure fuel delivery pipes **(2)** and **(10)**.
80. Screw the dual threaded shank screws **(4)** and remove the common rail **(6)** from the intake manifold **(5)**.



212830 29

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screws M8x1.25x125		**36 +/- 5 N·m**

81. Unscrew the screws **(1)** and **(5)** and remove the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)**.

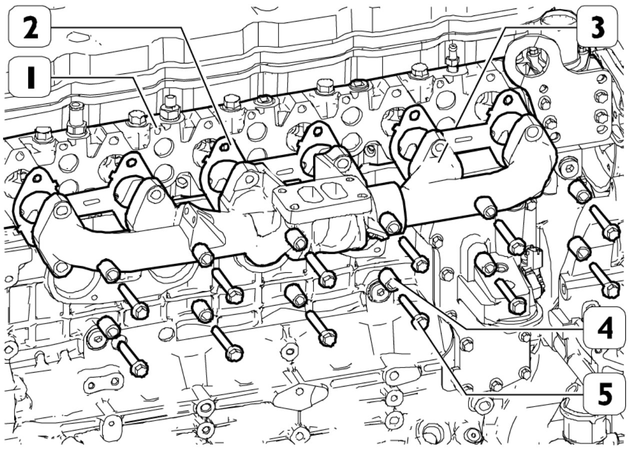


212831 30

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**

82. Unscrew the screws **(5)** together with the spacers **(4)** and remove the exhaust manifold **(3)** together with the relative gaskets **(2)** from the cylinder head **(1)**.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**

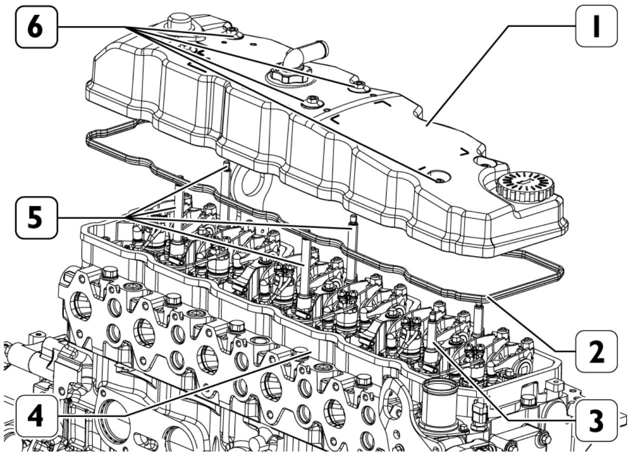


214769 31

83. Unscrew the fastening nuts **(6)** and remove the tappet cover **(1)** from the wiring support **(4)**, retrieving the relative gasket **(2)**.

84. Unscrew the threaded double-shank screws **(3)** and **(5)** from the wiring support **(4)**.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**

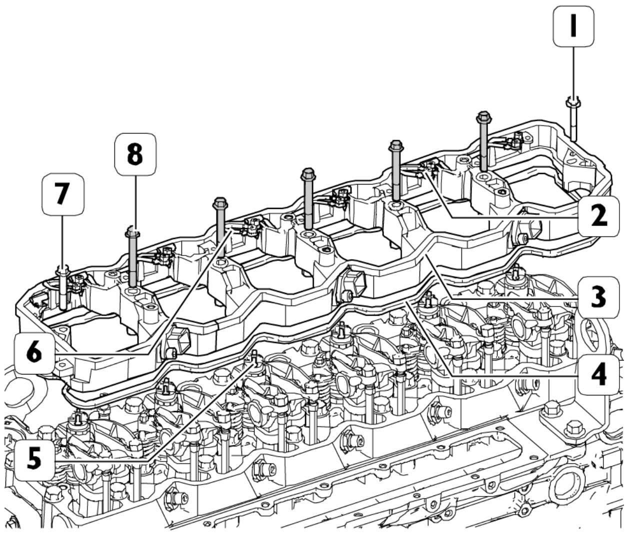


268014 32

85. Remove the nuts **(2)** and disconnect the electrical cables **(6)** from the electro-injectors **(5)**.

86. Unscrew the screws **(1)**, **(7)** and **(8)** and remove the electro-injector wiring support **(3)** complete with gasket **(4)**.

Description	Quantity	Value
Injector wiring support	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**

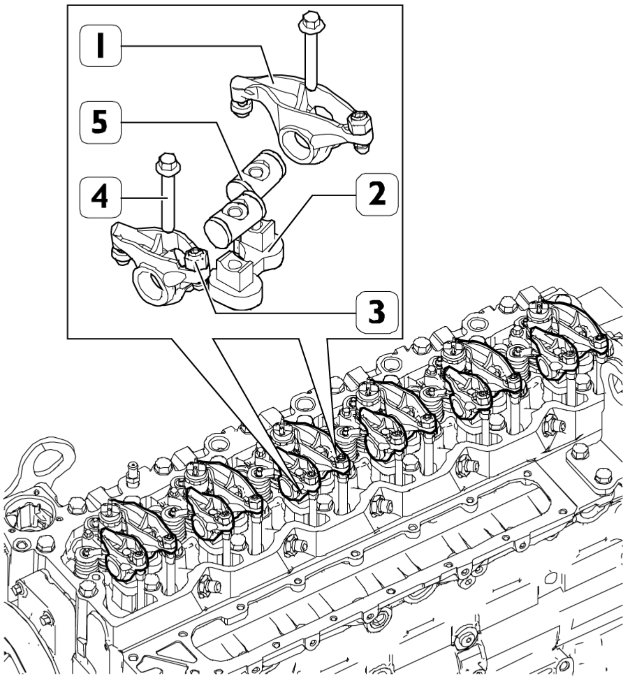


212833 33

87. Loosen the tappet adjuster retaining nuts **(3)** and unscrew the tappet adjuster screws.

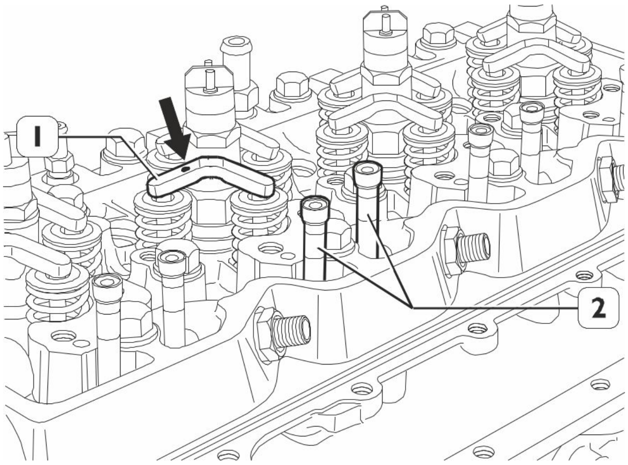
88. Unscrew the fastening screws **(4)** and remove the rocker unit from the cylinder head, including support **(2)**, rockers **(1)** and shafts **(5)**.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 34

89. Remove the bridges **(1)** from the valves and the push rods **(2)** from the cylinder head and crankcase.



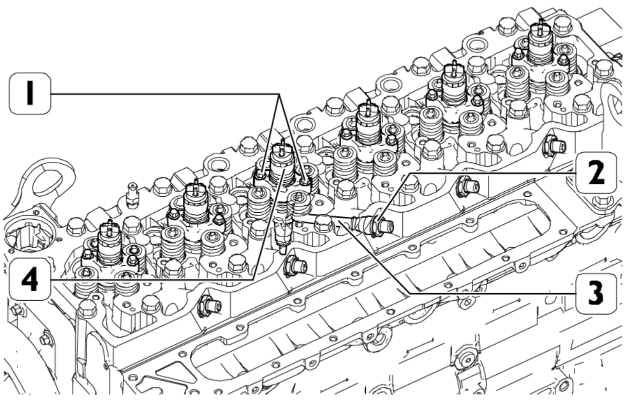
70345 35

90. Unscrew the fastening nuts **(2)** and remove the fuel manifolds **(3)**.

91. Unscrew the electro-injector **(1)** fastening screws **(4)**.

NOTE: *Disassembled fuel manifolds **(2)** must not be used again, but replaced with new ones.*

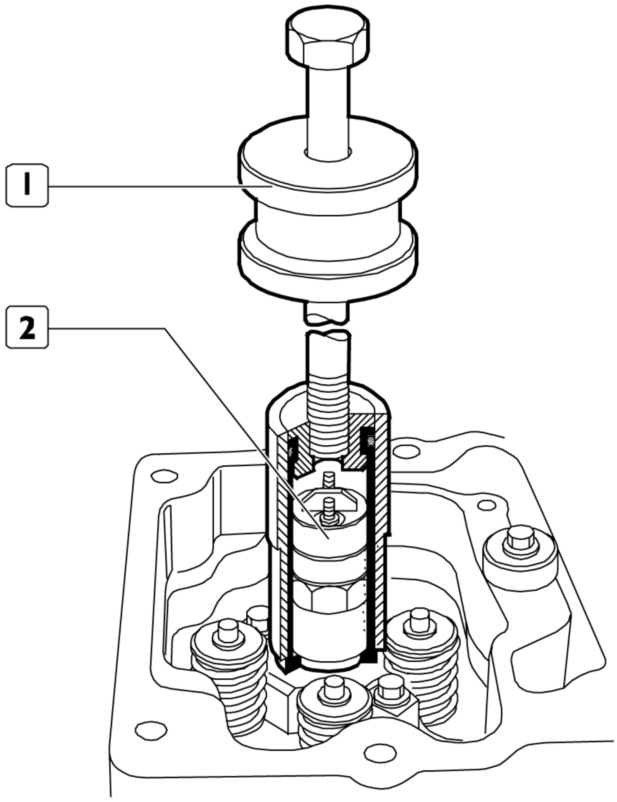
Description	Quantity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Step 3 Angle tightening	**25°**
		Step 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**



212835 36

92. Remove injector fastening screws and use the tool **(1)** to remove the injectors **(2)** from the cylinder head.

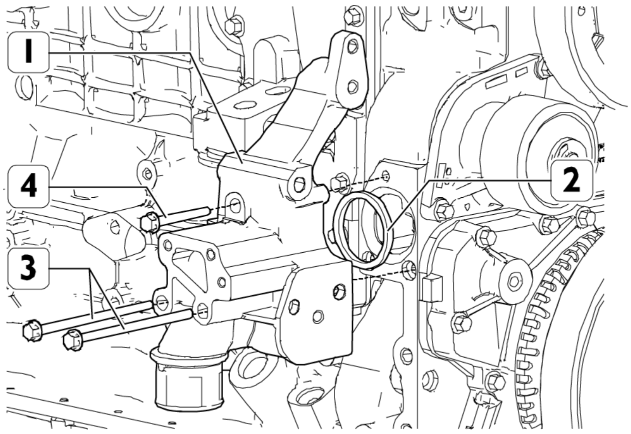
Tool / Material	
Tool to remove injectors	99342101



181861 37

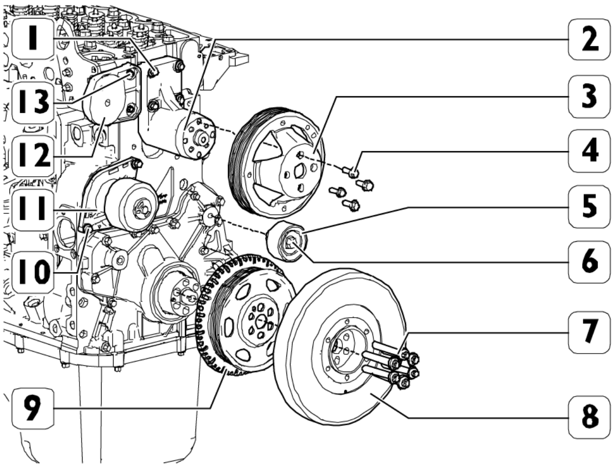
93. Unscrew the fastening screws **(3)** and **(4)** and remove the engine coolant inlet **(1)**, recovering the gasket **(2)**.

Description	Step	Value
Engine coolant inlet	2 screws M10x1.5x130	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212836 38

94. Unscrew the fastening screws **(4)** and remove the fan control pulley **(3)**.
95. Unscrew the fastening screws **(1)** and remove the fan pulley mount **(2)**.
96. Unscrew the fastening screw **(13)** and remove the automatic belt tensioner mount **(12)**.
97. Unscrew the fastening screws **(6)** and remove the idler pulley **(5)**.
98. Unscrew the fastening screws **(7)** and remove the damper pulley **(8)** together with the crankshaft pulley **(9)**.
99. Unscrew the fastening screws **(10)** and remove the water pump **(11)**.



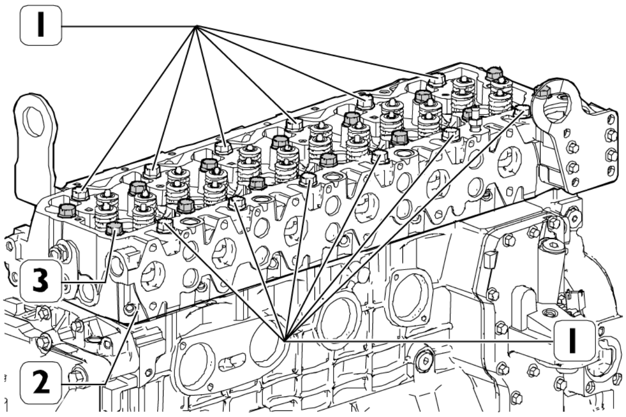
212837 39

NOTE: *The flywheel blocking device can aid the removal of the damper pulley **(8)** fitted onto the crankshaft pulley **(9)**.*

Description	Quantity	Step	Value
Fan pulley mount	4 screws M8 x 1.25 x 45		**24 +/- 4 N·m**
Fan control pulley	4 screws M10 x 1.25		**68 +/- 7 N·m**
Idler pulley	1 screw M10 x 1.5		**43 +/- 6 N·m**
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
Water pump	2 screws M8 x 1.25 x 35		**24 +/- 4 N·m**
Automatic belt tensioner support	2 screws M8 x 1.25 x 30		**24 +/- 4 N·m**

100. Unscrew the screws **(1)** and **(3)** fixing the cylinder head **(2)** to the crankcase.

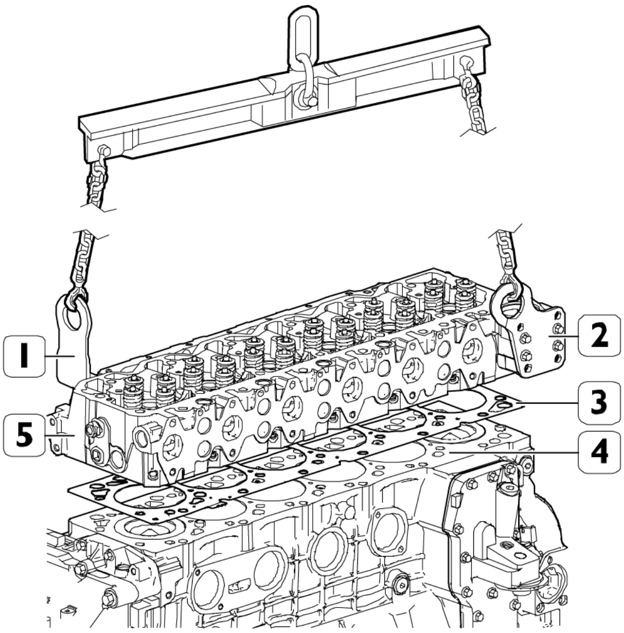
Description	Quantity	Step	Value
Cylinder head	12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Step 3 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Step 3 Angle tightening	**90°**



212838 40

101. Use suitable lifting hooks **(1)** and **(2)** in order to lift and remove the cylinder head **(5)** together with the gasket **(3)** from the engine block **(4)** by using a hoist with the tool.

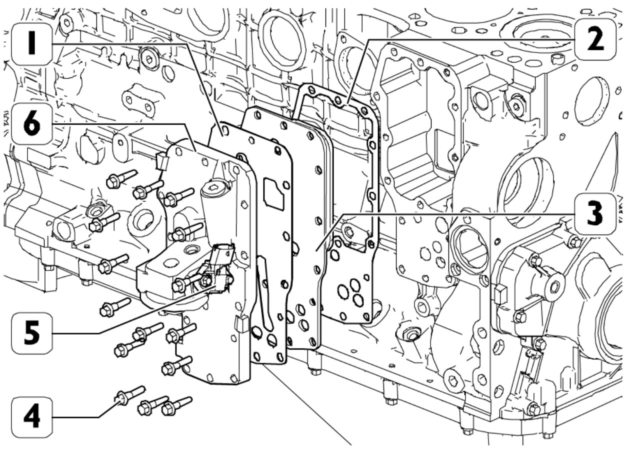
Tool / Material	
Rocking sling for removing/installing engine	99360595



212839 41

102. Unscrew the fastening screws **(4)** and remove the oil filter / heat exchanger together with oil pressure and temperature sensor **(5)**, including the oil filter support **(6)**, heat exchanger plate **(3)** and the relative gaskets **(1)** and **(2)**.

Description	Quantity	Value
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35	**26 +/- 4 N·m**

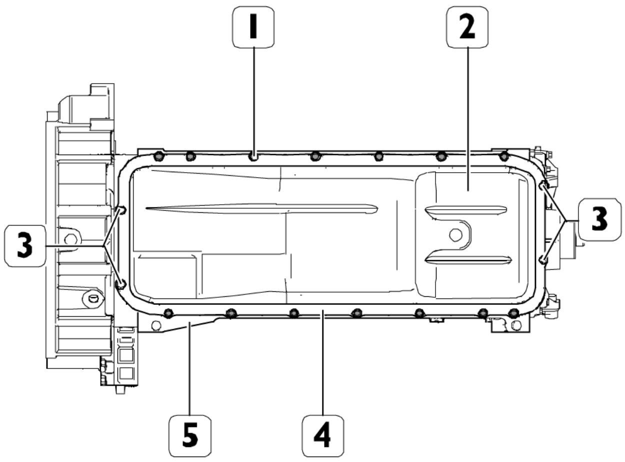


212840 42

103. Overturn the engine.

104. Unscrew the fastening screws **(1)** and **(3)** and remove the oil sump **(2)** from the crankcase **(5)**, recovering the relevant gasket **(4)**.

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screws M8 x 1.25 x 45	**27 – 30 N·m**

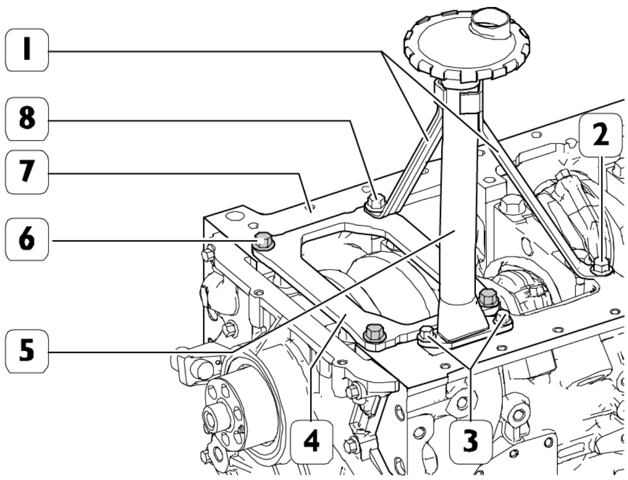


212841 43

105. Unscrew the fastening screws **(2)** and **(8)** and remove the oil suction strainer pipe brackets **(1)**.

106. Unscrew the fastening screws **(3)** and remove the oil suction strainer pipe **(5)** recovering the relevant gasket from the crankcase **(7)**.

107. Unscrew the fastening screws **(6)** and remove the stiffening plate **(4)** from the crankcase **(7)**.



212842 44

Description	Quantity	Step	Value
Suction strainer retainer		2 screws M8 X 20	**25 N·m**
		2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe	2 screws M8 x 20		**25 +/- 2,5 N·m**
Crankcase stiffening plate	4 screws M10x1.5x25		**43 +/- 5 N·m**

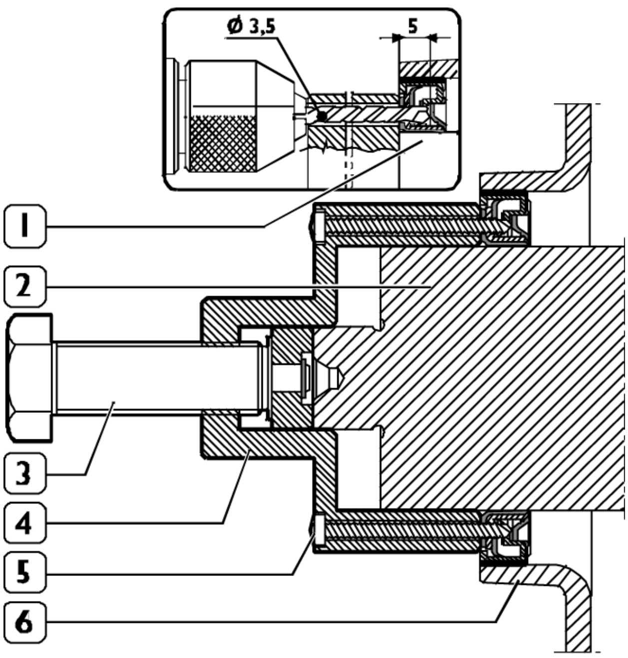
108. Take out the crankshaft seal ring from the front cover.

109. Apply the special tool **(4)** to the front crankshaft tang **(2)** and through the tool guiding holes, drill the internal seal ring **(1)** with a drill (ø **3,5 mm**) to a depth of **5 mm**.

Tool / Material	
Tool to remove crankshaft front gasket	99340055

110. Secure the tool to the ring screwing in the 6 screws supplied.

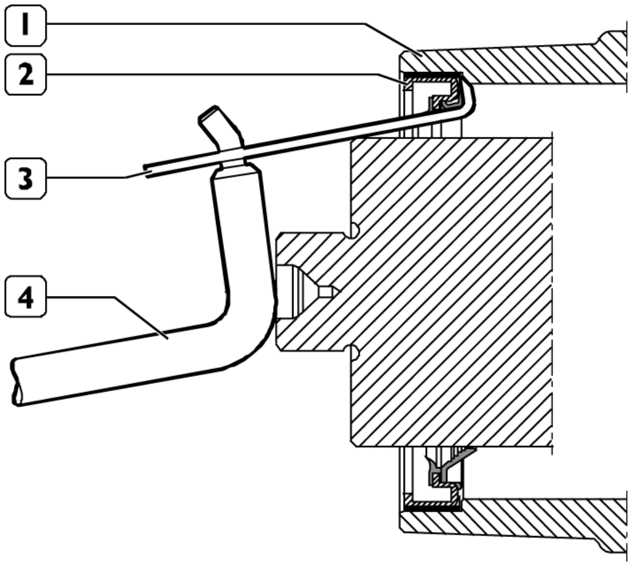
111. Then extract the ring **(1)** by screwing in the screw **(3)**.



00900T 45

112. Fit the appropriate tie-rod **(3)** of the tool onto the external seal **(2)** and using the lever **(4)**, extract it from the front cover **(1)**.

Tool / Material	
Tool for removing gaskets	99363204

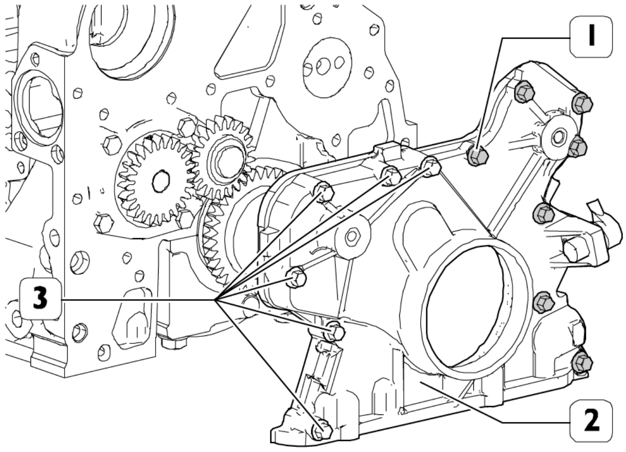


00904T 46

113. Unscrew the fastening screws **(1)** and **(3)** and remove the front cover **(2)** together with the crankshaft rpm increment speed sensor.

NOTE: *Take note of the assembly position of screw* ***(1)*** *and* ***(3)****, since the screws have different length.*

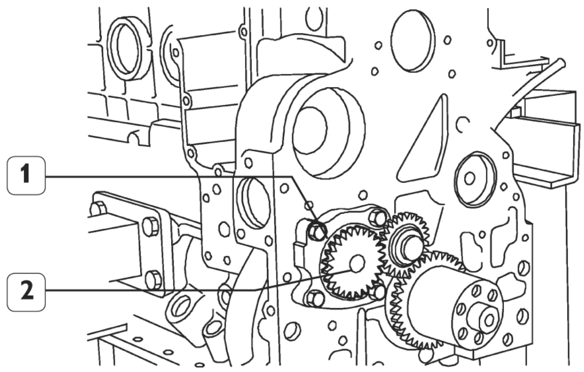
Description	Step	Value
Front gear case	7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
	6 screws M8 x 1.25	**24 +/- 4 N·m**



212843 47

114. Remove the screws **(1)** and disconnect the oil pump **(2)**.

Description	Quantity	Step	Value
Oil pump	4 screws M8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
		Phase 2 Tighten	**24 +/- 4 N·m**



75811 48

115. Apply the tool on the flywheel housing in block the engine flywheel **(3)** rotation.

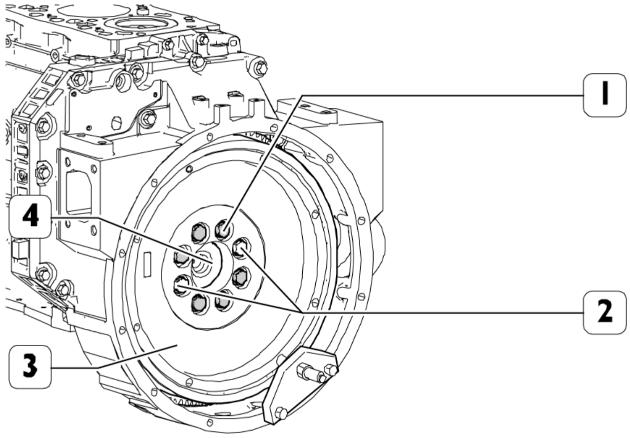
Tool / Material	
Flywheel restrainer	99360351

116. Unscrew the two opposite **(2)** screws fixing the engine flywheel **(3)** to the crankshaft **(4)**.

117. Introduce two withdrawal pins in the ports (see the following picture).

118. Rotate the engine vertically (with the flywheel at the top) acting on the crank of the rotating support.

119. Loosen the remaining screws **(1)** fixing the engine flywheel **(3)** to the crankshaft **(4)** and remove the flywheel blocking tool.



212844 49

Tool / Material	
Flywheel restrainer	99360351

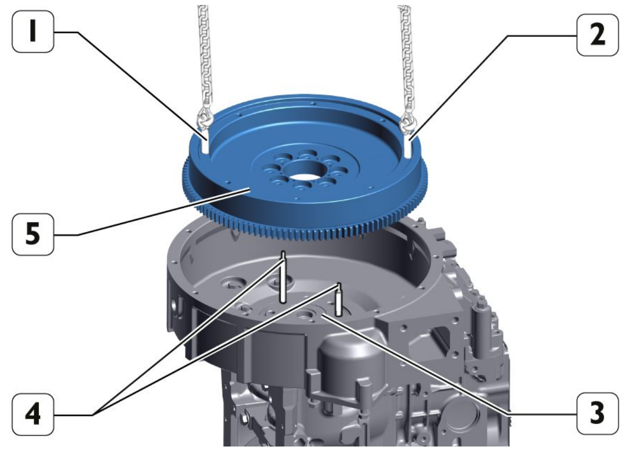
Description	Quantity	Step	Value
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
		Phase 2 Angle tightening	**60°**

120. Screw in two medium length screws in the ports **(2)** to sling the engine flywheel **(3)**.

121. Rotate the engine again horizontally (main bearing caps facing down) using the crank of the rotating support

122. Through the two guide pins **(4)** that were previously screwed into the crankshaft ports **(1)**, control the extraction of the flywheel **(3)** by means of a hoist with a tool.

Tool / Material	
Rocking sling for removing/installing engine	99360595



249902 50

123. Extract the flywheel housing seal ring by fitting the tool **(3)** on the rear shank **(5)** of the crankshaft.

Tool / Material	
Tool to remove crankshaft rear gasket	99340056

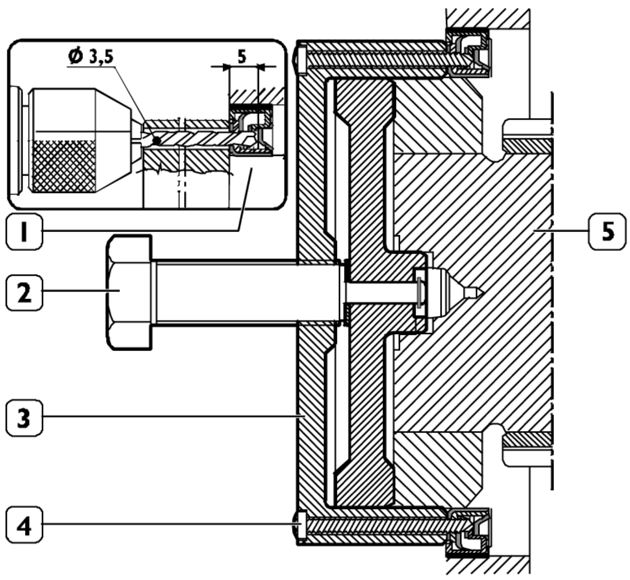
124. Through the guiding holes of the tool itself, drill the internal seal ring with a bit (Ø 3.5 mm) to a depth of 5 mm.

125. Fix tool 99340056 **(3)** to the ring **(1)** by screwing in the 6 screws (4) provided.

126. Then extract the ring **(1)** by screwing in the screw **(2)**.

127. Fit the appropriate tie-rod of the tool onto the flywheel housing external seal and extract it using the lever

Tool / Material	
Tool for removing gaskets	99363204

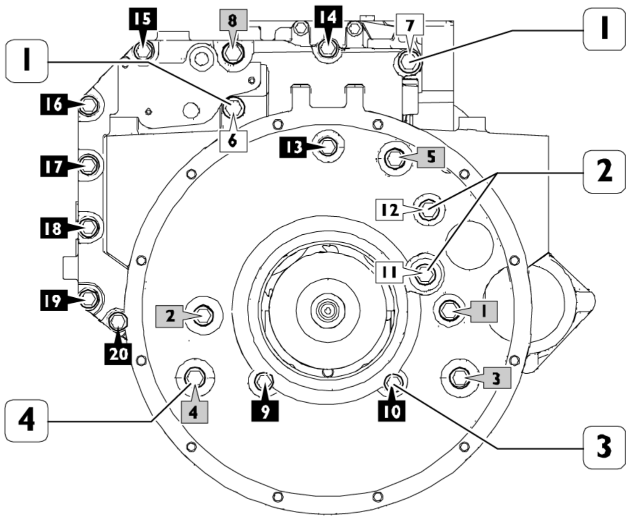


00903T 51

128. Unscrew the fastening screws **(1)**, **(2)**, **(3)** and **(4)** and remove the flywheel housing.

NOTE: *Note down the installation positions of the screws since they are of different sizes.*

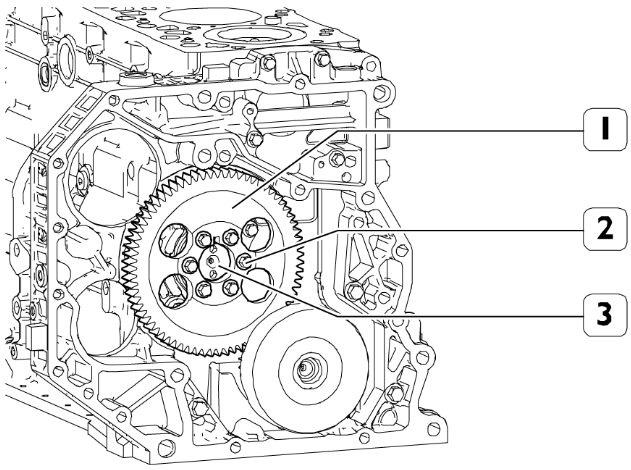
Description	Step	Value
Flywheel housing	8 screws M12 x 1.75	**85 +/- 10 N·m**
	12 screws M10 x 1.5	**49 +/- 5 N·m**
	2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**



212846 52

129. Unscrew the fastening screws **(2)** and remove the timing gear **(1)** from the camshaft.

Description	Quantity	Value
Camshaft gear	6 screws M8 x 1.25	**36 +/- 2 N·m**

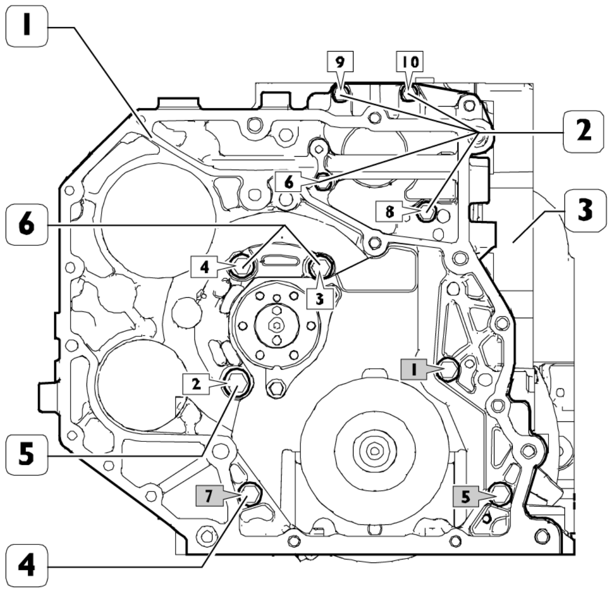


212847 53

130. Unscrew the fastening screws **(2)**, **(4)**, **(5)** and **(6)** and remove the timing gear case **(1)** from the crankcase **(3)**.

NOTE: *Note down the installation positions of the screws since they are of different sizes.*

Description	Step	Value
Rear gear case	1 screw M12 x 1.75	**77 +/- 12 N·m**
	4 screws M8 x 1.25	**24 +/- 4 N·m**
	5 screws M10 x 1.5	**47 +/- 5 N·m**



212849 54

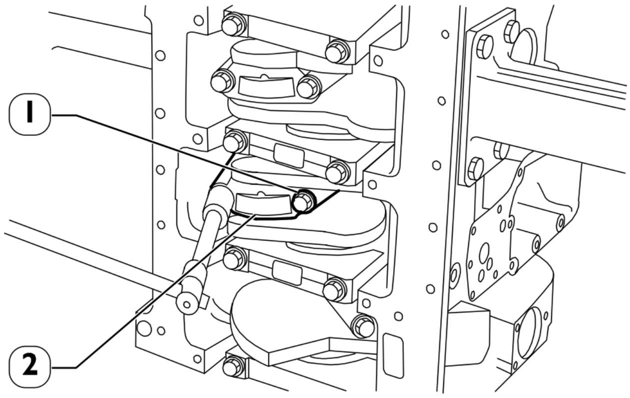
REMOVING THE ENGINE CRANKCASE AT THE BENCH

131. Remove the fastening screws **(1)** from the connecting rod caps **(2)** and remove them.

132. 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.*

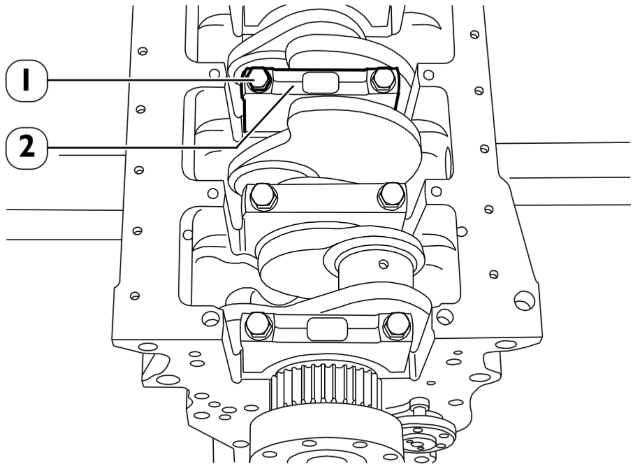
Description	Quantity	Step	Value
Connecting rod caps	12 screws M10x1.25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**



70158 55

133. Remove the screws **(1)** and disassemble the main bearing caps **(2)**.

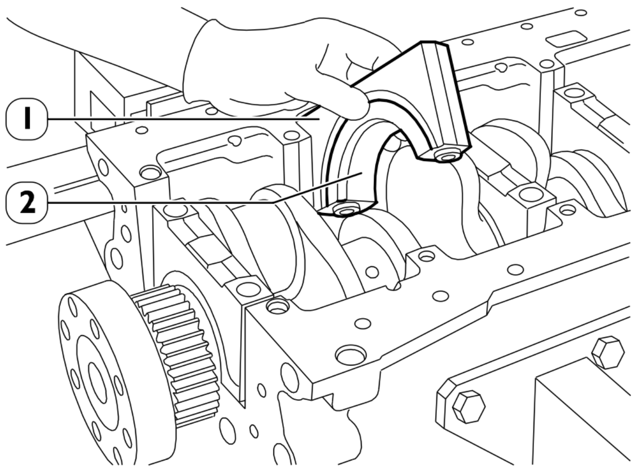
Description	Quantity	Step	Value
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**



70159 56

134. The second last main bearing cap **(1)** and the relevant support are fitted with shoulder half-bearing **(2)**.

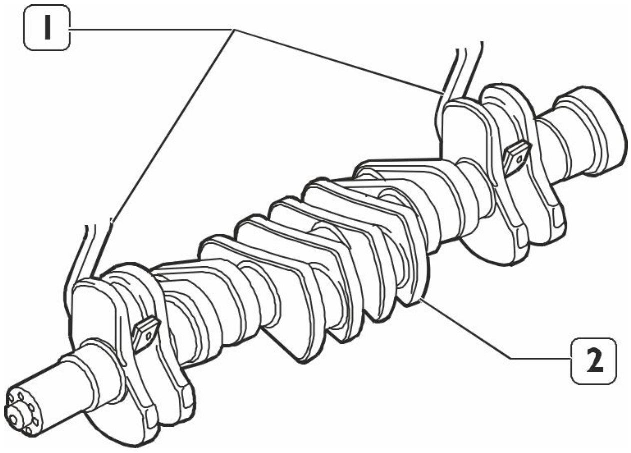
NOTE: *Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.*



70160 57

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

Tool / Material	
Crankshaft lifting tackle	99360500

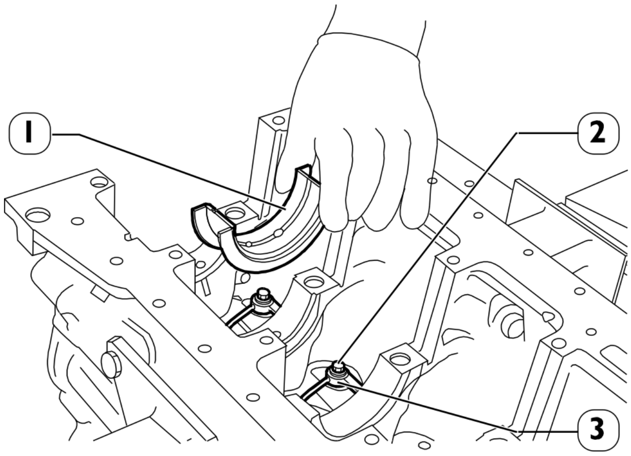


74774 58

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

137. Remove the screws **(2)** and disassemble the oil injectors **(3)**.

Description	Quantity	Value
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20	**15 +/- 3 N·m**

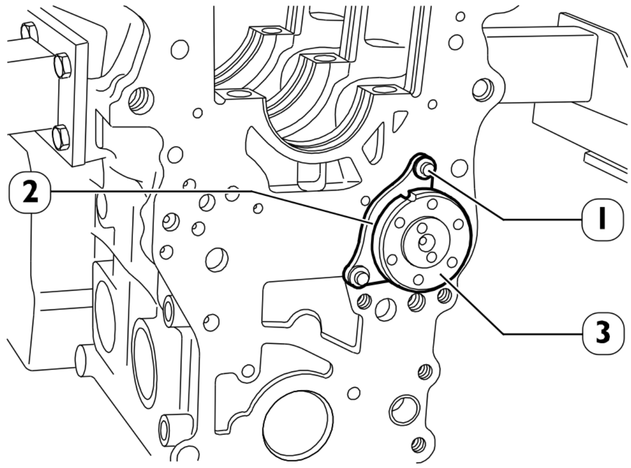


70162 59

138. Remove the screws **(1)** and disassemble the camshaft **(3)** retaining plate **(2)**.

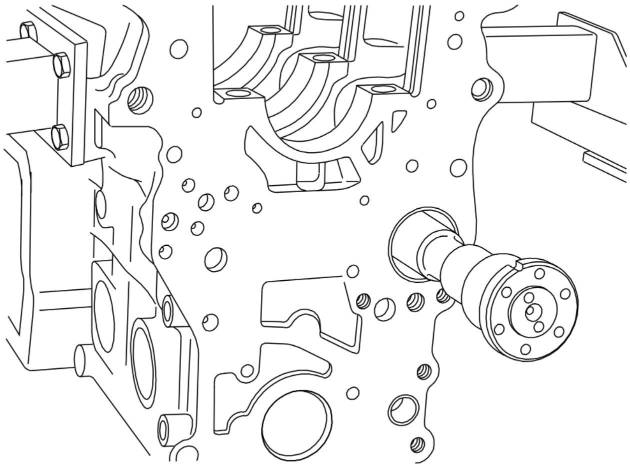
NOTE: *Take note of the plate assembly position **(2)**.*

Description	Quantity	Value
Camshaft longitudinal retaining plate	2 screws M8 x 1.25	**24 +/- 4 N·m**



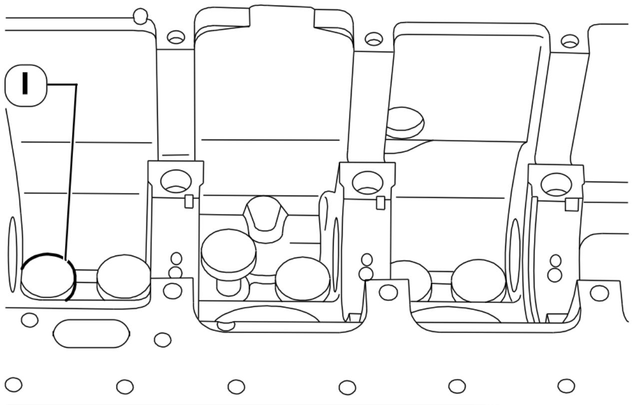
70163 60

139. Carefully withdraw the camshaft **(1)** from the crankcase.



70164 61

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



70165 62

540110 ENGINE - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Description	Quantity	Step	Value
Blow-by breather pipe	2 fittings M12 x 1.5		**20 +/- 4 N·m**
Blow-by breather plate	1 screw M6 x 1		**10 +/- 2 N·m**
Blow-by filter	3 screws M6 x 1		**10 +/- 2 N·m**
Engine Controller Module		3 screws M8 x 1.25 x 45	**14 N·m**
Engine flywheel housing		8 screws M12 x 1.75	**85 +/- 10 N·m**
		12 screws M10 x 1.5	**49 +/- 5 N·m**
		2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**
Injector wiring mount	7 screws M8 x 1.25		**24 +/- 4 N·m**
Turbo charger		4 nuts M10 x 1.5	**45 +/- 2 N·m**
		4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50		**6 +/- 1 N·m**

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205
Brackets fixing engine to revolving stand 99322205	99361037
Crankshaft front seal installer	99346252
Crankshaft rear seal installer	99346253
Flywheel crank handle (use with 99360222)	99360221
Flywheel restrainer	99360351
Pinion (use with 99360221)	99360222
Rocking sling for removing/installing engine	99360595

Checking and assembly of tappets and camshaft

1. Check the bushings as described in **BUSHES - Check (54.12)**.
2. Check the tappet sleeves as described in **TAPPETS - Check (54.12)**.
3. Check the camshaft as described in **CAMSHAFT - Check (54.12)**.
4. Assemble the tappets and camshaft as described in **CAMSHAFT - Assemble (54.12)**

Assembly of main half-bearings and crankshaft

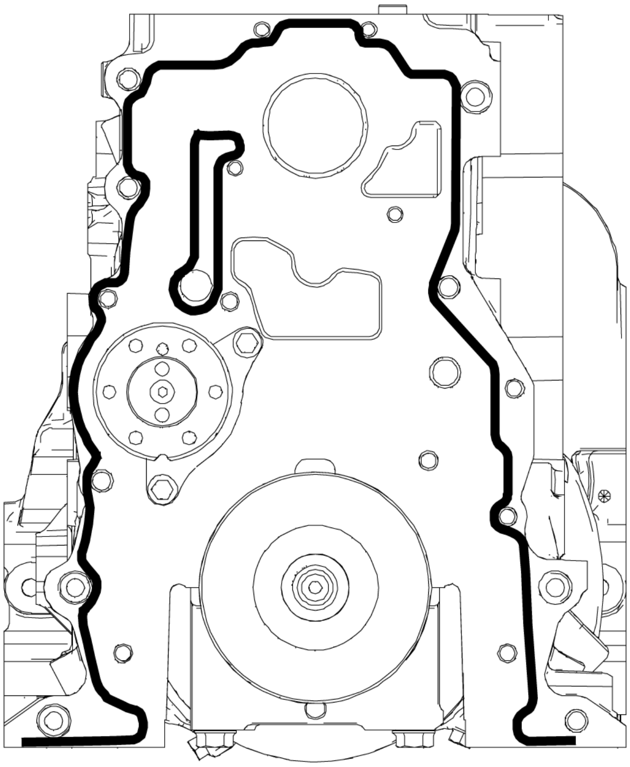
5. Check the crankshaft as described in **CRANKSHAFT - Measure (54.08)**.
6. Assemble the main bearings as described in **MAIN BEARINGS - Assemble (54.08)**.
7. Assemble the crankshaft as described in **CRANKSHAFT - Assemble (54.08)**.
8. Check the thrust clearance of the crankshaft as described in **CRANKSHAFT - Check (54.08)**.

Installing the connecting rod-piston assembly

9. Check the piston components as described in **PISTON - Measure (54.08)**.
10. Check the connecting rod as described in **CONNECTING ROD - Check (54.08)**.
11. Check the rings as described in **COMPRESSION RINGS - Check (54.08)**.

12. Check the assembly of the rings as described in **COMPRESSION RINGS - Assemble (54.08)**.
13. Fit the connecting rod-piston assembly as described in **PISTON - Pre-assemble (54.08)**.
14. Assemble the big-end bearing as described in **CONNECTING ROD BEARING - Assemble (54.08)**.
15. Assemble the piston as described in **PISTON - Assemble (54.08)**.
16. Check the protrusion of the pistons as described in **PISTON - Check (54.08)**.

Installation of main components

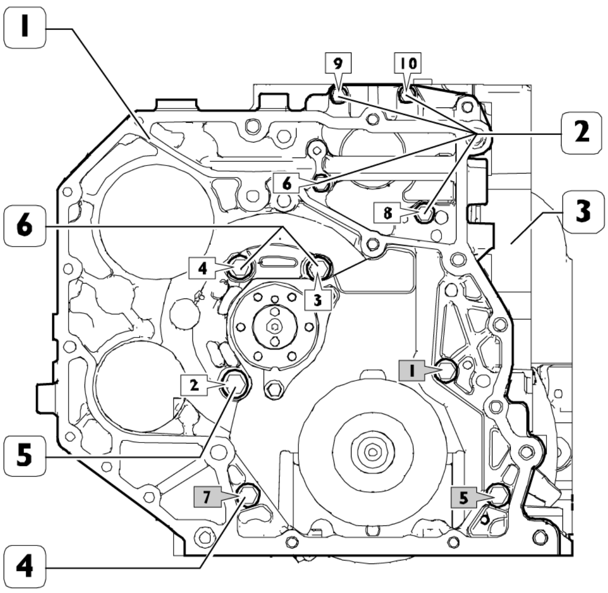


212850 1

LOCTITE® 5205 (E IVECO STD. 18-1730) SEALANT APPLICATION AREAS ON THE GEAR CASE

17. Carefully clean the timing gear case and the crankcase.

NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Smear the case with the prescribed sealant **LOCTITE® 5205 (E IVECO STD. 18-1730)** to obtain a bead of few mm diameter.*
Application must be uniform (no lumps), without any air bubbles, thin areas or gaps.
Any flaws must be corrected in as short time as possible.
Do not use an excessive amount of sealant for the joint. Excess sealant will come out on both sides of the joint with the risk of clogging the lubricant passage.
*After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*



212849 2

DIAGRAM FOR TIGHTENING THE REAR TIMING GEAR CASE FASTENING SCREWS

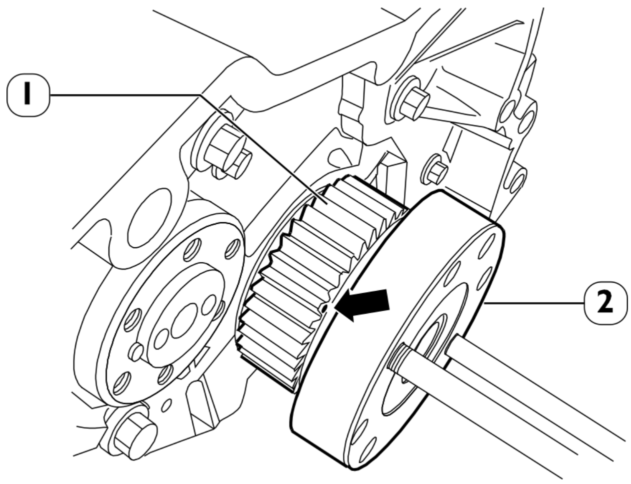
18. Refit the timing gear case **(1)** to the crankcase **(3)**.
19. Screw the fastening screws **(2)**, **(4)**, **(5)** and **(6)** to the same position found at removal and tighten them to the prescribed torque following the sequence shown in the figure.

NOTE: *Before each assembly operation, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Step	Value
Rear gear case	1 screw M12 x 1.75	**77 +/- 12 N·m**
	4 screwsM8 x 1.25	**24 +/- 4 N·m**
	5 screws M10 x 1.5	**47 +/- 5 N·m**

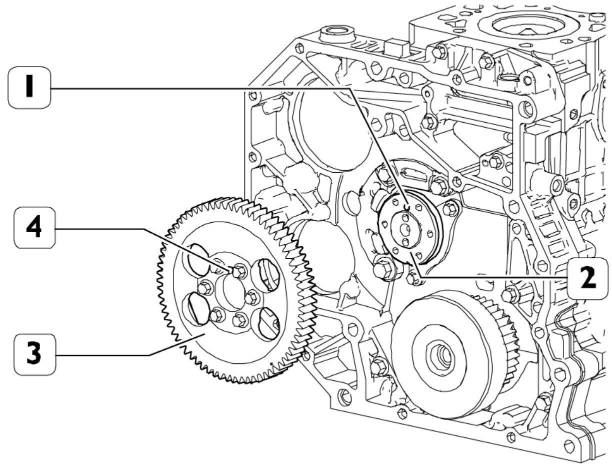
20. With a felt-tip pen, highlight the conducting gear tooth **(1)** fitted on the crankshaft **(2)** with a chamfer for timing.

NOTE: *Screw in two pins to facilitate crankshaft rotation.*



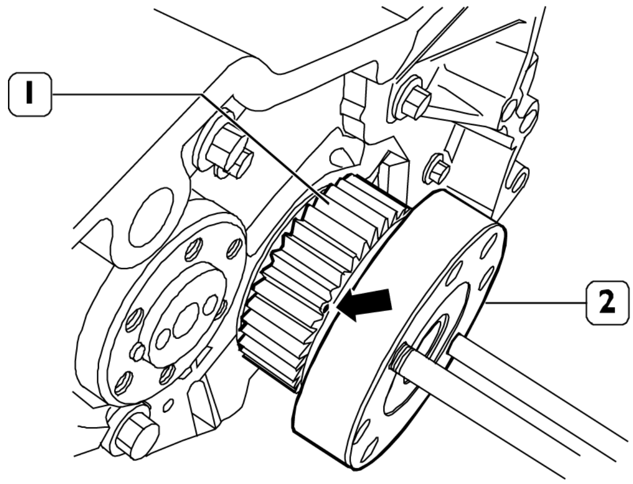
70211 3

21. Make sure that during the assembly of the timing gear **(3)** on the crankshaft **(2)**, the reference pins **(1)** and **(4)** match.



212848 4

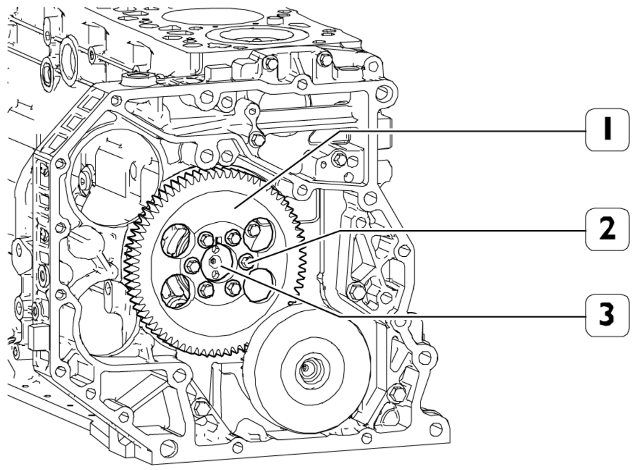
22. Turn the crankshaft **(3)** and the camshaft **(4)** so that when fitting the driven gear **(1)** on the latter, the stencilled mark on the gear **(1)** coincides with the groove on the gear tooth **(2)**.



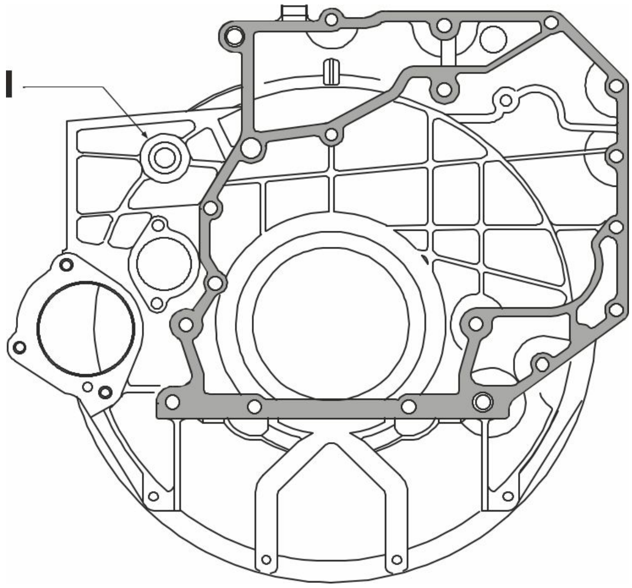
114791 5

23. Tighten the screws **(1)** securing the gear **(2)** to the camshaft **(3)** to the specified torque.

Description	Quantity	Value
Camshaft gear	6 screws M8 x 1.25	**36 +/- 2 N·m**



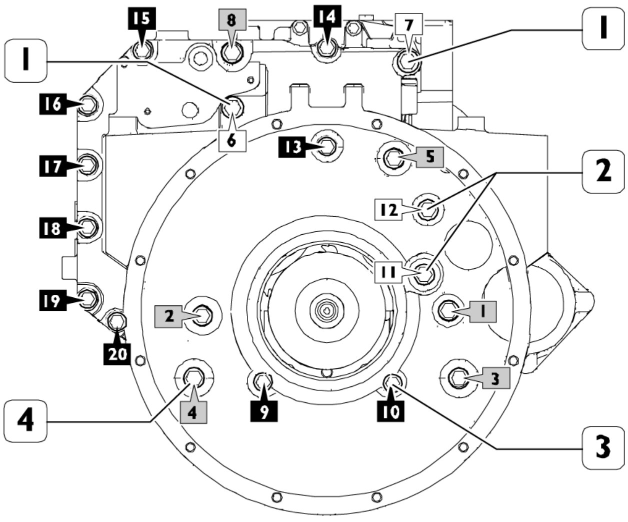
212847 6



70214 7

SEALANT APPLICATION DIAGRAM LOCTITE® 5205 (E IVECO STD. 18-1730)

NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Apply **LOCTITE® 5205 (E IVECO STD. 18-1730)** sealant onto the housing to form a bead of several mm in diameter. This must be uniform (no lumps), no air bubbles, thin areas or gaps.*
Any flaws must be corrected in as short time as possible.
Avoid using too much material to seal the joint.
*Excess sealant will come out on both sides of the joint with the risk of clogging the lubricant passage. After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*



212846 8

TIGHTENING SEQUENCE DIAGRAM OF FLYWHEEL HOUSING FASTENING SCREWS

24. Refit the flywheel housing to the crankcase.

25. Screw the fastening screws **(1)**, **(2)**, **(3)** and **(4)** to the same position found at removal and tighten them to the prescribed torque following the sequence shown in the figure.

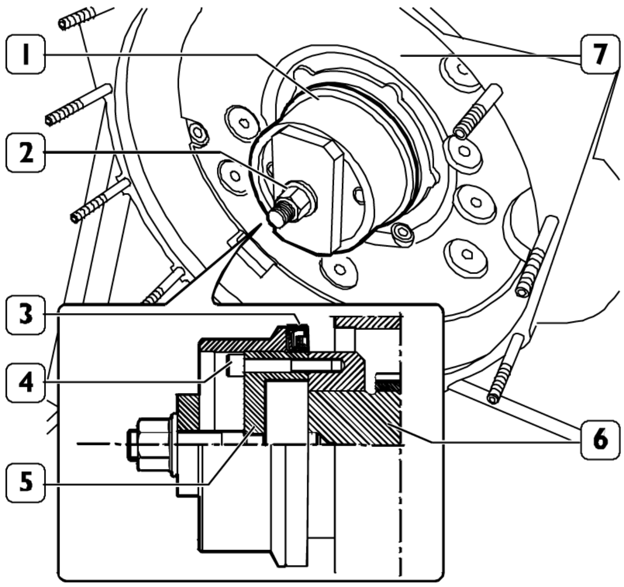
NOTE: *Before each assembly operation, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Step	Value
Engine flywheel housing	8 screws M12 x 1.75	**85 +/- 10 N·m**
	12 screws M10 x 1.5	**49 +/- 5 N·m**
	2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**

26. 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)**.

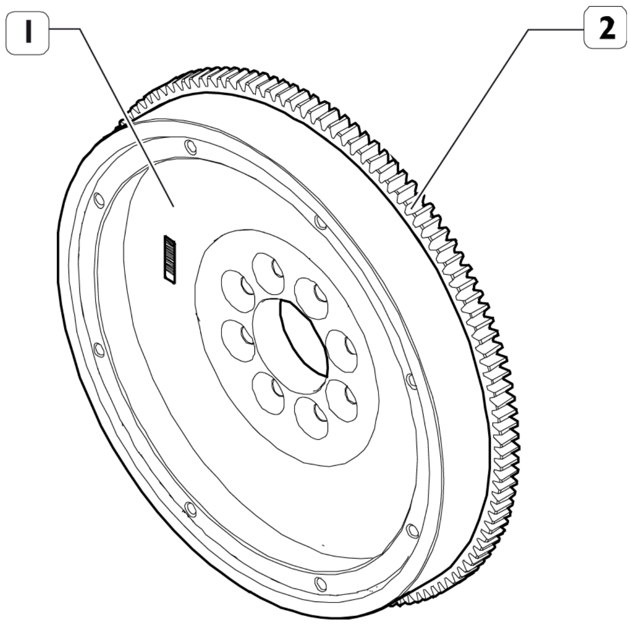
Tool / Material	
Crankshaft rear seal installer	99346253

27. Position part **(1)** on part **(5)** and screw down the nut **(2)** to fit the seal fully **(3)** in the flywheel housing **(7)**.



0901T 9

28. Check the supporting surface **(1)** of the clutch plate and if it is scratched, it must be turned.
29. Check the condition of the ring gear teeth **(2)**.
30. If breakage or excessive wear is found, remove the ring gear from the flywheel using a generic drift and fit the new one, previously heated to a temperature of **150 °C** for **15 – 20 min**; the chamfer made along the inner diameter of the crown wheel must face the engine flywheel.

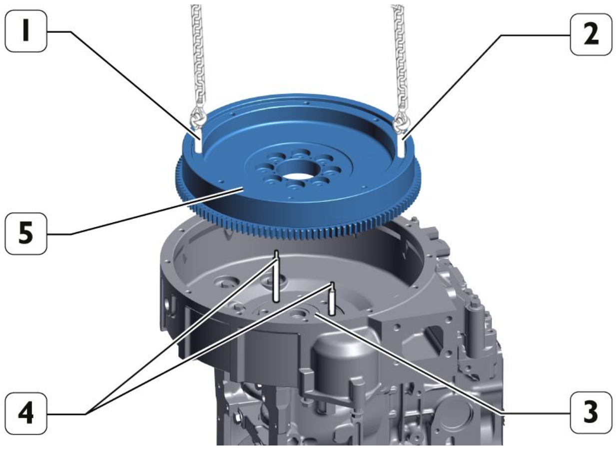


200508 10

31. Rotate the engine vertically (with the flywheel at the top) acting on the rotating mount crank.

32. Screw in two medium length screws into the holes **(1)** and **(2)** to sling the engine flywheel **(5)**.
33. Screw two guide pins **(4)** of a suitable length into the crankshaft holes **(3)** and fit the flywheel **(5)** using a hoist with tool.

Tool / Material	
Rocking sling for removing/installing engine	99360595



249902 11

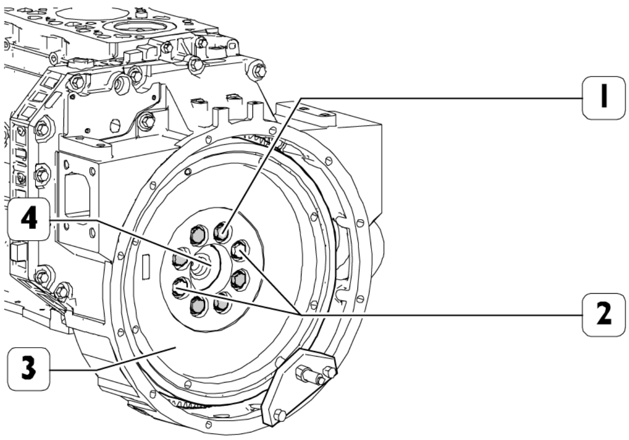
34. Rotate the engine horizontally (with the cylinder head at the top) acting on the rotating mount crank.
35. Apply the tool on the flywheel housing in block the engine flywheel **(3)** rotation.

Tool / Material	
Flywheel restrainer	99360351

36. Remove the two withdrawal pins in the ports (see the previous picture).
37. Tighten the screws **(1)** and **(2)** securing the flywheel **(3)** to the crankshaft **(4)** in two steps.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

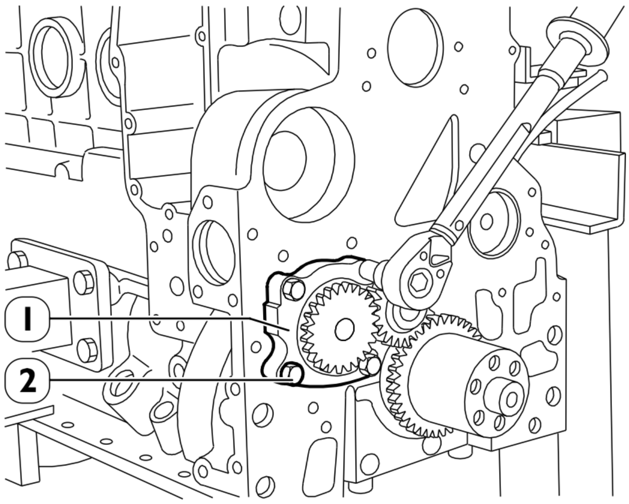
Description	Quantity	Step	Value
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
		Phase 2 Angle tightening	**60°**



212844 12

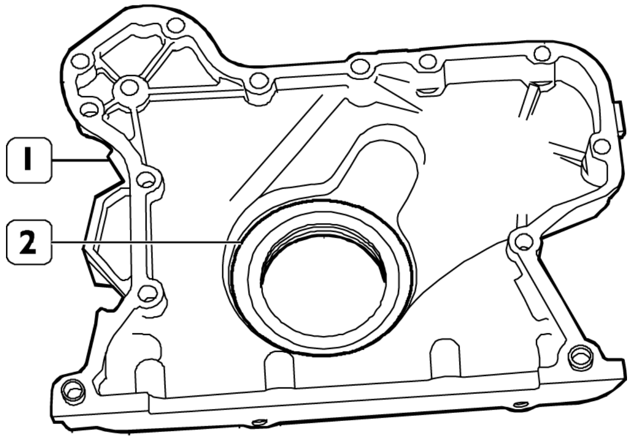
38. Fit the oil pump **(1)**.
39. Insert fastening screws **(2)** and tighten them to the specified torque.

Description	Quantity	Step	Value
Oil pump	4 screwsM8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
		Phase 2 Tighten	**24 +/- 4 N·m**



70220 13

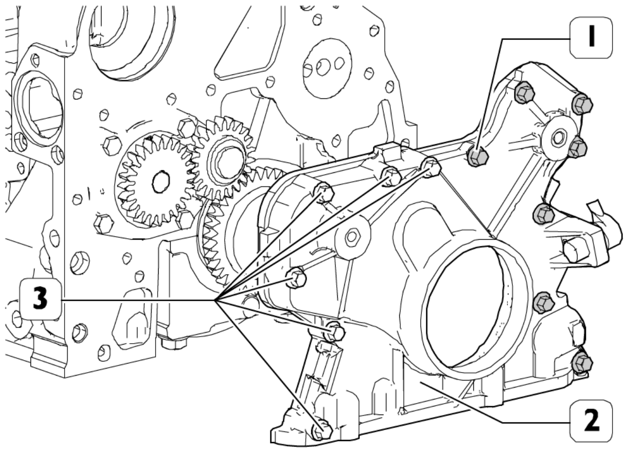
40. Remove the sealing ring **(2)** from the front cover **(1)**, carefully clean the coupling surfaces and smear them with **LOCTITE® 5205 (E IVECO STD. 18-1730)**.



106549 14

41. Fit the front cover **(2)** together with the crankshaft rpm increment speed sensor to the engine block.
42. Screw the fastening screws **(1)** and **(3)** to the same position found at removal and tighten them to the prescribed torque.

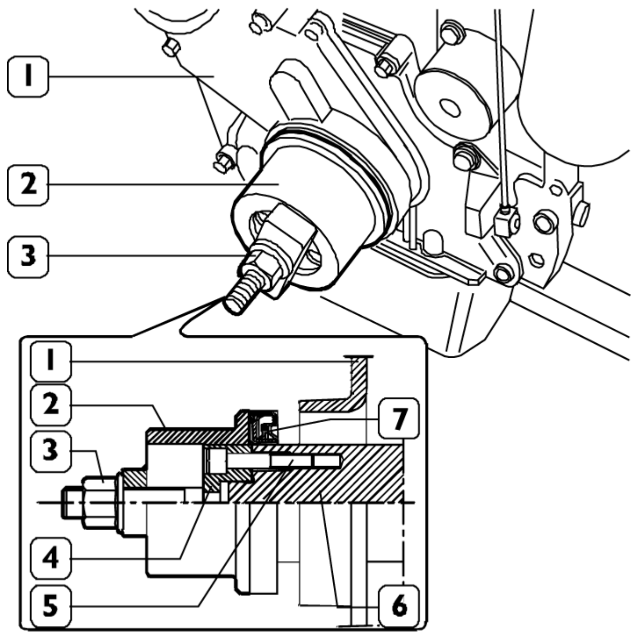
Description	Step	Value
Front gear case	7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
	6 screws M8 x 1.25	**24 +/- 4 N·m**



212843 15

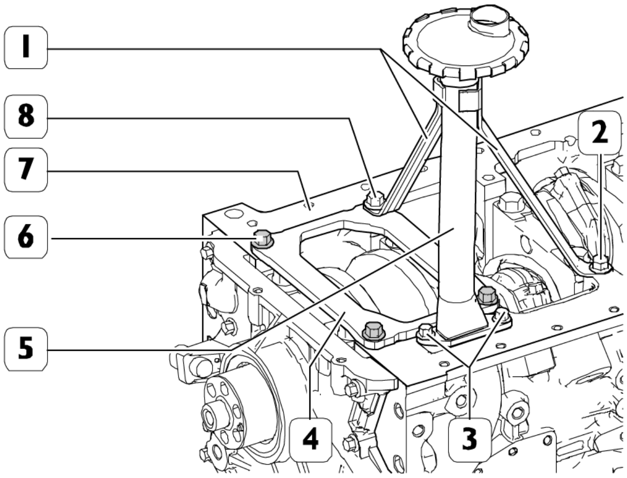
43. Apply the part **(4)** of the tool to the front crankshaft tang **(6)** securing it with the screws **(5)** and fit the new seal ring **(7)**. Position part **(2)** on part **(4)**, tighten the nut **(3)** until the seal ring **(7)** is fully assembled on the front cover **(1)**.

Tool / Material	
Crankshaft front seal installer	99346252



00902T 16

44. Overturn the engine.
45. Fit the oil suction strainer pipe **(5)** on the crankcase **(7)** after having inserted a new gasket and tighten the fastening screws **(3)** to the specified torque.
46. Fit the stiffening plate **(4)** and the oil suction strainer pipe brackets **(1)** on the crankcase **(7)** and tighten the fastening screws **(2)**, **(6)** and **(8)** to the specified torque.

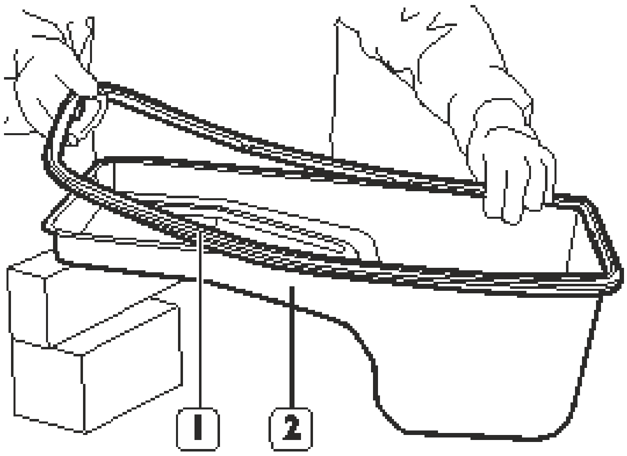


212842 17

Description	Quantity	Step	Value
Suction strainer retainer		2 screws M8 X 20	**25 N·m**
		2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe	2 screws M8 x 20		**25 +/- 2,5 N·m**
Crankcase stiffening plate	4 screwsM10x1.5x25		**43 +/- 5 N·m**

47. Position the gasket **(1)** on the oil sump **(2)**.

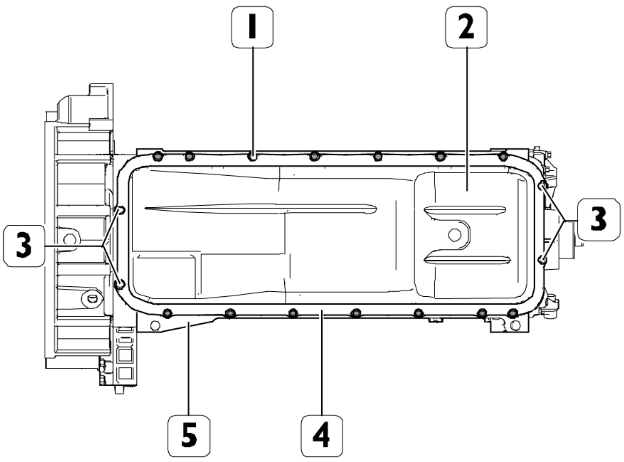
NOTE: *If the gasket is not faulty, it can be reused.*



74770 18

48. Fit the oil sump **(2)** in position on the crankcase **(5)** and apply the relevant plate **(4)** to it.
49. Tighten the fastening screws **(1)** and **(3)** to the prescribed torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*



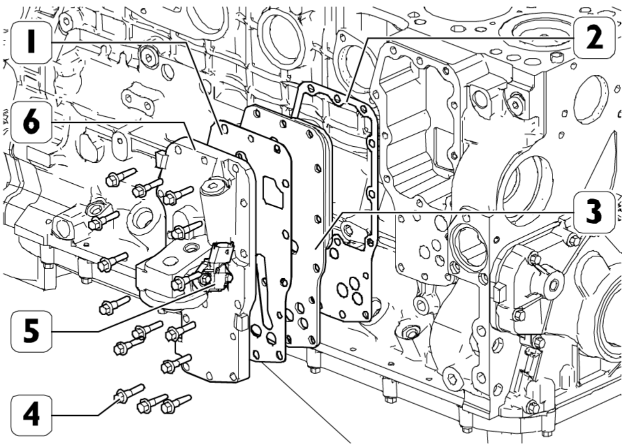
212841 19

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screwsM8 x 1.25 x 45	**27 – 30 N·m**

50. Fit the oil filter / heat exchanger with the oil temperature and pressure sensor **(5)** on the crankcase together with the following elements: oil filter bracket **(6)**, heat exchanger plate **(3)** and relative gaskets **(1)** and **(2)**.
51. Tighten the fastening screws **(4)** to the specified torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Value
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35	**26 +/- 4 N·m**

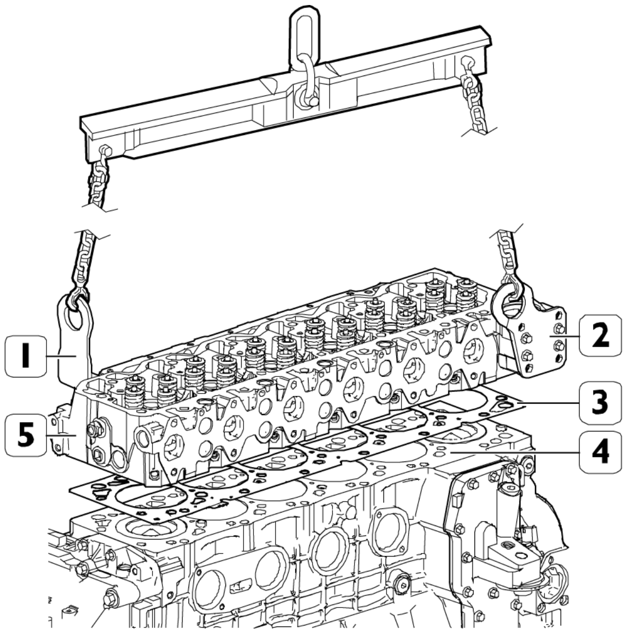


212840 20

52. If the valves have been removed from the head, refit them before refitting the head on the crankcase.
53. Use suitable lifting hooks **(1)** and **(2)** in order to lift and fit the cylinder head **(5)** on the crankcase **(4)** after having inserted a new gasket **(3)** by using a hoist with the tool.

NOTE: *Check that the mating surfaces of the cylinder head **(5)** and engine block **(4)** are clean.*
There are two types of cylinder head gaskets:
*- Type A, **1,25 mm** thick*
*- Type B **1,15 mm** thick.*
Check the average protrusion S of the pistons:
*If S > **0,40 mm**, use gasket type A.*
*If S ≤ **0,40 mm** use gasket type B.*
Keep the cylinder head gasket clean.
*Fit the cylinder head gasket **(3)** with the "TOP" marking facing the head.*
The arrow shows the point where the gasket thickness is given.

Tool / Material	
Rocking sling for removing/installing engine	99360595

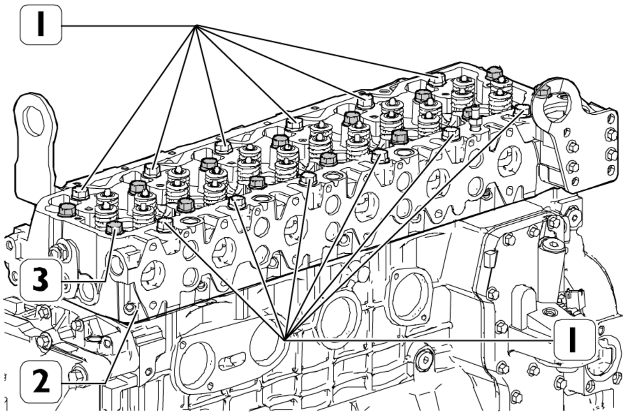


212839 21

54. After having correctly positioned the gasket on the crankcase, assemble the cylinder head **(2)** and tighten the new fastening screws **(1)** and **(3)** in three steps, in the order and manner shown in the figure below.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Step	Value
Cylinder head	12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**



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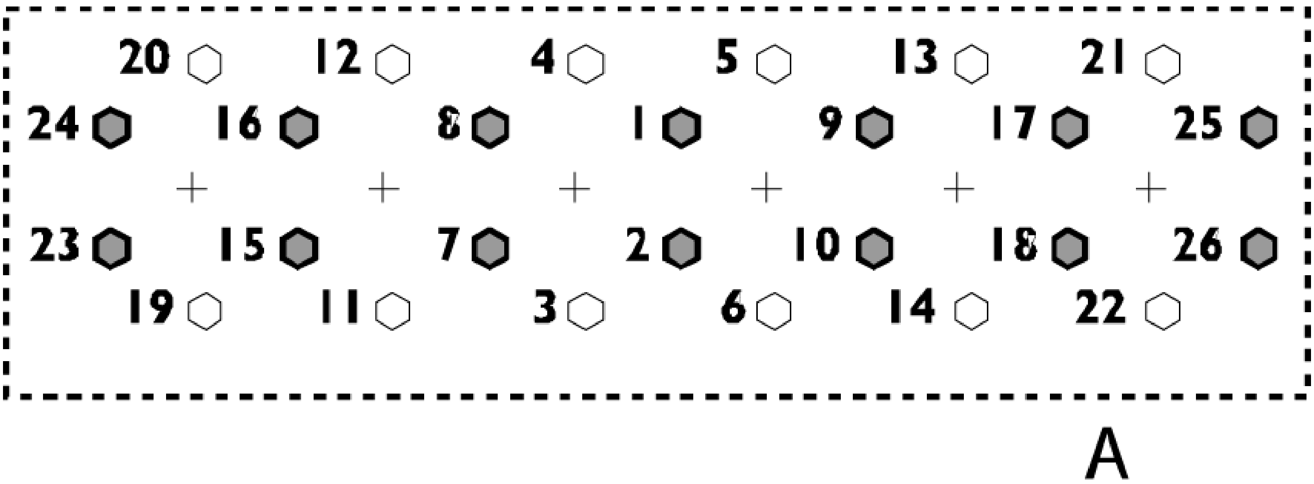

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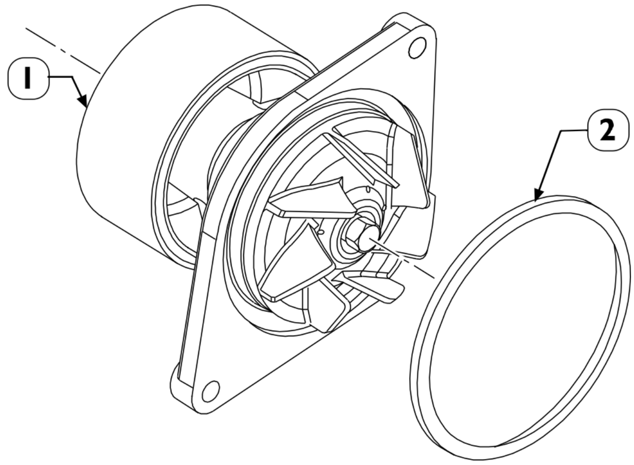
Diagram of the tightening sequence for the cylinder head fixing screws

A. Front side

55. Fit a new seal ring **(1)** to the water pump **(2)**.



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56. Install the water pump **(11)** and tighten the fastening screws **(10)** to the prescribed torque.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**

57. Install the crankshaft pulley **(9)** together with the damper pulley **(8)** and tighten the fastening screws **(7)**.

Description	Quantity	Step	Value
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**

58. Install the idler guide pulley **(5)** and tighten the fastening screw **(6)** to the prescribed torque.

Description	Quantity	Value
Idler pulley	1 screw M10 x 1.5	**43 +/- 6 N·m**

59. Install the automatic belt tensioner mount **(12)** and tighten the fastening screws **(13)** to the prescribed torque.

Description	Quantity	Value
Automatic belt tensioner support	2 screws M8 x 1.25 x 30	**24 +/- 4 N·m**

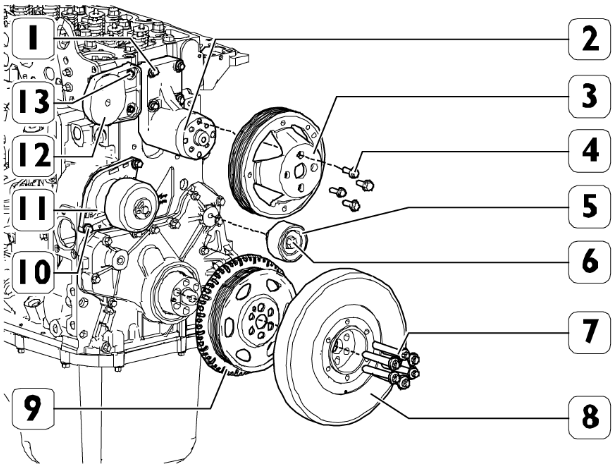
60. Install the fan pulley mount **(2)** and tighten the fastening screws **(1)** to the prescribed torque.

Description	Quantity	Value
Fan pulley mount	4 screwsM8 x 1.25 x 45	**24 +/- 4 N·m**

61. Install the fan control pulley **(3)** and tighten the fastening screws **(4)**.

NOTE: *The flywheel blocking device can aid the installation of the damper pulley* ***(8)*** *fitted onto the crankshaft pulley* ***(9)***.

Description	Quantity	Value
Fan control pulley	4 screws-M10 x 1.25	**68 +/- 7 N·m**

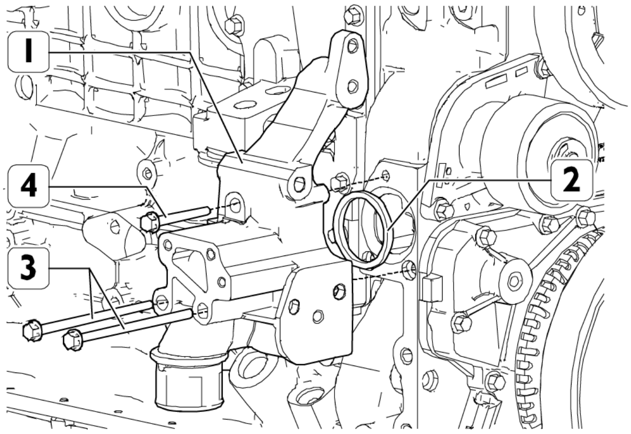


212837 25

62. Fit the engine coolant inlet **(1)** after having positioned a new gasket **(2)**, so that the two reference hollow pins are set against the crankcase.
63. Tighten the fastening screws **(3)** and **(4)** to the prescribed torque.

NOTE: *Before any assembly operation, always check that the hole and the screw thread do not show any sign of wear or dirt.*

Description	Step	Value
Engine coolant inlet	2 screws M10x1.5x130	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



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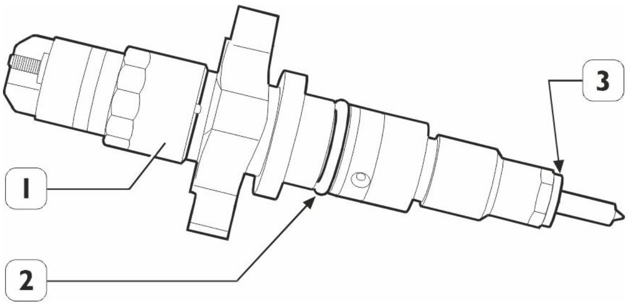
64. Fit both a new sealing ring **(2)** lubricated with Vaseline and a new sealing washer **(3)** on the injector **(1)**.



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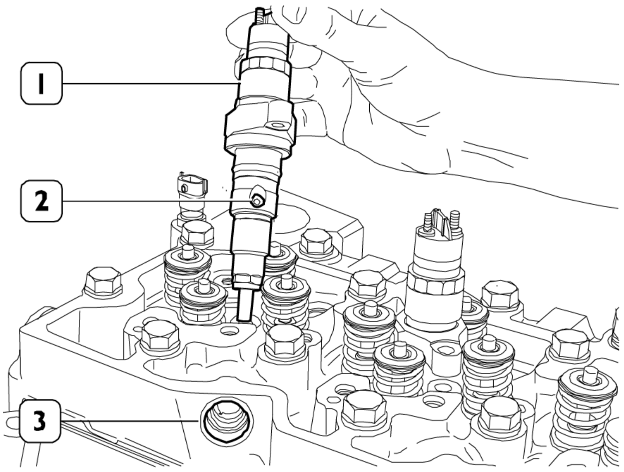
65. Fit the electro-injectors **(1)** on the cylinder head seats, directed so that the fuel inlet hole **(2)** is facing the fuel manifold seat **(3)** side.
66. Position the electro-injector fastening brackets and screw in the screws without tightening them.



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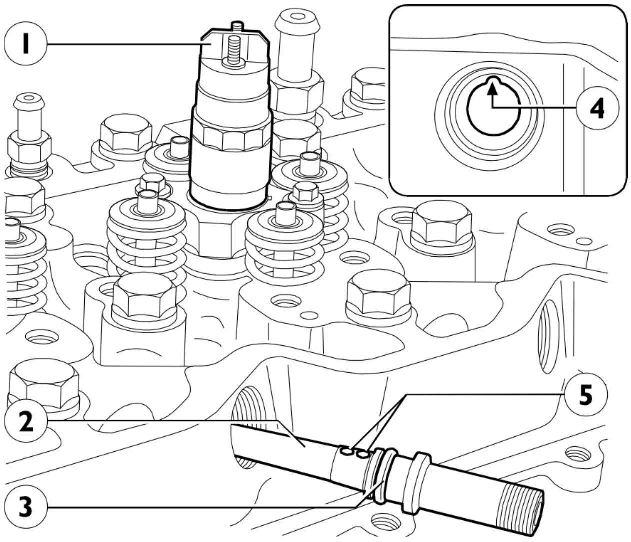
67. Fit a new sealing ring **(3)** lubricated with Vaseline on the fuel manifold **(2)** and fit it into the cylinder head seat so that the positioning balls **(5)** coincide with the relevant housing **(4)**.

NOTE: *Disassembled fuel manifolds **(2)** must not be used again, but must be replaced with other new ones. The fuel manifolds **(2)** in the engines have two positioning balls.*



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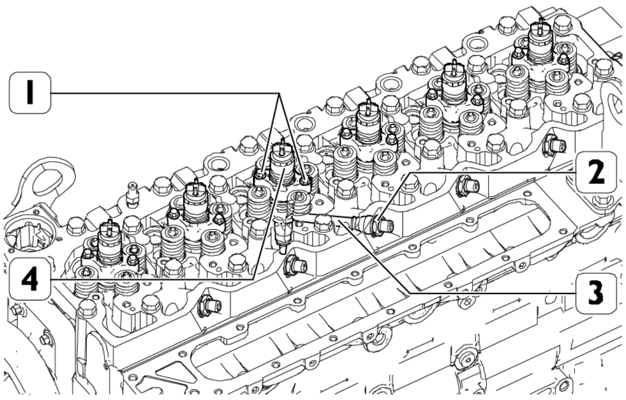
68. Screw the fastening nuts **(2)** without locking them.

69. Tighten gradually and alternately the electro-injector **(4)** fastening screws **(1)** to the prescribed torque in four stages.

70. Tighten the fuel manifold **(3)** fastening nuts **(2)** to the prescribed torque.

NOTE: *During this operation, the injector **(4)** must be moved so that the manifold is properly inserted into the fuel inlet hole **(3)**.*

Description	Quantity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Phase 3 Angle tightening	**25°**
		Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**



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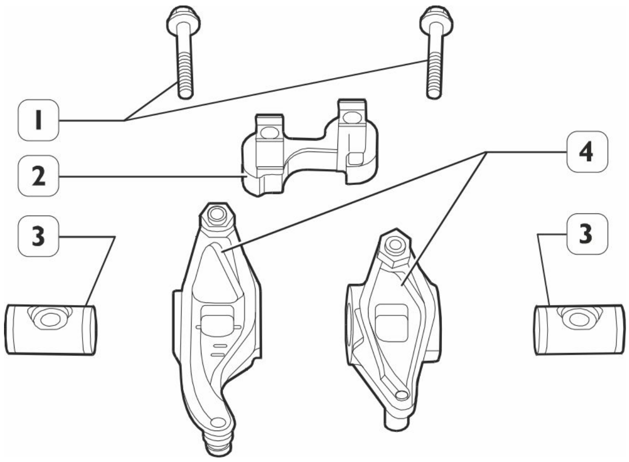

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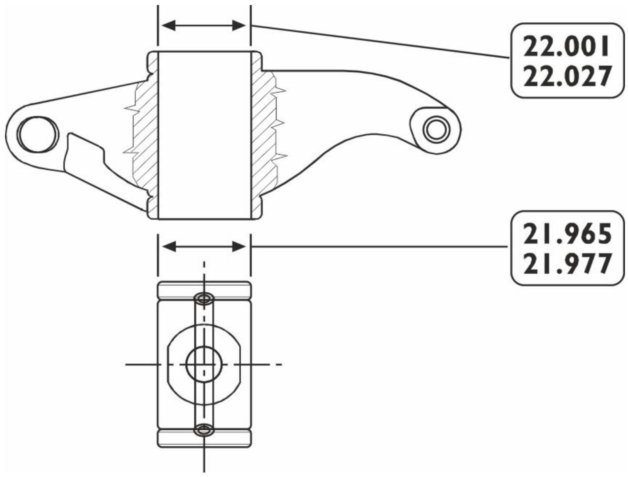
ROCKER ASSEMBLY COMPONENTS:

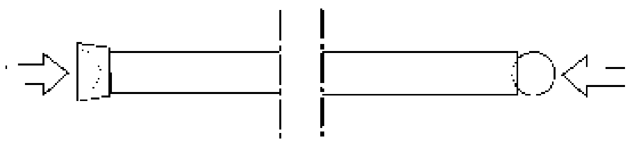
1. Screws
2. Carrier
3. Shafts
4. Rocker arms



70344 32

SHAFT-ROCKER MAIN DATA

71. Check that shaft-rocker arm bushing surfaces are not excessively worn or damaged.
72. Before assembly, check the rocker arm controls rods: there should be no deformation; the spherical contact seats with the rocker arm adjusting screw and the lift (arrows) should not present signs of seizure or wear and replace them if they do.
73. Intake and exhaust valve push-rods are identical and are therefore interchangeable.



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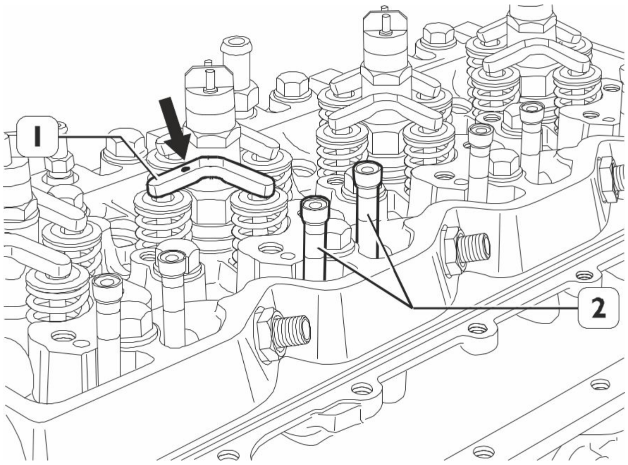
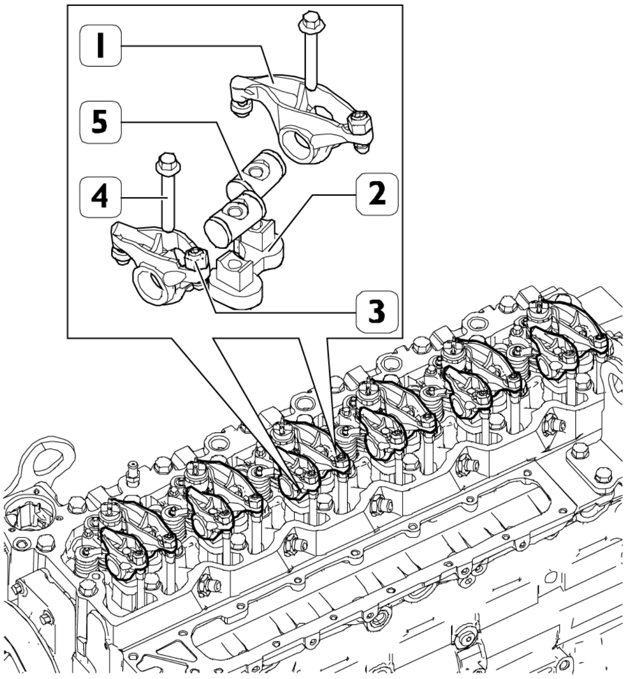
74. Fit the rods **(2)**.
75. Position bridges **(1)** on valves with marks **(→)** facing the exhaust manifold.



70345 34

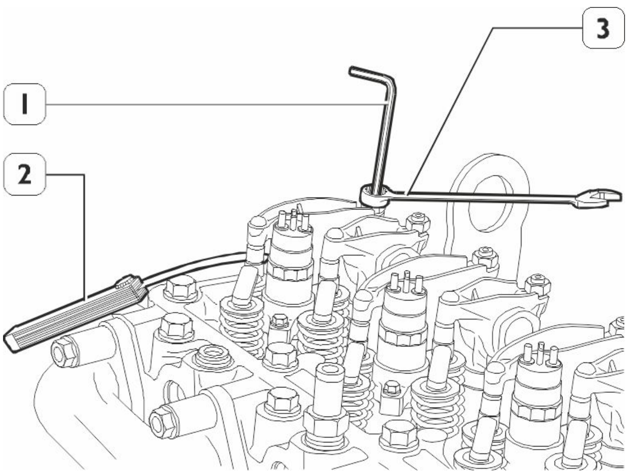
76. Check that the tappet adjuster screws and retaining nuts **(3)** are loose to prevent them sticking on the rods when refitting the rocker assembly.
77. Install the rocker unit consisting of bracket **(2)**, rockers **(1)** shafts **(5)** and secure them to the cylinder head by tightening the fastening screws **(4)** to the prescribed torque.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 35

78. The adjustment of the clearance between the rocker arms and the intake and exhaust valves must be strictly carried out using an Allen wrench **(1)**, a box-end wrench **(3)** and a feeler gauge **(2)**.
79. Clearance shall be as follows:
    - intake valves **0,25 +/- 0,05 mm**;
    - Exhaust valves **0,51 +/- 0,05 mm**.



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80. To carry out rocker arm - valve clearance adjustment more quickly, proceed as follows:

81. Rotate the crankshaft, balance the valves of cylinder no. 1 and adjust the valves marked with an asterisk as shown in the tables below:

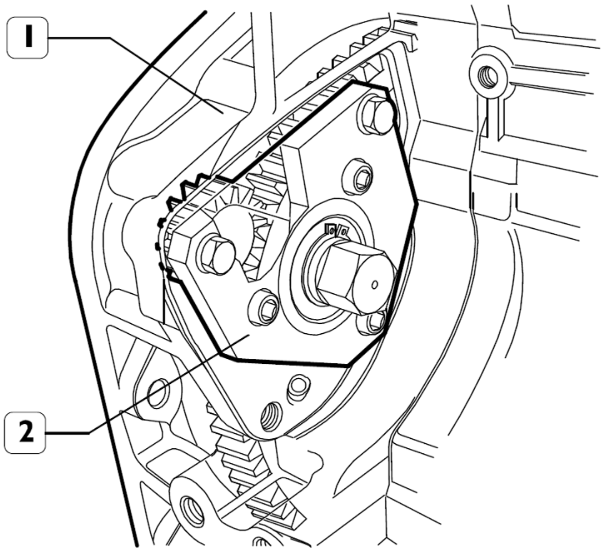
cylinder n	1	2	3	4	5	6
intake	–	–	*	–	*	*
exhaust	–	*	–	*	–	*

82. Rotate the crankshaft, balance the valves of cylinder no. 6 and adjust the valves marked with an asterisk as shown in the tables below:

cylinder n	1	2	3	4	5	6
intake	*	*	–	*	–	–
exhaust	*	–	*	–	*	–

83. To rotate the crankshaft, fit the tool **(2)** in the seat of the electric starter motor housed in the flywheel housing **(1)**.

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



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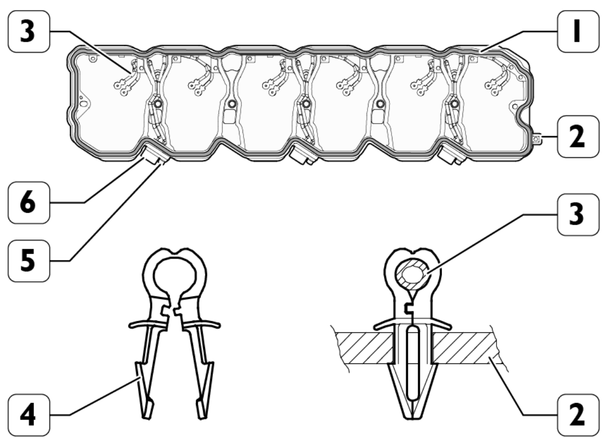
84. Check the condition of the wiring **(3)**, if damaged, replace it by cutting the collars **(4)** and removing the screws **(5)** securing the support to the connectors **(6)**.
85. Open a new collar **(4)**, insert the new cable **(3)**, close the collar and fit it into its eat on the support **(2)**.
86. Tighten the screws **(5)** to the specified torque.
87. Fit a new gasket **(1)** on the support **(2)**.



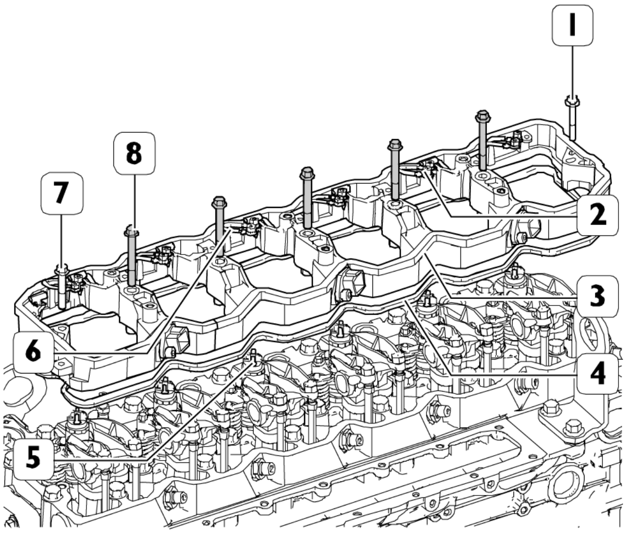
267944 38

88. Fit the electro-injector wiring support **(3)** complete with a new gasket **(4)** and tighten the screws **(1)**, **(7)** and **(8)** to the prescribed torque.

89. Connect the electrical wiring **(6)** to the electro-injectors **(5)** and using a torque wrench tighten the securing nuts **(2)** to the specified torque.

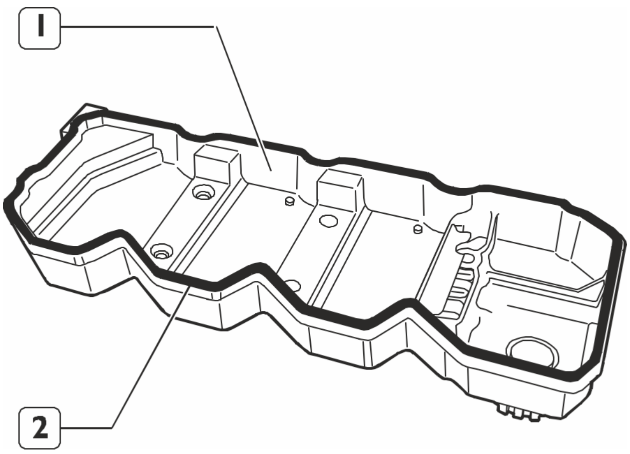
NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**



212833 39

90. Place a new gasket **(2)** on the tappet cover **(1)**.



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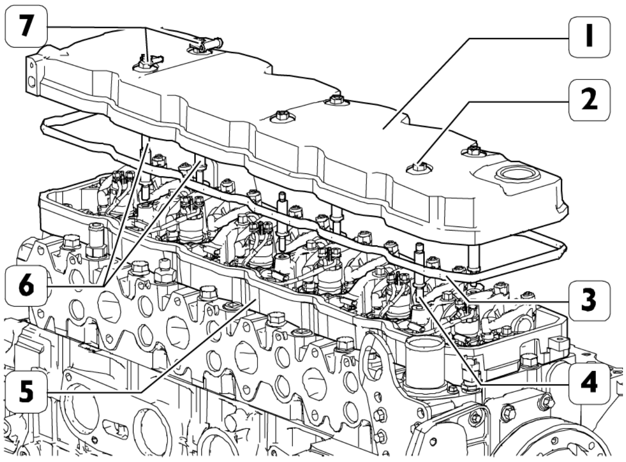
91. Screw the double-shank threaded screws **(4)** and **(6)** into the wiring support **(5)**.

92. Install the tappet cover **(1)** on the wiring support **(5)** after having inserted a new gasket **(3)**.

93. Tighten the fastening nuts **(2)** and **(7)** to the prescribed torque.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**

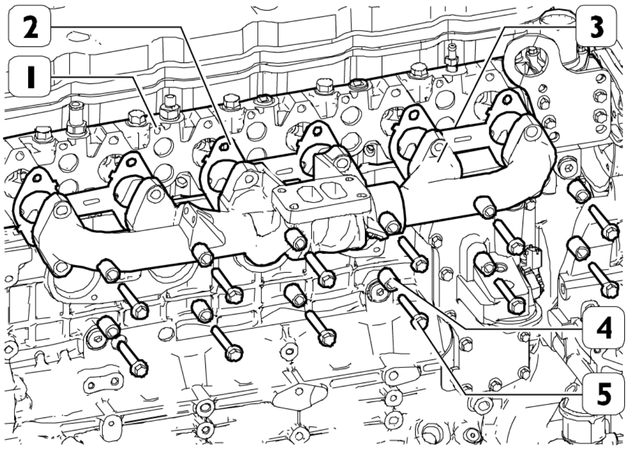


212832 41

94. Fit the exhaust manifold **(3)**in position with the new gasket **(2)** to the cylinder head **(1)** and tighten the fastening screws **(5)** after having inserted spacers **(4)** to the prescribed torque following the order and mode shown in the figure below.

NOTE: *Always replace the gaskets* ***(2)*** *with new spare parts.*
Check the thread of the fastening screws: it must not show signs of wear or deposits of dirt.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



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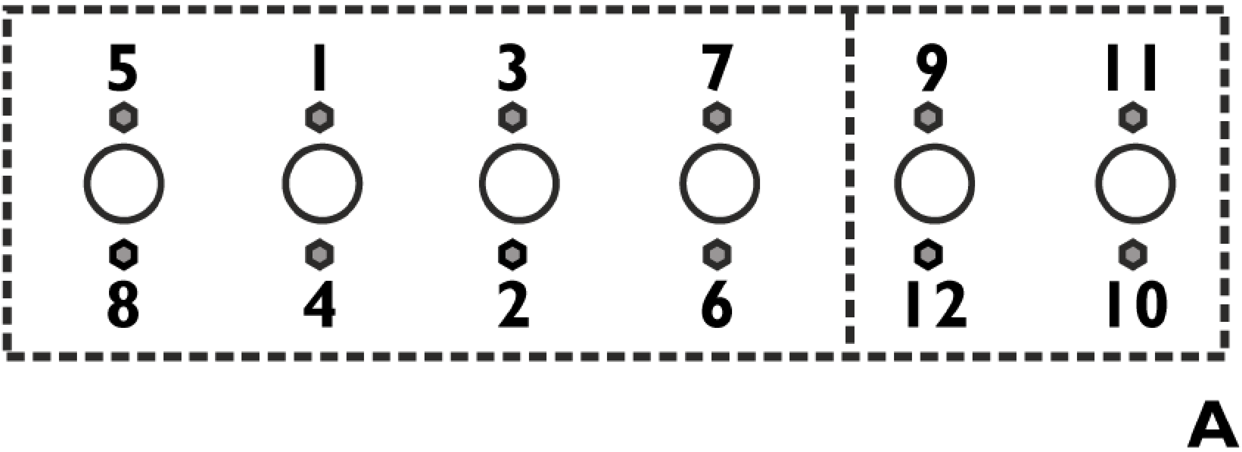


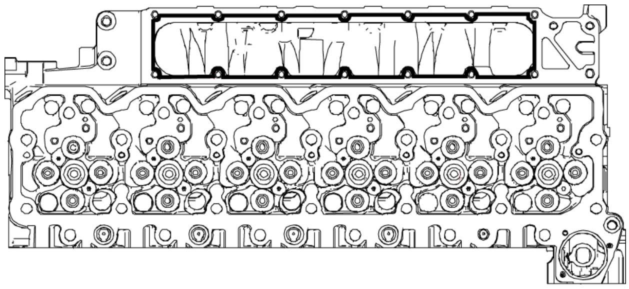
209215 43

Diagram of the tightening sequence for the exhaust manifold fastening screws

A. Front side

95. Carefully clean the contact surfaces and apply a continuous sealant bead of **LOCTITE® 5970 (A IVECO STD. 18-1733)** to the surface of the cylinder head as shown in the figure.

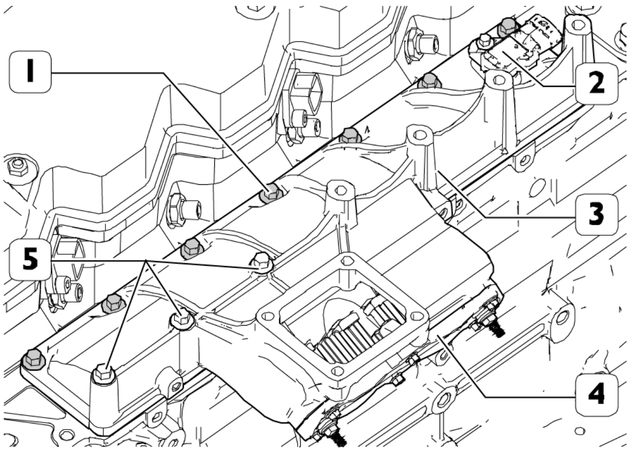
NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Apply **LOCTITE® 5970 (A IVECO STD. 18-1733)** to obtain a bead of a few mm diameter.*
It must be uniform (no grains), with no air bubbles and with no thin areas or discontinuities.
Ensure that any imperfections are corrected immediately.
Do not use too much sealant to seal the joint.
If too much sealant is used it could come out from the sides of the joint, causing the lubricant passage to clog.
*After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*



209211 44

96. Install the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** on the cylinder head and tighten the fastening screws **(1)** and **(5)** to the prescribed torque.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**

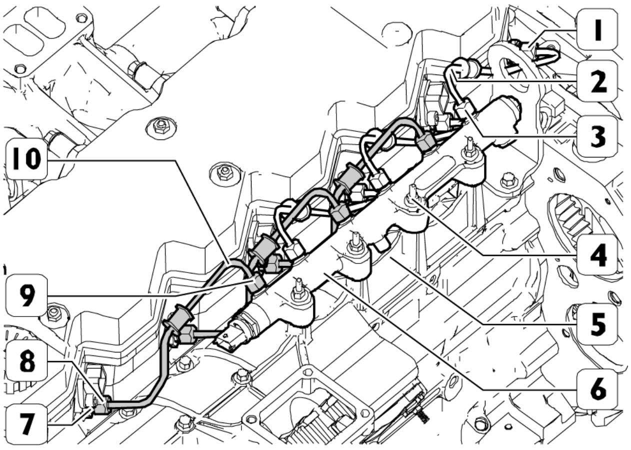


212831 45

97. Install the common rail and the high-pressure fuel delivery pipes as follows:
98. Install the common rail **(6)** on the intake manifold **(5)** and manually tighten the threaded double-shank shoulder screws **(4)**.
99. Tighten the two central screws **(4)** to a torque of **0,1 N·m**.
100. Fit the high-pressure fuel delivery pipes **(2)** and **(10)** and manually tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** first from the common rail side and then from the cylinder head side.
101. Tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to a torque of **5 N·m**, fist of all from the cylinder head side and then from the common rail side.
102. Tighten the threaded double-shank shoulder screws **(4)** fixing the common rail **(6)** on the intake manifold **(5)** to the prescribed torque.
103. tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to the prescribed torque, first from the common rail side and then from the cylinder head side.

NOTE: *The high pressure fuel delivery pipes must be replaced each time they are disconnected. The flexible pipe fittings must be tightened to the specified torque using a wrench and a torque wrench.*

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screwsM8x1.25x125		**36 +/- 5 N·m**



212830 46

104. Make sure that the high-pressure fuel pump **(4)** is suitably supported.

105. Screw in the studs **(5)**. Fit the high pressure fuel pump **(4)** complete with the mechanical pump, flange and gear and tighten the fastening nuts **(5)** to the specified torque.

Description	Step	Value
High-pressure pump	3 nuts M8x8	**24 +/- 4 N·m**
	3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**

106. Install the stud, the support with a new sealing ring and the camshaft timing segment speed sensor **(6)**. Tighten the fastening nut **(7)** to the specified torque.

Description	Quantity	Value
Camshaft timing sensor	1 nut with stud M6 x 1	**12 N·m**

107. If present, install the power take-off **(PTO)** together with the flange and the gear.

108. Fit the cover **(2)** after having inserted a new gasket and tighten the fastening screws **(1)** and **(3)** to the prescribed torque.

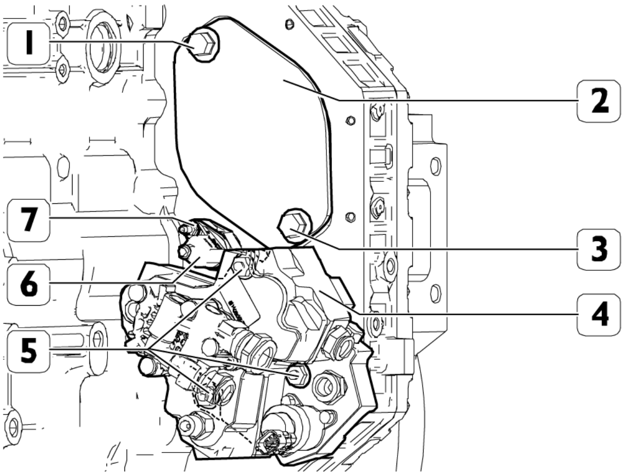
Description	Quantity	Value
Power take-off cover	2 screws M12x1.7 5x25	**80 +/- 5 N·m**

109. Fit the blow-by filter **(8)** in position on the flywheel housing and tighten the fastening screws **(7)** to the specified torque.

110. Install the oil return pipe **(5)** with new copper washers and tighten the fittings **(2)** and **(6)** to the prescribed torque.

111. Insert the blow-by breather pipe **(3)** in the union located on the timing gear case and fasten it with the clips **(4)**. Tighten the screw **(1)** fastening the tappet cover to the specified torque.

Description	Quantity	Value
Blow-by breather plate	1 screw M6 x 1	**10 +/- 2 N·m**
Blow-by breather pipe	2 fittings M12 x 1.5	**20 +/- 4 N·m**
Blow-by filter	3 screws M6 x 1	**10 +/- 2 N·m**



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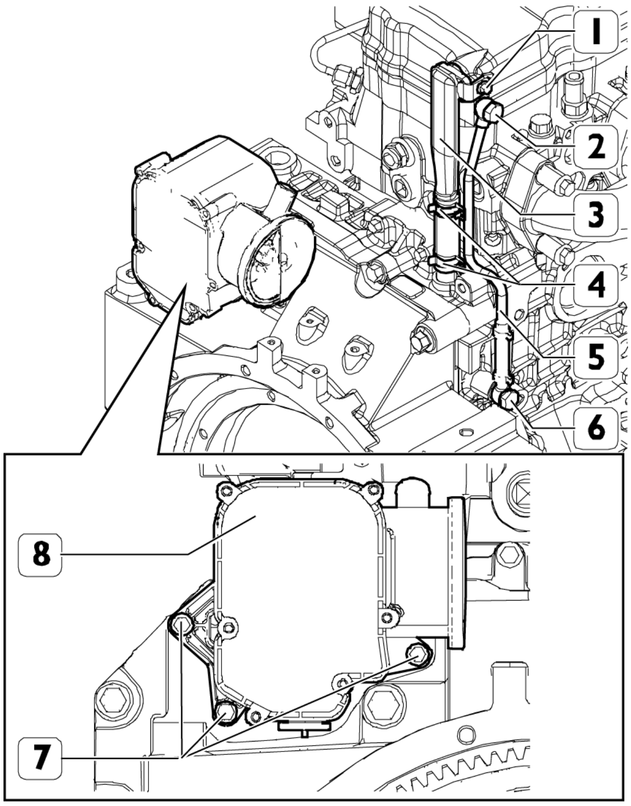


212828 48

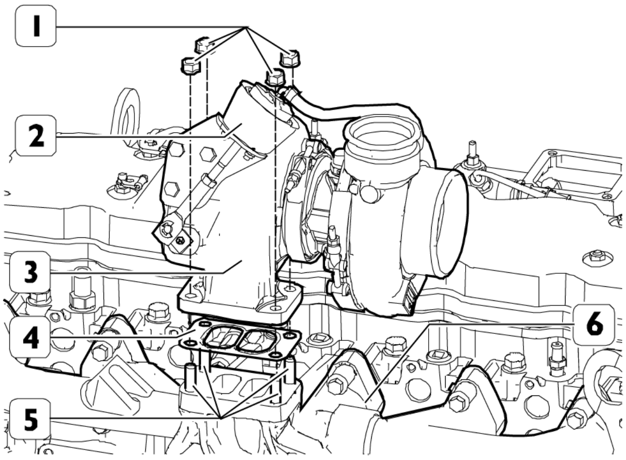
112. Fit the turbocharger **(3)**:

113. screw the studs **(5)** onto the exhaust manifold **(6)**.

114. hold the turbocharger **(3)** together with the waste-gate valve **(2)** and place it on the exhaust manifold **(6)** after having inserted a new gasket **(4)**.

115. Tighten the fastening nuts **(1)** to the prescribed torque.

Description	Step	Value
Turbo charger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**

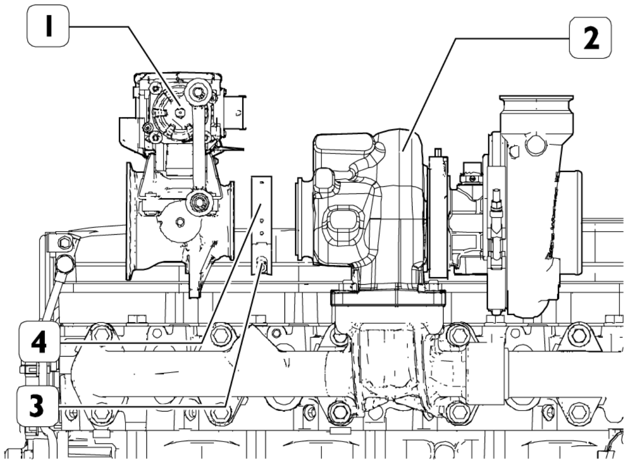


214768 49

116. Install the motorized throttle valve **(1)** onto the turbocharger **(2)**.

117. Turn the screw **(3)** and tighten the V-clamping collar **(4)** to a torque of.

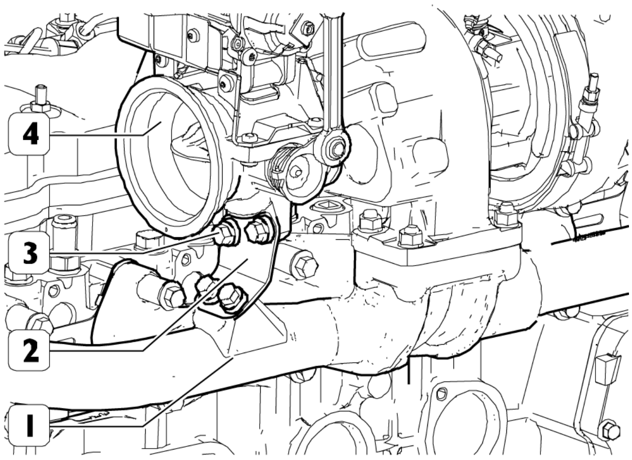
Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**



215025 50

118. Assemble the bracket **(2)** fixing the motorized throttle valve **(4)** to the exhaust manifold **(1)** and tighten the fastening screws **(3)** to the prescribed torque.

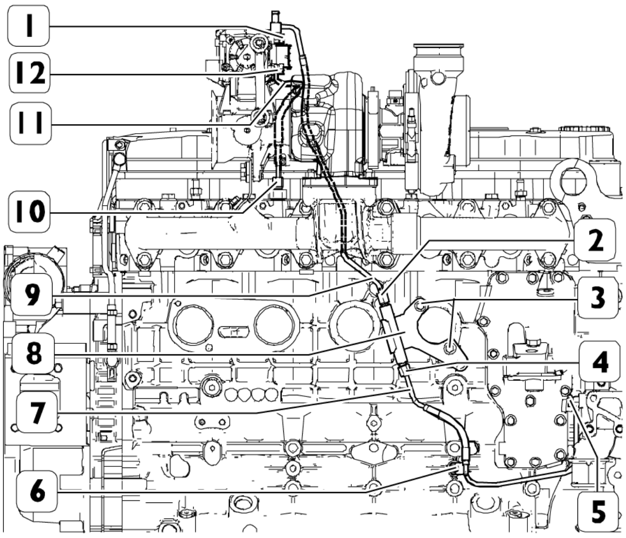
Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	**25 N·m**



215026 51

119. Install the motorized throttle valve water inlet and outlet pipes as follows:
120. Fit the water delivery pipe **(11)** and tighten the fastening nut **(10)** and the fitting **(12)** to the prescribed torque.
121. Fit the water return pipe union **(8)** and tighten the fastening screws **(3)** to the specified torque.
122. Fit the lower-section water return pipe **(7)** and tighten the fastening nut **(4)**, connector **(5)** and screw **(6)** to the prescribed torque.
123. Fit the upper-section water return pipe **(9)** and tighten the fastening nut **(2)** and connector **(1)** to the prescribed torque.

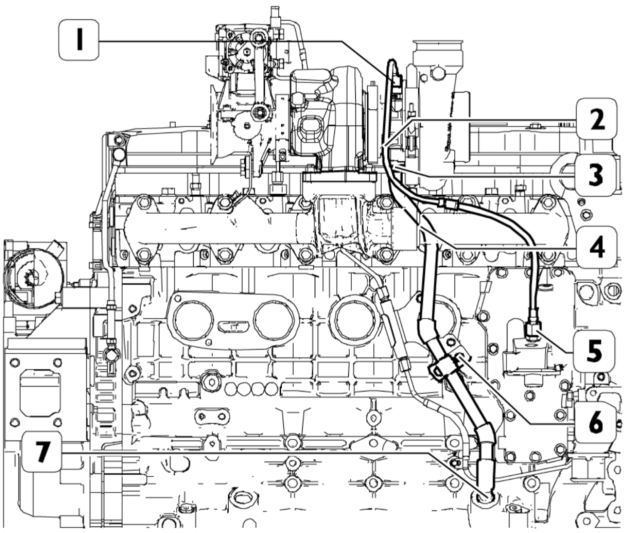
Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**



215035 52

124. Fit the lubricant drain pipe **(4)** on the turbocharger, screwing the fitting **(7)** onto the crankcase.
125. Screw the fastening screws **(3)** into the lower part of the turbocharger, after fitting a new gasket.
126. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
127. Install the lubricant oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger and tighten the hose couplings **(1)** and **(5)** to the prescribed torque.

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**

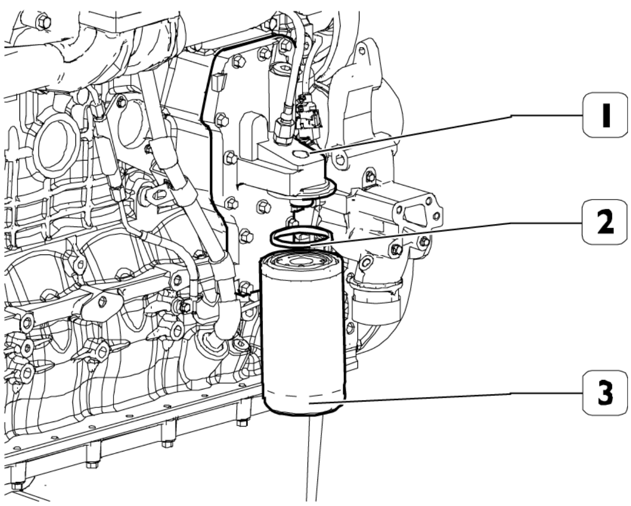


215034 53

128. Moisten the sealing gasket **(2)** of the oil filter **(3)** with a thin layer of oil.
129. Manually tighten the oil filter **(3)** on the support **(1)** until it comes into contact with the gasket **(2)**.
130. Tighten the oil filter **(3)** further to the prescribed torque using a specific tool.

Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**

131. Operate the engine for a few minutes and then recheck the level using the dipstick. Top up if necessary to compensate for the oil used for refilling the filtering cartridge.



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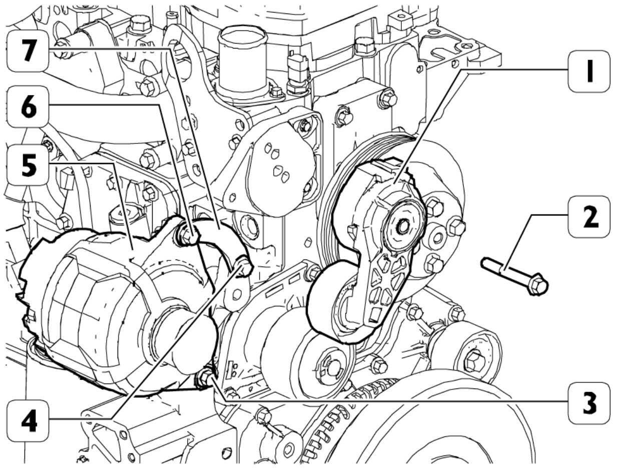
132. Install the bracket **(7)** securing the alternator **(5)** and tighten the screws **(3)**, **(4)** and **(6)** to the prescribed torque.

133. Fit the automatic belt tensioner **(1)** and tighten the fastening screw **(2)** to the required torque.

Description	Quantity	Step	Value
Automatic belt tensioner	1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Alternator		1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**



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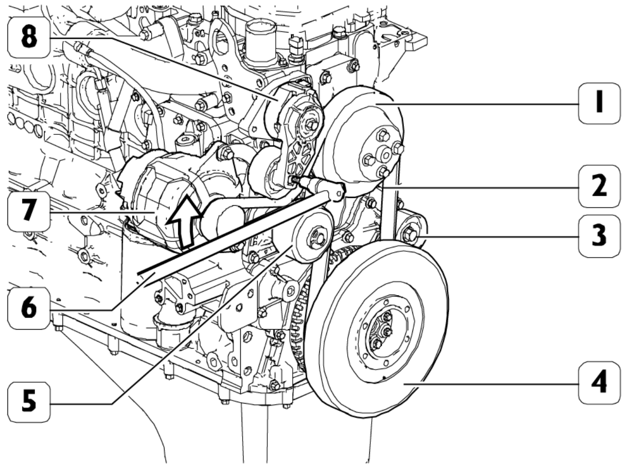
134. Fit the Poly V belt **(2)** on the pulleys and guide roller.

135. Use the appropriate tool **(6)** on the automatic belt tensioner **(8)** to fit the new belt **(2)** in the operating position.

136. No further adjustments are required. The belt tension **(2)** is adjusted automatically via the calibrated spring in the automatic belt tensioner **(8)**.



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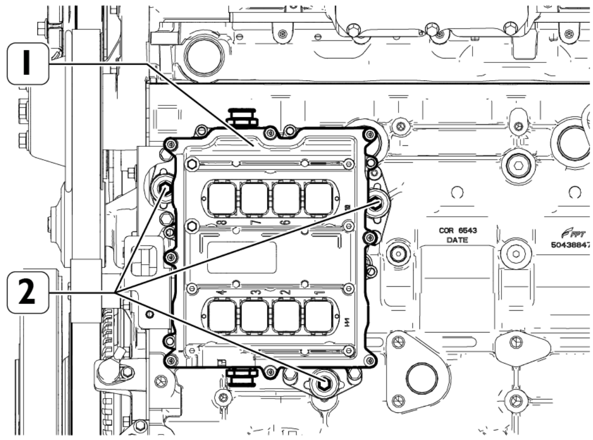
137. Fit the ECU **(1)**, together with the heat exchanger and tighten the screws **(2)** to the prescribed torque.

138. If the rubber buffers are cracked or excessively deformed, replace them.

139. Install the low-pressure fuel pipe that connects the fuel pre-filter to the engine management control unit heat exchanger and connect the retainer.

Description	Step	Value
Engine Controller Module	3 screws M8 x 1.25 x 45	**14 N·m**



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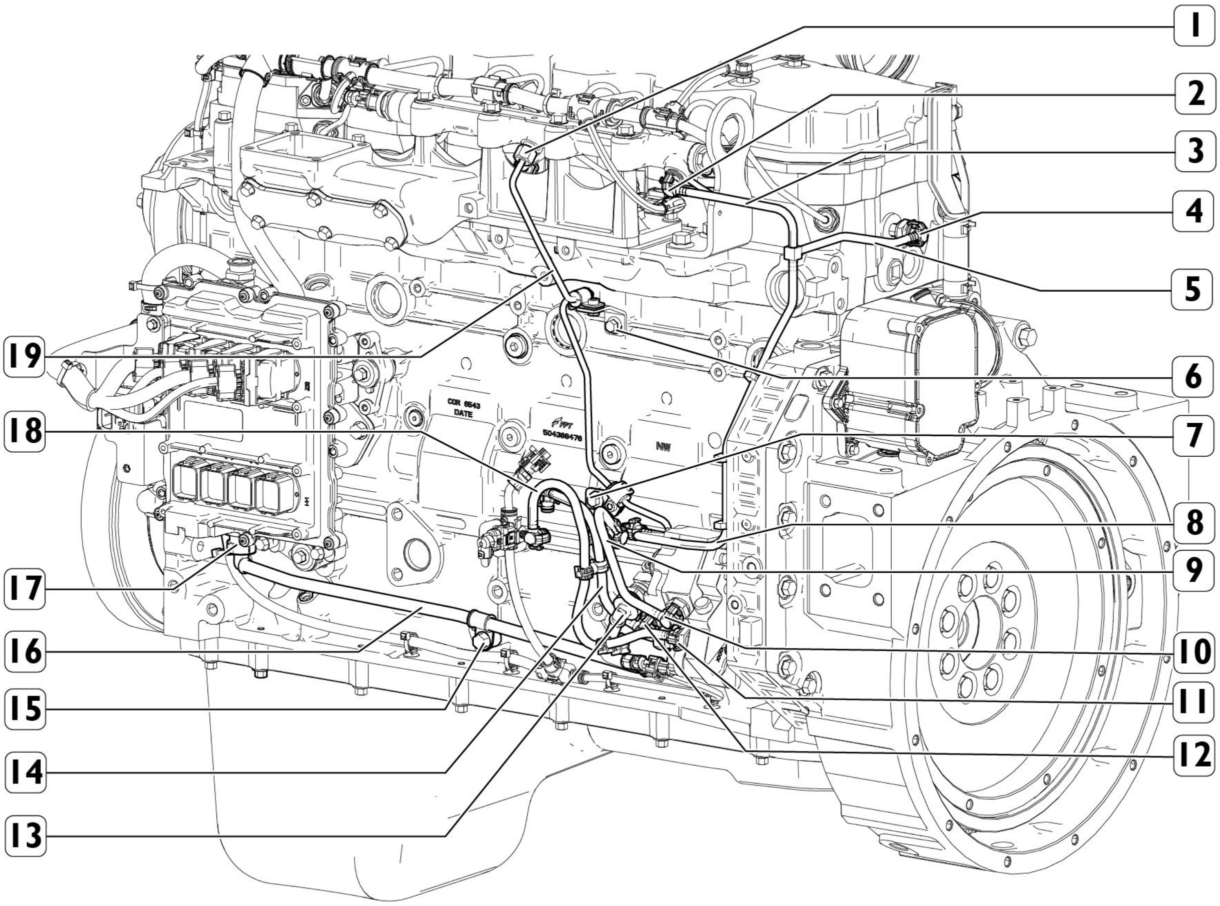

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140. Connect the high-pressure fuel pipe **(19)** to the engine block and tighten the fastening screws **(6)** and **(7)** to the prescribed torque.

141. Connect the pipe **(19)** to the high pressure pump and the common rail and tighten the hose couplings **(1)** to the prescribed torque.

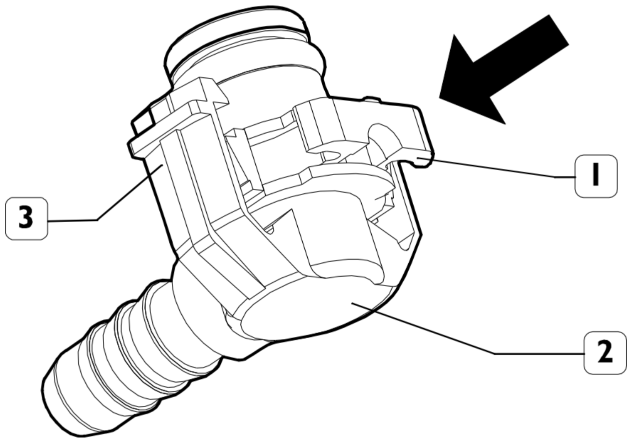
NOTE: *The high-pressure fuel pipe must always be replaced each time it is removed.*

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**

142. Fit the fuel return pipes **(3)**, **(5)** and **(8)** from the common rail and electro-injectors to the fuel filter support and connect the retainers **(2)** and **(4)**.
143. Fit the fuel return pipe **(9)** from the high-pressure pump to the fuel filter support and connect the retainer **(10)**.
144. Fit the low-pressure fuel pipe **(14)** from the mechanical pump to the fuel filter and connect the retainer **(12)**.
145. Fit the low-pressure fuel pipe **(16)** from the engine control unit heat exchanger to the mechanical pump, tighten the fastening screw **(15)** to the prescribed torque and connect the retainers **(13)** and **(17)**.
146. Fit the low pressure **(18)** fuel pipe from the fuel filter to the high pressure pump and connect the retainer **(11)**.
147. To connect the low-pressure fuel pipe to the connection fitting, insert the quick-fit coupling **(2)** into the connection fitting until the catch **(3)** engages.

NOTE: *Check proper fuel pipe connection.*

148. Correctly position the engine cable and close the clips retaining the engine cable to the crankcase. Connect the engine cable to the control unit **(8)**, to the motorised throttle valve actuator connector **(2)** and to all the sensors and senders indicated in the electrical equipment section.



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REMOVING THE ENGINE FROM THE ROTATING STAND

149. To complete the engine assembly, it is necessary to remove it from the rotating stand.

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

150. Use a hoist with the tool to support the engine and loosen the screws securing the brackets to the rotating stand.

Tool / Material	
Rocking sling for removing/installing engine	99360595
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

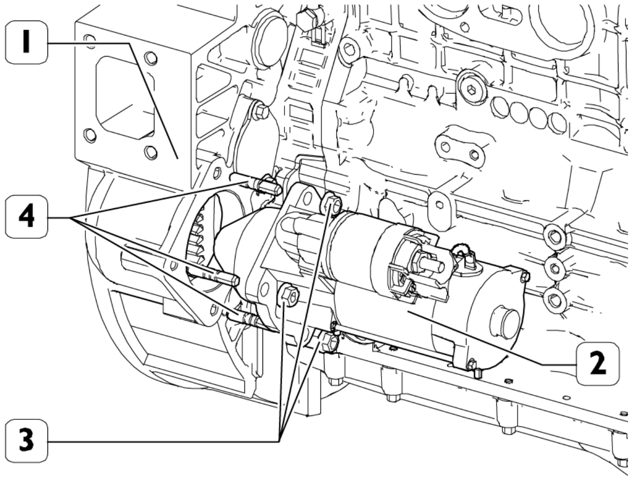
151. Disassemble the brackets from the engine after having placed it correctly on a suitable support.

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037

COMPLETING ENGINE ASSEMBLY

152. Screw in the studs **(4)** and fit the electric starter motor **(2)** into the flywheel housing **(1)**. Tighten the fastening nuts **(3)** to the specified torque.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**



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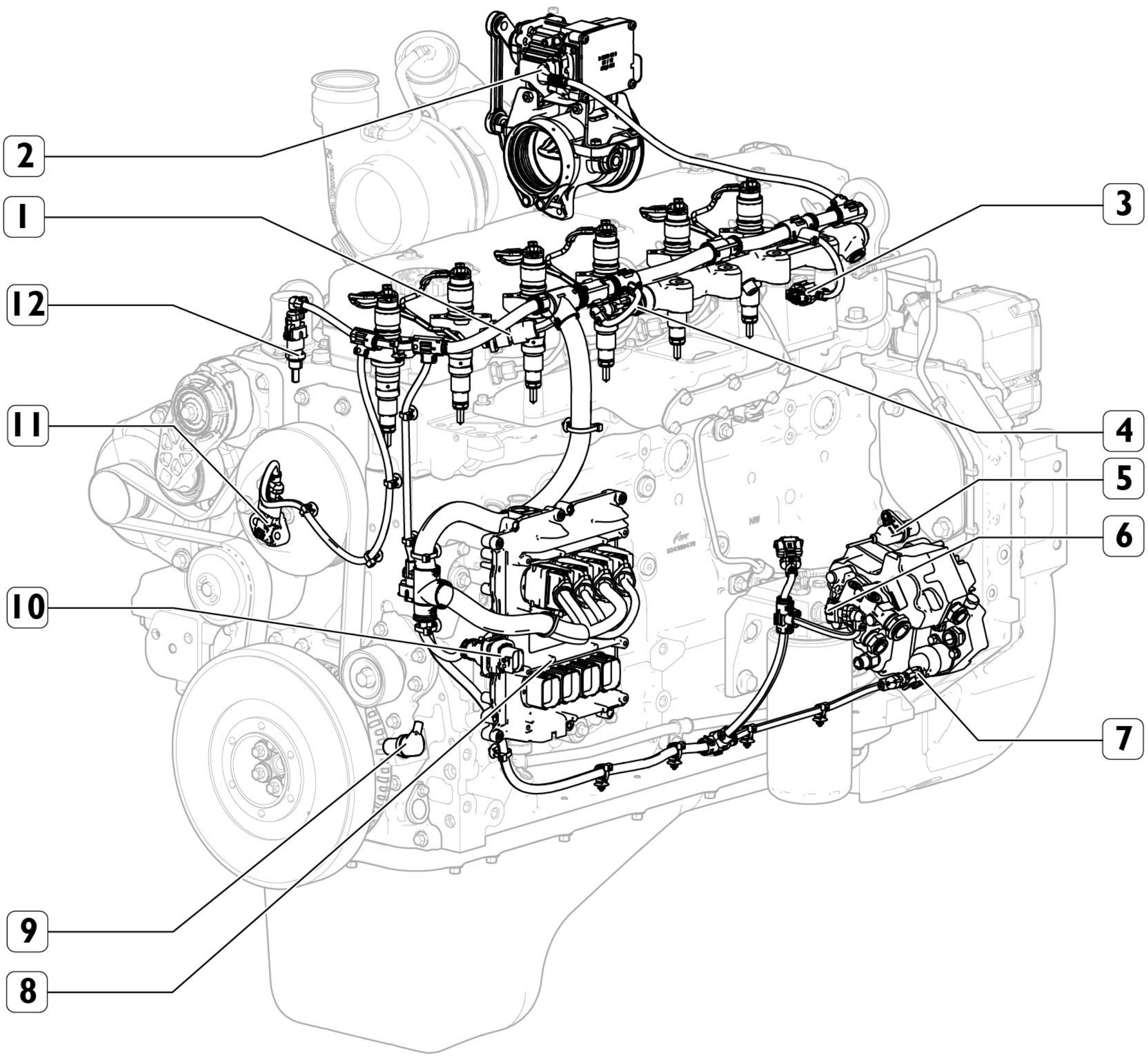
153. Fit the engine cable connecting it to the control unit **(8)**, to the motorised throttle valve actuator connector **(2)** and to all the sensors and transmitters to which it is connected.



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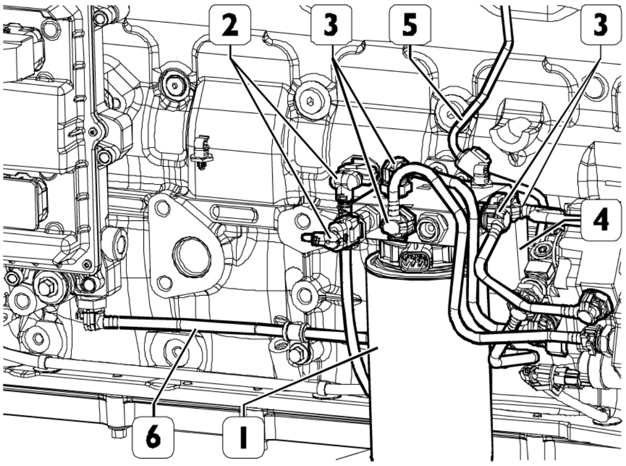
154. Place the fuel filter support **(4)** in position together with the bracket, if present, and tighten the retaining screws to the specified torque.

155. Connect the low- pressure fuel pipes **(3)** to the filter support.

156. Connect the fuel temperature sensor and the camshaft timing sensor electrical connections **(2)**.

157. Fully screw the fuel filter **(1)** onto the fitting on the mount by hand, then tighten the fuel filter to the specified torque.

Description	Quantity	Value
Fuel filter	1 adapter M20 x 1.5	**20 +/- 2 N·m**



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CHECKS AND INSPECTIONS

NOTE: *The following checks must be performed after mounting the engine onto the genset. Check that all the fluids are at the correct level before installing the engine.*

158. Start the engine, leave it running just above the idling speed, wait until the coolant reached the temperature necessary to open the thermostat and then check:
    - that there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required;
    - thoroughly check the connections of the low-pressure fuel pipe to the respective fittings;
    - that there are no oil leaks between the cover and the cylinder head, between the oil sump and the engine block, between the heat exchanger oil filter and the relevant housings and between the different pipes in the lubricating circuit;
    - that there are no fuel leaks from the fuel pipes;
    - there are no air leaks from pneumatic pipes (if present);
    - Also check the correct operation of the warning lights set on the instrument panel and of the equipment disconnected when the engine was removed;
    - carefully check and bleed the engine cooling equipment with repeated bleeding operations.

540110 ENGINE - Assemble

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Air filter bracket	2 screws M6 x 1 x 14		**0 +/- 0 N·m**
Air pipe collar	1 screw		**6,05 +/- 0,45 N·m**
Alternator		1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**
Automatic belt tensioner	1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Automatic belt tensioner support	2 screws M8 x 1.25 x 30		**24 +/- 4 N·m**
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25		**25 N·m**
Bracket supporting air filter on flywheel housing		1 screw M10 x 1.5 x 20	**0 +/- 0 N·m**
		2 screws M12x1.75x25	**0 +/- 0 N·m**
Breather pipe collar on radiator	1 screw		**2,25 +/- 0,25 N·m**
Camshaft gear	6 screws M8 x 1.25		**36 +/- 2 N·m**
Camshaft timing sensor	1 nut with stud M6 x 1		**12 N·m**
Common rail	4 screws M8x1.25x125		**36 +/- 5 N·m**
Crankcase stiffening plate	4 screws M10x1.5x25		**43 +/- 5 N·m**
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Step 3 Angle tightening	**90°**
Electric starter motor		3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
		3 nuts M10 x 1.5	**43 +/- 6 N·m**
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Step 3 Angle tightening	**25°**
		Step 4 Angle tightening	**25°**
Engine controller		3 screws M8 x 1.25 x 45	**14 N·m**
Engine coolant inlet		2 screws M10x1.5x130	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
		2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
		Phase 2 Angle tightening	**60°**
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25		**24,5 +/- 2,5 N·m**
Exhaust manifold	12 screws M10x1.5x65		**55 +/- 3 N·m**
Fan	6 screws M10x1.5x130		**24 +/- 4 N·m**
Fan control pulley	4 screws M10 x 1.25		**68 +/- 7 N·m**
Fan pulley mount	4 screws M8 x 1.25 x 45		**24 +/- 4 N·m**
Flywheel housing		8 screws M12 x 1.75	**85 +/- 10 N·m**
		12 screws M10 x 1.5	**49 +/- 5 N·m**
		2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**
Front gear case		7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
		6 screws M8 x 1.25	**24 +/- 4 N·m**

Description	Quantity	Step	Value
Fuel filter	1 adapter M20 x 1.5		**20 +/- 2 N·m**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
High-pressure pump		3 nuts M8x8	**24 +/- 4 N·m**
		3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**
Idler pulley	1 screw M10 x 1.5		**43 +/- 6 N·m**
Injector wiring support	7 screws M8 x 1.25		**24 +/- 4 N·m**
Intake manifold		7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
		3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
		2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Interface box		8 nuts M6 x 1	**9 +/- 1 N·m**
		2 screws M12x1.75x25	**80 +/- 8 N·m**
Motorized throttle valve water pipes		2 fittings M10 x 1	**20 N·m**
		3 nuts M12 x 1.5	**45 N·m**
		2 screws M8 x 20	**23 +/- 2,3 N·m**
		1 fitting M10 x 1	**25 N·m**
		1 screw M8 x 16	**23 +/- 2,3 N·m**
Oil filter	1 adapter M27 x 2		**18 +/- 2 N·m**
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35		**26 +/- 4 N·m**
Oil pump	4 screws M8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
		Phase 2 Tighten	**24 +/- 4 N·m**
Oil suction strainer pipe	2 screws M8 x 20		**25 +/- 2,5 N·m**
Oil sump		14 screws M8 x 1.25 x 40	**27 – 30 N·m**
		4 screws M8 x 1.25 x 45	**27 – 30 N·m**
Power take-off cover	2 screws M12x1.75x25		**80 +/- 5 N·m**
Protective grille	12 screws M8 x 1.25 x 20		**23 +/- 2 N·m**
Radiator mount	4 nuts M14 x 2		**114,5 +/- 11,5 N·m**
Rear gear case		1 screw M12 x 1.75	**77 +/- 12 N·m**
		4 screws M8 x 1.25	**24 +/- 4 N·m**
		5 screws M10 x 1.5	**47 +/- 5 N·m**
Rocker assembly bracket		5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
		2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**
Suction strainer retainer		2 screws M8 X 20	**25 N·m**
		2 screws M10 x 1.5 x 20	**42 N·m**
Tappet cover		6 nuts M8 x 1.25	**20 +/- 2 N·m**
Throttle valve supporting bracket	4 screws M8 x 1.25 x 25		**25 +/- 3 N·m**
Turbocharger		4 nuts M10 x 1.5	**45 +/- 2 N·m**
		4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50		**6 +/- 1 N·m**
Turbocharger lubrication oil pipes		2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
		2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
		2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**
Water pump	2 screws M8 x 1.25 x 35		**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4		**1,5 +/- 0,25 N·m**

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205
Brackets fixing engine to revolving stand 99322205	99361037
Crankshaft front seal installer	99346252
Crankshaft rear seal installer	99346253
Flywheel restrainer	99360351
Rocking sling for removing/installing engine	99360595

Checking and assembly of tappets and camshaft

1. Check the bushings as described in **BUSHES - Check (54.12)**.
2. Check the tappet sleeves as described in **TAPPETS - Check (54.12)**.
3. Check the camshaft as described in **CAMSHAFT - Check (54.12)**.
4. Assemble the tappets and camshaft as described in **CAMSHAFT - Assemble (54.12)**

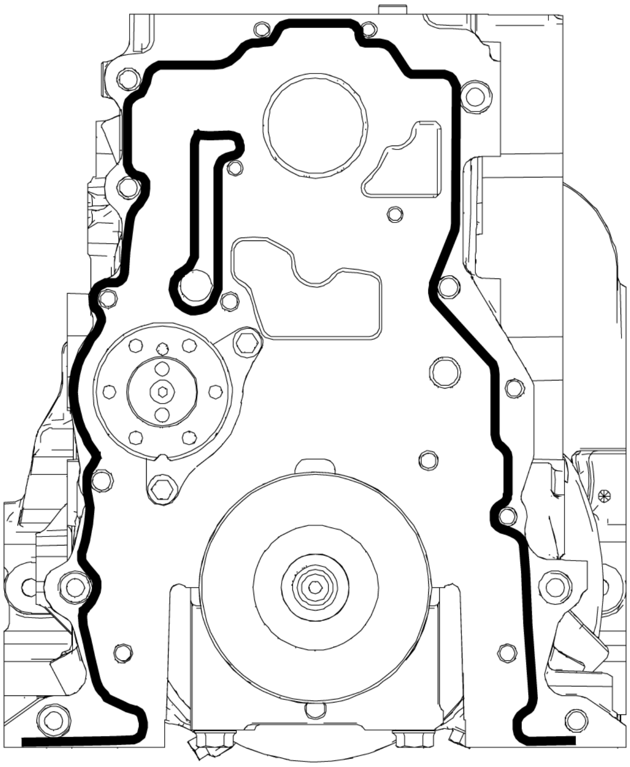
Assembly of main half-bearings and crankshaft

5. Check the crankshaft as described in **CRANKSHAFT - Measure (54.08)**.
6. Assemble the main bearings as described in **MAIN BEARINGS - Assemble (54.08)**.
7. Assemble the crankshaft as described in **CRANKSHAFT - Assemble (54.08)**.
8. Check the thrust clearance of the crankshaft as described in **CRANKSHAFT - Check (54.08)**.

Installing the connecting rod-piston assembly

9. Check the piston components as described in **PISTON - Measure (54.08)**.
10. Check the connecting rod as described in **CONNECTING ROD - Check (54.08)**.
11. Check the rings as described in **COMPRESSION RINGS - Check (54.08)**.
12. Check the assembly of the rings as described in **COMPRESSION RINGS - Assemble (54.08)**.
13. Fit the connecting rod-piston assembly as described in **PISTON - Pre-assemble (54.08)**.
14. Assemble the big-end bearing as described in **CONNECTING ROD BEARING - Assemble (54.08)**.
15. Assemble the piston as described in **PISTON - Assemble (54.08)**.
16. Check the protrusion of the pistons as described in **PISTON - Check (54.08)**.

Installation of main components



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LOCTITE® 5205 (E IVECO STD. 18-1730) SEALANT APPLICATION AREAS ON THE GEAR CASE

17. Carefully clean the timing gear case and the crankcase.

NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Smear the case with the prescribed sealant **LOCTITE® 5205 (E IVECO STD. 18-1730)** to obtain a bead of few mm diameter.*
Application must be uniform (no lumps), without any air bubbles, thin areas or gaps.
Any flaws must be corrected in as short time as possible.
Do not use an excessive amount of sealant for the joint. Excess sealant will come out on both sides of the joint with the risk of clogging the lubricant passage.
*After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*

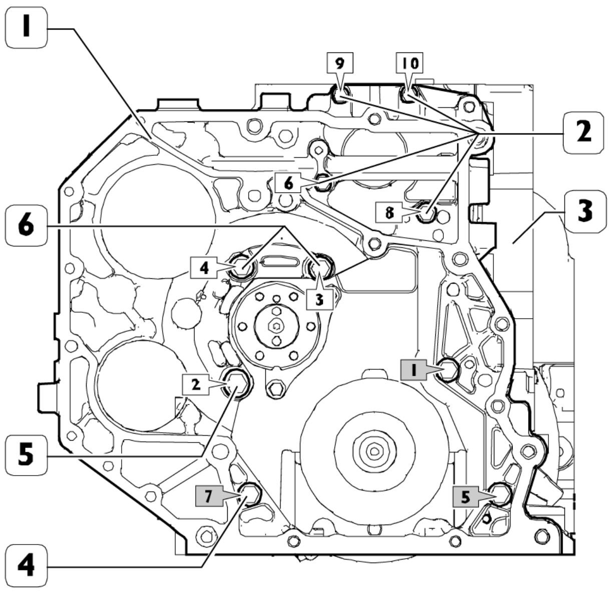

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DIAGRAM FOR TIGHTENING THE REAR TIMING GEAR CASE FASTENING SCREWS

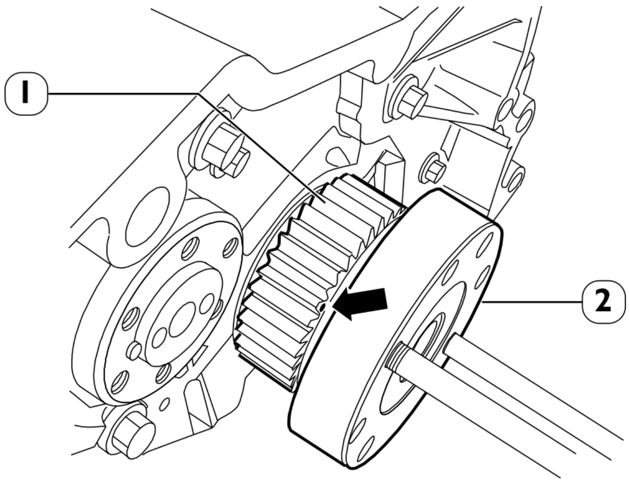
18. Refit the timing gear case **(1)** to the crankcase **(3)**.
19. Screw the fastening screws **(2)**, **(4)**, **(5)** and **(6)** to the same position found at removal and tighten them to the prescribed torque following the sequence shown in the figure.

NOTE: *Before each assembly operation, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Step	Value
Rear gear case	1 screw M12 x 1.75	**77 +/- 12 N·m**
	4 screws M8 x 1.25	**24 +/- 4 N·m**
	5 screws M10 x 1.5	**47 +/- 5 N·m**

20. With a felt-tip pen, highlight the conducting gear tooth **(1)** fitted on the crankshaft **(2)** with a chamfer for timing.

NOTE: *Screw in two pins to facilitate crankshaft rotation.*



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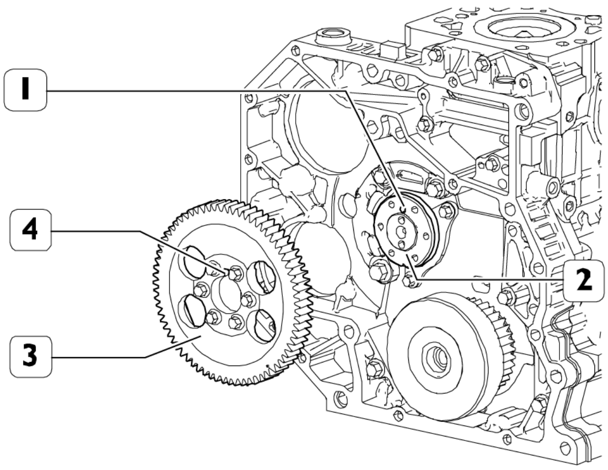
21. Make sure that during the assembly of the timing gear **(3)** on the crankshaft **(2)**, the reference pins **(1)** and **(4)** match.



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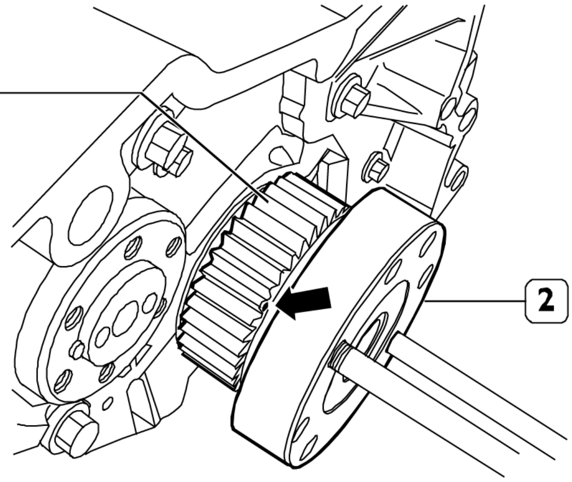
22. Turn the crankshaft **(3)** and the camshaft **(4)** so that when fitting the driven gear **(1)** on the latter, the stencilled mark on the gear **(1)** coincides with the groove on the gear tooth **(2)**.



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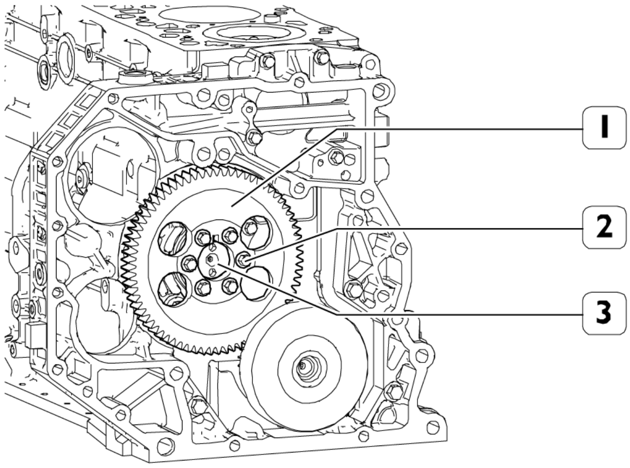
23. Tighten the screws **(1)** securing the gear **(2)** to the camshaft **(3)** to the specified torque.

Description	Quantity	Value
Camshaft gear	6 screws M8 x 1.25	**36 +/- 2 N·m**



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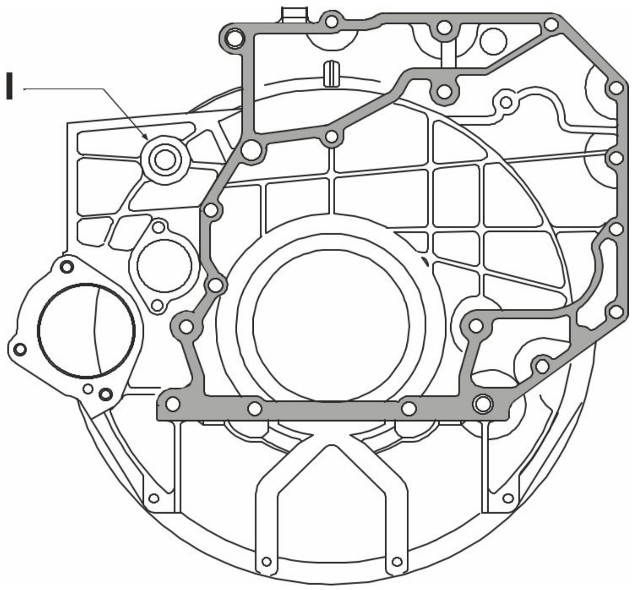

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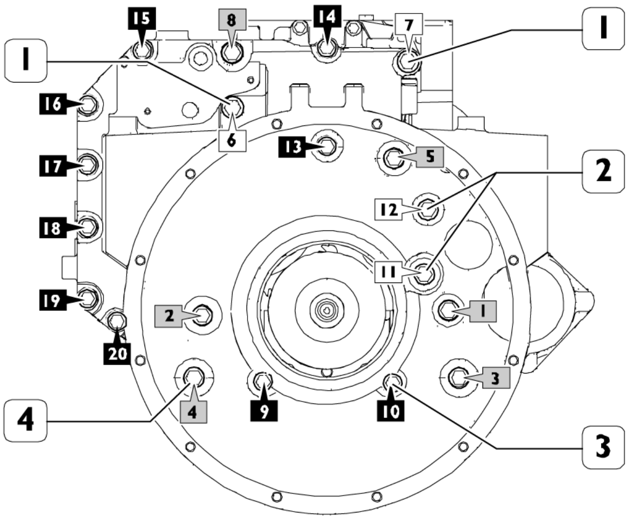
SEALANT APPLICATION DIAGRAM LOCTITE® 5205 (E IVECO STD. 18-1730)

NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Apply **LOCTITE® 5205 (E IVECO STD. 18-1730)** sealant onto the housing to form a bead of several mm in diameter.*
This must be uniform (no lumps), no air bubbles, thin areas or gaps.
Any flaws must be corrected in as short time as possible.
Avoid using too much material to seal the joint.
*Excess sealant will come out on both sides of the joint with the risk of clogging the lubricant passage. After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*



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TIGHTENING SEQUENCE DIAGRAM OF FLYWHEEL HOUSING FASTENING SCREWS

24. Refit the flywheel housing to the crankcase.
25. Screw the fastening screws **(1)**, **(2)**, **(3)** and **(4)** to the same position found at removal and tighten them to the prescribed torque following the sequence shown in the figure.

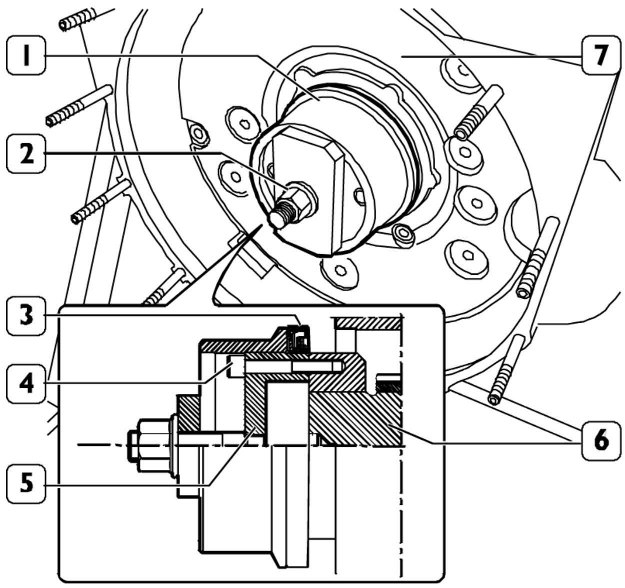
NOTE: *Before each assembly operation, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Step	Value
Flywheel housing	8 screws M12 x 1.75	**85 +/- 10 N·m**
	12 screws M10 x 1.5	**49 +/- 5 N·m**
	2 screws M12 x 1.75 x 100	**85 +/- 210 N·m**

26. 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)**.

Tool / Material	
Crankshaft rear seal installer	99346253

27. Position part **(1)** on part **(5)** and screw down the nut **(2)** to fit the seal fully **(3)** in the flywheel housing **(7)**.



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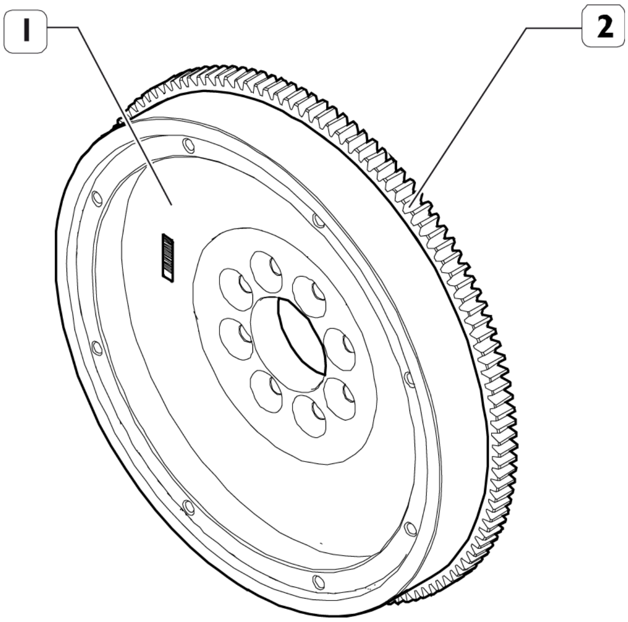
28. Check the supporting surface **(1)** of the clutch plate and if it is scratched, it must be turned.
29. Check the condition of the ring gear teeth **(2)**.
30. If breakage or excessive wear is found, remove the ring gear from the flywheel using a generic drift and fit the new one, previously heated to a temperature of **150 °C** for **15 – 20 min**; the chamfer made along the inner diameter of the crown wheel must face the engine flywheel.



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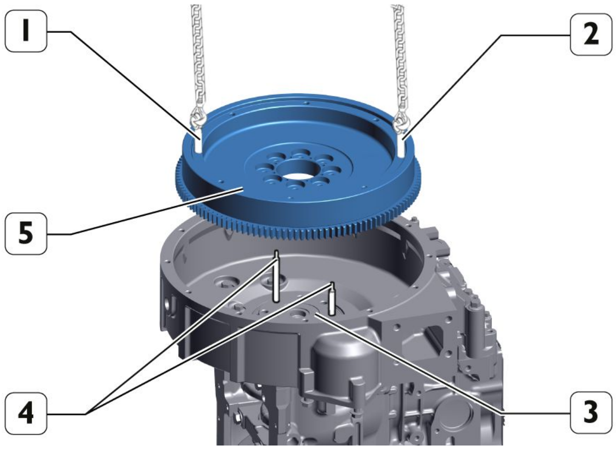
31. Rotate the engine vertically (with the flywheel at the top) acting on the rotating mount crank.
32. Screw in two medium length screws into the holes **(1)** and **(2)** to sling the engine flywheel **(5)**.
33. Screw two guide pins **(4)** of a suitable length into the crankshaft holes **(3)** and fit the flywheel **(5)** using a hoist with tool.

Tool / Material	
Rocking sling for removing/installing engine	99360595

34. Rotate the engine horizontally (with the cylinder head at the top) acting on the rotating mount crank.



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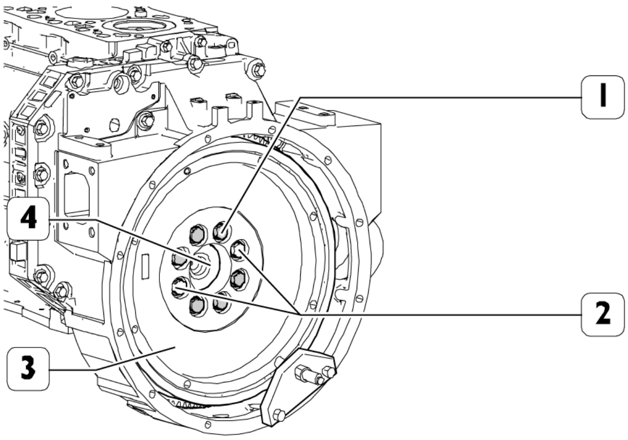
35. Apply the tool on the flywheel housing in block the engine flywheel **(3)** rotation.

Tool / Material	
Flywheel restrainer	99360351

36. Remove the two withdrawal pins in the ports (see the previous picture).
37. Tighten the screws **(1)** and **(2)** securing the flywheel **(3)** to the crankshaft **(4)** in two steps.

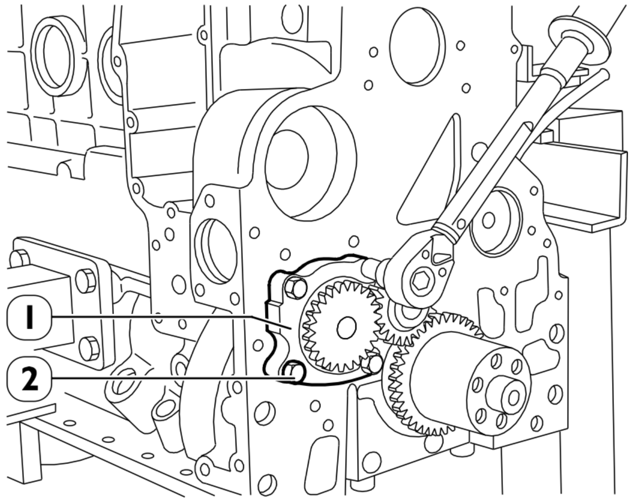
Description	Quantity	Step	Value
Engine flywheel	8 screws M12 x 1.25	Phase 1 Tighten	**30 +/- 4 N·m**
		Phase 2 Angle tightening	**60°**



212844 12

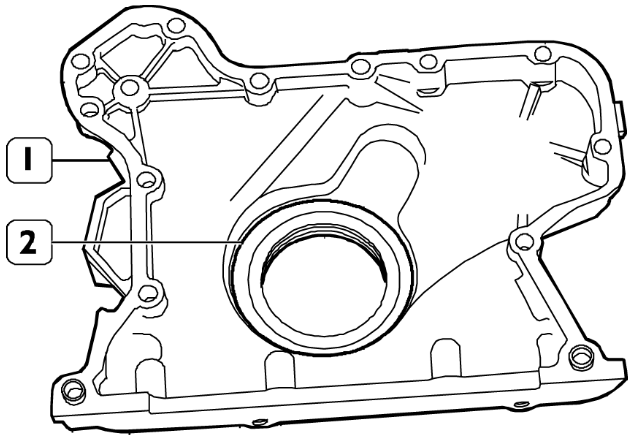
38. Fit the oil pump **(1)**.
39. Insert fastening screws **(2)** and tighten them to the specified torque.

Description	Quantity	Step	Value
Oil pump	4 screws M8 x 1.25	Phase 1 Pre-tightening	**8 +/- 1 N·m**
		Phase 2 Tighten	**24 +/- 4 N·m**



70220 13

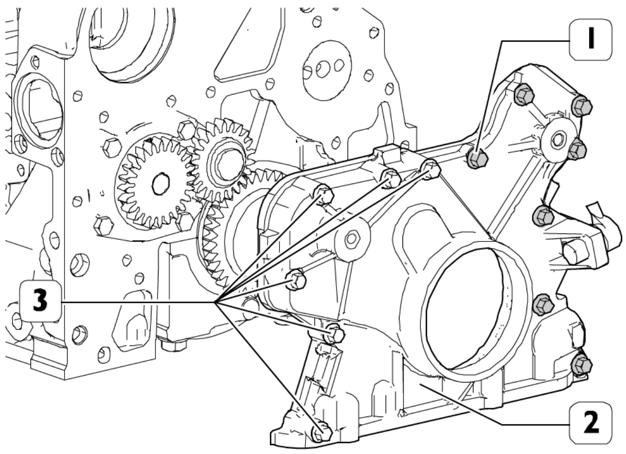
40. Remove the sealing ring **(2)** from the front cover **(1)**, carefully clean the coupling surfaces and smear them with **LOCTITE® 5205 (E IVECO STD. 18-1730)**.



106549 14

41. Fit the front cover **(2)** together with the crankshaft rpm increment speed sensor to the engine block.
42. Screw the fastening screws **(1)** and **(3)** to the same position found at removal and tighten them to the prescribed torque.

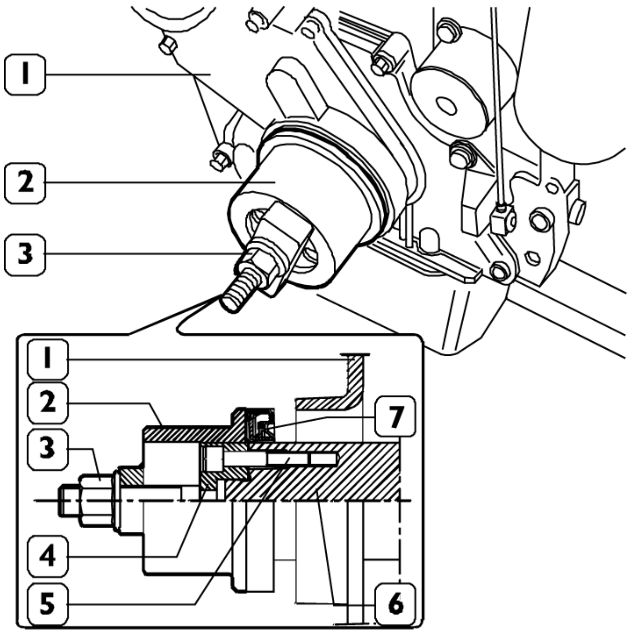
Description	Step	Value
Front gear case	7 screws M8 x 1.25 x 30	**24 +/- 4 N·m**
	6 screws M8 x 1.25	**24 +/- 4 N·m**



212843 15

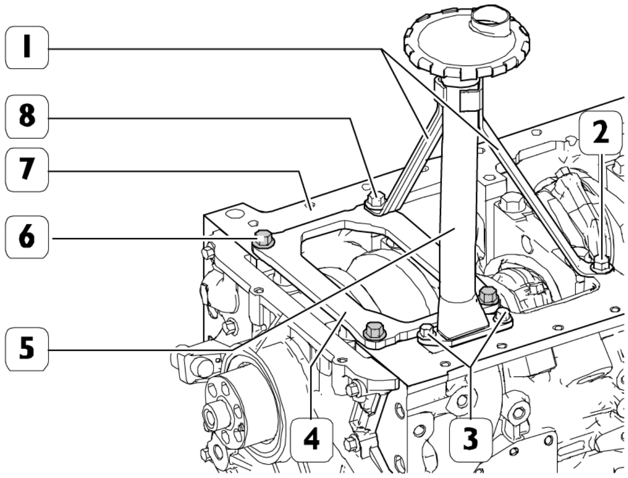
43. Apply the part **(4)** of the tool to the front crankshaft tang **(6)** securing it with the screws **(5)** and fit the new seal ring **(7)**. Position part **(2)** on part **(4)**, tighten the nut **(3)** until the seal ring **(7)** is fully assembled on the front cover **(1)**.

Tool / Material	
Crankshaft front seal installer	99346252



00902T 16

44. Overturn the engine.
45. Fit the oil suction strainer pipe **(5)** on the crankcase **(7)** after having inserted a new gasket and tighten the fastening screws **(3)** to the specified torque.
46. Fit the stiffening plate **(4)** and the oil suction strainer pipe brackets **(1)** on the crankcase **(7)** and tighten the fastening screws **(2)**, **(6)** and **(8)** to the specified torque.

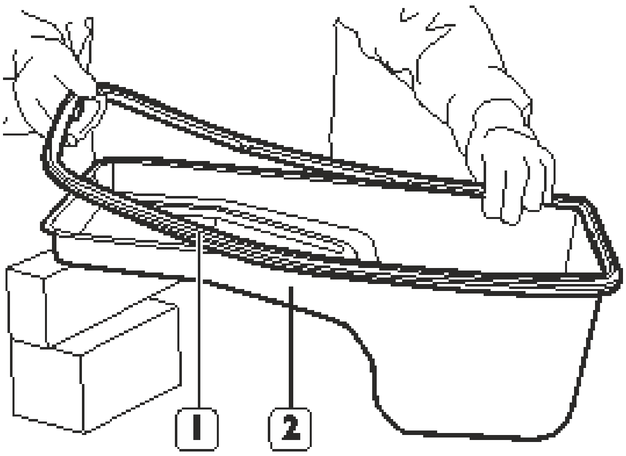


212842 17

Description	Quantity	Step	Value
Suction strainer retainer		2 screws M8 X 20	**25 N·m**
		2 screws M10 x 1.5 x 20	**42 N·m**
Oil suction strainer pipe	2 screws M8 x 20		**25 +/- 2,5 N·m**
Crankcase stiffening plate	4 screws M10x1.5x25		**43 +/- 5 N·m**

47. Position the gasket **(1)** on the oil sump **(2)**.

NOTE: *If the gasket is not faulty, it can be reused.*

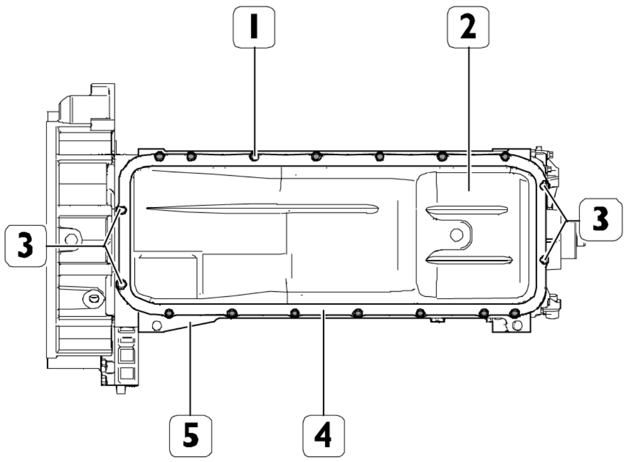


74770 18

48. Fit the oil sump **(2)** in position on the crankcase **(5)** and apply the relevant plate **(4)** to it.
49. Tighten the fastening screws **(1)** and **(3)** to the prescribed torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screws M8 x 1.25 x 45	**27 – 30 N·m**

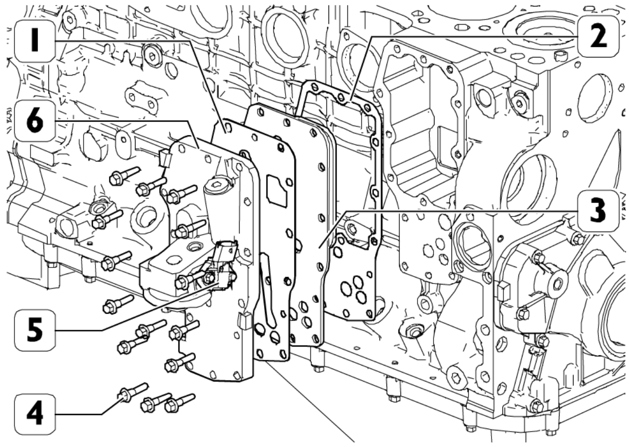


212841 19

50. Fit the oil filter / heat exchanger with the oil temperature and pressure sensor **(5)** on the crankcase together with the following elements: oil filter bracket **(6)**, heat exchanger plate **(3)** and relative gaskets **(1)** and **(2)**.
51. Tighten the fastening screws **(4)** to the specified torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Value
Oil filter bracket and heat exchanger	15 screws M8 x 1.25 x 35	**26 +/- 4 N·m**

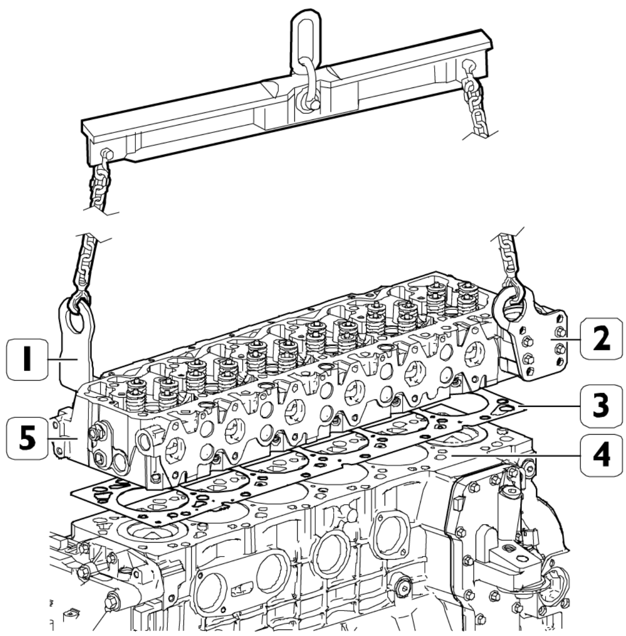


212840 20

52. If the valves have been removed from the head, refit them before refitting the head on the crankcase.
53. Use suitable lifting hooks **(1)** and **(2)** in order to lift and fit the cylinder head **(5)** on the crankcase **(4)** after having inserted a new gasket **(3)** by using a hoist with the tool.

NOTE: *Check that the mating surfaces of the cylinder head **(5)** and engine block **(4)** are clean.*
There are two types of cylinder head gaskets:
*- Type A, **1,25 mm** thick*
*- Type B **1,15 mm** thick.*
Check the average protrusion S of the pistons:
*If S > **0,40 mm**, use gasket type A.*
*If S ≤ **0,40 mm** use gasket type B.*
Keep the cylinder head gasket clean.
*Fit the cylinder head gasket **(3)** with the "TOP" marking facing the head.*
The arrow shows the point where the gasket thickness is given.

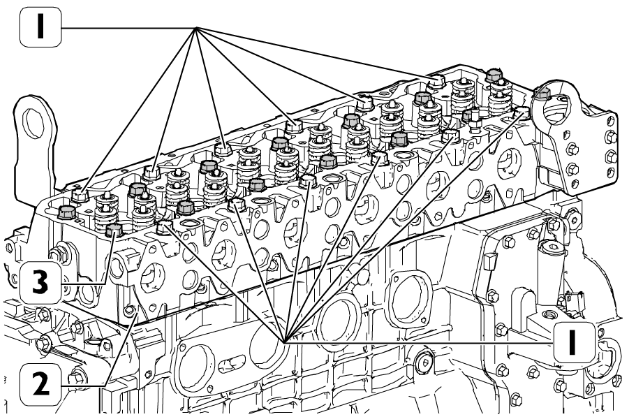
Tool / Material	
Rocking sling for removing/installing engine	99360595



212839 21

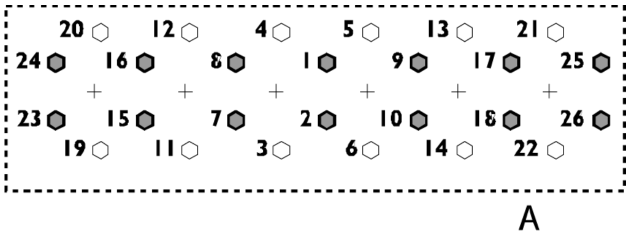
54. After having correctly positioned the gasket on the crankcase, assemble the cylinder head **(2)** and tighten the new fastening screws **(1)** and **(3)** in three steps, in the order and manner shown in the figure below.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*



212838 22

Description	Quantity	Step	Value
Cylinder head	12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Step 3 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Step 3 Angle tightening	**90°**

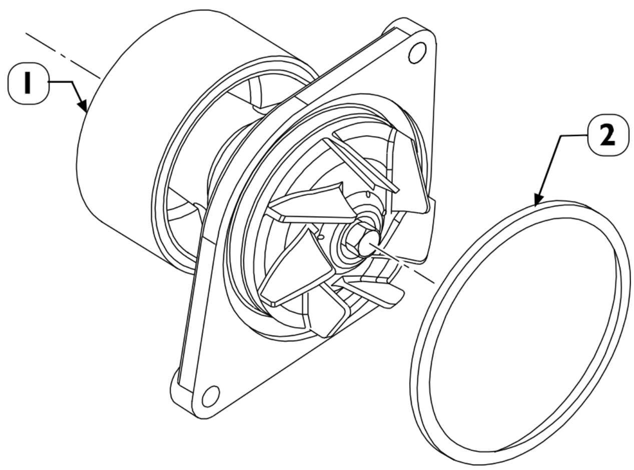


70476 23

Diagram of the tightening sequence for the cylinder head fixing screws

A. Front side

55. Fit a new seal ring **(1)** to the water pump **(2)**.



70221 24

56. Install the water pump **(11)** and tighten the fastening screws **(10)** to the prescribed torque.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**

57. Install the crankshaft pulley **(9)** together with the damper pulley **(8)** and tighten the fastening screws **(7)**.

Description	Quan-tity	Step	Value
Crankshaft pulley with damper pulley	6 screws M12 x 1.25	Phase 1 Tighten	**50 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**

58. Install the idler guide pulley **(5)** and tighten the fastening screw **(6)** to the prescribed torque.

Description	Quantity	Value
Idler pulley	1 screw M10 x 1.5	**43 +/- 6 N·m**

59. Install the automatic belt tensioner mount **(12)** and tighten the fastening screws **(13)** to the prescribed torque.

Description	Quantity	Value
Automatic belt tensioner support	2 screws M8 x 1.25 x 30	**24 +/- 4 N·m**

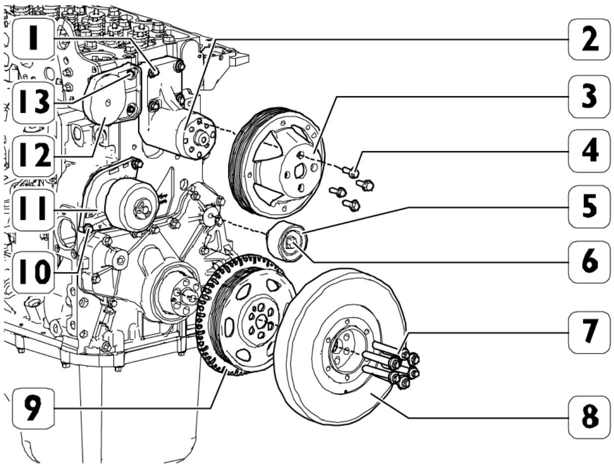
60. Install the fan pulley mount **(2)** and tighten the fastening screws **(1)** to the prescribed torque.

Description	Quantity	Value
Fan pulley mount	4 screws M8 x 1.25 x 45	**24 +/- 4 N·m**

61. Install the fan control pulley **(3)** and tighten the fastening screws **(4)**.

NOTE: *The flywheel blocking device can aid the installation of the damper pulley **(8)** fitted onto the crankshaft pulley **(9)**.*

Description	Quantity	Value
Fan control pulley	4 screws M10 x 1.25	**68 +/- 7 N·m**



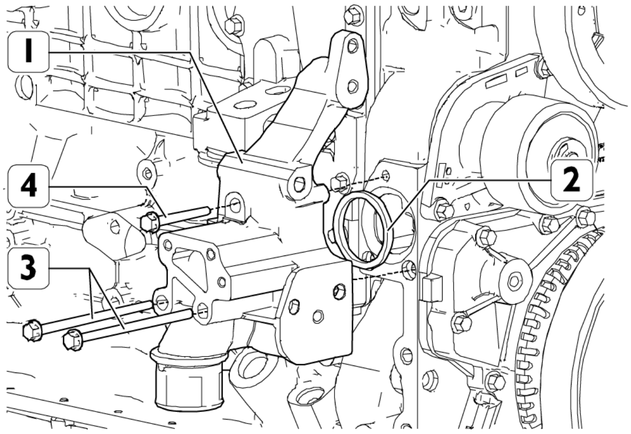
212837 25

62. Fit the engine coolant inlet **(1)** after having positioned a new gasket **(2)**, so that the two reference hollow pins are set against the crankcase.

63. Tighten the fastening screws **(3)** and **(4)** to the prescribed torque.

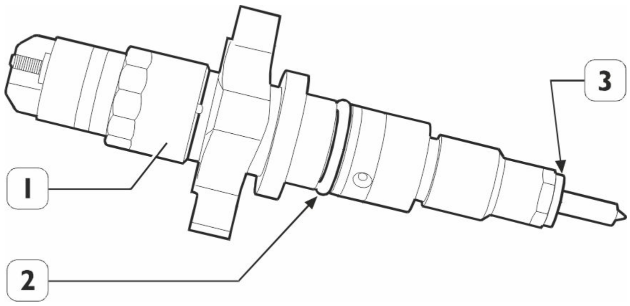
NOTE: *Before any assembly operation, always check that the hole and the screw thread do not show any sign of wear or dirt.*

Description	Step	Value
Engine coolant inlet	2 screws M10x1.5x130	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 70	**43 +/- 6 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212836 26

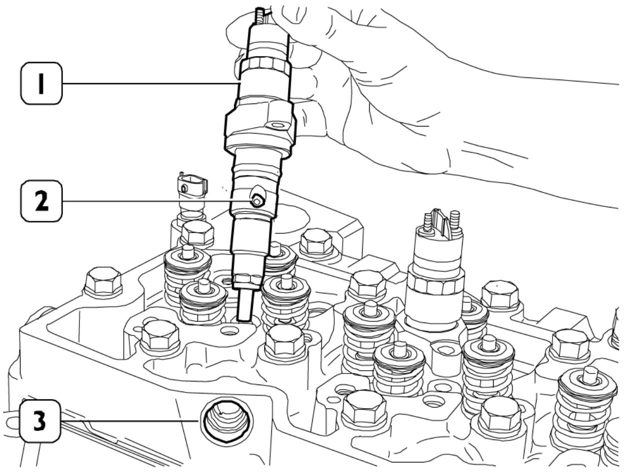
64. Fit both a new sealing ring **(2)** lubricated with Vaseline and a new sealing washer **(3)** on the injector **(1)**.



70338 27

65. Fit the electro-injectors **(1)** on the cylinder head seats, directed so that the fuel inlet hole **(2)** is facing the fuel manifold seat **(3)** side.

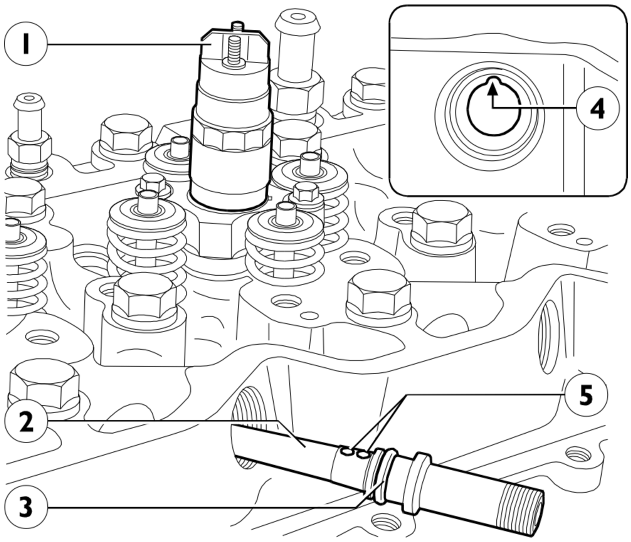
66. Position the electro-injector fastening brackets and screw in the screws without tightening them.



203451 28

67. Fit a new sealing ring **(3)** lubricated with Vaseline on the fuel manifold **(2)** and fit it into the cylinder head seat so that the positioning balls **(5)** coincide with the relevant housing **(4)**.

NOTE: *Disassembled fuel manifolds **(2)** must not be used again, but must be replaced with other new ones. The fuel manifolds **(2)** in the engines have two positioning balls.*



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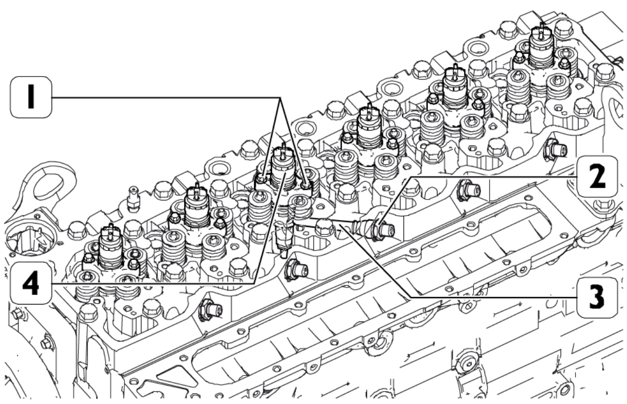
68. Screw the fastening nuts **(2)** without locking them.
69. Tighten gradually and alternately the electro-injector **(4)** fastening screws **(1)** to the prescribed torque in four stages.
70. Tighten the fuel manifold **(3)** fastening nuts **(2)** to the prescribed torque.

NOTE: *During this operation, the injector **(4)** must be moved so that the manifold is properly inserted into the fuel inlet hole **(3)**.*

Description	Quantity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Step 3 Angle tightening	**25°**
		Step 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**



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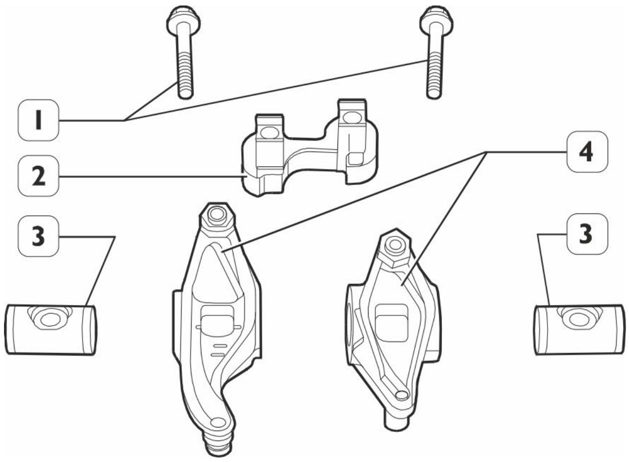

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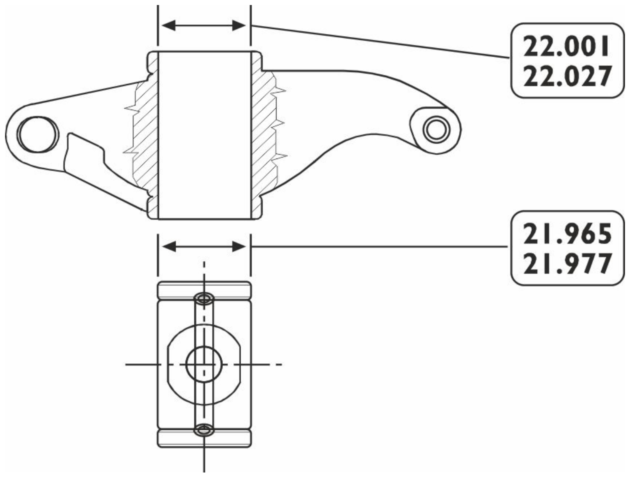
ROCKER ASSEMBLY COMPONENTS:

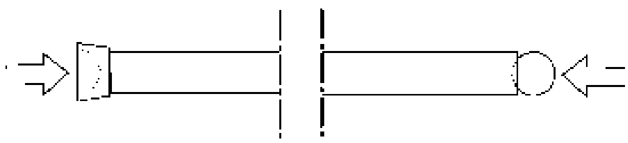
1. Screws
2. Carrier
3. Shafts
4. Rocker arms



70344 32

SHAFT-ROCKER MAIN DATA

71. Check that shaft-rocker arm bushing surfaces are not excessively worn or damaged.
72. Before assembly, check the rocker arm controls rods: there should be no deformation; the spherical contact seats with the rocker arm adjusting screw and the lift (arrows) should not present signs of seizure or wear and replace them if they do.
73. Intake and exhaust valve push-rods are identical and are therefore interchangeable.



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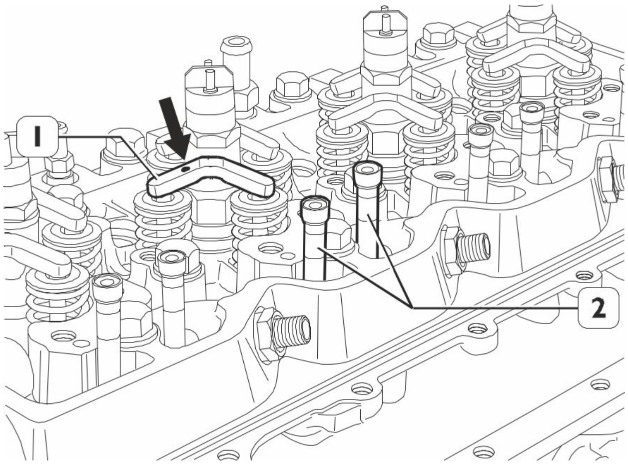
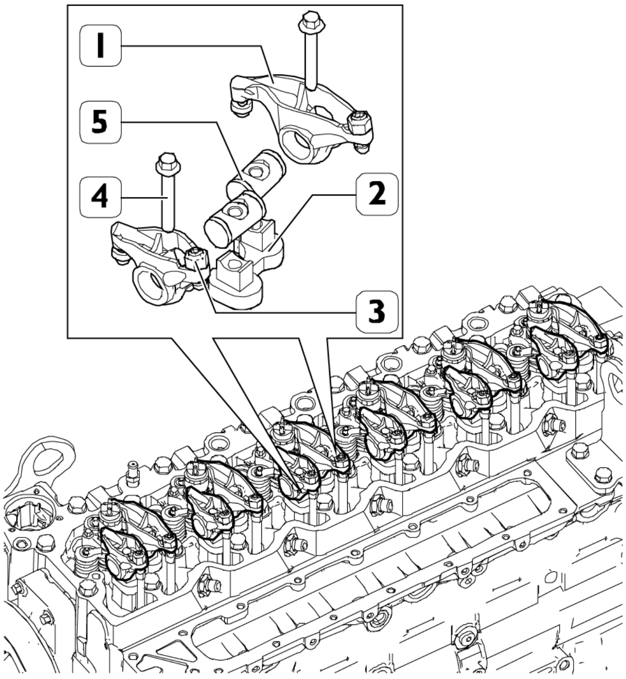
74. Fit the rods **(2)**.
75. Position bridges **(1)** on valves with marks **(→)** facing the exhaust manifold.



70345 34

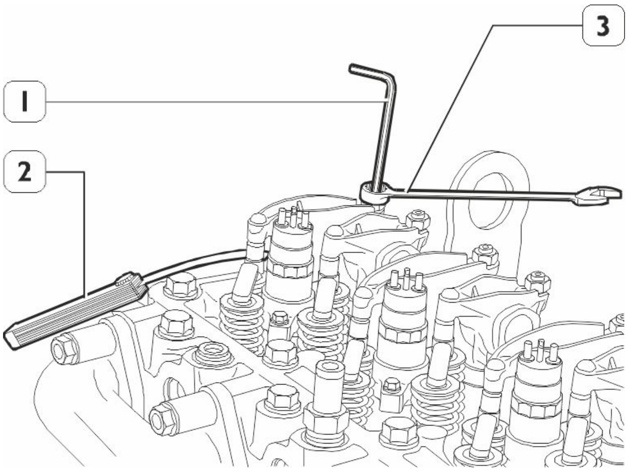
76. Check that the tappet adjuster screws and retaining nuts **(3)** are loose to prevent them sticking on the rods when refitting the rocker assembly.
77. Install the rocker unit consisting of bracket **(2)**, rockers **(1)** shafts **(5)** and secure them to the cylinder head by tightening the fastening screws **(4)** to the prescribed torque.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 35

78. The adjustment of the clearance between the rocker arms and the intake and exhaust valves must be strictly carried out using an Allen wrench **(1)**, a box-end wrench **(3)** and a feeler gauge **(2)**.
79. Clearance shall be as follows:
    - intake valves **0,25 +/- 0,05 mm**;
    - Exhaust valves **0,51 +/- 0,05 mm**.



70520 36

80. To carry out rocker arm - valve clearance adjustment more quickly, proceed as follows:

81. Rotate the crankshaft, balance the valves of cylinder no. 1 and adjust the valves marked with an asterisk as shown in the tables below:

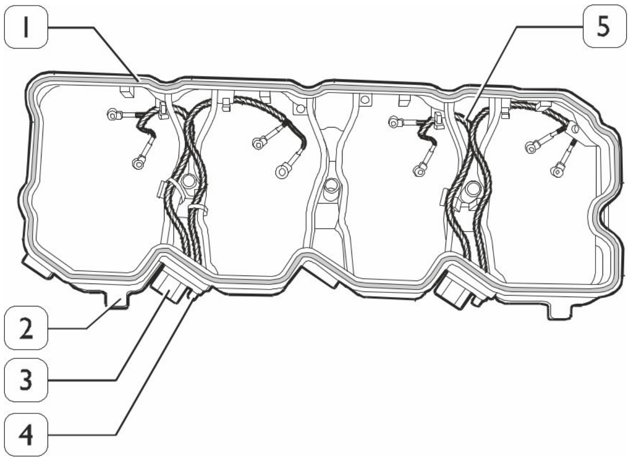
cylinder n	1	2	3	4	5	6
intake	–	–	*	–	*	*
exhaust	–	*	–	*	–	*

82. Rotate the crankshaft, balance the valves of cylinder no. 6 and adjust the valves marked with an asterisk as shown in the tables below:

cylinder n	1	2	3	4	5	6
intake	*	*	–	*	–	–
exhaust	*	–	*	–	*	–

83. Check the conditions of the electrical wiring **(5)**, if damaged, replace cutting the clips securing the wiring to the support **(2)** and removing the screws **(4)** securing the support to the connectors **(3)**.

84. Fit a new gasket **(1)** on the support **(2)**.



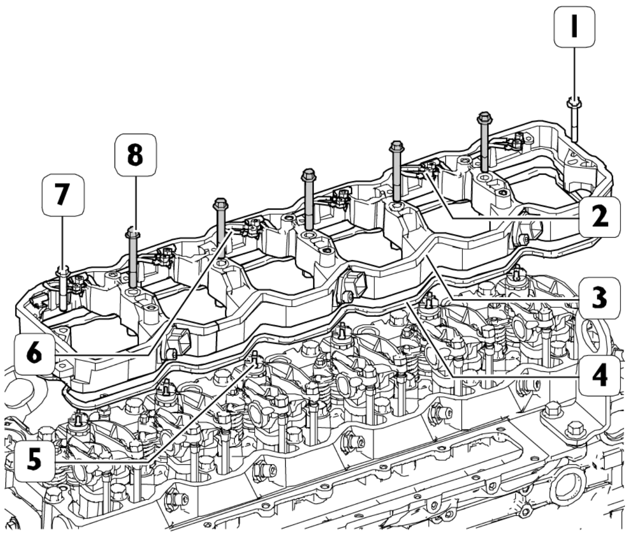
70352 37

85. Fit the electro-injector wiring support **(3)** complete with a new gasket **(4)** and tighten the screws **(1)**, **(7)** and **(8)** to the prescribed torque.

86. Connect the electrical wiring **(6)** to the electro-injectors **(5)** and using a torque wrench tighten the securing nuts **(2)** to the specified torque.

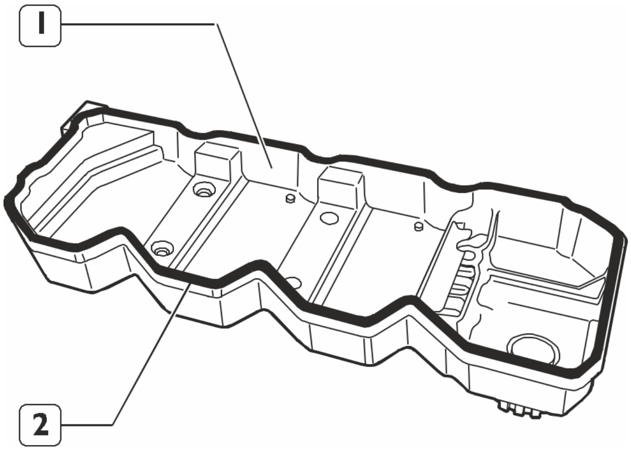
NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Value
Injector wiring support	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**



212833 38

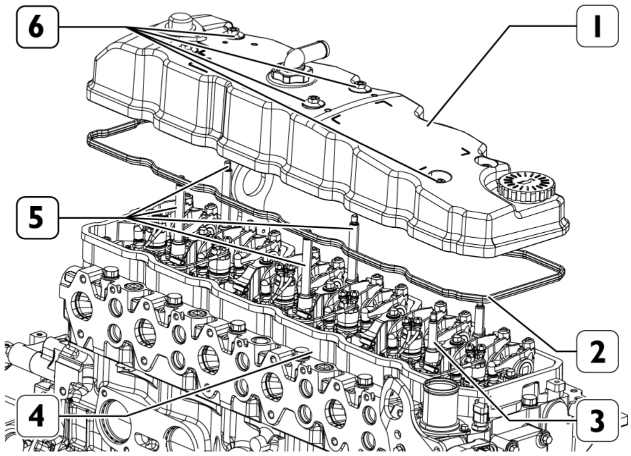
87. Place a new gasket **(2)** on the tappet cover **(1)**.



70355 39

88. Screw the double-shank threaded screws **(3)** and **(5)** into the wiring support **(4)**.
89. Install the tappet cover **(1)** on the wiring support **(4)** after having inserted a new gasket **(2)**.
90. Tighten the fastening nuts **(6)** to the prescribed torque.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**



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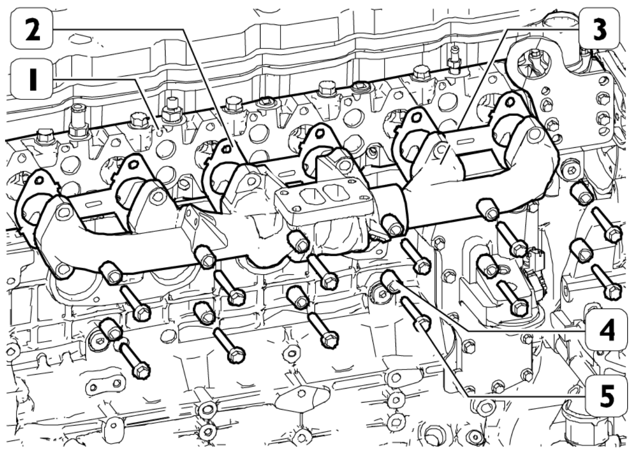
91. Fit the exhaust manifold **(3)**in position with the new gasket **(2)** to the cylinder head **(1)** and tighten the fastening screws **(5)** after having inserted spacers **(4)** to the prescribed torque following the order and mode shown in the figure below.

NOTE: *Always replace the gaskets* ***(2)*** *with new spare parts.*
Check the thread of the fastening screws: it must not show signs of wear or deposits of dirt.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



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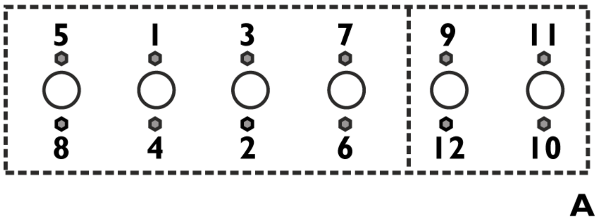
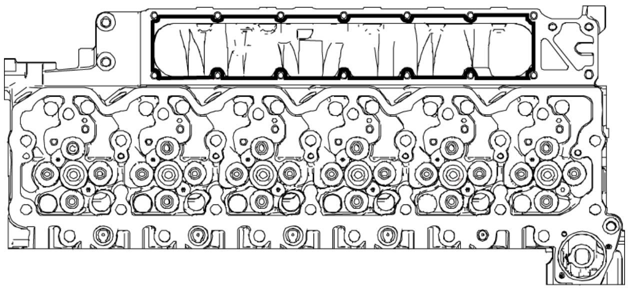


209215 42

Diagram of the tightening sequence for the exhaust manifold fastening screws

A. Front side

92. Carefully clean the contact surfaces and apply a continuous sealant bead of **LOCTITE® 5970 (A IVECO STD. 18-1733)** to the surface of the cylinder head as shown in the figure.

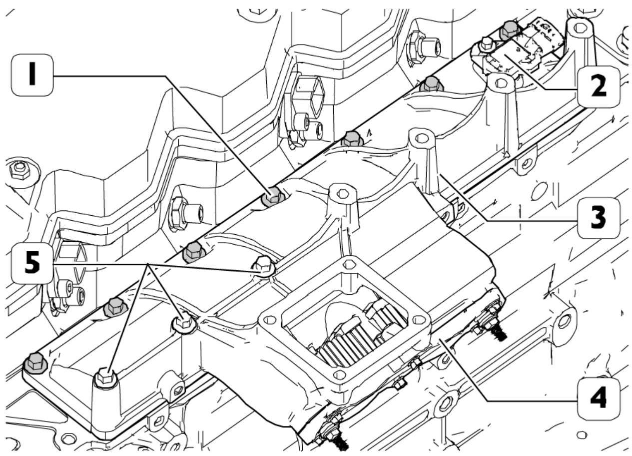


209211 43

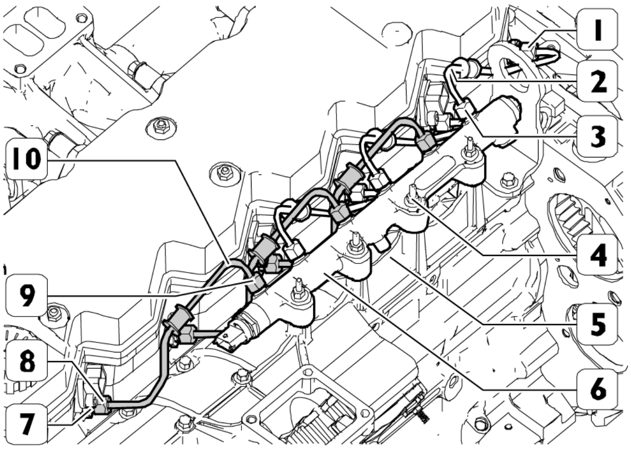
NOTE: *Perfect seal is only obtained by cleaning accurately the surface to seal.*
*Apply **LOCTITE® 5970 (A IVECO STD. 18-1733)** to obtain a bead of a few mm diameter.*
It must be uniform (no grains), with no air bubbles and with no thin areas or discontinuities.
Ensure that any imperfections are corrected immediately.
Do not use too much sealant to seal the joint.
If too much sealant is used it could come out from the sides of the joint, causing the lubricant passage to clog.
*After applying the sealant, the joint must be assembled immediately (**10 – 20 min**).*

93. Install the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** on the cylinder head and tighten the fastening screws **(1)** and **(5)** to the prescribed torque.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212831 44



212830 45

94. Install the common rail and the high-pressure fuel delivery pipes as follows:
95. Install the common rail **(6)** on the intake manifold **(5)** and manually tighten the threaded double-shank shoulder screws **(4)**.
96. Tighten the two central screws **(4)** to a torque of **0,1 N·m**.
97. Fit the high-pressure fuel delivery pipes **(2)** and **(10)** and manually tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** first from the common rail side and then from the cylinder head side.
98. Tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to a torque of **5 N·m**, fist of all from the cylinder head side and then from the common rail side.
99. Tighten the threaded double-shank shoulder screws **(4)** fixing the common rail **(6)** on the intake manifold **(5)** to the prescribed torque.
100. tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to the prescribed torque, first from the common rail side and then from the cylinder head side.

NOTE: *The high pressure fuel delivery pipes must be replaced each time they are disconnected. The flexible pipe fittings must be tightened to the specified torque using a wrench and a torque wrench.*

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screws M8x1.25x125		**36 +/- 5 N·m**

101. Make sure that the high-pressure fuel pump **(4)** is suitably supported.

102. Screw in the studs **(5)**. Fit the high pressure fuel pump **(4)** complete with the mechanical pump, flange and gear and tighten the fastening nuts **(5)** to the specified torque.

Description	Step	Value
High-pressure pump	3 nuts M8x8	**24 +/- 4 N·m**
	3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**

103. Install the stud, the support with a new sealing ring and the camshaft timing segment speed sensor **(6)**. Tighten the fastening nut **(7)** to the specified torque.

Description	Quantity	Value
Camshaft timing sensor	1 nut with stud M6 x 1	**12 N·m**

104. If present, install the power take-off **(PTO)** together with the flange and the gear.

105. Fit the cover **(2)** after having inserted a new gasket and tighten the fastening screws **(1)** and **(3)** to the prescribed torque.

Description	Quantity	Value
Power take-off cover	2 screws M12x1.75x25	**80 +/- 5 N·m**

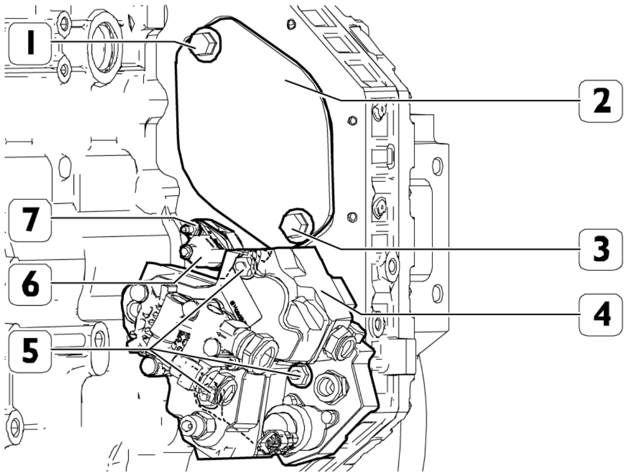
106. Fit the turbocharger **(1)**:

107. screw the studs **(4)** onto the exhaust manifold **(3)**.

108. Hold the turbocharger **(1)** and place it on the exhaust manifold **(3)** correctly positioning a new gasket **(2)**.

109. Tighten the fastening nuts **(1)** to the prescribed torque.

Description	Step	Value
Turbocharger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



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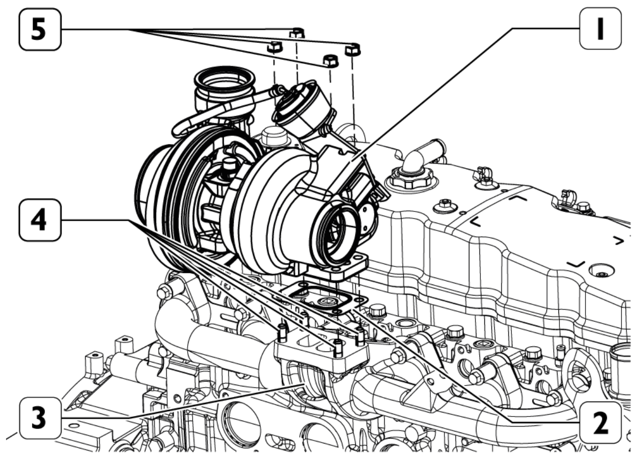


268013 47

110. Install the motorized throttle valve **(8)** onto the turbocharger .

111. Turn the screw **(7)** and tighten the V-clamping collar to a torque of.

Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**

112. Correctly position the water delivery pipe **(2)** to the valve and tighten the connection **(1)** and the fitting **(3)**.

Description	Quantity	Value
Throttle valve supporting bracket	4 screws M8 x 1.25 x 25	**25 +/- 3 N·m**

113. Assemble the bracket **(6)** fixing the motorized throttle valve **(8)** to the exhaust manifold **(5)** and tighten the fastening screws **(4)** to the prescribed torque.

Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25	**25 N·m**

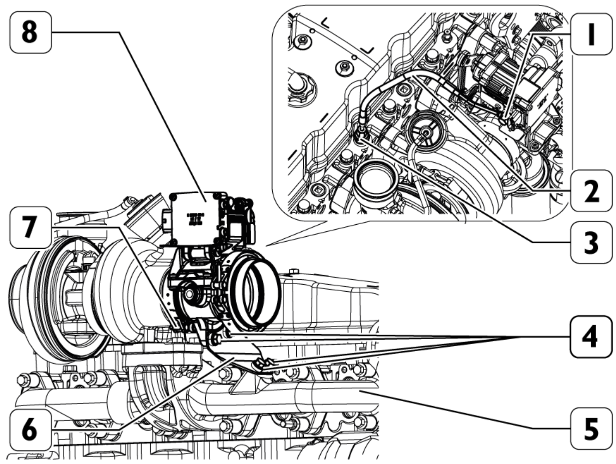
114. Install the motorized throttle valve water inlet and outlet pipes as follows:

115. Fit the water return pipe union **(8)** and tighten the fastening screws **(3)** to the specified torque.

116. Fit the lower-section water return pipe **(7)** and tighten the fastening nut **(4)**, connector **(5)** and screw **(6)** to the prescribed torque.

117. Fit the upper-section water return pipe **(9)** and tighten the fastening nut **(2)** and connector **(1)** to the prescribed torque.

Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**



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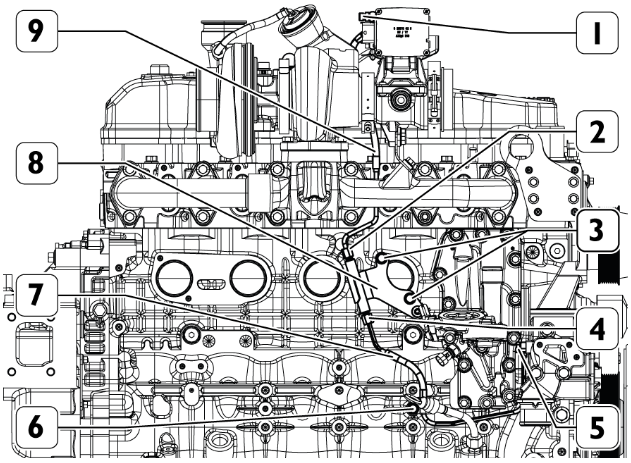


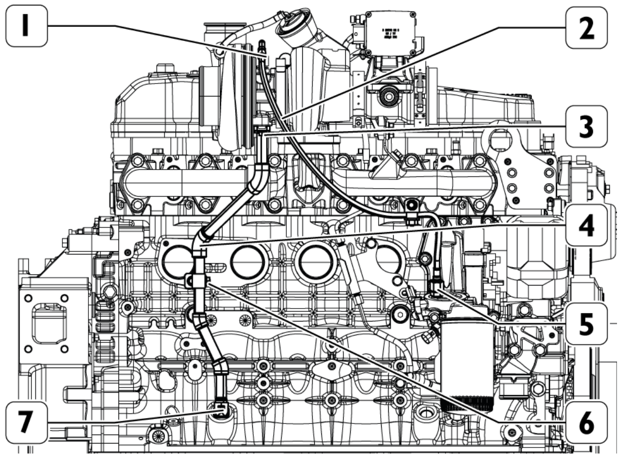
49

118. Fit the lubricant drain pipe **(4)** on the turbocharger, screwing the fitting **(7)** onto the crankcase.

119. Screw the fastening screws **(3)** into the lower part of the turbocharger, after fitting a new gasket.

120. Unscrew the screws **(6)** securing the pipe **(4)** to the crankcase by means of the fastening collar.

121. Install the lubricant oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger and tighten the hose couplings **(1)** and **(5)** to the prescribed torque.



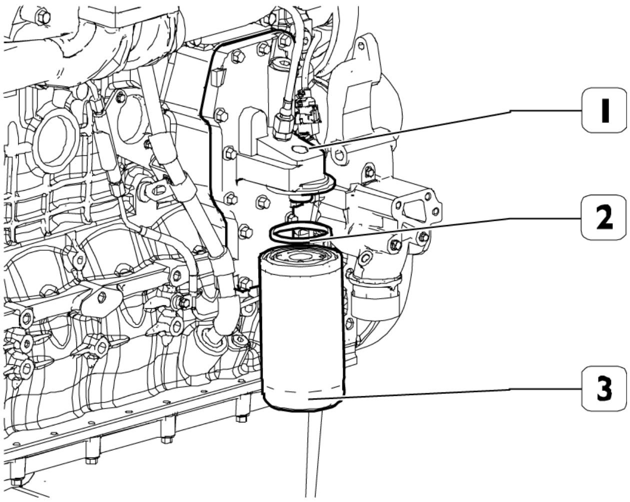
268009 50

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**

122. Moisten the sealing gasket **(2)** of the oil filter **(3)** with a thin layer of oil.

123. Manually tighten the oil filter **(3)** on the support **(1)** until it comes into contact with the gasket **(2)**.

124. Tighten the oil filter **(3)** further to the prescribed torque using a specific tool.



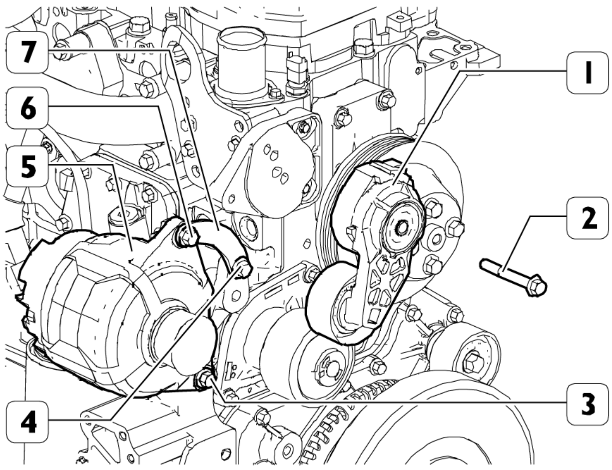
209220 51

Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**

125. Operate the engine for a few minutes and then recheck the level using the dipstick. Top up if necessary to compensate for the oil used for refilling the filtering cartridge.

126. Install the bracket **(7)** securing the alternator **(5)** and tighten the screws **(3)**, **(4)** and **(6)** to the prescribed torque.

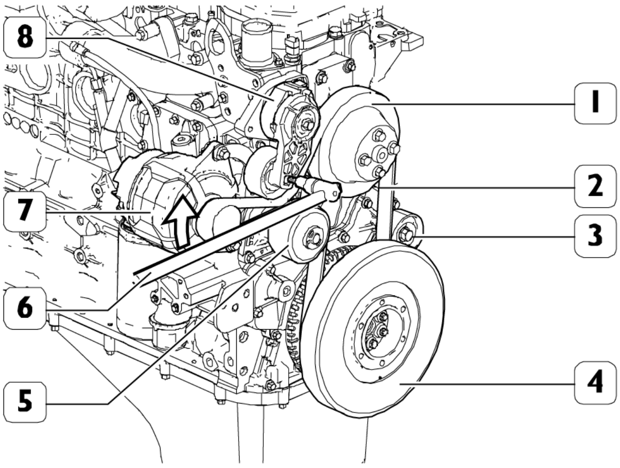
127. Fit the automatic belt tensioner **(1)** and tighten the fastening screw **(2)** to the required torque.



215031 52

Description	Quantity	Step	Value
Automatic belt tensioner	1 screw M10 x 1.5 x 70		**43 +/- 6 N·m**
Alternator		1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
		1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

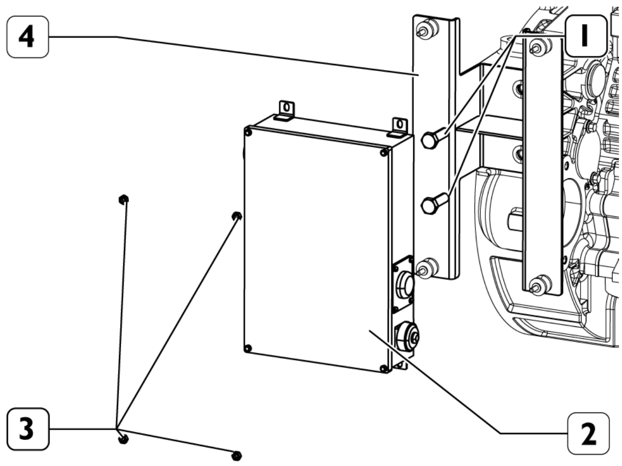
128. Fit the Poly V belt **(2)** on the pulleys and guide roller.
129. Use the appropriate tool **(6)** on the automatic belt tensioner **(8)** to fit the new belt **(2)** in the operating position.
130. No further adjustments are required. The belt tension **(2)** is adjusted automatically via the calibrated spring in the automatic belt tensioner **(8)**.



215030 53

131. Correctly position the bracket **(4)** and tighten the screws **(1)**.
132. Correctly position the connection unit **(2)** and tighten the nuts **(3)**.

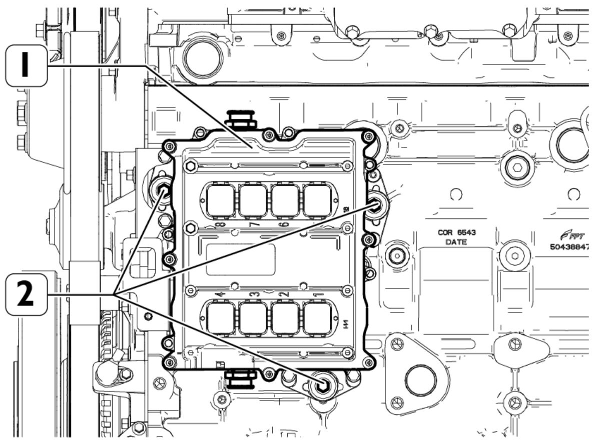
Description	Step	Value
Interface box	8 nuts M6 x 1	**9 +/- 1 N·m**
	2 screws M12x1.75x25	**80 +/- 8 N·m**



268010 54

133. Fit the ECU **(1)**, together with the heat exchanger and tighten the screws **(2)** to the prescribed torque.
134. If the rubber buffers are cracked or excessively deformed, replace them.
135. Install the low-pressure fuel pipe that connects the fuel pre-filter to the engine management control unit heat exchanger and connect the retainer.

Description	Step	Value
Engine controller	3 screws M8 x 1.25 x 45	**14 N·m**



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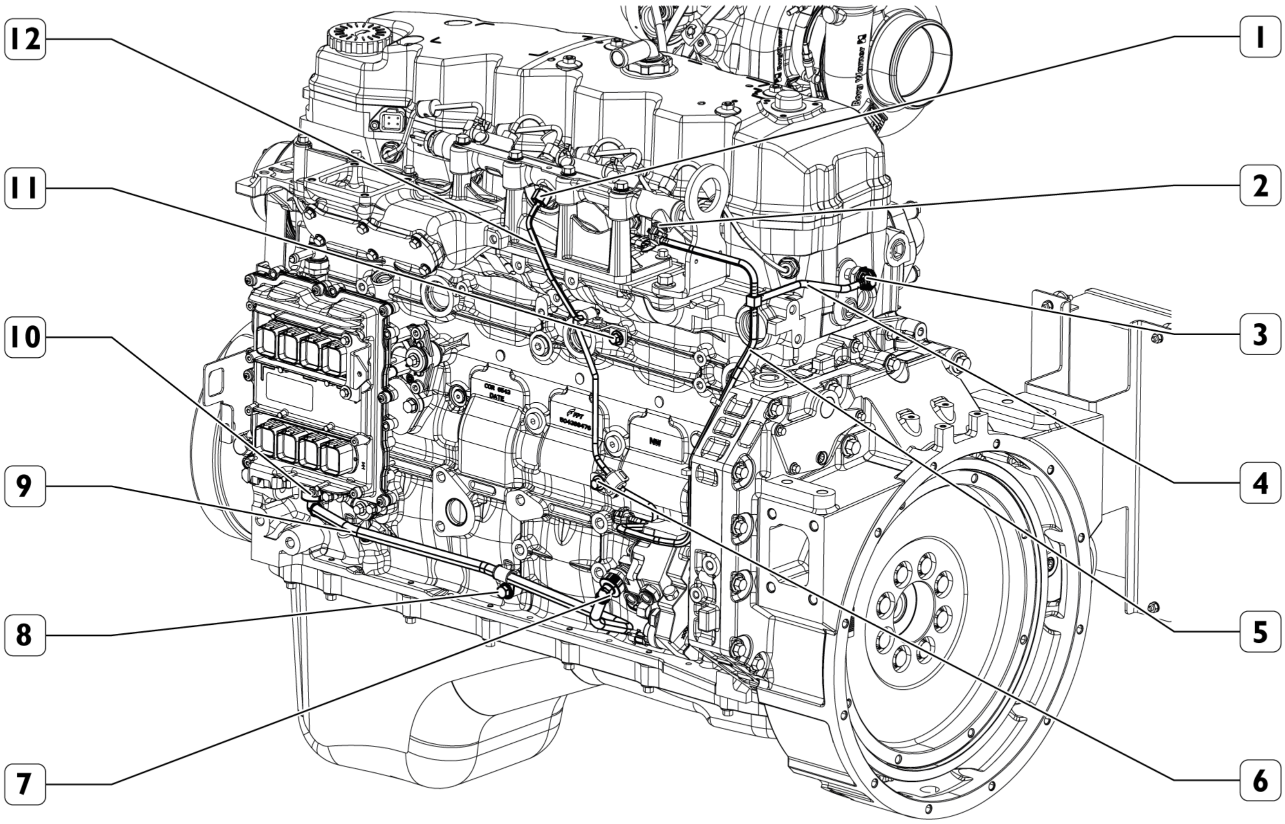


268008 56

136. Connect the high-pressure fuel pipe **(12)** to the engine block and tighten the fastening screws **(6)** and **(11)** to the prescribed torque.

137. Connect the pipe **(12)** to the high-pressure pump and the common rail and tighten the hose couplings **(1)** to the specified torque.

NOTE: *The high-pressure fuel pipe must always be replaced each time it is removed.*

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16		**25 N·m**

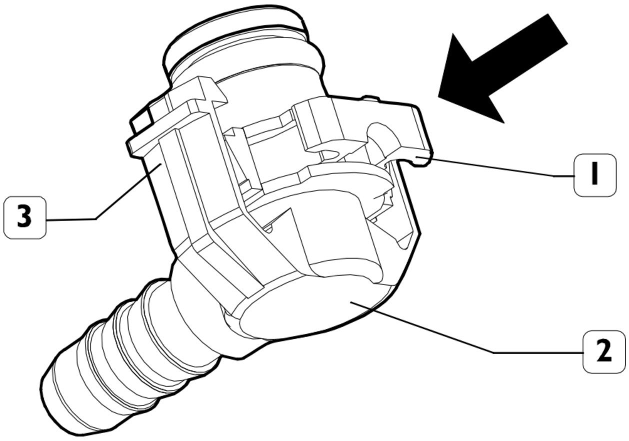
138. Fit the fuel return pipes **(4)** and **(5)** from the common rail and injectors to the fuel filter bracket and connect the retainers **(2)** and **(3)**.

139. Fit the low-pressure fuel pipe **(9)** from the engine control unit heat exchanger to the mechanical pump, tighten the fastening screw **(8)** to the prescribed torque and connect the retainers **(7)** and **(10)**.

140. To connect the low-pressure fuel pipe to the connection fitting, insert the quick-fit coupling **(2)** into the connection fitting until the catch **(3)** engages.

NOTE: *Check proper fuel pipe connection.*

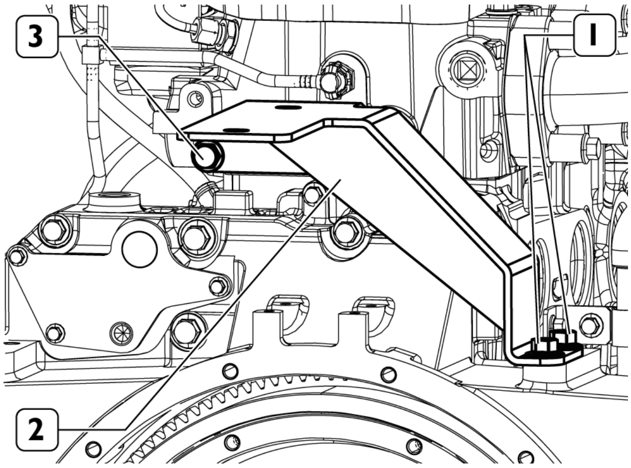
141. Correctly position the engine cable and close the clips retaining the engine cable to the crankcase. Connect the engine cable to the control unit **(8)**, to the motorised throttle valve actuator connector **(2)** and to all the sensors and senders indicated in the electrical equipment section.



116237 57

142. Correctly position the bracket **(2)** and tighten the screws **(1)** and **(3)**.

Description	Step	Value
Bracket supporting air filter on flywheel housing	1 screw M10 x 1.5 x 20	**0 +/- 0 N·m**
	2 screws M12x1.75x25	**0 +/- 0 N·m**

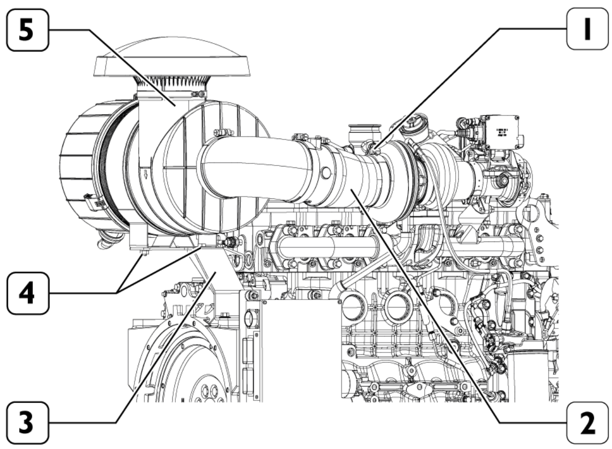


268005 58

143. Correctly position the air filter **(5)** on the supporting bracket **(3)** and tighten the nuts **(4)**.

144. Tighten the screw collar **(1)** to the air pipe **(2)**.

Description	Quantity	Value
Air filter bracket	2 screws M6 x 1 x 14	**0 +/- 0 N·m**



268004 59

REMOVING THE ENGINE FROM THE ROTATING STAND

145. To complete the engine assembly, it is necessary to remove it from the rotating stand.

Tool / Material	
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

146. Use a hoist with the tool to support the engine and loosen the screws securing the brackets to the rotating stand.

Tool / Material	
Rocking sling for removing/installing engine	99360595
Brackets fixing engine to revolving stand 99322205	99361037
Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)	99322205

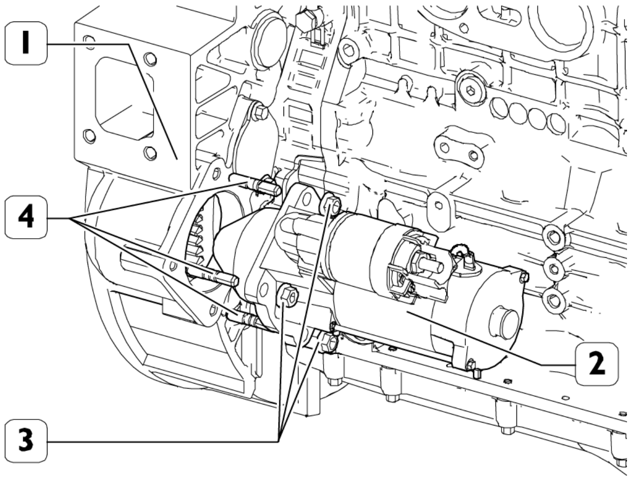
147. Disassemble the brackets from the engine after having placed it correctly on a suitable support.

Tool / Material	
Brackets fixing engine to revolving stand 99322205	99361037

COMPLETING ENGINE ASSEMBLY

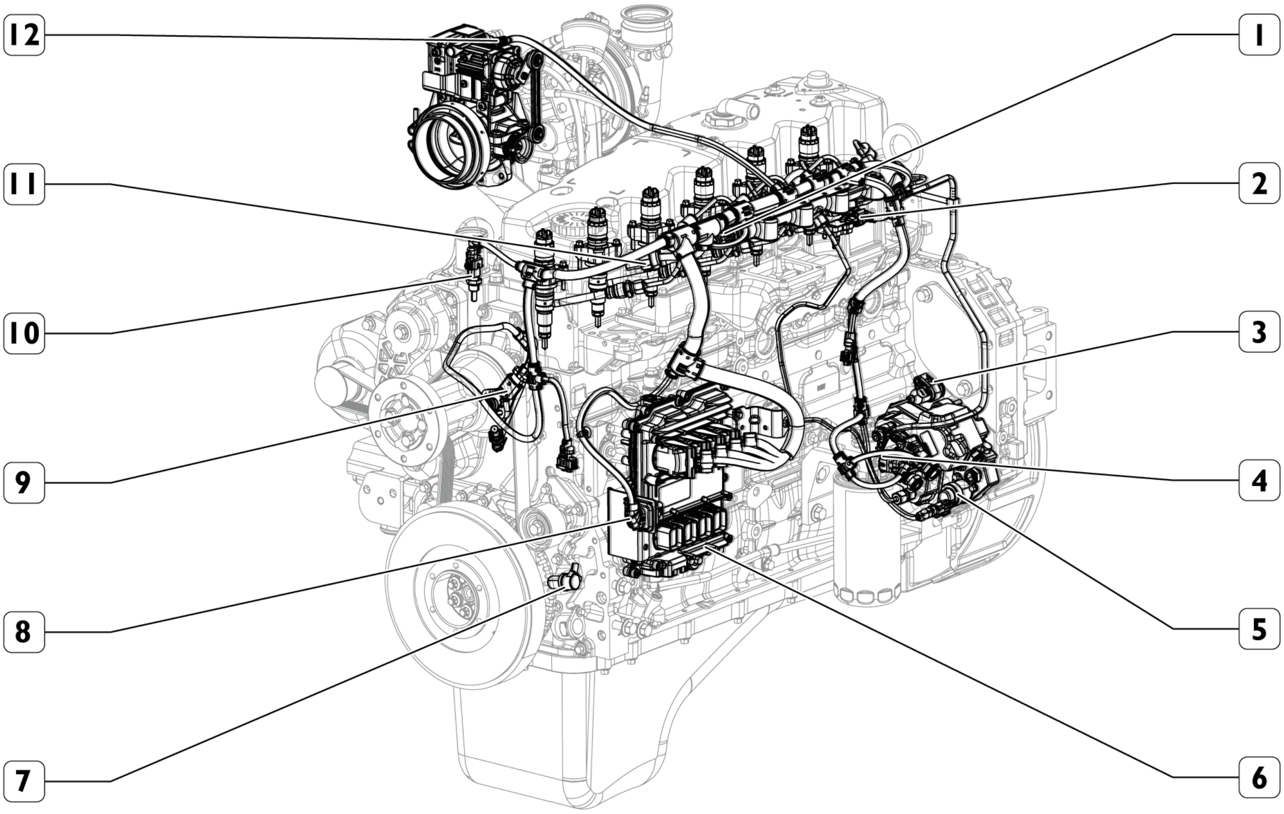
148. Screw in the studs **(4)** and fit the electric starter motor **(2)** into the flywheel housing **(1)**. Tighten the fastening nuts **(3)** to the specified torque.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**



215015 60

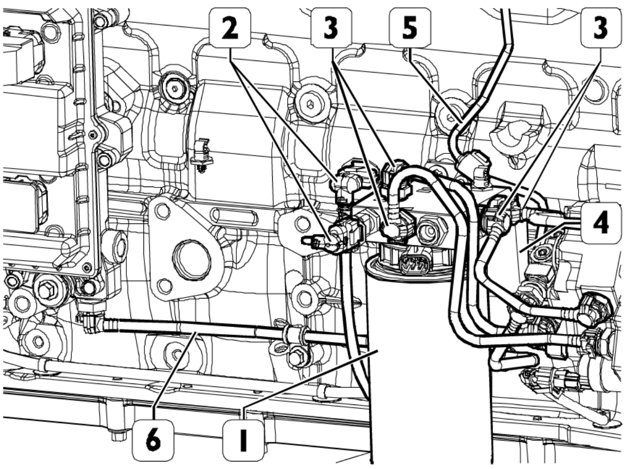
149. Fit the engine cable connecting it to the control unit **(6)**, to the motorised throttle valve actuator connector **(12)** and to all the sensors and transmitters to which it is connected.



268007 61

150. Place the fuel filter support **(4)** in position together with the bracket, if present, and tighten the retaining screws to the specified torque.
151. Connect the low- pressure fuel pipes **(3)** to the filter support.
152. Reposition the pipes **(5)** and **(6)**.
153. Connect the fuel temperature sensor and the camshaft timing sensor electrical connections **(2)**.
154. Fully screw the fuel filter **(1)** onto the fitting on the mount by hand, then tighten the fuel filter to the specified torque.

Description	Quantity	Value
Fuel filter	1 adapter M20 x 1.5	**20 +/- 2 N·m**



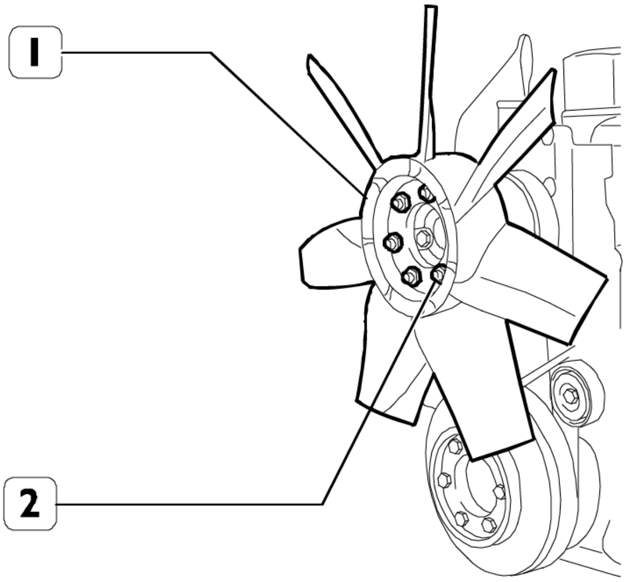
166072 62

155. Position the fan **(1)**, with the spacer.

Description	Quantity	Value
Fan	6 screws M10x1.5 x130	**24 +/- 4 N·m**

156. Tighten the screws **(2)**.

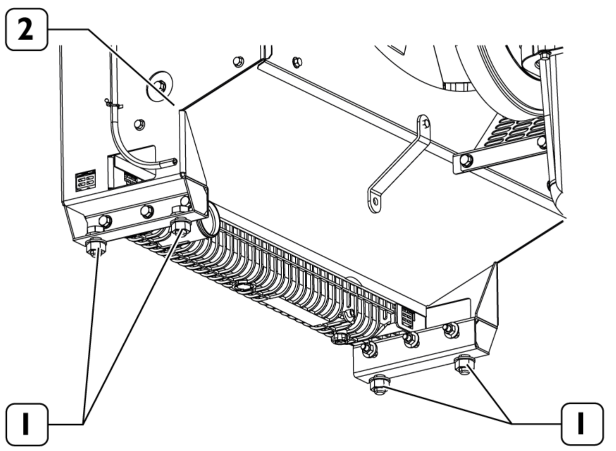
NOTE: *The shape and size of the fan vary depending on engine use.*
The relative illustrations provide a general outline of the work to be carried out.
However the procedures described are applicable anyway.



129297 63

157. Correctly position the radiator unit **(2)** and tighten the nuts **(1)**.

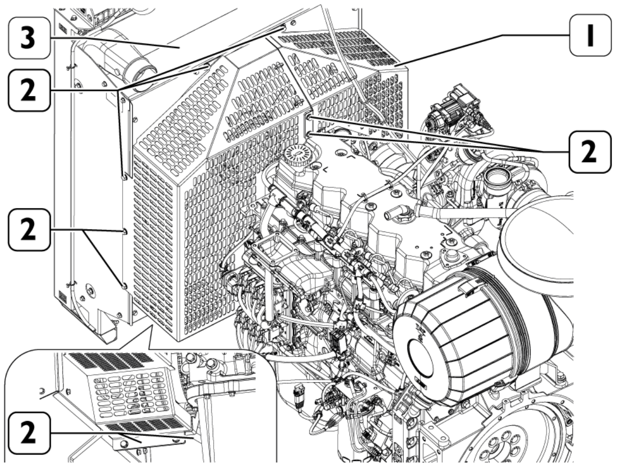
Description	Quantity	Value
Radiator mount	4 nuts M14 x 2	**114,5 +/- 11,5 N·m**



268003 64

158. Correctly position the protective grille **(1)** and tighten the screws **(2)**.

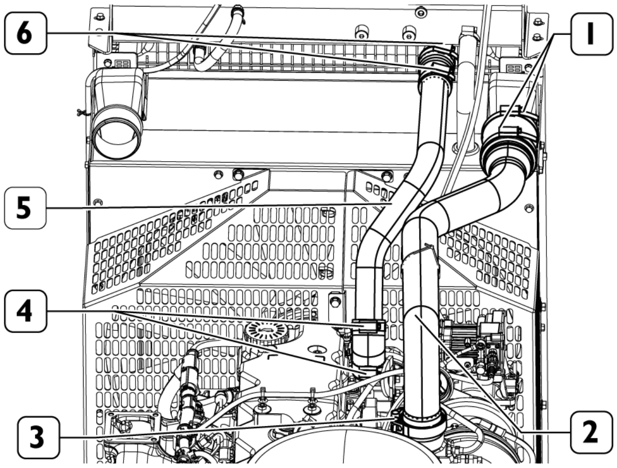
Description	Quantity	Value
Protective grille	12 screws M8 x 1.25 x 20	**23 +/- 2 N·m**



268002 65

159. Correctly position the air inlet pipe **(2)** to the radiator.
160. Tighten the screws on the collars **(1)** and tighten the screw **(3)** of the V-collar.
161. Correctly position the water outlet pipe **(5)** from the thermostat.
162. Tighten the screws on the collars **(6)** and **(4)**.

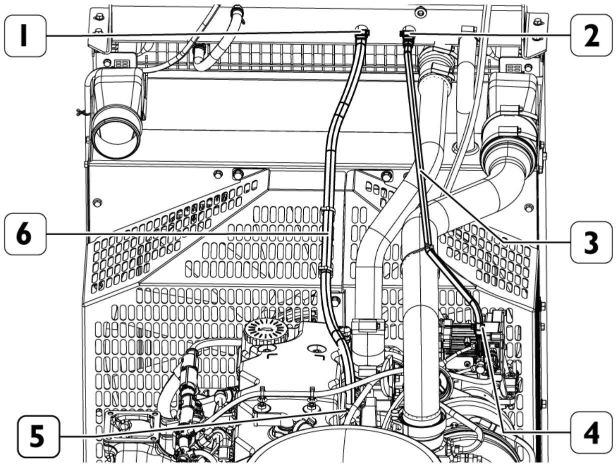
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267995 66

163. Correctly position the water pipe to the radiator **(3)**.
164. Tighten the screws on the collars **(2)** and **(4)**.
165. Correctly position the water pipe to the radiator **(6)**.
166. Tighten the screws on the collars **(1)** and **(5)**.

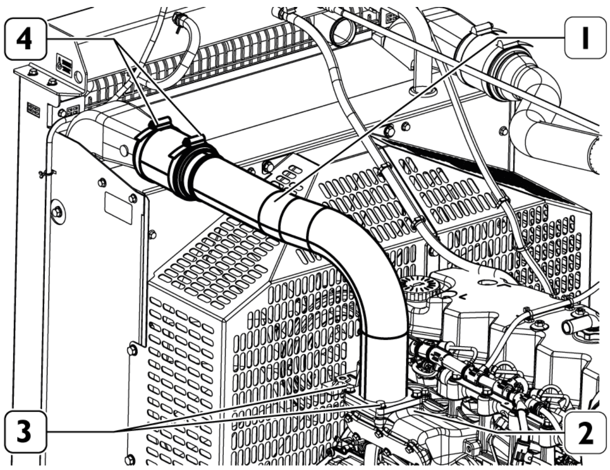
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267994 67

167. Connect the pipe **(1)** to the intake manifold **(2)** and tighten the screws **(3)**.
168. Connect the pipe **(1)** to the radiator unit and tighten the relative collars **(4)**.

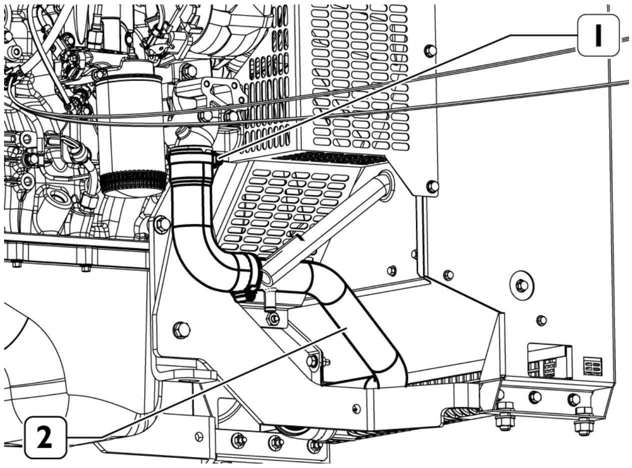
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



268000 68

169. Connect the pipe **(2)** and tighten the screw **(1)** of the V-collar.

Description	Quantity	Value
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**

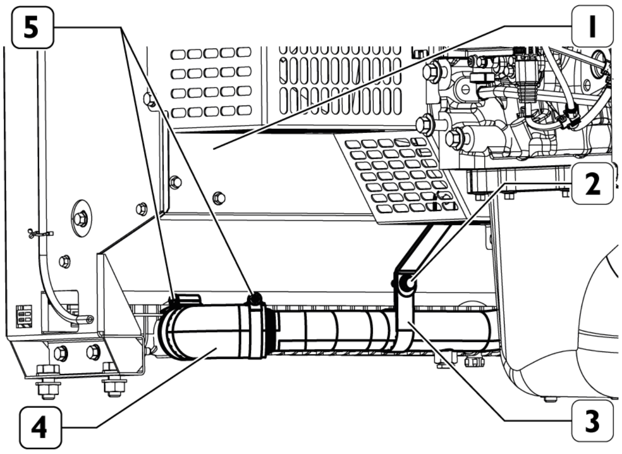


267998 69

170. Correctly position the pipe **(4)** with the bracket **(3)** and tighten the screw **(2)**.

171. Connect the pipe **(4)** to the radiator unit and tighten the relative collars **(5)**.

Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267999 70

CHECKS AND INSPECTIONS

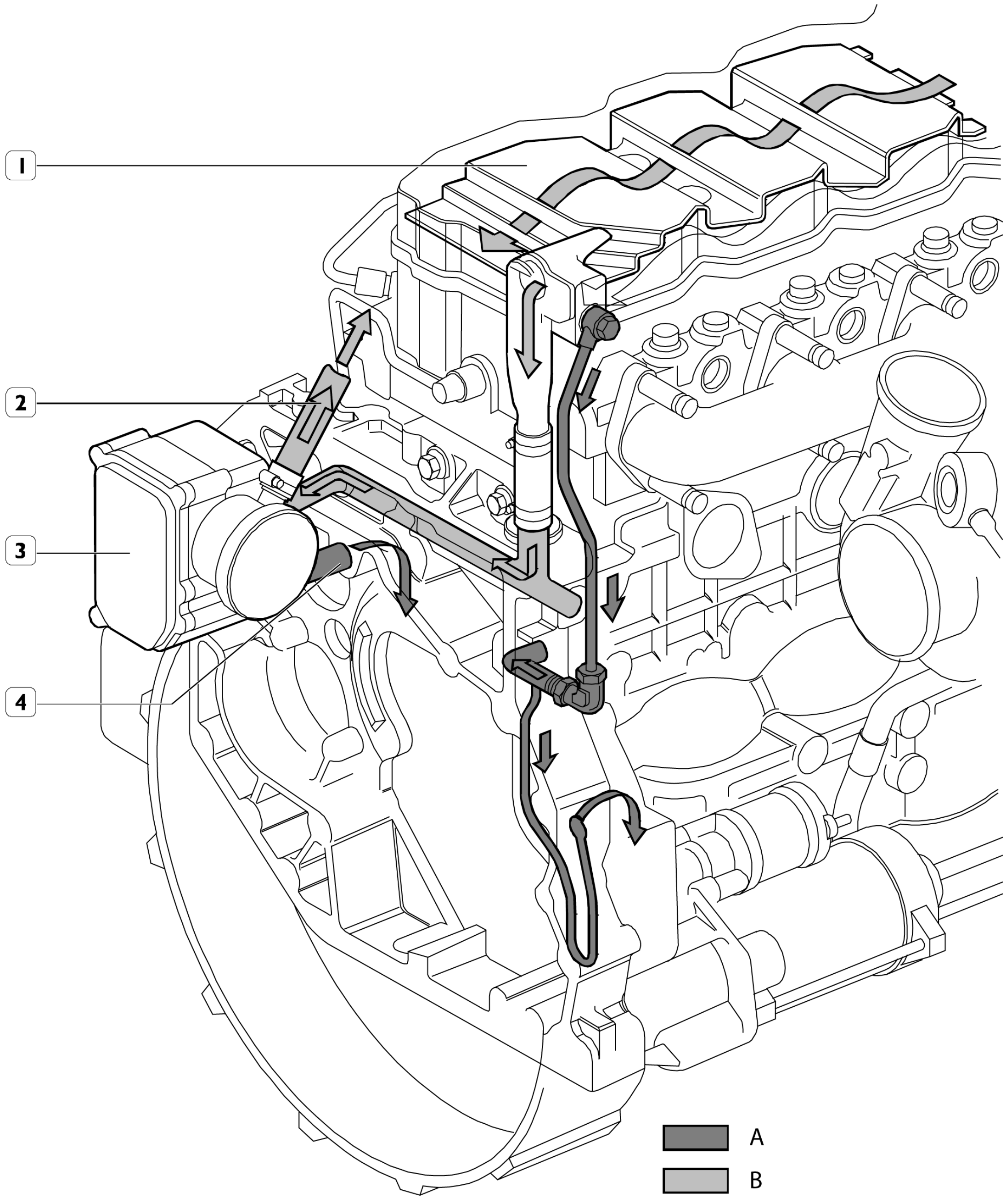
NOTE: *The following checks must be performed after mounting the engine onto the genset. Check that all the fluids are at the correct level before installing the engine.*

172. Start the engine, leave it running just above the idling speed, wait until the coolant reached the temperature necessary to open the thermostat and then check:
    - that there are no water leaks from the connecting sleeves of engine cooling circuit pipes and cab internal heating pipes, tighten the clamping collars if required;
    - thoroughly check the connections of the low-pressure fuel pipe to the respective fittings;
    - that there are no oil leaks between the cover and the cylinder head, between the oil sump and the engine block, between the heat exchanger oil filter and the relevant housings and between the different pipes in the lubricating circuit;
    - that there are no fuel leaks from the fuel pipes;
    - there are no air leaks from pneumatic pipes (if present);
    - Also check the correct operation of the warning lights set on the instrument panel and of the equipment disconnected when the engine was removed;
    - carefully check and bleed the engine cooling equipment with repeated bleeding operations.

540480 ENGINE BREATHER - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Oil vapours recirculation



1

A. Oil condensate

B. Oil vapours

1. Pre-separator
2. Exhaust to the outside (temporary)
3. Filter
4. Return to engine

The tappet cover houses the pre-separator **(1)** whose shape and position determines an increase in oil vapour outlet speed and condenses a part of the vapours at the same time.

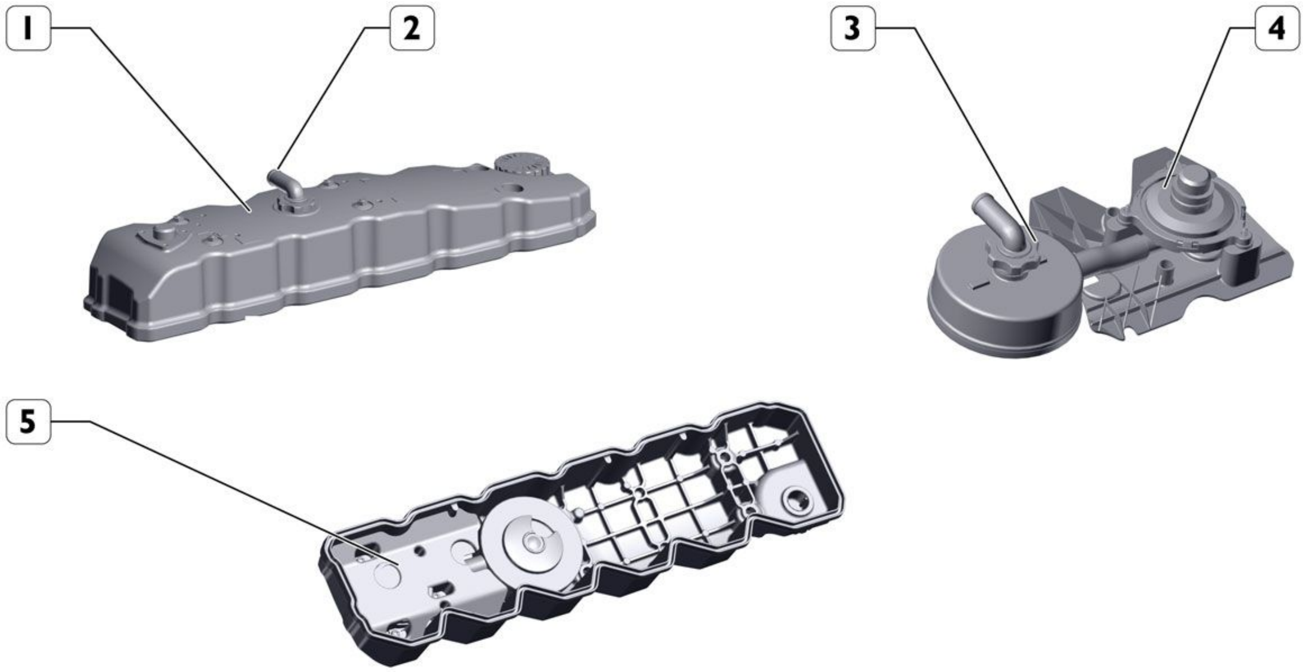
The condensate oil returns to the sump whereas the residual vapours are directed, collected and filtered in the blow-by filter **(3)**.

In the blow-by **(3)**, part of the vapours condense and return to the oil sump whereas the remaining part is reintroduced into the cycle through pipe **(2)**.

540480 ENGINE BREATHER - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

OIL VAPOUR RECYCLING



250619 1

1. Tappet cover
2. Oil vapour breather
3. Oil vapour separator control valve
4. Oil vapour filter housing
5. Oil deflector

The oil vapour recirculation circuit is used to decant and burn the breather gases from the crankcase.

These gases consist of a mix of air, fuel vapours and lubricant oil vapours.

The gases from the crankcase rise back up to the cylinder head and are then conveyed into a separator fitted inside the tappet cover.

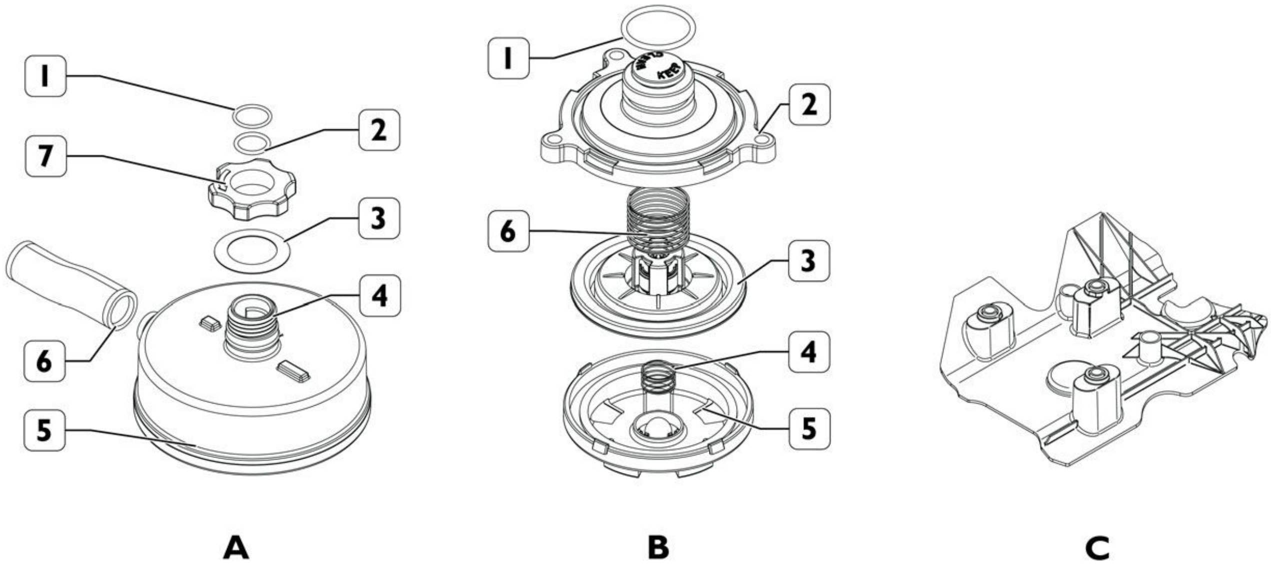
The separator is equipped with a diaphragm valve which allows:

- the condensation and recovery of the vapours;
- the lower part of the crankcase to be kept at the right vacuum value.

540486 FILTER ELEMENT - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Components



250622 1

(A) Blow-by filter - (B) Control valve - (C) Oil baffle

Blow-by filter:

1. O Ring filter 539
2. O ORing filter 0176 - 24
3. Washer - Belleville
4. Filter O-ring
5. Filter
6. Flexible pipe connection
7. Nut

Control valve:

1. Gasket O-ring regulator
2. Dust and upper regulator
3. Diaphragm valve
4. Lower adjustment spring
5. BTM adjustment
6. Upper adjustment spring

BLOW-BY FILTER	
Flow rate of the blow-by filter	< **180 L/min**
CCV filter efficiency	> **80%**
Operating temperature	**- 30 – + 120 °C**
Oil drain valve	**30 g**

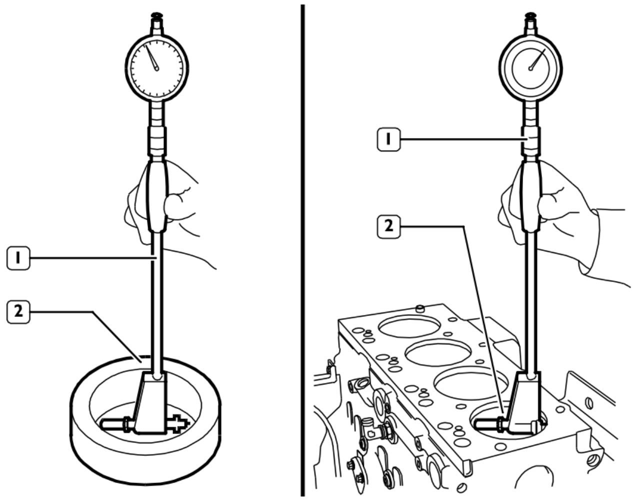
OIL PRESSURE	
Operating range of pressure relief valve	**65 – 120 mbar**
Max. flow rate	< **120 L/min**

The oil baffle prevents loss of the lubricant, retaining the fluids and at the same time, protecting against the introduction of hazardous foreign bodies.

540410 ENGINE BLOCK - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

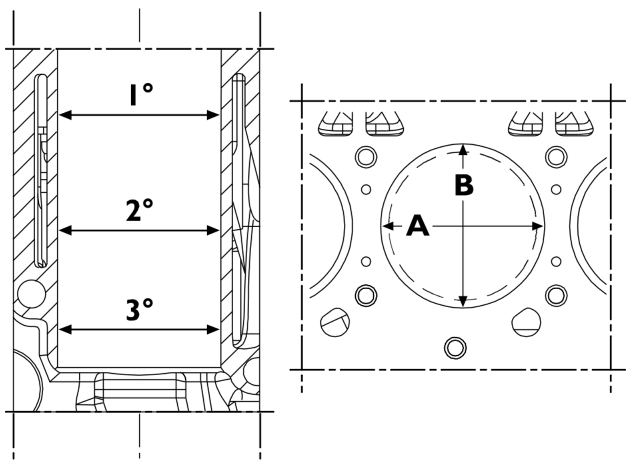
1. Once the engine is disassembled, thoroughly clean the cylinder-crankcase assembly.
2. Use the suitable rings to handle the cylinder assembly.
3. Carefully inspect the crankcase for cracks.
4. Check the condition of casting hole plugs. If the caps are rusted or there is any doubt over the efficiency of the seal the produce, replace the caps with new ones.
5. Inspect the surfaces of the cylinder sleeves; they should not be scored, seized, ovalised, conical or worn to excess.
6. The internal diameter of the cylinder liners is checked to ascertain the extent of ovalisation, 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.



70166 1

NOTE: *If the ring gauge is not available, use a micrometer for zero-setting.*

7. Measurements shall be performed on each cylinder, at three different heights in the barrel 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.
8. Should ovalisation, taper or wear be found, bore and grind the cylinder liners. Refacing of the cylinder sleeves should be performed in relation to the diameter of the pistons supplied as spare parts, which are upsized by **0,4 – 0,8 mm** of the nominal value and to the prescribed assembly clearance.

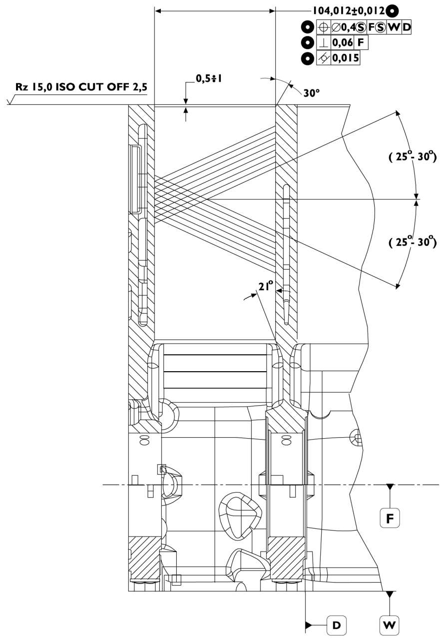


70167 2

9. Check main bearing housings as follows:

NOTE: *When refacing, all pipes must have the same increase (* ***0,4 – 0,8 mm****).*

10. fit the main bearings caps on the supports without bearings;
11. tighten the fastening screws to the specified torque;
12. use the proper internal gauge to check whether the housing diameter is falling within the specified value.
13. Replace crankcase if higher value is found.



107804 3

540430 OIL SUMP - Remove

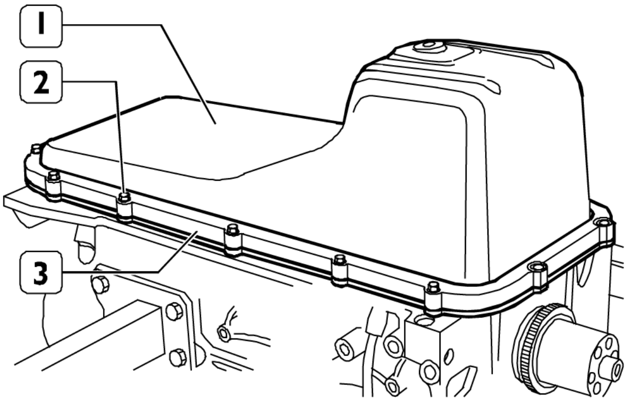
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Position an appropriate container for the oil collection under the sump in line with the drain plug .
2. Open the oil filler on the cylinder head and remove the dipstick to aid the flow of oil.
3. Unscrew the drain plug and let the oil in the sump drain out completely.

NOTE: *It is recommended to drain the engine oil when hot.*

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

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screwsM8 x 1.25 x 45	**27 – 30 N·m**



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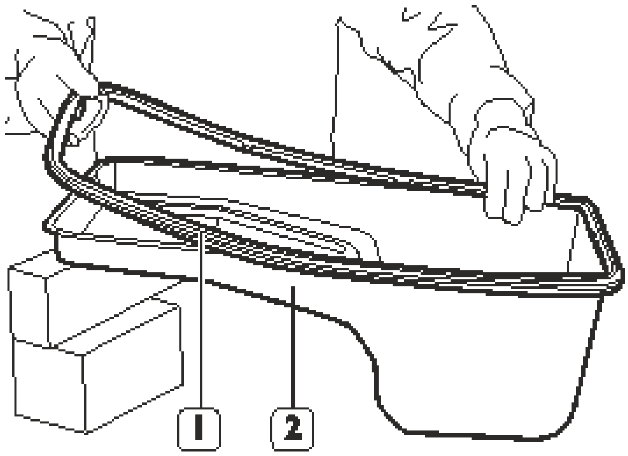
540430 OIL SUMP - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screwsM8 x 1.25 x 45	**27 – 30 N·m**

1. Position the gasket **(1)** on the oil sump **(2)**.

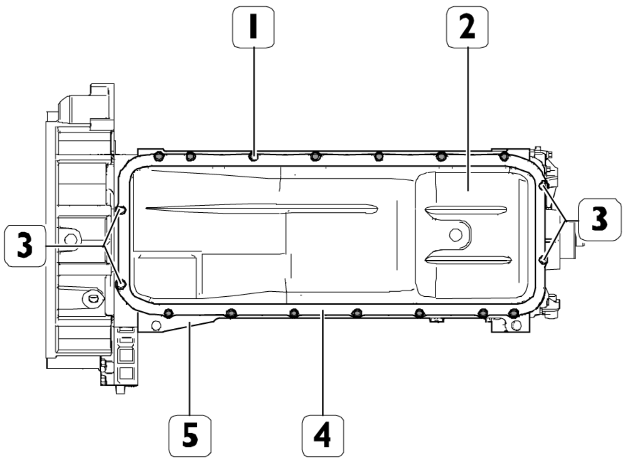
NOTE: *If the gasket is not faulty, it can be reused.*



74770 1

2. Fit the oil sump **(2)** in position on the crankcase **(5)** and apply the relevant plate **(4)** to it.
3. Tighten the fastening screws **(1)** and **(3)** to the prescribed torque.
4. Using a new gasket, tighten the drain plug and then fill it with clean oil.

Description	Step	Value
Oil sump	14 screws M8 x 1.25 x 40	**27 – 30 N·m**
	4 screwsM8 x 1.25 x 45	**27 – 30 N·m**



212841 2

General prescriptions
For correct engine operation, only use recommended oils or oils with the required characteristics. Failure to observe these indications will void the service 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

5. Check the oil level using the dipstick: the level must come close to the MAX notch which can be seen on the dipstick.
6. If this is not the case, top-up as necessary.

540480 ENGINE BREATHER - Replace

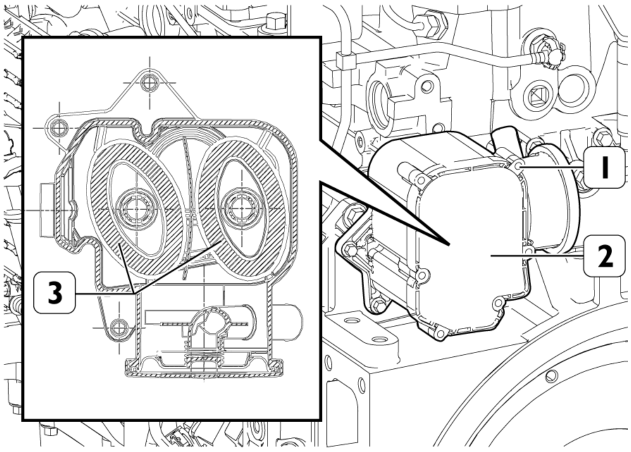
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Blow-by filter replacement

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. The blow-by filter was devised and designed for collecting, filtering and condensing lubricant oil vapours.
2. Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.
3. Unscrew the fastening screws **(1)** and remove the Blow-by filter cover **(2)**.
4. Replace and install the two cartridge filters **(3)** included in the filtering unit **(2)**.
5. Fit the blow-by filter cover **(2)** and tighten the fastening screws **(1)**.

NOTE: *The blow-by filter was designed to collect, filter and condensate the lubricant vapours.*
Carry out the procedure only while the engine is OFF and at a low temperature to prevent the risk of burns.



209217 1

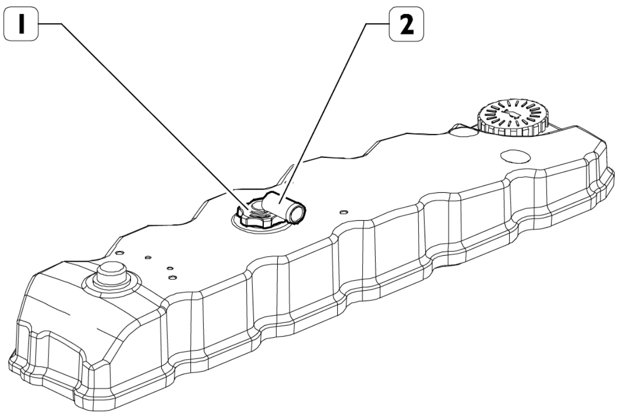
540480 ENGINE BREATHER - Replace

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Blow-by filter change

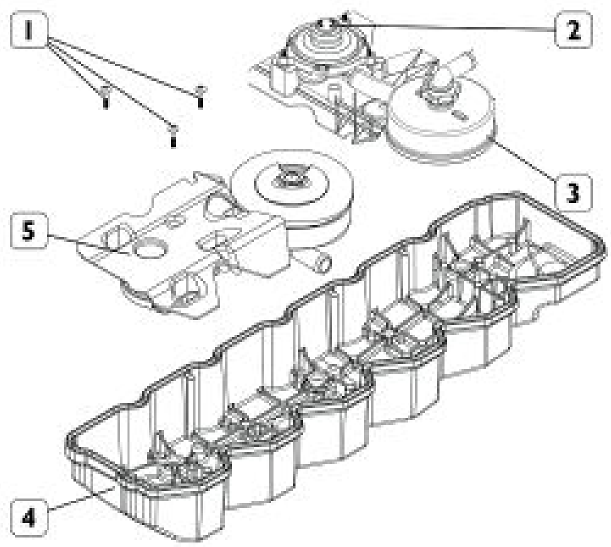
Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.
2. Loosen the ring nut **(1)** and remove the breather pipe **(2)**, by rotating it to release it from the bayonet coupling.



254421 1

3. Unscrew the self-locking screws **(1)** securing the oil baffle **(5)**, control valve **(2)** and filter element **(3)** to the tappet cover **(4)** and remove it together with the other elements.
4. Fit the control valve with a new O-ring together with the filter element and tighten the new screws to a torque of **6 N·m**.
5. Partially screw in the ring nut on the filter element, insert the pipe rotating it to until the filter element engages with the bayonet connection.
6. Complete the tightening of the ring nut.



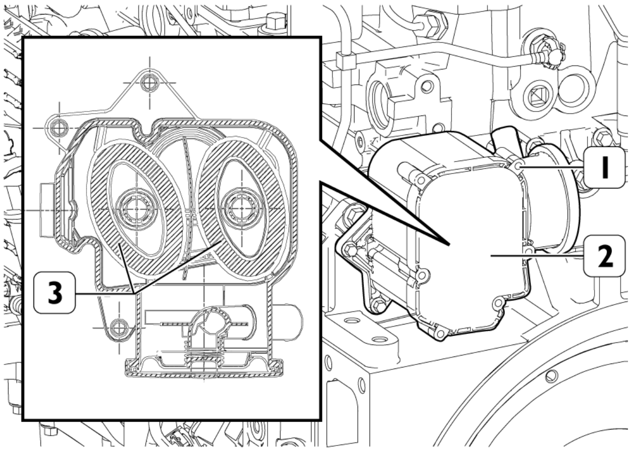
254422 2

540480 ENGINE BREATHER - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Only proceed when the engine is not running.
2. Unscrew the fastening screws **(1)** and remove the Blow-by filter cover **(2)**.
3. Carefully clean the internal surfaces and the two cartridge filters **(3)** in the filter unit.
4. Refit the parts and tighten the screws.



209217 1

540480 ENGINE BREATHER - Check

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

Only continue of the engine is not running and is at a low temperature, to prevent the risk of burns.

1. Check that the filter element is completely free of deposits. Otherwise, replace it.

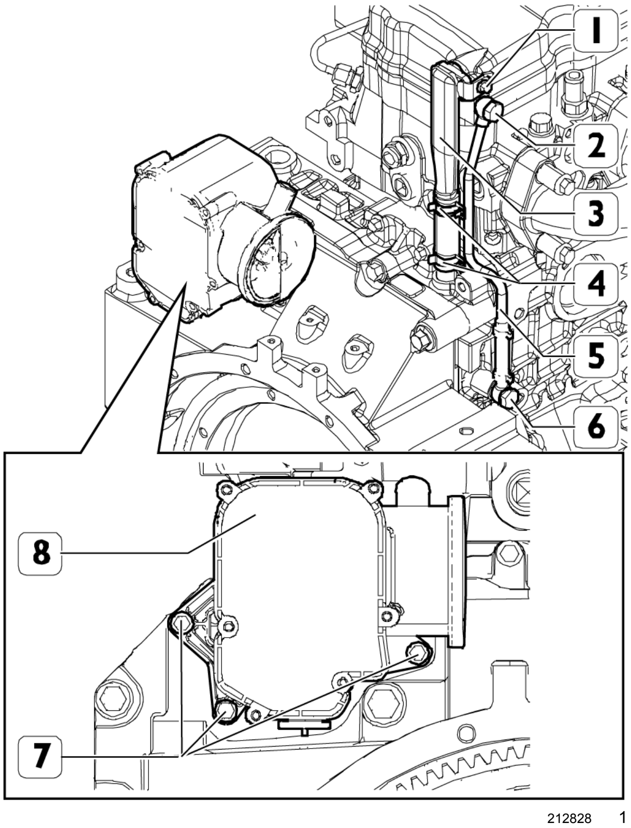
General prescriptions
Dispose of consumable materials and the parts in contact with them (for example filters) in accordance with the law. The workshops of the FPT Service Network are equipped for this purpose.
Correct behavior will ensure that vehicle is used as environmentally friendly as possible

540480 ENGINE BREATHER - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Position a suitable container to collect the oil.
2. Unscrew the fastening screw **(1)**, loosen the retaining clamps **(4)** and remove the blow-by breather pipe **(3)**.
3. Unscrew the connectors **(2)** and **(6)** and remove the oil return pipe **(5)**.
4. Unscrew the fastening screws **(7)** and remove the blow-by filter **(8)**.

Description	Quantity	Value
Blow-by breather plate	1 screw M6 x 1	**10 +/- 2 N·m**
Blow-by breather pipe	2 fittings M12 x 1.5	**20 +/- 4 N·m**
Blow-by filter	3 screws M6 x 1	**10 +/- 2 N·m**



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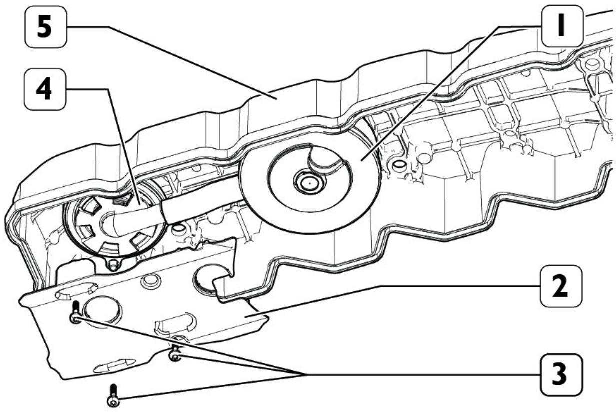
540480 ENGINE BREATHER - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
ENGINE SUPPLY AIR FILTER - Remove (50.51)
Prior operation:
ROCKER COVER - Remove (54.06)

1. Unscrew the screw **(3)** and remove the baffle **(2)** .
2. Remove the blow-by filter **(1)** after having unscrewed the plug on the upper part of the cover **(5)** with the relevant pipe .
3. Remove the oil vapour separator control valve **(4)**.



267321 1

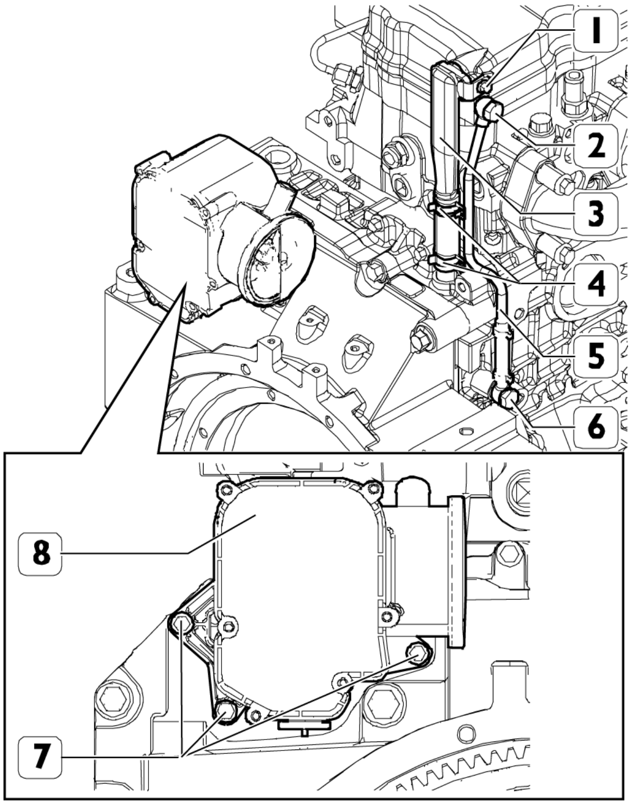
540480 ENGINE BREATHER - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Description	Quantity	Value
Blow-by breather pipe	2 fittings M12 x 1.5	**20 +/- 4 N·m**
Blow-by breather plate	1 screw M6 x 1	**10 +/- 2 N·m**
Blow-by filter	3 screws M6 x 1	**10 +/- 2 N·m**

1. Fit the blow-by filter **(8)** in position on the flywheel housing and tighten the fastening screws **(7)** to the specified torque.
2. Install the oil return pipe **(5)** with new copper washers and tighten the fittings **(2)** and **(6)** to the prescribed torque.
3. Insert the blow-by breather pipe **(3)** in the union located on the timing gear case and fasten it with the clips **(4)**. Tighten the screw **(1)** fastening the tappet cover to the specified torque.

Description	Quantity	Value
Blow-by breather plate	1 screw M6 x 1	**10 +/- 2 N·m**
Blow-by breather pipe	2 fittings M12 x 1.5	**20 +/- 4 N·m**
Blow-by filter	3 screws M6 x 1	**10 +/- 2 N·m**

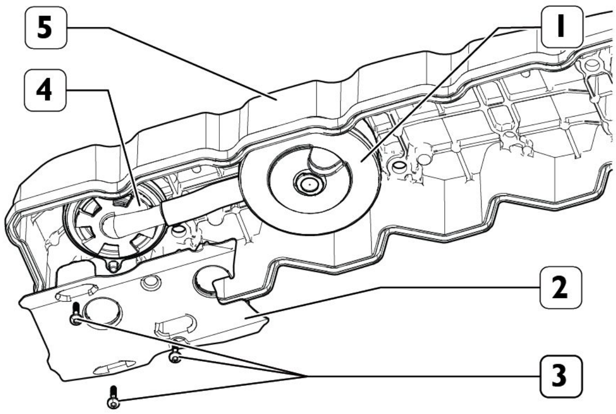


212828 1

540480 ENGINE BREATHER - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Fit the blow-by filter **(1)** with the relative pipe screwing the plug onto the top part of the tappet cover **(5)**.
2. Fit the oil vapour separator control valve **(4)**.
3. Fit the baffle **(2)** and tighten the screws **(1)**.



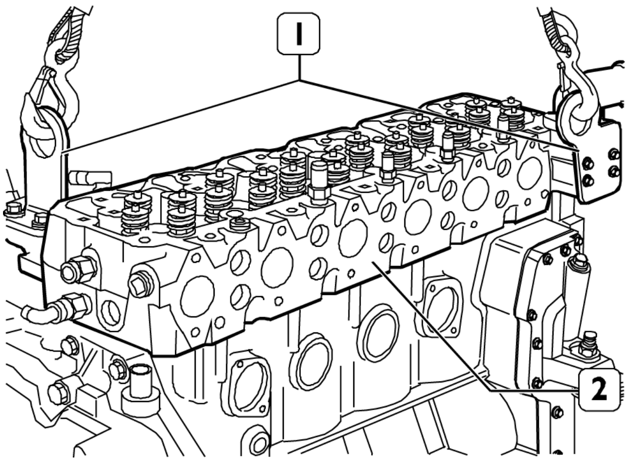
267321 1

Next operation:
ROCKER COVER - Install (54.06)
Next operation:
ENGINE SUPPLY AIR FILTER - Install (50.51)

540610 CYLINDER HEAD - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Remove the engine cable as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Remove the thermostat as described in the procedure **THERMOSTAT - Remove (54.32)**.
3. Remove the Common Rail as described in the procedure **HIGH PRESSURE ACCUMULATOR - Remove (77.45)**.
4. Remove the rocker arm assembly as described in the procedure **ROCKER ARM ASSY - Remove (54.12)**.
5. Remove the injectors as described in the procedure **INJECTOR - Remove (77.50)**.
6. Remove the turbocharger as described in the procedure **TURBO CHARGER - Remove (54.24)**.
7. Remove the exhaust manifold as described in the procedure **EXHAUST MANIFOLD - Remove (54.07)**.
8. Remove the intake manifold as described in the procedure **INTAKE MANIFOLDS - Remove (54.07)**.
9. Unscrew the retaining screws, hook metal cables onto the brackets **(1)** and remove the cylinder head **(2)** from the engine block using a hoist.
10. Remove the cylinder head gasket.



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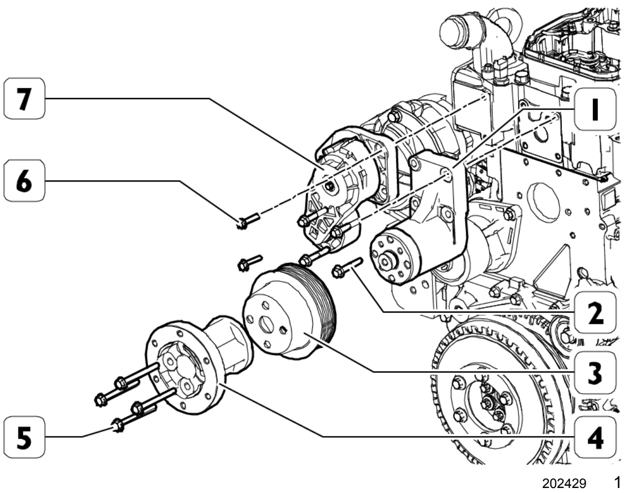
540610 CYLINDER HEAD - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)
Prior operation:
FAN - Remove (54.34)
Prior operation:
ENGINE CABLES - Remove (76.91)
Prior operation:
WATER PUMP DRIVE BELT - Remove (54.34)
Prior operation:
TURBO CHARGER - Remove (54.24)
Prior operation:
PIPES - Remove (54.20)
Prior operation:
EXHAUST MANIFOLD - Remove (54.07)
Prior operation:
INTAKE MANIFOLDS - Remove (54.07)
Prior operation:
ENGINE SUPPLY AIR FILTER - Remove (50.51)
Prior operation:
ROCKER COVER - Remove (54.06)
Prior operation:
INJECTOR - Remove (77.50)
Prior operation:
ROCKER ARM ASSY - Remove (54.12)

1. Unscrew the screws **(6)** and remove the automatic belt tensioner **(7)**.
2. Loosen the screws **(5)** and remove the spacer **(4)** for the fan coupling together with the pulley **(3)**.
3. Unscrew the screws **(2)**.
4. Remove the fan support **(1)**.

Description	Quantity	Step	Value
Screw for belt tensioner 4898548	1 x M10 x 1.5		**43 +/- 6 N·m**



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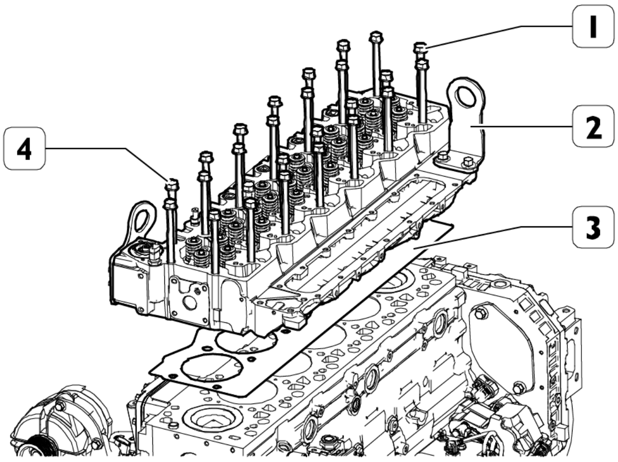
5. Unscrew the screws **(1)** and **(4)**.
6. Using the lifting eyelets **(2)**, remove the cylinder head together with all the elements relating to the timing gear: Intake valve; Exhaust valve; Valve spring; Washers; Cotters.
7. Recover the gasket **(3)**.

Description	Step	Value
Cylinder head fastening screws	Phase 1 M12 x 1.75 x 130	**35 +/- 5 N·m**
	Phase 2 M12 x 1.75 x 130	**90°**
	Phase 3 M12 x 1.75 x 130	**90°**
	Phase 1 M12 x 1.75 x 150	**55 +/- 5 N·m**
	Phase 2 M12 x 1.75 x 150	**90°**
	Phase 3 M12 x 1.75 x 150	**90°**



214305 2

540610 CYLINDER HEAD - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

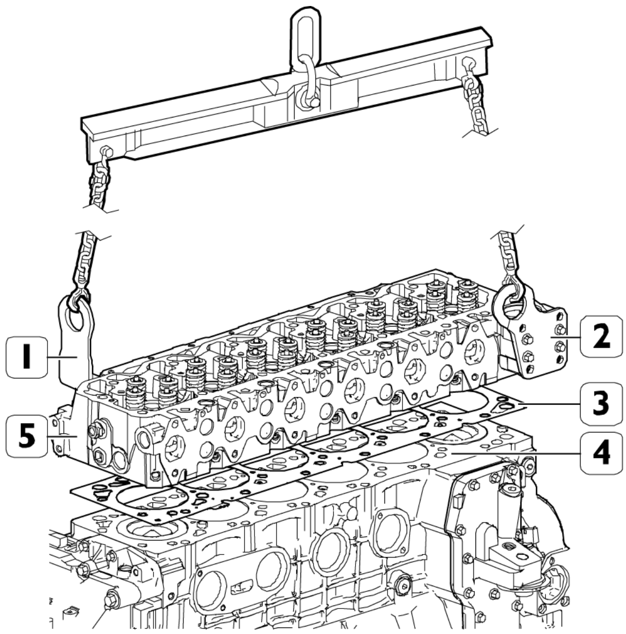
Description	Quantity	Step	Value
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**

Tool / Material	
Rocking sling for removing/installing engine	99360595

1. Use suitable lifting hooks **(1)** and **(2)** in order to lift and fit the cylinder head **(5)** on the crankcase **(4)** after having inserted a new gasket **(3)** by using a hoist with the tool.

NOTE: *Clean the cylinder head **(5)** and engine block **(4)** contact surfaces.*
There are two types of cylinder head gaskets:
*- Type A thick **1,25 mm***
*- Type B **1,15 mm** thick.*
*Check the average protrusion S of the pistons: If S > **0,40 mm**, use type A gasket.*
*If S ≤ **0,40 mm** use gasket type B.*
Keep the new cylinder head gasket clean.
*Arrange a new cylinder head gasket **(3)** on the engine block with the marking "TOP" facing the head.*
The arrow shows the point where the gasket thickness is given.

Tool / Material	
Rocking sling for removing/installing engine	99360595



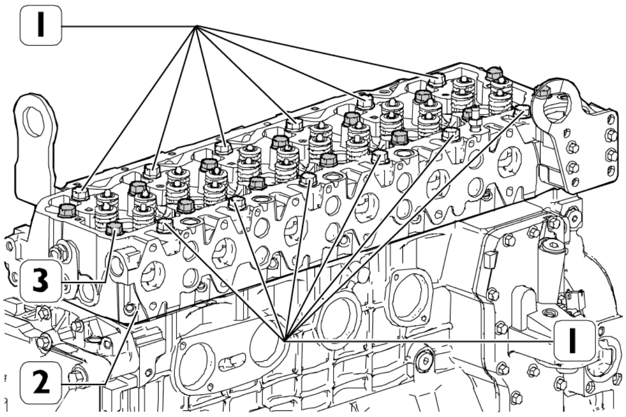
212839 1

2. If the valves have been removed from the head, refit them before refitting the head on the crankcase.

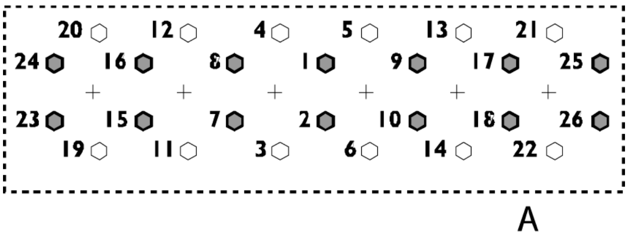
3. After having correctly positioned the gasket on the crankcase, assemble the cylinder head **(2)** and tighten a set of fastening screws **(1)** and **(3)** in three steps, following the order and mode shown in the figure below.

NOTE: *The screws **(1)** and **(3)** must be tightened following a "spiral" pattern starting in the middle and going outwards.*

Description	Quantity	Step	Value
Cylinder head	12 screws M12 x 1.75 x 130	Phase 1 Tighten	**35 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**
Cylinder head	14 screws M12 x 1.75 x 150	Phase 1 Tighten	**55 +/- 5 N·m**
		Phase 2 Angle tightening	**90°**
		Phase 3 Angle tightening	**90°**



212838 2



70476 3

Diagram of the tightening sequence for the cylinder head fixing screws

A. Front side

4. Install the intake manifold as described in the procedure **INTAKE MANIFOLDS - Install (54.07)**.
5. Install the exhaust manifold as described in the procedure **EXHAUST MANIFOLD - Install (54.07)**.
6. Install the turbocharger as described in the procedure **TURBO CHARGER - Install (54.24)**.
7. Install the injectors as described in the procedure **INJECTOR - Install (77.50)**.
8. Fit the rocker arm assembly as described in the procedure **ROCKER ARM ASSY - Install (54.12)**.
9. Install the Common Rail as described in the procedure **HIGH PRESSURE ACCUMULATOR - Install (77.45)**.
10. Install the thermostat as described in the procedure **THERMOSTAT - Install (54.32)**.
11. Fit the engine cable as described in the procedure **ENGINE CABLES - Install (76.91)**.

540610 CYLINDER HEAD - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

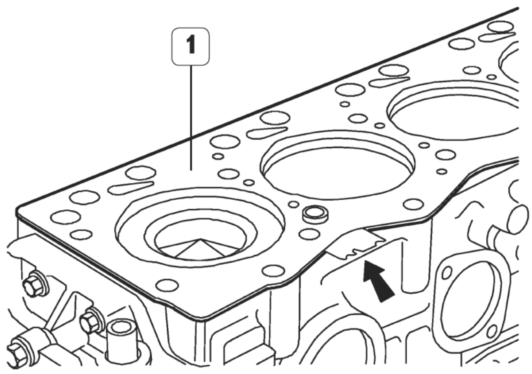
Description	Quantity	Step	Value
Cylinder head fastening screws		Phase 1 M12 x 1.75 x 130	**35 +/- 5 N·m**
		Phase 2 M12 x 1.75 x 130	**90°**
		Phase 3 M12 x 1.75 x 130	**90°**
		Phase 1 M12 x 1.75 x 150	**55 +/- 5 N·m**
		Phase 2 M12 x 1.75 x 150	**90°**
		Phase 3 M12 x 1.75 x 150	**90°**
Screw for belt tensioner 4898548	1 x M10 x 1.5		**43 +/- 6 N·m**

1. Correctly position the gasket **(1)** on the monobloc.

NOTE: *Check that the block contact surface is clean. Do not moisten the gasket. It is recommended that the gasket is kept in its packaging until it is fitted on the head. The gasket is to be fitted in such a way that the writing on the gasket can be read as shown in the figure.*

NOTE: *With piston protrusion equal to or less than 0.4, fit a gasket with a thickness of 1.15. With piston protrusion greater than 0.4, fit a gasket with a thickness of 1.25.*

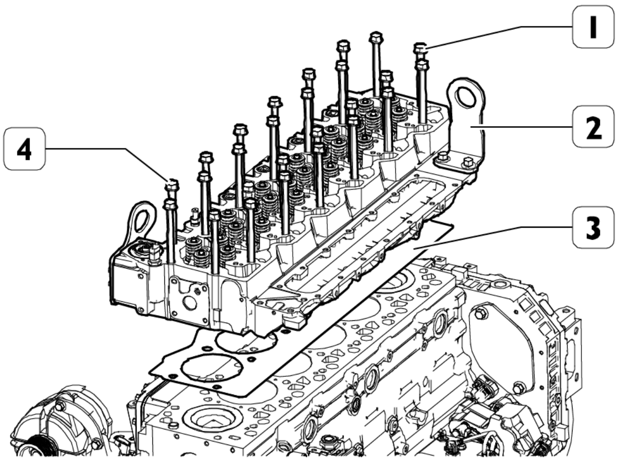
NOTE: *If the valves have been removed from the head, they must be refitted before assembling the head on the block.*



87759 1

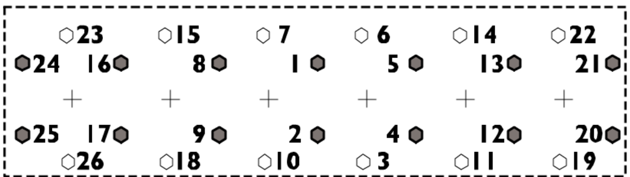
2. Position the cylinder head **(3)** on the monobloc.
3. Tighten the screws **(1)** and **(4)**.

Description	Step	Value
Cylinder head fastening screws	Phase 1 M12 x 1.75 x 130	**35 +/- 5 N·m**
	Phase 2 M12 x 1.75 x 130	**90°**
	Phase 3 M12 x 1.75 x 130	**90°**
	Phase 1 M12 x 1.75 x 150	**55 +/- 5 N·m**
	Phase 2 M12 x 1.75 x 150	**90°**
	Phase 3 M12 x 1.75 x 150	**90°**



214305 2

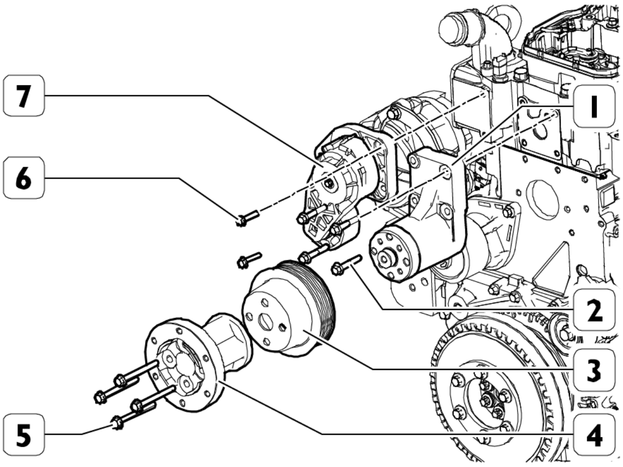
4. Fit the bolts on the engine head.
5. The bolts must be tightened following a "spiral" pattern, starting from the bolts in the centre and moving outwards. Tighten the bolts in a number of steps until they are correctly tightened.



214306 3

6. Correctly position the fan support **(1)** and tighten the screws **(2)**.
7. Position the spacer **(4)** for the fan coupling together with the pulley **(3)**.
8. Tighten the screws **(5)**.
9. Position the automatic belt tensioner **(7)** and tighten the screws **(6)**.

Description	Quantity	Step	Value
Screw for belt tensioner 4898548	1 x M10 x 1.5		**43 +/- 6 N·m**



202429 4

Next operation:
ROCKER ARM ASSY - Install (54.12)
Next operation:
INJECTOR - Install (77.50)
Next operation:
ROCKER COVER - Install (54.06)
Next operation:
ENGINE SUPPLY AIR FILTER - Install (50.51)
Next operation:
INTAKE MANIFOLDS - Install (54.07)
Next operation:
EXHAUST MANIFOLD - Install (54.07)
Next operation:
PIPES - Install (54.20)
Next operation:
TURBO CHARGER - Install (54.24)
Next operation:
WATER PUMP DRIVE BELT - Install (54.34)
Next operation:
ENGINE CABLES - Install (76.91)
Next operation:
FAN - Install (54.34)
Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

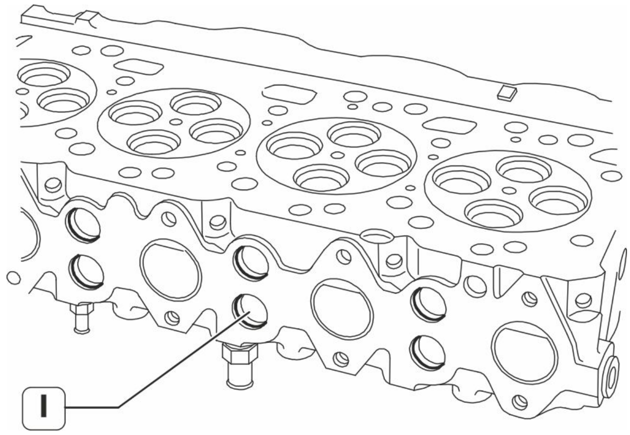
540610 CYLINDER HEAD - Check

Cylinder head hydraulic seal check

1. Check the hydraulic seal using a suitable tool.
2. Using a pump inject water heated to ~ **90 °C** and with the pressure of **2 – 3 bar**.
3. Replace the casting hole plugs **(1)** if they are found to leak, using a suitable drift for their disassembly - assembly.

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

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



70323 1

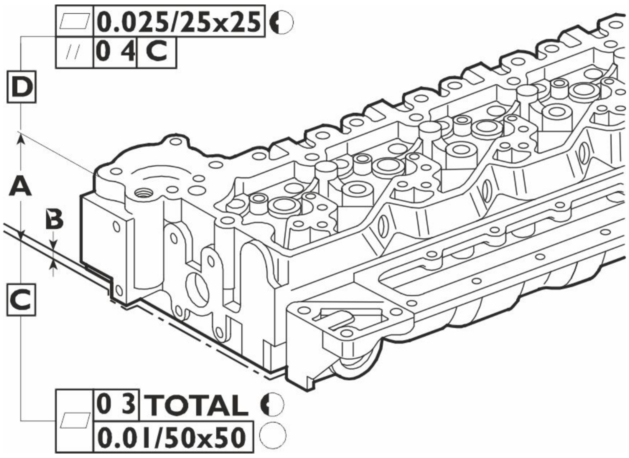
540610 CYLINDER HEAD - Check

Prior operation:
VALVES - Disassemble (54.06)

Cylinder head contact surface check

1. Distortion found along the whole cylinder head must not exceed **0,20 mm**.
2. If higher values are found grind the cylinder head according to values and indications shown in the following figure.
3. Check that the nominal thickness **(A)** of the cylinder head is **105 +/- 0,25 mm**, the maximum removal of the metal must not exceed thickness B of **0,13 mm**.

NOTE: *After regrinding, check that the recess value of the valves. Regrind the valve seats if necessary to obtain the specified value.*

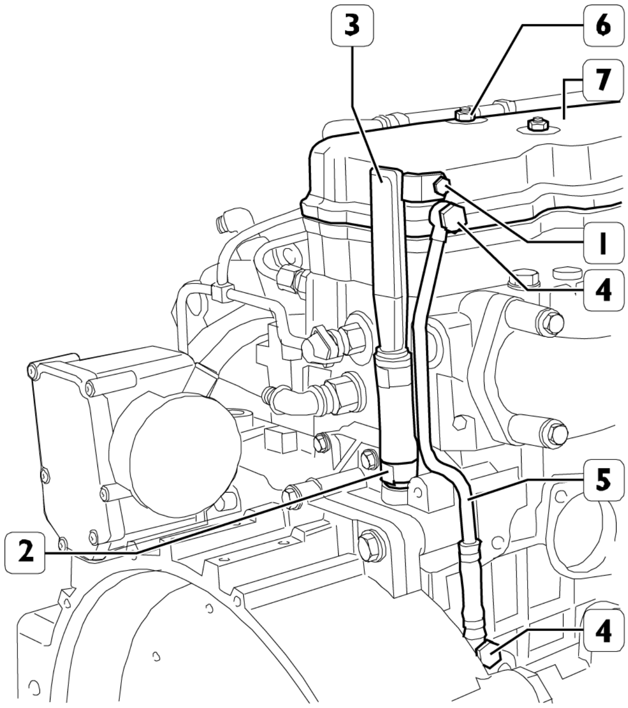


70325 1

540630 ROCKER COVER - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

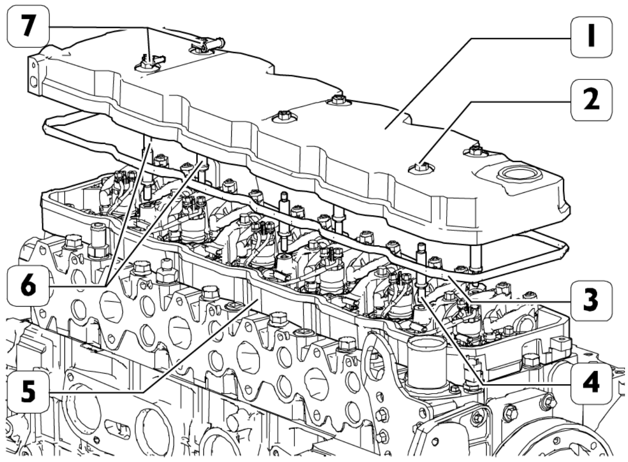
1. Unscrew the screw **(1)**. Loosen the flexible clip **(2)** and remove the oil vapour recirculation pipe **(3)**.
2. Unscrew the fittings **(4)** and remove the pipe **(5)**.



166630 1

3. Unscrew the fastening nuts **(2)** and **(7)** and remove the tappet cover **(1)** from the wiring support **(5)**, retrieving the relative gasket **(3)**.
4. Unscrew the threaded double-shank screws **(4)** and **(6)** from the wiring support **(5)**.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**



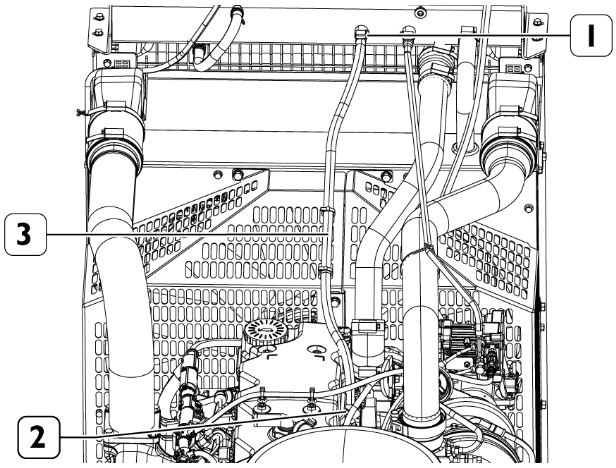
212832 2

540630 ROCKER COVER - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Unscrew the screws on the collars **(1)** and **(2)**.
2. Disconnect the water pipe **(3)** from the radiator unit.

Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



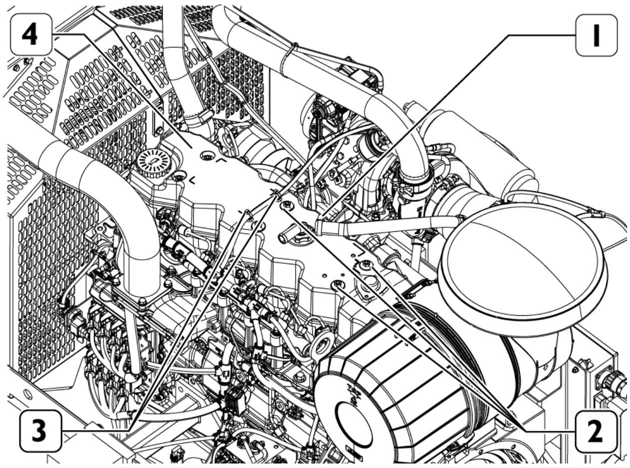
268018 1

3. Unscrew the screw of the collar **(1)**.

Description	Quantity	Value
Pipe between blow-by and air filter	1 screw M20 x 35	**3,25 +/- 0,25 N·m**

4. Disconnect the collars **(3)** from the engine cable.
5. Unscrew the fastening screws **(2)** and remove the tappet cover **(4)** together with the gasket.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**

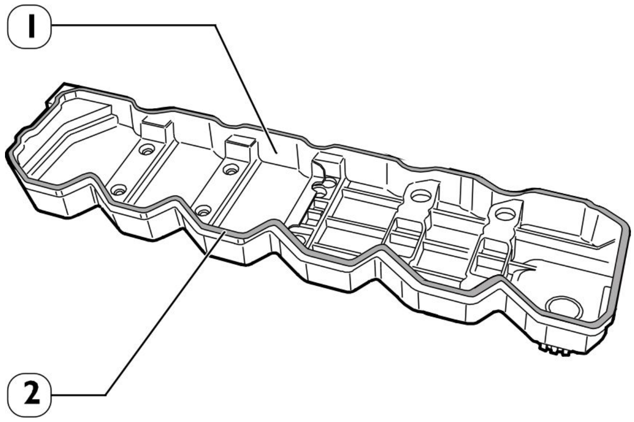


268019 2

540630 ROCKER COVER - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

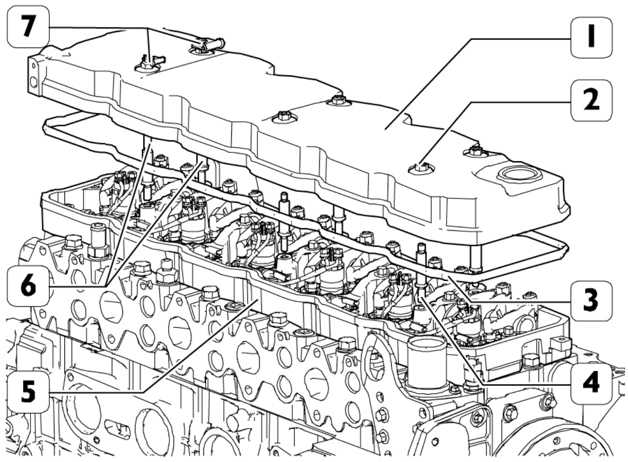
1. Place a new gasket **(2)** on the tappet cover **(1)**.



74757 1

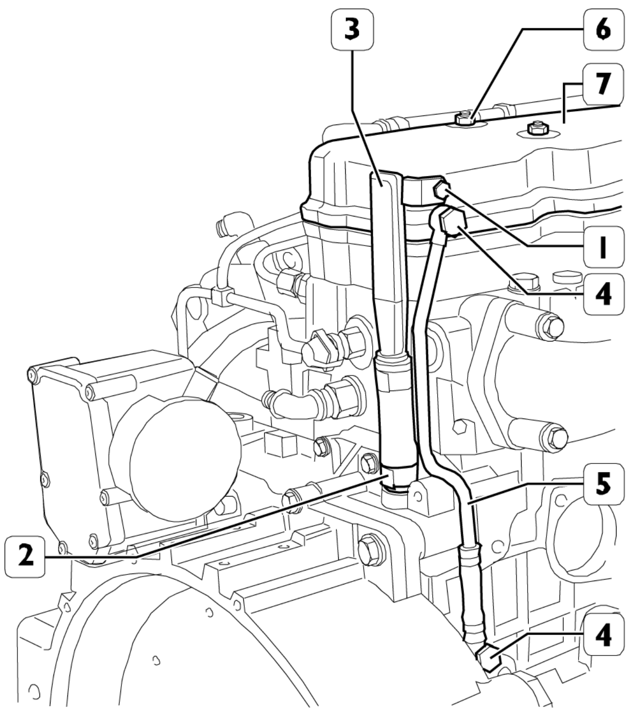
2. Screw the double-shank threaded screws **(4)** and **(6)** into the wiring support **(5)**.
3. Install the tappet cover **(1)** on the wiring support **(5)** after having inserted a new gasket **(3)**.
4. Tighten the fastening nuts **(2)** and **(7)** to the prescribed torque.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**



212832 2

5. Place the pipe **(5)** in position with new copper washers in the fittings **(4)** on the tappet cover and on the timing case. Then tighten the fittings **(4)** to the specified torque.
6. Place the oil vapour recovery pipe **(3)** into the coupling located on the timing case and secure it with the elastic strap **(2)**.
7. Insert the upper coupling of the oil vapour pipe **(5)** with a new seal ring, into the seat on the tappet cover and tighten the screw **(1)**.



166630 3

540630 ROCKER COVER - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

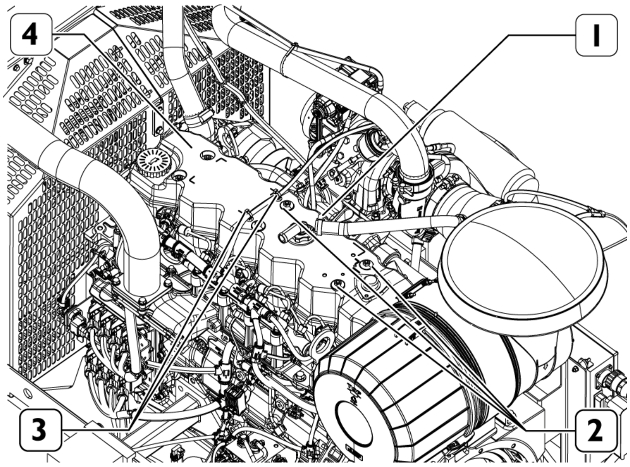
Description	Quantity	Step	Value
Breather pipe collar on radiator	1 screw		**2,25 +/- 0,25 N·m**
Pipe between blow-by and air filter	1 screw M20 x 35		**3,25 +/- 0,25 N·m**
Tappet cover		6 nuts M8 x 1.25	**20 +/- 2 N·m**

1. Fit a new gasket on the tappet cover **(4)**.
2. Correctly position the tappet cover and tighten the fastening nuts **(2)** to the specified torque.

Description	Step	Value
Tappet cover	6 nuts M8 x 1.25	**20 +/- 2 N·m**

3. Connect the collars **(3)** to the engine cable.
4. Connect the connection pipe between the blow-by filter and the air filter and tighten the screw on the collar **(1)**.

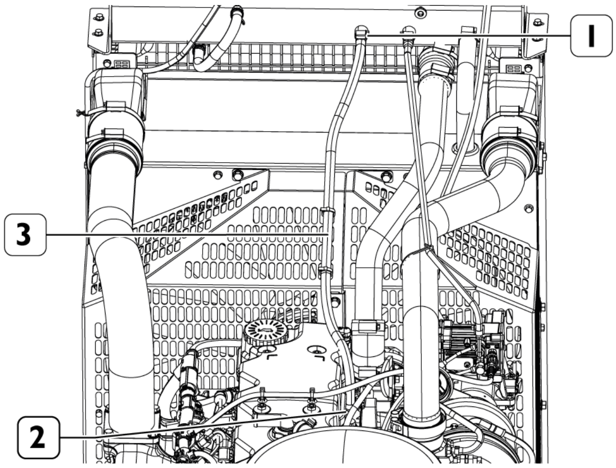
Description	Quantity	Value
Pipe between blow-by and air filter	1 screw M20 x 35	**3,25 +/- 0,25 N·m**



268019 1

5. Connect the water pipe **(3)** to the radiator unit.
6. Tighten the screws on the collars **(1)** and **(2)**.

Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



268018 2

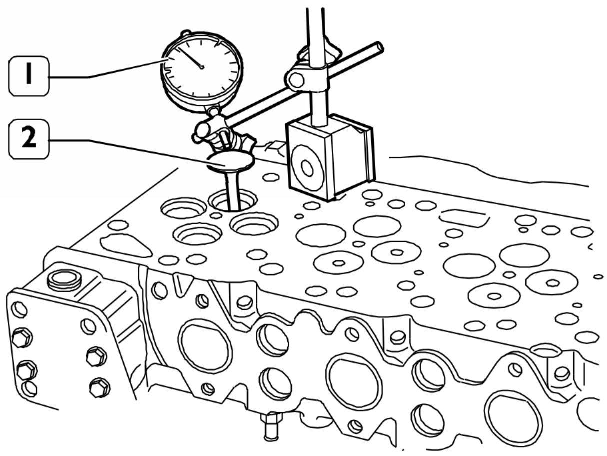
540661 VALVE SEAT - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
VALVES - Disassemble (54.06)

Checking valve stem and valve guide clearance and valve centring

1. Insert the valve **(2)**in its seat and let the head protrude about ten millimetres.
2. The checks are made using a magnetic stand dial gauge **(1)** positioned as shown, the assembly clearance is: **0,032 – 0,072 mm**.
3. Making the valve **(2)** turn, check that the run out error is no greater than **0,03 mm**.
4. If there is an excessive radial clearance or centring error, recheck the valve dimensions and replace the worn parts.



70327 1

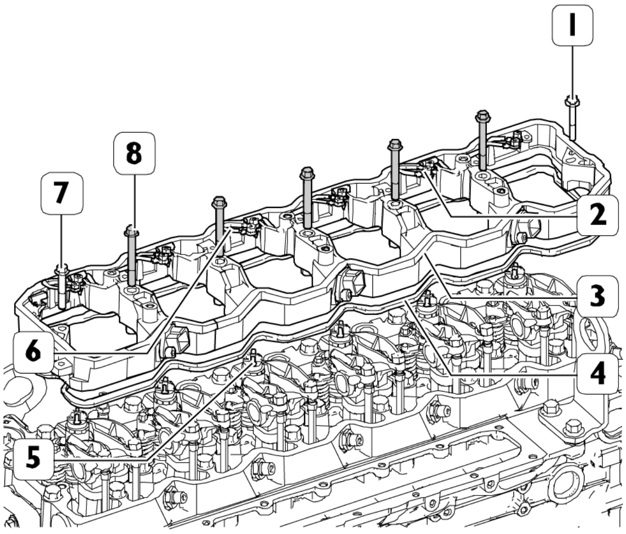
540634 CYLINDER HEAD TOP - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Removal of electro-injector wiring support

1. Remove the tappet cover as described in the procedure **ROCKER COVER - Remove (54.06)**.
2. Disconnect the engine cable from the connectors of the injector wiring as described in the procedure **ENGINE CABLES - Remove (76.91)**.
3. Remove the nuts **(2)** and disconnect the electrical cables **(6)** from the electro-injectors **(5)**.
4. Unscrew the screws **(1)**, **(7)** and **(8)** and remove the electro-injector wiring support **(3)** complete with gasket **(4)**.

Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**



212833 1

540634 CYLINDER HEAD TOP - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

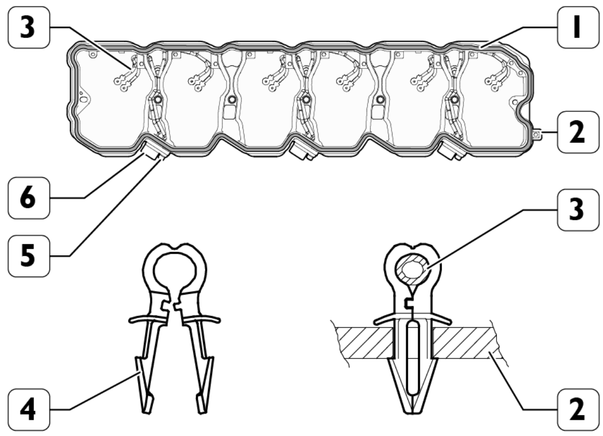
Description	Quantity	Value
Engine cable connector on injector wiring mount	3 screws M6 x 1 x 16	**5 +/- 1 N·m**
Injector wiring mount	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**

Refitting electro-injector wiring support

1. Check the condition of the wiring **(3)**, if damaged, replace it by cutting the collars **(4)** and removing the screws **(5)** securing the support to the connectors **(6)**.
2. Open a new collar **(4)**, insert the new cable **(3)**, close the collar and fit it into its eat on the support **(2)**.
3. Tighten the screws **(5)** to the specified torque.

Description	Quantity	Value
Engine cable connector on injector wiring mount	3 screws M6 x 1 x 16	**5 +/- 1 N·m**

4. Fit a new gasket **(1)** on the support **(2)**.

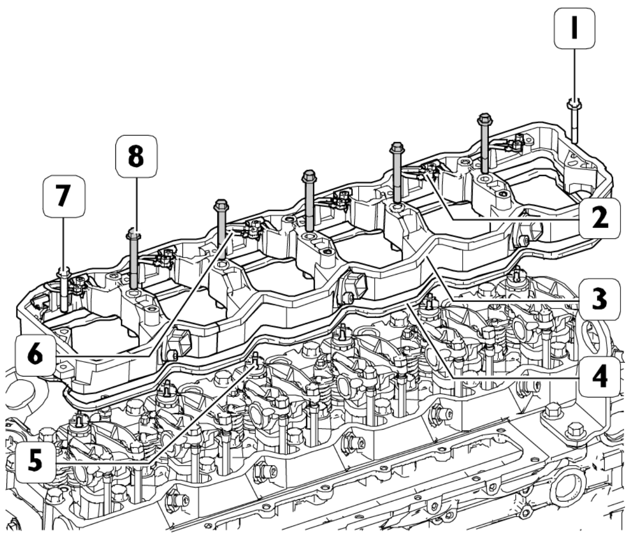


267944 1

5. Fit the injector wiring mount **(3)** complete with a new gasket **(4)** and tighten the screws **(1)**, **(7)** and **(8)** to the specified torque.
6. Connect the electrical wiring **(6)** to the electro-injectors **(5)** and using a torque wrench tighten the securing nuts **(2)** to the specified torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*

Description	Quantity	Value
Injector wiring mount	7 screws M8 x 1.25	**24 +/- 4 N·m**
Wiring on each electro-injector	12 nuts M4	**1,5 +/- 0,25 N·m**



212833 2

7. Connect the engine cable as described in the procedure **ENGINE CABLES - Install (76.91)**.
8. Fit the tappet cover as described in the procedure **ROCKER COVER - Install (54.06)**.

540662 VALVES - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Engine valves remover/installer	99360268

Disassembling valves

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.

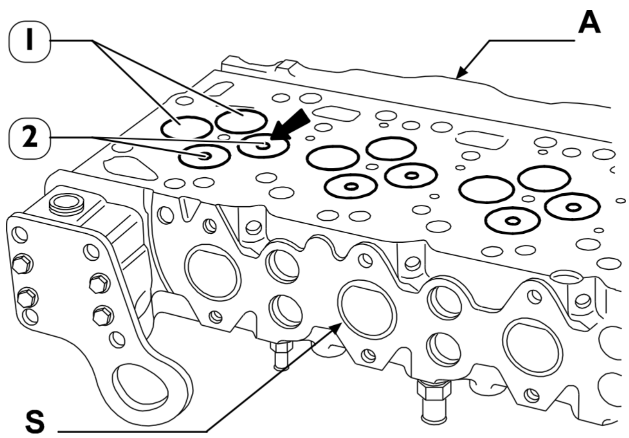
   (1) Intake valves

   (2) Exhaust valves

   (A) Intake side

   (S) Exhaust side

NOTE: *The intake **(1)** and exhaust **(2)** valves have the same size heads. The central slot (→) of the exhaust valve head **(2)** distinguishes it from that of the intake valve **(1)**.*



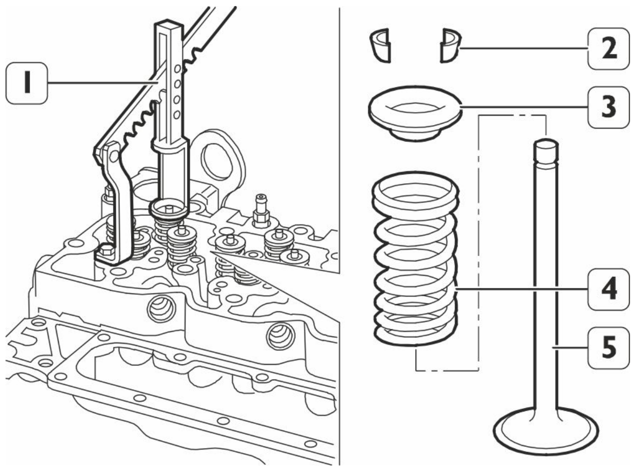
070319A 1

2. The removal of the valves is carried out with a specific tool **(1)** exerting pressure on the washer **(3)** so that when the springs **(4)** are compressed, it is possible to remove the cotters **(2)**, then the washer **(3)** and the springs **(4)**.

Tool / Material	
Engine valves remover/installer	99360268

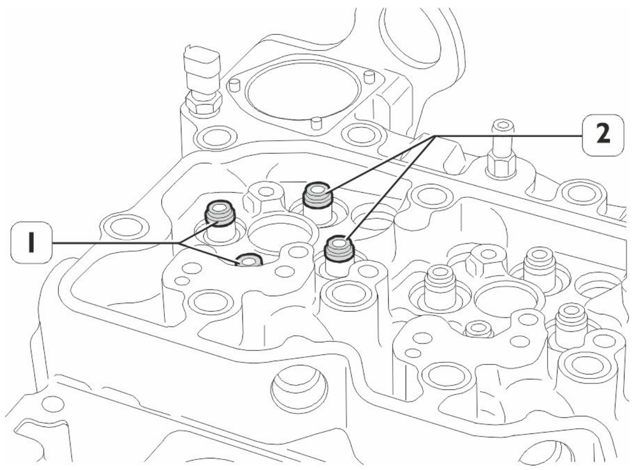
3. Repeat this operation for all the valves.

4. Turn the cylinder head upside down and remove the valves **(5)**.



770321 2

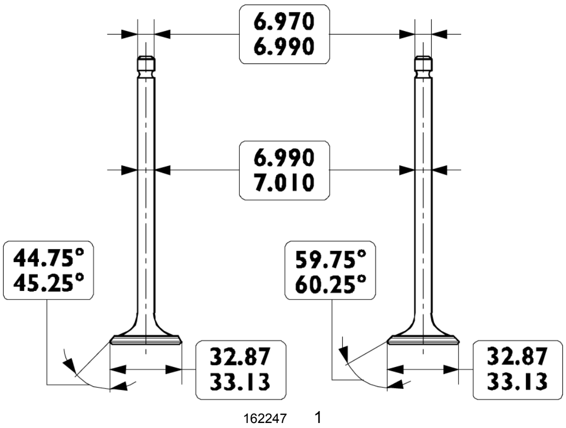
5. Remove the sealing rings **(1)**, **(2)**from the relative valve guides.



70322 3

540662 VALVES - Measure

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



1

INTAKE AND EXHAUST VALVE MAIN DATA

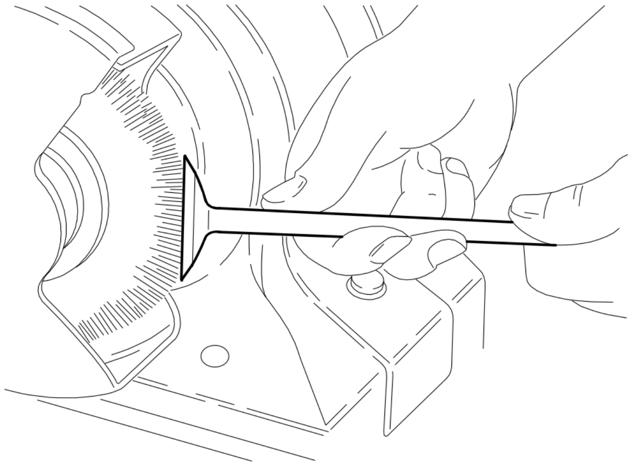
540662 VALVES - Cleaning

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
VALVES - Disassemble (54.06)

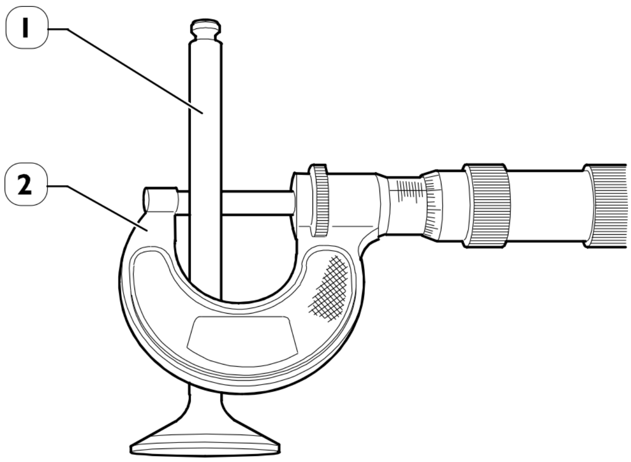
Removing carbon deposits, checking and grinding valves

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.



18625 1

4. Check the valve stem **(1)** using a micrometer **(2)**. The value should be between **6,990 – 7,010 mm**.



18882 2

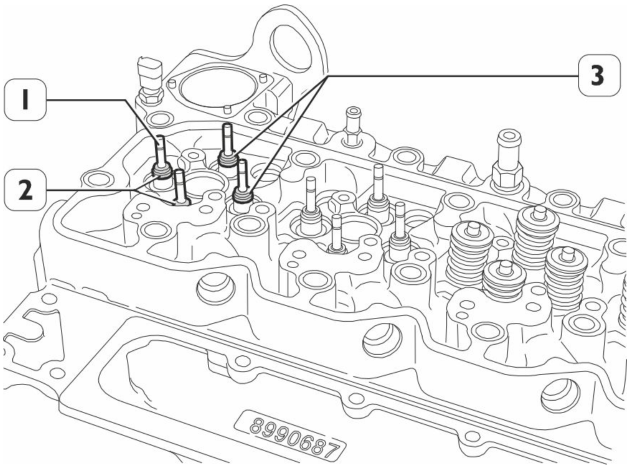
540662 VALVES - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Engine valves remover/installer	99360268

Valve fitting

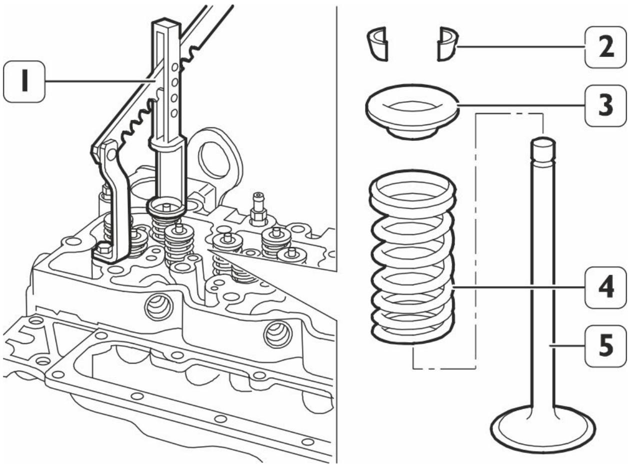
1. Lubricate the stem of the valves **(1)** and insert them into the relevant valve guides according to the position marked during removal.
2. Fit the seal rings **(2)** and **(3)** onto the valve guide.



70334 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)**.

Tool / Material	
Engine valves remover/installer	99360268



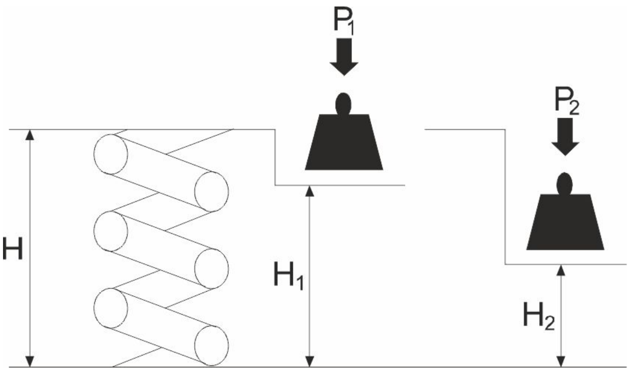
770321 2

540665 VALVE SPRING - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
VALVES - Disassemble (54.06)

Valve spring check



KEY DATA FOR CHECKING INTAKE AND EXHAUST VALVE SPRINGS

1. Before refitting use tool to check spring flexibility. Compare load and elastic deformation data with those of the new springs shown in the following table.

Height		Under a load of:	
H	**47,75 mm**	Spare	
H1	**35,33 mm**	P1	**339,8 +/- 19 mm**
H2	**25,2 mm**	P2	**741 +/- 39 mm**

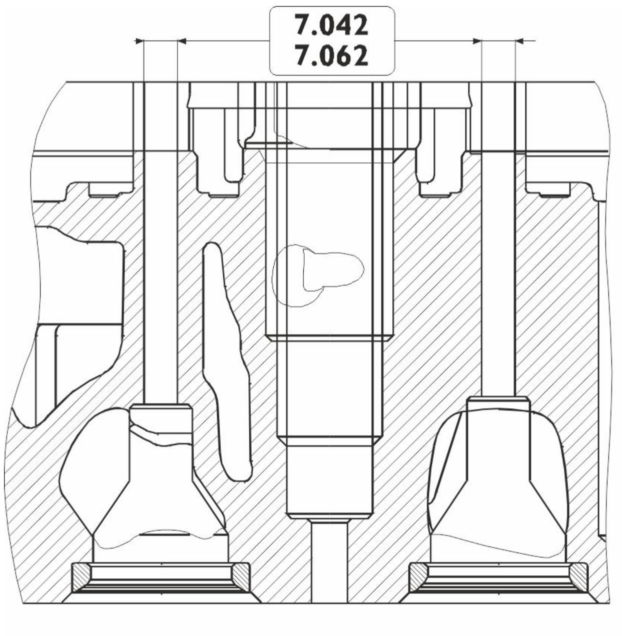
540667 VALVE GUIDE - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
VALVES - Disassemble (54.06)

Valve guide check

1. Using a bore gauge, measure the inside diameter of the valve guides; it must be equal to the value shown in the figure.



79457 1

540667 VALVE GUIDE - Replace

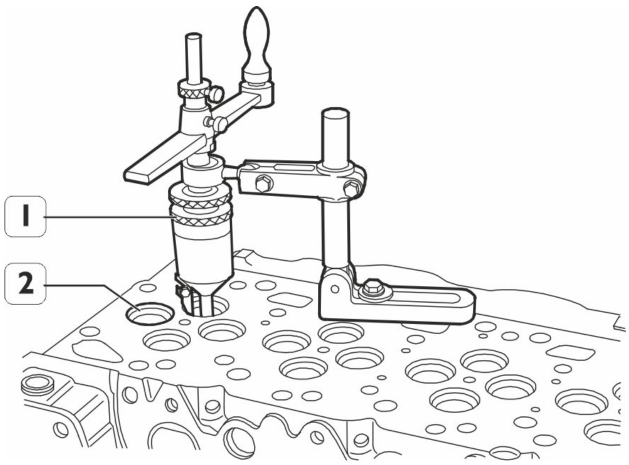
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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

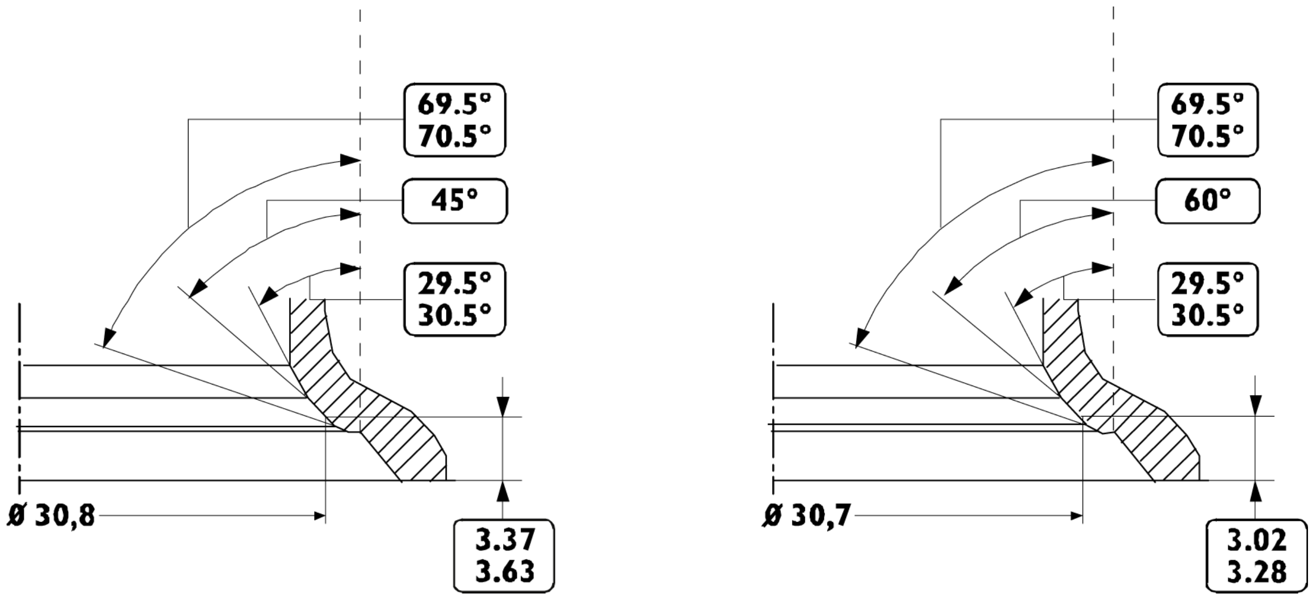
Prior operation:
VALVES - Disassemble (54.06)

Regrinding - replacing valve seats

1. Check the valve seats **(2)**. If slight scoring or burns are found, regrind using the tool **(1)** according to the angle values shown in the following figure.



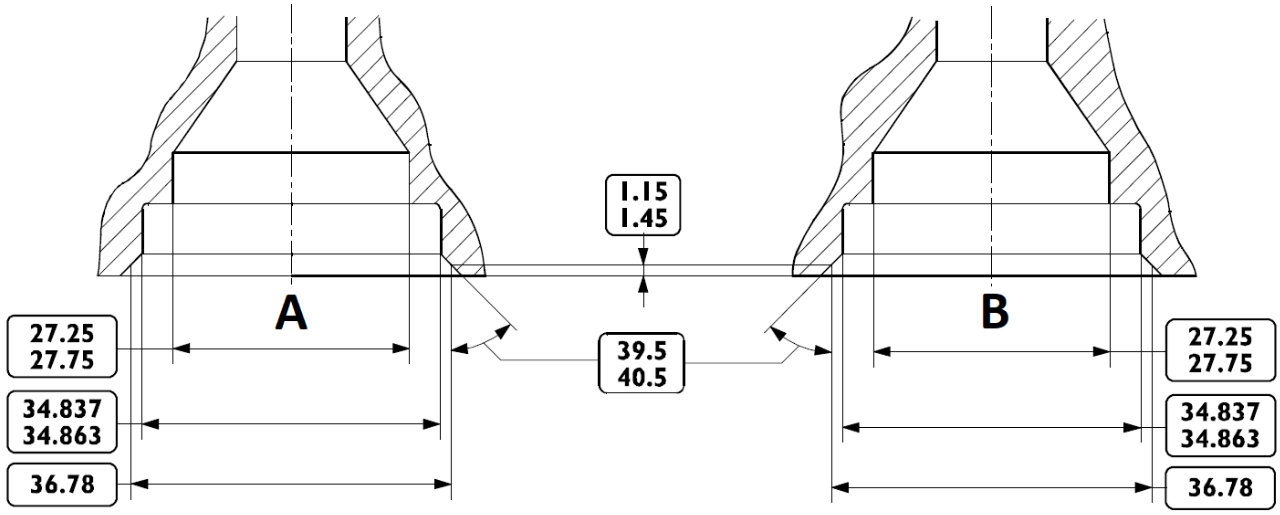
70330 1



107281 2

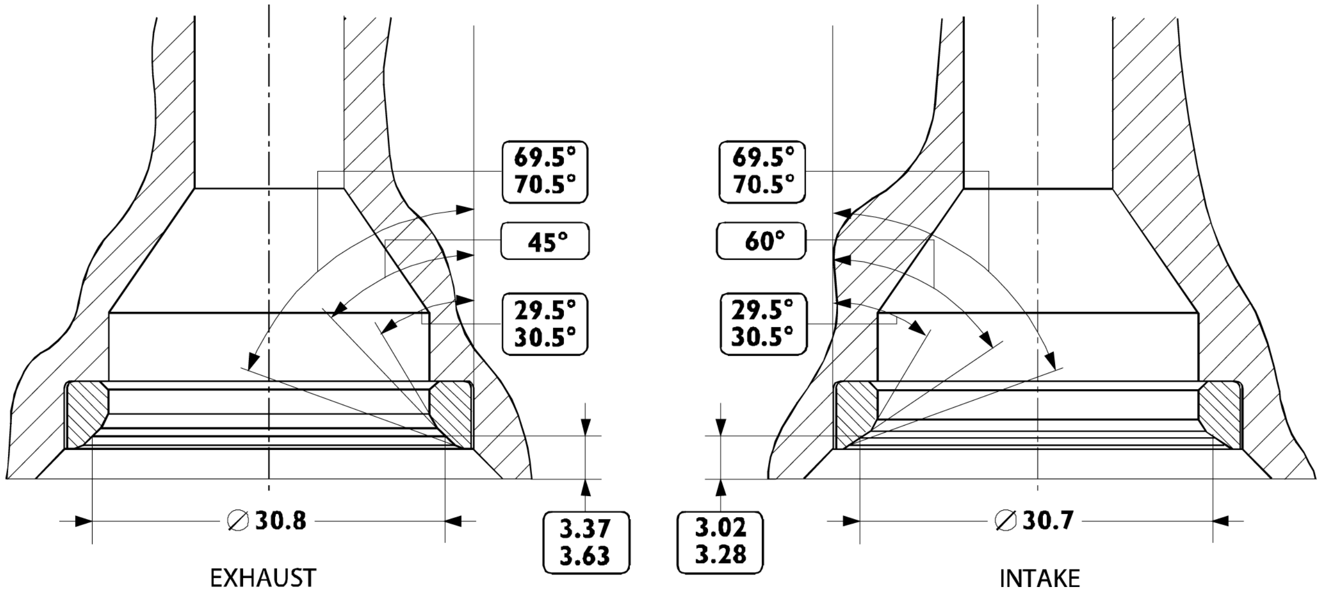
MAIN DATA OF ENGINE VALVE SEATS

2. The valve seats are cast into the cylinder head and processed.



265943 3

3. If valve seats cannot be restored just by regrinding, it is possible to assemble the spare inserts provided.
4. Then using the suitable tool, regrind the valve seats according to the values given in the figure.
5. To fit the valve seats in the cylinder head, it is necessary to heat the cylinder head to **80 – 100 °C** and, using a suitable drift, fit it in the new previously cooled valve seats **(2)**.
6. Then use the specific tool to grind the valve seats to the values shown in the following figure.

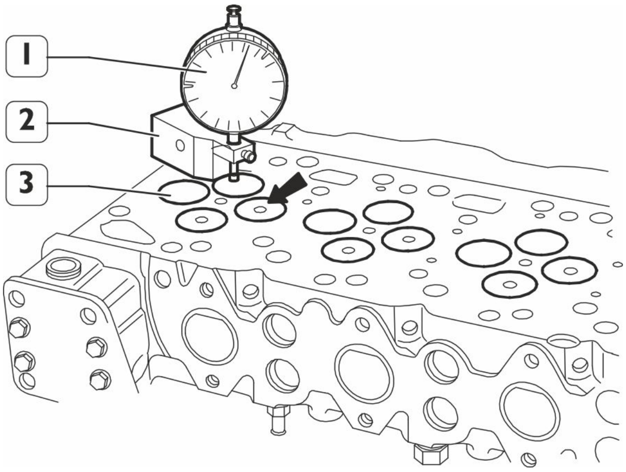


162248 4

MAIN VALVE SEAT DATA

7. After regrinding, use the base **(2)** and the dial gauge **(1)** to check that the recess value of the valves **(3)** is as prescribed.

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



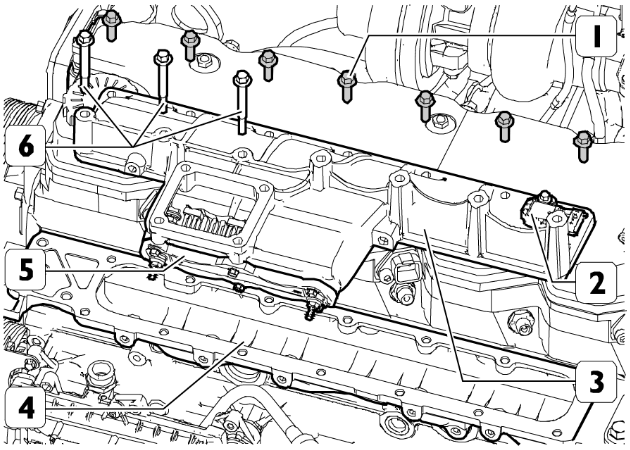
70333 5

540710 INTAKE MANIFOLDS - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Remove the Common Rail as described in the procedure **HIGH PRESSURE ACCUMULATOR - Remove (77.45)**.
2. Disconnect the electrical connections of the cold start-up heater (if fitted).
3. Unscrew the fastening screws **(1)** and **(6)** and remove the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** from the cylinder head **(4)**.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



209212 1

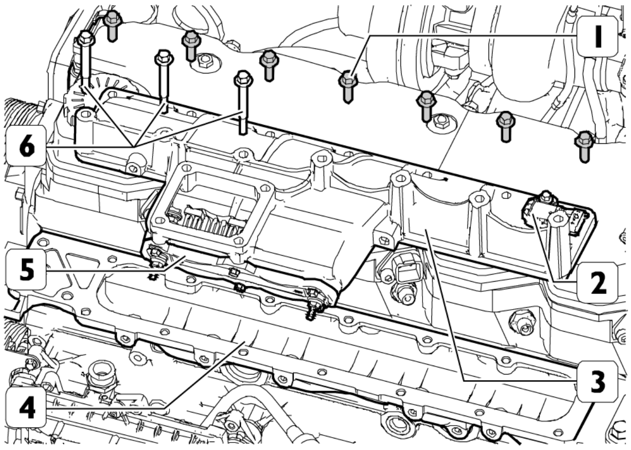
540710 INTAKE MANIFOLDS - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
HIGH PRESSURE ACCUMULATOR - Remove (77.45)

1. Disconnect the electrical connections of the cold start-up heater (if fitted).
2. Unscrew the fastening screws **(1)** and **(6)** and remove the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** from the cylinder head **(4)**.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



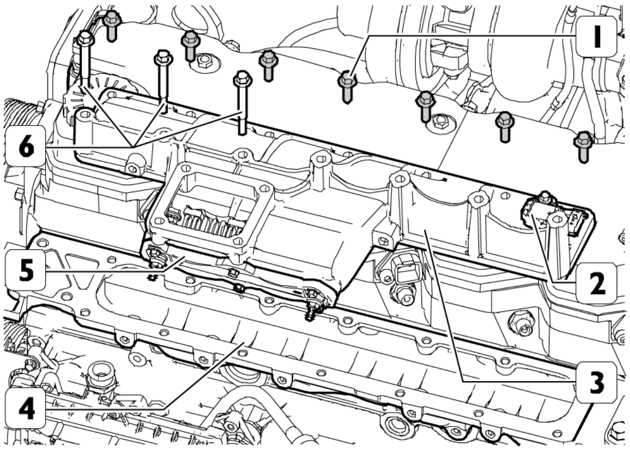
209212 1

540710 INTAKE MANIFOLDS - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

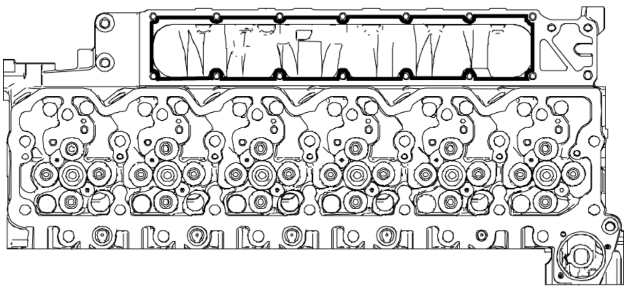
1. Fit the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** on the cylinder head **(4)** and tighten the fastening screws **(1)** and **(6)** to the prescribed torque.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



209212 1

2. Carefully clean the contact surfaces and apply a continuous sealant bead of **LOCTITE® 5970 (A IVECO STD. 18-1733)** to the surface of the cylinder head as shown in the figure.



209211 2

NOTE: *Cleaning the surface to be sealed is necessary and essential in order to obtain an effective seal. Apply the sealant* ***LOCTITE® 5970 (A IVECO STD. 18-1733)****to form a bead of a few mm in diameter. It must be continuous (without lumps), free of air bubbles, thin sections or irregularities. Correct any imperfections promptly. Do not apply excessive product to seal the joint. Too much sealant would tend to leak on both sides of the joint by clogging the lubricant passages. After having applied the sealant, the joints must be assembled immediately (within* ***10 – 20 min****).*

3. Install the Common Rail as described in the procedure **HIGH PRESSURE ACCUMULATOR - Install (77.45)**.
4. Connect the cold-start heater electrical connections (if fitted).

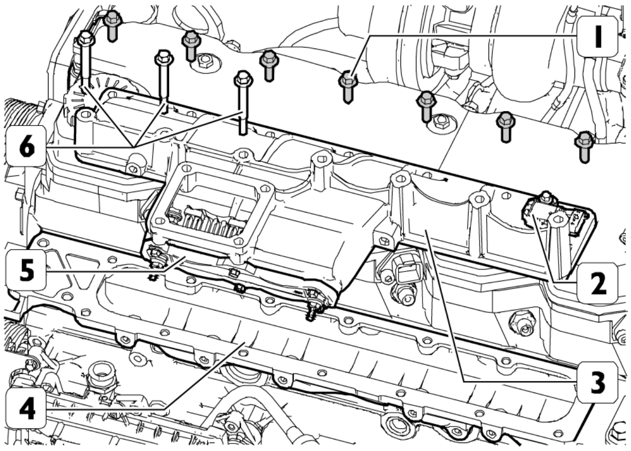
540710 INTAKE MANIFOLDS - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**

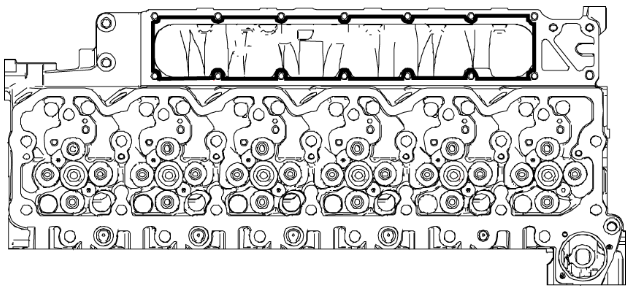
1. Fit the intake manifold **(3)** together with the boost pressure and air temperature sensor **(2)** on the cylinder head **(4)** and tighten the fastening screws **(1)** and **(6)** to the prescribed torque.

Description	Step	Value
Intake manifold	7 screws M8 x 1.25 x 25	**24 +/- 4 N·m**
	3 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



209212 1

2. Carefully clean the contact surfaces and apply a continuous sealant bead of **LOCTITE® 5970 (A IVECO STD. 18-1733)** to the surface of the cylinder head as shown in the figure.



209211 2

NOTE: *Cleaning the surface to be sealed is necessary and essential in order to obtain an effective seal. Apply the sealant **LOCTITE® 5970 (A IVECO STD. 18-1733)**to form a bead of a few mm in diameter. It must be continuous (without lumps), free of air bubbles, thin sections or irregularities. Correct any imperfections promptly. Do not apply excessive product to seal the joint. Too much sealant would tend to leak on both sides of the joint by clogging the lubricant passages. After having applied the sealant, the joints must be assembled immediately (within **10 – 20 min**).*

3. Connect the cold-start heater electrical connections (if fitted).

Next operation:
HIGH PRESSURE ACCUMULATOR - Install (77.45)

540720 EXHAUST MANIFOLD - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Exhaust duct(s) condition check

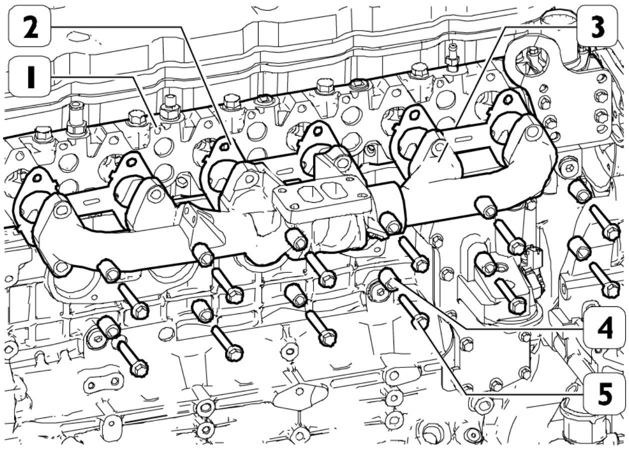
1. Visually check that the exhaust system is not obstructed or damaged.
2. Make sure that there is no the risk of dangerous fumes inside the vehicle. Contact the Manufacturer if necessary.

540720 EXHAUST MANIFOLD - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Remove the turbocharger as described in the procedure **TURBO CHARGER - Remove (54.24)**.
2. Unscrew the screws **(5)** together with the spacers **(4)** and remove the exhaust manifold **(3)** together with the relative gaskets **(2)** from the cylinder head **(1)**.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



214769 1

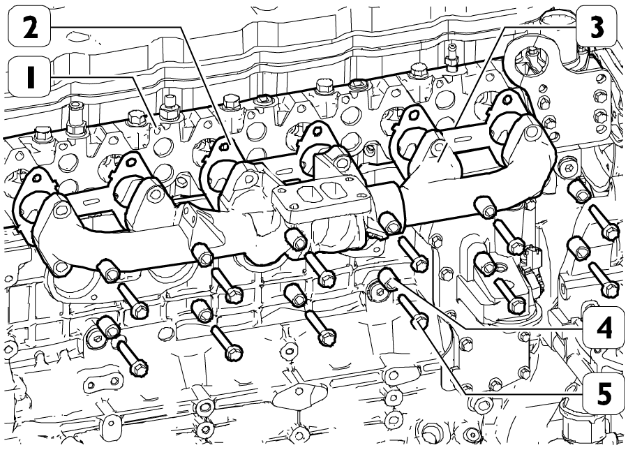
540720 EXHAUST MANIFOLD - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
ENGINE SUPPLY AIR FILTER - Remove (50.51)
Prior operation:
TURBO CHARGER - Remove (54.24)

1. Unscrew the screws **(5)** together with the spacers **(4)** and remove the exhaust manifold **(3)** together with the relative gaskets **(2)** from the cylinder head **(1)**.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



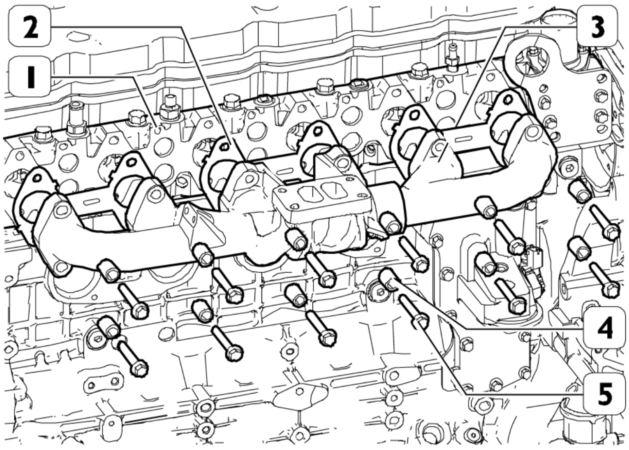
214769 1

540720 EXHAUST MANIFOLD - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

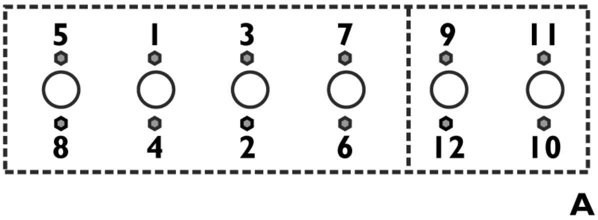
1. Fit new gaskets **(2)** on the exhaust manifold **(3)**;
2. Assemble the exhaust manifold **(3)** on the cylinder head **(1)** and tighten the fastening screws **(5)** together with spacers **(4)** to the prescribed torque following the order and mode shown in the figure below.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



214769 1

3. Install the turbocharger as described in the procedure **TURBO CHARGER - Install (54.24)**.



209215 2

Diagram of the tightening sequence for the exhaust manifold fastening screws

A. Front side

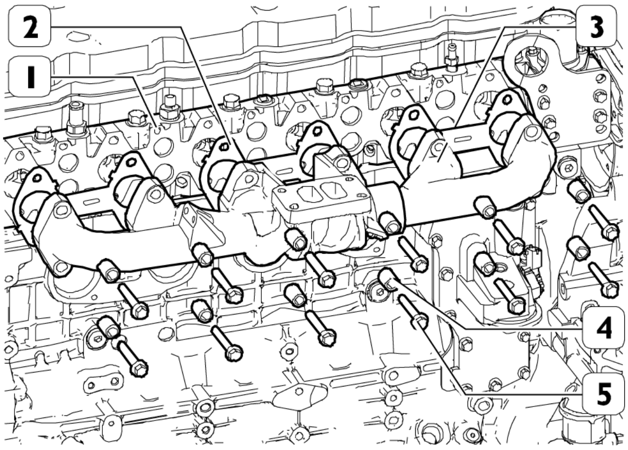
540720 EXHAUST MANIFOLD - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

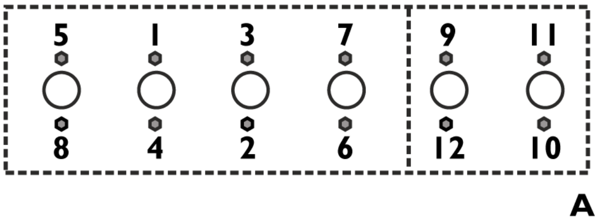
Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5x65	**55 +/- 3 N·m**

1. Fit new gaskets **(2)** on the exhaust manifold **(3)**;
2. Assemble the exhaust manifold **(3)** on the cylinder head **(1)** and tighten the fastening screws **(5)** together with spacers **(4)** to the prescribed torque following the order and mode shown in the figure below.

Description	Quantity	Value
Exhaust manifold	12 screws M10x1.5 x65	**55 +/- 3 N·m**



214769 1



209215 2

Diagram of the tightening sequence for the exhaust manifold fastening screws

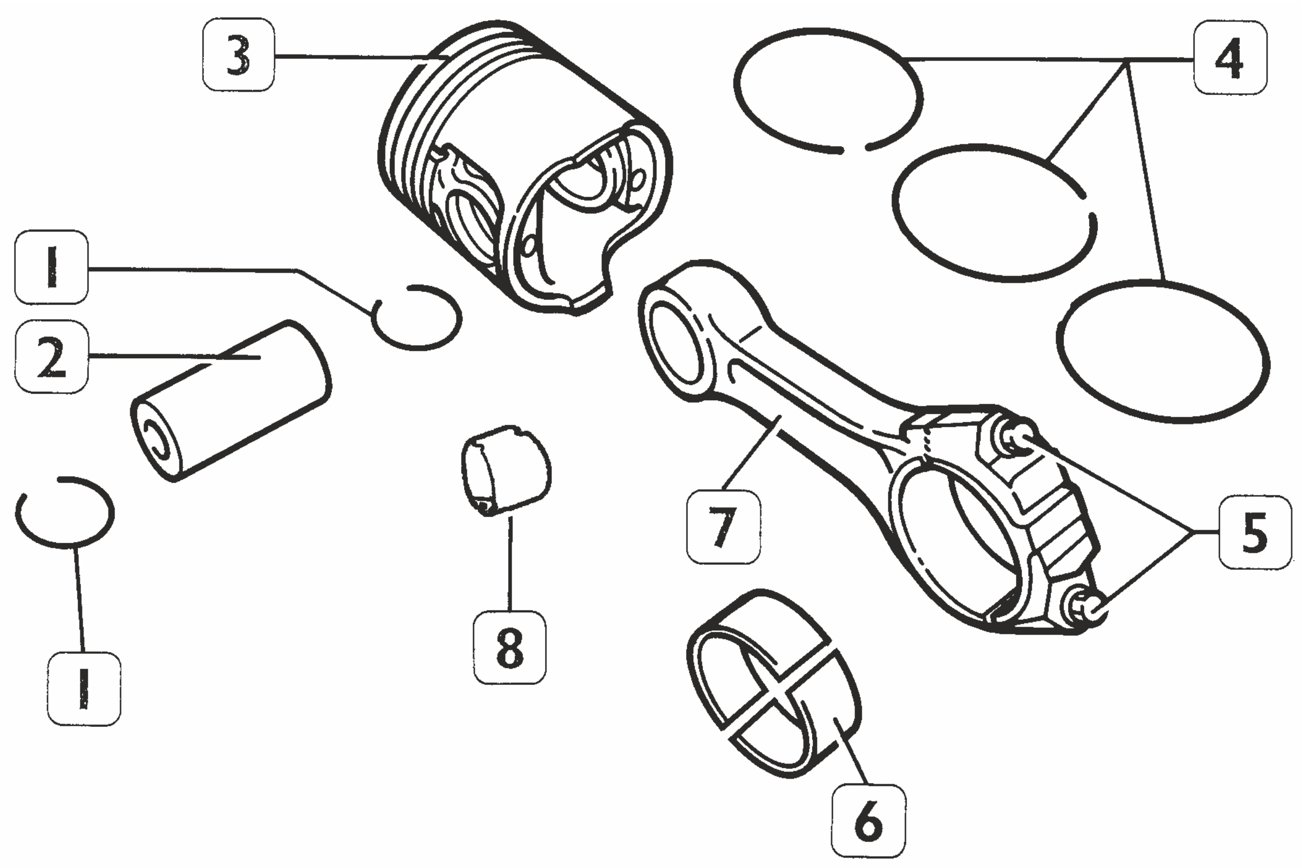
A. Front side

Next operation:
TURBO CHARGER - Install (54.24)
Next operation:
ENGINE SUPPLY AIR FILTER - Install (50.51)

5408 ENGINE COMPONENTS - Overhaul

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

OVERHAULING THE CONNECTING ROD-PISTON ASSEMBLY



70191 1

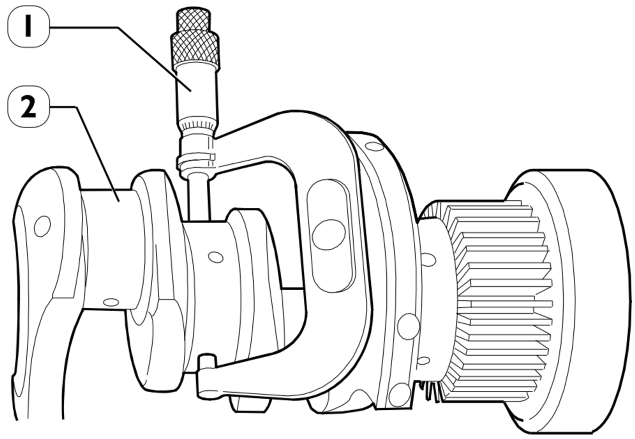
1. Retaining rings
2. Pin
3. Piston
4. Cut piston rings
5. Screws
6. Half bearings
7. Connecting rod
8. Bushing

540810 CRANKSHAFT - Measure

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Measuring main journals and crankpins

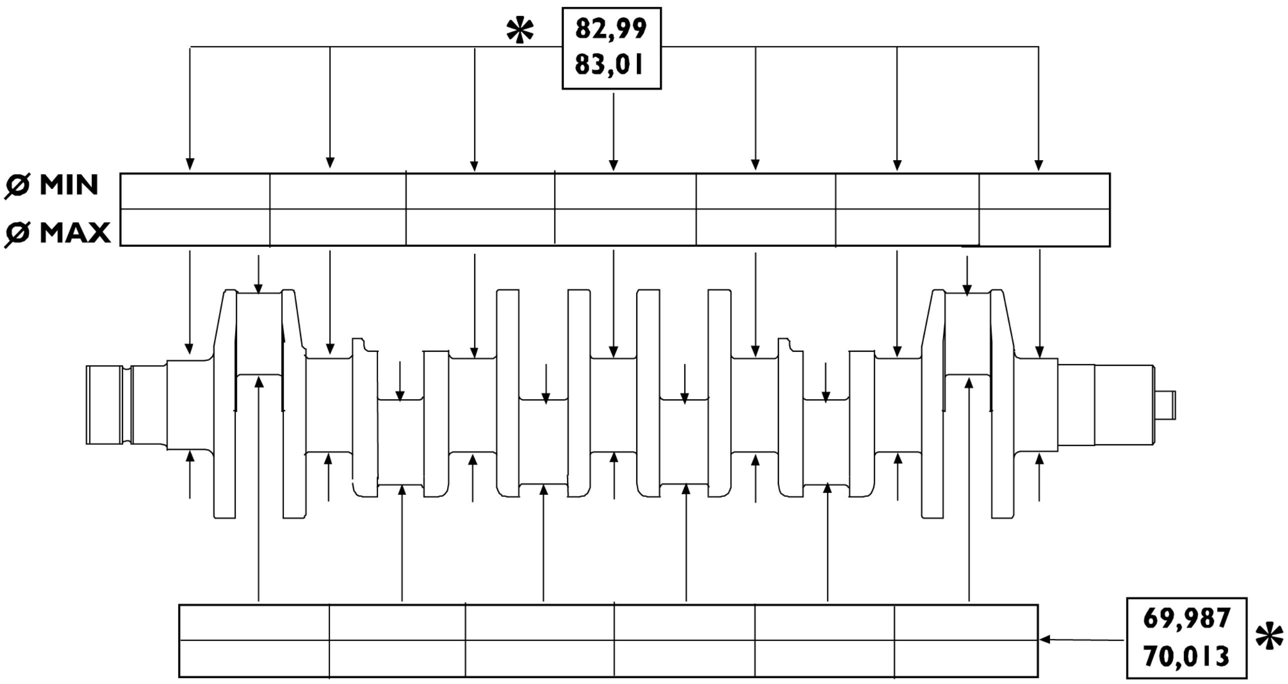
1. Grind journals and crankpins if seizure, scoring or excessive ovalisation are found. Before grinding the journals **(2)** measure them with a micrometer **(1)** to decide the final diameter to which the pins are to be ground.



70182 1

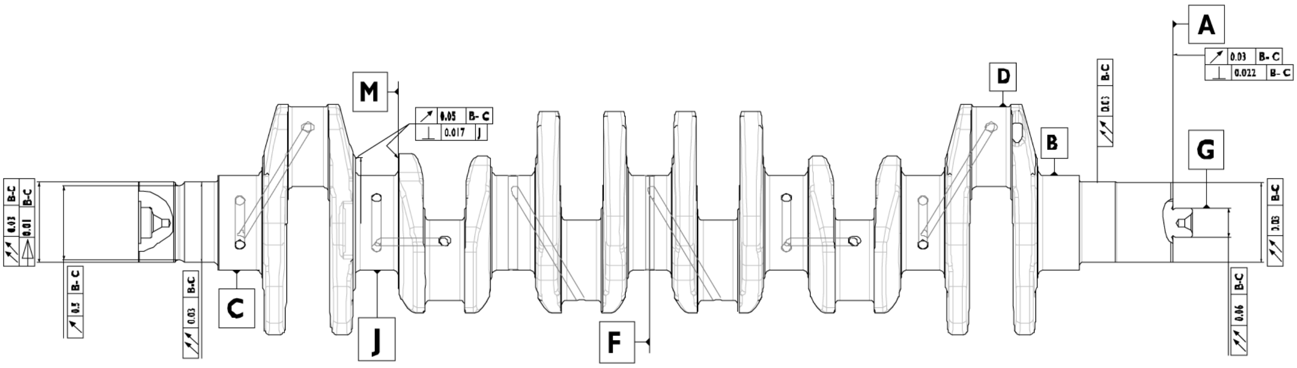
2. Undersize classes are of: **0,250 – 0,500 mm**.

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.



183662 2

FILL THIS TABLE WITH THE VALUES MEASURED ON THE OUTPUT SHAFT SUPPORTS AND CRANKPINS - (*) Rated value (dimensions in mm)

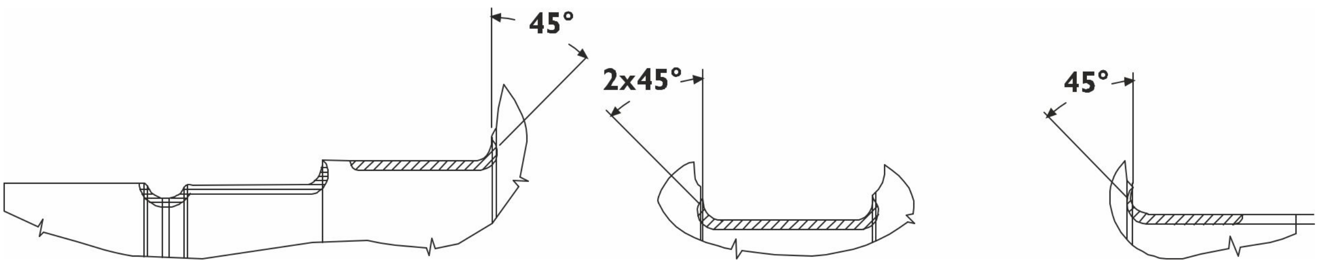


183663 3

MAIN OUTPUT SHAFT TOLERANCES

TOLERANCES	TOLERANCE 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	⊖



70237 4

MAIN BEARING ON TIMING SYSTEM CONTROL SIDE – INTERMEDIATE MAIN BEARINGS – FIRST MAIN BEARING ON FRONT SIDE

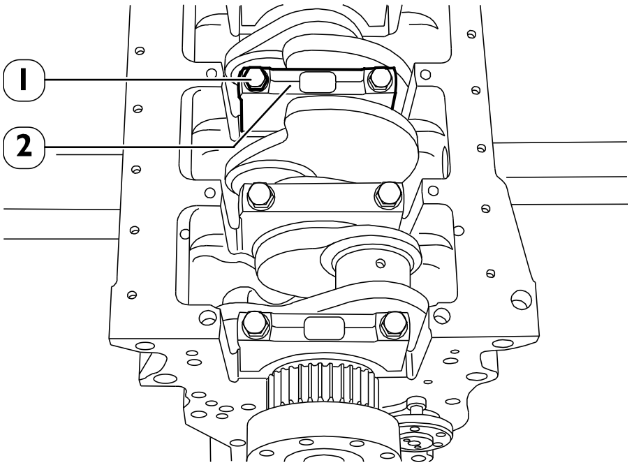
540810 CRANKSHAFT - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Crankshaft lifting tackle	99360500

1. Unscrew the screws **(1)** and disassemble the main bearing caps **(2)**.

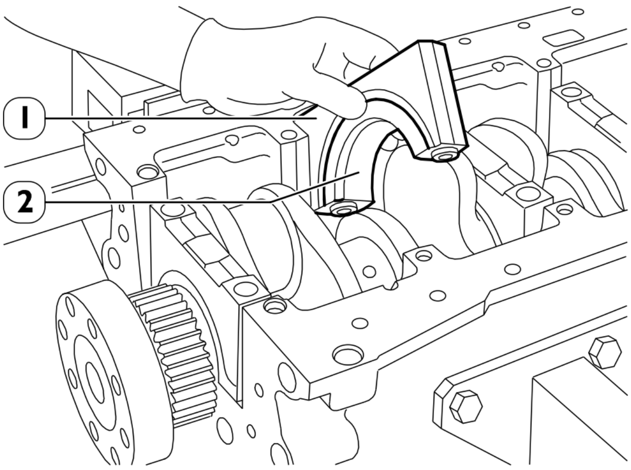
Description	Quantity	Step	Value
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**



70159 1

2. The second last main bearing cap **(1)** and the relevant support are fitted with shoulder half-bearing **(2)**.

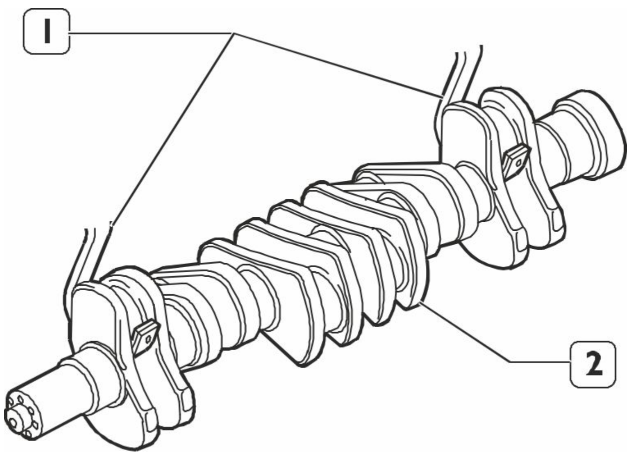
NOTE: *Take note of lower and upper half bearing assembling positions since in case of reuse they shall be fitted in the same position found at removal.*



70160 2

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

Tool / Material	
Crankshaft lifting tackle	99360500



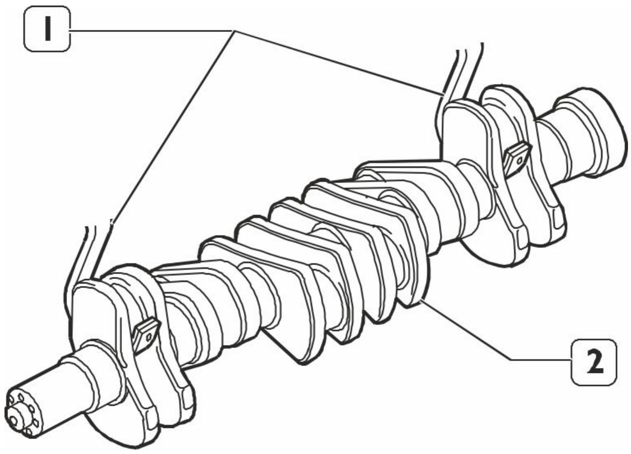
74774 3

540810 CRANKSHAFT - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

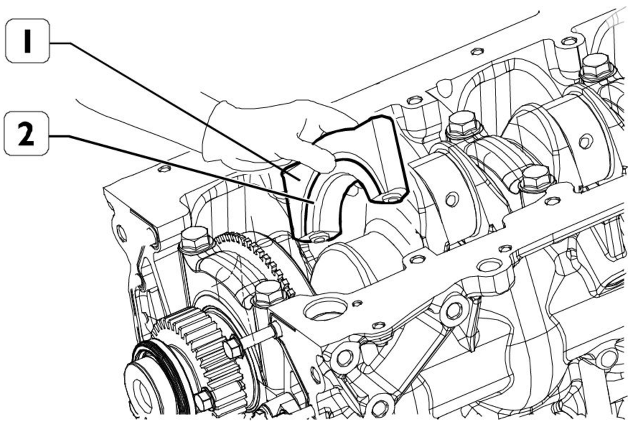
Description	Quantity	Step	Value
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**

1. Install the crankshaft **(2)**.



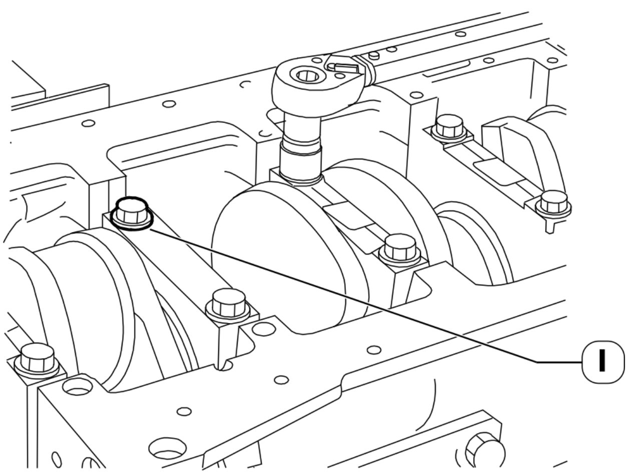
74774 1

2. Thoroughly clean the parts and remove any trace of oil.
3. Fit caps **(1)**, including the half bearings **(2)** on the relevant supports.



128169 2

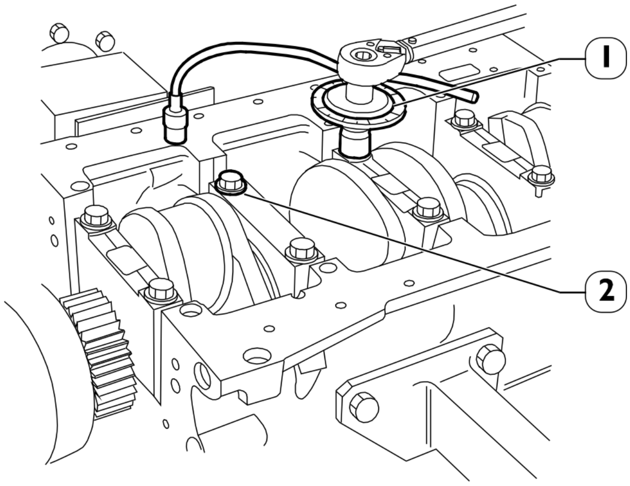
4. Screw in the new screws **(1)** and tighten them in two steps as indicated.



70187 3

5. In the 2nd stage, with suitable tool **(1)** positioned as shown in the figure, tighten screws as prescribed.

Description	Quan-tity	Step	Value
Crankshaft caps	12 screws M12 x 1.25 x 52	Phase 1 Tighten	**80 +/- 6 N·m**
		Phase 2 Angle tightening	**90°**



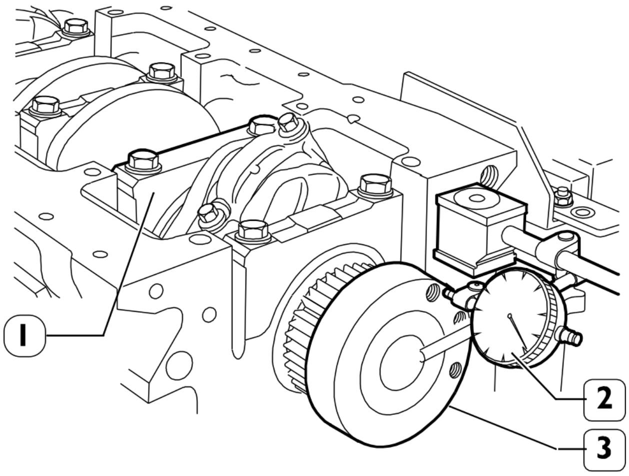
70188 4

540810 CRANKSHAFT - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Checking axial play of the crankshaft

1. This check is performed by setting a magnetic stand dial gauge **(2)** on the crankshaft **(3)**, as shown in the figure.
2. If higher value is found, replace main half-bearings of the second last rear support **(1)** and repeat the clearance check between crankshaft pins and main half-bearings.
3. The value to be found is the following: **0,068 – 0,412 mm**



70190 1

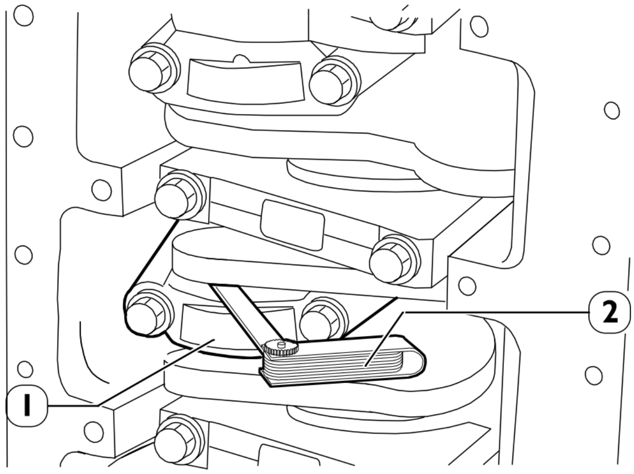
540812 CRANKPINS - Measure

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
PISTON - Assemble (54.08)

Crankpin assembly clearance measurement

1. Check manually that the connecting rods **(1)** slide axially on the crankshaft pins and that their end float, measured with a feeler gauge **(2)** is **0,10 – 0,33 mm**.



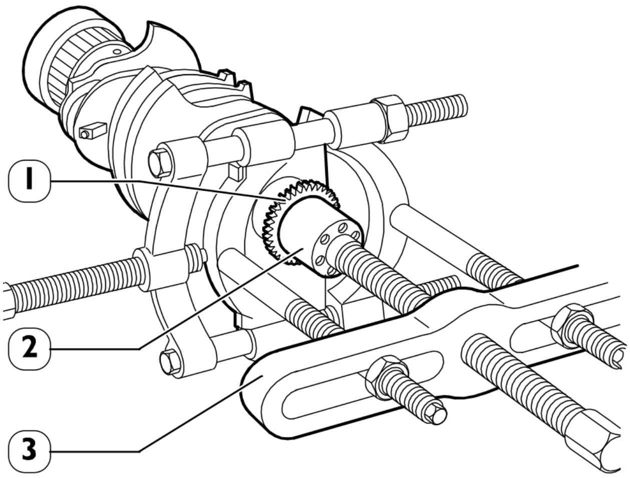
70207 1

540815 OIL PUMP CONTROL PINION GEAR - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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 °C** and keyed to the engine by interposing the key.



1

540816 MAIN BEARINGS - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

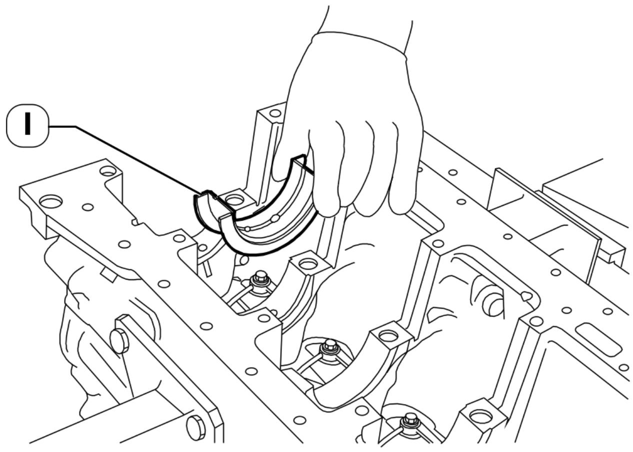
Main bearings assembly

1. The main bearings **(1)** are supplied with spare parts with smaller internal diameter of **0,250 – 0,500 mm**.

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 modify the bearings in any way.*

2. Clean accurately the main half-bearing **(1)** having the lubricating hole and fit them into their housings.
3. The second last main half-bearing **(1)** is fitted with shoulder half rings.

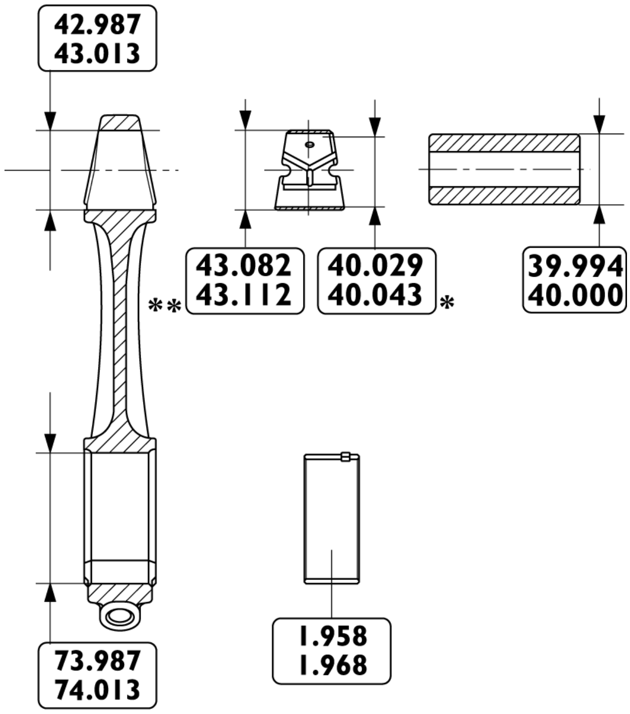


70185 1

540830 CONNECTING ROD - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

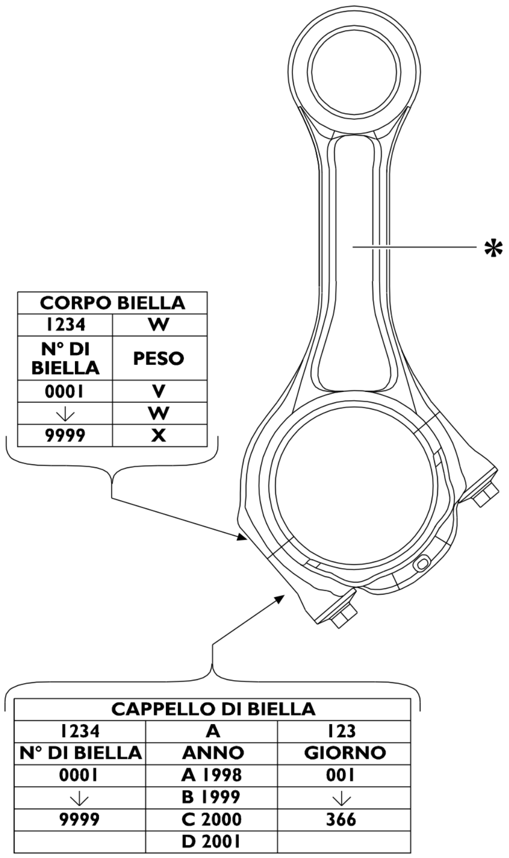
Connecting rods



245811 1

MAIN DATA FOR CONNECTING ROD, BUSH, PISTON PIN AND HALF-BEARINGS (*)Value for inside diameter to be obtained after driving in connecting rod small end and grinding.

NOTE: *To obtain best coupling the connecting rod cap coupling surfaces are knurled.*
It is therefore recommended to not remove the knurling.



70196 2

NOTE: *Every connecting rod is marked as follows:*
- a number on the body and cap indicating their coupling and the cylinder into which they are fitted. If they are replaced, the new connecting rod must be numbered with the same number as the one it is replacing;.
- On the body with a letter showing the weight class of the connecting rod fitted during production:
V, ***1560 – 1660 g*** *(yellow marking);*
W, ***1601 – 1640 g*** *(green marking);*
X, ***1641 – 1680 g*** *(blue marking);*
*Spare connecting rods are of the W class with green marking *.*
Removal of material is not allowed.

Bushes

1. Check the bushing in the small end has not come loose and shows no sign of scoring or seizure. Replace it if it does.
2. Removal and refitting shall be performed using the proper drift.
3. When driving it in, make absolutely sure that the holes for the oil to pass through the bushing and the small end coincide. Use the reamer to regrind the bushing in order to obtain the specified diameter.

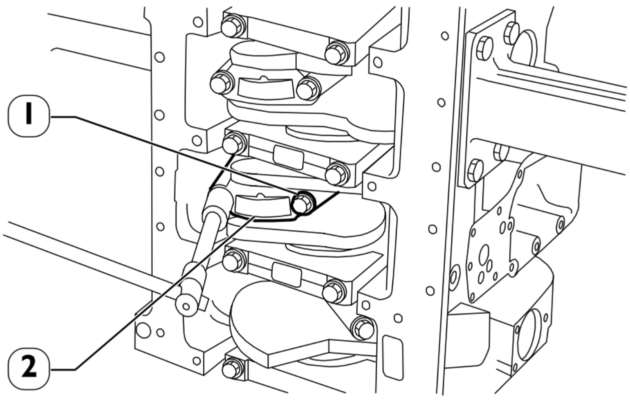
540840 PISTON - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.*

Description	Quantity	Step	Value
Connecting rod caps	12 screws M10x1.25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**



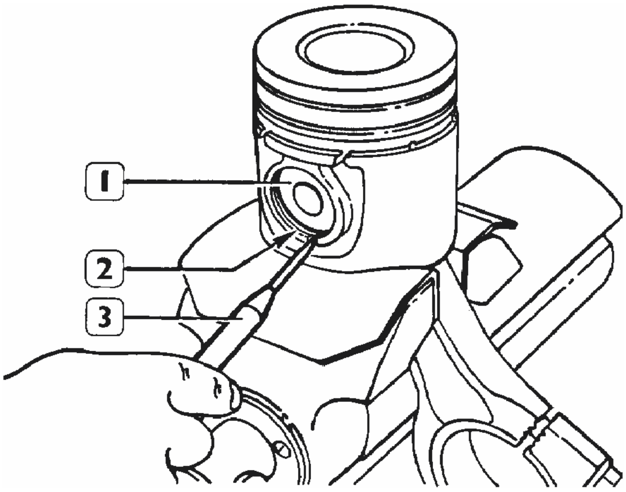
70158 1

540840 PISTON - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Piston removal

1. Disassembly of the pin **(1)** retaining rings **(2)** for the piston is carried out using a scriber **(3)**.



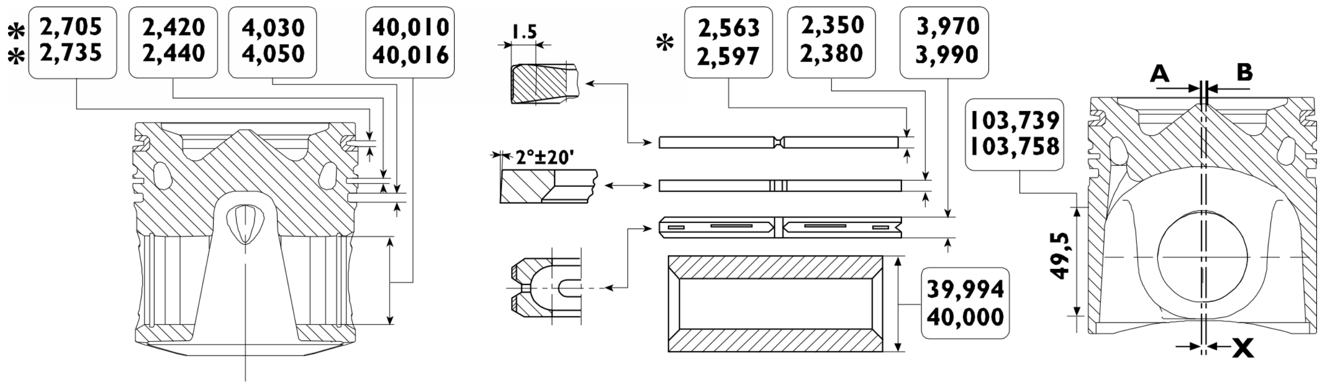
32614 1

540840 PISTON - Measure

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
COMPRESSION RINGS - Disassemble (54.08)

Measuring the piston diameter

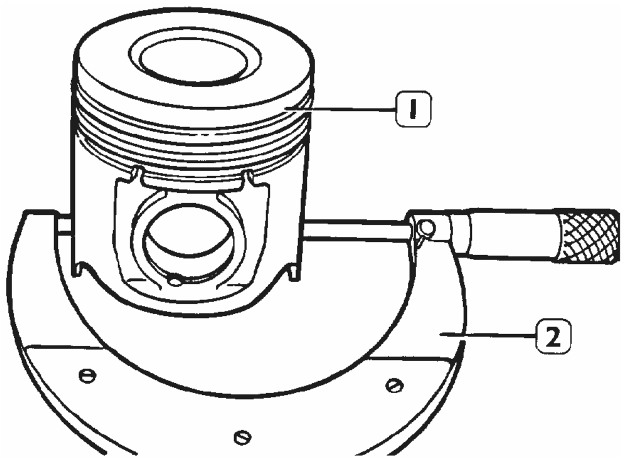


196434 1

MAIN DATA OF THE PISTON WITH PIN TUNNEL AND CIRCLIPS - (*) Value measured on 101 mm diameter

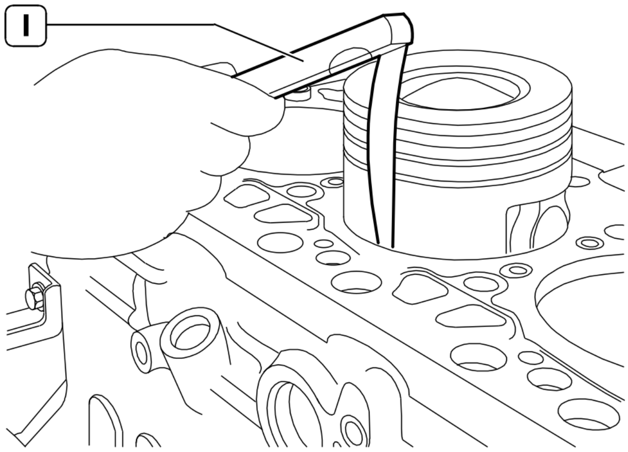
Pistons

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



32615 2

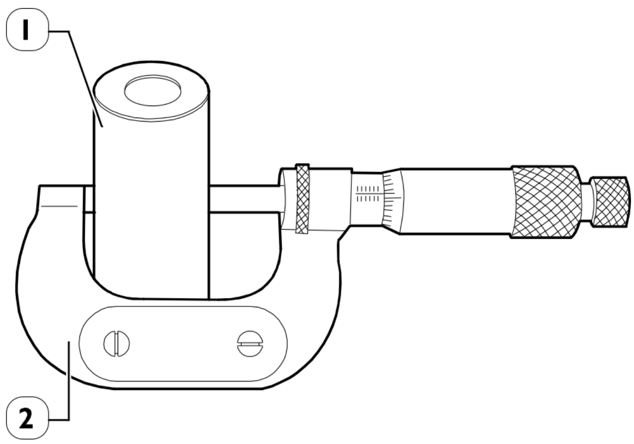
2. The clearance between the piston and the cylinder liner can also be checked with a feeler gauge **(1)** as shown in the figure.



70192 3

Piston pins

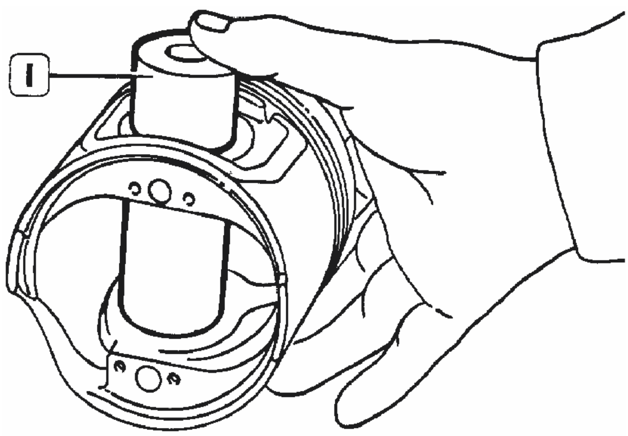
3. Measuring the diameter of the piston pin **(1)** using a micrometer **(2)**.



18857 4

Conditions for correct pin/piston coupling

4. Use engine oil to lubricate the pin **(1)** and the relative seat in the piston hubs; the pin must insert in the piston with slight manual pressure and must not slip out due to gravity.



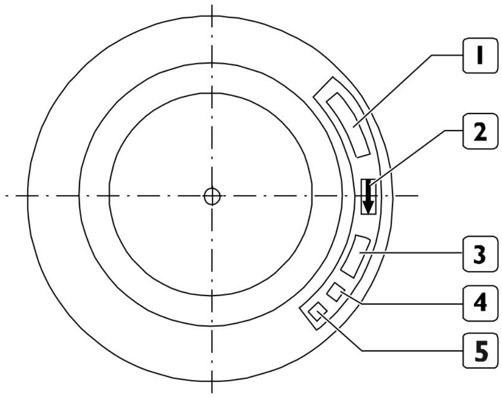
32619 5

540840 PISTON - Pre-assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Connecting rod-piston pairing

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



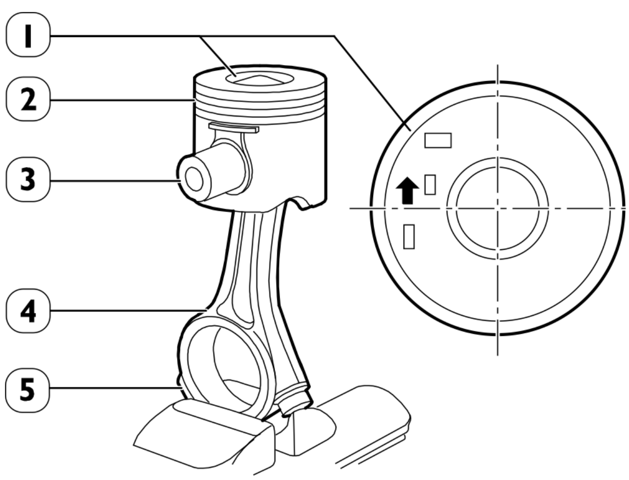
196437 1

FAN SIDE

The piston crown is marked as follows:

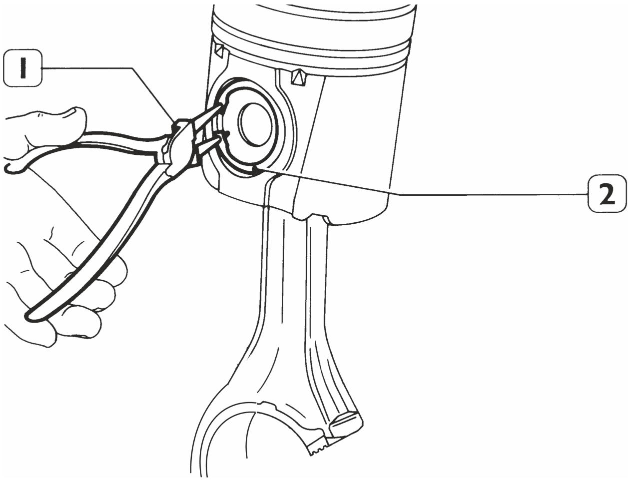
1. Spare part number
2. Arrow showing piston assembly direction in the cylinder liners. This arrow is to face the front side of the engine block (fan side)
3. Production date
4. Marking showing 1st slot insert testing
5. Product traceability

2. With the pin **(3)**, connect the piston **(2)** to the connecting rod **(4)** so that the piston **(2)** assembly reference arrow **(1)** in the cylinder liners and the numbers **(5)** printed on the connecting rod **(4)** appear as shown in the figure.



102596 2

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



126312 3

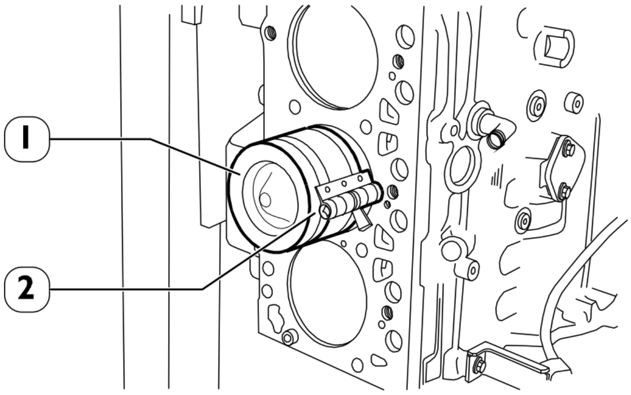
540840 PISTON - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Connecting rod caps	12 screws M10x1.25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**

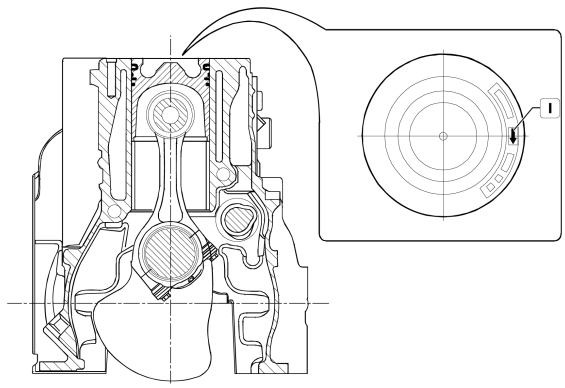
Fitting the connecting rod-piston assembly into the cylinder liners

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



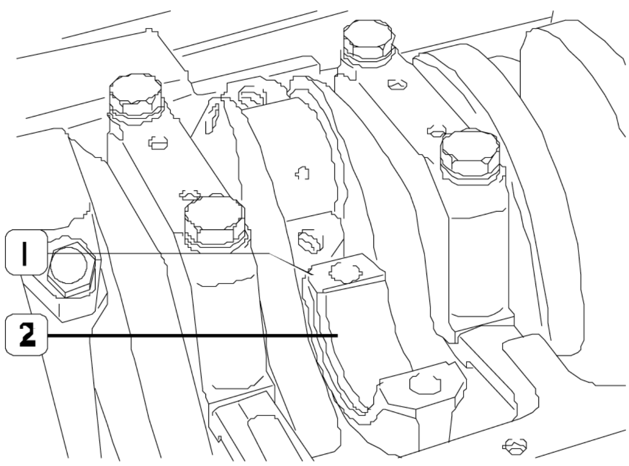
70201 1

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.



162245 2

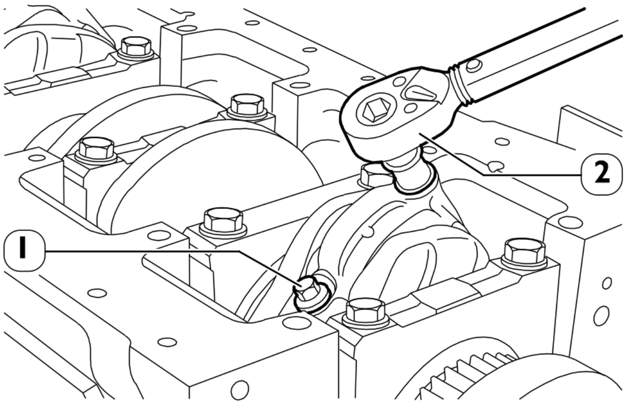
7. Carefully clean the parts and remove any trace of oil.
8. Fit the connecting rod caps **(3)** with the relative half-bearings **(2)**.



128170 3

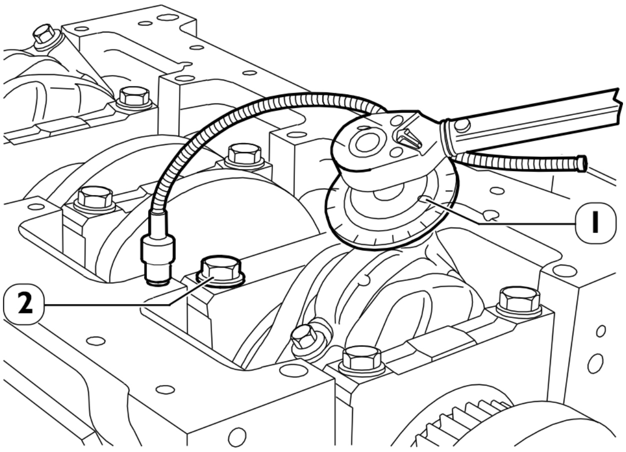
9. Use a torque wrench **(1)** to tighten the new screws **(2)** to the specified torque.

Description	Quan-tity	Step	Value
Connecting rod caps	12 scr-ews M10x1. 25x52	Phase 1 Tighten	**50 +/- 2 N·m**
		Phase 2 Angle tightening	**60°**



70204 4

10. Apply tool **(1)** to the socket wrench and tighten the screws **(2)** by a further **60 +/- 2°**.



70205 5

11. Check the clearance as described in **CRANKPINS - Measure (54.08)**.

540840 PISTON - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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

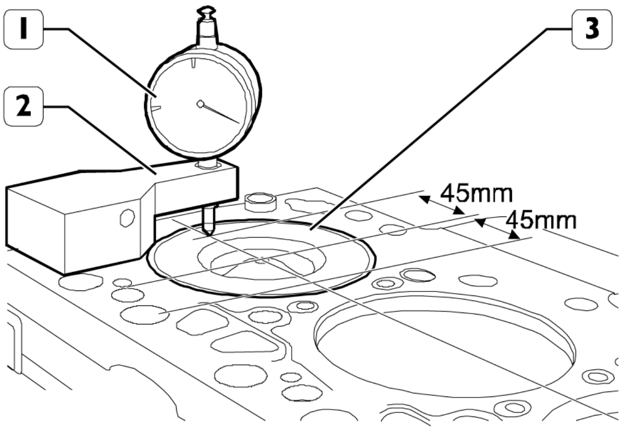
Prior operation:
PISTON - Assemble (54.08)

Piston protrusion check

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:

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

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.



166655 1

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.

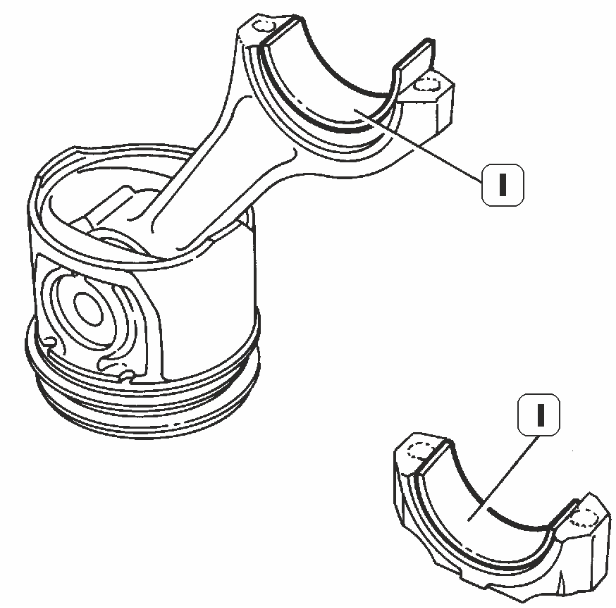
540831 CONNECTING ROD BEARING - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.



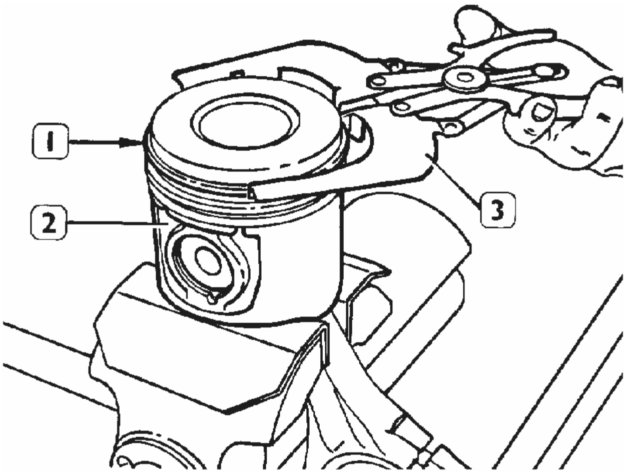
70200 1

540842 COMPRESSION RINGS - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Piston rings removal

1. Removal of piston rings **(1)** from the pin **(2)** using pliers **(3)**.



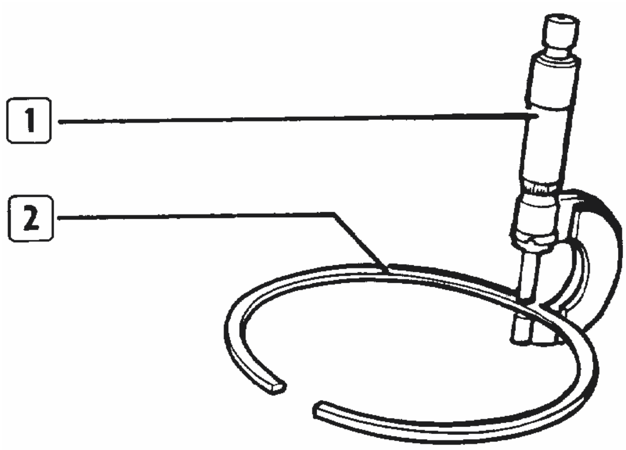
32613 1

540842 COMPRESSION RINGS - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

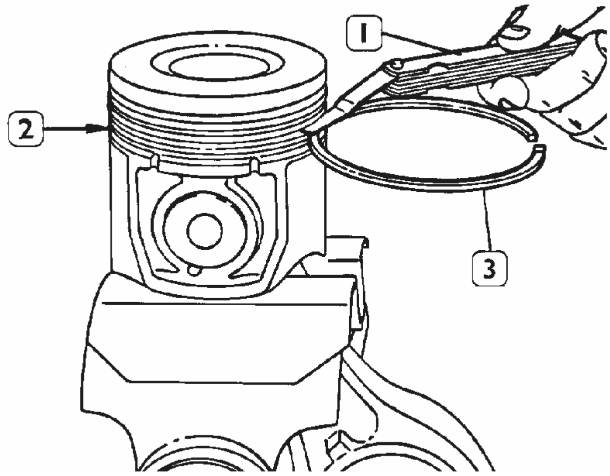
Cut piston rings

1. Use a micrometer **(1)** to check the thickness of the split ring **(2)**.

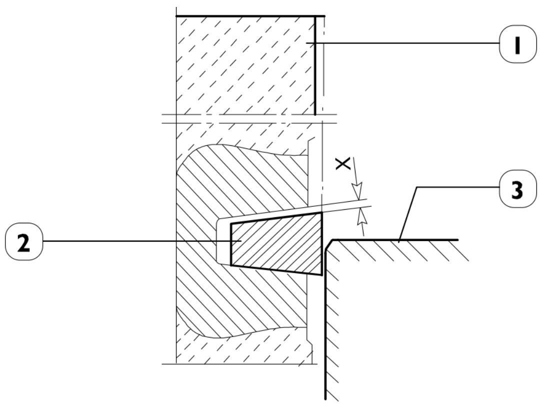


16552 1

2. Check the clearance between the sealing rings of the rings **(3)** of the 1st slot (only for pistons of turbocharged engines), of the 2nd and 3rd slots and the relevant housings on the piston **(2)** with a feeler gauge **(1)**.



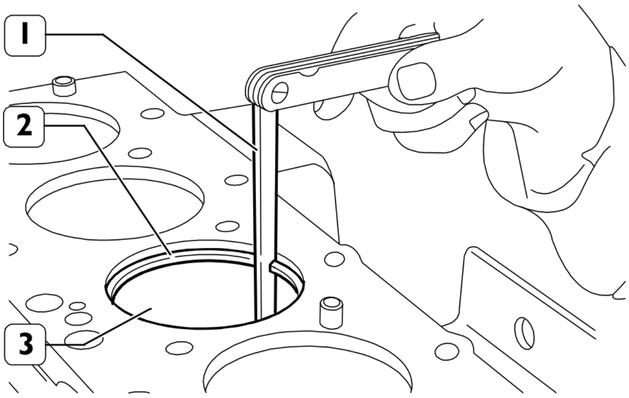
32620 2



41104 3

DIAGRAM FOR MEASURING THE CLEARANCE X BETWEEN THE FIRST PISTON SLOT AND THE TRAPEZOIDAL RING (turbocharged engines only)

3. Since the first sealing ring section is trapezoidal, the clearance between the slot and the ring is to be measured as follows: make the piston protrude **(1)** from the engine block so that the ring **(2)** protrudes half way from the cylinder liner **(3)**.
4. In this position, use a feeler gauge to check the clearance **(X)** between the ring and the slot: this clearance must be as specified.
5. With a feeler gauge **(1)** measure the clearance between the ends of the split rings **(2)** fitted into the cylinder liner **(3)**.



70194 4

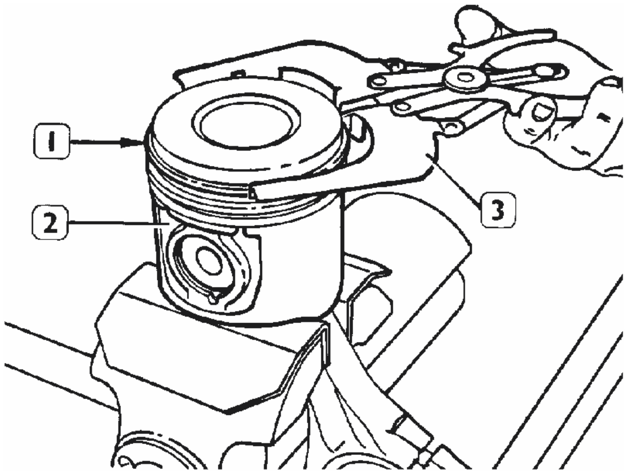
540842 COMPRESSION RINGS - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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 °C**

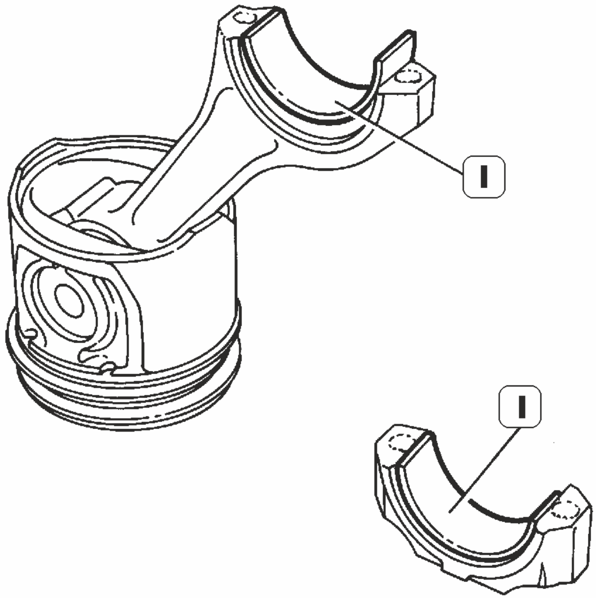
NOTE: *Spare piston rings are supplied in the sizes below: standard, marked with yellow paint;*
*- oversized by **0,5 mm** and marked with green/yellow paint.*



32613 1

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

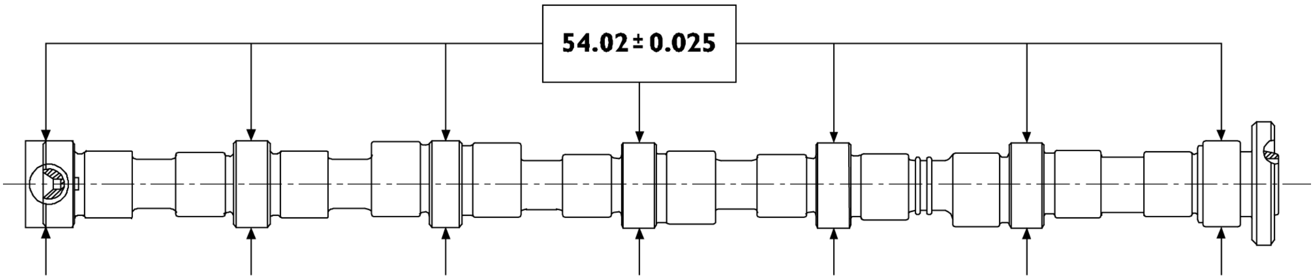
NOTE: *Not finding it necessary to replace the connecting rod bearings, you need to fit them back in exactly the same sequence and position as in removal.*
Do not make any adjustment on the half-bearings.



70200 2

541210 CAMSHAFT - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



84089 1

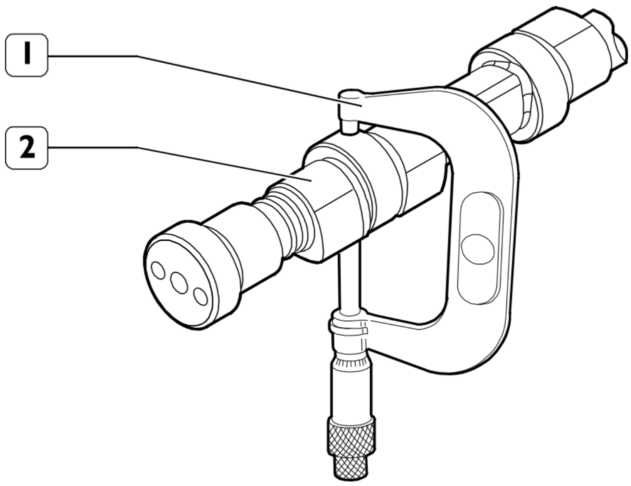
MAIN DATA ABOUT CAMSHAFT JOURNALS

1. The surfaces of the supporting pins of the shaft and those of the cams need to be extra smooth; if they show any signs of seizing or scoring, the shaft and the relative bushing should be replaced.

NOTE: *The values shown refer to the regular pin diameter.*

Checking cam lift and journals alignment

2. Set the camshaft on the tailstock and using a 1/100 gauge set on the central support, check that the alignment error does not exceed **0,4 mm**: change the shaft if it is any greater.
3. Check the cam lift: It must be **7,582 mm** for the exhaust cams and **6,045 mm** for the intake cams; if the value is different, replace the shaft.
4. Check camshaft **(2)** pin diameter using a micrometer **(1)** on two perpendicular axes.



70171 2

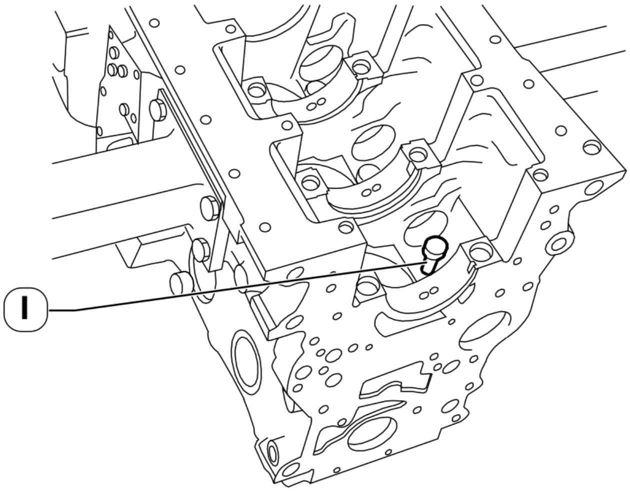
541210 CAMSHAFT - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Camshaft longitudinal retaining plate	2 screws M8 x 1.25	**24 +/- 4 N·m**
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20	**15 +/- 3 N·m**

Fitting tappets - Camshaft

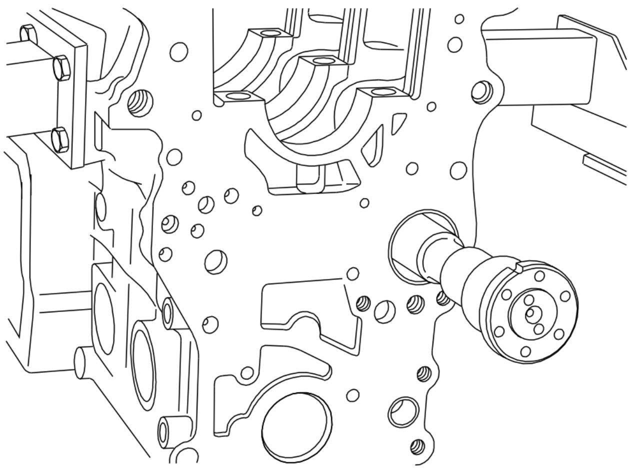
1. Lubricate the tappets **(1)** and fit them into the relevant seats on the crankcase.



70176 1

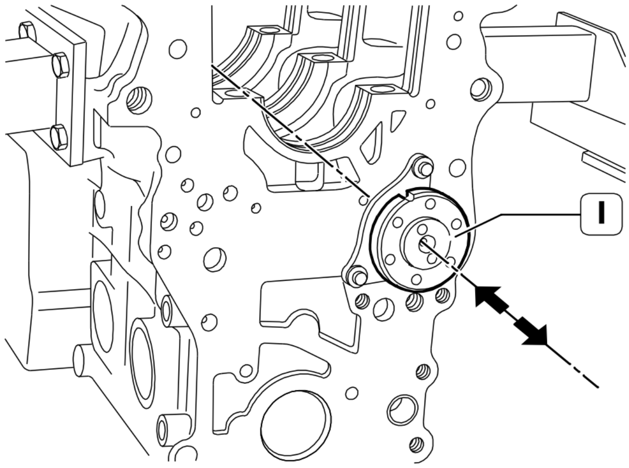
2. Lubricate the bushing and the other camshaft support seats and assemble the camshaft **(1)** taking care that, during the operation, the bushing or support seats are not damaged.
3. Set the camshaft **(3)** retaining plate **(1)** with the slot facing the top of the engine block and the marking facing the operator, then tighten the screws **(2)** to the specified torque.

Description	Quantity	Value
Camshaft longitudinal retaining plate	2 screws M8 x 1.25	**24 +/- 4 N·m**



70164 2

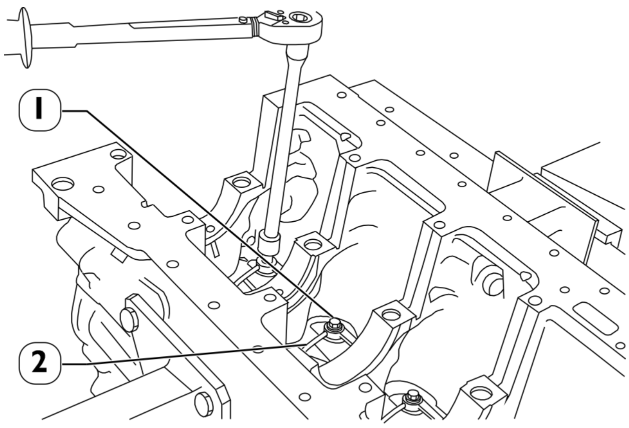
4. Check the axial clearance of the camshaft **(1)**. This should be **0,23 +/- 0,13 mm**.



70179 3

5. Fit nozzles **(2)** and tighten the fastening screws **(1)** to the specified torque.

Description	Quantity	Value
Cylinder liner lubrication nozzles	6 screws M8 x 1.25 x 20	**15 +/- 3 N·m**

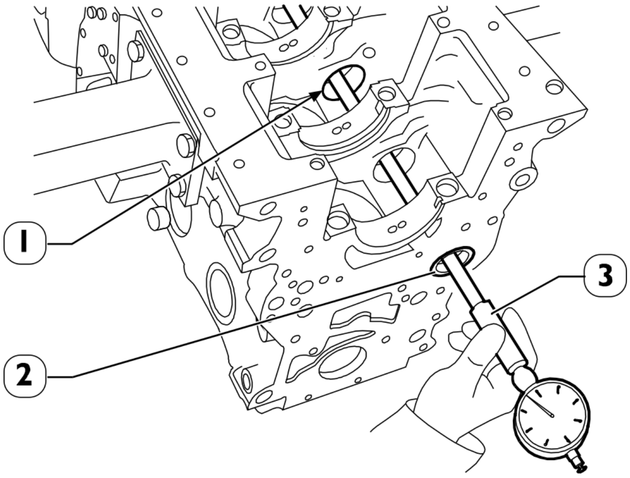


70180 4

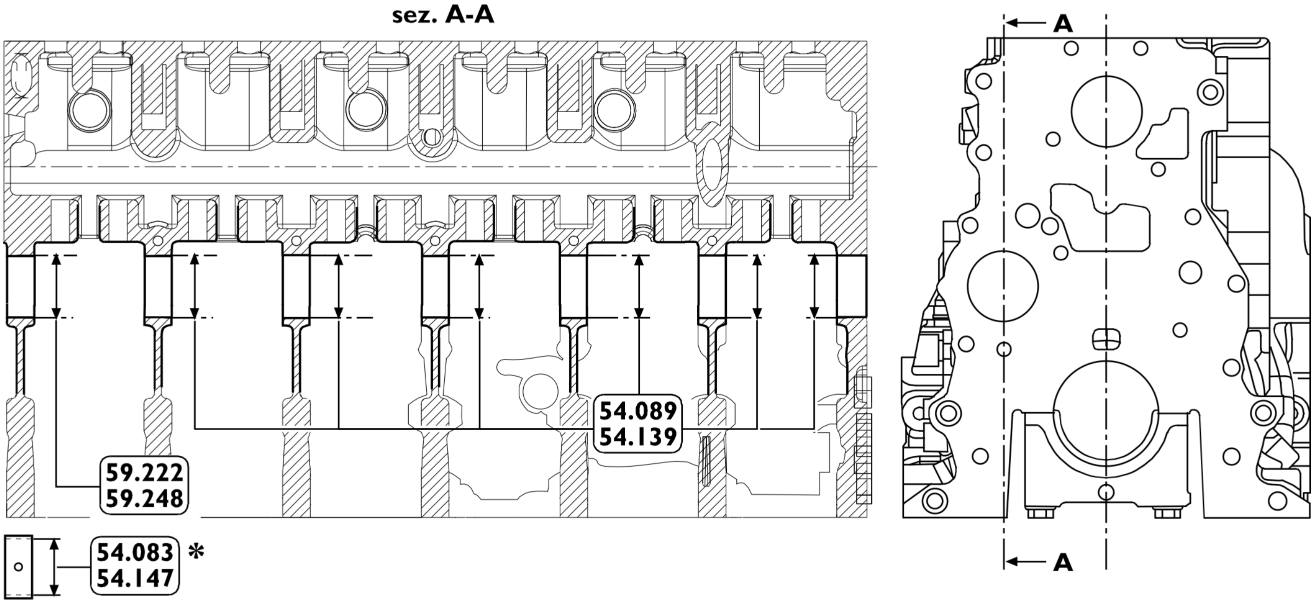
541213 BUSHES - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.



70172 1



107268 2

CAMSHAFT BUSH AND HOUSING MAIN DATA - (*)Value to be obtained after the installation of the bush (dimensions in mm).

541213 BUSHES - Replace

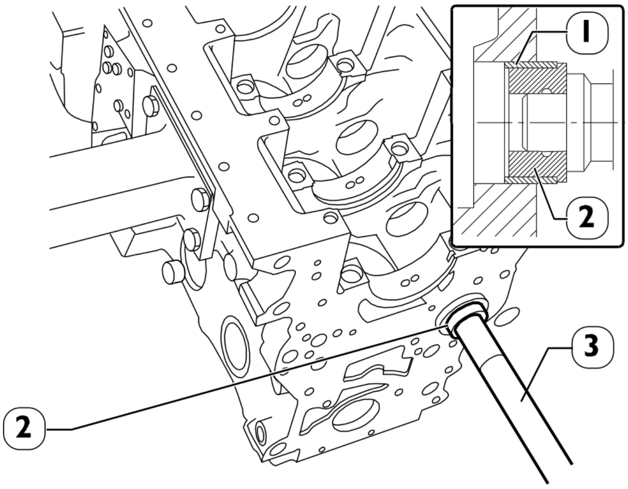
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.

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



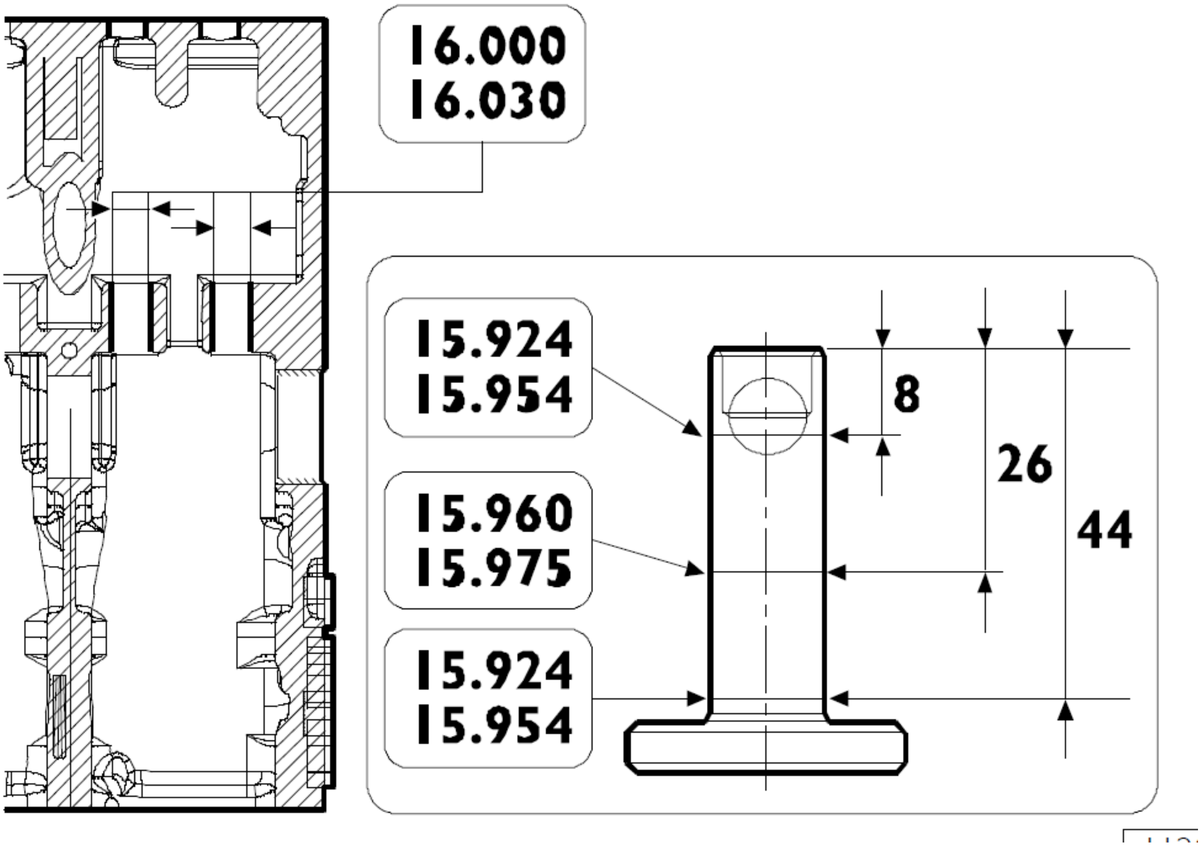
1

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

541224 TAPPETS - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tappets



112890A 1

MAIN DATA CONCERNING THE TAPPETS AND THE RELEVANT HOUSINGS ON THE ENGINE BLOCK (dimensions in mm).

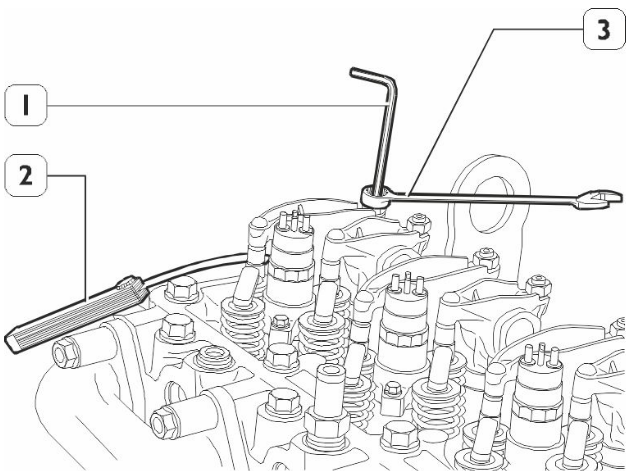
541230 ROCKER ARM ASSY - Adjust

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. The adjustment of the clearance between the rocker arms and the intake and exhaust valve control bridges must be strictly carried out using an Allen wrench **(1)**, a box-end wrench **(3)** and a feeler gauge **(2)**.



70520 1

2. Clearance shall be as follows:

Intake valves	**0,25 +/- 0,05 mm**
Exhaust valves	**0,51 +/- 0,05 mm**

3. To carry out clearance adjustment of the valve - rocker arm assembly more quickly, proceed as follows:
4. Rotate the crankshaft, balance the valves of cylinder no. 1 and adjust the valves marked with an asterisk as shown in the tables below.

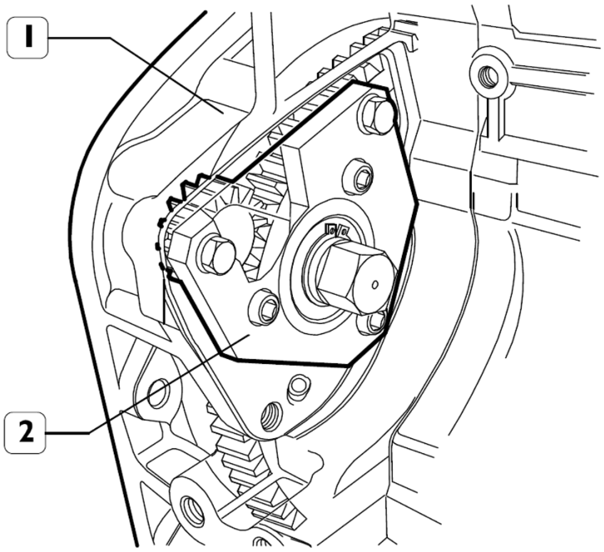
cylinder No.	1	2	3	4	5	6
intake	–	–	*	–	*	*
exhaust	–	*	–	*	–	*

5. Rotate the crankshaft, balance the valves of cylinder no. 6 and adjust the valves marked with an asterisk as shown in the tables below.

cylinder No.	1	2	3	4	5	6
intake	*	*	–	*	–	–
exhaust	*	–	*	–	*	–

6. To rotate the crankshaft, fit the tool **(2)** in the seat of the electric starter motor housed in the flywheel housing **(1)**.

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



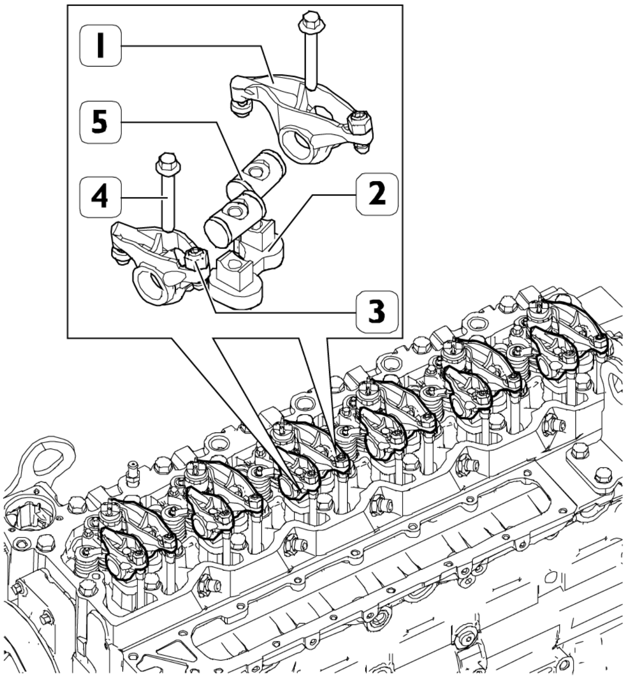
143281A 2

541230 ROCKER ARM ASSY - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

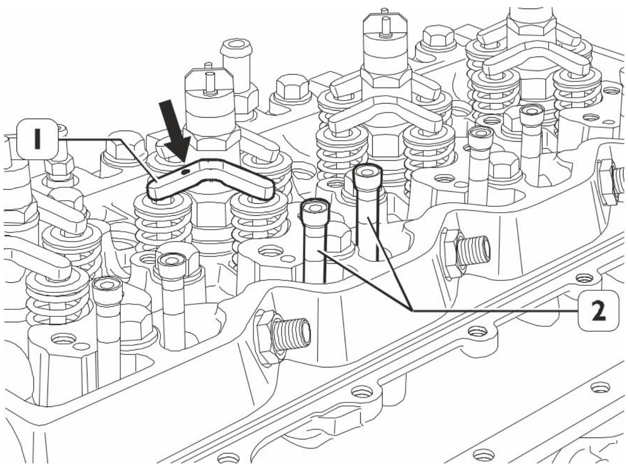
1. Remove the tappet cover as described in the procedure **ROCKER COVER - Remove (54.06)**.
2. Remove the injector wiring mount as described in the procedure **CYLINDER HEAD TOP - Remove (54.06)**.
3. Loosen the tappet adjuster retaining nuts **(3)** and unscrew the tappet adjuster screws.
4. Unscrew the fastening screws **(4)** and remove the rocker unit from the cylinder head, including support **(2)**, rockers **(1)** and shafts **(5)**.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 1

5. Remove the bridges **(1)** from the valves and the pushrods **(2)** from the cylinder head and crankcase.



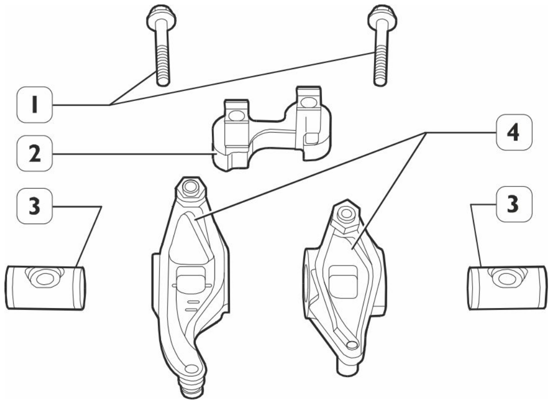
70345 2

541230 ROCKER ARM ASSY - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**

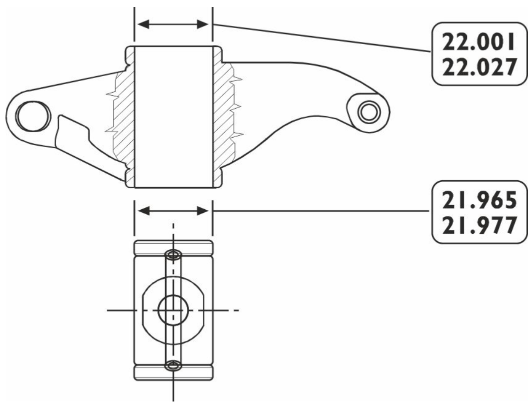
Tool / Material	
Flywheel crank handle (use with 99360222)	99360221
Pinion (use with 99360221)	99360222



70343 1

ROCKER ARM ASSEMBLY COMPONENTS

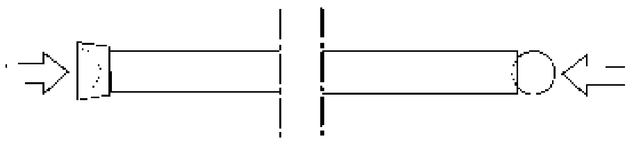
1. Screws
2. Carrier
3. Shafts
4. Rocker arms



70344 2

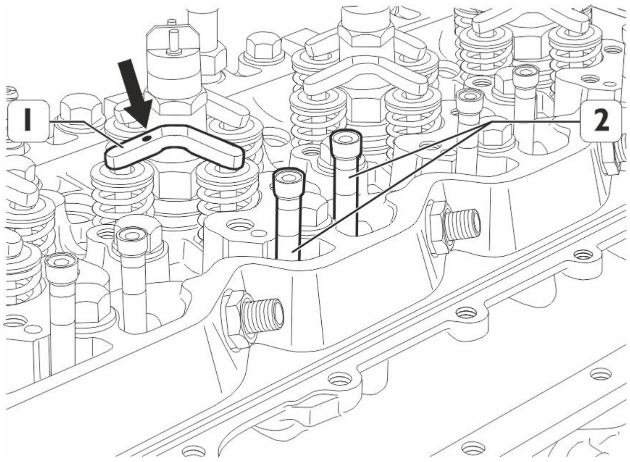
SHAFT-ROCKER MAIN DATA

1. Check that shaft / rocker arm surfaces are not excessively worn or damaged.
2. The rocker arm control rods must not be deformed; the spherical seats in contact with the rocker arm adjustment screws and with the "arrow" tappet must not show signs of seizing or wear; otherwise replace them. The rods that control the intake and exhaust valves are identical and therefore can be interchanged.



122587 3

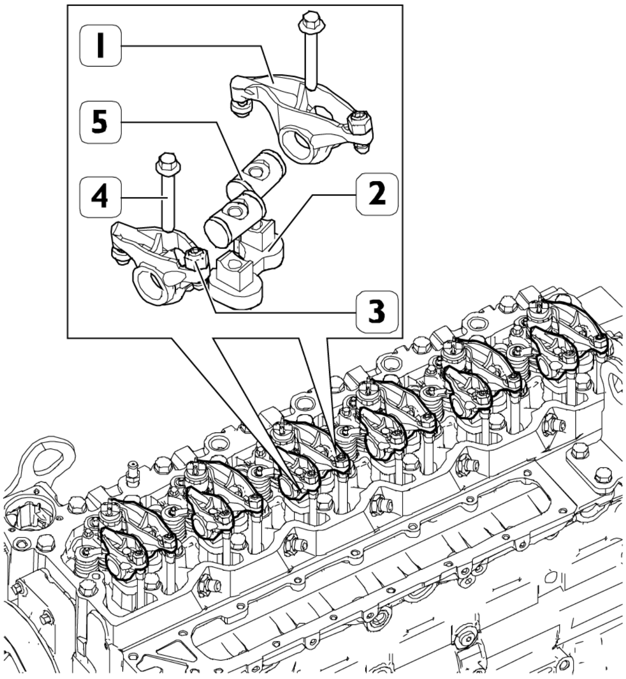
3. Fit the rods **(2)**.
4. Position bridges **(1)** on valves with marks **(→)** facing the exhaust manifold.



74765 4

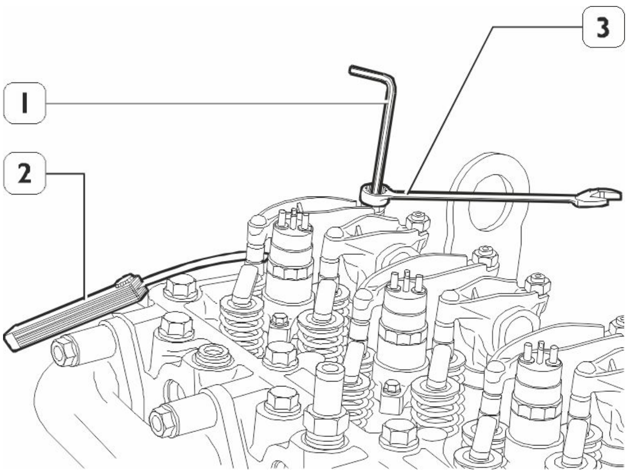
5. Check that the tappet adjuster screws and retaining nuts **(3)** are loose to prevent them sticking on the rods when refitting the rocker assembly.
6. Install the rocker unit consisting of bracket **(2)**, rockers **(1)** shafts **(5)** and secure them to the cylinder head by tightening the fastening screws **(4)** to the prescribed torque.

Description	Step	Value
Rocker assembly bracket	5 screws M8 x 1.25 x 70	**24 +/- 4 N·m**
	2 screws M8 x 1.25 x 50	**24 +/- 4 N·m**



212834 5

7. The adjustment of the clearance between the rocker arms and the intake and exhaust valves must be strictly carried out using an Allen wrench **(1)**, a box-end wrench **(3)** and a feeler gauge **(2)**.



70520 6

8. Clearance shall be as follows:

Intake valves	**0,25 +/- 0,05 mm**
Exhaust valves	**0,51 +/- 0,05 mm**

9. To carry out clearance adjustment of the valve - rocker arm assembly more quickly, proceed as follows:
10. Rotate the crankshaft, balance the valves of cylinder no. 1 and adjust the valves marked with an asterisk as shown in the tables below.

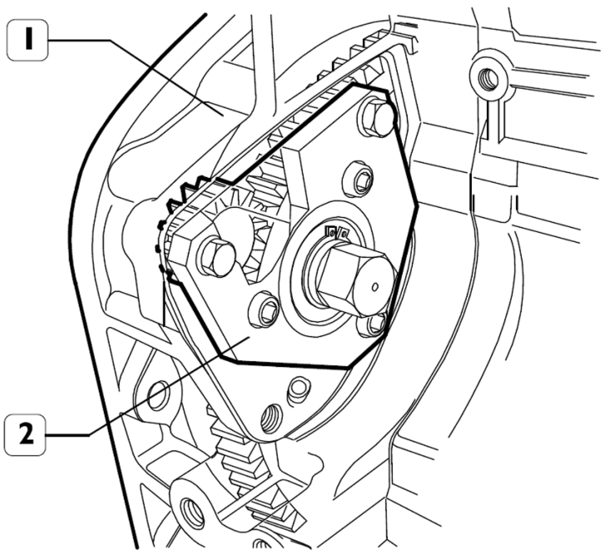
cylinder n	1	2	3	4	5	6
intake	–	–	*	–	*	*
exhaust	–	*	–	*	–	*

11. Rotate the crankshaft, balance the valves of cylinder no. 6 and adjust the valves marked with an asterisk as shown in the tables below.

cylinder n	1	2	3	4	5	6
intake	*	*	–	*	–	–
exhaust	*	–	*	–	*	–

12. To rotate the crankshaft, fit the tool **(2)** in the seat of the electric starter motor housed in the flywheel housing **(1)**.

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



143281A 7

13. Fit the injector wiring mount as described in the procedure **CYLINDER HEAD TOP - Install (54.06)**.
14. Fit the tappet cover as described in the procedure **ROCKER COVER - Install (54.06)**.

5420 FUEL FEED - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

DESCRIPTION OF THE FUEL SUPPLY SYSTEM

The fuel system has been designed to eliminate PARTICULATE emissions.

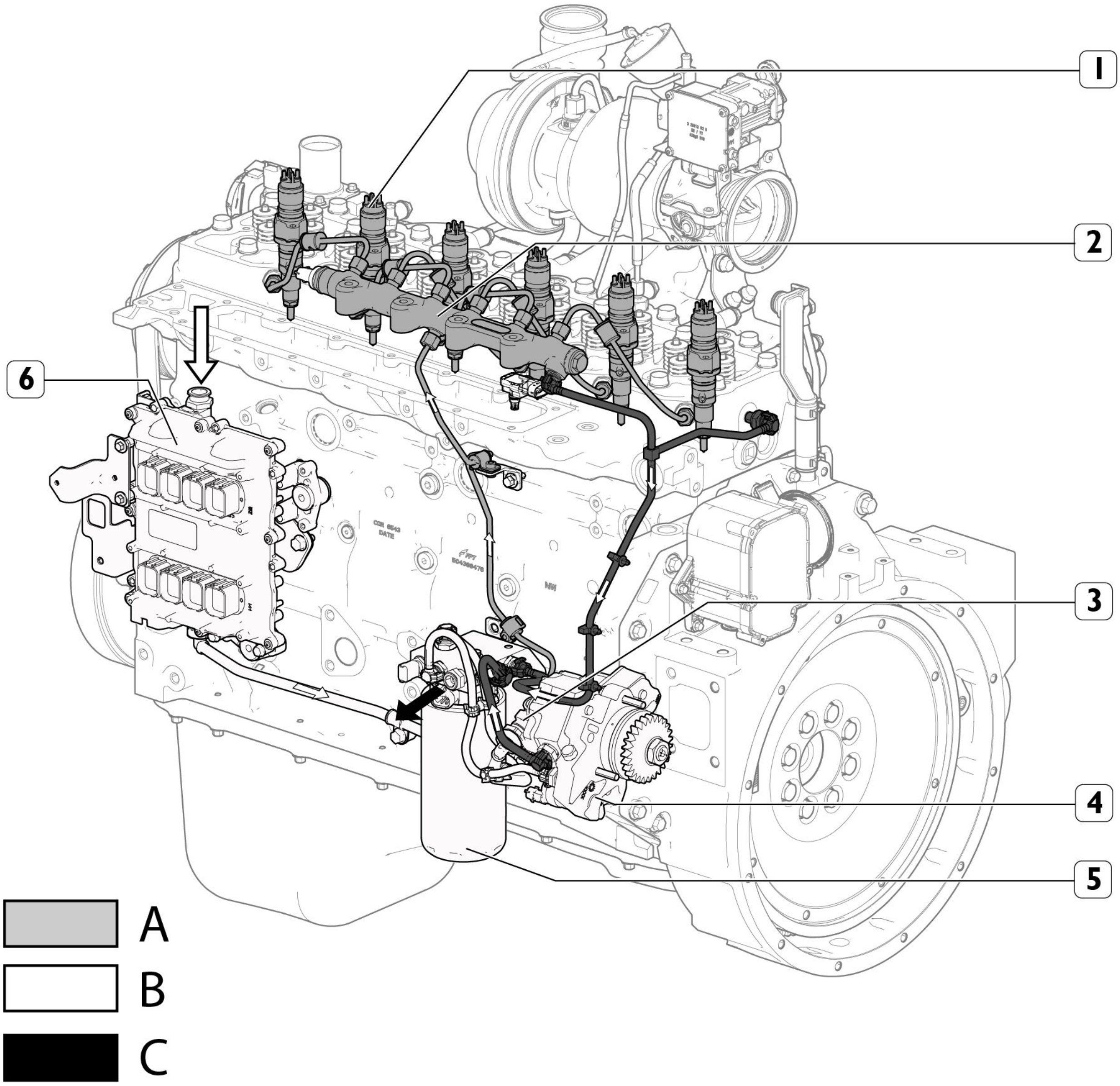
In fact, the Common Rail system allows injection of fuel at pressures reaching **1600 bar**, while the precision of the injection, obtained by means of the electronic management of the system, optimises engine operation by limiting emissions and consumption.

After

The Common Rail system has a special pump that continuously keeps fuel at high pressure, independently from stroke and the cylinder which is 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.



265944 1

1. Injector
2. Common Rail
3. Mechanical fuel pump
4. Fuel high pressure pump
5. Fuel filter
6. MD1CE101 engine control unit

A. High-pressure
B. Low-pressure
C. Fuel discharge

The fuel system comprises a low pressure circuit and a high pressure circuit.

The high pressure circuit is made up of the following pipes:

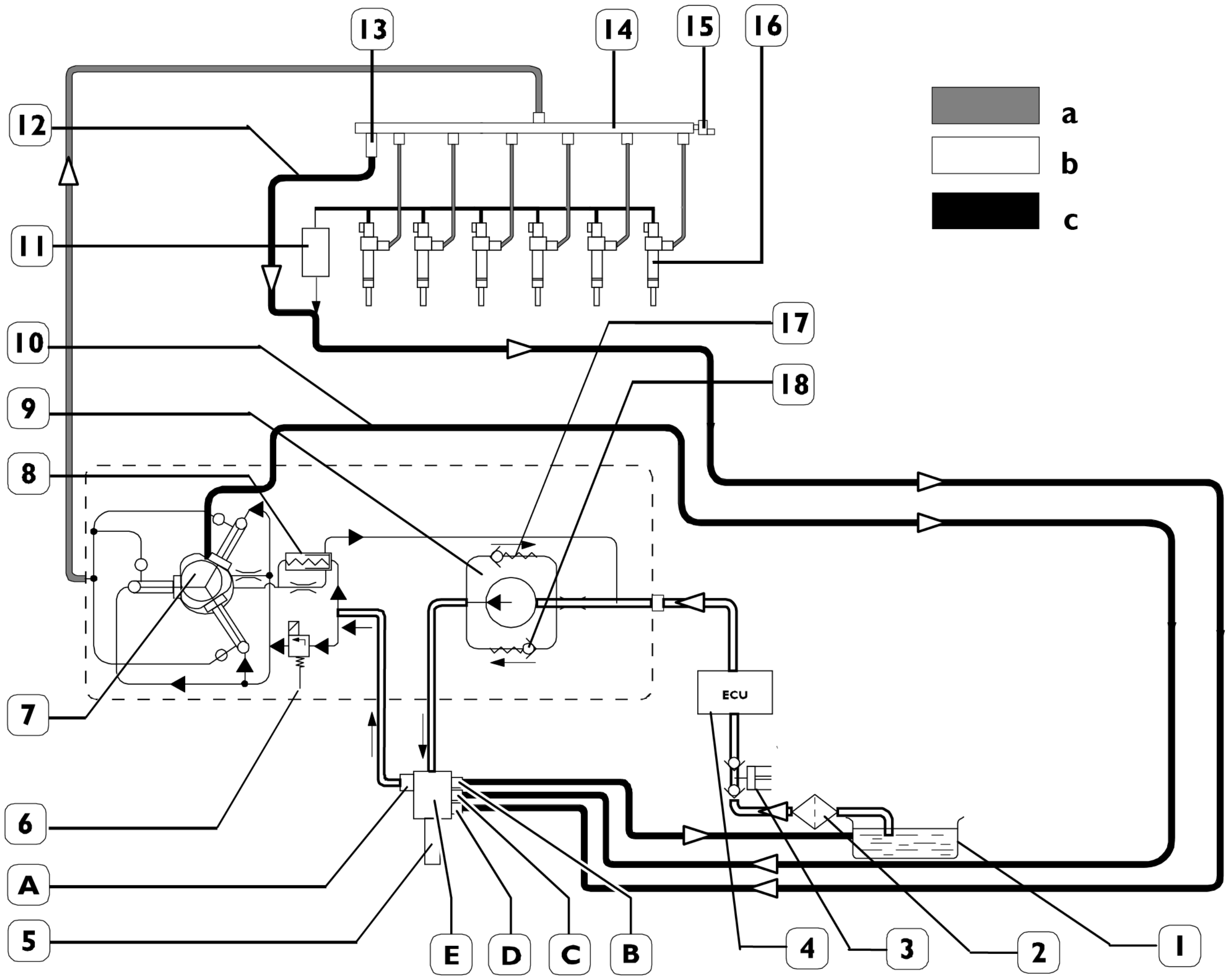
- pipe connecting the high-pressure pump outlet to the common rail;
- Common Rail;
- piping supplying electro-injectors from rail.

The low pressure circuit is made up of the following pipes:

- fuel intake pipe from tank to pre-filter with a priming pump;
- pipes supplying the mechanical pump via the heat exchanger of the engine control unit;
- pipes supplying the high-pressure pump through the fuel filter.

The fuel drain circuit from Common Rail, injectors and the high-pressure pump return flow complete the system.

Fuel system diagram



213604 2

(1) Fuel tank – (2) Pre-filter – (3) Manual pump – (4) Control unit – (5) Fuel filter – (6) Flow rate modulator – (7) High-pressure pump – (8) Limiting valve on high-pressure pump 5 bar – (9) Mechanical supply pump – (10) High-pressure pump reflux pipe – (11) Quick coupler for fuel return from the injectors – (12) Return pipe – (13) Common rail excess pressure valve – (14) Common rail – (15) Pressure sensor – (16) Injector – (17) By-pass valve – (18) By-pass valve (a) High pressure – (b) Low pressure – (c) Fuel outlet

Fuel filter connections:

A. Outlet connection to the high pressure pump
B. Outlet connection for the fuel drain in the tank
C. Inlet connection for the fuel drain from the high pressure pump
D. Inlet connection for the fuel drain from the common rail and injectors
E. Inlet connection from the mechanical fuel pump

The flow regulator **(6)**, located upstream of the high-pressure pump, regulates the flow of fuel needed in the low-pressure system. Afterwards, the high-pressure pump takes care of supplying the rail properly.

This solution, by only pressurizing the necessary fuel, improves the energy efficiency and restricts system fuel heating.

The function of the relief valve **(8)**, mounted on the high-pressure pump, is to maintain the flow rate, at the flow regulator inlet, constant at **5 bar**, regardless of the efficiency of the fuel filter and of the system situated upstream.

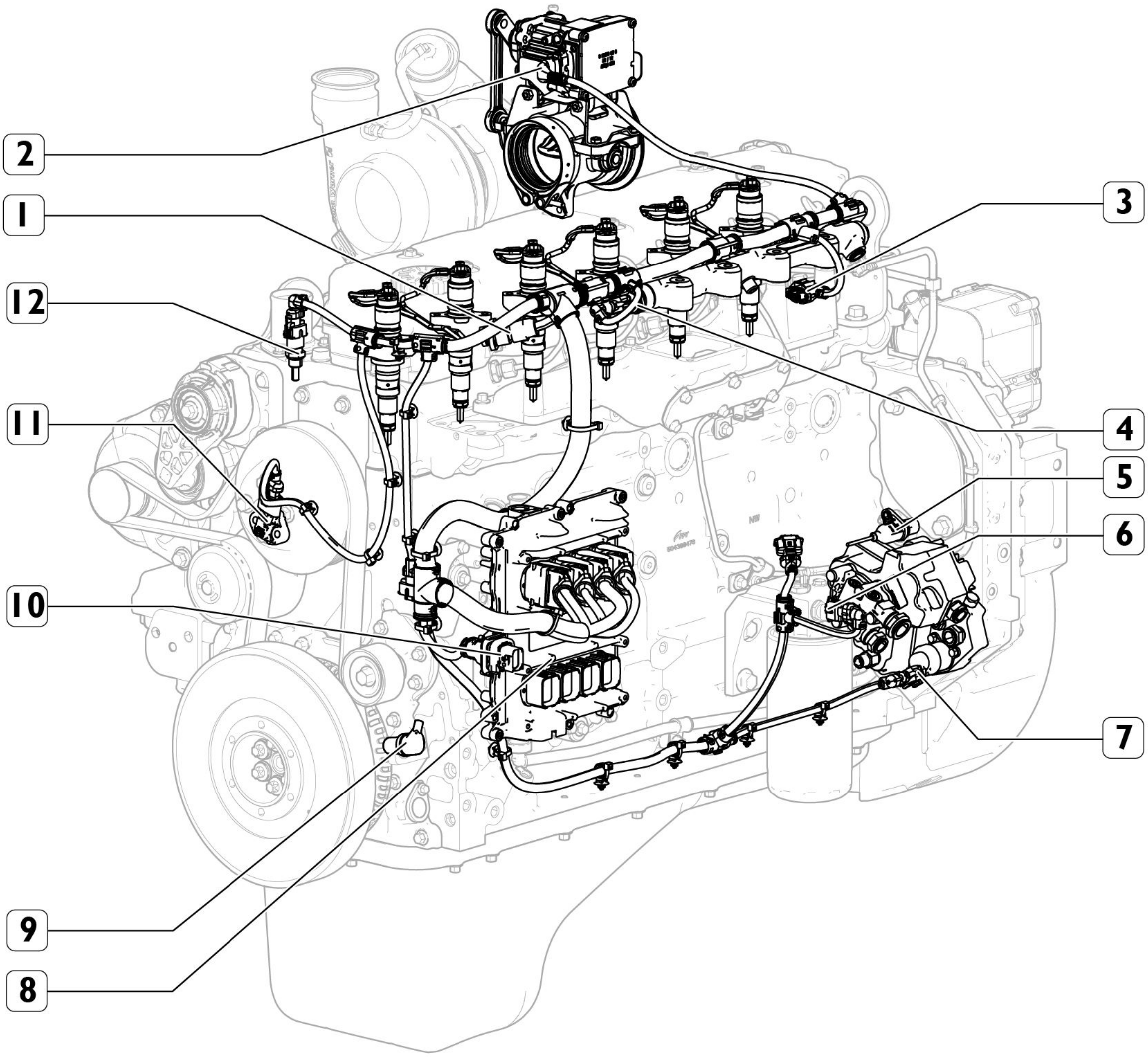
The quick coupling for the fuel return pipe **(11)** housed on the cylinder head, fit on the injector return, limits the return flow from the injectors.

Two by-pass valves are placed in parallel with the mechanical supply pump.

The by-pass valve **(17)** allows fuel to flow from mechanical pump outlet to its inlet, when the fuel filter inlet pressure exceeds the allowed threshold value.

The by - pass valve **(18)** allows the fuel supply system to be filled through the manual priming pump **(3)**.

Electrical system



265939 3

(1) Injector connections - (2) Motorised throttle valve actuator connector (Exhaust valve) - (3) Supercharging pressure and air temperature sensor - (4) Rail pressure sensor - (5) Camshaft timing segment speed sensor - (6) Fuel temperature sensor - (7) High-pressure fuel pump dosing unit - (8) MD1 engine control unit - (9)

Crankshaft incremental speed sensor - (10) In-line connector - (11) Engine oil temperature and pressure sensor - (12) Coolant temperature sensor

Sensors

Through the sensors, present on the engine, the ECU controls the engine operation.

Air pressure/temperature sensor

This component combines a temperature and a pressure sensor.

Fitted on the intake manifold, it measures the max. inlet air capacity to calculate precisely the fuel quantity to inject at every cycle.

The output voltage is proportional to the pressure or temperature measured by the sensor.

Engine oil temperature - pressure sensor

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

It measures the engine oil temperature and pressure.

Fuel pressure sensor

Assembled on a rail end, it measures the fuel pressure in the rail in order to determine the injection pressure.

The injection pressure value is used to control the pressure and to determine the 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.

Increment speed sensor (Crankshaft)

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

Timing sensor

This inductive type sensor is located on the rear left part of the engine. It generates signals obtained from magnetic flow lines that are closed though holes on the gear keyed onto the camshaft. The signal generated by this sensor is used by the ECU as the injection timing signal.

Though being equal to the crankshaft sensor, it is NOT interchangeable since it has a different outside shape.

System functions

Self-diagnostics

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

Engine pre-heating resistance management

The pre-post heating is activated if even one of the water, air or fuel temperature sensors signals a temperature lower than **5 °C**.

Synchronisation 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 management

Depending on engine load, measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have the 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 flow regulator and changes the injection time of injectors.

Within certain thresholds, it also takes into account the battery voltage.

Maximum speed limiting

Approaching the peak rpm, the ECU limits the fuel flow by reducing the opening time of the electro-injectors.

The peak rpm of the engines is **2375 +/- 50 RPM**. Above this rate the ECU deactivates the electro-injectors

Cut Off

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

- it cuts off electro-injectors supply;
- it re-activates the injectors shortly before idle speed is reached;
- operates 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 °C**C (measured by the sensor placed on fuel filter) the control unit intervenes and reduces the injection pressure.

If the temperature exceeds **90 °C**, the power is reduced to **60%**.

After Run

The engine stop request is processed by the control unit and is compared with the vehicle speed. Once the engine has stopped, the Afterrun procedure is launched i.e. the engine control unit microprocessor transfers some data from the main memory (volatile) to the non-volatile erasable and rewritable memory (EEprom) including the fault log, so that they are available at the next engine start (Run up).

Risk of damage
After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the "Key off", the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

5420 FUEL FEED - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

DESCRIPTION OF THE FUEL SUPPLY SYSTEM

The fuel system has been designed to eliminate PARTICULATE emissions.

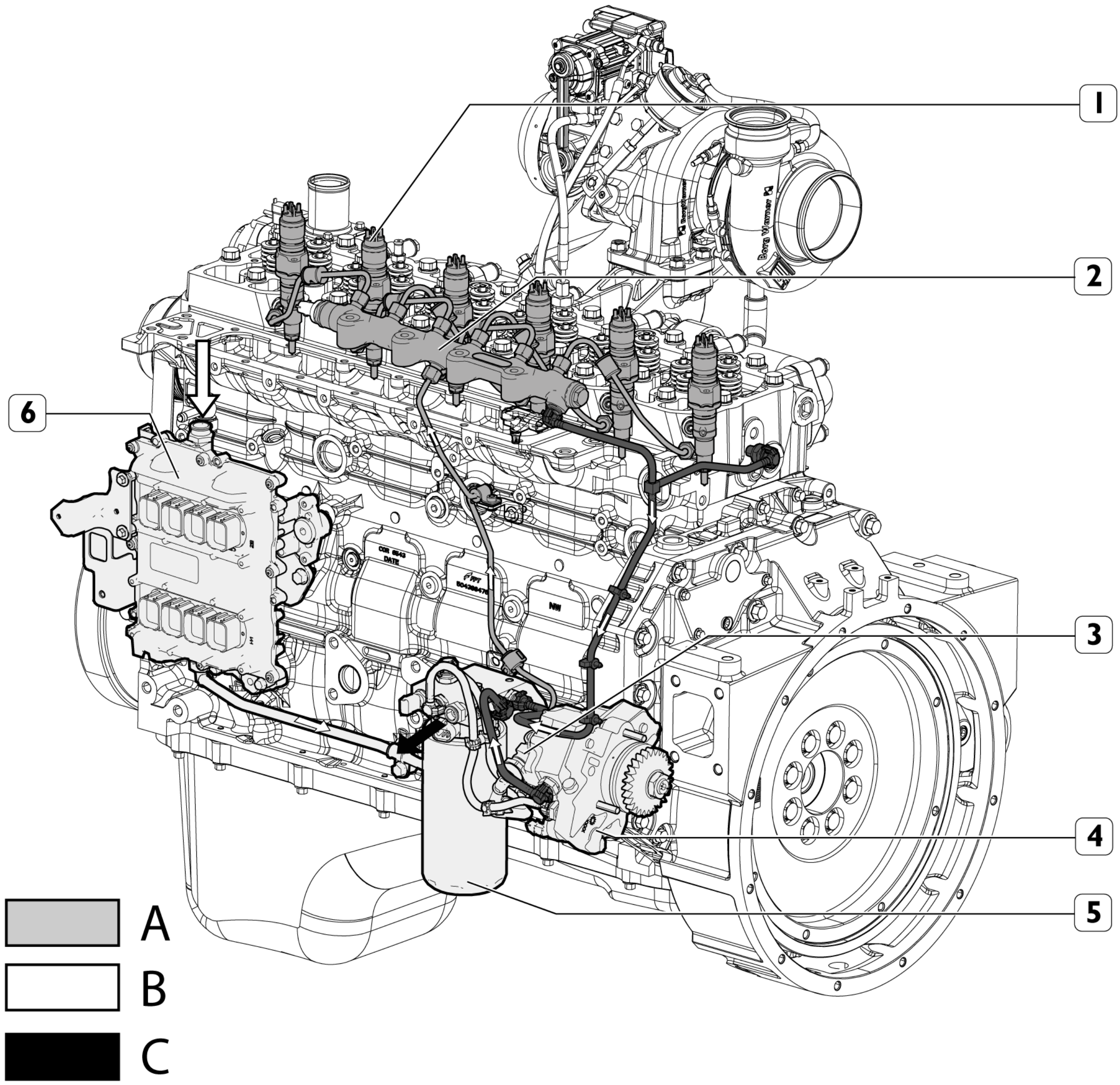
In fact, the Common Rail system allows injection of fuel at pressures reaching **1600 bar**, while the precision of the injection, obtained by means of the electronic management of the system, optimises engine operation by limiting emissions and consumption.

After

The Common Rail system has a special pump that continuously keeps fuel at high pressure, independently from stroke and the cylinder which is 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.



268539 1

1. Electro-injector
2. Common Rail
3. Mechanical fuel pump
4. High-pressure fuel pump
5. Fuel filter
6. MD1CE101 engine control unit

A. High-pressure
B. Low-pressure
C. Fuel discharge

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

The high pressure circuit is made up of the following pipes:

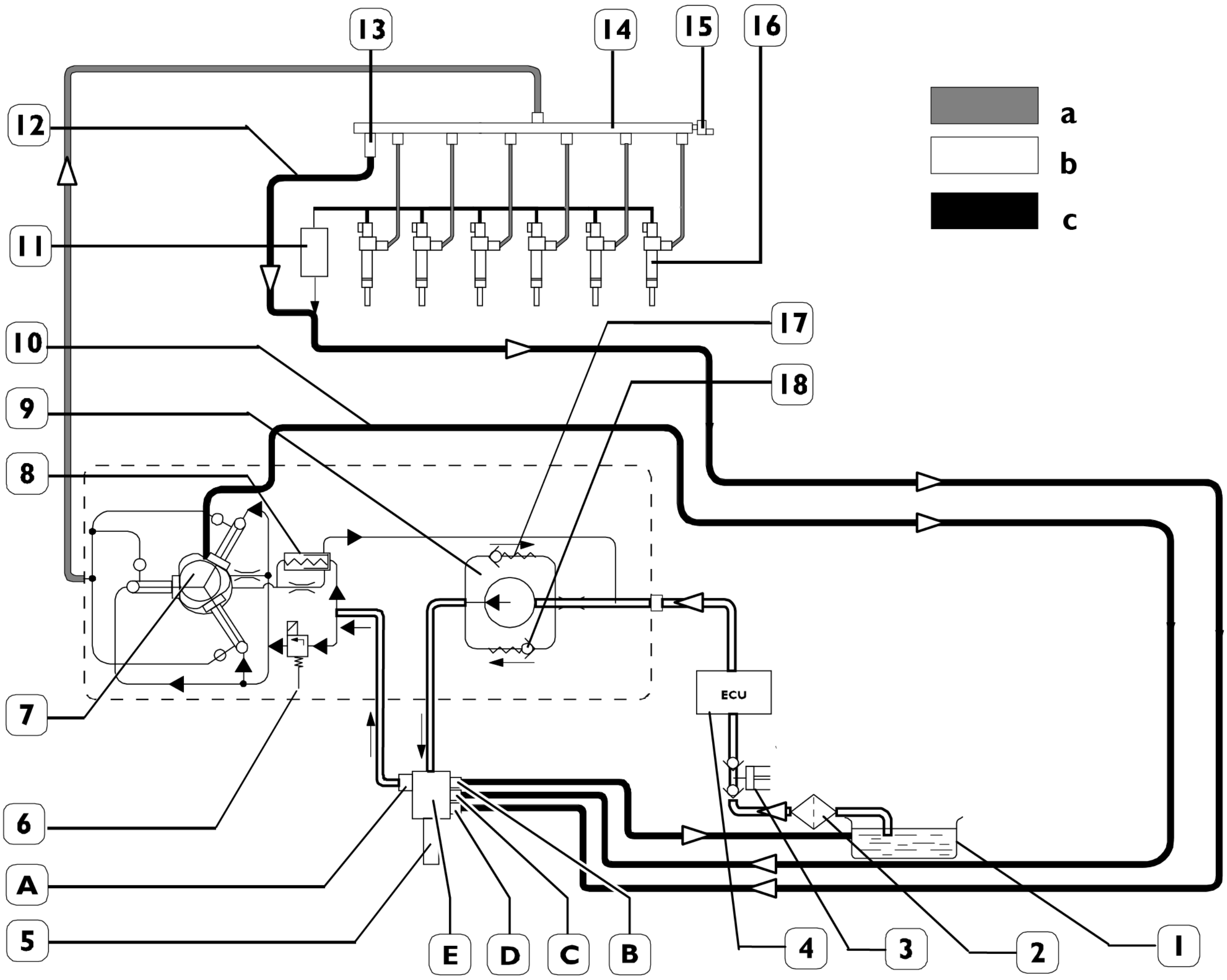
- pipe connecting the high-pressure pump outlet to the common rail;
- Common Rail;
- piping supplying electro-injectors from rail.

The low pressure circuit is made up of the following pipes:

- fuel intake pipe from tank to pre-filter with a priming pump;
- pipings supplying the mechanical pump through the engine control unit heat exchanger;
- pipes supplying the high-pressure pump through the fuel filter.

The fuel drain circuit from Common Rail, injectors and the high-pressure pump return flow complete the system.

Fuel system diagram



213604 2

(1) Fuel tank – (2) Pre-filter – (3) Manual pump – (4) Control unit – (5) Fuel filter – (6) Flow rate modulator – (7) High-pressure pump – (8) Limiting valve on high-pressure pump 5 bar – (9) Mechanical supply pump – (10) High-pressure pump reflux pipe – (11) Quick coupler for fuel return from the injectors – (12) Return pipe – (13) Common rail excess pressure valve – (14) Common rail – (15) Pressure sensor – (16) Injector – (17) By-pass valve – (18) By-pass valve (a) High pressure – (b) Low pressure – (c) Fuel outlet

Fuel filter connections:

A. Outlet connection to the high pressure pump
B. Outlet connection for the fuel drain in the tank
C. Inlet connection for the fuel drain from the high pressure pump
D. Inlet connection for the fuel drain from the common rail and injectors
E. Inlet connection from the mechanical fuel pump

The flow regulator **(6)**, located upstream of the high-pressure pump, regulates the flow of fuel needed in the low-pressure system. The high-pressure pump then ensures that fuel reaches the rail correctly.

This solution, by only pressurizing the necessary fuel, improves the energy efficiency and restricts system fuel heating.

The function of the relief valve **(8)**, mounted on the high-pressure pump, is to maintain the flow rate, at the flow regulator inlet, constant at **5 bar**, regardless of the efficiency of the fuel filter and of the system situated upstream.

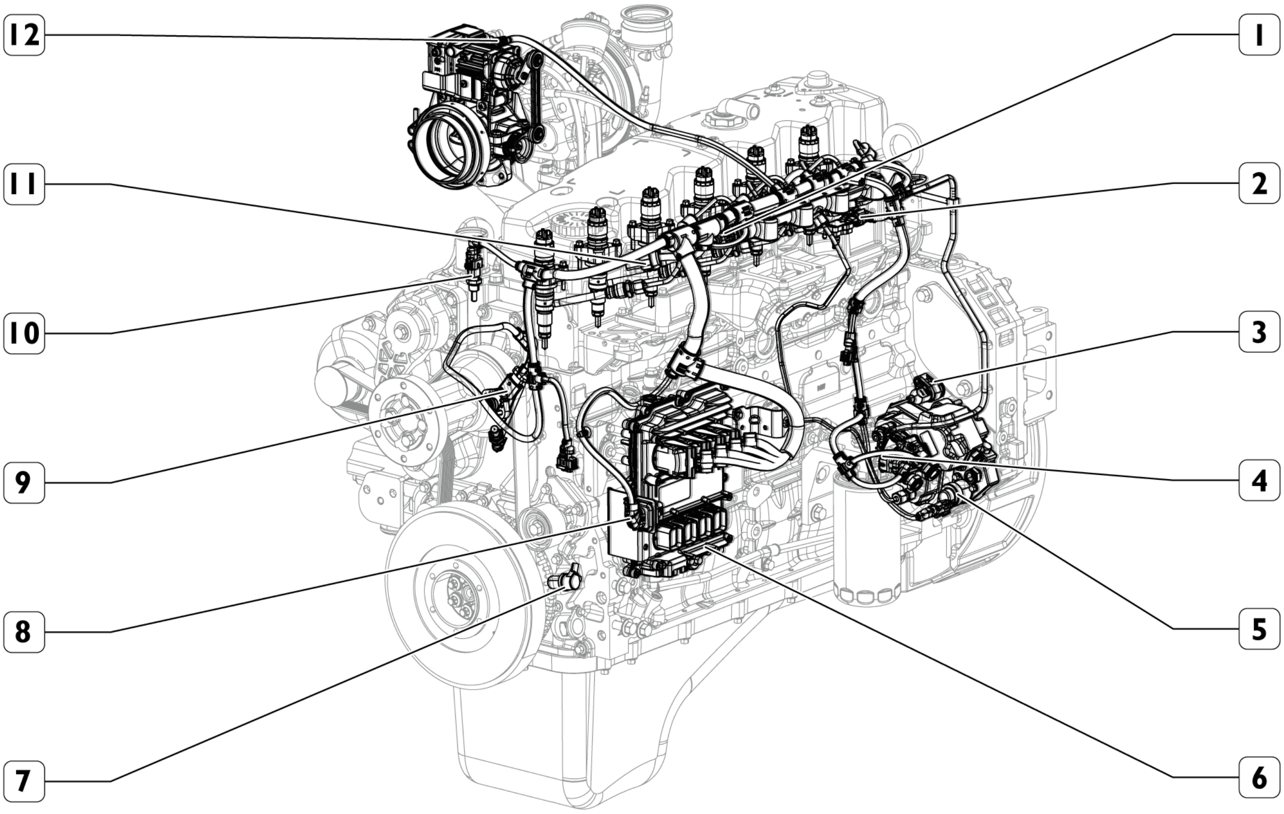
The quick coupling for the fuel return pipe **(11)** housed on the cylinder head, fit on the injector return, limits the return flow from the injectors.

Two by-pass valves are placed in parallel with the mechanical supply pump.

The by-pass valve **(17)** allows fuel to flow from mechanical pump outlet to its inlet, when the fuel filter inlet pressure exceeds the allowed threshold value.

The by - pass valve **(18)** allows the fuel supply system to be filled through the manual priming pump **(3)**.

Electric system



268007 3

(1) Rail pressure sensor - (2) Air temperature and boost pressure sensor - (3) Timing sensor - (4) Fuel temperature sensor - (5) High-pressure fuel pump dosing unit - (6) Engine control unit - (7) Engine speed sensor - (8) In-line connector - (9) Oil pressure and temperature sensor - (10) Coolant temperature sensor - (11) Injector connections - (12) Motorised throttle valve actuator connector

Sensors

Through the sensors, present on the engine, the ECU controls the engine operation.

Air pressure/temperature sensor

This component combines a temperature and a pressure sensor.

Fitted on the intake manifold, it measures the max. inlet air capacity to calculate precisely the fuel quantity to inject at every cycle.

The output voltage is proportional to the pressure or temperature measured by the sensor.

Engine oil temperature - pressure sensor

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

It measures the engine oil temperature and pressure.

Fuel pressure sensor

Assembled on one end of the rail, it measures the fuel pressure in the rail in order to determine the injection pressure.

The injection pressure value is used to control the pressure and to determine the 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.

Increment speed sensor (Crankshaft)

This is an inductive sensor located at the front of the engine. Signals generated through the magnetic flux that closes on the phonic wheel change their frequencies depending on crankshaft rotation speed.

Timing sensor

It is an inductive sensor located at the rear of the engine. It generates signals obtained from magnetic flux lines which close through the holes in gears fitted on the camshaft. The signal generated by this sensor is used by the electronic control unit as an injector timing signal.

Though being equal to the crankshaft sensor, it is NOT interchangeable since it has a different outside shape.

System functions

Self-diagnosis

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

Engine pre-heating resistance management

The pre-post heating is activated if even one of the water, air or fuel temperature sensors signals a temperature lower than **5 °C**.

Synchronisation 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 management

Depending on engine load, measured by processing signals coming from various sensors, the control unit controls the regulator in order to always have the 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 flow regulator and changes the injection time of injectors.

Within certain thresholds, it also takes into account the battery voltage.

Maximum speed limiting

Approaching the peak rpm, the ECU limits the fuel flow by reducing the opening time of the electro-injectors.

The maximum speed of engines is equal to **2375 +/- 50 RPM**. For speeds beyond that, the control unit deactivates the electro-injectors

Cut Off

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

- it cuts off supply to the electro-injectors;
- it re-activates the injectors shortly before idle speed is reached;
- operates 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 °C**C (measured by the sensor placed on fuel filter) the control unit intervenes and reduces the injection pressure.

If the temperature exceeds **90 °C**, the power is reduced to **60%**.

After Run

The engine stop request is processed by the control unit and is compared with the vehicle speed. Once the engine has stopped, the After-run procedure is launched i.e. the engine control unit microprocessor transfers some data from the main memory (volatile) to the non-volatile erasable and rewritable memory(EEprom) including the fault log, so that they are available at the next engine start (Run up).

Risk of damage
After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the “Key off”, the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

542010 FILTER ASSEMBLY - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

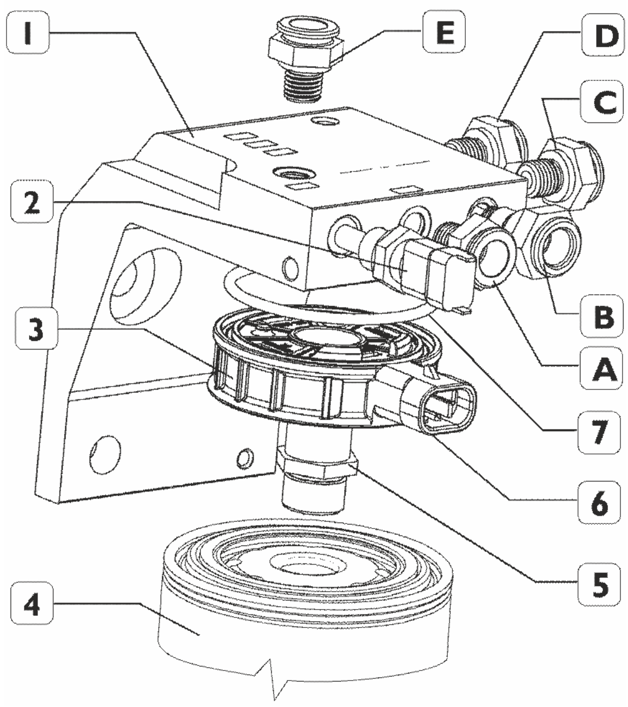
Fuel filter

Located on the base of the engine in the circuit between the fuel pump and the high pressure pump (CP3).

Fuel temperature sensor and heater resistances are located on the support.

The fuel temperature indicated by the relative sensor at the MD1CE101 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 °C**and is deactivated when the fuel temperature exceeds **5 °C**.



1

1. Fuel filter bracket
2. Fuel temperature sensor
3. Electric fuel heater
4. Fuel filter
5. Adapter
6. Heater connector
7. Gasket

Fuel filter connections:

A. Outlet connection to the high pressure pump
B. Outlet connection for the fuel drain in the tank
C. Inlet connection for the fuel drain from the high pressure pump
D. Inlet connection for the fuel drain from the common rail and injectors

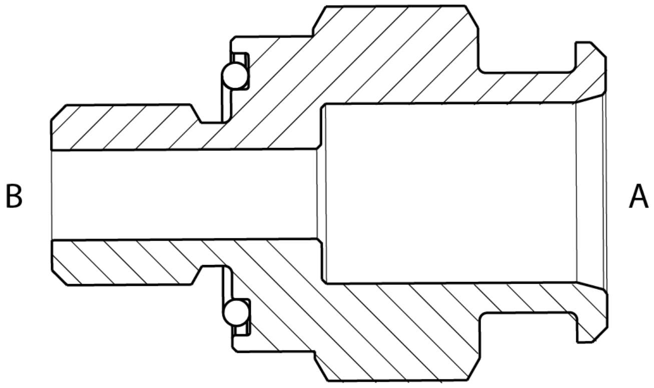
E. Inlet connection from the mechanical fuel pump

542020 PIPES - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Quick coupler for fuel return

Housed on the rear section of the cylinder head, it regulates the fuel return pressure from the injectors.



186859A 1

A. To tank

B. From electro-injectors

5420 FUEL FEED - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

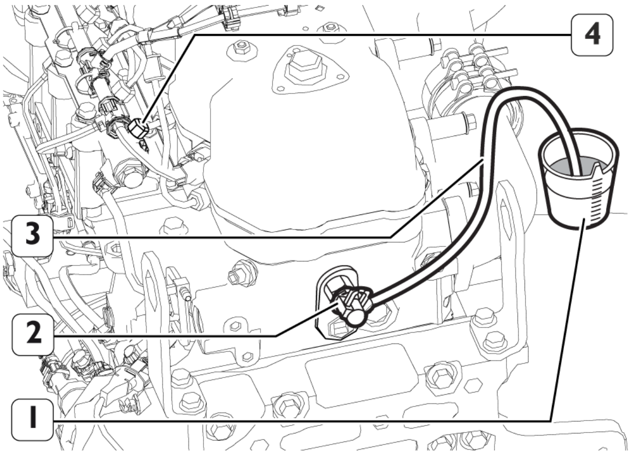
Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

Fuel recirculation test

1. Insert the cap **(4)** and connect the quick-fit coupling **(2)** on the pipe **(3)** to the measure **(1)** provided in the kit for checking the fuel circuit.

Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

2. First of all make sure that the idle engine speed is set to the default setting. Check the recirculating amounts of fuel from the cylinder head.
3. The conditions for measuring the amount of fuel return from the electro-injector are:
   1. engine idling and without air compressor or air conditioning system in operation
   2. engine at operating temperature (> **50 °C**)
4. The amount coming out must not exceed **90 mL** of diesel in **1 min**. The excess recirculation (more than **90 mL** of diesel/minute) can be caused by:
   1. incorrect coupling between one or more electro-injectors and the corresponding needles
   2. problem of an internal leak in the electro-injector
5. To identify the faulty electro-injector, follow the method indicated here.
6. Measure the amount of fuel coming out /minute from the coupling on the cylinder head with a graded container.
7. After having verified that the recirculation exceeds **90 mL** / minute, plug the rail outlet of the electro-injectors one at a time. The faulty electro-injector is the one whose exclusion will produce a significant reduction in recirculation. Remember that if an electro-injector is replaced, the duct also needs to be replaced.
8. After having identified the electro-injectors / ducts with high recirculating amounts, check that the ducts are tightened as required and, if they are loose, tighten them and then check the recirculating value again.
9. If the ducts are tightened correctly, remove the duct and check that the ball end facing the electro-injector is not deformed. If it is, replace it and check the recirculating value again. If the duct is not deformed, replace the electro-injector and the duct as there will be a leak inside the electro-injector.



255210 1

10. Check the recirculating value again.
11. The faulty electro-injector is the one whose exclusion produces a significant reduction in the recirculating amount.

Example:

Electro-injector removed	mL
1st electro-injector line removed and plugged	**100 mL**
2nd electro-injector line removed and plugged	**25 mL**
3rd electro-injector line removed and plugged	**100 mL**
4th electro-injector line removed and plugged	**100 mL**
5th electro-injector line removed and plugged	**100 mL**
6th electro-injector line removed and plugged	**100 mL**

12. The result indicates that there is probably a fault in electro-injector no. 2.

542010 FILTER ASSEMBLY - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Checking for water in fuel filter or pre-filter

NOTE: *The components of the common rail system can be quickly damaged if the fuel contains water or other impurities.*
Act quickly on the pre-filter (not available on the engine block) to drain any water from inside the fuel circuit.

542010 FILTER ASSEMBLY - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Remover,cartridge filter	99360076

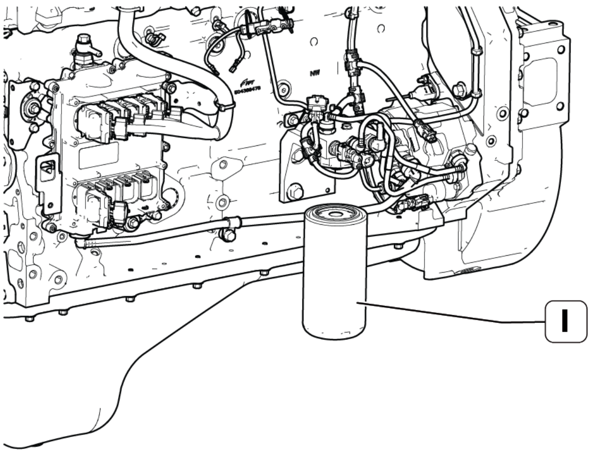
Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Drain the fuel from the filter by acting on the water bleeding valve plug.
2. Collect the fuel in a clean container.
3. Loosen the cartridge **(1)** using the designated tool.

Tool / Material	
Remover,cartridge filter	99360076

4. Collect any fuel still present in the filtering cartridge.
5. Clean the gasket seat on the support and lightly oil the gasket on the new filtering cartridge.
6. Manually tighten the new filtering cartridge until the gasket rests completely on its seat.
7. Tighten it further using the tool.

Tool / Material	
Remover,cartridge filter	99360076



267330 1

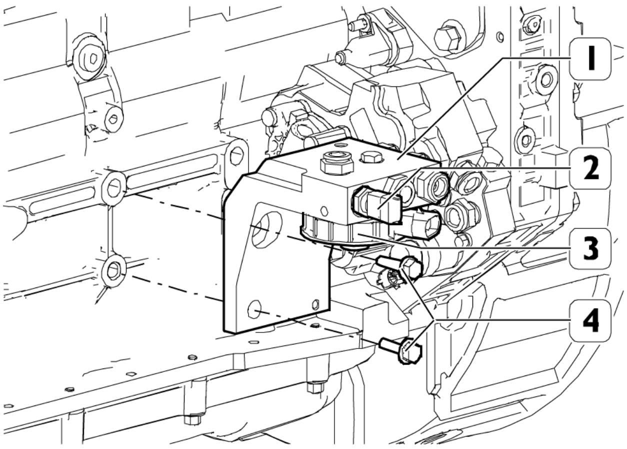
542014 FILTER SUPPORT - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Remove the engine cable as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Remove the fuel pipes as described in the procedure **PIPES - Remove (54.20)**.
3. Remove the fuel filter as described in the procedure **FILTER ASSEMBLY - Replace (54.20)**.
4. Position a container to collect the diesel under the fuel filter bracket **(1)**.
5. Unscrew the fastening screws **(4)** and remove the fuel filter bracket **(1)** together with the electric fuel pre-heater **(3)** and the fuel temperature sensor **(2)**.

NOTE: *Pay attention to the electric fuel pre-heater (if installed) and the relative electric connections.*

Description	Quantity	Value
Fuel filter bracket	2 screws M12x1.7 5x30	**80 +/- 8 N·m**



215018 1

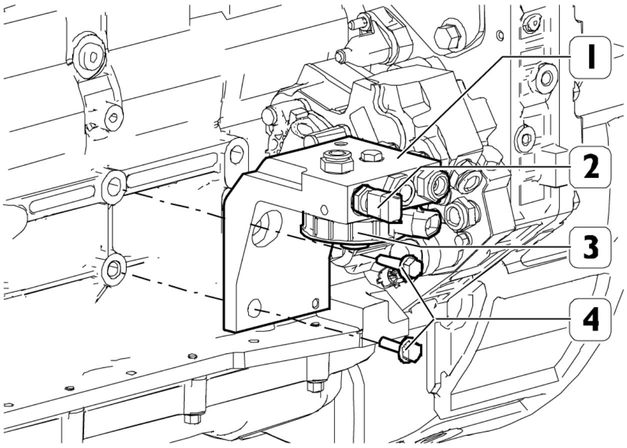
542014 FILTER SUPPORT - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Fuel filter bracket	2 screws M12x1.75x30	**80 +/- 8 N·m**

1. Position a container to collect the diesel under the fuel filter bracket **(1)**.
2. Fit the fuel filter support **(1)** together with the electric fuel pre-heater **(3)** and the fuel temperature sensor **(2)** on the crankcase and tighten the fastening screws **(4)**.

Description	Quantity	Value
Fuel filter bracket	2 screws M12x1.75x30	**80 +/- 8 N·m**



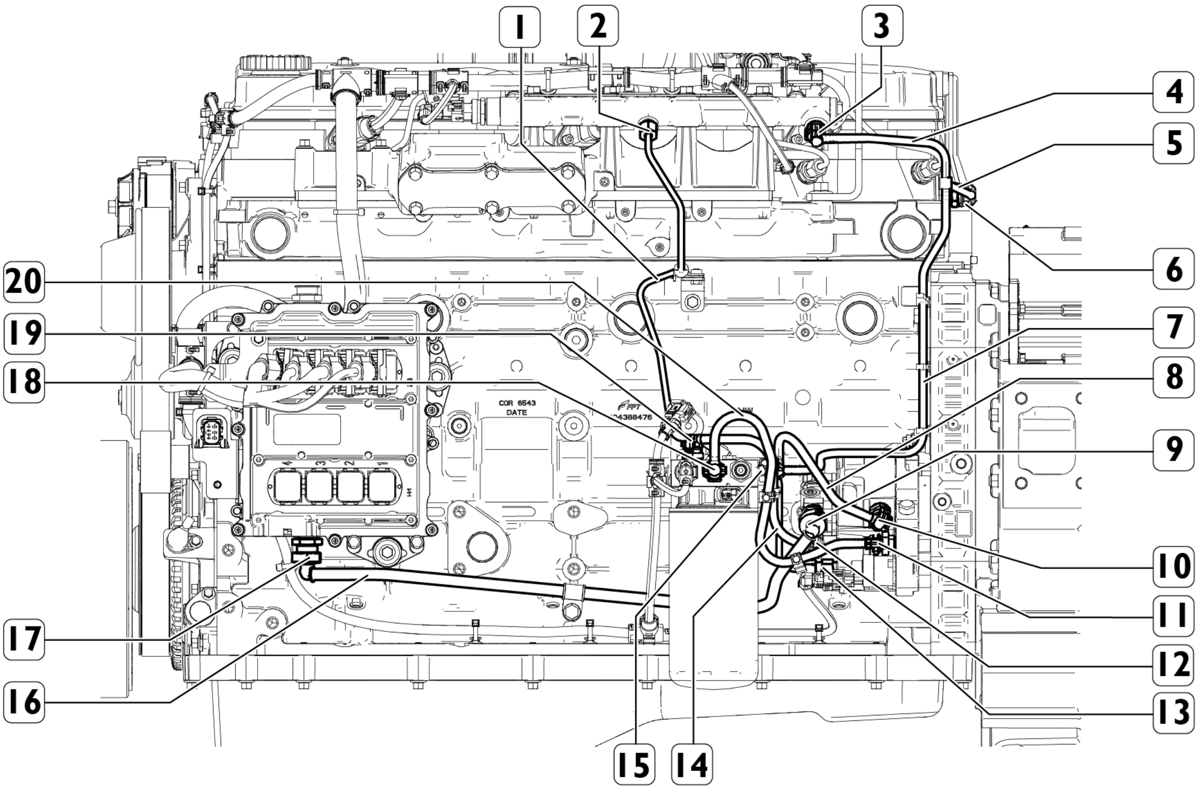
215018 1

3. Fit the fuel filter as described in the procedure **FILTER ASSEMBLY - Replace (54.20)**.
4. Fit the fuel pipes as described in the procedure **PIPES - Install (54.20)**.
5. Fit the engine cable as described in the procedure **ENGINE CABLES - Install (76.91)**.

542020 PIPES - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Removal and installation of fuel pipes



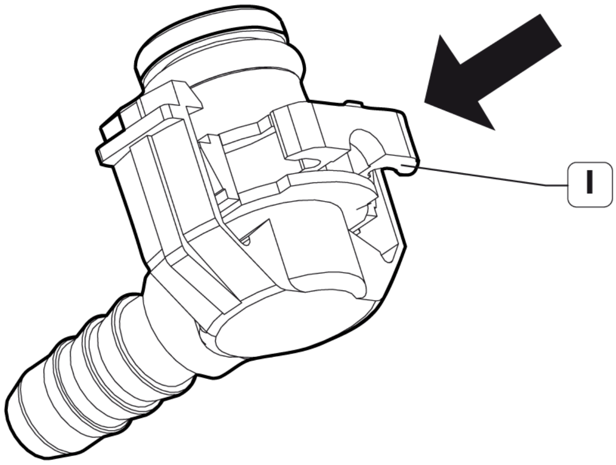
265945 1

1. Remove the engine cable as described in the relative procedure. Prepare a suitable container for collecting the fuel.
2. Disconnect the retainers **(11)** and **(18)** and remove the low-pressure **(20)** fuel pipe from the fuel filter to the high-pressure pump;
3. Disconnect the retainers **(9)** and **(17)** and remove the low-pressure fuel pipe **(16)** from the engine control unit heat exchanger to the mechanical pump;
4. Disconnect the retainers **(12)** and **(19)** and remove the low-pressure fuel pipe **(14)** from the mechanical pump to the fuel filter.
5. Disconnect the retainers **(10)** and **(15)** and remove the backflow fuel pipe **(8)** from the high-pressure pump to the fuel filter support;
6. Disconnect the retainers **(3)** and **(6)** and remove the fuel return pipes **(4)**, **(5)** and **(7)** from the common rail and electro-injectors to the fuel filter support.

7. Unscrew the hose couplings **(2)** and **(13)** of the high-pressure fuel pipe **(1)** from the high-pressure pump to the common rail;
8. Unscrew the screw fastening the pipe **(1)** to the engine block and remove it.

Description	Quantity	Value
Fuel pipe from high pressure pump to Common Rail	1 screw M8 x 1.25 x 20 +1 screw M8 x 1.25 x 16	**25 N·m**

9. To disconnect the low pressure/fuel return pipes from the relevant quick connecting joints, press and hold the locking retainer **(1)** as shown in the figure.

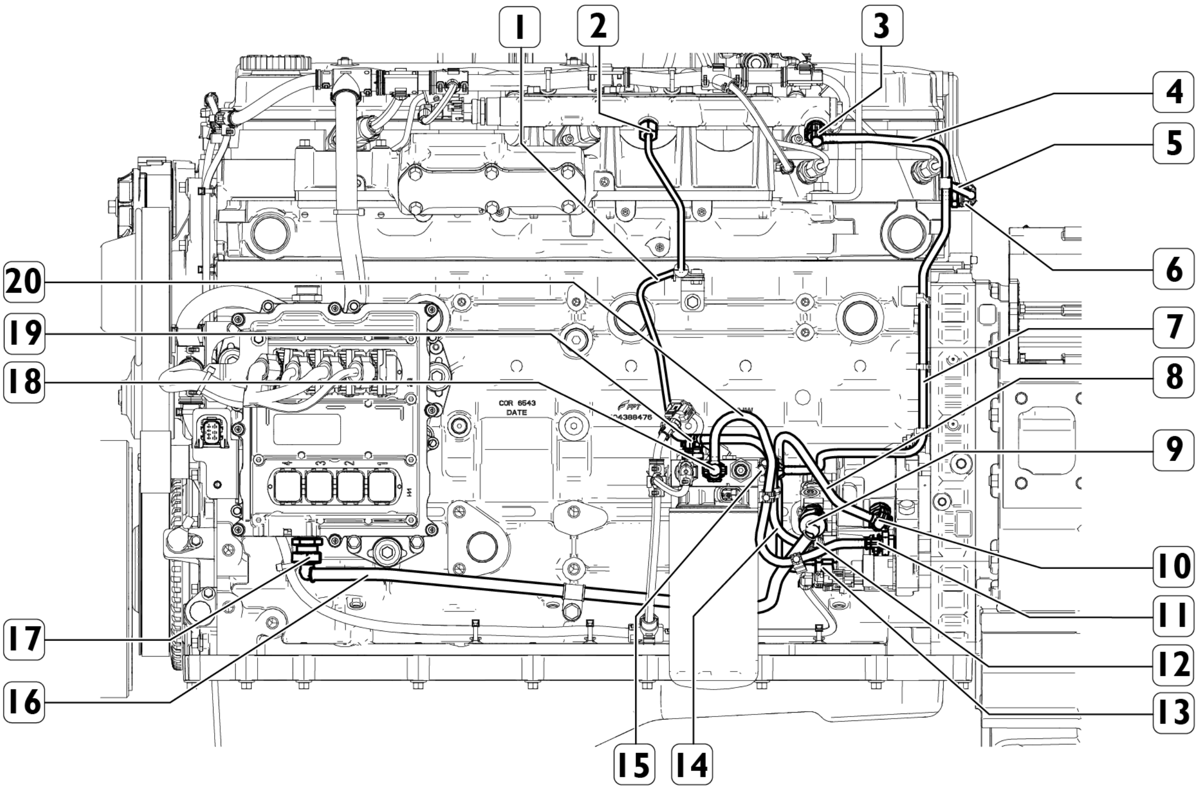


179038 2

542020 PIPES - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**



265945 1

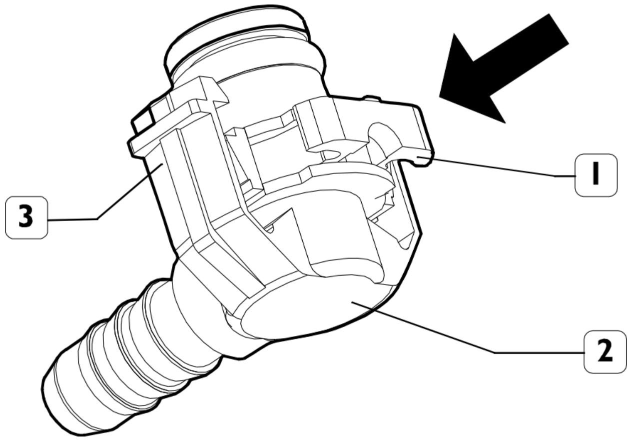
1. Fit the pipe **(1)** to the engine block and tighten the fastening screw to the prescribed torque.
2. Connect the high-pressure fuel pipe **(1)** to the high-pressure pump and the common rail and tighten the hose couplings **(2)** and **(13)** to the prescribed torque.

NOTE: *The high-pressure fuel pipe must be replaced each time it is disconnected. The fittings of the flexible pipes must be tightened to the specified torque.*

Description	Quantity	Step	Value
Fuel pipe from high pressure pump to Common Rail	2 fittings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**

3. Fit the fuel return pipes **(4)**, **(5)** and **(7)** from the common rail and electro-injectors to the fuel filter support and connect the retainers **(3)** and **(6)**.

4. Fit the backflow fuel pipe **(8)** from the high pressure pump to the fuel filter support and connect the retainers **(10)** and **(15)**.
5. Fit the low-pressure fuel pipe **(14)** from the mechanical pump to the fuel filter and connect the retainers **(12)** and **(19)**.
6. Fit the low pressure fuel pipe **(16)** from the engine control unit heat exchanger to the mechanical pump and connect the retainers **(9)** and **(17)**.
7. Fit the low-pressure fuel pipe **(20)** from the fuel filter to the high-pressure pump and connect the retainers **(11)** and **(18)**.
8. Install the engine cable as described in the procedure **ENGINE CABLES - Remove (76.91)**.
9. To connect the low-pressure fuel pipe to the connection fitting, insert the quick-release coupling **(2)** into the connection fitting and push in until the catch **(3)** engages.



116237 2

5424 SUPERCHARGING - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The turbocharging system consists of: an air filter, a turbocharger and an intercooler.

The air cleaner is a dry type composed of a filtering cartridge that is periodically changeable.

The function of the turbocharger is to use the energy of the engine's exhaust gas to deliver pressurised air to the cylinders.

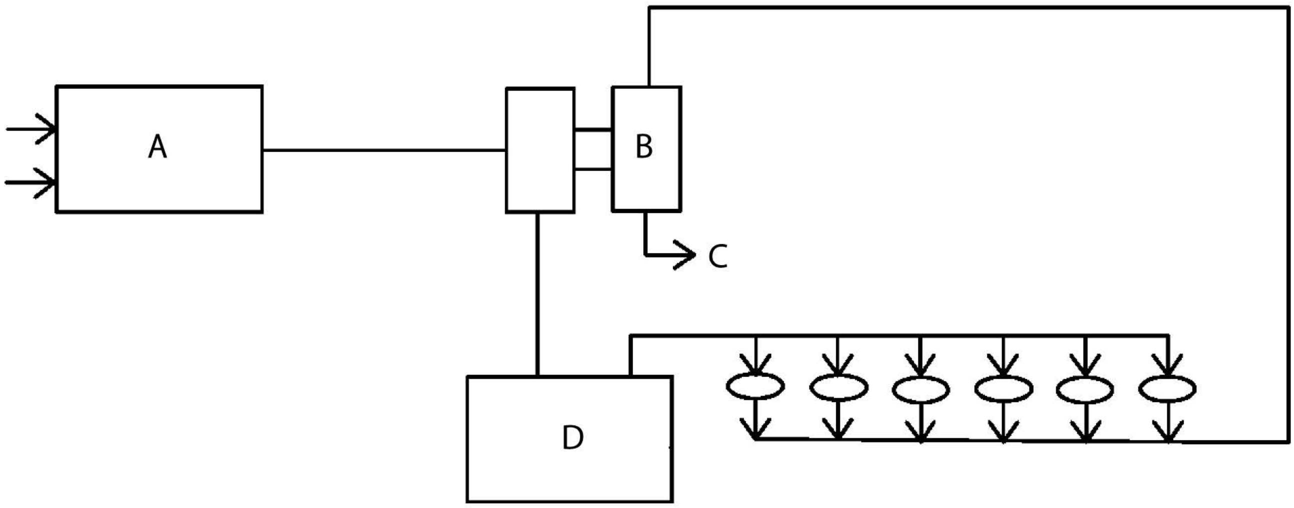
The intercooler is composed of a radiator applied on the engine coolant radiator, and it is used for lowering the temperature of the air coming out from the turbocharger to send it to the cylinders.

The turbocharging system consists of: an air filter, a turbocharger and an intercooler.

The air cleaner is a dry type composed of a filtering cartridge that is periodically changeable.

The function of the turbocharger is to use the energy of the engine exhaust gases to convey air under pressure to the cylinders.

The intercooler consists of a radiator applied to the engine coolant radiator. It serves to lower the temperature of the air coming out from the turbocharger before sending it to the cylinders.

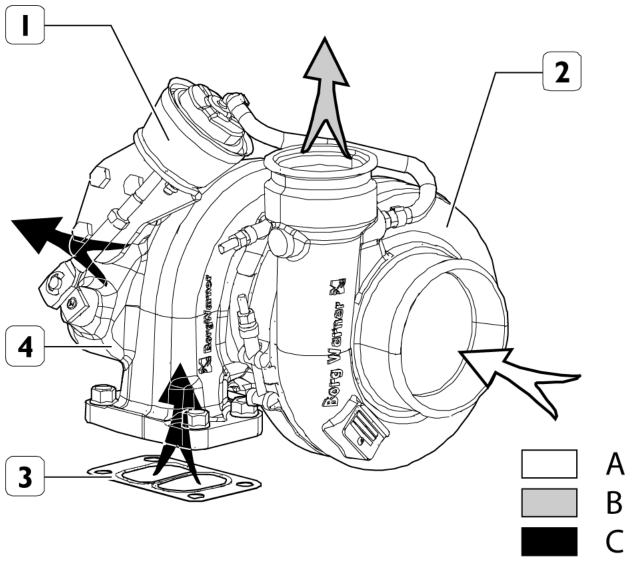


74195 1

542410 TURBO CHARGER - Overview BorgWarner waste-gate (WGT)

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The turbocharger is installed on the exhaust manifold.



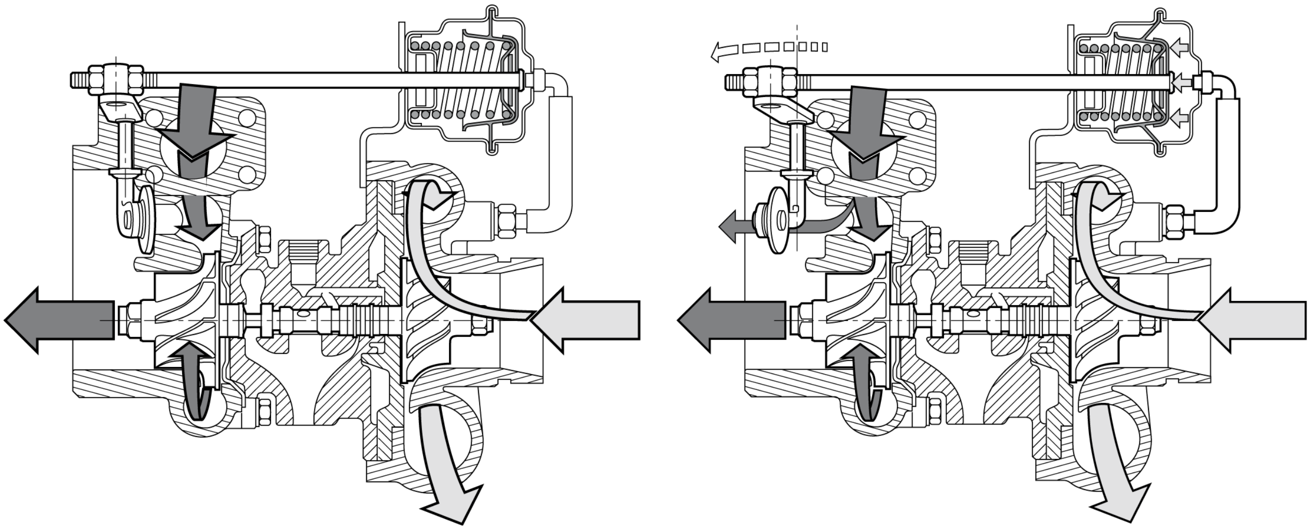
209192 1

A. Intake air
B. Compressed air
C. Exhaust gas

1. Waste-Gate valve
2. Air compressor
3. Gasket on exhaust manifold
4. Exhaust gas turbine

The turbocharger mainly consists of:

- 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;
- an overpressure relief valve (waste-gate) fitted to the turbine body. The function of this valve is to choke the exhaust gas outlet, by conveying part of the gas directly into the exhaust pipe, when the boosting pressure downstream of the turbocharger reaches the calibration value.



75532 2

DEMONSTRATIVE CROSS-SECTION OF A TURBOCHARGER WITH WASTE-GATE VALVE Throttle valve closed - Throttle valve open

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.*

Checking axial play of bearings.

Position the feeler of the magnetic-stand dial gauge on the turbocharger spindle end and set the dial gauge to zero.

Move the turbocharger shaft axially and check that the clearance is not higher than the prescribed value.

Where a different value is found, replace the turbocharger.

Turbocharger actuator

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.

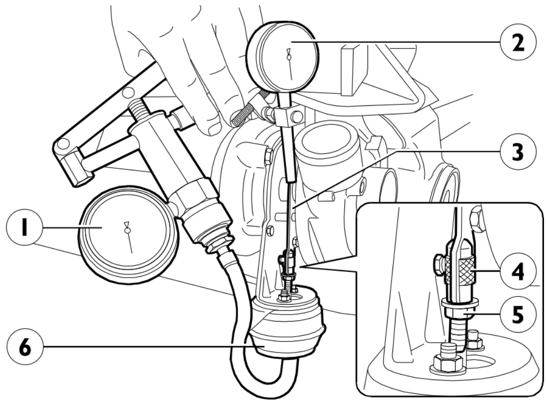
542418 WASTE GATE VALVE - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.

Check and adjustment



1

Cover the air, exhaust gas and lubricant oil inlets and outlets.

Thoroughly clean the outside of the turbocharger using an anti-corrosive and antioxidant fluid and check the actuator **(6)**.

Clamp the turbocharger in a vice.

Disconnect the actuator pipe **(6)** and fit the pipe of pump 99367121 to the actuator pipe **(1)** filler.

Apply the magnetic-base dial gauge **(2)** to the exhaust gas inlet flange in the turbine.

Position the dial gauge pointer **(2)** on the end of the tie rod **(3)** then set the dial gauge **(2)** to zero.

Use the pump **(1)** to blow compressed air into the actuator **(6)** at the specified pressure, making sure that this value stays constant for the entire duration of the check, if not replace the actuator **(6)**.

In the above-mentioned conditions, the tie rod must have carried out the required stroke.

NOTE: *During the operation, beat the actuator* ***(6)*** *slightly in order to eliminate possible sticking of the actuator internal spring.*

If a different value is found, loosen the nut **(5)** and act on the knurled ring nut **(4)**.

542410 TURBO CHARGER - Check

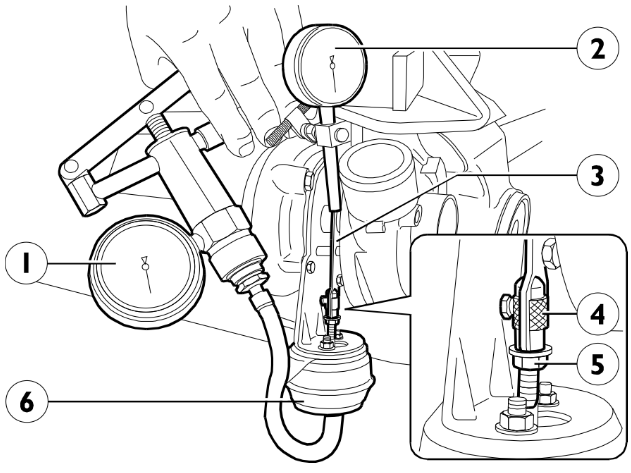
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Check and adjustment

1. Cover air, exhaust gas and lubricant inlets and outlets.
2. Thoroughly clean the outside of the turbocharger 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 the prescribed pressure) into the actuator **(6)**, then make sure that this pressure value will remain the same during the entire duration of the check. Otherwise, replace the actuator **(6)**.
8. In this set-up, the tie rod must have travelled by the specified distance.

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 act on the knurled ring nut **(4)**.



1

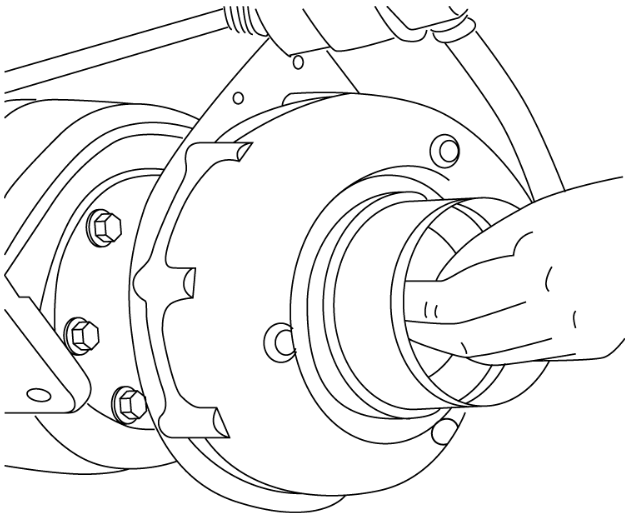
Control pressure	**2.5 +/- 0.005 bar**
Actuator stroke on control pressure	**3.25 +/- 0.4 mm**

542410 TURBO CHARGER - Visual inspection

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

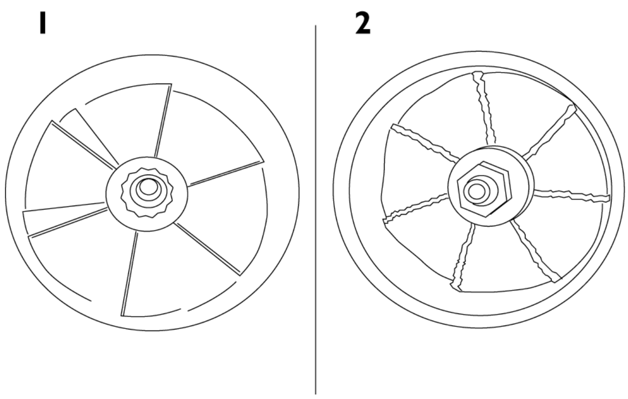
Turbocharger visual inspection

1. Only proceed with the engine stopped.
2. Manually tighten the shaft but allowing it still to rotate, and check for any jams.



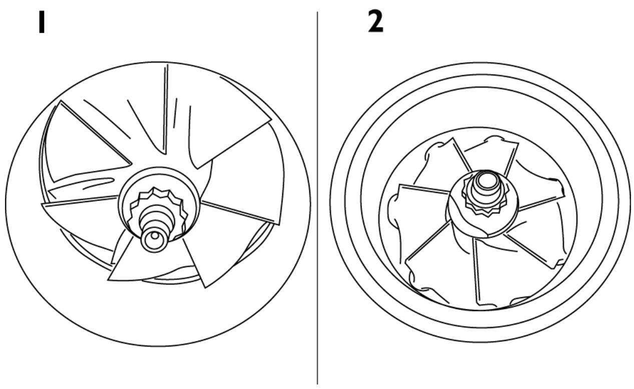
254423 1

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



254424 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

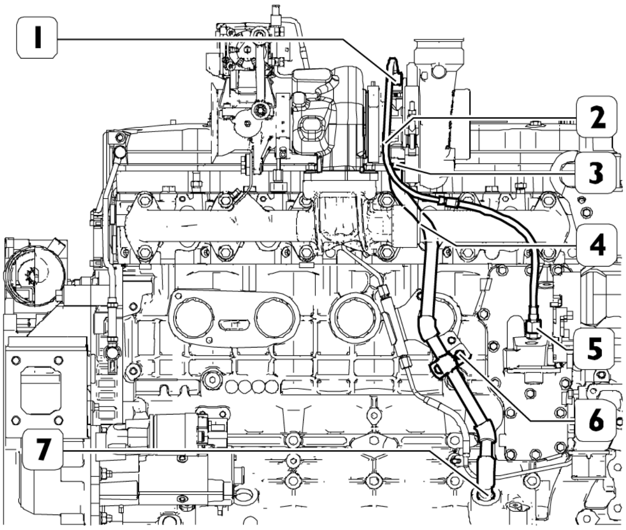


254425 3

542410 TURBO CHARGER - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

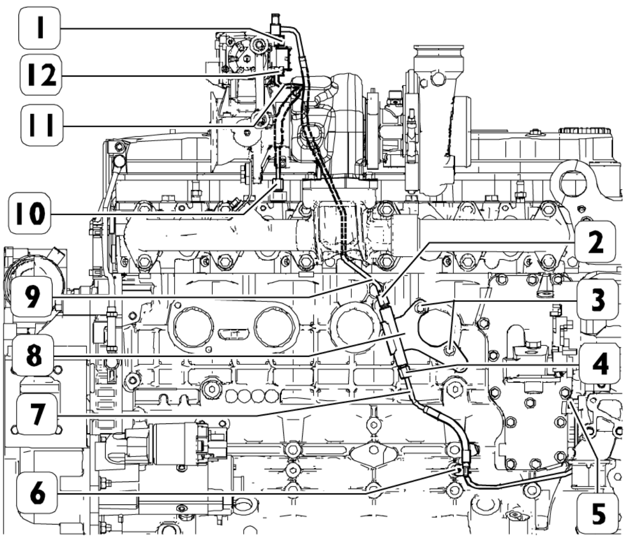
1. Remove the engine oil filter as described in the procedure **ENGINE OIL FILTER CARTRIDGE - Replace (54.30)**. Disconnect the engine cable from the motorised throttle valve as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Position a suitable container to collect the oil.
3. Unscrew the hose couplings **(1)** and **(5)** and remove the lubricating oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger.
4. Remove the lubricant oil drain pipe **(4)** from the turbocharger, proceeding as follows:
5. unscrew the mounting screws **(3)** on the lower part of the turbocharger, recovering the relative gasket.
6. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
7. unscrew the coupling **(7)** from the crankcase.



215023 1

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**

8. Position a suitable container to collect the coolant.
9. Remove the water inlet and outlet pipes of the motorised throttle valve by unscrewing the fastening nut **(2)** and the coupling **(1)** and remove the top section of the water return pipe **(9)**.
10. Unscrew the fastening nut **(4)**, the connector **(5)** and the screw **(6)** and remove the lower section water return pipe **(7)**.
11. Unscrew the fastening screws **(3)** and remove the water return pipe union **(8)**.
12. Unscrew the fastening nut **(10)** and the connector **(12)** and remove the water delivery pipe **(11)**.

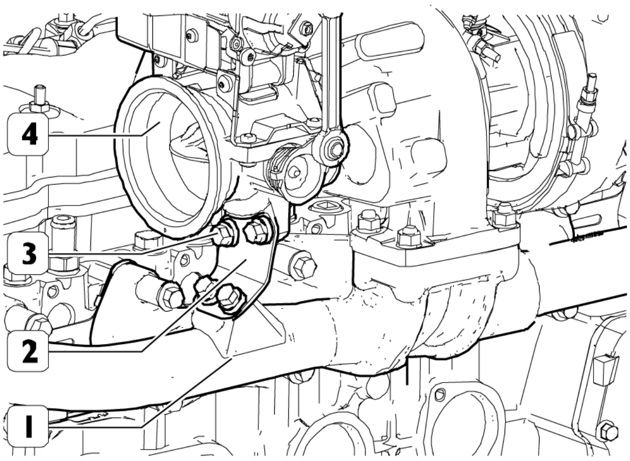


215024 2

Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**

13. Unscrew the fastening screws **(3)** and remove the bracket **(2)** fixing the motorized throttle valve **(4)** to the exhaust manifold **(1)**.

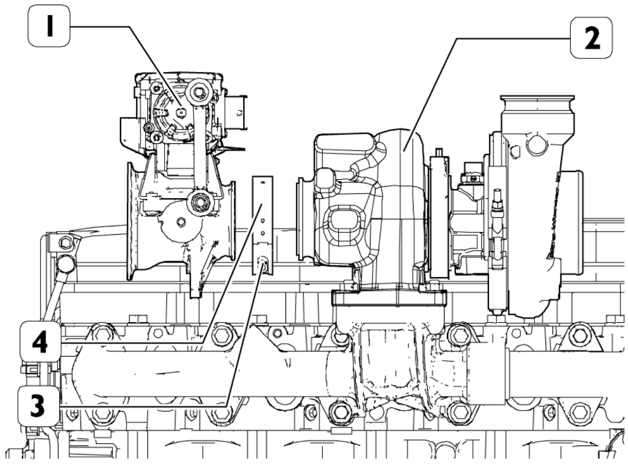
Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	**25 N·m**



215026 3

14. Unscrew the screw **(3)** and loosen the V-clamping collar **(4)** to remove the motorized throttle valve **(1)** from the turbocharger **(2)**.

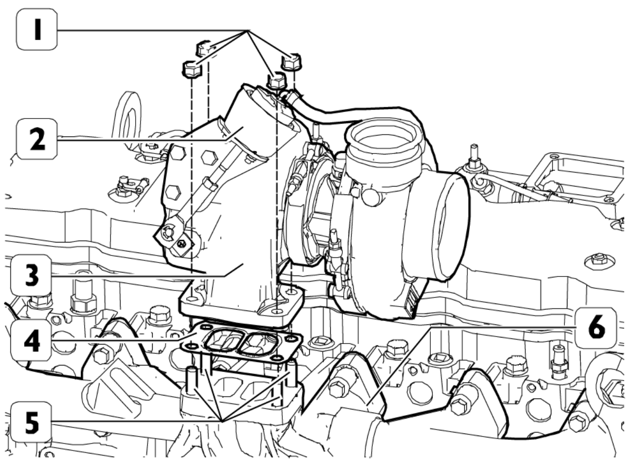
Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**



215025 4

15. Unscrew the fastening nuts **(1)** and remove the turbocharger **(3)** together with the waste-gate valve **(2)**, recovering the relevant gasket **(4)**.
16. Unscrew the studs **(5)** from the exhaust manifold **(6)**.

Description	Step	Value
Turbo charger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



214768 5

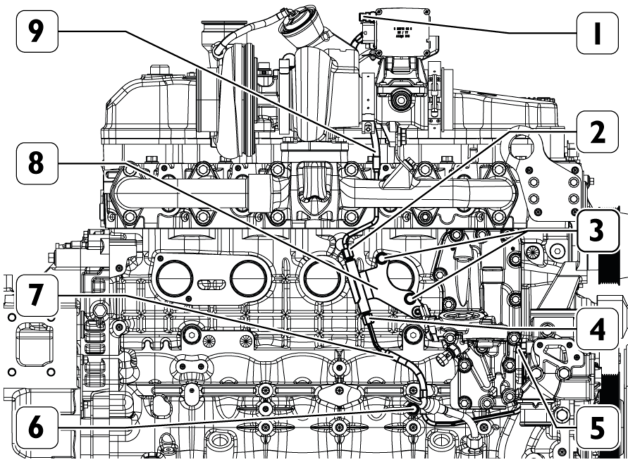
542410 TURBO CHARGER - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Throttle valve water pipe	1 connection M10 x 1	**20 +/- 2 N·m**
	1 fitting M12 x 1.5	**45 +/- 5 N·m**

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)
Prior operation:
ENGINE SUPPLY AIR FILTER - Remove (50.51)
Prior operation:
ENGINE OIL FILTER CARTRIDGE - Replace (54.30)
Prior operation:
ENGINE CABLES - Remove (76.91)

1. Position a suitable container to collect the oil.
2. Unscrew the hose couplings **(1)** and **(5)** and remove the lubricating oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger.
3. Remove the lubricant oil drain pipe **(4)** from the turbocharger, proceeding as follows:
4. unscrew the mounting screws **(3)** on the lower part of the turbocharger, recovering the relative gasket.
5. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
6. unscrew the coupling **(7)** from the crankcase.

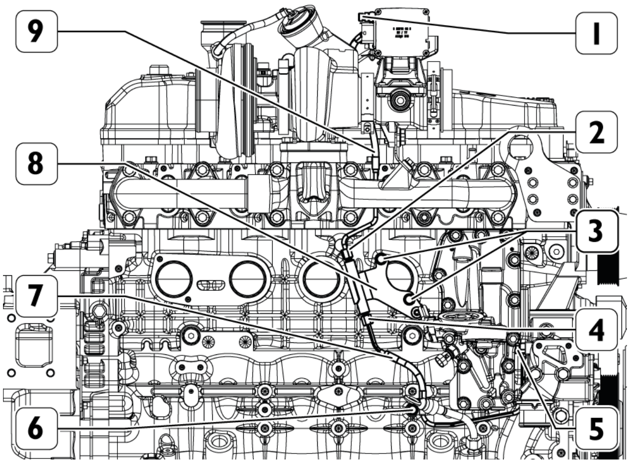


268011 1

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**

7. Position a suitable container to collect the coolant.
8. Remove the motorised throttle valve water inlet and outlet pipe proceeding as follows, unscrewing the fastening nut **(2)** and the fitting **(1)** and remove the top part of the water return pipe **(9)**.
9. Unscrew the fastening nut **(4)**, the connector **(5)** and the screw **(6)** and remove the lower section water return pipe **(7)**.
10. Unscrew the fastening screws **(3)** and remove the water return pipe union **(8)**.

Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**



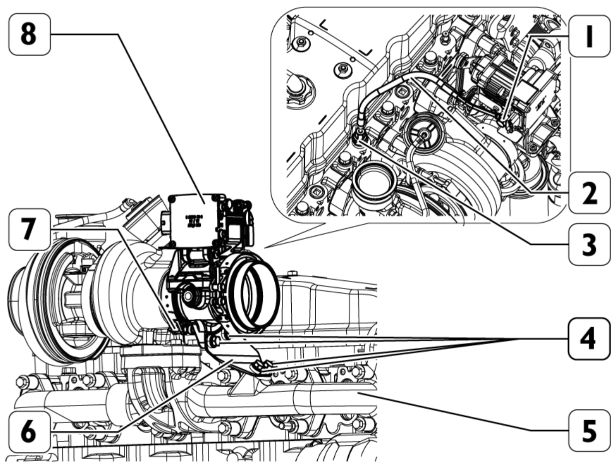
268011 2

11. Unscrew the fastening screws **(4)** and remove the bracket **(6)** fixing the motorised throttle valve **(8)** to the exhaust manifold **(5)**.

Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25	**25 N·m**

12. Unscrew the connection **(1)** and the fitting **(3)** and remove the water delivery pipe **(2)** to the valve.

Description	Step	Value
Throttle valve water pipe	1 connection M10 x 1	**20 +/- 2 N·m**
	1 fitting M12 x 1.5	**45 +/- 5 N·m**



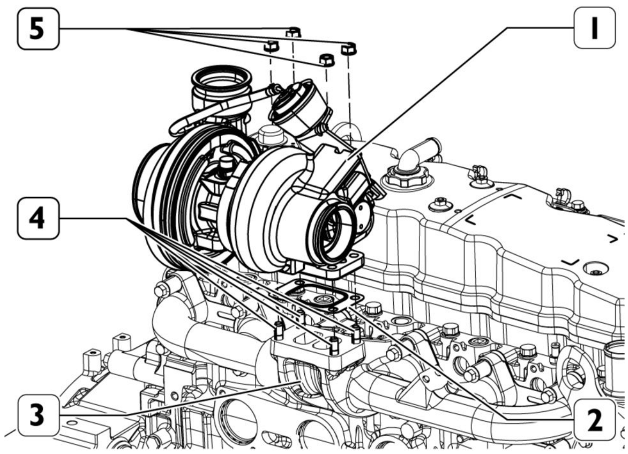
268012 3

13. Unscrew the screw **(7)** and loosen the V-clamping collar to remove the motorized throttle valve **(8)** from the turbocharger .

Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**

14. Unscrew the fastening nuts **(5)** and remove the turbocharger **(1)**, recovering the relevant gasket **(2)**.
15. Unscrew the studs **(4)** from the exhaust manifold **(3)**.

Description	Step	Value
Turbocharger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



268013 4

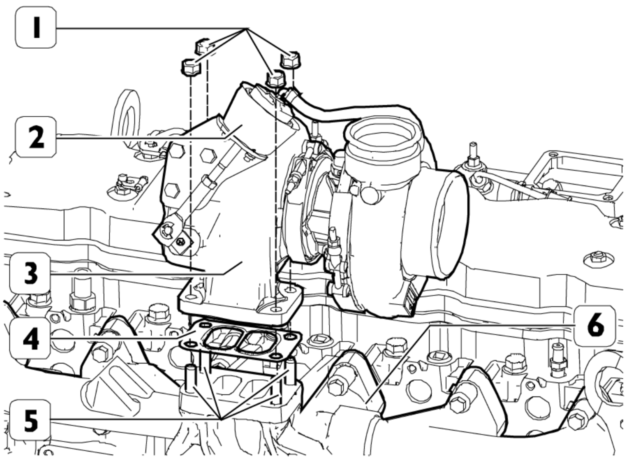
542410 TURBO CHARGER - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Description	Quantity	Step	Value
Turbo charger		4 nuts M10 x 1.5	**45 +/- 2 N·m**
		4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50		**6 +/- 1 N·m**

1. Fit the turbocharger **(3)**:
2. screw the studs **(5)** onto the exhaust manifold **(6)**.
3. hold the turbocharger **(3)** together with the waste-gate valve **(2)** and place it on the exhaust manifold **(6)** after having inserted a new gasket **(4)**.
4. Tighten the fastening nuts **(1)** to the prescribed torque.

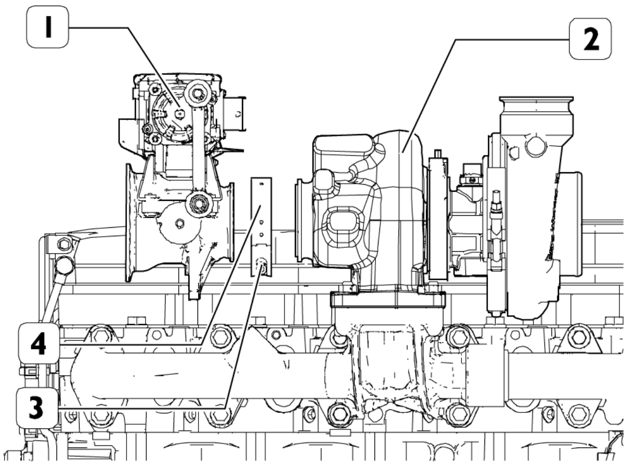
Description	Step	Value
Turbo charger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



214768 1

5. Install the motorized throttle valve **(1)** onto the turbocharger **(2)**.
6. Turn the screw **(3)** and tighten the V-clamping collar **(4)** to a torque of.

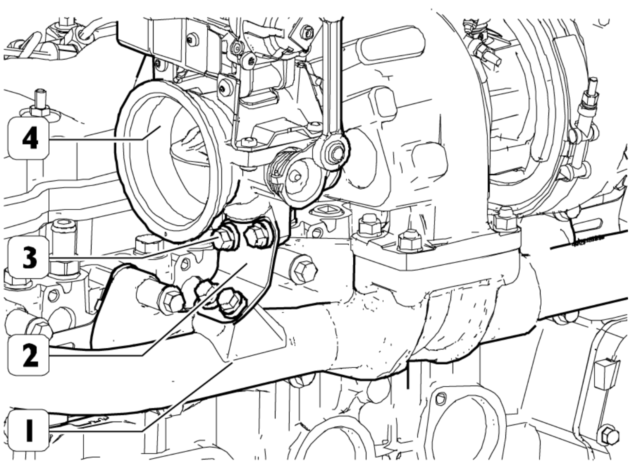
Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**



215025 2

7. Assemble the bracket **(2)** fixing the motorized throttle valve **(4)** to the exhaust manifold **(1)** and tighten the fastening screws **(3)** to the prescribed torque.

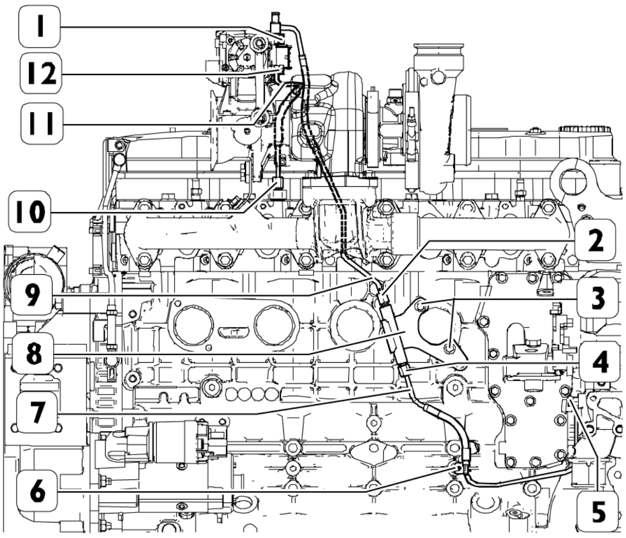
Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screwsM8 x 1.25 x 25	**25 N·m**



215026 3

8. Install the motorized throttle valve water inlet and outlet pipes as follows:
9. Fit the water delivery pipe **(11)** and tighten the fastening nut **(10)** and the fitting **(12)** to the prescribed torque.
10. Fit the water return pipe union **(8)** and tighten the fastening screws **(3)** to the specified torque.
11. Fit the lower-section water return pipe **(7)** and tighten the fastening nut **(4)**, connector **(5)** and screw **(6)** to the prescribed torque.
12. Fit the upper-section water return pipe **(9)** and tighten the fastening nut **(2)** and connector **(1)** to the prescribed torque.

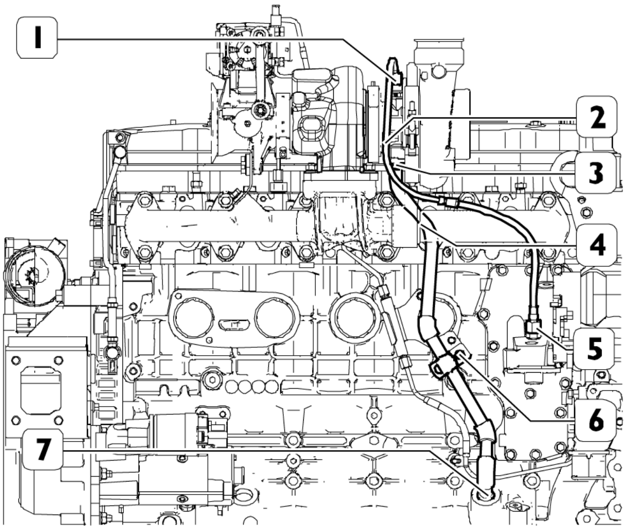
Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**



215024 4

13. Fit the lubricant oil drain pipe **(4)** onto the turbocharger, proceeding as follows:
14. Screw the coupling **(7)** on the crankcase.
15. Screw the fastening screws **(3)** into the lower part of the turbocharger, after fitting a new gasket.
16. Unscrew the screw **(6)** securing the pipe **(4)** to the engine block by means of the fastening collar.
17. Install the lubricant oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger and tighten the hose couplings **(1)** and **(5)** to the prescribed torque.

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**



215023 5

18. Connect the engine cable to the motorised throttle valve as described in the procedure **ENGINE CABLES - Install (76.91)**.
19. Fit the engine oil filter as described in the procedure **ENGINE OIL FILTER CARTRIDGE - Replace (54.30)**.

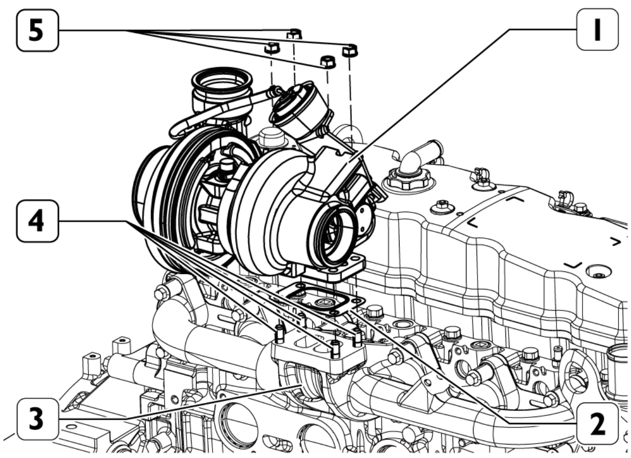
542410 TURBO CHARGER - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25		**25 N·m**
Motorized throttle valve water pipes		2 fittings M10 x 1	**20 N·m**
		3 nuts M12 x 1.5	**45 N·m**
		2 screws M8 x 20	**23 +/- 2,3 N·m**
		1 fitting M10 x 1	**25 N·m**
		1 screw M8 x 16	**23 +/- 2,3 N·m**
Throttle valve water pipe		1 connection M10 x 1	**20 +/- 2 N·m**
		1 fitting M12 x 1.5	**45 +/- 5 N·m**
Turbocharger		4 nuts M10 x 1.5	**45 +/- 2 N·m**
		4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50		**6 +/- 1 N·m**
Turbocharger lubrication oil pipes		2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
		2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
		2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**

1. Fit the turbocharger **(1)**:
2. screw the studs **(4)** onto the exhaust manifold **(3)**.
3. Hold the turbocharger **(1)** and place it on the exhaust manifold **(3)** correctly positioning a new gasket **(2)**.
4. Tighten the fastening nuts **(1)** to the prescribed torque.

Description	Step	Value
Turbocharger	4 nuts M10 x 1.5	**45 +/- 2 N·m**
	4 studs M10 x 1.5 x 42	**25 +/- 5 N·m**



268013 1

5. Install the motorized throttle valve **(8)** onto the turbocharger .
6. Turn the screw **(7)** and tighten the V-clamping collar to a torque of.

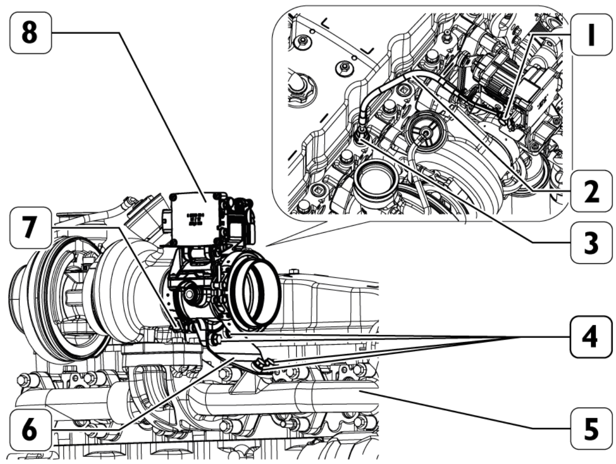
Description	Quantity	Value
Turbocharger exhaust outlet to throttle valve	1 screw M6 x 1 x 50	**6 +/- 1 N·m**

7. Correctly position the water delivery pipe **(2)** to the valve and tighten the connection **(1)** and the fitting **(3)**.

Description	Step	Value
Throttle valve water pipe	1 connection M10 x 1	**20 +/- 2 N·m**
	1 fitting M12 x 1.5	**45 +/- 5 N·m**

8. Assemble the bracket **(6)** fixing the motorized throttle valve **(8)** to the exhaust manifold **(5)** and tighten the fastening screws **(4)** to the prescribed torque.

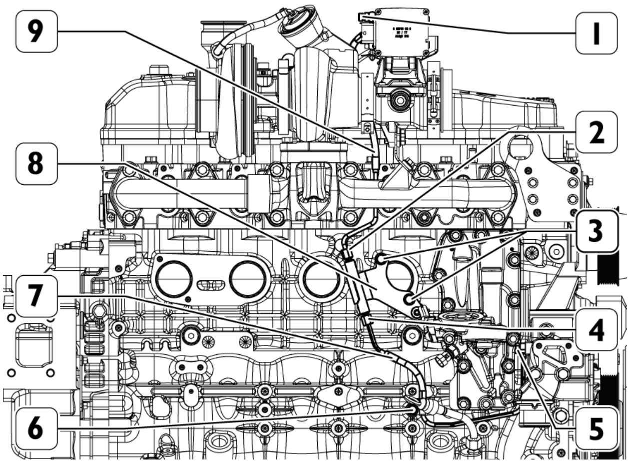
Description	Quantity	Value
Bracket fixing motorized throttle valve to exhaust manifold	4 screws M8 x 1.25 x 25	**25 N·m**



268012 2

9. Install the motorized throttle valve water inlet and outlet pipes as follows:
10. Fit the water return pipe union **(8)** and tighten the fastening screws **(3)** to the specified torque.
11. Fit the lower-section water return pipe **(7)** and tighten the fastening nut **(4)**, connector **(5)** and screw **(6)** to the prescribed torque.
12. Fit the upper-section water return pipe **(9)** and tighten the fastening nut **(2)** and connector **(1)** to the prescribed torque.

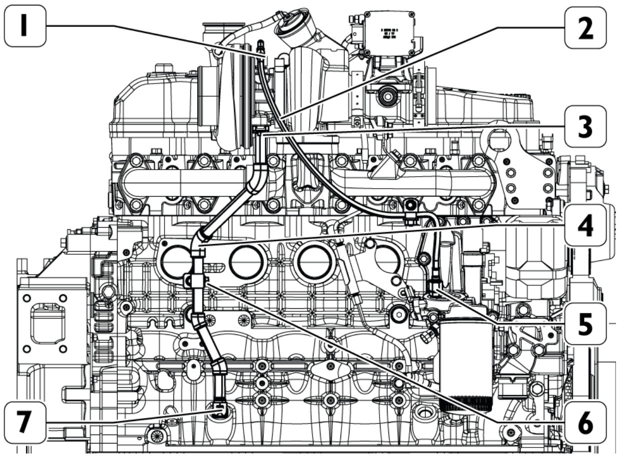
Description	Step	Value
Motorized throttle valve water pipes	2 fittings M10 x 1	**20 N·m**
	3 nuts M12 x 1.5	**45 N·m**
	2 screws M8 x 20	**23 +/- 2,3 N·m**
	1 fitting M10 x 1	**25 N·m**
	1 screw M8 x 16	**23 +/- 2,3 N·m**



268011 3

13. Fit the lubricant drain pipe **(4)** on the turbocharger, screwing the fitting **(7)** onto the crankcase.
14. Screw the fastening screws **(3)** into the lower part of the turbocharger, after fitting a new gasket.
15. Unscrew the screws **(6)** securing the pipe **(4)** to the crankcase by means of the fastening collar.
16. Install the lubricant oil delivery pipe **(2)** from the upper part of the heat exchanger to the turbocharger and tighten the hose couplings **(1)** and **(5)** to the prescribed torque.

Description	Step	Value
Turbocharger lubrication oil pipes	2 nuts 11 / 16 - 16 M16	**36 +/- 5 N·m**
	2 screws M8 x 1.25 x 25	**23 +/- 2 N·m**
	2 screws M8 x 1.25 x 16	**23 +/- 2 N·m**



268009 4

Next operation:
ENGINE CABLES - Remove (76.91)
Next operation:
ENGINE OIL FILTER CARTRIDGE - Replace (54.30)
Next operation:
ENGINE SUPPLY AIR FILTER - Install (50.51)
Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

5430 LUBRICATION - Overview

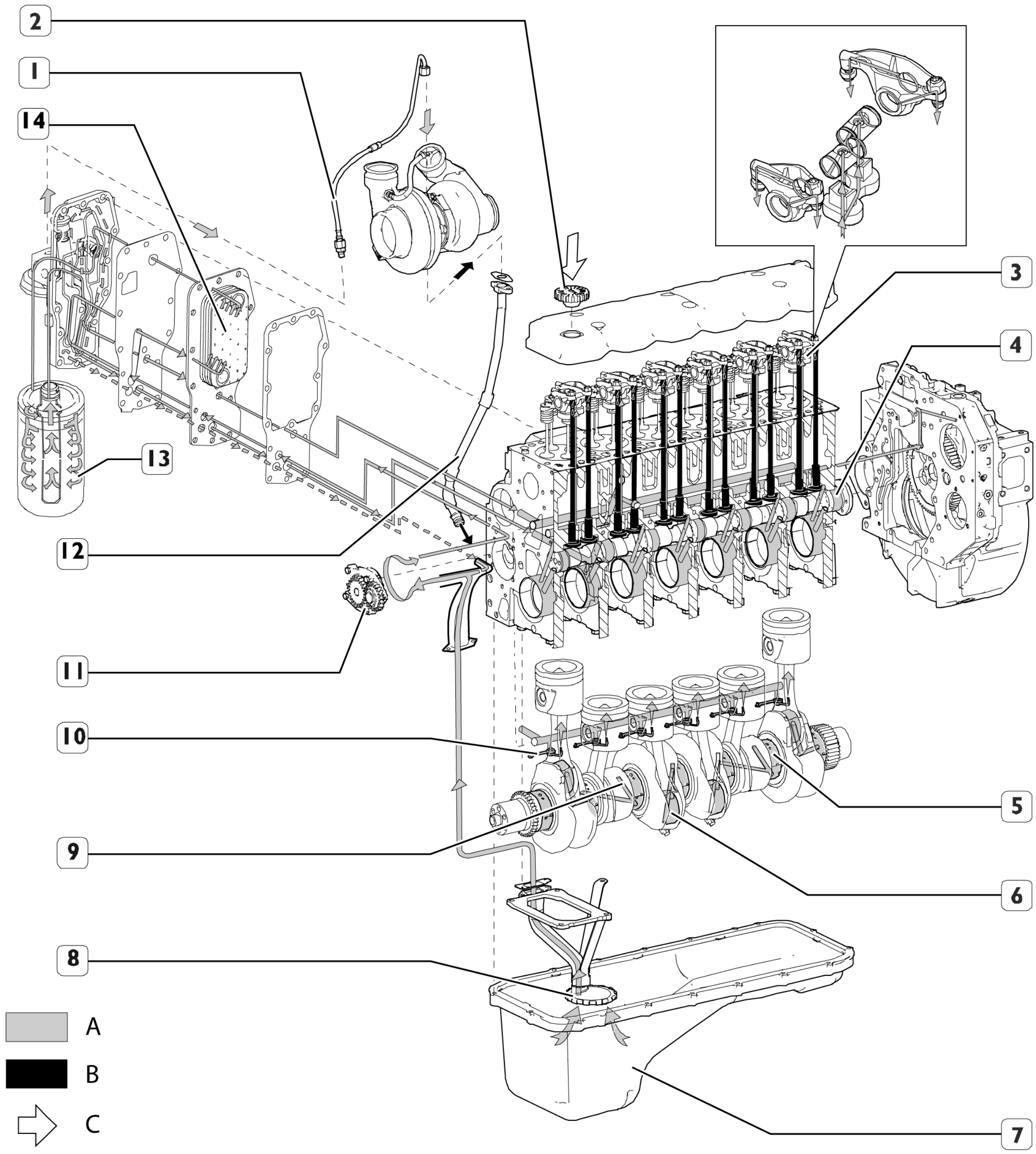
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The forced circulation lubrication is carried out by the rotor oil pump, housed in the front part of the crankcase and driven by the straight-toothed gear keyed to the crankshaft tang.

The lubricant oil is conveyed from the oil sump to the crankshaft, to the camshaft and to the valve control.

Lubrication also includes the heat exchanger, the turbocharger and the compressor if there is a compressed air system.

All these components often vary depending on use and are therefore dealt with in the specific part of the manual.



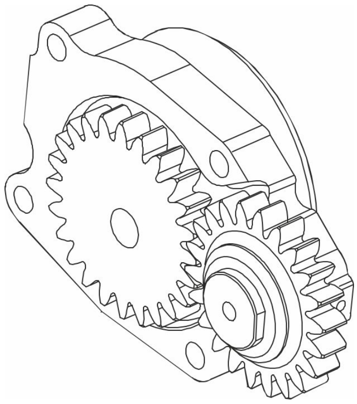
215007 1

(1) Turbocharger lubrication oil delivery pipe – (2) Lubricant oil filler plug – (3) Rocker arm shaft hole – (4) Camshaft bush – (5) Main half-bearings – (6) Connecting rod half-bearings – (7) Oil sump – (8) Oil suction – (9) Crankshaft transverse channels – (10) Piston cooling nozzles – (11) Rotary oil pump – (12) Turbocharger lubrication oil discharge pipe – (13) Oil filter – (14) Lubricant oil / coolant heat exchanger

A. Oil circuit under pressure
B. Oil return to sump by fall
C. Oil filling

543010 OIL PUMP - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



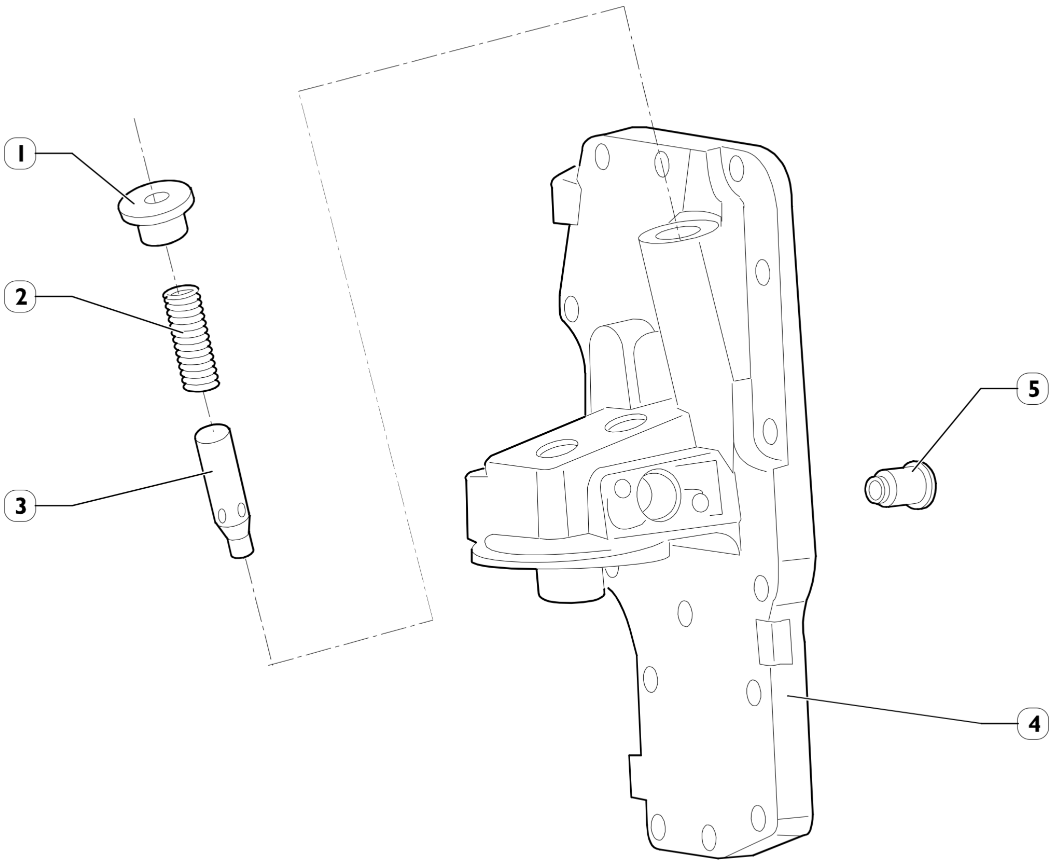
70576 1

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 shall not be overhauled. If faults are found, replace it.*

543075 OIL PRESSURE ADJUSTMENT VALVE - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



107418 1

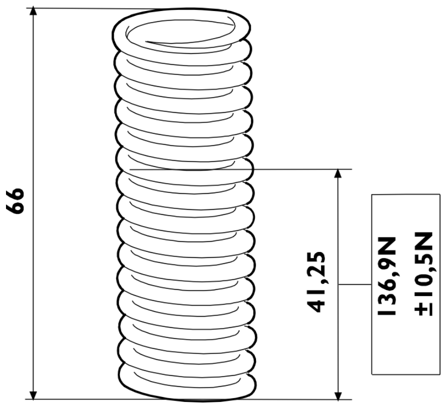
Unscrew the plug **(1)**, remove the spring **(2)** and the control valve **(3)** from the support **(4)**.

Check whether the valve **(3)** is not scored and is sliding smoothly into its seat. The spring **(2)** shall not be broken or yielded.

Pressure regulation at **100 °C** oil temperature:

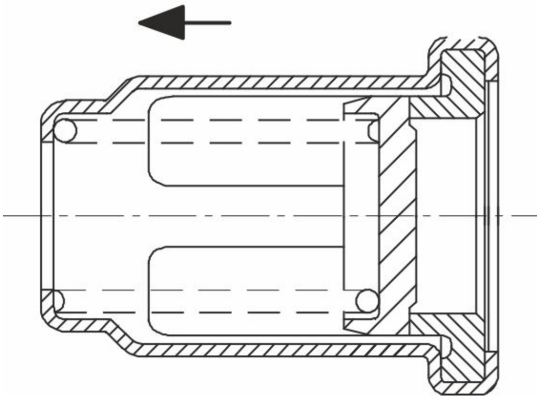
- min pressure: **1,2 bar**
- maximum pressure: **3,8 bar**

By-pass valve **(5)** to cut out clogged oil filter.



107419 2

MAIN DATA TO CHECK THE OIL PRESSURE RELIEF VALVE SPRING



70482 3

Max. seepage: **20 cm³/l** at a pressure of **0,83 bar** and an oil temperature of **26,7 °C**.

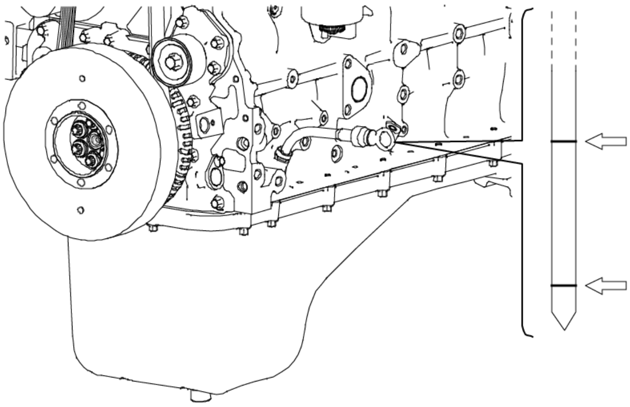
543070 ENGINE OIL FILTER CARTRIDGE - Visual inspection

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Engine lubricant oil level check

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Only proceed when the engine is not turning and is at low temperature in order not to run the risk of burns.
2. Use the oil dipstick to check that the lubricant oil level is between the "Min" and "Max" limits.
3. If the level is insufficient, it is necessary to top up with lubricant oil which meets the international specifications ACEA E5 (high power engines): Remove the lubricant oil cap and pour engine lubricant oil through the hole.
4. Use the oil dipstick to check that the lubricant oil level does not exceed the "Max" limit.



202110 1

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

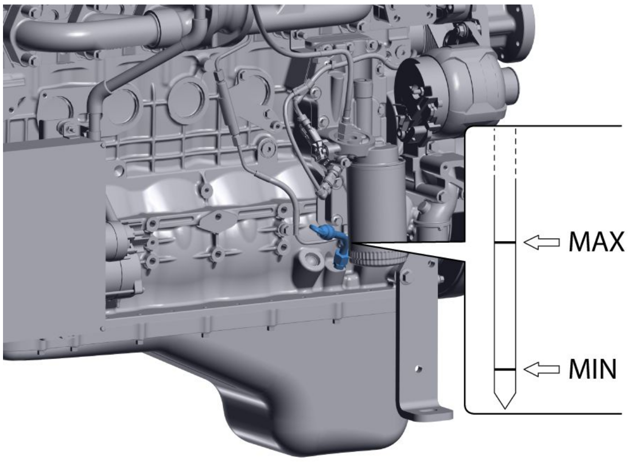
543070 ENGINE OIL FILTER CARTRIDGE - Visual inspection

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Engine lubricant oil level check

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Only proceed when the engine is not turning and is at low temperature in order not to run the risk of burns.
2. Use the oil dipstick to check that the lubricant oil level is between the "Min" and "Max" limits.
3. If the level is too low, top-up with lubricant oil meeting the requirements of international standards ACEA E5 (high engine power): remove the lubricant oil filler plug and introduce engine oil through the hole.
4. Use the oil dipstick to check that the lubricant oil level does not exceed the "Max" limit.



267991 1

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

543070 ENGINE OIL FILTER CARTRIDGE - Change fluid

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. It is recommended to drain the oil when the engine is hot.
2. Position an appropriate container for the oil collection under the sump in line with the drain plug.
3. Unscrew the cap and then remove the oil level dipstick and the filler plug to facilitate the lubricant oil flow.

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

4. When draining has been completed, screw in the plug and then fill with clean oil.

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

5. Check the level with the dipstick until obtaining a filling near the maximum level notch shown on the dipstick.

543070 ENGINE OIL FILTER CARTRIDGE - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**

Tool / Material	
Remover,cartridge filter	99360076

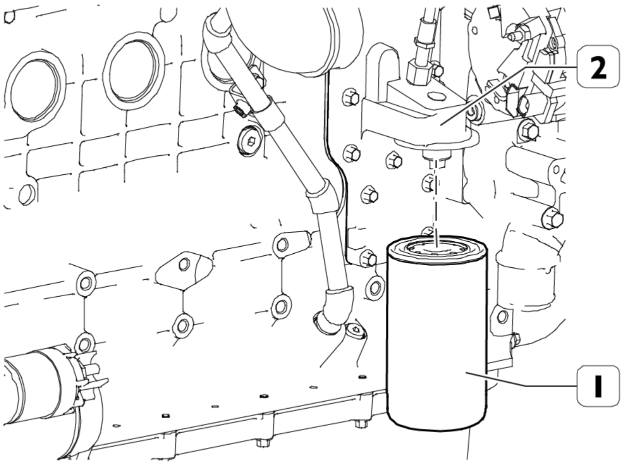
Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

NOTE: *The oil filter must be replaced when the lubricant oil is changed.*

1. Proceed only with engine not running and at low temperature to avoid any risk of burns.
2. Position a container to recover the oil.
3. Use the designated tool to unscrew the oil filter **(1)**.

Tool / Material	
Remover,cartridge filter	99360076

Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**



202120 1

4. Risk of skin irritation or allergic reactions
The engine oil is highly pollutant and harmful.
In case of contact with skin, wash thoroughly with water and detergent.
Suitably protect skin and eyes; take measures as set forth by safety regulations.
Failure to comply with these prescriptions can result in the risk of serious injury

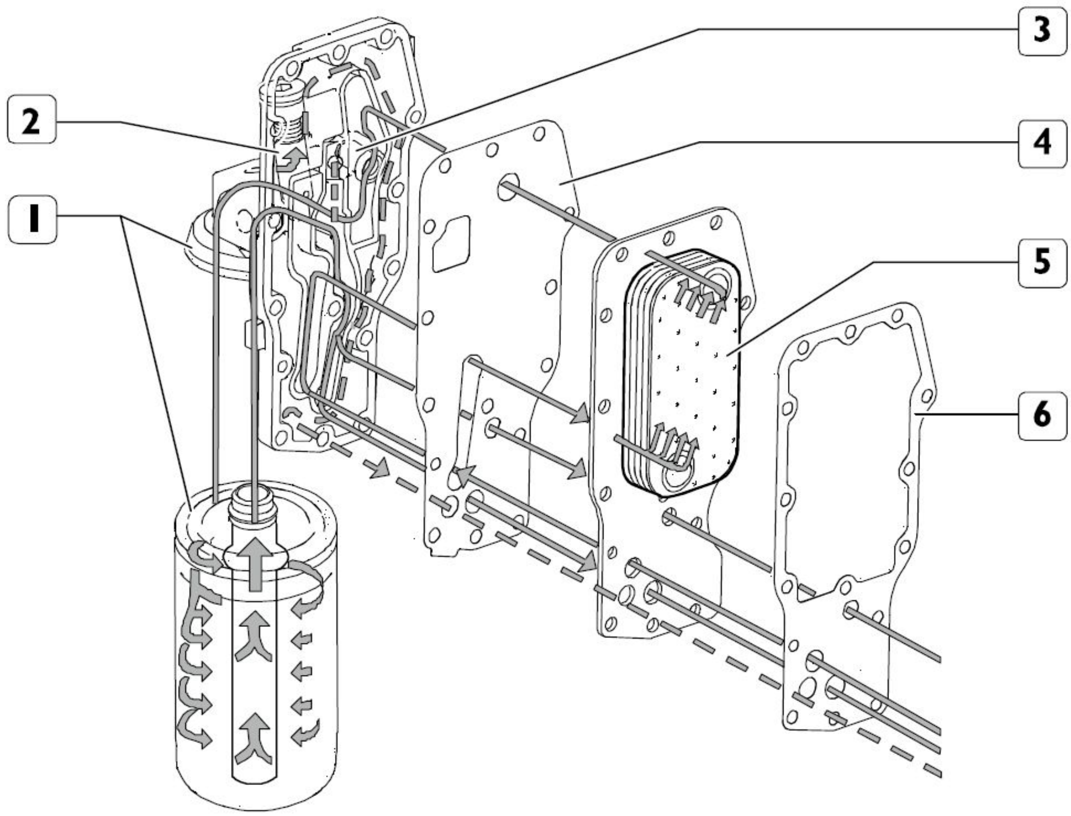
NOTICE: *The oil filter contains a significant amount of engine oil.*
Position a suitable container to collect the oil.

5. Tighten the oil filter **(1)** at the specific housing on the heat exchanger **(2)**.
6. Operate the engine for a few minutes and then recheck the level using the dipstick. Top up if necessary to compensate for the oil used for refilling the filtering cartridge.

Description	Quantity	Value
Oil filter	1 adapter M27 x 2	**18 +/- 2 N·m**

543110 HEAT EXCHANGER - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



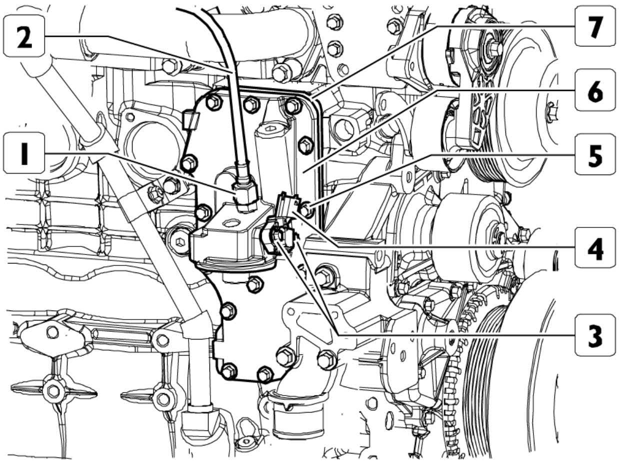
200097A 1

1. Oil filter support
2. Lubricant pressure control valve
3. By-pass valve to cut out clogged oil filter
4. Internal heat exchanger gasket
5. Heat exchanger lubricant oil / coolant
6. Gasket between heat exchanger and crankcase

543110 HEAT EXCHANGER - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Remove the auxiliary components belt as described in the procedure **WATER PUMP DRIVE BELT - Replace (54.34)**.
2. Remove the alternator as described in the procedure **ALTERNATOR ASSEMBLY - Remove (76.03)**.
3. Position a suitable container to collect any engine oil which may leak out.
4. Remove the engine oil filter as described in the procedure **ENGINE OIL FILTER CARTRIDGE - Replace (54.30)**.
5. Unscrew fitting **(1)** and remove oil delivery pipe **(2)** to turbocharger.
6. Remove the screws **(3)** and disassemble the oil temperature/pressure **(4)** sensor.
7. Remove the screws **(5)** and disassemble the oil filter/heat exchanger support **(6)**, intermediate plate **(7)** and corresponding gaskets.



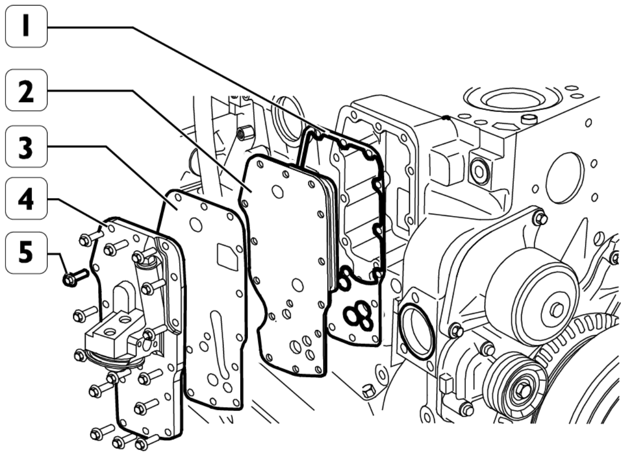
166651 1

543110 HEAT EXCHANGER - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

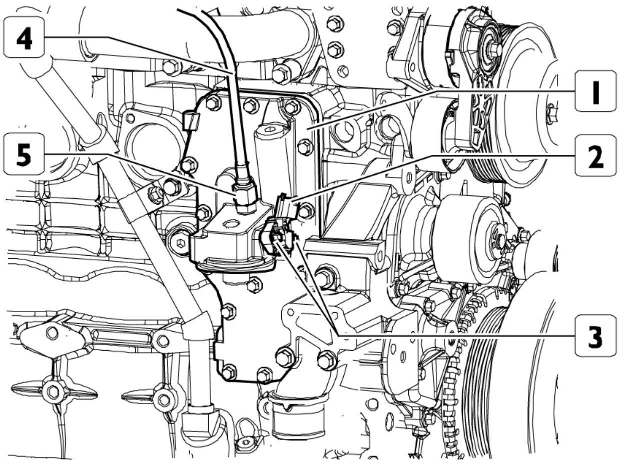
1. Fit the following to the crankcase: a new gasket **(1)**, the heat exchanger **(2)** a new gasket **(3)** and the oil filter bracket **(4)**.
2. Fasten the screws **(5)** and tighten them to the specified torque.

NOTE: *Before assembly, check that the thread on the holes and the screws shows no sign of wear or dirt.*



107275A 1

3. Place the oil temperature/pressure sensor **(2)** in position **(1)** with a new seal ring, then screw in the retaining screws **(3)** and tighten them to the specified torque.
4. Fit oil delivery pipe **(1)** screwing up the fitting **(2)**.



166652 2

5. Fit the engine oil filter as described in the procedure **ENGINE OIL FILTER CARTRIDGE - Replace (54.30)**.
6. Fit the alternator as described in the procedure **ALTERNATOR ASSEMBLY - Install (76.03)**.
7. Fit the auxiliary members' belt as described in the procedure **WATER PUMP DRIVE BELT - Replace (54.34)**.
8. Check the oil level using the dipstick: the level must come close to the MAX notch which can be seen on the dipstick.
9. If this is not the case, top-up as necessary.

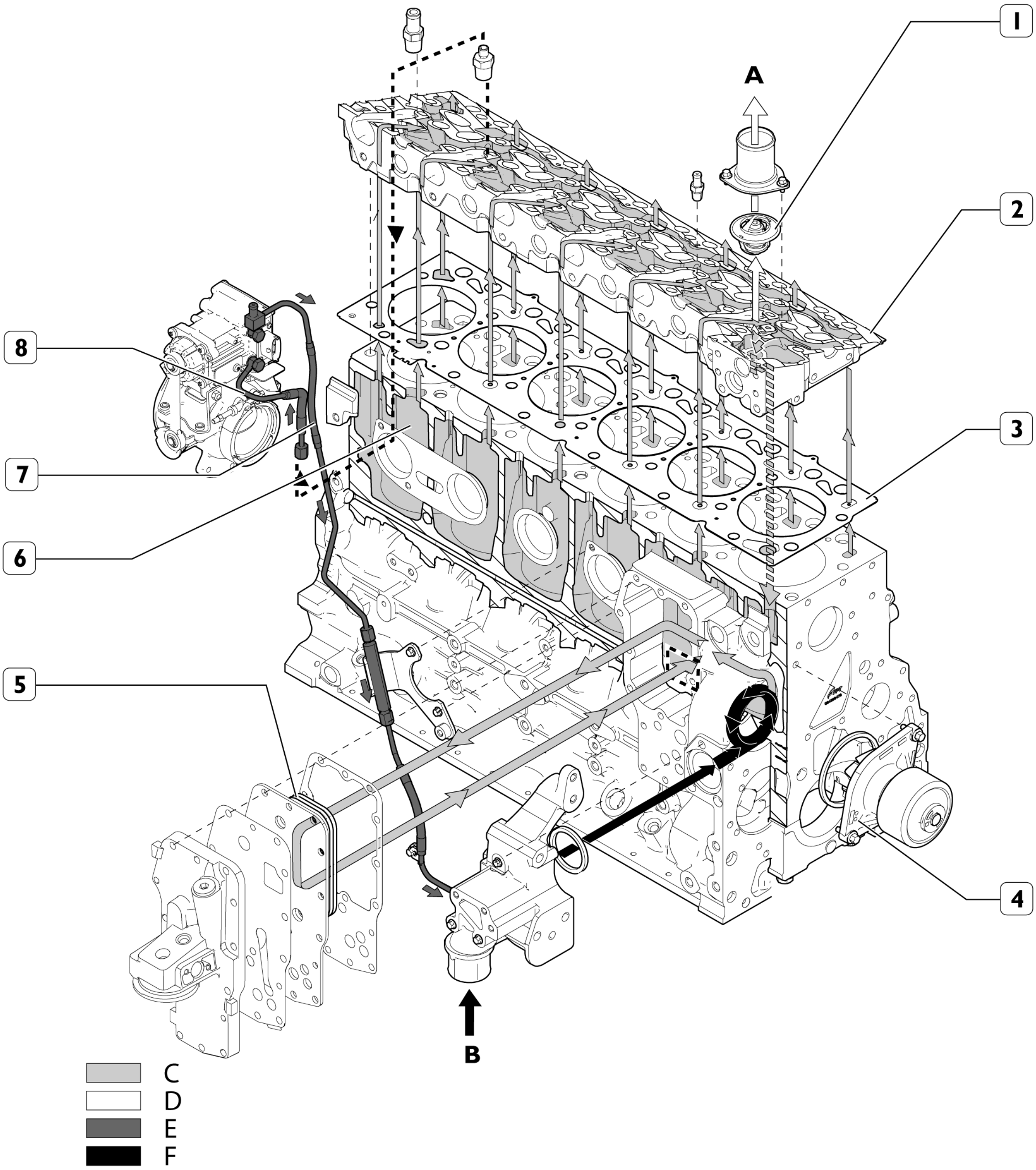
5432 WATER COOLING - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

The engine cooling system, of the closed-loop forced-circulation type, generally consists of the following components:

1. expansion tank: the position, shape and dimensions can change depending on the engine outfitting;
2. radiator, for dissipating the heat taken from the engine by the coolant. This component can also change depending on the outfitting both in terms of position and dimensions;
3. viscostatic fan with the function of increasing the dissipating power of the radiator: this is also part of the specific engine version;
4. a heat exchanger to cool the lubricant oil: this is also part of the specific engine version;
5. centrifugal water pump set in the front part of the crankcase;
6. a thermostat to control coolant circulation;
7. the circuit can also extend to the compressor if the construction provides for its presence.

COOLING SYSTEM DIAGRAM



209190 1

(1) Thermostat to regulate temperature - (2) Cylinder head cooling channels - (3) Cylinder head gasket - (4) Water pump - (5) Lubricant oil / coolant heat exchanger - (6) Coolant chamber around the cylinder liners - (7) Motorised throttle valve actuator water return pipe - (8) Motorised throttle valve actuator water delivery pipe

A. Engine coolant outlet pipe (to the radiator)
B. Engine coolant inlet pipe (from the radiator)
C. Water recirculating in the engine
D. Water leaving the thermostat
E. Water cooling motorized throttle valve actuator
F. Pump inlet water

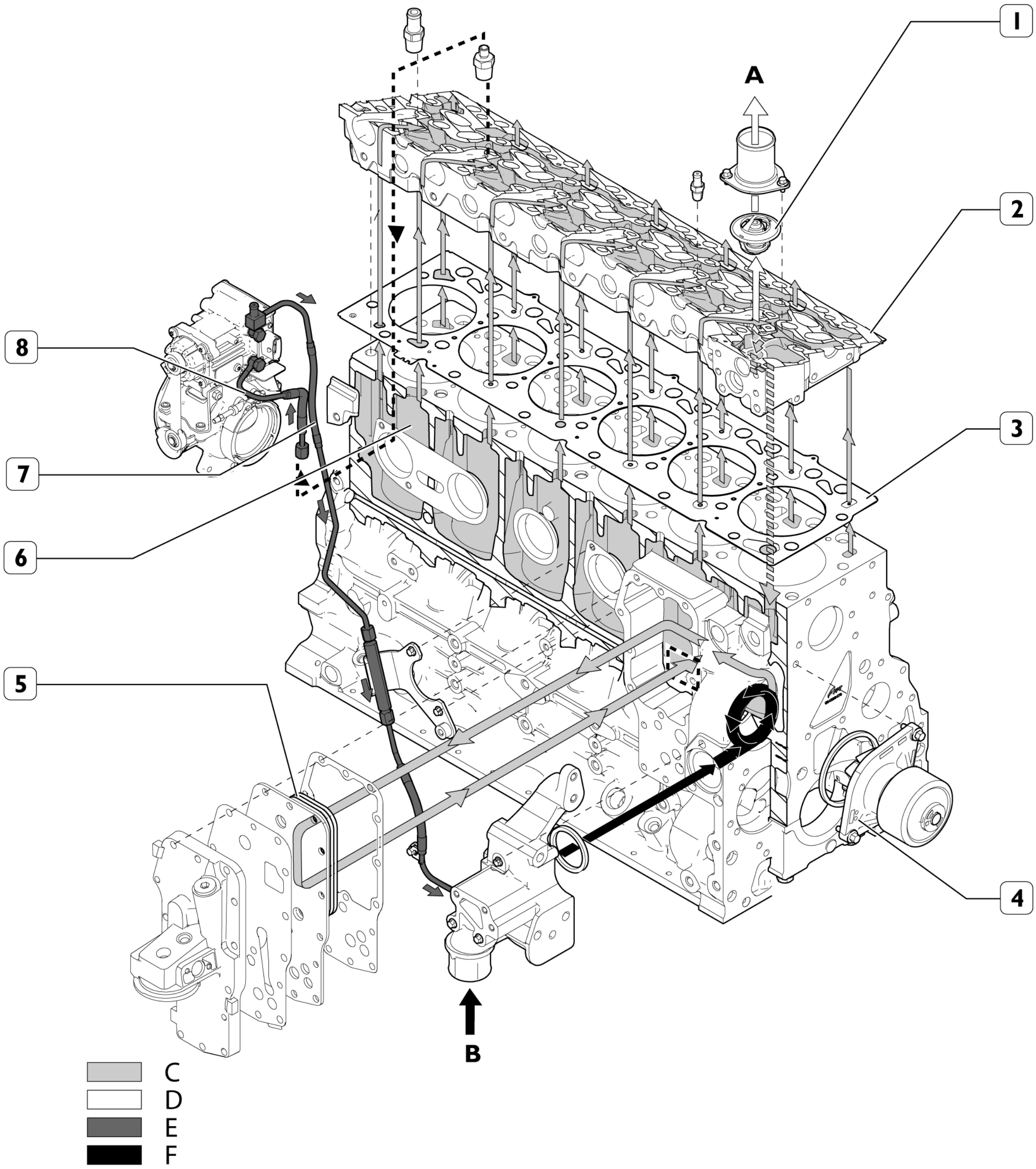
5432 WATER COOLING - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The engine cooling system, of the closed-loop forced-circulation type, generally consists of the following components:

1. expansion tank: the position, shape and dimensions can change depending on the engine version
2. radiator, which has the task of dissipating the heat taken from the engine by the coolant. Also the position and dimensions of this component can change depending on the version;
3. viscostatic fan with the task of increasing the dissipating radiator power: also it is part of the specific engine version;
4. a heat exchanger to cool the lubricant: also it is part of the specific engine version;
5. centrifugal water pump set in the front part of the crankcase;
6. a thermostat to control coolant circulation;
7. the circuit can also extend to the compressor if the construction provides for its presence.

COOLING SYSTEM DIAGRAM

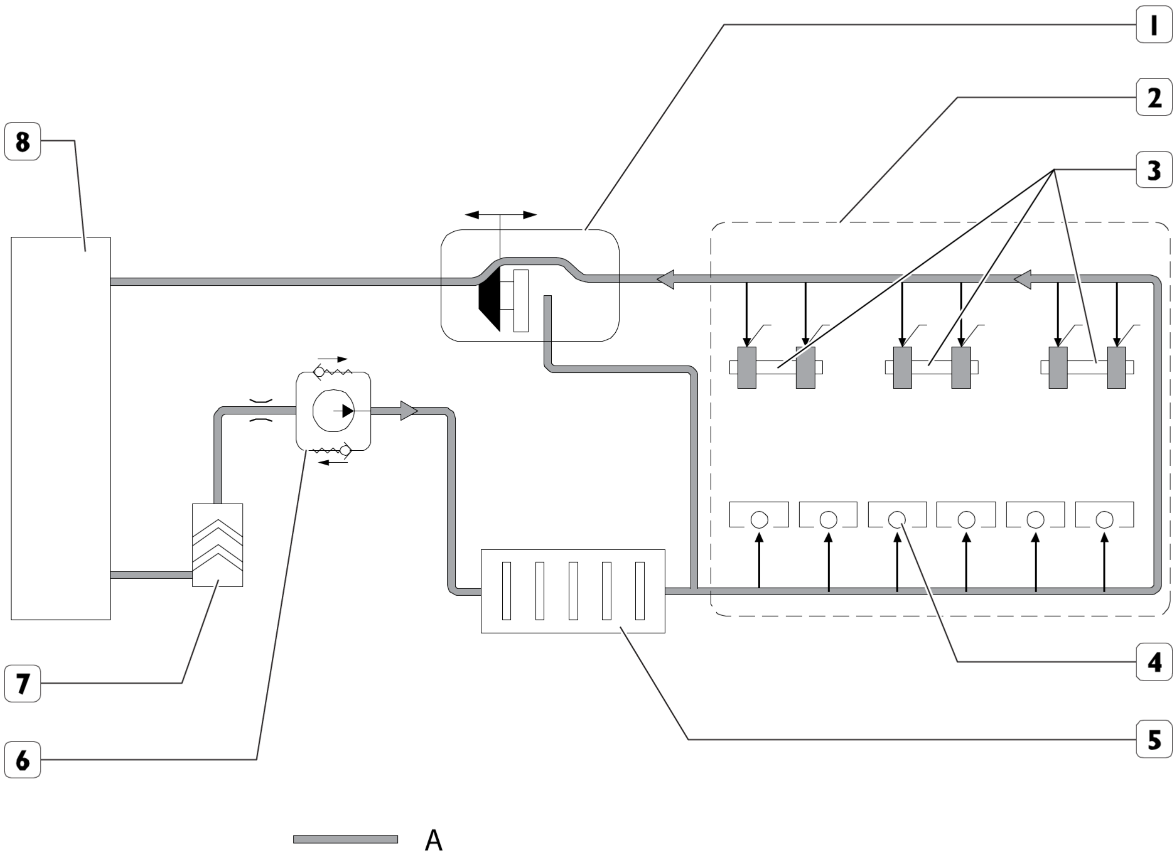


209190 1

(1) Thermostat to regulate temperature - (2) Cylinder head cooling channels - (3) Cylinder head gasket - (4) Water pump - (5) Lubricant oil / coolant heat exchanger - (6) Coolant chamber around the cylinder liners - (7) Motorised throttle valve actuator water return pipe - (8) Motorised throttle valve actuator water delivery pipe

A. Engine coolant outlet pipe (to the radiator)
B. Engine coolant inlet pipe (from the radiator)
C. Water recirculating in the engine
D. Water leaving the thermostat
E. Water cooling motorized throttle valve actuator
F. Water coming into pump

COOLING DIAGRAM

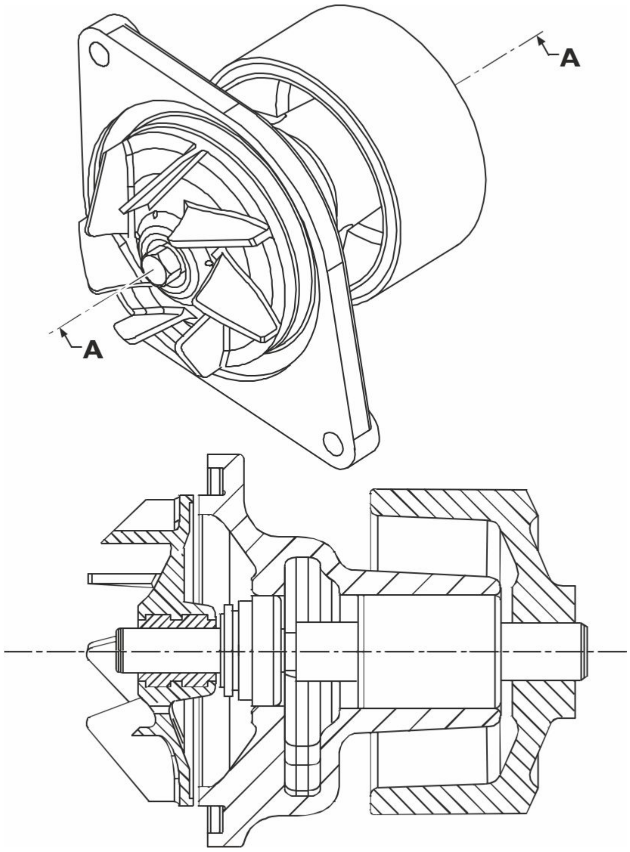


202104 2

1. Thermostat
2. Control volume "Engine"
3. Rocker assembly
4. Pistons
5. Heat exchanger
6. Water pump
7. Flow conveyor
8. Radiator

543210 WATER PUMP ASSEMBLY - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



70486 1

The water pump is located in a housing obtained in the crankcase and is controlled by and a poly-V belt.

An automatic tensioner keeps the belt tension.

Pump performance

Pump performance	
Coolant temperature	**100 +/- 5 °C**
Concentration of antifreeze	**50%**

Parameters

Pump speed	Capacity	Pressure
5000 RPM	**210 L/min**	**2,00 – 2,45 bar**
2500 RPM	**110 L/min**	**0,50 – 0,65 bar**

543250 THERMOSTAT - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The thermostat, located in the cylinder head, is of the by-pass type and doesn't need regulations.

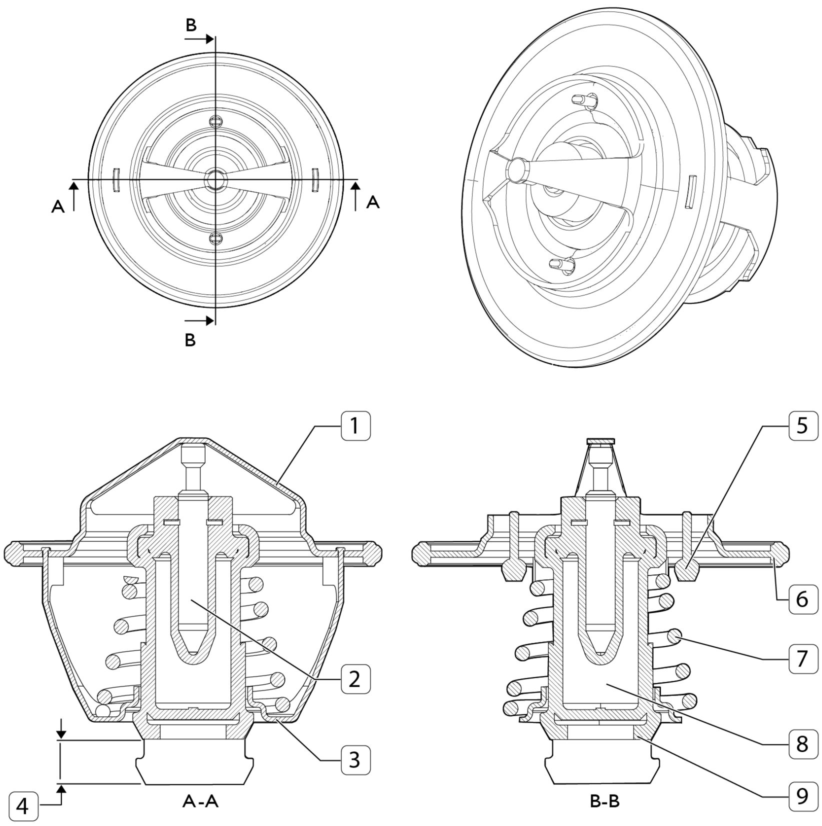
If there are doubts as to its proper functioning, replace it.

The main components of a thermostat are: a valve fastened to a piston integrated in a special wax, flange, spring and frame.

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:

1. It heats the engine faster, blocking the circulation of the coolant between the engine and the radiator until the engine reaches its predefined temperature.
2. 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.



209191A 1

1. Flange
2. Stem (piston)
3. Chassis
4. Minimum stroke at the temperature of full opening
5. Pin

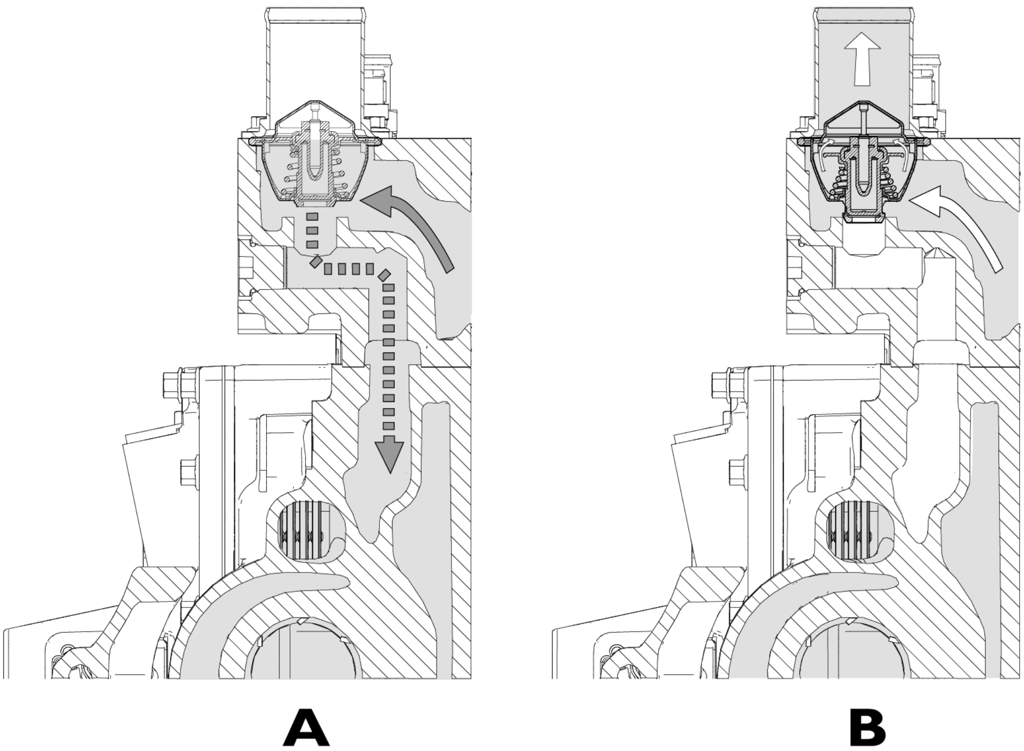
6. Flange seal
7. Main spring
8. Wax element
9. By-pass valve

Thermostat performance

Thermostat performance	
Minimum permitted operating temperature	**-40 °C**
Maximum permitted operating temperature	**135 °C**
Max. allowed peak temperature (**5 min**)	**150 °C**
Max differential operating pressure	**3 bar**
Start opening	**79 +/- 2 °C**
Complete opening temperature	**96 °C**
Minimum stroke at the temperature of full opening	**7,5 mm**

Description and 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 action of the spring and reducing the flow of the coolant towards the radiator.



209198A 2

A. Closed thermostat (coolant supply to the water pump via the by-pass duct)

B. Open thermostat (coolant supply to the radiator)

5432 WATER COOLING - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Engine coolant level check

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. The check should be performed both when the engine is stopped and when it is running.
2. Check the pipes from the engine to the radiator, from the expansion tank and vice versa; detect leakages, the state of the pipes, in particular near the junction clamps.
3. Check the cleanliness of the radiator, the integrity of the fan fins, possible leakage from the clamps, sleeves, and the radiant body.

General prescriptions
Due to the high temperatures reached inside the system, do not act straight after the engine has stopped but wait until the temperature has dropped. Protect your eyes and skin from any unexpected jets of coolant.
Correct behavior will ensure that vehicle is used as environmentally friendly as possible

4. The density of the coolant must however be checked every year before the winter and be changed every two years.

NOTICE: *After a new refill, de-aerate the system using the breathers on the engine. Failure to de-aerate the system could cause serious damage to the engine as a result of air pockets in the engine head.*

5. Make sure that when the engine is cold the fluid level in the exchanger covers the internal elements of the exchanger.
6. Top up if necessary, using water free of impurities. Do not use distilled water.

NOTE: *if frequent top-ups are necessary, the cooling circuit must be diagnosed.*

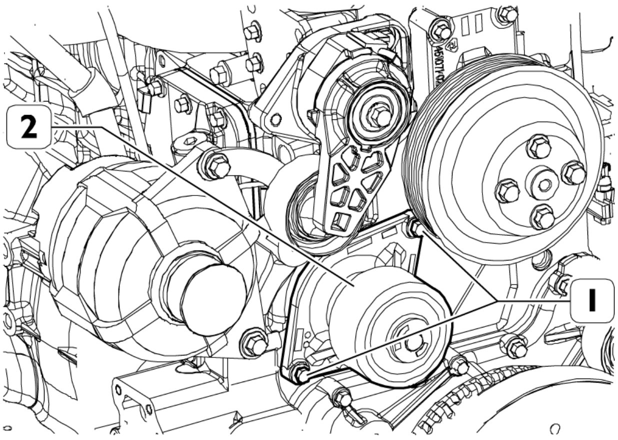
7. If the version has an external level indicator on the heat exchanger, proceed with the top up making sure that the liquid does not completely fill the exchanger. This is to ensure that the volume of the liquid can increase as the temperature increases.

543210 WATER PUMP ASSEMBLY - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Remove the auxiliary components belt as described in the procedure **WATER PUMP DRIVE BELT - Replace (54.34)**.
2. Position a suitable container to collect any coolant which may leak out.
3. Unscrew the screws **(1)** and remove the water pump **(2)**.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**



166100 1

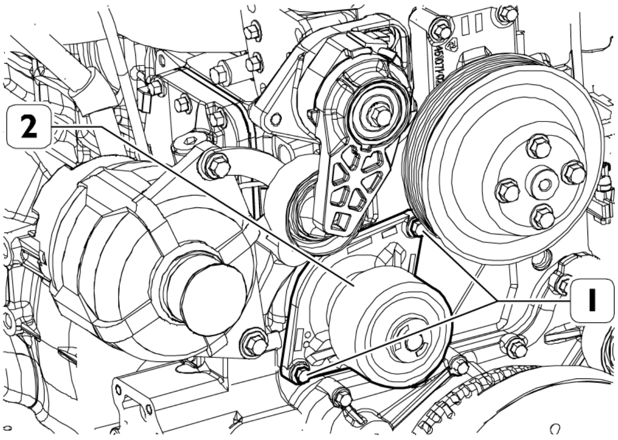
543210 WATER PUMP ASSEMBLY - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)
Prior operation:
FAN - Remove (54.34)
Prior operation:
WATER PUMP DRIVE BELT - Remove (54.34)

1. Position a suitable container to collect any coolant which may leak out.
2. Unscrew the screws **(1)** and remove the water pump **(2)**.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**

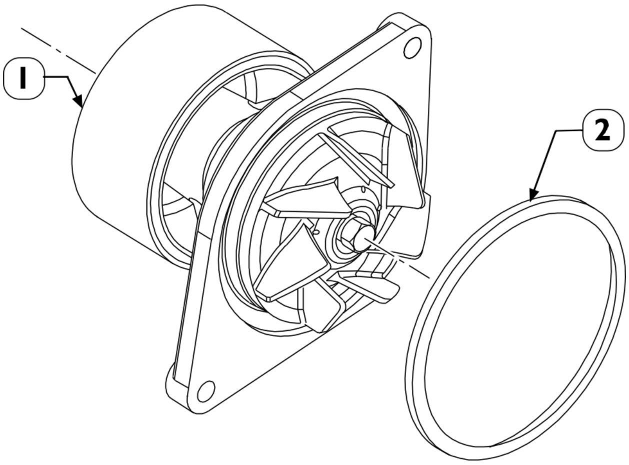


166100 1

543210 WATER PUMP ASSEMBLY - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

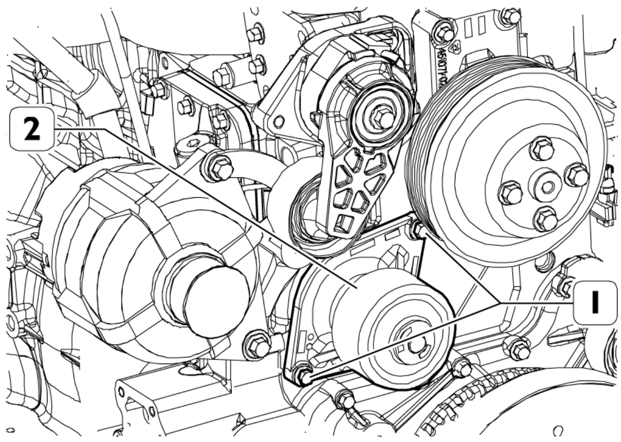
1. fit a new sealing ring **(1)** to the water pump **(2)**.



70221 1

2. Position the water pump in its housing **(2)**, tighten the fastening screws **(1)** to the specified torque.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**



166100 2

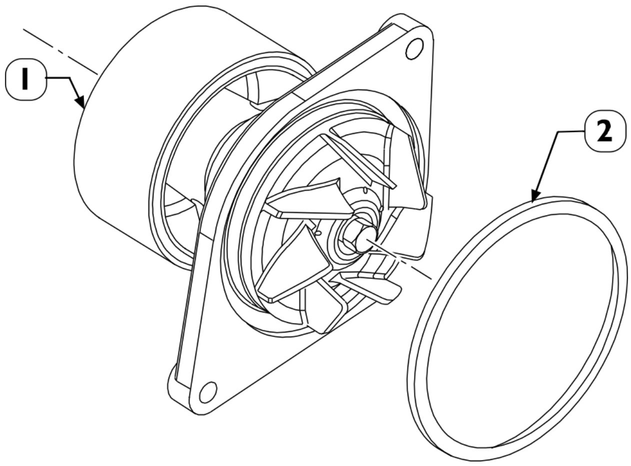
3. Fit the auxiliary members' belt as described in the procedure **WATER PUMP DRIVE BELT - Replace (54.34)**.

543210 WATER PUMP ASSEMBLY - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**

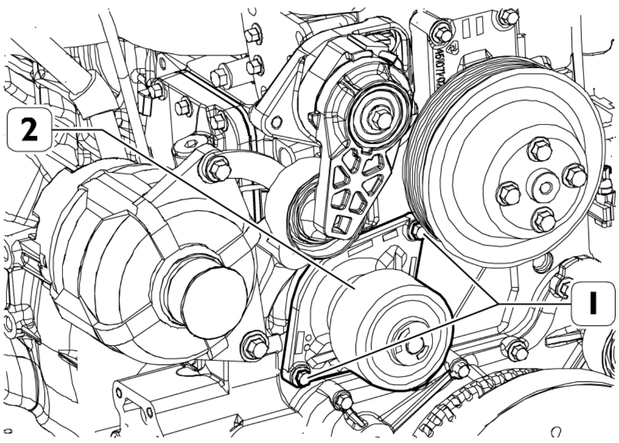
1. Fit a new seal ring **(1)** to the water pump **(2)**.



70221 1

2. Position the water pump in its housing **(2)**, tighten the fastening screws **(1)** to the specified torque.

Description	Quantity	Value
Water pump	2 screws M8 x 1.25 x 35	**24 +/- 4 N·m**



166100 2

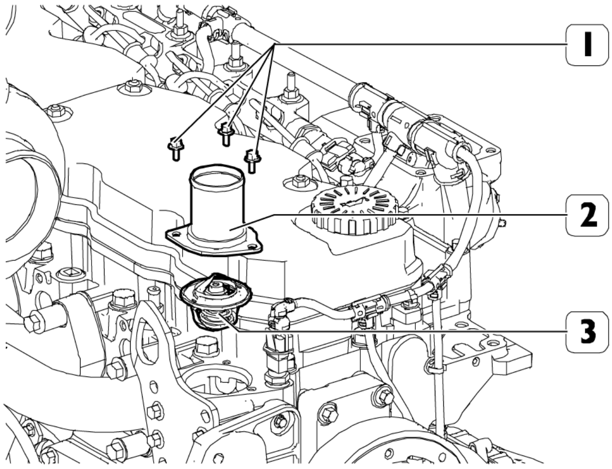
Next operation:
WATER PUMP DRIVE BELT - Install (54.34)
Next operation:
FAN - Install (54.34)
Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

543250 THERMOSTAT - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Loosen the fastening screws **(1)** and remove the delivery pipe of the engine coolant **(2)** and the thermostat **(3)** complete with the gasket.

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	**13,5 +/- 1,5 N·m**



209202 1

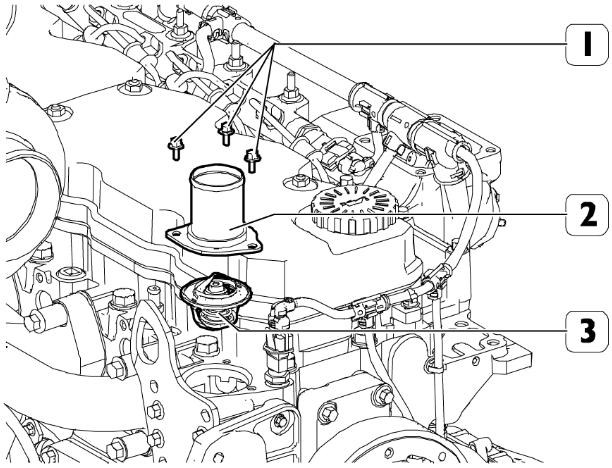
543250 THERMOSTAT - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)

1. Loosen the fastening screws **(1)** and remove the delivery pipe of the engine coolant **(2)** and the thermostat **(3)** complete with the gasket.

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	**13,5 +/- 1,5 N·m**



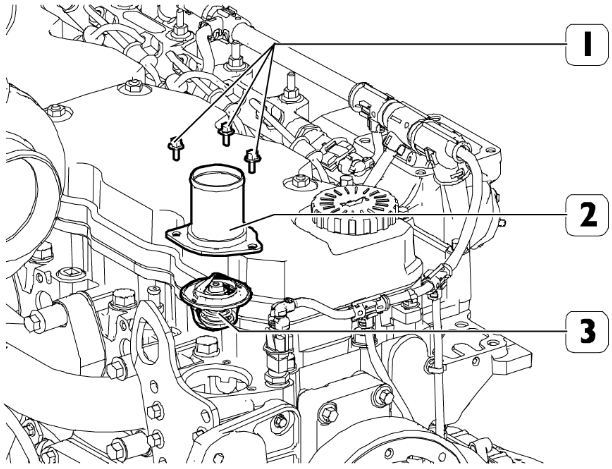
209202 1

543250 THERMOSTAT - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Fit the thermostat **(3)** complete with the gasket and the engine coolant delivery pipe **(2)**. Tighten the fastening screws **(1)** to the specified torque.

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	**13,5 +/- 1,5 N·m**



209202 1

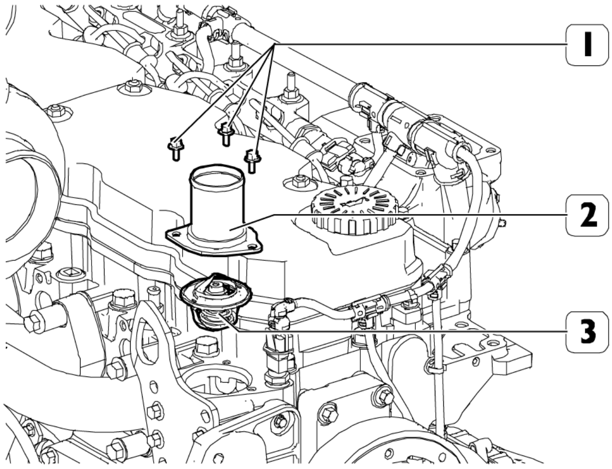
543250 THERMOSTAT - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	**13,5 +/- 1,5 N·m**

1. Fit the thermostat **(3)** complete with the gasket and the engine coolant delivery pipe **(2)**. Tighten the fastening screws **(1)** to the specified torque.

Description	Quantity	Value
Thermostat	3 screws M6 x 1 x 12	**13,5 +/- 1,5 N·m**



209202 1

Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

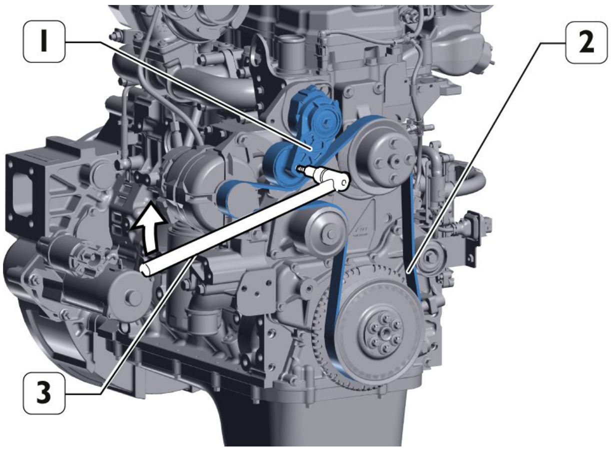
543411 WATER PUMP DRIVE BELT - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tension and condition check of auxiliary members’ belt

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Proceed only with engine not running and at low temperature to avoid any risk of burns.
2. Visually check that the auxiliary members' belt **(2)** is not worn or damaged. Otherwise, replace it.
3. Use a **(3)** inch socket wrench to check the efficiency of the automatic belt tensioner **(1)**.



251138A 1

543411 WATER PUMP DRIVE BELT - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

General prescriptions
Replace the ancillary belt if it shows signs of abrasions, cracks or tears or if it is soiled with oil or fuel.
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

Risk of injury:
When the engine is off, but still hot, the belt may start to move without warning. Wait for the engine temperature to decrease to prevent serious danger
of an accident.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

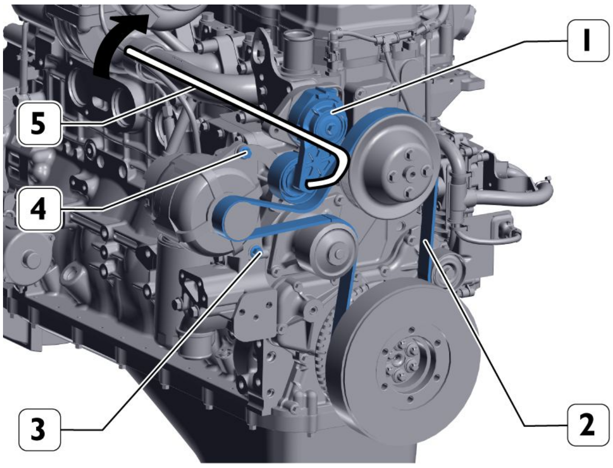
1. Remove the protective grilles and the fan together with the spacer by undoing the relative fasteners.
2. Loosen the bolt **(3)** anchoring the alternator to its lower mount and the screw **(4)** securing the alternator to the bracket.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

3. Using the tool **(5)**, turn the automatic belt tensioner **(1)** in the direction of the arrow and remove the belt **(2)**.
4. Using the tool **(5)**, turn the automatic tensioner **(1)** in the direction of the arrow and reposition the new belt **(2)** inside the shoulders of all the pulleys.
5. Tighten the bolt **(3)** anchoring the alternator to its lower mount and the screw **(4)** securing the alternator to the bracket.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

6. Reposition the fan, together with spacer, in its seat and the protective grilles and tighten the relative fasteners.

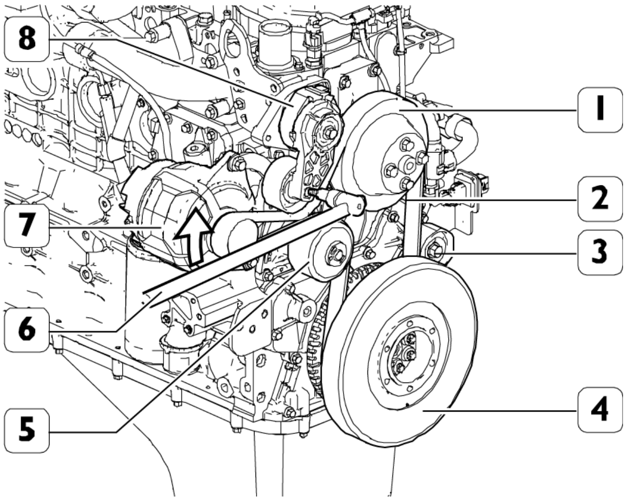


267992 1

543411 WATER PUMP DRIVE BELT - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Remove the belt **(2)** by acting on the automatic belt tensioner **(8)** with the appropriate tool **(6)** from alternator **(7)**, water pump **(5)**, fan control pulley **(1)**, crankshaft pulley with damper **(4)** and fixed guide roller **(3)**.



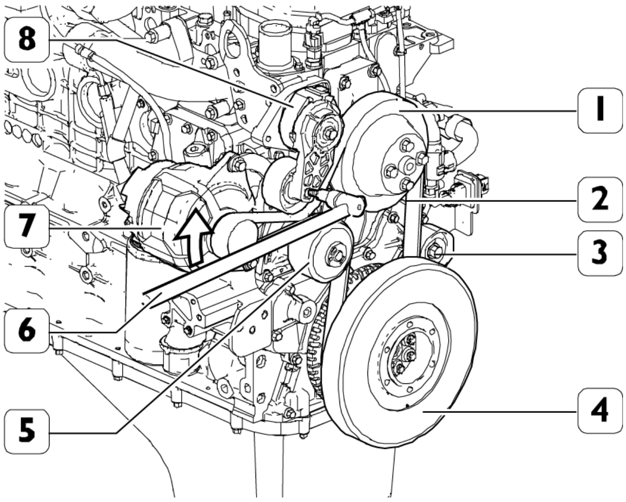
215006 1

543411 WATER PUMP DRIVE BELT - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)
Prior operation:
FAN - Remove (54.34)

1. Remove the belt **(2)** by acting on the automatic belt tensioner **(8)** with the appropriate tool **(6)** from alternator **(7)**, water pump **(5)**, fan control pulley **(1)**, crankshaft pulley with damper **(4)** and fixed guide roller **(3)**.

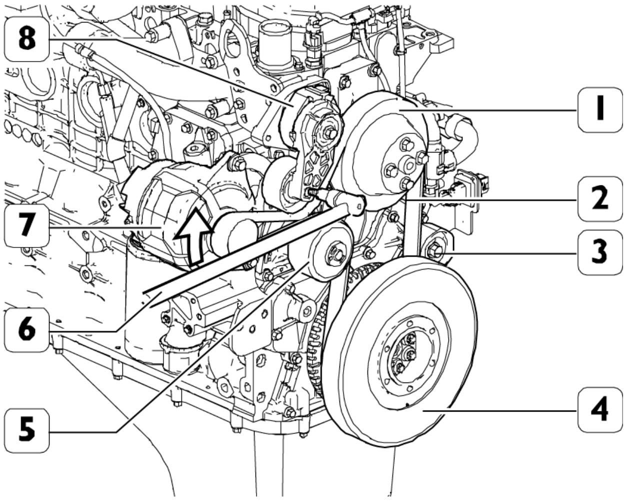


215006 1

543411 WATER PUMP DRIVE BELT - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Fit the Poly V belt **(2)** on the pulleys and guide roller.
2. Use the appropriate tool **(6)** on the automatic belt tensioner **(8)** to fit the new belt **(2)** in the operating position.
3. Additional adjustments are not required. The belt tension **(2)** is adjusted automatically by the calibrated spring in the automatic belt tensioner **(8)**.
4. Run the engine for a few hours and check that the belt **(2)** is positioned correctly.

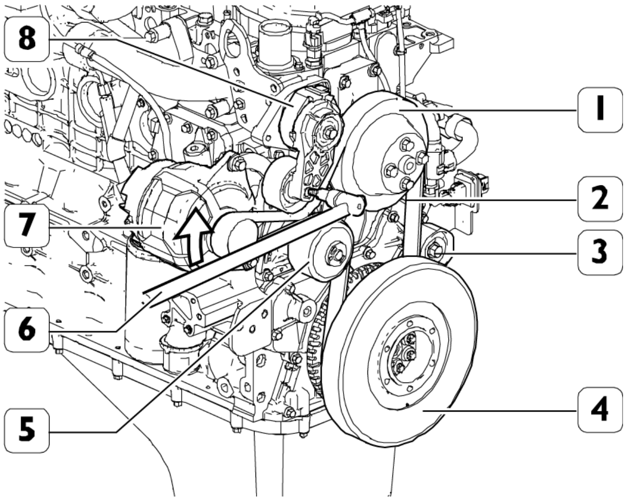


215006 1

543411 WATER PUMP DRIVE BELT - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Fit the Poly V belt **(2)** on the pulleys and guide roller.
2. Use the appropriate tool **(6)** on the automatic belt tensioner **(8)** to fit the new belt **(2)** in the operating position.
3. No further adjustments are required. The belt tension **(2)** is adjusted automatically via the calibrated spring in the automatic belt tensioner **(8)**.
4. Run the engine for a few hours and check that the belt **(2)** is positioned correctly.



215006 1

Next operation:
FAN - Install (54.34)
Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

543420 FAN - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

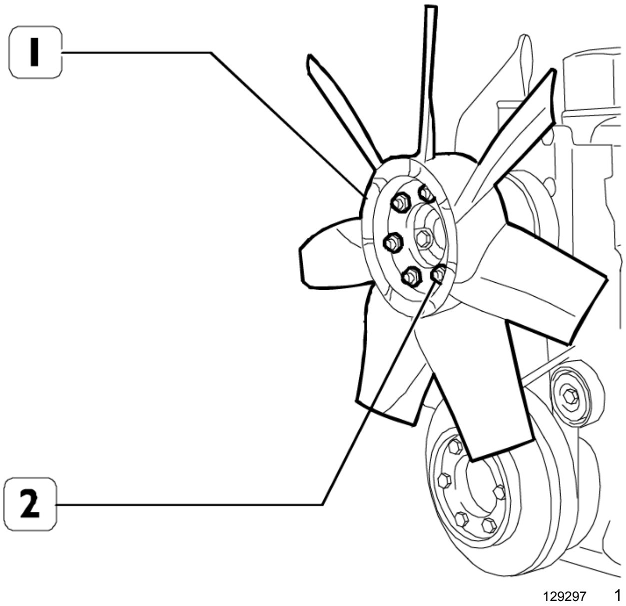
Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)

1. Unscrew the screws **(2)**.

Description	Quantity	Value
Fan	6 screws M10x1.5 x130	**24 +/- 4 N·m**

2. Remove the fan **(1)** with the spacer.

NOTE: *The shape and size of the fan vary depending on engine use.*
The relative illustrations provide a general outline of the work to be carried out.
However the procedures described are applicable anyway.



1

543420 FAN - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

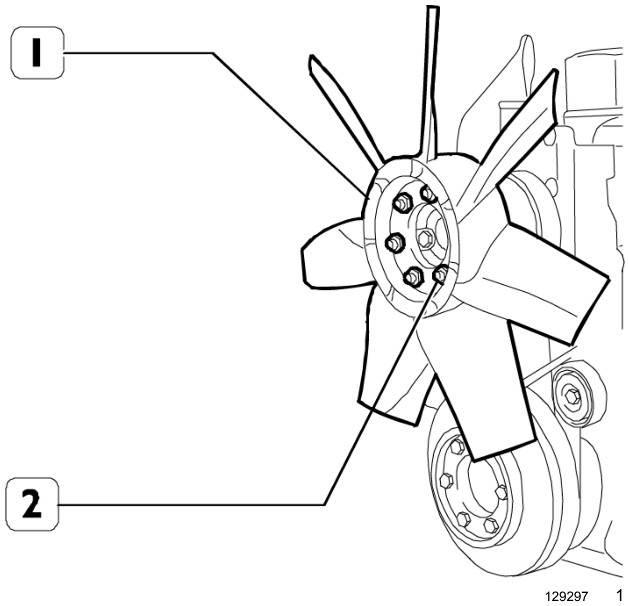
Description	Quantity	Value
Fan	6 screws M10x1.5x130	**24 +/- 4 N·m**

1. Position the fan **(1)**, with the spacer.

Description	Quantity	Value
Fan	6 screws M10x1.5 x130	**24 +/- 4 N·m**

2. Tighten the screws **(2)**.

NOTE: *The shape and size of the fan vary depending on engine use.*
The relative illustrations provide a general outline of the work to be carried out.
However the procedures described are applicable anyway.



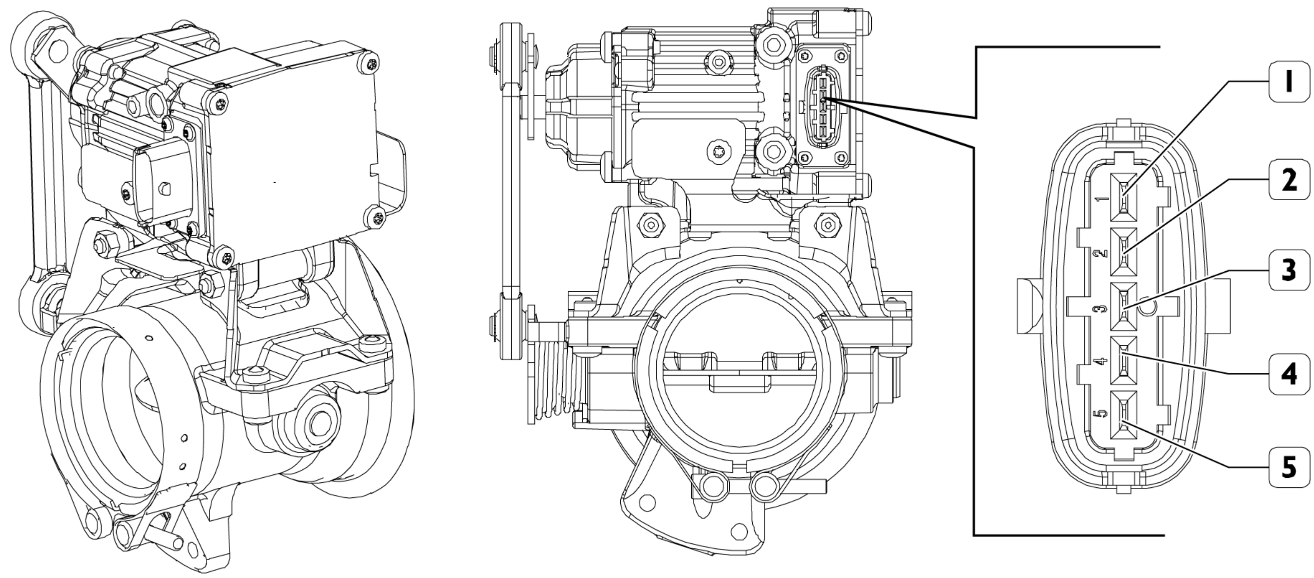
1

Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

543712 BUTTERFLY VALVE - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Motorised throttle valve actuator connector (exhaust valve)



215013 1

Ref.	Description	control unit pin
1	Battery voltage (V Bat)	–
2	Ground	–
3	–	–
4	Can L	18A
5	Can H	17A

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ENGINE - 54

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

(*) See content for specific models

Contents

INJECTION - 77

(*) See content for specific models

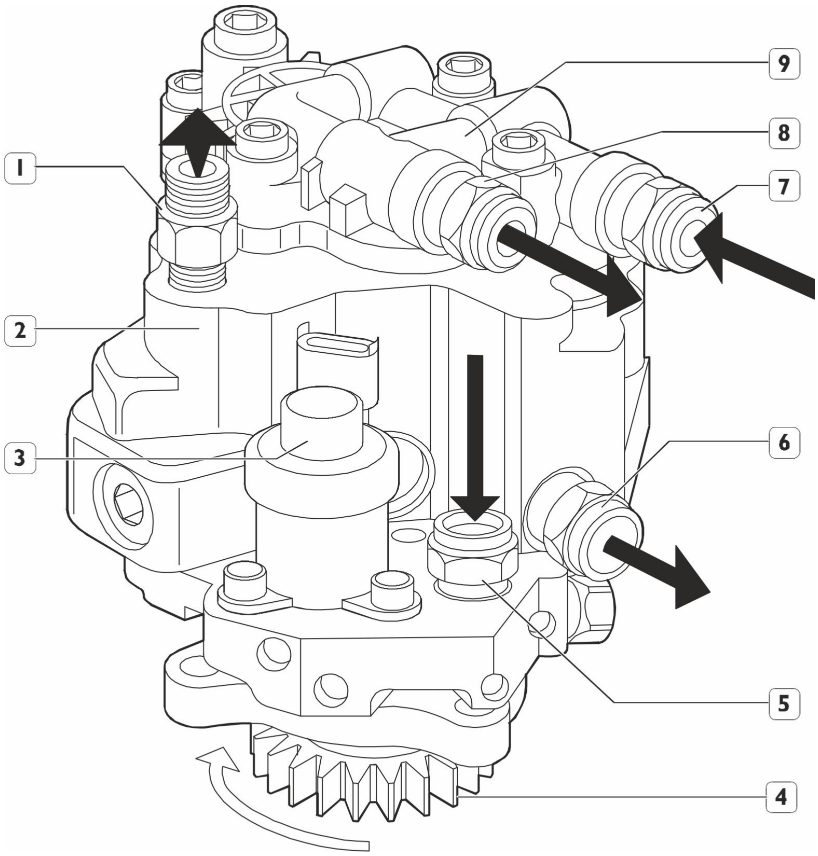
(*) See content for specific models

771010 INJECTION PUMP ASSY - Overview CP3 HIGH-PRESSURE PUMP

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

The CP3 high pressure pump with three radial plungers controlled by the timing gears, does not require timing. The mechanical supply pump controlled by the high pressure pump shaft is mounted on the rear side of the high pressure pump.

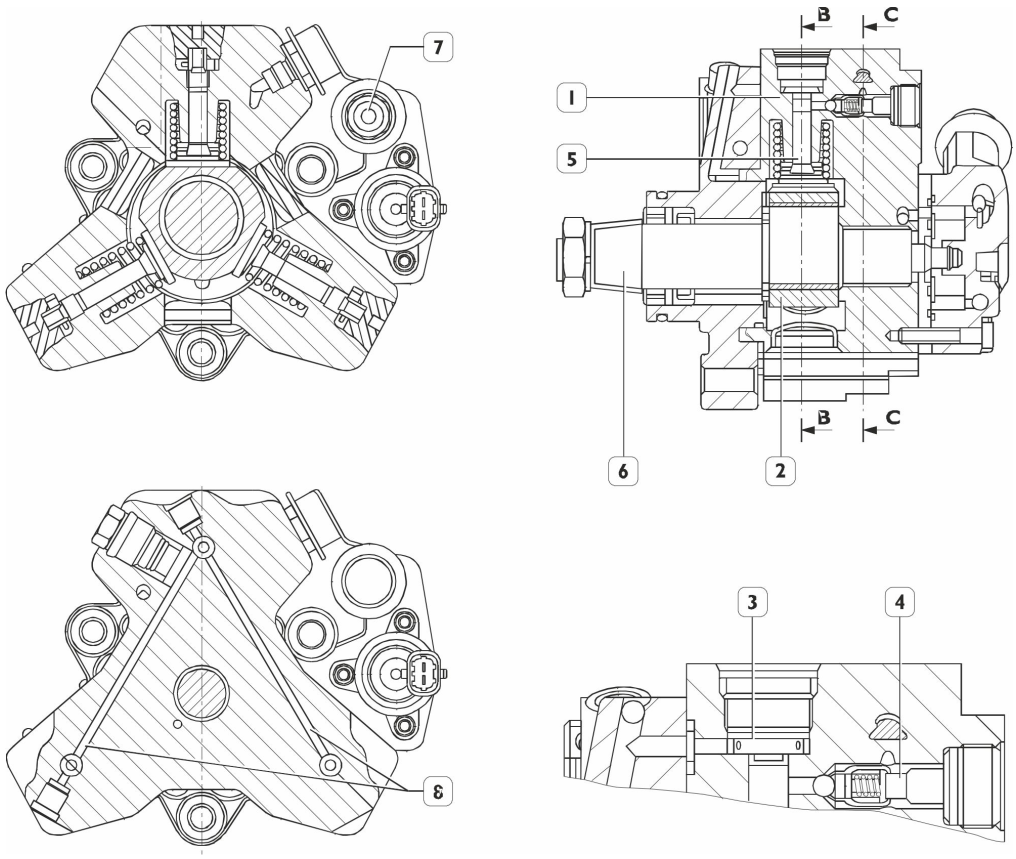
NOTE: *The high pressure pump cannot be overhauled and should not therefore be removed. The fastening screws should not be tampered with. The only possible service operation is the replacement of the drive gear.*



72595 1

1. Connection between fuel outlet and rail
2. High-pressure pump
3. Fuel flow regulator
4. Drive gear
5. Fuel inlet fitting from filter
6. Fuel outlet to filter support fitting
7. Fuel inlet from control unit heat exchanger fitting
8. Fuel outlet from mechanical pump to filter fitting
9. Mechanical supply pump

High-pressure pump internal structure



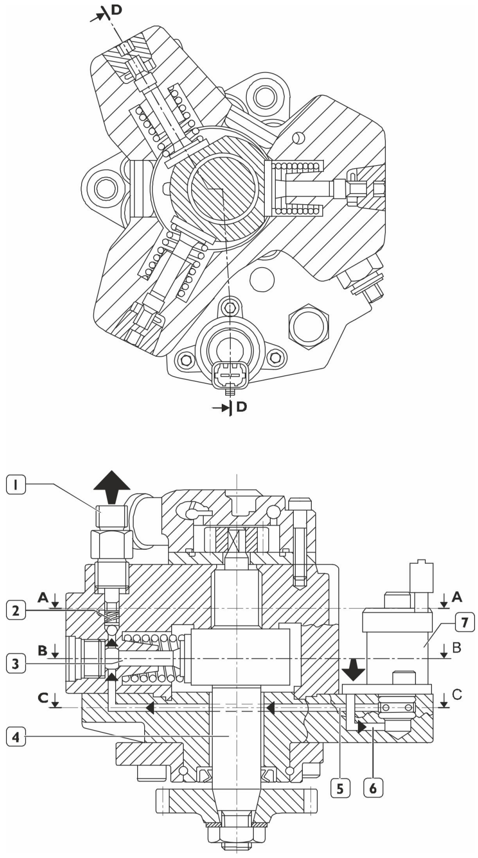
70498 2

1. Cylinder
2. Three lobe element
3. Cap intake valve
4. Ball delivery valve
5. Piston
6. Pump shaft
7. Low pressure fuel inlet
8. Fuel canals to power plungers

Each plunger unit consists of:

- a piston **(5)** actuated by a three lobe element **(2)** floating on the pump shaft **(6)**. The element **(2)**, floating on an offset part of the shaft **(6)**, does not rotate with the shaft during the shaft's rotation, but is only moved in a circular movement on a wider range, alternatively activating the three plungers;
- cap intake valve **(3)**;
- ball delivery valve **(4)**.

Operating principle

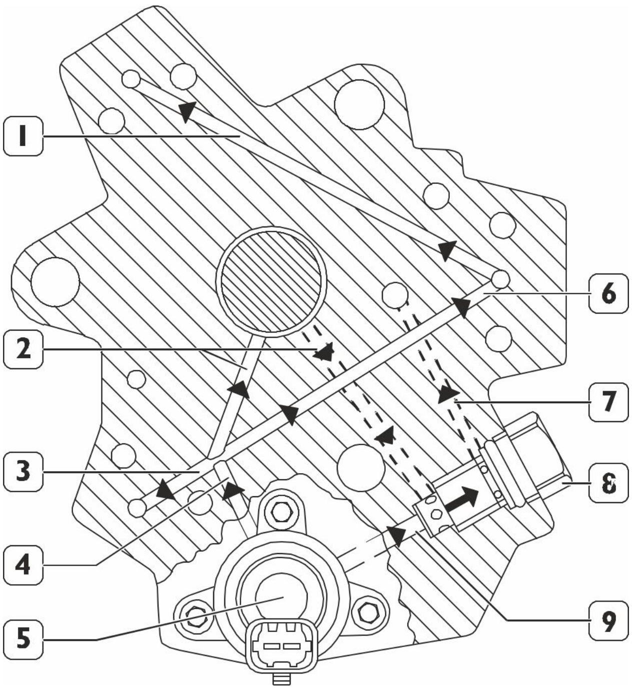


72597 3

1. Connection between fuel outlet and rail
2. Delivery valve to rail
3. Plunger
4. Pump shaft
5. Pumping element supply duct
6. Pressure regulator supply duct
7. Flow regulator

The plunger **(3)** is oriented towards the cam on the pump shaft **(4)**. During the operation phase, the plunger is powered through the power supply duct **(5)**. The flow regulator **(7)** establishes the amount of fuel sent to the pumping element.

The flow rate regulator, based on the PWM command from the control unit, shuts the flow of fuel to the plunger. During the compression stage of the plunger, the fuel reaches the pressure required to open the delivery valve to the common rail **(2)** and to supply it through the outlet **(1)**.



72598 4

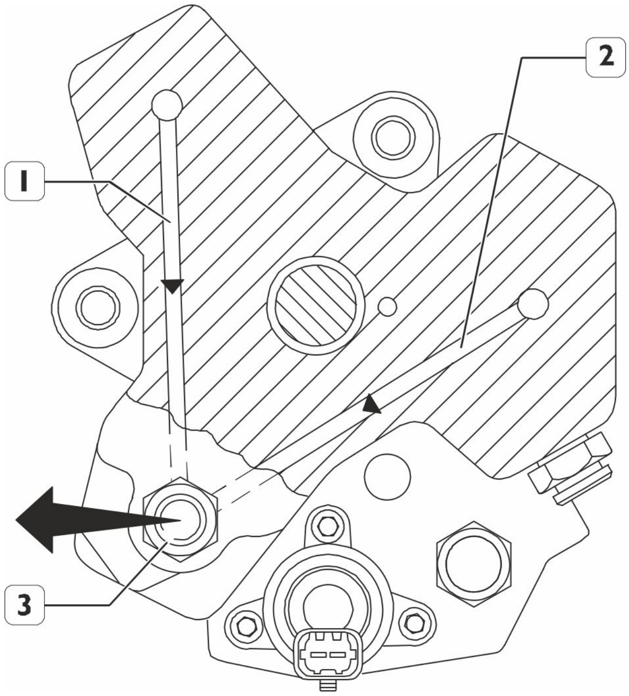
1. Plunger inlet
2. Ducts for pump lubrication
3. Plunger inlet
4. Main pumping element supply duct
5. Flow regulator
6. Plunger inlet
7. Regulator discharge duct
8. Relief valve **5 bar**
9. Fuel discharge from regulator inlet

The figure above shows the low-pressure fuel paths inside the pump; it highlights the main duct feeding the pumping elements **(4)**, the ducts feeding the pumping elements **(1)** - **(3)** - **(6)**, the ducts used to lubricate the pump **(2)**, the flow regulator **(5)**, the relief valve **5 bar (8)** and the fuel outlet **(7)**.

The pump shaft is lubricated by the fuel through the delivery and return ducts **(2)**.

The load regulator **(5)** sets the quantity of fuel with which the plungers must be supplied; the excess fuel flows through the duct **(9)**.

The pressure relief valve **5 bar**, not only acts as a manifold for the fuel discharge, but it also serves to keep the pressure constant at **5 bar** at the regulator inlet.



72601 5

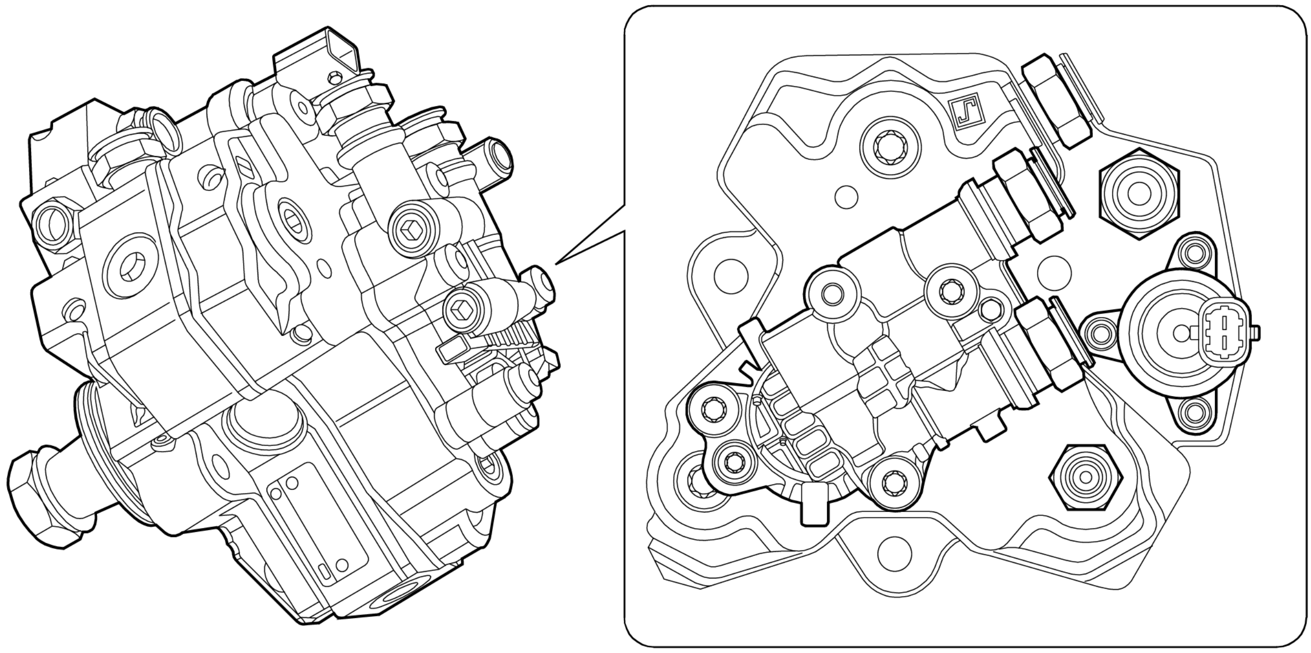
1. Fuel outlet duct
2. Fuel outlet duct
3. Fuel outlet from pump with connector for high-pressure pipe for the common rail.

The figure above shows the flow of the fuel at high pressure through the outlet ducts of the plungers.

771034 HIGH PRESSURE ADJ UNIT - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Flow regulator on the high-pressure fuel pump



000912T_B 1

A. Flow regulator

The amount of fuel which powers the high pressure pump is dosed by the flow regulator on the low pressure system; The flow regulator is managed by the MD1 control unit.

Delivery pressure to the rail is modulated between **250 – 1450 bar** by the electronic control unit acting on the flow regulator solenoid valve.

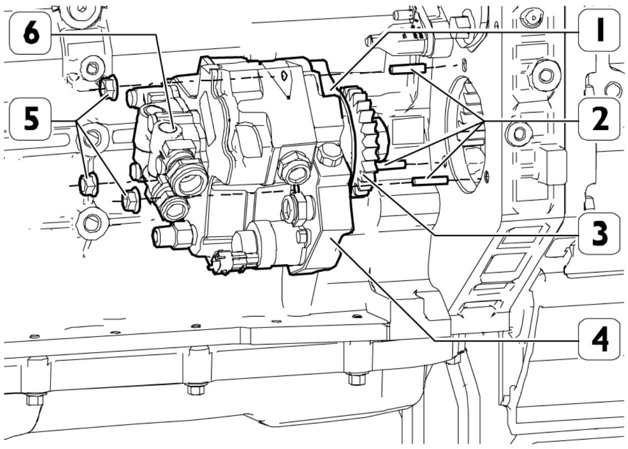
- It is a N.O. solenoid valve.
- It is connected to the control unit at pins 4H - 5H.
- Its resistance is approximately **3,2 Ω**.

771010 INJECTION PUMP ASSY - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Remove the engine cable as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Remove the fuel pipes as described in the procedure **PIPES - Remove (54.20)**.
3. Remove the fuel filter as described in the procedure **FILTER ASSEMBLY - Replace (54.20)**.
4. Remove the fuel filter bracket as described in the procedure **FILTER SUPPORT - Remove (54.20)**.
5. Position a suitable container to catch any fuel.
6. Make sure that the high-pressure fuel pump **(4)** is suitably supported.
7. Unscrew the fastening nuts **(5)** and remove the fuel high-pressure pump **(4)** complete with the mechanical pump **(6)**, the flange **(1)** and the gear **(3)**.
8. Unscrew the studs **(2)**.

Description	Step	Value
High-pressure pump	3 nuts M8x8	**24 +/- 4 N·m**
	3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**



209206 1

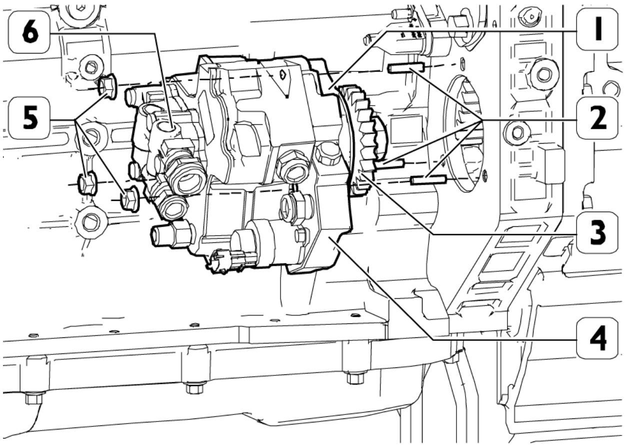
771010 INJECTION PUMP ASSY - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
High-pressure pump	3 nuts M8x8	**24 +/- 4 N·m**
	3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**

1. Screw in the studs **(2)** and fit the fuel high-pressure pump **(4)** complete with the mechanical pump **(6)**, the flange **(1)** and the gear **(3)**.
2. Tighten the fastening nuts **(5)** to the prescribed torque.

Description	Step	Value
High-pressure pump	3 nuts M8x8	**24 +/- 4 N·m**
	3 studs M8 x 1.25 x 50	**11 +/- 3 N·m**



209206 1

3. Fit the fuel filter bracket as described in the procedure **FILTER SUPPORT - Install (54.20)**.
4. Fit the fuel filter as described in the procedure **FILTER ASSEMBLY - Replace (54.20)**.
5. Fit the fuel pipes as described in the procedure **PIPES - Install (54.20)**.
6. Fit the engine cable as described in the procedure **ENGINE CABLES - Install (76.91)**.

771013 CONTROL GEAR - Disassemble

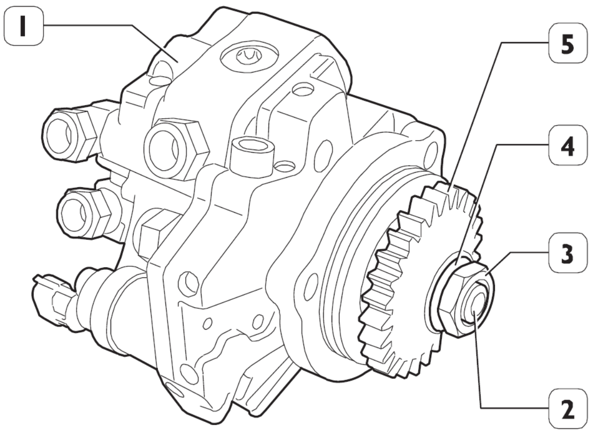
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Clamp	99341015
Double effect bridge	99341001
Pair of retainers	99341009

1. Lock rotation of the high-pressure pump **(1)** drive shaft **(2)**.
2. Remove the nut **(3)**, and washer **(4)** using a dual-actuated bridge, brackets and clamps, detach the gear **(5)** from the shaft **(2)**.

Description	Quantity	Value
High-pressure pump gear	1 nut M8 x 1.5	**105 +/- 5 N·m**

Tool / Material	
Double effect bridge	99341001
Pair of retainers	99341009
Clamp	99341015



158823A 1

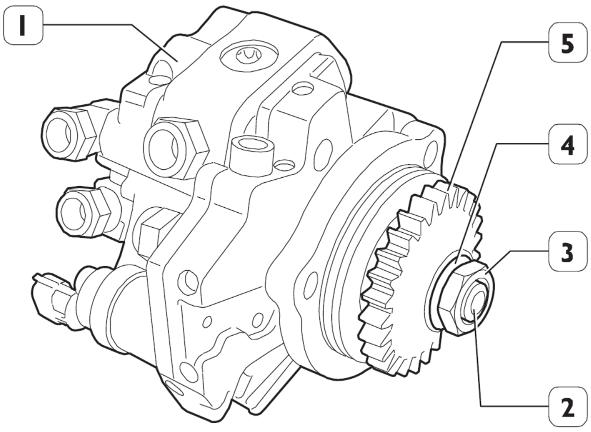
771013 CONTROL GEAR - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
High-pressure pump gear	1 nut M8 x 1.5	**105 +/- 5 N·m**

1. For reassembly, reverse the order of the removal operations, and tighten nut **(3)** to a torque of:

Description	Quantity	Value
High-pressure pump gear	1 nut M8 x 1.5	**105 +/- 5 N·m**



1

772656 FUEL TEMPERATURE SENSOR - Overview

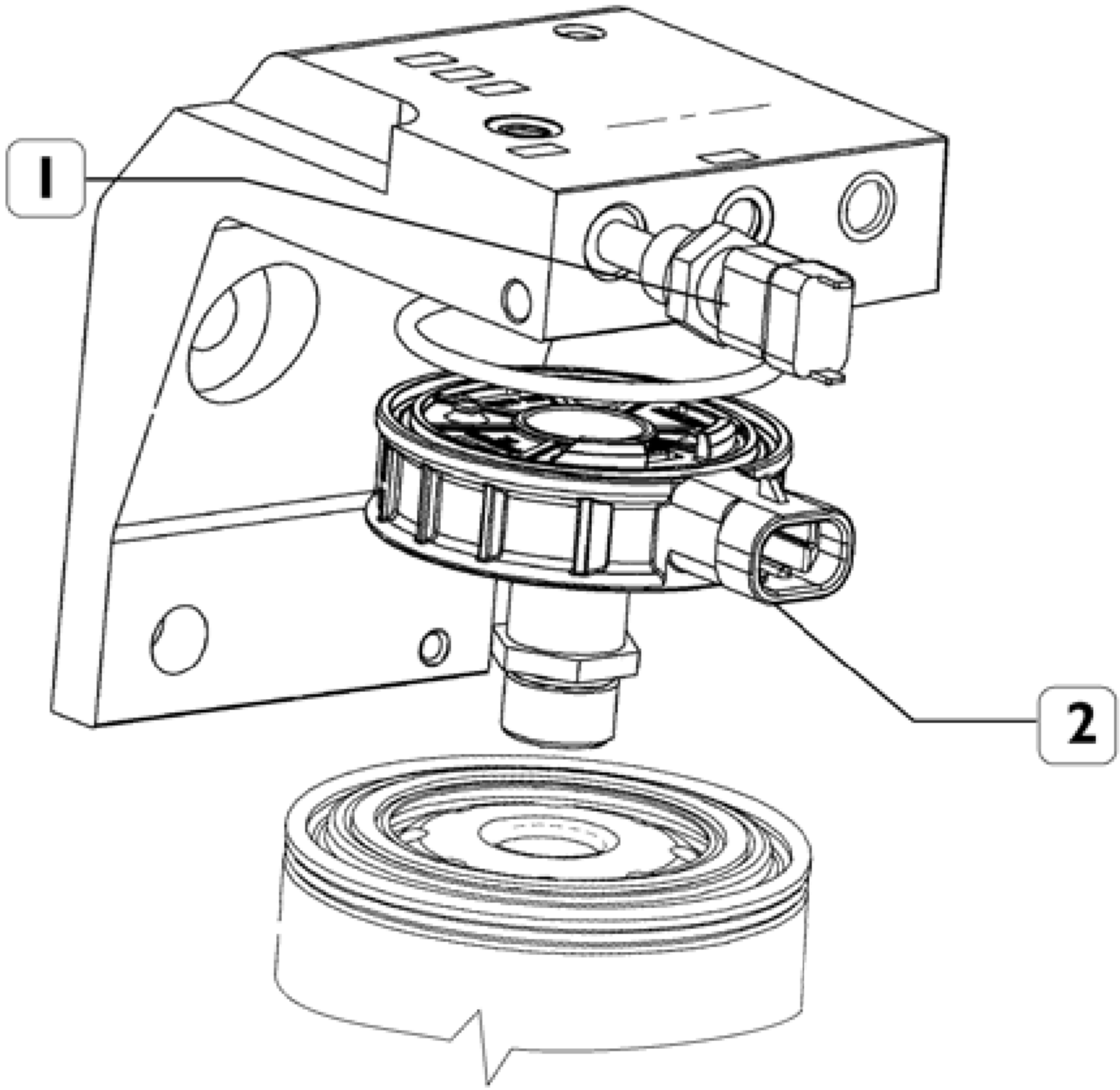
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

This sensor is identical to the previous one.

It detects the temperature of the fuel to give the control unit information about the fuel temperature conditions.

It is connected to the control unit at pins 16H - 26H.

Its resistance at **20 °C** is approximately **2,50 kΩ**.

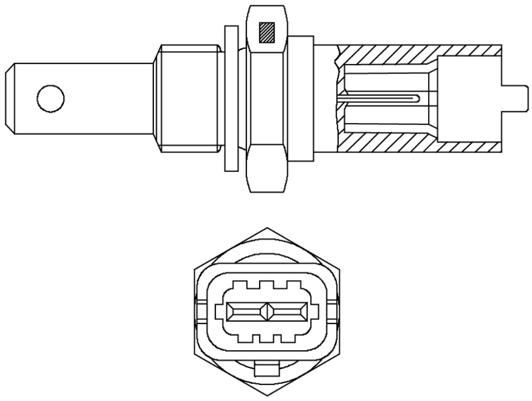


135233 1

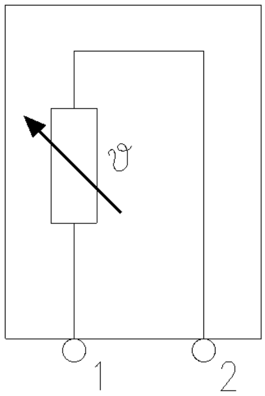
1. Fuel temperature sensor

2. Filter heating element

The ECU controls the filter heater control at a fuel temperature ≤. **5 °C**.



107799 2



107798 3

Ref.	Description	Control unit PIN
1	Ground	16H
2	Temperature Signal	26H

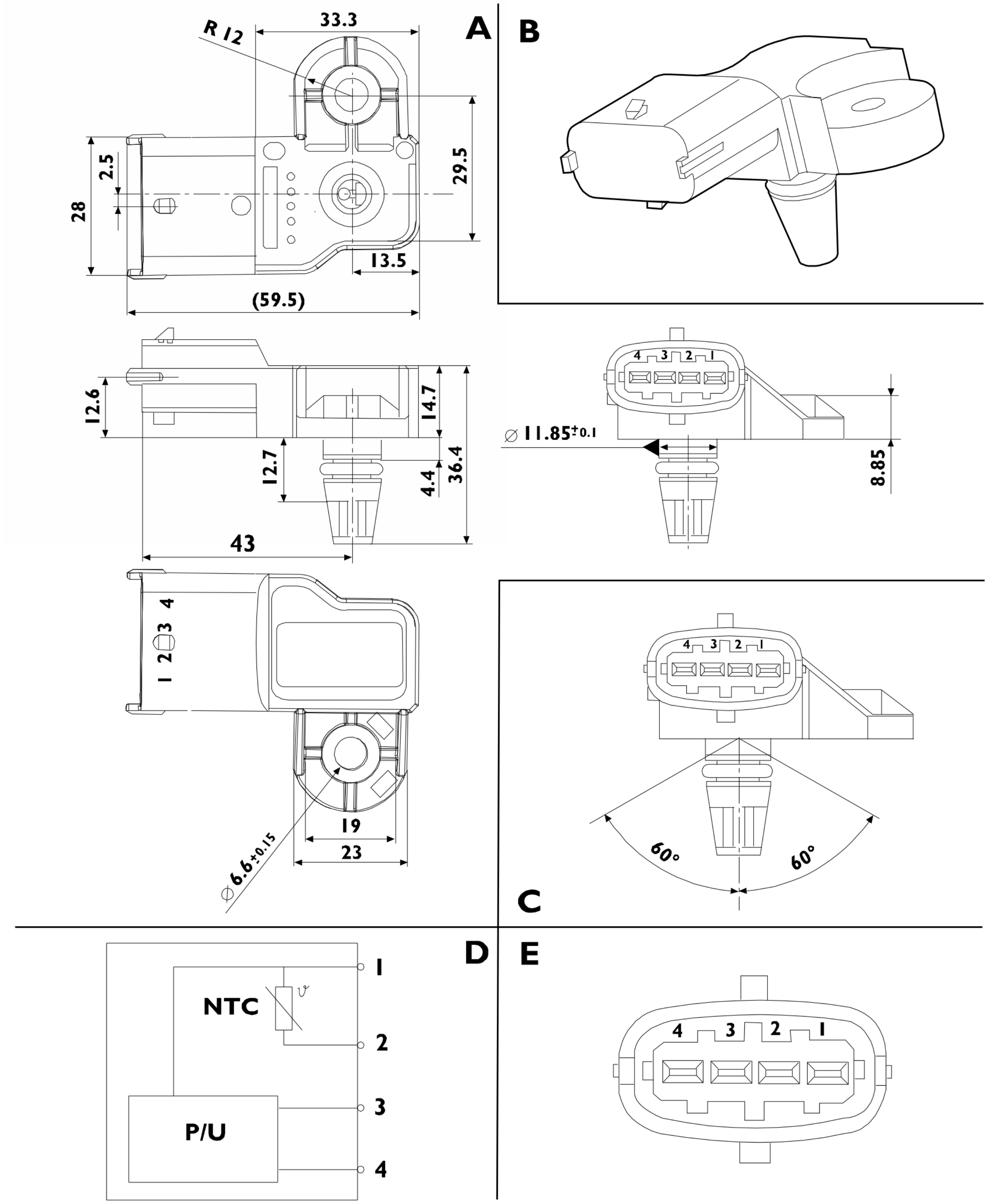
772646 AIR PRESSURE SENSOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

This component combines a temperature 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 output voltage is proportional to the pressure or temperature measured by the sensor.



196905 1

A. Technical view
B. Perspective view
C. Recommended assembly position
D. Electrical schema
E. Connector

Technical characteristics

Supplier: BOSCH

Technical data	
Sensor power supply	**5 V**
Storage temperature	**- 40 – 130 °C**

Pin - out

Pin	Description	Control unit PIN
1	Mass	22H
2	Air temperature signal	6H
3	Sensor power supply (+ **5 V**)	21H
4	Air pressure signal	32H

Temperature and pressure sensor resistance

Parameter	Symbol	Value		
		Min	Nom	Max
Us load or ground resistance	Rpull-up	**5 kΩ**		
	Rpull-down	**10 kΩ**		
Ground outlet resistance, Us open	Rio	**1,0 kΩ**	**1,6 kΩ**	**2,0 kΩ**
Us outlet resistance², ground open	Rhi	**1,0 kΩ**	**1,6 kΩ**	**2,0 kΩ**

Resistance for temperature or voltage for temperature

Temperature	Resistance R			Tolerance	Tolerance test with T ± 1K	
	rated	minimum	maximum	in K	minimum	maximum
-40 °C	**45303 Ω**	**43076 Ω**	**47529 Ω**	± 0.9	40730	50314
-35 °C	**34273 Ω**	**32643 Ω**	**35902 Ω**	± 0.9	30908	37953
-30 °C	**26108 Ω**	**24907 Ω**	**27309 Ω**	± 0.9	23603	28829
-25 °C	**19999 Ω**	**19108 Ω**	**20889 Ω**	± 0.9	18142	22023
-20 °C	**15458 Ω**	**14792 Ω**	**16124 Ω**	± 0.8	14055	16970
-15 °C	**12000 Ω**	**11499 Ω**	**12501 Ω**	± 0.8	10945	13144
-10 °C	**9395 Ω**	**9015 Ω**	**9775 Ω**	± 0.8	8595	10261
-5 °C	**7413 Ω**	**7123 Ω**	**7704 Ω**	± 0.8	6801	8074
0 °C	**5895 Ω**	**5671 Ω**	**6118 Ω**	± 0.8	5420	6403
5 °C	**4711 Ω**	**4537 Ω**	**4884 Ω**	± 0.8	4343	5106
10 °C	**3791 Ω**	**3656 Ω**	**3927 Ω**	± 0.8	3504	4100
15 °C	**3068 Ω**	**2962 Ω**	**3174 Ω**	± 0.8	2842	3310
20 °C	**2499 Ω**	**2416 Ω**	**2583 Ω**	± 0.8	2323	2690
25 °C	**2056 Ω**	**1990 Ω**	**2123 Ω**	± 0.8	1916	2207
30 °C	**1706 Ω**	**1653 Ω**	**1760 Ω**	± 0.8	1591	1827
35 °C	**1411 Ω**	**1368 Ω**	**1455 Ω**	± 0.8	1318	1510
40 °C	**1174 Ω**	**1139 Ω**	**1209 Ω**	± 0.8	1100	1254
45 °C	**987,4 Ω**	**959,0 Ω**	**1016 Ω**	± 0.8	927.0	1051
50 °C	**833,8 Ω**	**810,5 Ω**	**857,0 Ω**	± 0.8	783.1	886.3
55 °C	**702,7 Ω**	**683,7 Ω**	**721,7 Ω**	± 0.8	661.2	746.6
60 °C	**595,4 Ω**	**579,7 Ω**	**611,0 Ω**	± 0.8	561.6	631.4
65 °C	**508,2 Ω**	**495,3 Ω**	**521,1 Ω**	± 0.8	480.2	537.8
70 °C	**435,6 Ω**	**424,9 Ω**	**446,4 Ω**	± 0.8	412.1	460.3
75 °C	**374,1 Ω**	**365,2 Ω**	**383,1 Ω**	± 0.8	354.4	394.9
80 °C	**322,5 Ω**	**315,0 Ω**	**329,9 Ω**	± 0.8	306.0	339.8
85 °C	**279,5 Ω**	**273,2 Ω**	**285,8 Ω**	± 0.8	265.7	294.0
90 °C	**243,1 Ω**	**237,8 Ω**	**248,4 Ω**	± 0.8	231.5	255.4
95 °C	**212,6 Ω**	**208,1 Ω**	**217,1 Ω**	± 0.8	202.7	223.0
100 °C	**186,6 Ω**	**182,9 Ω**	**190,3 Ω**	± 0.8	178.0	195.4
105 °C	**163,8 Ω**	**160,3 Ω**	**167,2 Ω**	± 0.8	156.2	171.6
110 °C	**144,2 Ω**	**141,0 Ω**	**147,3 Ω**	± 0.9	137.5	151.0

115 °C	**127,3 Ω**	**124,4 Ω**	**130,1 Ω**	± 0.9	121.4	133.4
120 °C	**112,7 Ω**	**110,1 Ω**	**115,2 Ω**	± 1.0	107.5	118.0
125 °C	**100,2 Ω**	**97,81 Ω**	**102,5 Ω**	± 1.0	95.55	104.9
130 °C	**89,28 Ω**	**87,13 Ω**	**91,43 Ω**	± 1.1	85.13	93.52
135 °C	**79,63 Ω**	**77,67 Ω**	**81,59 Ω**	± 1.1	75.93	83.45
140 °C	**71,18 Ω**	**69,39 Ω**	**72,97 Ω**	± 1,2	67.88	74.60
145 °C	**63,85 Ω**	**62,21 Ω**	**65,48 Ω**	± 1,2	60.88	66.91
150 °C	**57,39 Ω**	**55,89 Ω**	**58,89 Ω**	± 1,3	54.75	60.15

773010 COMPLETE SUPPLY PUMP - Overview

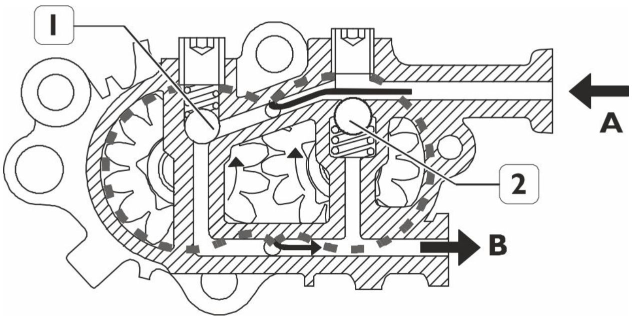
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Mechanical supply pump

The mechanical fuel pump is a gear pump that is assembled on the rear part of the high pressure pump that it supplies.

It is driven by the high pressure pump shaft.

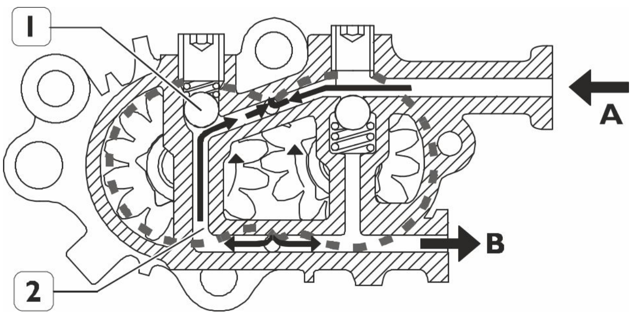
Normal operating conditions



72592 1

(A) Fuel inlet from tank - (B) Fuel outlet to filter - (1) - (2) By-pass in the closed position

Outlet overpressure condition

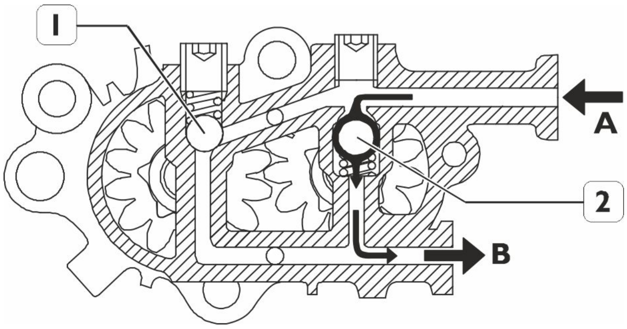


72593 2

The by-pass valve **(1)** operates in output **(B)** and generates an overpressure.

This pressure, overcoming the elastic resistance of the valve spring **(1)**, connects the output with the entrance through the duct **(2)**.

Air bleeding conditions



72594 3

The by-pass valve **(2)** cuts in when, with engine off, the fuel system is to be filled through the priming pump.

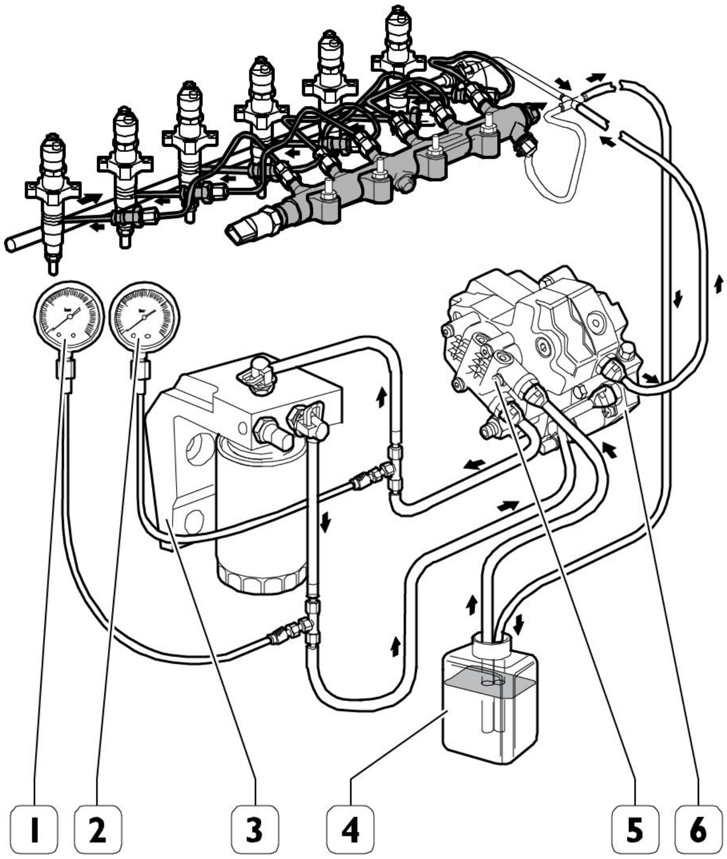
In this situation the by-pass valve **(1)** stays closed whereas by-pass valve **(2)** opens due to inlet pressure, and fuel is drained out through **(B)**.

NOTE: *The mechanical supply pump cannot be replaced individually, therefore it cannot be removed from the high pressure pump.*

773010 COMPLETE SUPPLY PUMP - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453
Tool to check the diesel supply circuit and the common-rail injection system	99305453



214343 1

1. Filter outlet pipe pressure gauge
2. Filter inlet pipe pressure gauge
3. Fuel filter bracket
4. External container
5. Gear pump
6. High-pressure mechanical fuel pump CP 3.3

1. The gear pump **(5)** has the function of supplying the CP.3.3 **(6)** high-pressure pump. It is controlled by the shaft of the high-pressure pump and is fitted on its rear part. By keeping the kit instrumentation fitted as shown in the figure with batteries charged to **24,7 V**, the engine should start within **20 s** after activation of the starter motor, sucking the diesel fuel from an external container **(4)** located a maximum of **1 m** below the engine.

2. If the pump does not suck the diesel fuel within the time indicated and therefore the engine does not start, replace the pump.

NOTE: *If the test was performed with a new mechanical supply pump from Spare parts, before doing the test, a first start is necessary in order to restore normal operation conditions.*

3. After starting the engine, at **1500 RPM** check that the pressure on the gauge **(2)** is between **6 – 9 bar**.

Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

4. If the value is lower than **6 bar** replace the pump, and if the value is higher than **9 bar** replace the diesel filter.

Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

5. The pressure gauge **(1)** should show a pressure exceeding **9 bar**. If the pressure is lower than this value, replace the fuel filter. If the problem persists, check the tightness of the fittings of the fuel filter support and the input of the high pressure pump.

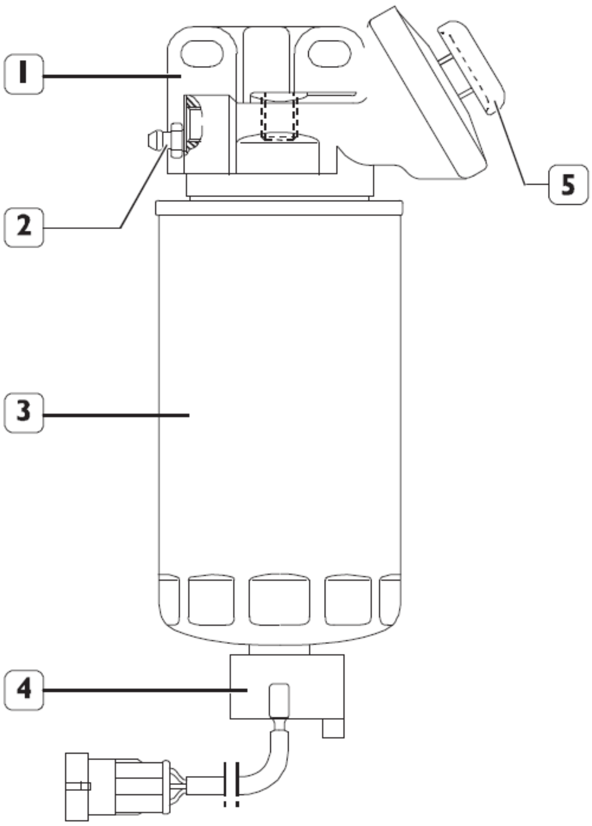
Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

NOTE: *A new mechanical fuel pump which is interchangeable with the previous version has been included in Spares. The new pump has a new seal protecting against water entering the area where the two pumps are joined, thus preventing the formation of rust which could cause breakage of the shaft connecting the high and low-pressure pumps. The pump is equipped with seal, however the single seal is provided as a spare.*
When the low-pressure pump has to be replaced, thoroughly clean the mating area with high-pressure pump CP.3.3.

6. Remove the tool.

773110 FUEL PRE-FILTER - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL



70494A 1

The fuel filter is of the high water separation type, it is mounted on the vehicle chassis and has the sensor **(4)** for detecting water in the fuel located on the cartridge **(3)** base.

The filter bracket houses the manual priming pump **(5)** and a screw **(2)** for bleeding the air from the system.

The presence of condensate in the filter is signalled by sensor **(4)** when a warning light on the instrument panel comes on.

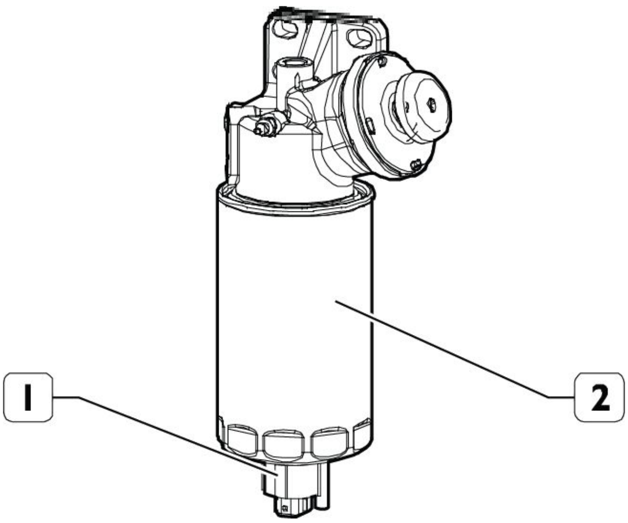
Risk of damage
If the warning light comes on, act immediately to remove the cause; the common rail system components damage quickly if there are impurities or water in the fuel.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

773110 FUEL PRE-FILTER - Drain fluid

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. The high risk of refuelling with fuel that is polluted by foreign bodies and water makes it advisable to carry out this control every time you refuel.
2. Proceed with the engine stopped.
   - Place a container under the pre-filter **(2)**to collect the fluid.
   - Unscrew the plug **(1)** located in the lower part of the pre-filter **(2)**; in some configurations the plug includes a sensor for detecting water in the diesel.
   - Let the fluid drain out until only diesel can be seen.
   - Close the plug again, tightening it completely by hand.
   - Dispose of the drained fluids according to current requirements.



227502 1

General prescriptions
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.
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

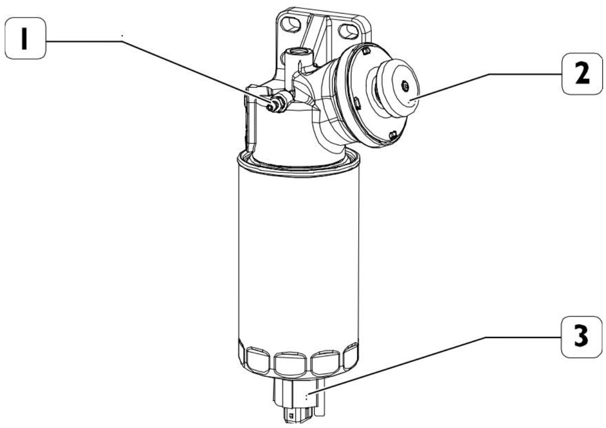
773110 FUEL PRE-FILTER - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Position a collection container under the pre-filter, open the plug **(3)** and drain the diesel contained in the pre-filter.
2. Unscrew the pre-filter and replace it.
3. Before refitting the new cartridge, moisten the seal with diesel or engine oil.
4. Screw the cartridge on by hand until it comes into contact with the mounting, then tighten it to the required torque.
5. Close the diesel oil drain plug.

NOTE: *The filter cartridge must not be prefilled when replacing it. This is to prevent impurities from entering circulation which could damage injector/pump system components. Bleed the air from the fuel circuit.*

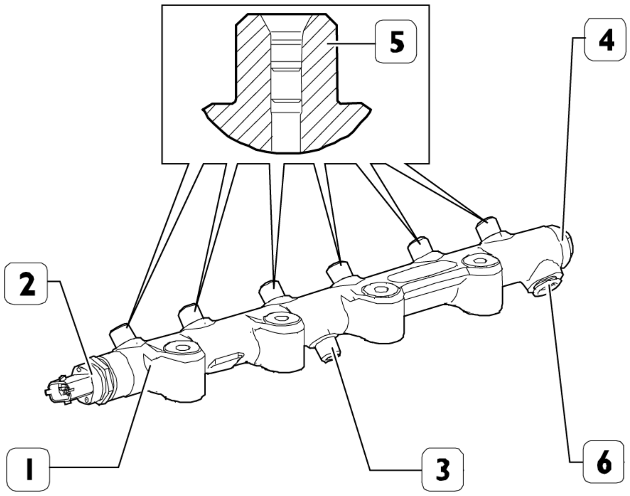


215045 1

774510 HIGH PRESSURE ACCUMULATOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Rail (pressure accumulator)



209187 1

1. rail ;
2. Pressure sensor;
3. Fuel inlet from the high-pressure pump;
4. Overpressure valve.

The rail volume is of reduced sizes 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 **(5)** have been fitted to the fuel delivery couplings, which control the fuel waves generated by the high-pressure pump.

A fuel pressure sensor **(2)** 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

Fitted at one end of the rail, it serves to protect system components if a fault in either the rail pressure sensor or the CP3 pump pressure regulator causes an excessive increase of pressure in the high-pressure system.

When the pressure in the rail reaches **1750 bar**, 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 bar**
Overpressure valve opening start	**1750 bar**

Complete opening of overpressure valve	**1950-2050 bar**

774511 PRESSURE SENSOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

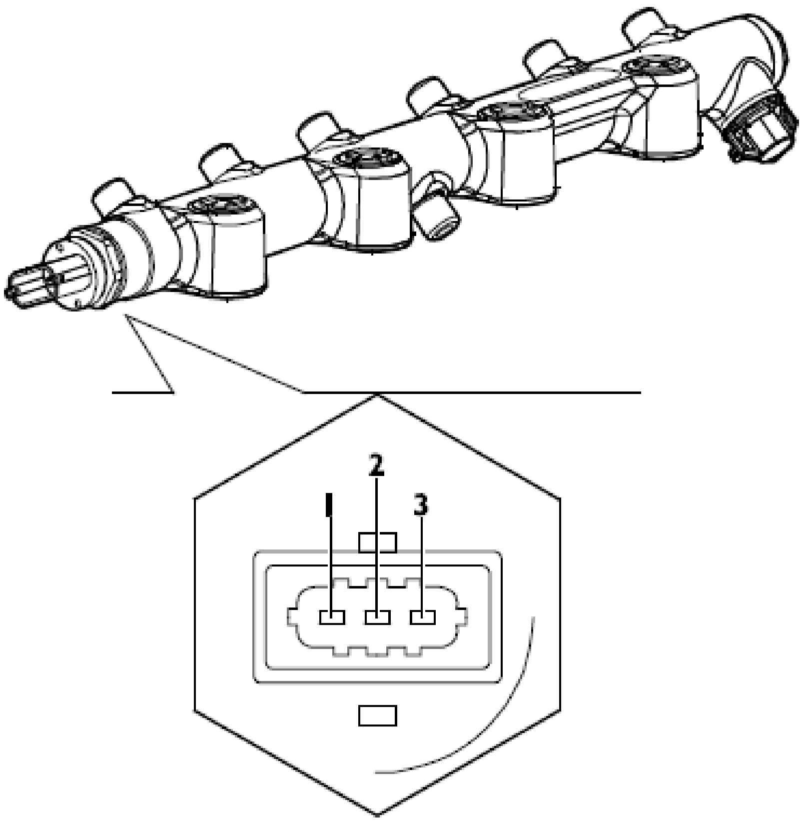
Assembled on one end of the rail, it measures the existing fuel pressure and informs the control unit (feed - back).

The injection pressure value is used to control the pressure and to determine the duration of the injection electronic command.

It is connected to the control unit at pins 27D - 30D - 32D.

It is powered at **5 V**.

Rail pressure sensor connector



0051065T 1

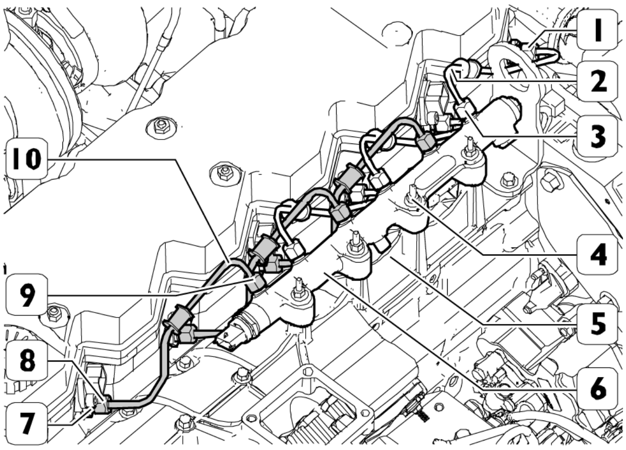
Ref.	Description	Control unit PIN
1	Ground	27D
2	Signal	30D
3	Power supply	32D

774510 HIGH PRESSURE ACCUMULATOR - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Position a suitable container to collect any fuel which may leak out.
2. Disconnect the fuel pressure sensor cable as described in the procedure **ENGINE CABLES - Remove (76.91)**.
3. Disconnect the low-pressure fuel return pipe from the common rail as described in the procedure **PIPES - Remove (54.20)**.
4. Unscrew the hose couplings **(1)**, **(3)**, **(8)** and **(9)** from the common rail **(6)** and the injector manifolds **(7)** and remove the high-pressure fuel delivery pipes **(2)** and **(10)**.
5. Screw the dual threaded shank screws **(4)** and remove the common rail **(6)** from the intake manifold **(5)**.

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screwsM8x1.25x125		**36 +/- 5 N·m**



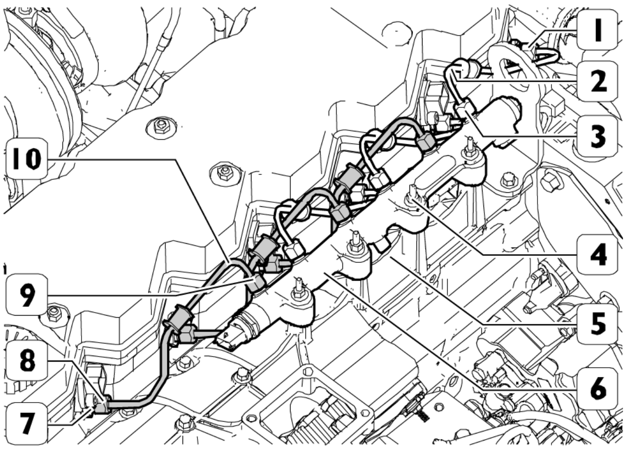
209210 1

774510 HIGH PRESSURE ACCUMULATOR - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Common rail	4 screwsM8x-1.25x125		**36 +/- 5 N·m**
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**

1. Install the common rail and the high-pressure fuel delivery pipes as follows:
2. Fit the common rail **(6)** on the intake manifold **(5)** and manually tighten the threaded double-shank shoulder screws **(4)**;
3. tighten the two central screws **(4)** to a torque of **0,1 N·m**;
4. fit the high-pressure fuel delivery pipes **(2)** and **(10)** and manually tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** first from the common rail side and then from the cylinder head side;
5. tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to a torque of **5 N·m**, first from the cylinder head side and then from on the common rail side;
6. tighten the threaded double-shank shoulder screws **(4)** fixing the common rail **(6)** on the intake manifold **(5)** to the prescribed torque;
7. tighten the hose couplings **(1)**, **(3)**, **(8)** and **(9)** to the prescribed torque, first from the common rail side and then from the cylinder head side.



209210 1

NOTE: *The high-pressure fuel delivery pipes must be replaced each time they are disconnected. The flexible pipe fittings must be tightened to the specified torque.*

Description	Quantity	Step	Value
High-pressure fuel delivery pipe from rail to injector	12 couplings M14 x 1.5	Phase 1 Tighten	**10 N·m**
		Phase 2 Angle tightening	**55°**
Common rail	4 screwsM8x1.25x125		**36 +/- 5 N·m**

8. Fit the fuel pipe from the high-pressure pump to the common rail and connect the low-pressure fuel return pipe to the common rail as described in the procedure **PIPES - Install (54.20)**.
9. Connect the fuel pressure sensor connector as described in the procedure **ENGINE CABLES - Install (76.91)**.

774513 OVER PRESURE VALVE - Pressure test

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

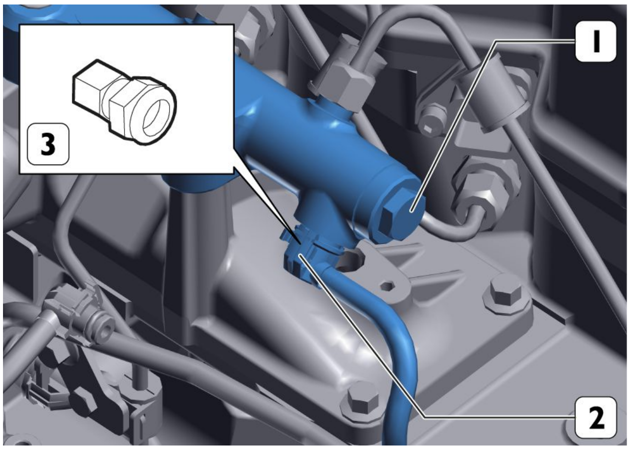
Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453

Test on the pressure relief valve on the rail

The function of the valve fitted at one end of rail is to protect system components against any fault which might result in overpressure in high pressure system.

1. Disconnect the recirculation pipe **(2)** of the overpressure valve **(1)** and plug the pipe using the Voss fitting **(3)** supplied with the tool.

Tool / Material	
Tool to check the diesel supply circuit and the common-rail injection system	99305453



255208 1

2. No diesel fuel leaks must be detected from valves at any engine rpm.
3. If the diagnostic system indicates the fault code Rail overpressure relief valve management, this means that the control unit has identified the valve opening due to a significant change in the pressure of the rail (greater than **1800 bar**).
4. Since the valve opening is due to an abnormal pressure increase, the valve is not faulty even if a significant quantity of diesel is coming out.
5. If diesel leaks are detected from the valve **(1)** and the fault code is not emitted, replace the valve.

NOTE: *When replacing the pressure relief valve, the parameters must be reset using the diagnostics instrument.*

775010 INJECTOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Electro-injector

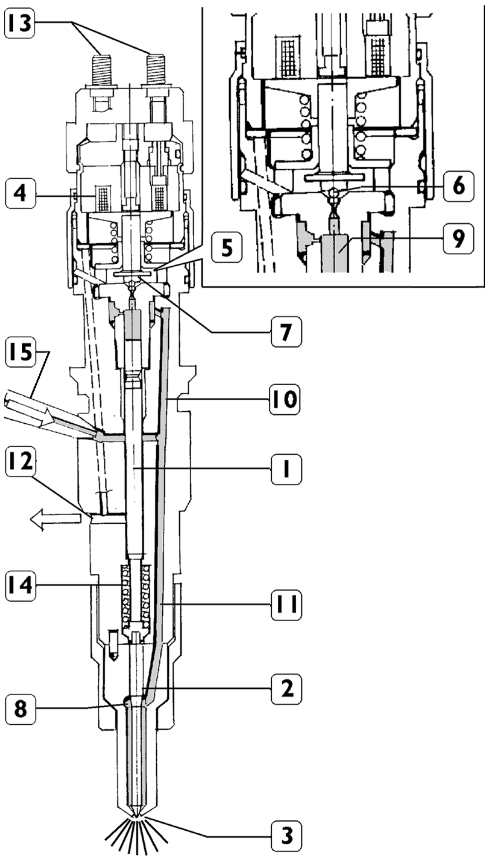
The construction of the injector is similar to traditional construction, apart from the fact that it has no needle return springs.

The electroinjector essentially consists of two parts:

- actuator - spray nozzle consisting of a pressure rod **(1)**, a needle **(2)** and a jet **(3)**;
- driving solenoid valve consisting of a coil **(4)** and pilot valve **(5)**.

The solenoid valve controls the needle lift of the nozzle.

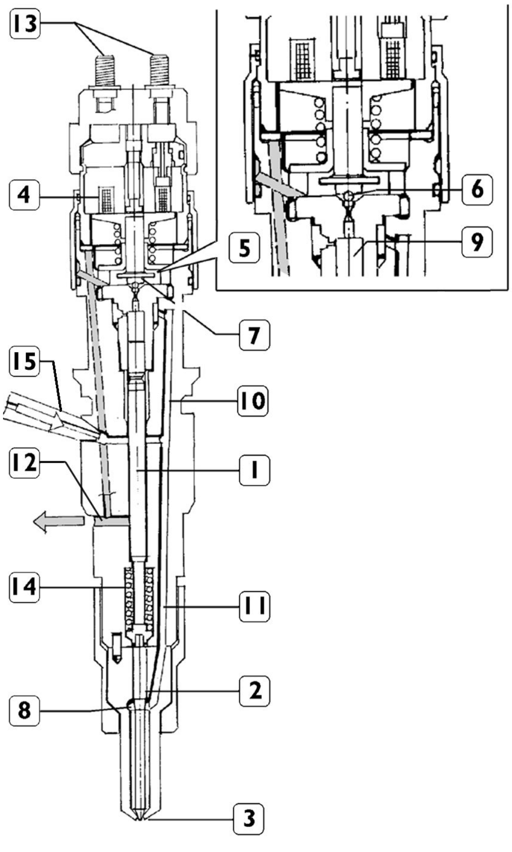
Injector in resting position



1

(1) Pressure rod – (2) Needle – (3) Nozzle – (4) Coil – (5) Pilot valve – (6) Ball shutter – (7) Control area – (8) Pressure chamber – (9) Control volume – (10) Control duct – (11) Supply duct – (12) Control fuel outlet – (13) Electrical connection – (14) Spring – (15) High-pressure fuel inlet

Beginning of injection



2

When the coil **(4)** is energised, it causes the shutter **(6)** to move upwards. The fuel in the control volume **(9)** flows back towards the return duct **(12)** resulting in a pressure drop in control volume **(9)**. At the same time, the fuel pressure in the pressure chamber **(8)** moves the needle up **(2)**, resulting in the fuel being injected into the cylinder.

End of injection

When power to the coil **(4)** is cut off, the shutter **(6)** closes again so as to re-create an equilibrium which moves the needle **(2)** back into its closed position and stops the injection process.

NOTE: *The electro-injector cannot be overhauled and therefore it must not be disassembled.*

Electro-injectors

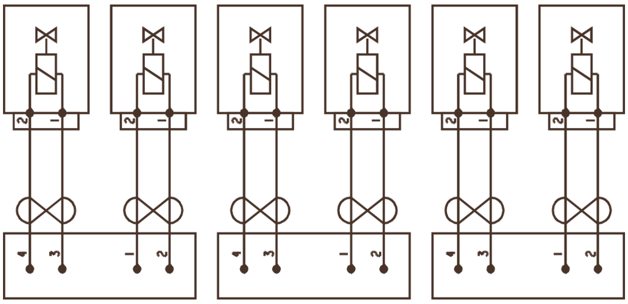
It is a N.O. type solenoid valve.

They are connected separately to the MD1 control unit on connector 8.

The resistance of the coil of each individual injector is of **0,56 – 0,57 Ω**.

Ref.		Description	Control unit PIN
CONNECTOR 1	1	Cylinder 2 injector	7
	2	Cylinder 2 injector	8
	3	Cylinder 1 injector	2
	4	Cylinder 1 injector	1
CONNECTOR 2	1	Cylinder 4 injector	10
	2	Cylinder 4 injector	11
	3	Cylinder 3 injector	5
	4	Cylinder 3 injector	4

Ref.		Description	Control unit PIN
CONNECTOR 3	1	Cylinder 6 injector	13
	2	Cylinder 6 injector	14
	3	Cylinder 5 injector	17
	4	Cylinder 5 injector	16



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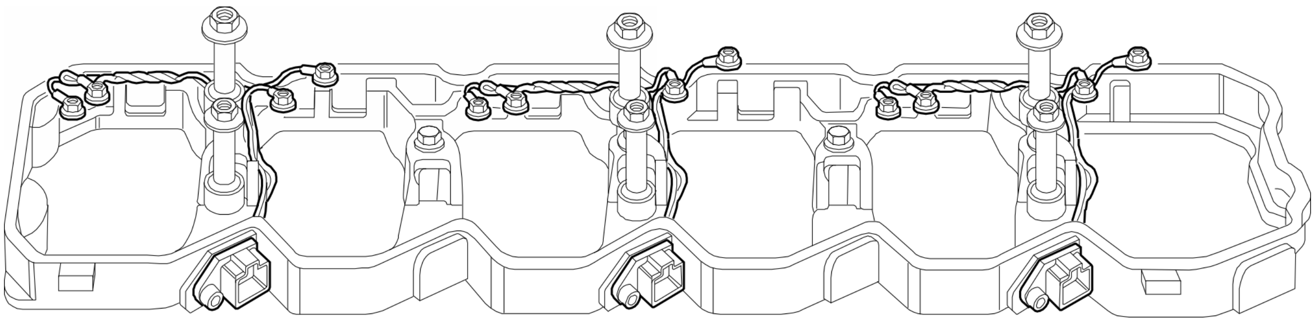


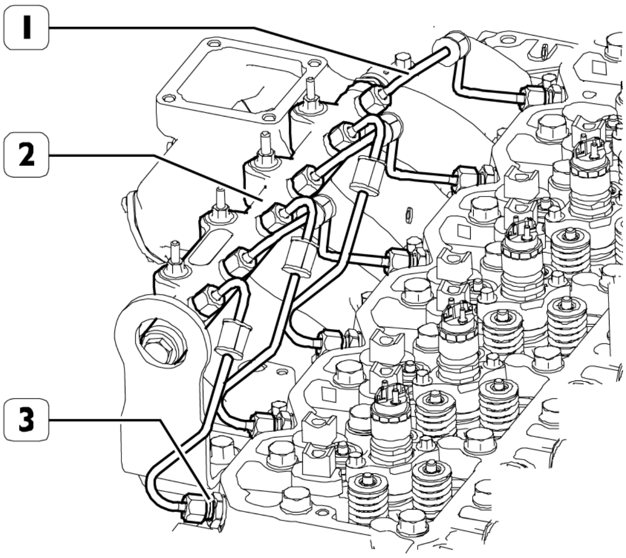
50349 4

775010 INJECTOR - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
Tool to remove injectors	99342101

1. Remove the tappet cover as described in the procedure **ROCKER COVER - Remove (54.06)**.
2. Remove the injector wiring mount as described in the procedure **CYLINDER HEAD TOP - Remove (54.06)**.
3. Remove the rocker arm assembly as described in the procedure **ROCKER ARM ASSY - Remove (54.12)**.
4. Position a suitable container to collect any fuel which may leak out.
5. Disconnect the high-pressure hose couplings **(1)** from the common rail **(2)** and the injector manifolds **(3)**, then remove them.

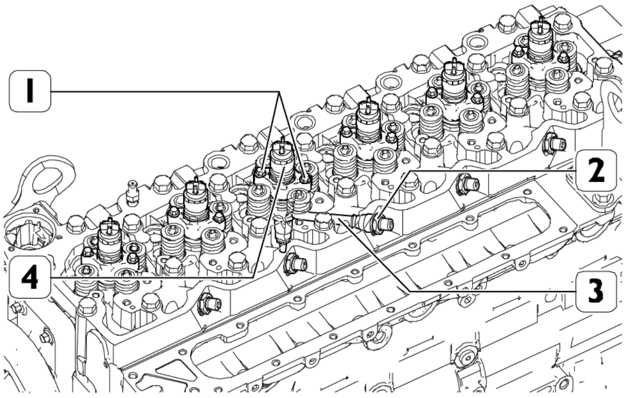


166638 1

6. Unscrew the fastening nuts **(2)** and remove the fuel manifolds **(3)**.
7. Unscrew the electro-injector **(1)** fastening screws **(4)**.

NOTE: *Disassembled fuel manifolds **(2)** must not be used again, but replaced with new ones.*

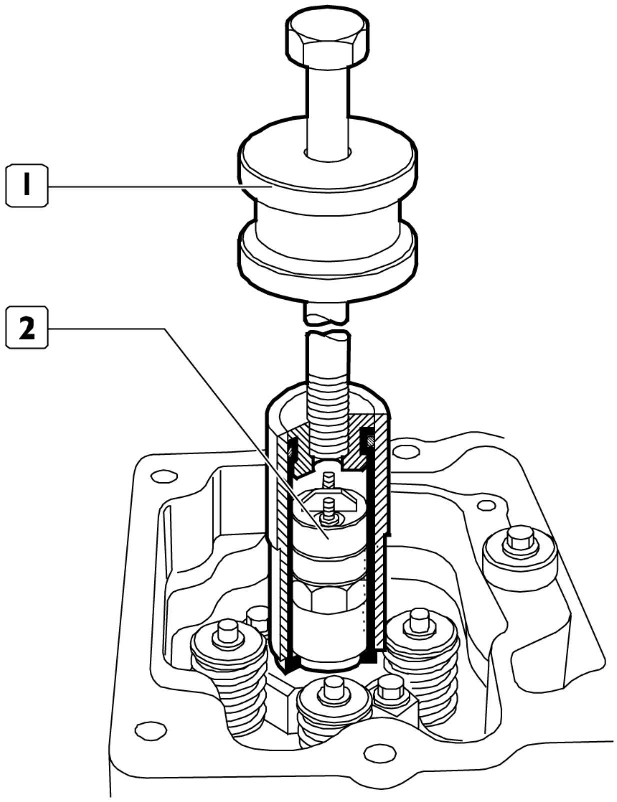
Description	Quan-tity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Phase 3 Angle tightening	**25°**
		Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**



212835 2

8. Remove injector fastening screws and use the tool **(1)** to remove the injectors **(2)** from the cylinder head.

Tool / Material	
Tool to remove injectors	99342101



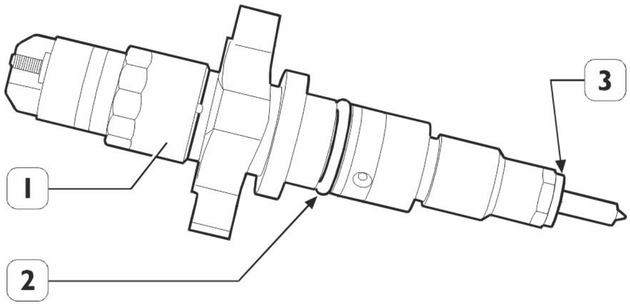
181861 3

775010 INJECTOR - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

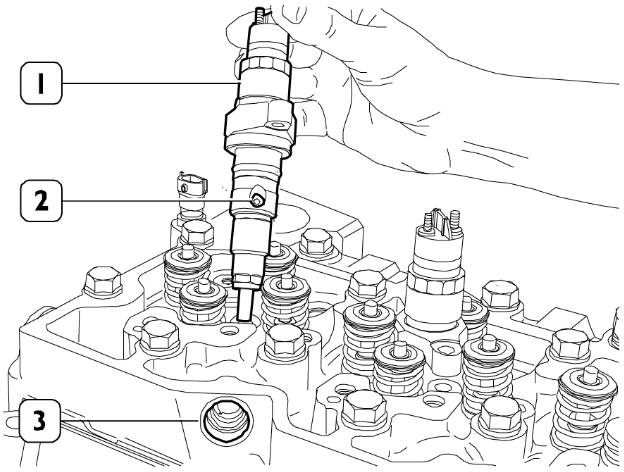
Description	Quantity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Phase 3 Angle tightening	**25°**
		Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1.5x9.5		**55 +/- 5 N·m**

1. Fit both a new sealing ring **(2)** lubricated with Vaseline and a new sealing washer **(3)** on the injector **(1)**.



70338 1

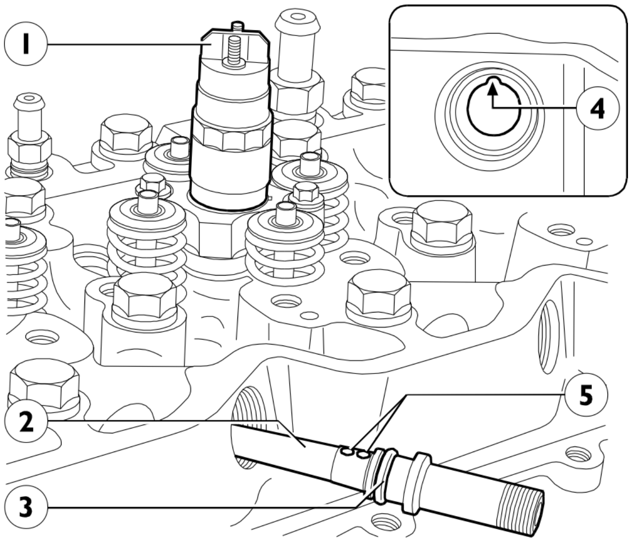
2. Place the injectors **(1)** in position on the cylinder head seats so that the fuel inlet hole **(2)** is facing the fuel manifold seat **(3)** side.
3. Position the electro-injector fastening brackets and screw in the screws without tightening them.



203451 2

4. Fit a new seal ring **(3)** lubricated with Vaseline onto a new fuel manifold **(2)**.
5. Position the fuel manifold **(2)** in place on the cylinder head seat so that the positioning balls **(5)** coincide with the relevant housing **(4)**.

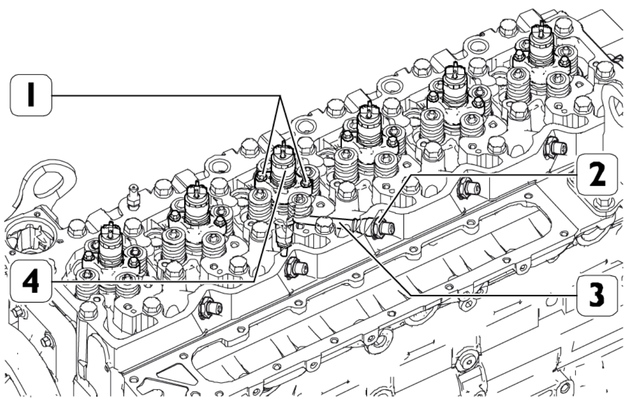
NOTE: *Disassembled fuel manifolds **(2)** must not be used again, but replaced with other new ones.*



91572 3

6. Screw the fastening nuts **(2)** without locking them.
7. Tighten gradually and alternately the electro-injector **(4)** fastening screws **(1)** to the prescribed torque in four stages.
8. Tighten the fuel manifold **(3)** fastening nuts **(2)** to the prescribed torque.

NOTE: *During this operation, manoeuvre the injector **(4)** so that the manifold **(3)** is properly inserted into the injector fuel inlet hole.*



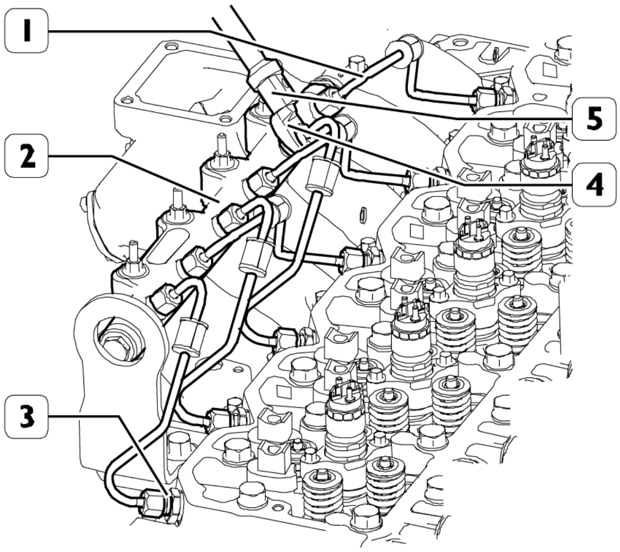
212835 4

Description	Quan-tity	Step	Value
Electro-injectors	12 screws M8 x 1.25	Phase 1 Tighten	**3,5 +/- 0,35 N·m**
		Phase 2 Angle tightening	**25°**
		Phase 3 Angle tightening	**25°**
		Phase 4 Angle tightening	**25°**
Fuel manifolds on cylinder head	6 nuts M22x1. 5x9.5		**55 +/- 5 N·m**

9. Place the new high-pressure fuel pipes **(1)** in position and tighten the couplings to the common rail **(2)** and to the injector manifolds **(3)** to the prescribed torque.

NOTE: *As the pipes **(1)** are subject to high pressure, they must always be replaced each time they are removed. The pipe fittings must be tightened to a torque of **24 +/- 4 N·m** using the wrench **(4)** and the torque wrench **(5)**.*

10. Fit the rocker arm assembly, the injector wiring mount and the tappet cover as described in the procedures **ROCKER ARM ASSY - Install (54.12)**, **CYLINDER HEAD TOP - Install (54.06)** and **ROCKER COVER - Install (54.06)**.



166640 5

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INJECTION - 77

(*) See content for specific models

Contents

CHASSIS - 50

(*) See content for specific models

(*) See content for specific models

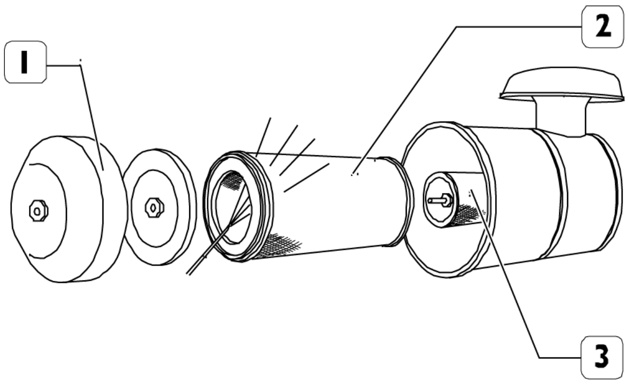
505110 ENGINE SUPPLY AIR FILTER - Cleaning

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Check of air filter and cleanliness of housing

1. Only proceed with the engine stopped.
2. Remove the filter cover **(1)** after first unscrewing the locking handle.
3. Remove the external cartridge **(2)**, after having released the second locking handle. During this operation, pay careful attention to ensure there is no contamination inside the sleeve.
4. Check that there is no dirt present. Otherwise, clean the filter element as indicated below.
5. Blow dry compressed air through the filter element, from the inside outwards (maximum pressure **200 kPa**). Do not use detergents; do not use diesel.
6. Never use tools to beat the filter element, and check its condition before replacing it.
7. Replace the filter if any breakages or tears are found.
8. Check that the gasket at the base of the filter is in a good condition. Some filtering systems are equipped with a second filter element **(3)** which does not require cleaning. It **(3)** must be changed at least once every three times that the main element is replaced **(2)**.
9. Position the new filter element **(2)** in its seat.
10. Reassemble by repeating the above operations in reverse order.
11. Restore the clogged indicator by pressing the button on the top part of the indicator. This operation is not necessary if there is an electric sensor.

NOTICE: *Take care to ensure that the parts are reassembled correctly.*
Imperfect assembly might result in unfiltered air being sucked into the engine, causing serious damage.



215046 1

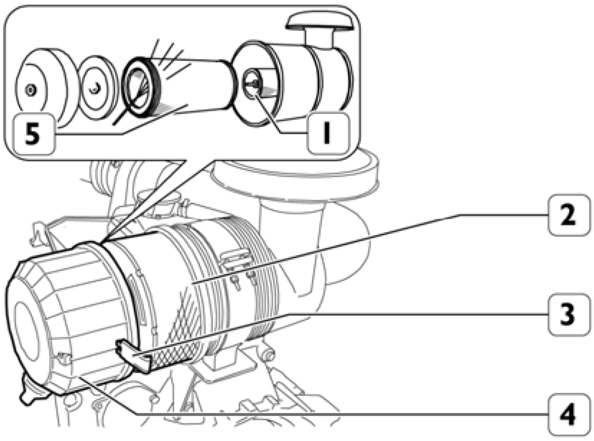
505110 ENGINE SUPPLY AIR FILTER - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Proceed when the engine is not turning.
2. Remove the air filter cover **(4)** after having released the two quick release catches **(3)**.
3. Remove the filter element **(5)**; make sure that dust does not enter the sleeve during this operation.
4. Replace the filter element **(5)** and the relative gasket.
5. Position the new filter element **(5)** in its housing.
6. Replace the air filter cover **(4)** and lock it in place using the two quick release catches **(3)**.

NOTE: *Some filter systems are fitted with a second filter element* ***(1)****.*



251122 1

General prescriptions
Do not use detergents or diesel to clean the air filter. Never strike the filter with tools. Careless assembly of the air filter can lead to the introduction of unfiltered air which can seriously damage 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

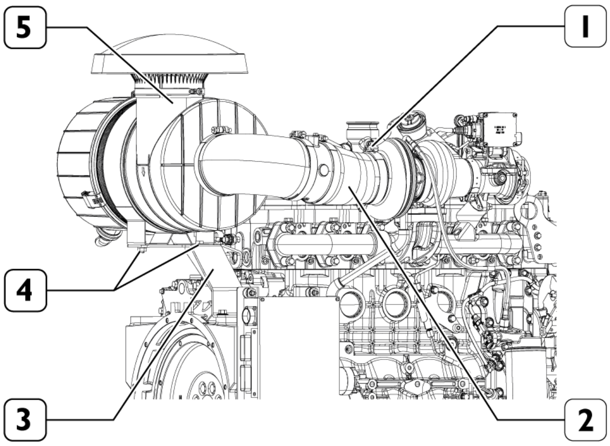
505110 ENGINE SUPPLY AIR FILTER - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
ENGINE CABLES - Remove (76.91)

1. Unscrew the screw collar **(1)** from the air pipe **(2)**.
2. Unscrew the nuts **(4)** and remove the air filter **(5)** from the supporting bracket **(3)**.

Description	Quantity	Value
Air filter bracket	2 screws M6 x 1 x 14	**0 +/- 0 N·m**



268004 1

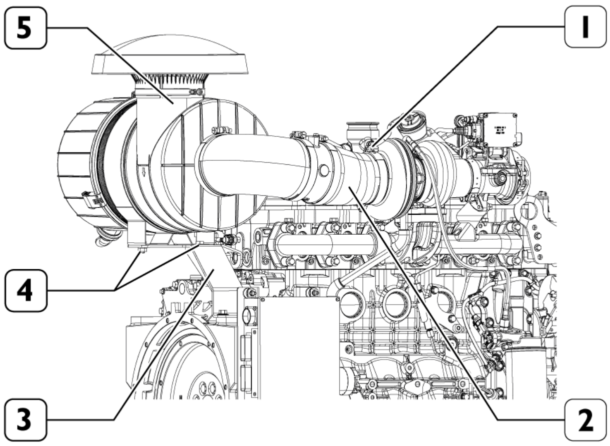
505110 ENGINE SUPPLY AIR FILTER - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Air filter bracket	2 screws M6 x 1 x 14	**0 +/- 0 N·m**

1. Correctly position the air filter **(5)** on the supporting bracket **(3)** and tighten the nuts **(4)**.
2. Tighten the screw collar **(1)** to the air pipe **(2)**.

Description	Quantity	Value
Air filter bracket	2 screws M6 x 1 x 14	**0 +/- 0 N·m**



268004 1

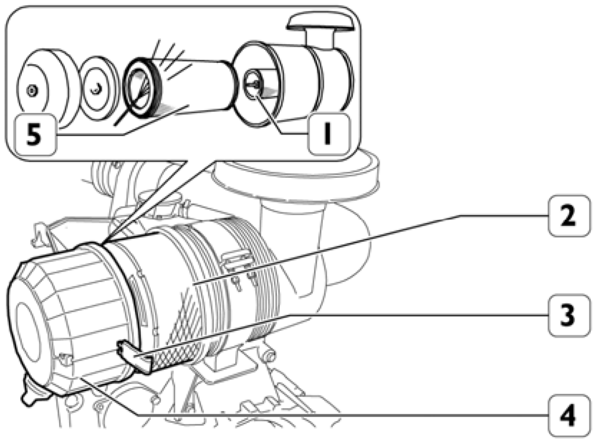
Next operation:
ENGINE CABLES - Install (76.91)

505111 AIR CLEANER CARTRIDGE - Cleaning

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Proceed when the engine is not turning.
2. Remove the air filter cover **(4)** after having released the two quick release catches **(3)**.
3. Remove the filter **(5)**; make sure that dust does not enter the sleeve during this operation.
4. Make sure there are no impurities. Otherwise, clean the filter element according to the instructions provided below.
5. Blow dehumidified compressed air through the filter element, from the inside outwards (maximum pressure **200 kPa**).
6. Check the condition of the air filter before refitting it. Replace it if broken or torn.
7. Check the condition of the gasket at its base.
8. Some filtering systems are equipped with a second filter element **(1)** which does not require cleaning.
9. Place the filter **(5)** in its housing.
10. Replace the air filter cover **(4)** and lock it in place using the two quick release catches **(3)**.



251122 1

General prescriptions
Do not use detergents or diesel to clean the air filter. Never strike the filter with tools. Careless assembly of the air filter can lead to the introduction of unfiltered air which can seriously damage 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

506010 RADIATOR - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Engine coolant level check

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 REFILLING table. 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.

506010 RADIATOR - Change fluid

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Only proceed when the engine is not turning and is at low temperature in order not to run the risk of burns.
2. Provide suitable containers that the cooling liquid is not dispersed in the environment.
3. Remove the pressurization 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. Do not fill the expansion tank to the brim.
8. With the coolant filler plug open, start the engine and let it idle for approx. one minute. This helps to completely release all the air from the cooling circuit.
9. Stop the engine and top up with more coolant, if necessary.
10. When the engine is cold, make sure that the coolant 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.

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

Risk of burns
When the engine is hot, pressure builds up in the cooling circuits which may eject hot liquid violently, resulting in a risk of burns.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

Risk of burns
Open the filler cap of the coolant tank only if necessary and only when the engine is cold.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

506010 RADIATOR - Cleaning

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Check that the air intake surfaces of the radiators are free of impurities.

Risk of injury:
When using compressed air, it is required to use suitable personal protections for hands, face and eyes.The requirements can be found in the ACCIDENT PREVENTION paragraph.
Failure to comply with these prescriptions can result in the risk of serious injury

506010 RADIATOR - Cleaning

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Check that the air intake surfaces of the radiators are free of impurities.
2. Clean them if using compressed air or steam.

Risk of injury:
When using compressed air, it is required to use suitable personal protections for hands, face and eyes.The requirements can be found in the ACCIDENT PREVENTION paragraph.
Failure to comply with these prescriptions can result in the risk of serious injury

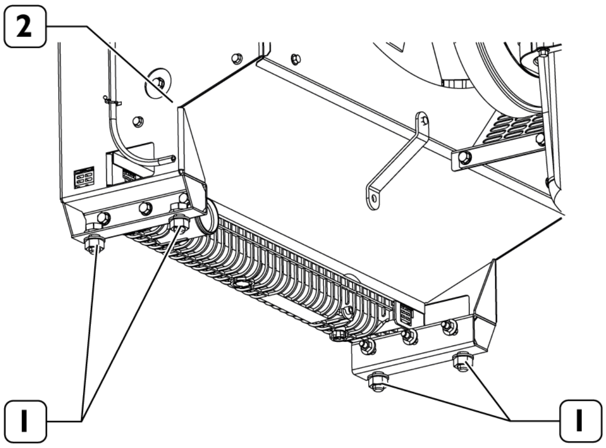
506010 RADIATOR - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)

1. Unscrew the nuts **(1)** and remove the radiator unit **(2)**.

Description	Quantity	Value
Radiator mount	4 nuts M14 x 2	**114,5 +/- 11,5 N·m**



268003 1

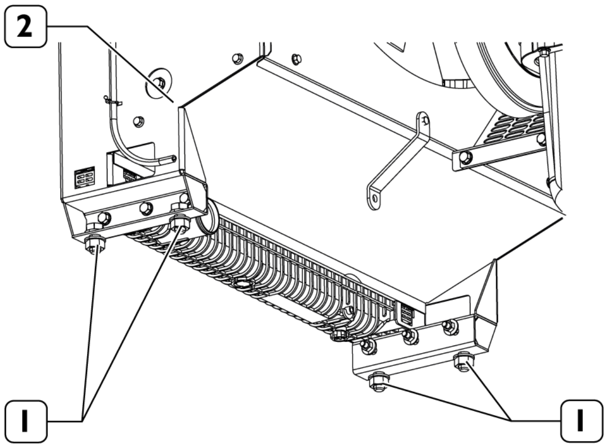
506010 RADIATOR - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Radiator mount	4 nuts M14 x 2	**114,5 +/- 11,5 N·m**

1. Correctly position the radiator unit **(2)** and tighten the nuts **(1)**.

Description	Quantity	Value
Radiator mount	4 nuts M14 x 2	**114,5 +/- 11,5 N·m**



268003 1

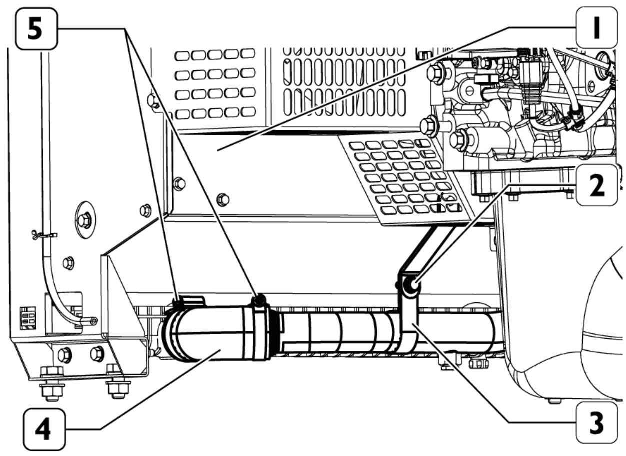
Next operation:
RADIATOR GRILLE - Install (50.60)

506015 RADIATOR GRILLE - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Position a suitable container under the pipe **(4)** to recover the coolant. Disconnect the pipe **(4)** acting on the relative collars **(5)**.
2. Undo the screw **(2)**.

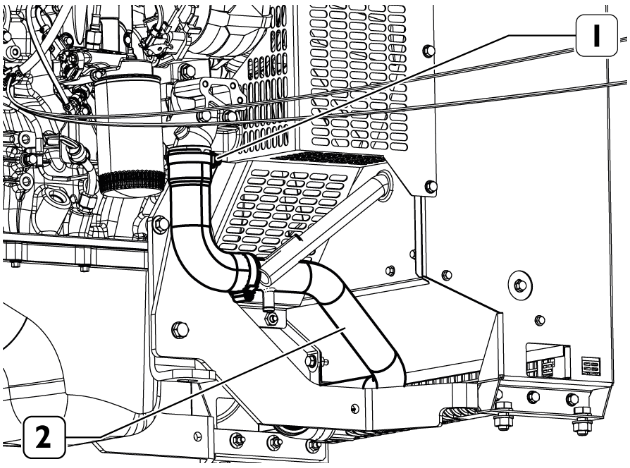
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267999 1

3. Unscrew the screw **(1)** of the V-collar.
4. Remove the pipe **(2)**.

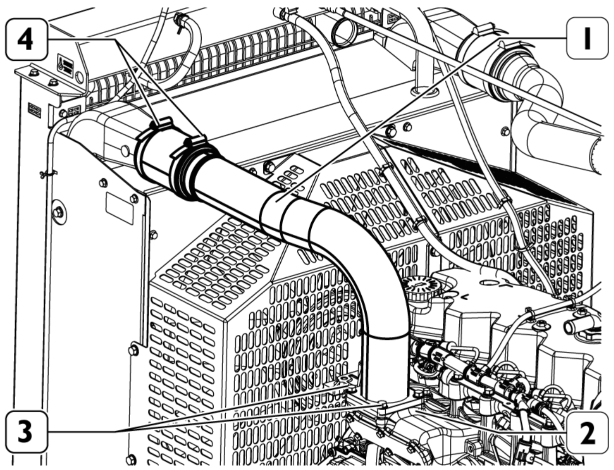
Description	Quantity	Value
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267998 2

5. Disconnect the pipe **(1)** acting on the relative clamps **(4)**.
6. Unscrew the screws **(3)** and remove the pipe **(1)** from the intake manifold **(2)**.

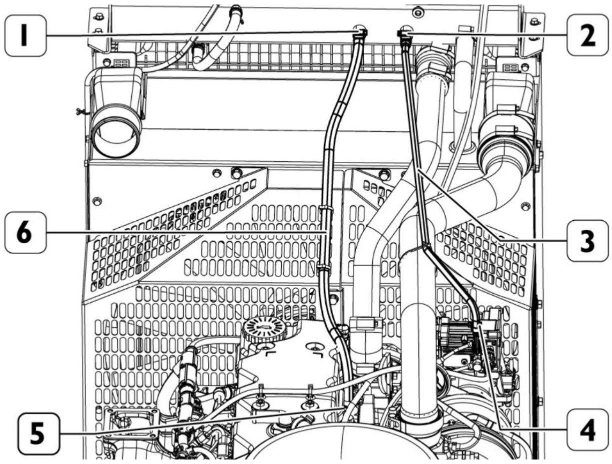
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



268000 3

7. Unscrew the screws on the collars **(1)** and **(5)**.
8. Disconnect the water pipe **(6)** from the radiator unit.
9. Unscrew the screws on the collars **(2)** and **(4)**.
10. Disconnect the water pipe **(3)** from the radiator unit.

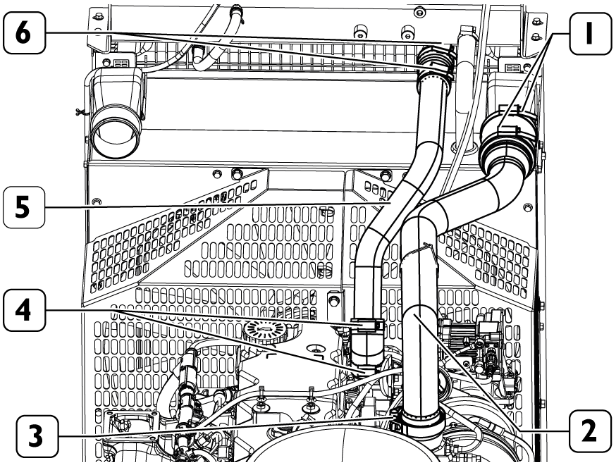
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267994 4

11. Unscrew the screws on the collars **(6)** and **(4)**.
12. Disconnect and remove the water outlet pipe **(5)** from the thermostat.
13. Unscrew the screws on the collar **(1)** and unscrew the screw **(3)** of the V-collar.
14. Disconnect and remove the air inlet pipe **(2)** to the radiator.

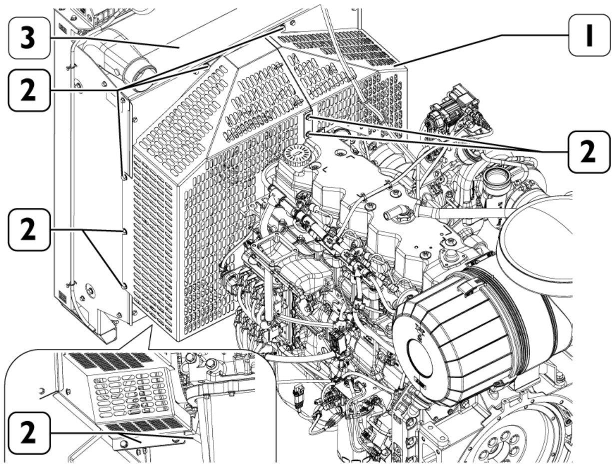
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267995 5

15. Unscrew the screws **(2)** and remove the protective grille **(1)** from the radiator unit **(3)**.

Description	Quantity	Value
Protective grille	12 screws M8 x 1.25 x 20	**23 +/- 2 N·m**



268002 6

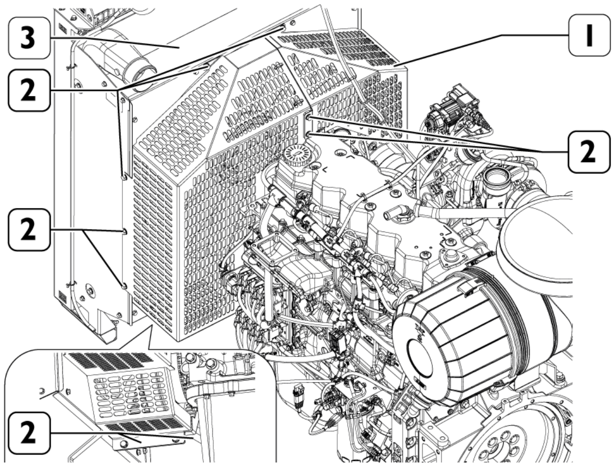
506015 RADIATOR GRILLE - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Value
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Protective grille	12 screws M8 x 1.25 x 20	**23 +/- 2 N·m**

1. Correctly position the protective grille **(1)** and tighten the screws **(2)**.

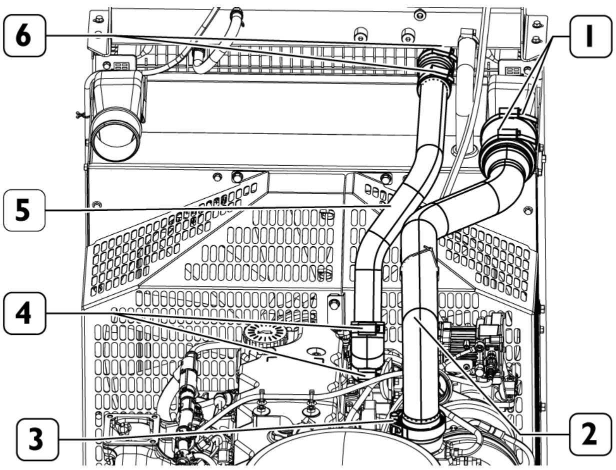
Description	Quantity	Value
Protective grille	12 screws M8 x 1.25 x 20	**23 +/- 2 N·m**



268002 1

2. Correctly position the air inlet pipe **(2)** to the radiator.
3. Tighten the screws on the collars **(1)** and tighten the screw **(3)** of the V-collar.
4. Correctly position the water outlet pipe **(5)** from the thermostat.
5. Tighten the screws on the collars **(6)** and **(4)**.

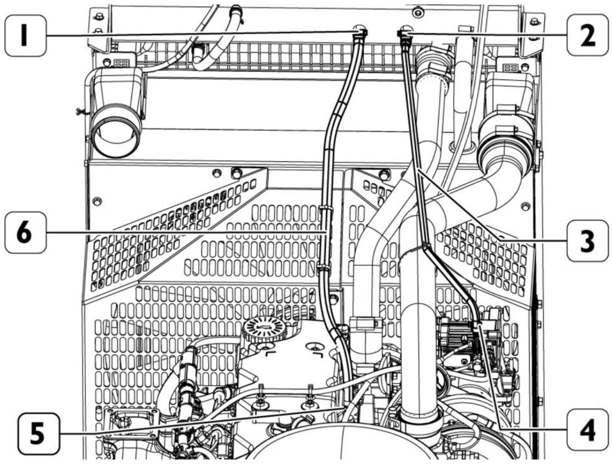
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267995 2

6. Correctly position the water pipe to the radiator **(3)**.
7. Tighten the screws on the collars **(2)** and **(4)**.
8. Correctly position the water pipe to the radiator **(6)**.
9. Tighten the screws on the collars **(1)** and **(5)**.

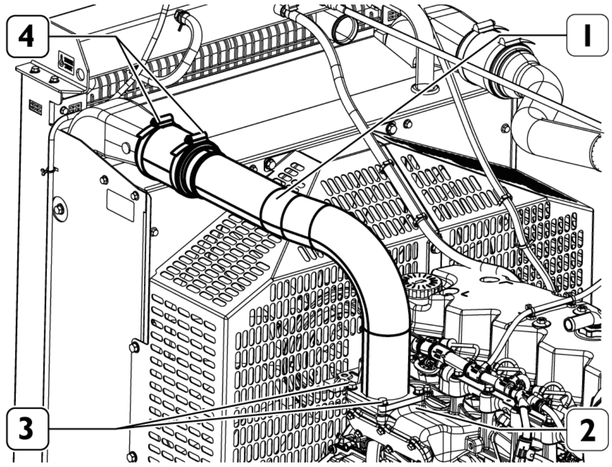
Description	Quantity	Value
Breather pipe collar on radiator	1 screw	**2,25 +/- 0,25 N·m**



267994 3

10. Connect the pipe **(1)** to the intake manifold **(2)** and tighten the screws **(3)**.
11. Connect the pipe **(1)** to the radiator unit and tighten the relative collars **(4)**.

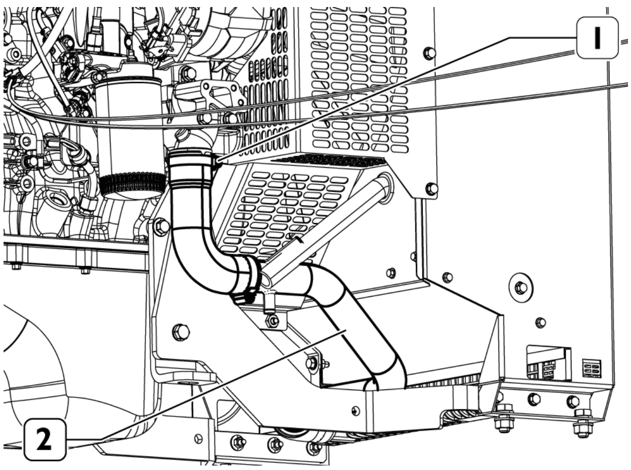
Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



268000 4

12. Connect the pipe **(2)** and tighten the screw **(1)** of the V-collar.

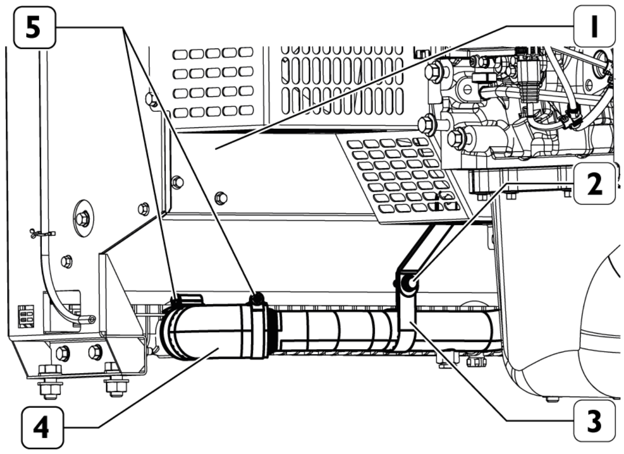
Description	Quantity	Value
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267998 5

13. Correctly position the pipe **(4)** with the bracket **(3)** and tighten the screw **(2)**.
14. Connect the pipe **(4)** to the radiator unit and tighten the relative collars **(5)**.

Description	Quantity	Value
Engine water inlet pipe collar	1 screw M8 x 1.25 x 25	**24,5 +/- 2,5 N·m**
Air pipe collar	1 screw	**6,05 +/- 0,45 N·m**



267999 6

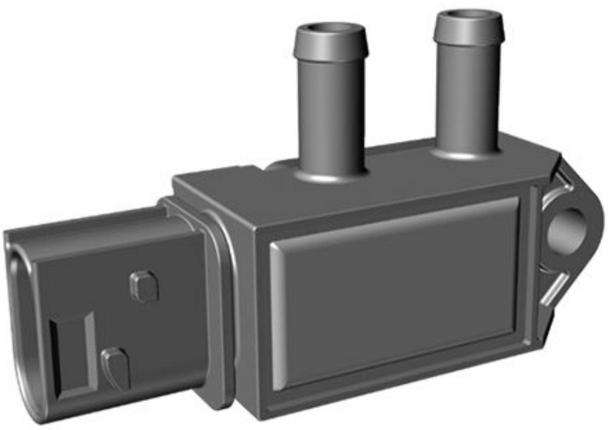
507134 PRESSURE SENSOR - Overview

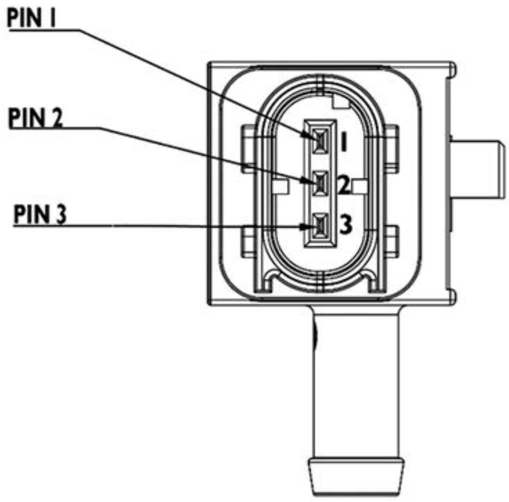
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Particulate pressure sensor (Δp)

This sensor measures the difference (Δp) between the pressure of the exhaust gas inlet and outlet of the catalytic converter filter thereby determining its efficiency and the state of clogging.

It converts the Δp value into a voltage Vo which is sent to the control unit according to the following diagram.



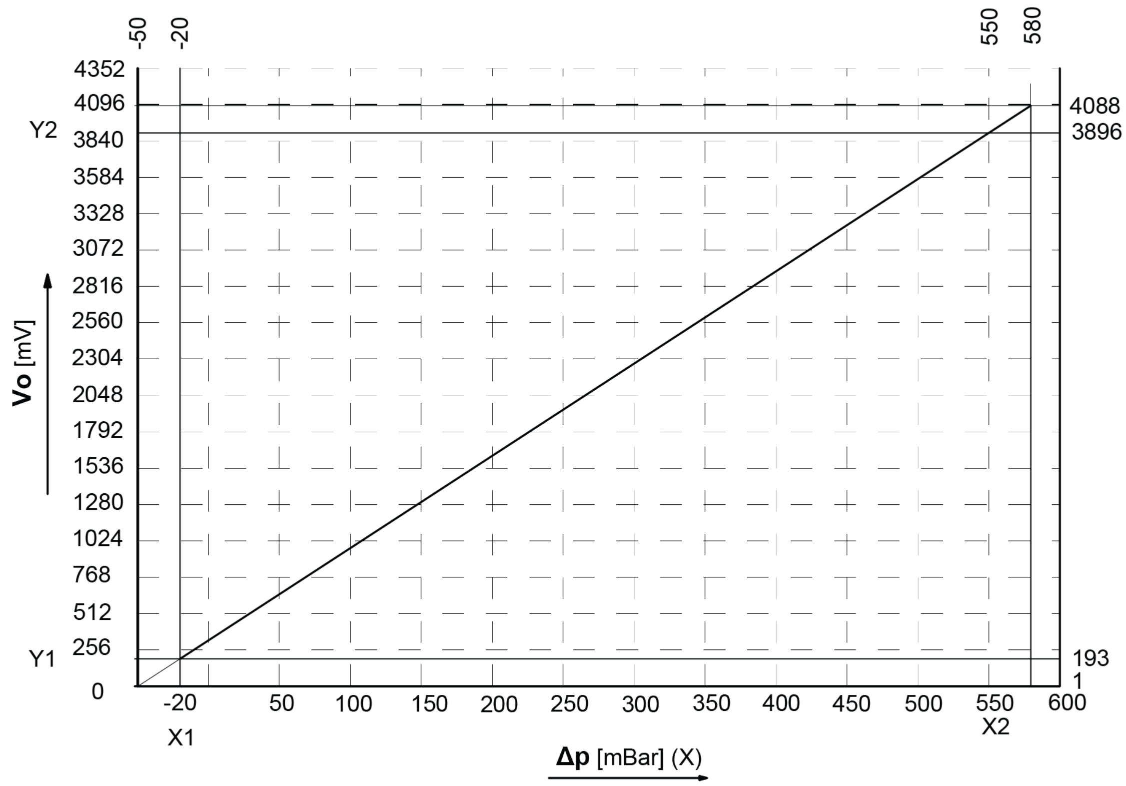


263962 1

ΔP sensor pin-out

Pin	Function
1	Power supply **+5 V**
2	Ground
3	signal

Voltage Vo as a function of Δp



265950 2

(Vo) Output voltage — (Δp) Difference between the SCR output and input voltage

507120 EXHAUST PIPES - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Visually check that the exhaust gas system is not obstructed or damaged.
2. Make sure that there is no risk of harmful fumes in the environment where the engine is being worked on. Contact the Manufacturer if necessary.

507220 FUEL TANK - Drain fluid

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

1. Perform the drainage/suction of water, condensation and impurities from the fuel tank/s by following the instructions contained in the manual supplied by the tank manufacturer.
2. Proceed as necessary based on the structure or location of the tank: engines that operate in adverse environments and conditions and/or that are refuelled using drums or jerry cans, require more attention when cleaning the tank.

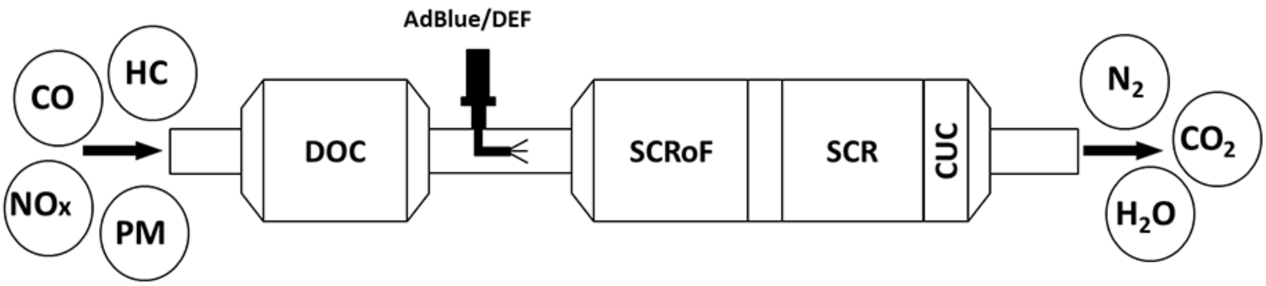
5074 AD-BLUE SYSTEM - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

EXHAUST GAS POST-TREATMENT SYSTEM (ATS)

Stage V regulations which impose a limit on the number of particles (PN) of particulate (compared to the previous legislation which imposes a maximum limit of particulate), has made the use of a DPF filter mandatory (Diesel Particulate Filter).

ATS configuration - Stage V



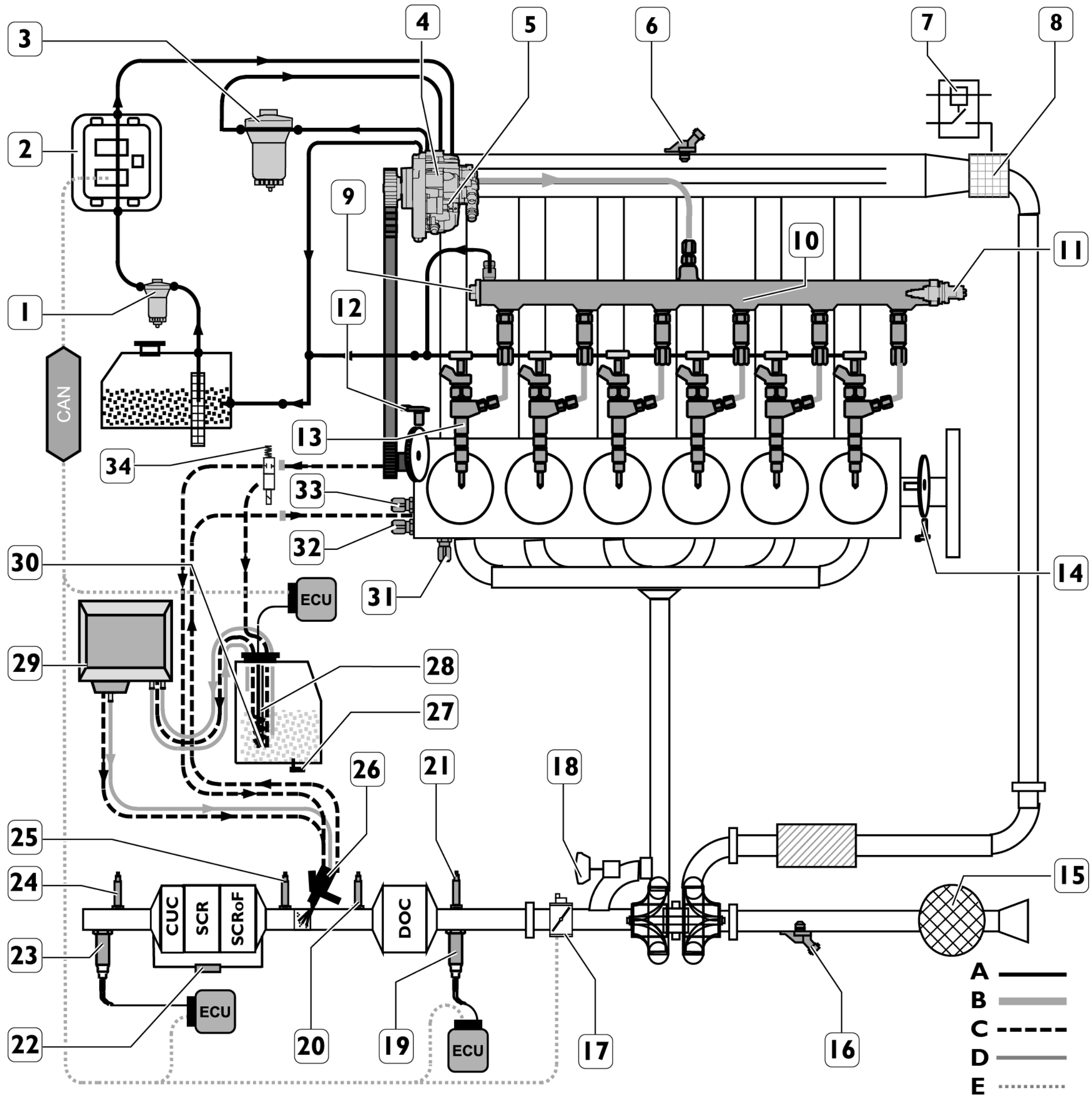
269358 1

- a DOC catalytic converter (Diesel Oxidation Catalyst);
- AdBlue dosing module (DM)
- SCRoF catalyst (Selective Catalytic Reduction on Filter);
- SCR catalyst (Selective Catalytic Reduction)
- CUC filter (Clean Up Catalyst)

In order to reduce the exhaust gas emissions to within the limits required by current standards, it is necessary to adopt the exhaust gas after-treatment system (ATS) which combines a number of devices:

- A DOC catalytic converter which, through a series of oxidation reactions, allows the treatment of HC (unburnt hydrocarbons) and CO (carbon monoxide) using the residual oxygen O_2 at the exhaust, transforming it into carbon dioxide (CO_2) and water (H_2O) through oxidation reactions. The oxidations of CO and HC are obtained through the use of noble metals such as platinum and palladium.
- Subsequently, the dosing module via the DNOx 2.2 system in the exhaust pipe upstream of the SCRoF, introduces a solution of water and urea (AdBlue) into the exhaust gas through a metering injector. The AdBlue is mixed by the Mixer and is converted into vaporized ammonia.
- The mixture of the exhaust gas and ammonia enters the SCRoF where the gas is filtered to remove the particulate and an initial reaction of the NOx n water vapour (H_2O) and free nitrogen (N_2) takes place.
- In the end phase there is a final SCR + CUC catalytic converter that allows the presence of NOx to be reduced further and the residual ammonia is captured via the CUC through the oxidation of the excess urea produced by the engine during the transitory phases.
- The SCRoF and SCR + CUC system is thermally insulated to maintain high internal temperatures capable of performing passive regeneration of the SCRoF. For this purpose there is a differential pressure sensor which, by detecting the difference in pressure between the inlet and outlet, provides the control unit with a filter clogging intensity signal.

SCRoF configuration diagram



265949 2

(1) Fuel pre-filter with heater and sensor detecting water in the filter - (2) MD1CE101 engine control unit - (3) Fuel filter with temperature sensor - (4) High-pressure pump - (5) High-pressure fuel pump dosing module - (6) Air temperature and boost pressure sensor (intake manifold) - (7) Grid heater relay - (8) Engine preheating grid heater resistor - (9) Overpressure valve - (10) Rail - (11) Rail pressure sensor - (12) Timing segmental speed sensor (camshaft) - (13) Injectors - (14) Incremental flywheel speed sensor (crankshaft) - (15) Air filter - (16) Intake air humidity and temperature sensor - (17) Motorised throttle valve (Exhaust flap) (CAN node) - (18) Wastegate valve - (19) NOx sensor upstream of DOC with control unit - (20) Temperature sensor downstream of DOC - (21) Temperature sensor upstream of DOC - (22) Differential pressure sensor - (23) NOx sensor downstream of SCR - (24) Temperature sensor downstream of SCR - (25) Temperature sensor downstream of SCRoF - (26) DNOx 2.5 dosing module (DM) - (27) Urea quality sensor (UQS) with control unit - (28) DEF tank level sensor - (29) 6HD pumping module (SM) - (30) DEF tank temperature sensor - (31) Crankshaft speed sensor - (32) Engine oil pressure and temperature sensor - (33) Engine coolant temperature sensor – (34) Engine coolant 3-way valve.

A. Exhaust gas
B. Compressed air
C. Inlet air
D. Engine coolant

E. Electrical cable
F. AdBlue path

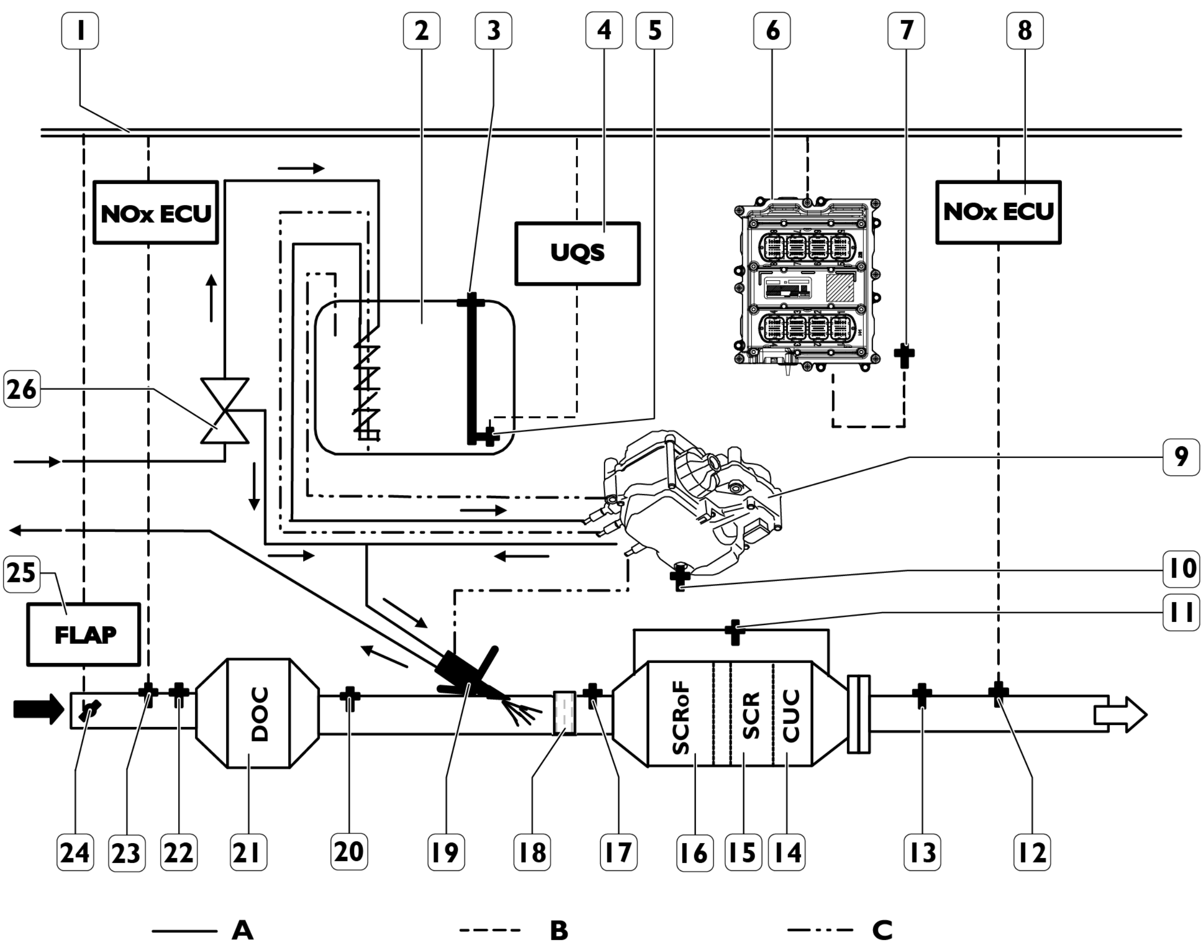
The ATS system is controlled electronically by the engine control unit which on the basis of the engine rpm, torque delivered, exhaust gas temperature, quantity of nitrogen oxides and intake air humidity, adjusts the flow rate of the AdBlue solution to be introduced into the system.

The pump module picks up the reagent solution from the tank and sends it under pressure to the mixing and injection module to be injected into the exhaust pipe.

The ATS system is managed by the engine control unit via a series of sensors:

- four exhaust gas temperature sensors
- two nitrogen oxide (NOx) detection sensors
- one humidity sensor fitted on the engine air intake pipe downstream of the air filter
- a differential pressure sensor
- a tank of reagent solution (water + urea: AdBlue) with a level indicator, temperature sensor and urea quality sensor;

ATS electronic management



265948 3

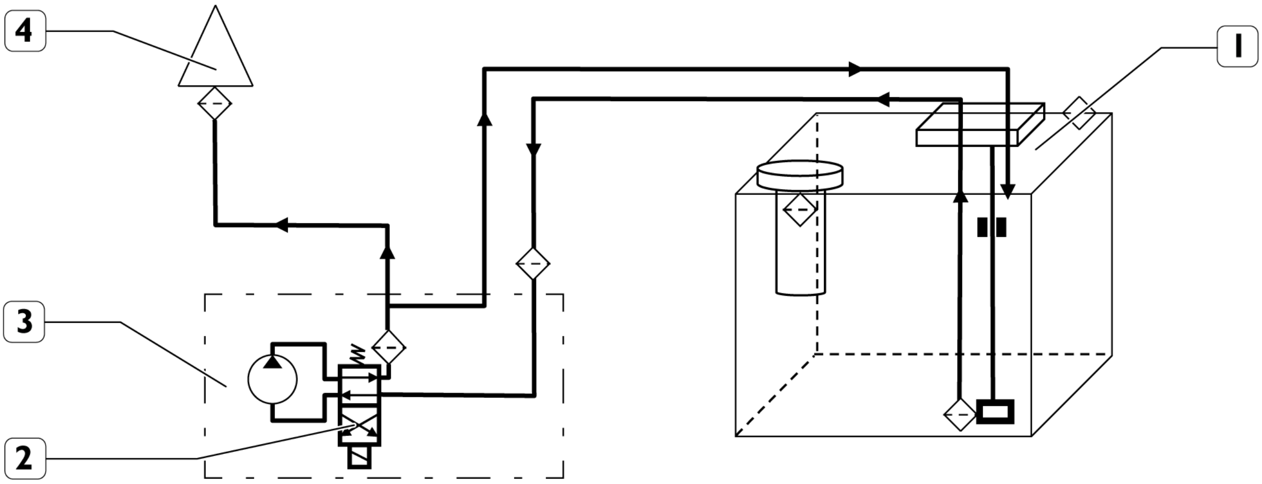
(1) CAN line - (2) AdBlue tank - (3) AdBlue tank level sensor - (4) Urea quality sensor and control unit - (5) AdBlue temperature sensor - (6) (MD1CE101) engine control unit - (7) Humidity and temperature sensor - (8) NOx sensor control unit downstream of exhaust - (9) DNOx 6HD supply module - (10) AdBlue system pressure sensor - (11) Differential pressure sensor - (12) NOx sensor - (13) SCR downstream temperature sensor - (14) Clean Up Catalyst (CUC) - (15) Selective Catalyst Reduction (SCR) - (16) Selective on Filter Catalyst Reduction (SCRoF) - (17) SCRoF upstream temperature sensor - (18) Mixer - (19) Dosing module -

(20) DOC downstream exhaust gas temperature sensor - (21) Diesel oxidation catalyst (DOC) - (22) DOC upstream exhaust gas temperature sensor - (23) NOx sensor upstream of ATS - (24) Throttle valve - (25) Flap valve position control unit - (26) Engine coolant 3-way valve.

A. AdBlue
B. Electrical cable
C. Engine coolant

The NOx sensors, the urea quality sensor and the throttle valve position sensor (Exhaust flap) communicate with the control unit via the CAN line.

AdBlue system



268021 4

(1) AdBlue tank - (2) Reverting valve - (3) DNOx 6HD Supply Module - (4) Dosing module

The system is managed by the engine control unit in three steps:

- Filling the system. When the ATS reaches the ideal temperature, the control unit activates the **(3)** DNOx 6HD Supply Module which takes **(1)** from the tank. The system is filled to **9 bar** (system pressure is detected by the pressure sensor in the Supply Module).
- Operation at full capacity. When the system is pressurised to **9 bar**, the dosing module **(4)** is able to intermittently introduce nebulised AdBlue into the exhaust gas.
- Emptying the system. When the engine stops, the After-run procedure is launched, namely the **(2)** reverting valve inside the **(3)** Supply Module changes position allowing the pump to empty the system. At this point the AdBlue in the system is conveyed into the **(1)** tank. During this process the **(4)** dosing module is opened allowing the system to be emptied. When the pressure sensor detects a vacuum, the **(4)** dosing module closes, the **(3)** Supply Module switches off and the position of the **(2)** reverting valve is inverted.

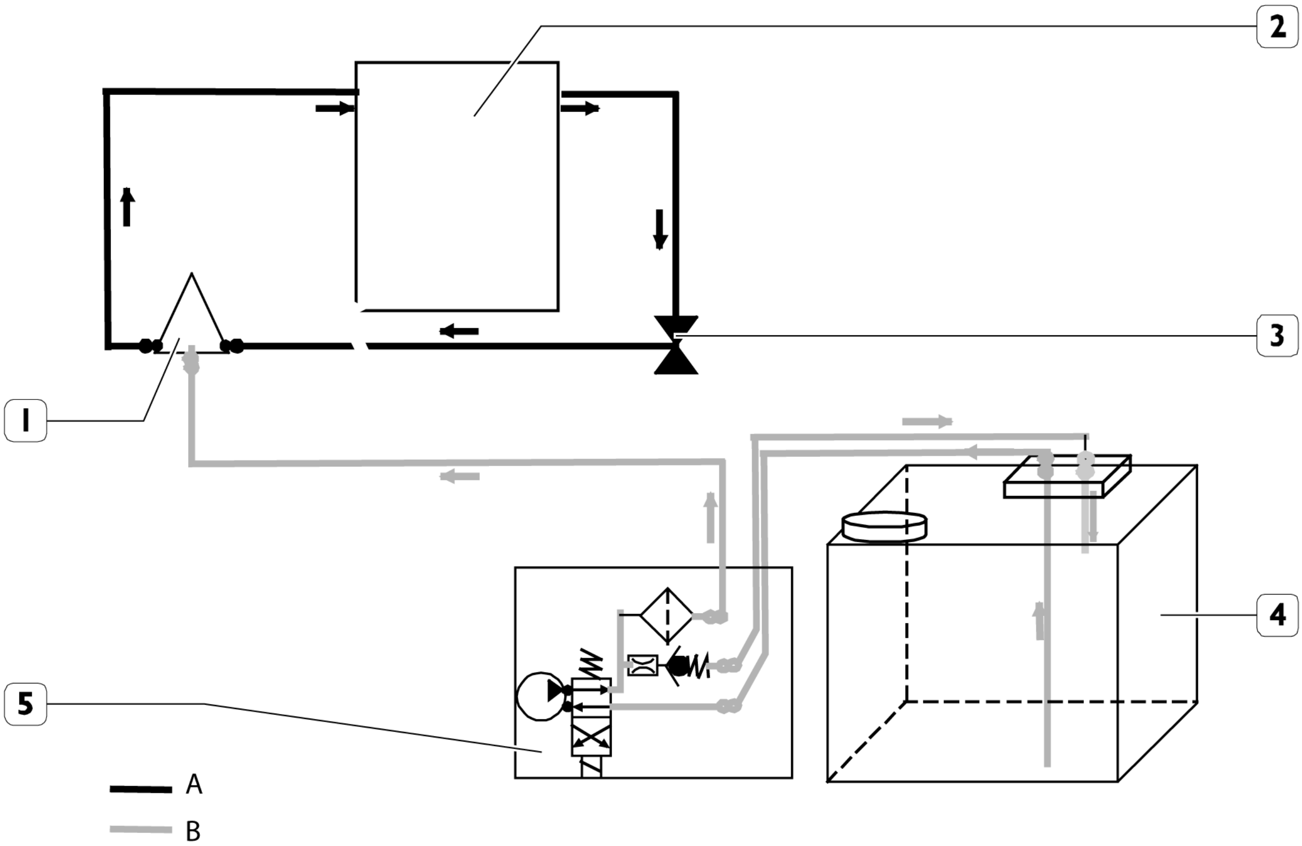
Risk of damage
After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the "Key off", the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

ATS system heating/cooling system

The system has two functions:

- continuous cooling of the dosing module;
- heating the AdBlue tank, the supply module and the AdBlue pipes and, at the same time, cooling the dosing module.

Dosing module cooling



185019 5

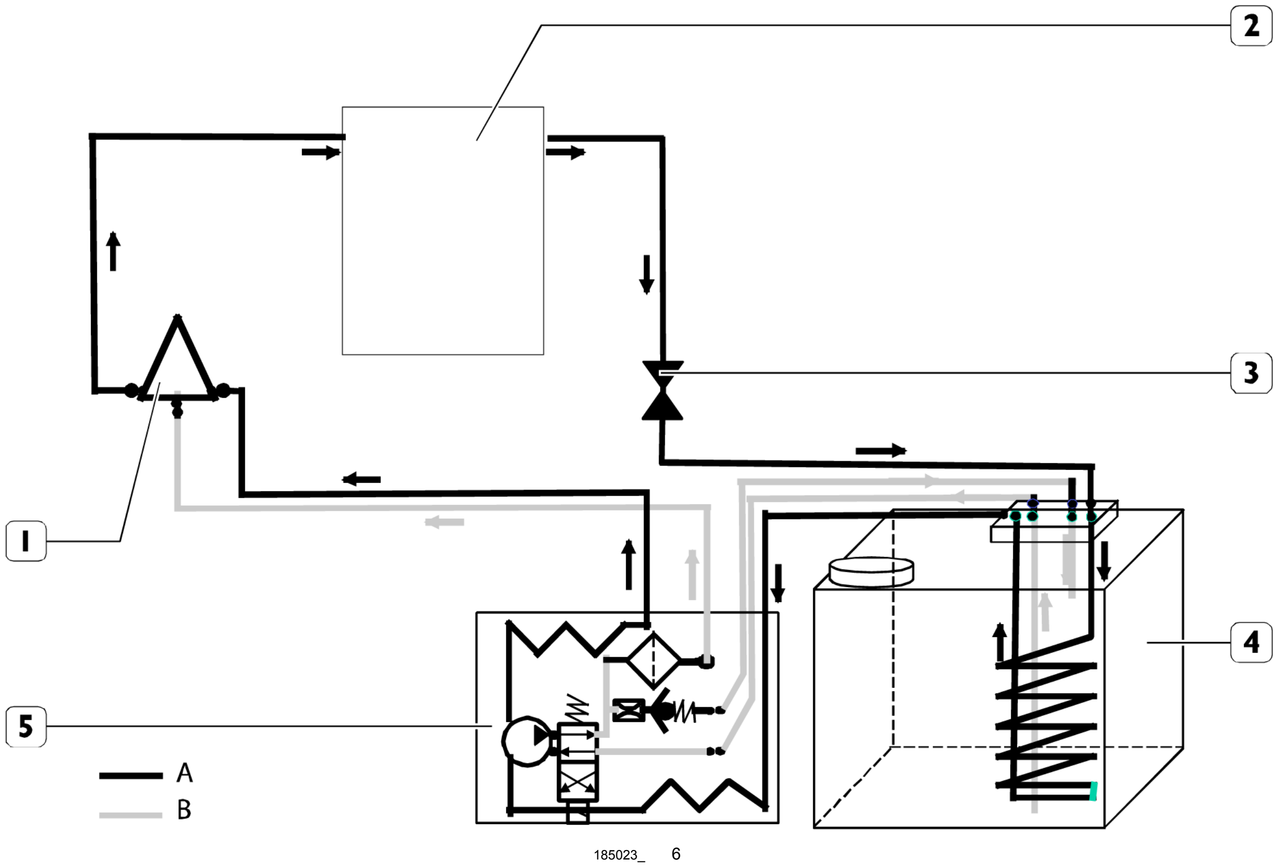
Cooling conditions

A. Engine coolant
B. AdBlue path

1. Dosing module
2. Engine
3. Diverter valve
4. AdBlue Tank
5. Supply Module

Given the unfavourable assembly position from the point of view of cooling and given the high temperatures that the exhaust gas reaches downstream of the catalytic converter, the dosing module is connected to the engine cooling circuit and continuously cooled.

Dosing module cooling and AdBlue plunger module and tank heating



CONDITION OF SIMULTANEOUS HEATING AND COOLING

A. Engine coolant
B. AdBlue path

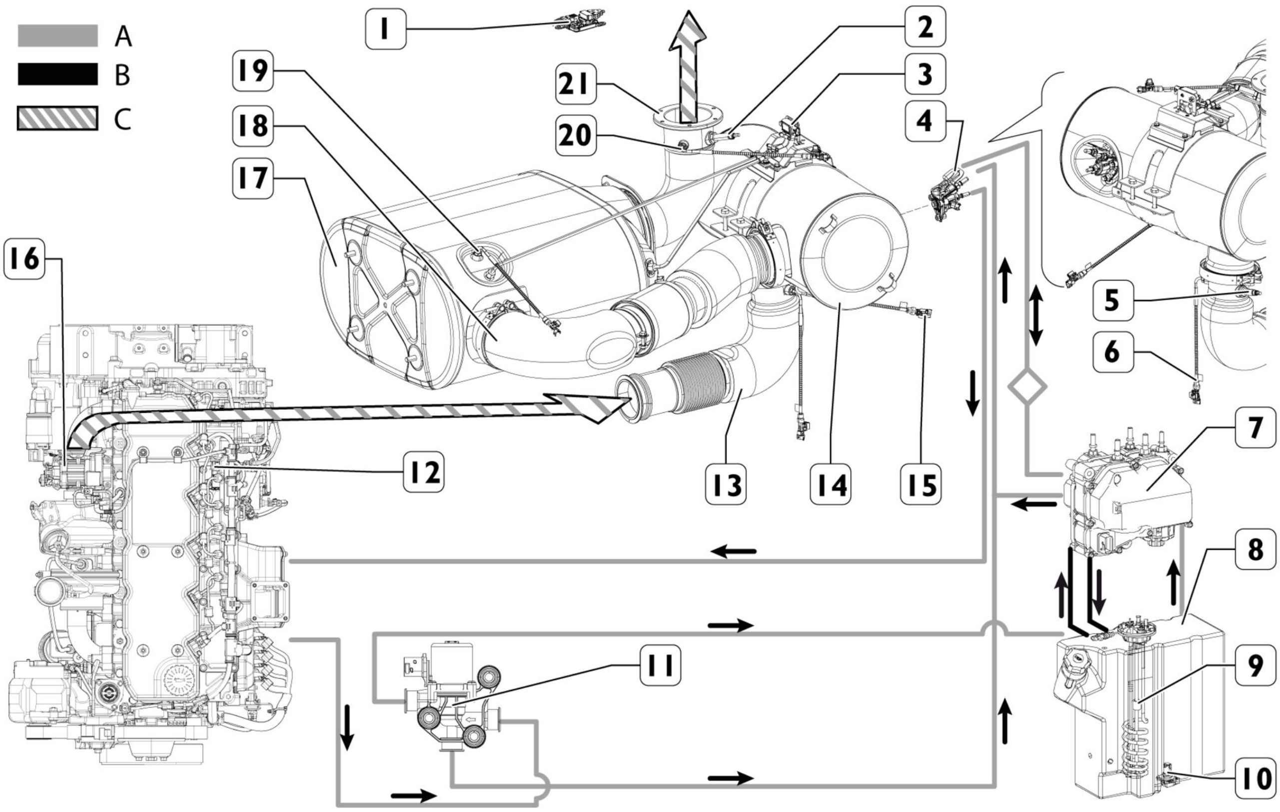
1. Dosing module
2. Engine
3. Diverter valve
4. AdBlue Tank
5. Supply Module

Please note that the AdBlue may freeze below temperatures of **- 11 °C**.

When the temperature of AdBlue in the tank falls below the acceptable limit, the switch valve **(3)** is activated which enables the flow of the engine coolant into the heating coil inside the tank **(4)** and then into the supply module **(5)**.

In this stage, the temperature of the engine cooling water is such that it acts as a heater for the components mentioned above.

After this, the engine coolant is conveyed towards the dosing module to lower the temperature.



268001 7

A. Engine coolant ducts
B. AdBlue ducts
C. Exhaust gas

1. NOx sensor control unit
2. NOx sensor downstream of SCRoF
3. Differential pressure sensor
4. DeNOx 2.5 dosing module
5. NOx sensor upstream of DOC
6. Exhaust gas temperature sensor upstream of DOC
7. DeNox 2.2 supply module
8. AdBlue Tank
9. AdBlue tank level sensor
10. Urea quality sensor (UQS)
11. Engine coolant 3-way valve
12. Intake air humidity and temperature sensor
13. Pipe fitting carried out by the Customer
14. Diesel oxidation catalyst (DOC)
15. Exhaust gas temperature sensor downstream of DOC
16. Exhaust Flap module
17. Selective catalytic reduction (SCRoF)
18. Pipe fitting carried out by the Customer
19. Exhaust gas temperature sensor upstream of SCRoF
20. Exhaust gas temperature sensor downstream of SCRoF
21. Pipe fitting carried out by the Customer

AdBlue specification

ISO 22241 / AUS32 / DIN V 70070

Solution of **32,5%** urea in water

	Min.	Max.
Urea content	**31,8%** of weight	**33,2%** of weight
Density at **20 °C**	**1,087 g/cm³**	**1,093 g/cm³**
Refraction index at **20 °C**	1.3814	1.3843
Alkali as NH3		**0,2%**
Biuret		**0,3%**
Aldehyde		**5 mg/kg**
Insolubles		**20 mg/kg**
Phosphate (PO4)		**0,5 mg/kg**
Calcium		**0,5 mg/kg**
Iron		**0,5 mg/kg**
Copper		**0,2 mg/kg**
Zinc		**0,2 mg/kg**
Chromium		**0,2 mg/kg**
Nickel		**0,2 mg/kg**
Aluminium		**0,5 mg/kg**
Magnesium		**0,5 mg/kg**
Sodium		**0,5 mg/kg**
Potassium		**0,5 mg/kg**

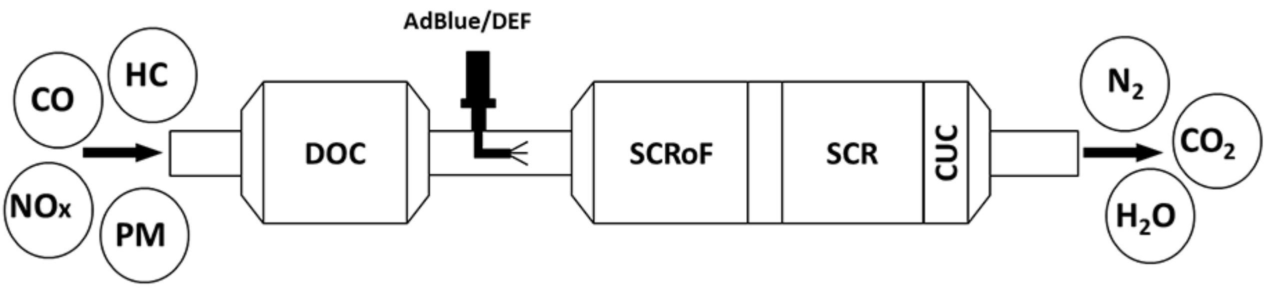
5074 AD-BLUE SYSTEM - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

EXHAUST GAS POST-TREATMENT SYSTEM (ATS)

Stage V regulations which impose a limit on the number of particles (PN) of particulate (compared to the previous legislation which imposes a maximum limit of particulate), has made the use of a DPF filter mandatory (Diesel Particulate Filter).

ATS configuration - Stage V



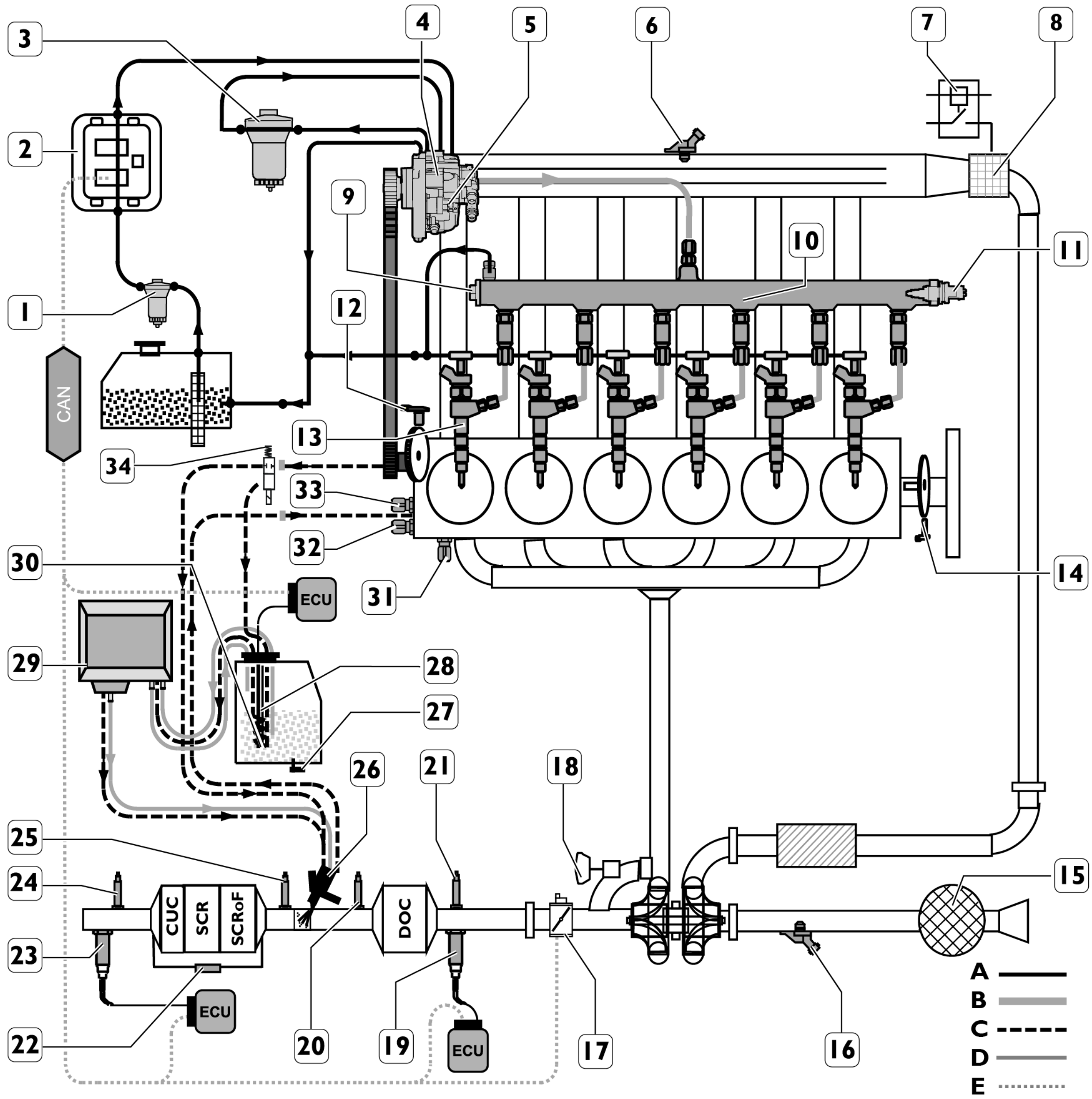
269358 1

- a DOC catalytic converter (Diesel Oxidation Catalyst);
- AdBlue dosing module (DM)
- SCRoF catalyst (Selective Catalytic Reduction on Filter);
- SCR catalyst (Selective Catalytic Reduction)
- CUC filter (Clean Up Catalyst)

In order to reduce the exhaust gas emissions to within the limits required by current standards, it is necessary to adopt the exhaust gas after-treatment system (ATS) which combines a number of devices:

- A DOC catalytic converter which, through a series of oxidation reactions, allows the treatment of HC (unburnt hydrocarbons) and CO (carbon monoxide) using the residual oxygen O_2 at the exhaust, transforming it into carbon dioxide (CO_2) and water (H_2O) through oxidation reactions. The oxidations of CO and HC are obtained through the use of noble metals such as platinum and palladium.
- Subsequently, the dosing module via the DNOx 2.2 system in the exhaust pipe upstream of the SCRoF, introduces a solution of water and urea (AdBlue) into the exhaust gas through a metering injector. The AdBlue is mixed by the Mixer and is converted into vaporized ammonia.
- The mixture of the exhaust gas and ammonia enters the SCRoF where the gas is filtered to remove the particulate and an initial reaction of the NOx n water vapour (H_2O) and free nitrogen (N_2) takes place.
- In the end phase there is a final SCR + CUC catalytic converter that allows the presence of NOx to be reduced further and the residual ammonia is captured via the CUC through the oxidation of the excess urea produced by the engine during the transitory phases.
- The SCRoF and SCR + CUC system is thermally insulated to maintain high internal temperatures capable of performing passive regeneration of the SCRoF. For this purpose there is a differential pressure sensor which, by detecting the difference in pressure between the inlet and outlet, provides the control unit with a filter clogging intensity signal.

SCRoF configuration diagram



265949 2

(1) Fuel pre-filter with heater and sensor detecting water in the filter - (2) MD1CE101 engine control unit - (3) Fuel filter with temperature sensor - (4) High-pressure pump - (5) High-pressure fuel pump dosing module - (6) Air temperature and boost pressure sensor (intake manifold) - (7) Grid heater relay - (8) Engine preheating grid heater resistor - (9) Overpressure valve - (10) Rail - (11) Rail pressure sensor - (12) Timing segmental speed sensor (camshaft) - (13) Injectors - (14) Incremental flywheel speed sensor (crankshaft) - (15) Air filter - (16) Intake air humidity and temperature sensor - (17) Motorised throttle valve (Exhaust flap) (CAN node) - (18) Wastegate valve - (19) NOx sensor upstream of DOC with control unit - (20) Temperature sensor downstream of DOC - (21) Temperature sensor upstream of DOC - (22) Differential pressure sensor - (23) NOx sensor downstream of SCR - (24) Temperature sensor downstream of SCR - (25) Temperature sensor downstream of SCRoF - (26) DNOx 2.5 dosing module (DM) - (27) Urea quality sensor (UQS) with control unit - (28) DEF tank level sensor - (29) 6HD pumping module (SM) - (30) DEF tank temperature sensor - (31) Crankshaft speed sensor - (32) Engine oil pressure and temperature sensor - (33) Engine coolant temperature sensor – (34) Engine coolant 3-way valve.

A. Exhaust gas
B. Compressed air
C. Inlet air
D. Engine coolant

E. Electrical cable

F. AdBlue path

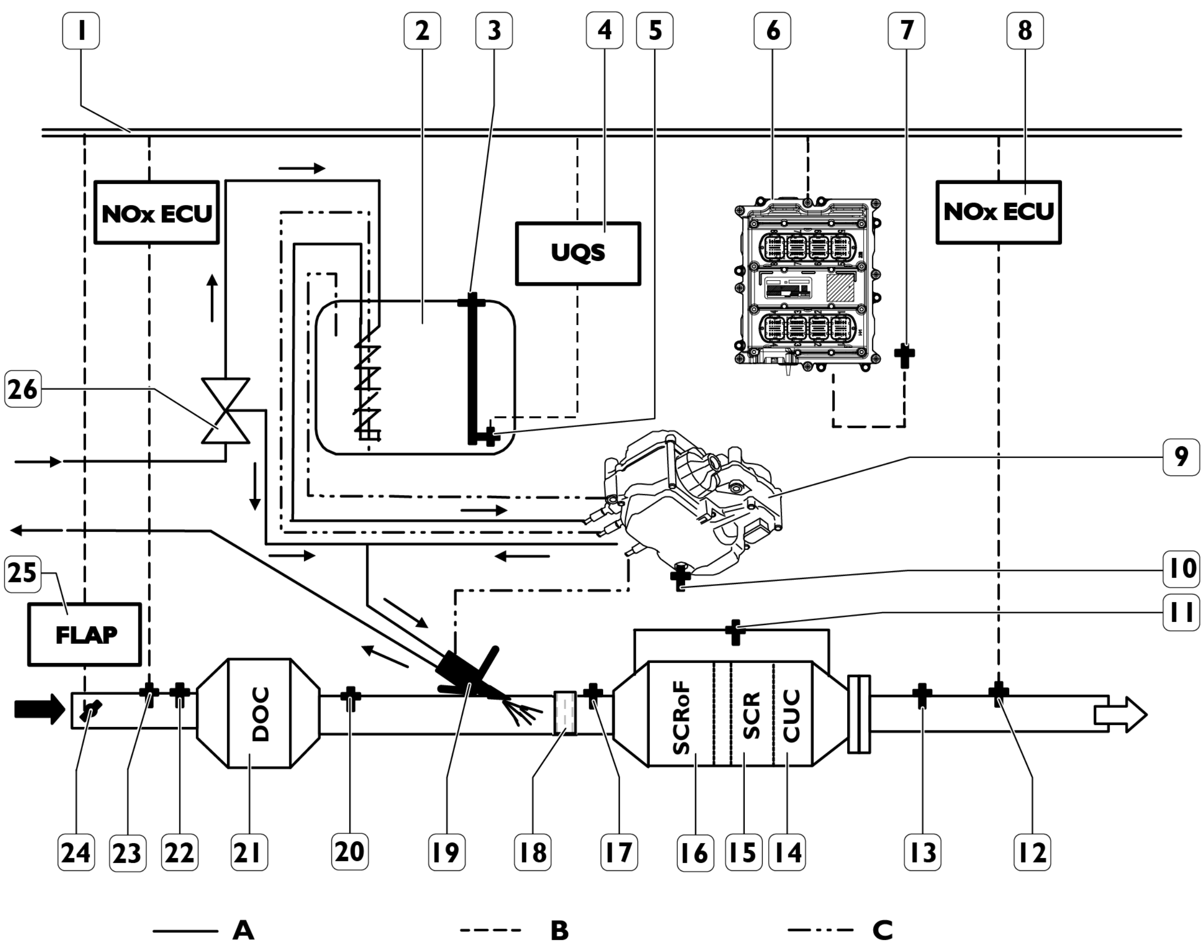
The ATS system is controlled electronically by the engine control unit which on the basis of the engine rpm, torque delivered, exhaust gas temperature, quantity of nitrogen oxides and intake air humidity, adjusts the flow rate of the AdBlue solution to be introduced into the system.

The pump module picks up the reagent solution from the tank and sends it under pressure to the mixing and injection module to be injected into the exhaust pipe.

The ATS system is managed by the engine control unit via a series of sensors:

- four exhaust gas temperature sensors
- two nitrogen oxide (NOx) detection sensors
- one humidity sensor fitted on the engine air intake pipe downstream of the air filter
- a differential pressure sensor
- a tank of reagent solution (water + urea: AdBlue) with a level indicator, temperature sensor and urea quality sensor;

ATS electronic management



265948 3

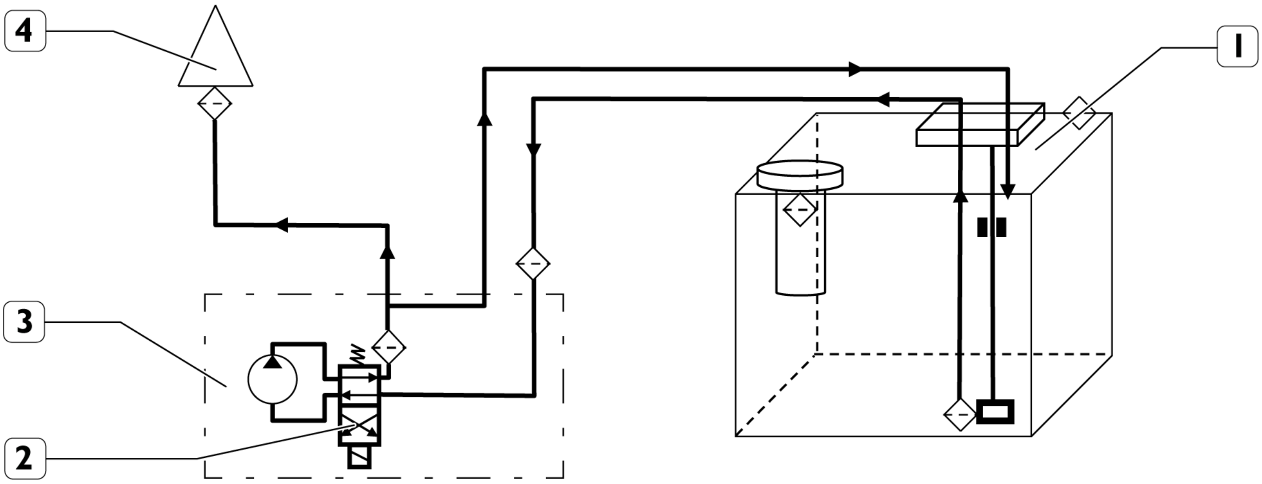
(1) CAN line - (2) AdBlue tank - (3) AdBlue tank level sensor - (4) Urea quality sensor and control unit - (5) AdBlue temperature sensor - (6) (MD1CE101) engine control unit - (7) Humidity and temperature sensor - (8) NOx sensor control unit downstream of exhaust - (9) DNOx 6HD supply module - (10) AdBlue system pressure sensor - (11) Differential pressure sensor - (12) NOx sensor - (13) SCR downstream temperature sensor - (14) Clean Up Catalyst (CUC) - (15) Selective Catalyst Reduction (SCR) - (16) Selective on Filter Catalyst Reduction (SCRoF) - (17) SCRoF upstream temperature sensor - (18) Mixer - (19) Dosing module -

(20) DOC downstream exhaust gas temperature sensor - (21) Diesel oxidation catalyst (DOC) - (22) DOC upstream exhaust gas temperature sensor - (23) NOx sensor upstream of ATS - (24) Throttle valve - (25) Flap valve position control unit - (26) Engine coolant 3-way valve.

A. AdBlue
B. Electrical cable
C. Engine coolant

The NOx sensors, the urea quality sensor and the throttle valve position sensor (Exhaust flap) communicate with the control unit via the CAN line.

AdBlue system



268021 4

(1) AdBlue tank - (2) Reverting valve - (3) DNOx 6HD Supply Module - (4) Dosing module

The system is managed by the engine control unit in three steps:

- Filling the system. When the ATS reaches the ideal temperature, the control unit activates the **(3)** DNOx 6HD Supply Module which takes **(1)** from the tank. The system is filled to **9 bar** (system pressure is detected by the pressure sensor in the Supply Module).
- Operation at full capacity. When the system is pressurised to **9 bar**, the dosing module **(4)** is able to intermittently introduce nebulised AdBlue into the exhaust gas.
- Emptying the system. When the engine stops, the After-run procedure is launched, namely the **(2)** reverting valve inside the **(3)** Supply Module changes position allowing the pump to empty the system. At this point the AdBlue in the system is conveyed into the **(1)** tank. During this process the **(4)** dosing module is opened allowing the system to be emptied. When the pressure sensor detects a vacuum, the **(4)** dosing module closes, the **(3)** Supply Module switches off and the position of the **(2)** reverting valve is inverted.

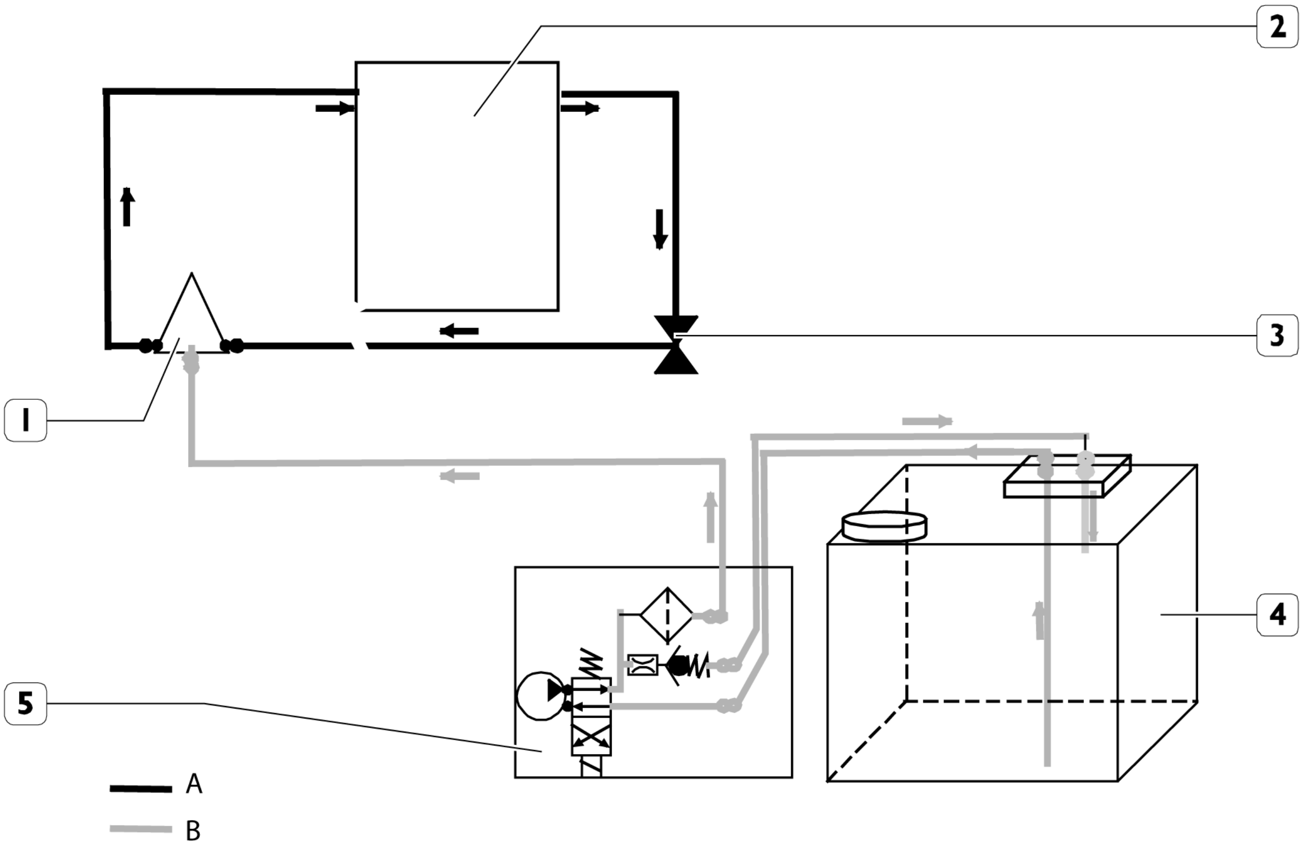
Risk of damage
After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the "Key off", the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

ATS system heating/cooling system

The system has two functions:

- continuous cooling of the dosing module;
- heating the AdBlue tank, the supply module and the AdBlue pipes and, at the same time, cooling the dosing module.

Dosing module cooling



185019 5

Cooling conditions

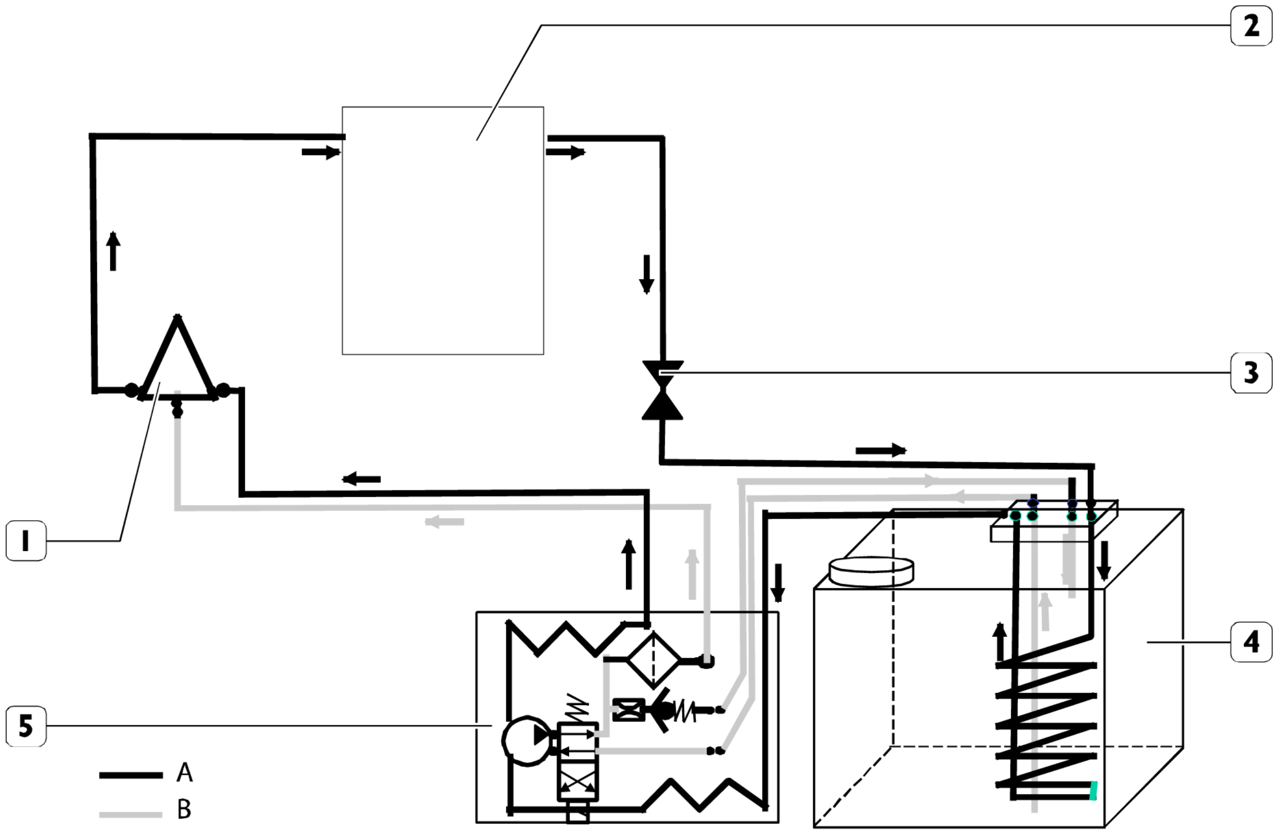
A. Engine coolant

B. AdBlue path

1. Dosing module
2. Engine
3. Diverter valve
4. AdBlue Tank
5. Supply Module

Given the unfavourable assembly position from the point of view of cooling and given the high temperatures that the exhaust gas reaches downstream of the catalytic converter, the dosing module is connected to the engine cooling circuit and continuously cooled.

Dosing module cooling and AdBlue plunger module and tank heating



CONDITION OF SIMULTANEOUS HEATING AND COOLING

A. Engine coolant
B. AdBlue path

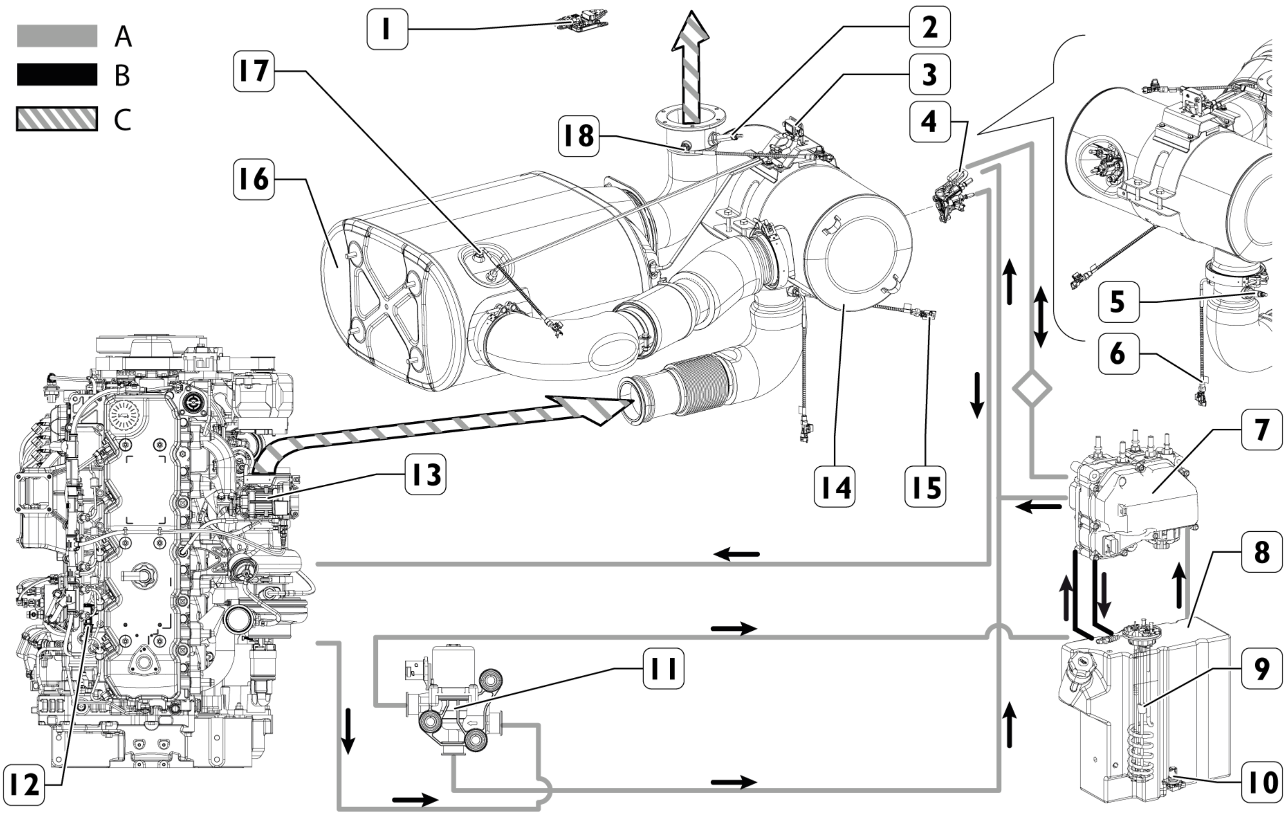
1. Dosing module
2. Engine
3. Diverter valve
4. AdBlue Tank
5. Supply Module

Please note that the AdBlue may freeze below temperatures of **- 11 °C**.

When the temperature of AdBlue in the tank falls below the acceptable limit, the switch valve **(3)** is activated which enables the flow of the engine coolant into the heating coil inside the tank **(4)** and then into the supply module **(5)**.

In this stage, the temperature of the engine cooling water is such that it acts as a heater for the components mentioned above.

After this, the engine coolant is conveyed towards the dosing module to lower the temperature.



268016 7

A. Engine coolant ducts
B. AdBlue ducts
C. Exhaust gas

1. NOx sensor control unit
2. NOx sensor downstream of SCRoF
3. Differential pressure sensor
4. DeNOx 2.5 dosing module
5. NOx sensor upstream of DOC
6. Exhaust gas temperature sensor upstream of DOC
7. DeNox 2.2 supply module
8. AdBlue Tank
9. AdBlue tank level sensor
10. Urea quality sensor (UQS)
11. Engine coolant 3-way valve
12. Intake air humidity and temperature sensor
13. Exhaust Flap module
14. Diesel oxidation catalyst (DOC)
15. Exhaust gas temperature sensor downstream of DOC
16. Selective catalytic reduction (SCRoF)
17. Exhaust gas temperature sensor upstream of SCRoF
18. Exhaust gas temperature sensor downstream of SCRoF

AdBlue specification

ISO 22241 / AUS32 / DIN V 70070

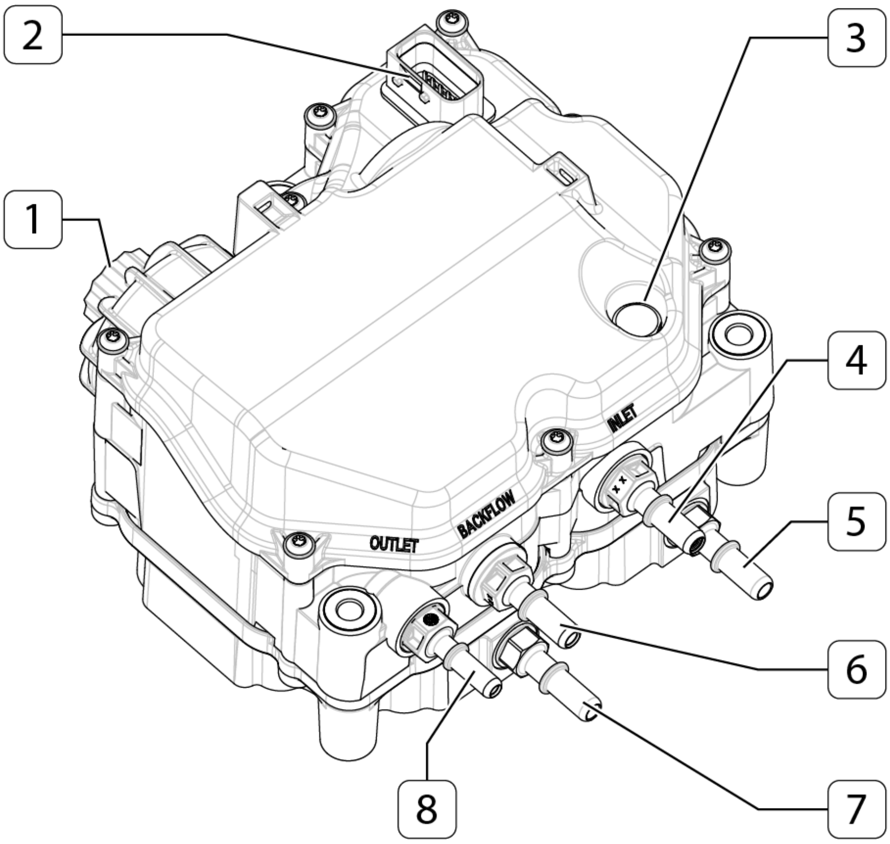
Solution of **32,5%** urea in water

	Min.	Max.
Urea content	**31,8%** of weight	**33,2%** of weight
Density at **20 °C**	**1,087 g/cm³**	**1,093 g/cm³**
Refraction index at **20 °C**	1.3814	1.3843
Alkali as NH3		**0,2%**
Biuret		**0,3%**
Aldehyde		**5 mg/kg**
Insolubles		**20 mg/kg**
Phosphate (PO4)		**0,5 mg/kg**
Calcium		**0,5 mg/kg**
Iron		**0,5 mg/kg**
Copper		**0,2 mg/kg**
Zinc		**0,2 mg/kg**
Chromium		**0,2 mg/kg**
Nickel		**0,2 mg/kg**
Aluminium		**0,5 mg/kg**
Magnesium		**0,5 mg/kg**
Sodium		**0,5 mg/kg**
Potassium		**0,5 mg/kg**

507410 AD-BLUE UNIT PUMP MODULE - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

DeNOx 6HD supply module (SM - Supply Module)



185025A 1

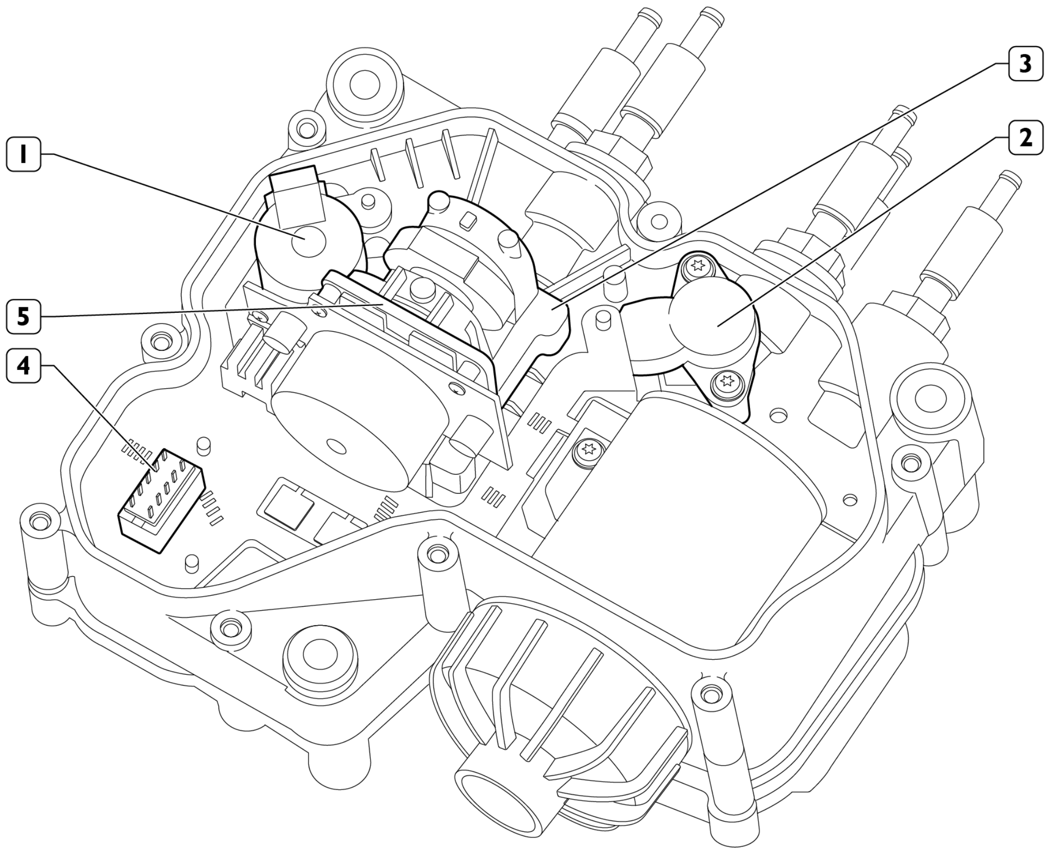
1. Main filter
2. Electrical connector
3. Pressure compensation diaphragm
4. Tank supply pipe
5. Pump module heating liquid intake pipe
6. AdBlue liquid return pipe to tank
7. Pump module heating liquid outlet pipe
8. Delivery line to dosing module

The AdBlue supply module is essentially composed of a diaphragm pump which draws the AdBlue from the tank and conveys it to the dosing module.

It is fitted with a circuit connected to the engine cooling system which, in case of low temperatures, prevents the AdBlue from freezing. A pressure and temperature sensor is located inside.

The amount of AdBlue sent to the dosing module and the injection pressure are controlled by the engine control unit and are dependent on the operating conditions of the engine and from the signals sent by the sensors.

The DNOx 6HD (SM) supply module is able to supply the system at **9 bar** for **15 kg/h**.



229718 2

1. 4/2 reversing valve
2. Pressure sensor
3. Temperature sensor
4. Electrical connector
5. Diaphragm pump

To prevent any damage to the pump and the dosing module, the supply module contains a filter which removes any impurities from the AdBlue.

To replace the filter, refer to the paragraph **AD-BLUE FILTER - Replace (50.74)**.

Technical specifications

Plunger module requested power

Rated voltage	Maximum current absorbed
12 V	**3700 mA** at **14 V** battery voltage
24 V	**2750 mA** at **28 V** battery

AdBlue module connector pin-out

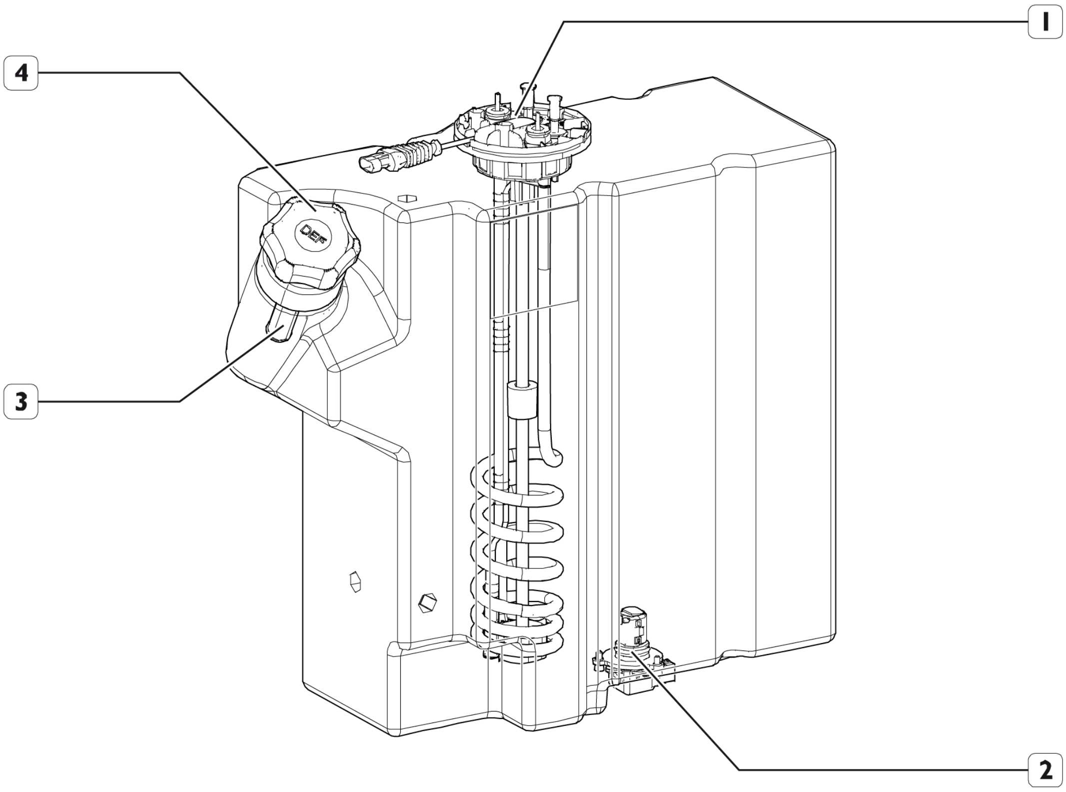
Ref.	Description
1	—
2	Urea pressure sensor power supply (+5V)
3	Urea pressure sensor signal
4	Urea pressure sensor ground
5	-
6	–
7	–
8	Ground for urea module electropump (diaphragm)
9	Urea module electropump supply (diaphragm)
10	PWM signal for urea module electropump (diaphragm)

Ref.	Description
11	Inversion solenoid valve power supply
12	Inversion solenoid valve signal

507420 AD-BLUE TANK - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tank



215387 1

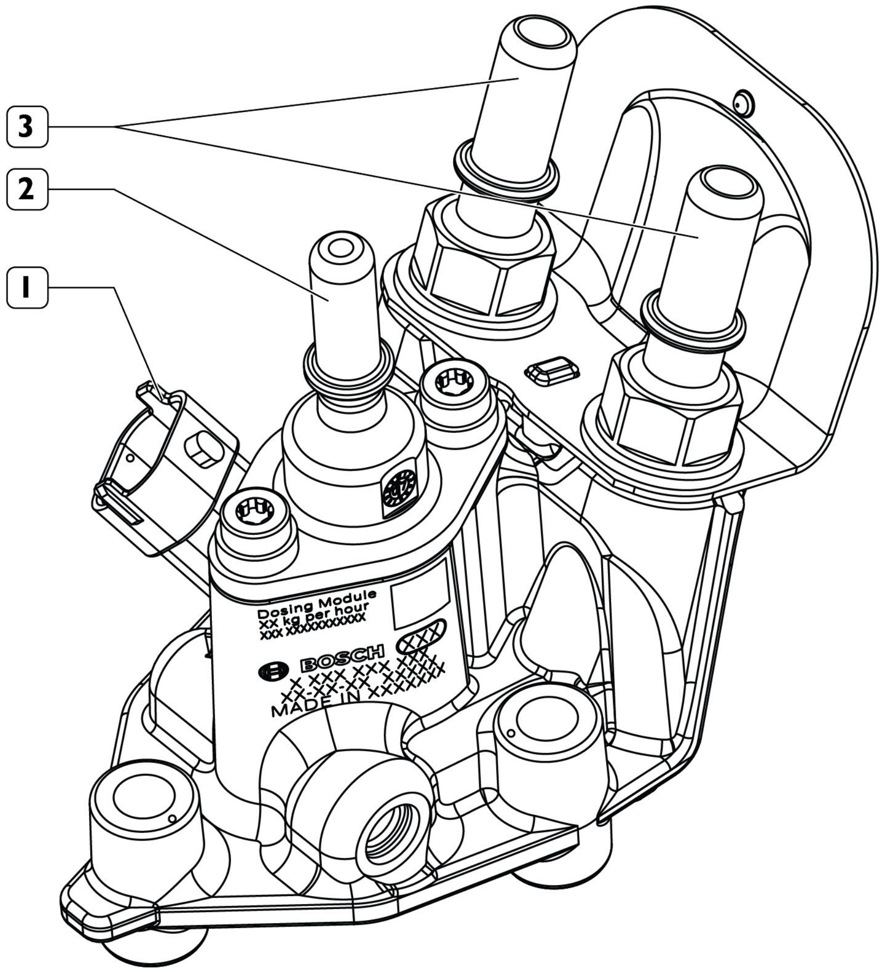
The tank, equipped with a level sensor **(1)** with a coil for heating the AdBlue and a temperature sensor, contains a reducing substance made up of a solution of **32,5%** urea and water known as AdBlue. There is a mesh filter **(3)** on the filler inlet **(4)** to prevent the introduction of any impurities into the tank during refilling operations. A urea quality sensor **(2)** is built into the tank to monitor the chemical composition of the AdBlue.

NOTE: *FPT recommends maintaining the AdBlue at a temperature below* ***50 °C*** *in the tank during operating conditions.*
Tank ventilation: the circuit must be protected from dust.

507431 AD-BLUE METERING DEV MODU - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

DM 2.5 dosing module (Dosing Module) - DNOx 2.2



267932 1

1. Electric connection
2. AdBlue intake
3. Coolant inlet/outlet

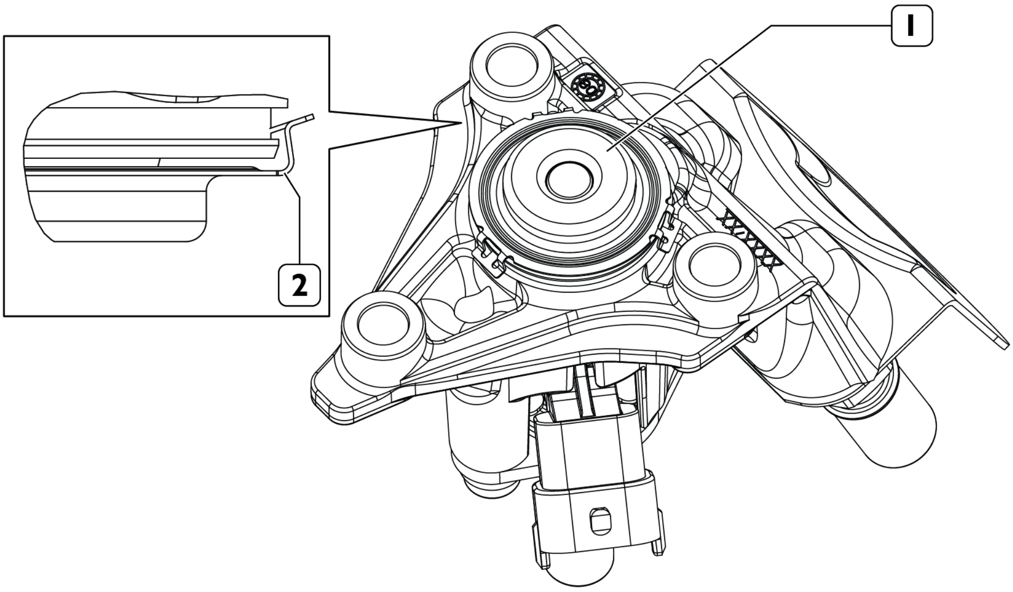
The dosing module is controlled by the engine control unit. It serves to dose the AdBlue solution to be injected into the exhaust pipe upstream of the SCR catalytic converter.

While in operation it is constantly subjected to high temperatures. For this reason it is connected to the engine cooling circuit by means of the pipes **(3)**.

The injector has 3 holes at 56° which allow uniform injection and vaporisation of the AdBlue into the exhaust gas.

AdBlue pressure.	
AdBlue maximum injection pressure	**9 bar**

Hydraulic capacity of the DM 2.5 dosing module (DNOx 2.2)	
Maximum with small urea injector	**~ 12 kg/h**



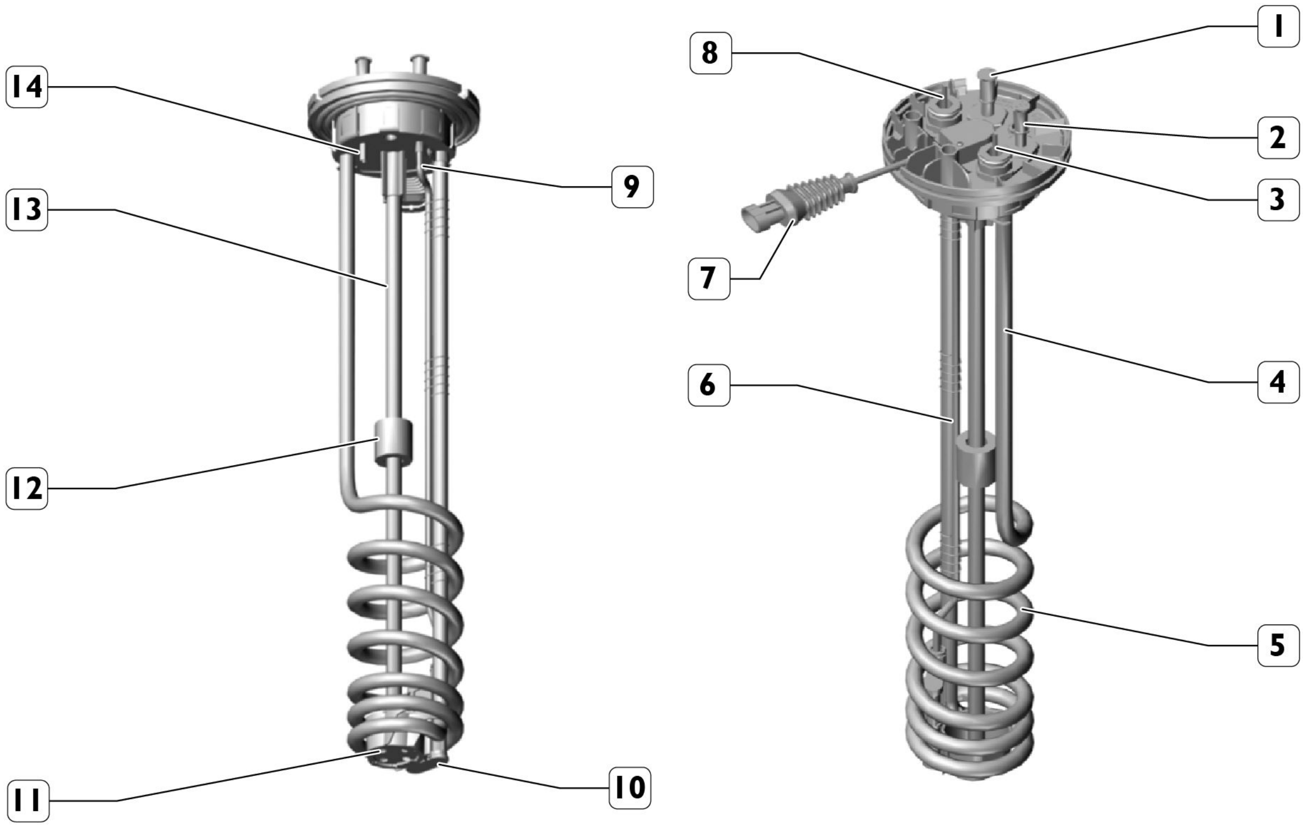
267933 2

The metering device is supplied with a sealing gasket and guard **(1)** which must be replaced each time it is removed. During removal operations, make sure that the insert **(2)** is inserted so that it locks on the metering device.

507424 AD-BLUE INDICATOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

AdBlue level gauge control



(1) AdBlue delivery fitting - (2) AdBlue return fitting - (3) Engine coolant outlet fitting - (4) Hot engine coolant outlet pipe - (5) AdBlue heating coil - (6) Engine coolant inlet pipe - (7) Connector - (8) Engine coolant inlet- (9) AdBlue intake pipe - (10) Filter - (11) Lower plate (AdBlue NTC temperature sensor) - (12) Float (AdBlue level sensor) - (13) Comb pipe - (14) AdBlue return pipe

The indicator control for the AdBlue liquid level is a device consisting of:

- a float (level sensor);
- an NTC temperature sensor;
- a coil for heating the liquid in low temperatures.

It informs the ECU of changes in the current due to the resistance, caused by the position of the float in relation to the level of the AdBlue liquid.

Frozen AdBlue can be melted by means of a coolant heater **(5)**.

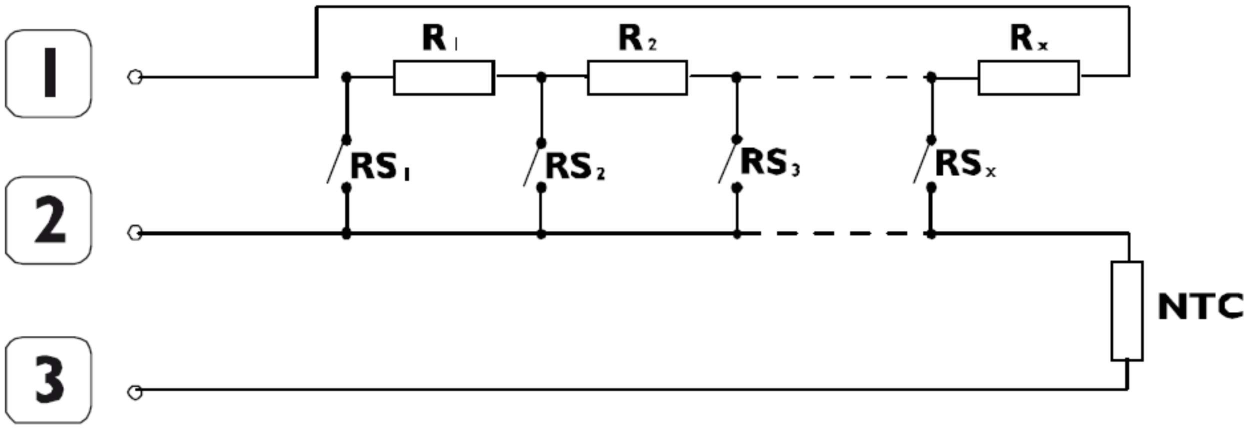
A solenoid operated by the control unit regulates the flow of fuel in the AdBlue tank heater/circuit.

The Urea quality sensor is integrated in the tank to meet the anti-tampering requirements.

NOTE: *Seal the connectors with a water tight seal before checking the AdBlue tank for leaks.*

Temperature sensor:	NTC type **1 +/- 5% kΩ** at **25 °C**
Recommended level sensor specifications:	**70 Ω** at low level **20 Ω** at high level

Electrical connections



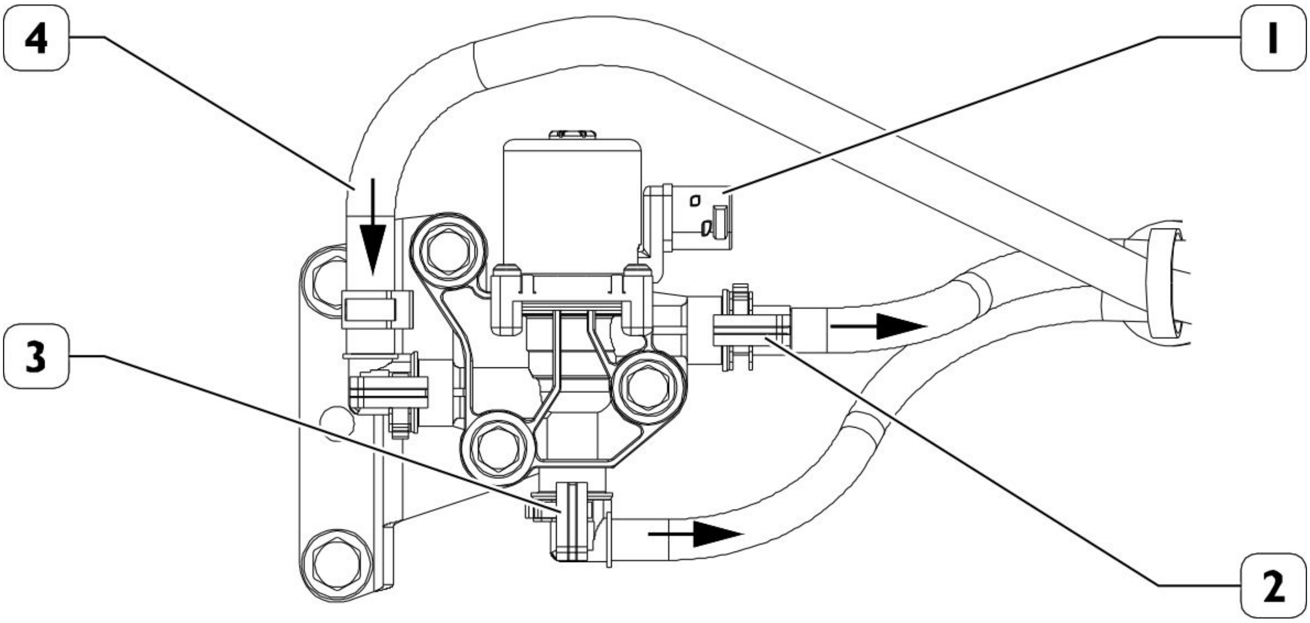
215389A 2

Ref.	Description
1	Level
2	Common ground
3	NTC signal (temperature)

507433 CROSSOVER VALVE - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Engine coolant 3-way valve



180580 1

1. Electrical connector
2. AdBlue tank heating fluid pipe
3. Dosing module coolant pipe
4. Engine coolant pipe

The switching valve is a 2 position/3 way solenoid valve. Based on the temperature measured by the NTC sensor, the switching valve opens or closes the passage of the engine coolant in the AdBlue tank heating coil. The cooling circuit for the dosing module always remains open.

The first position, in fact, allows the cooling of the dosing module (DM) whereas the second position allows the cooling of the AdBlue tank, the Supply Module (SM) and the relevant pipes, before heating the DM module.

Technical specifications

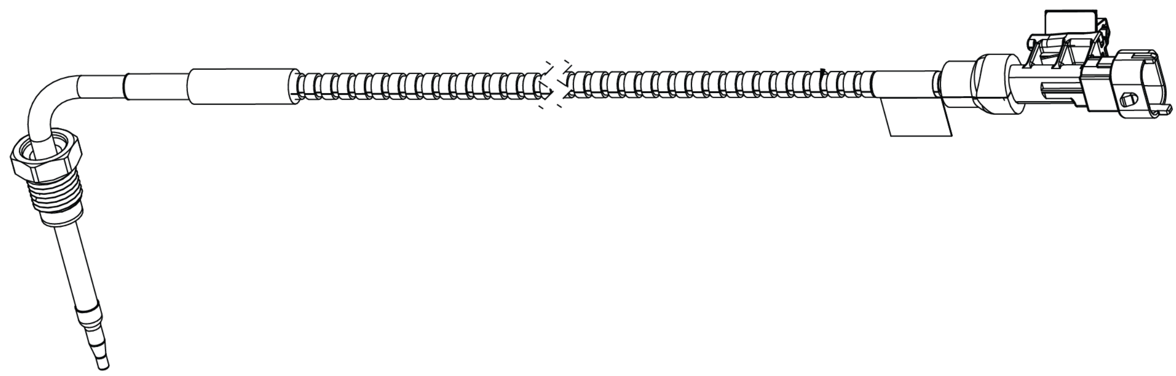
Technical data - diverter valve - system powered with rated voltage 12 V	
Rated voltage	**11 – 16 V**
Absorbed current	**1,1 A**

Technical data - diverter valve - system powered with rated voltage 24 V	
Operating voltage	**22 – 32 V**
Absorbed current	**0,75 A**

507434 TEMPERATURE SENSOR - Overview

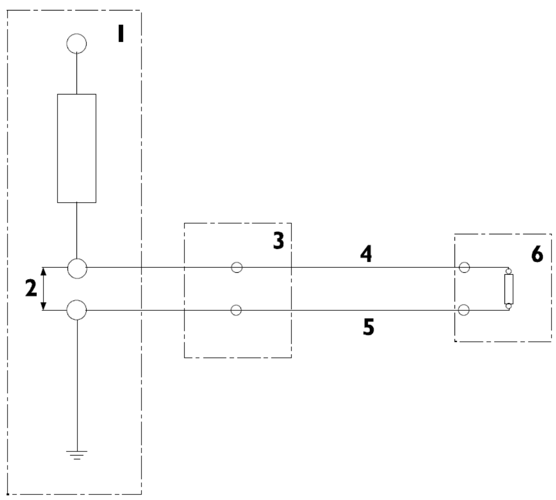
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Exhaust gas temperature sensor



267934 1

Functional wiring diagram



102304B 2

1. Supply voltage
2. Variable output voltage
3. Connector
4. Signal cable (grey)
5. Ground cable (white)
6. Sensor

This sensor serves to send the exhaust gas temperature values at the various points of the ATS to the control unit:

1. At the DOC inlet, signal used to protect the DOC from overheating.
2. At the DOC outlet, signal used to protect the DOC from overheating and to implement the optimal AdBlue injection strategy.
3. SCRoF inlet, signal used to protect the SCR from overheating, to implement the optimal AdBlue injection strategy and to control regeneration.
4. SCR outlet, signal used to protect the SCR from overheating and to implement the optimal AdBlue injection strategy.

EXHAUST GAS TEMPERATURE SENSOR CHARACTERISTICS	VALUE
Power supply	**+ 5 +/- 0,1% V**
Output resistance at a temperature of **- 40 – 800 °C**	**170.2 – 738.7 V**
Pull-up resistance	**1.000 +/- 0,1% Ω**
Lead resistance	**1 Ω**
Tightening torque	**45 +/- 4,5 N·m**

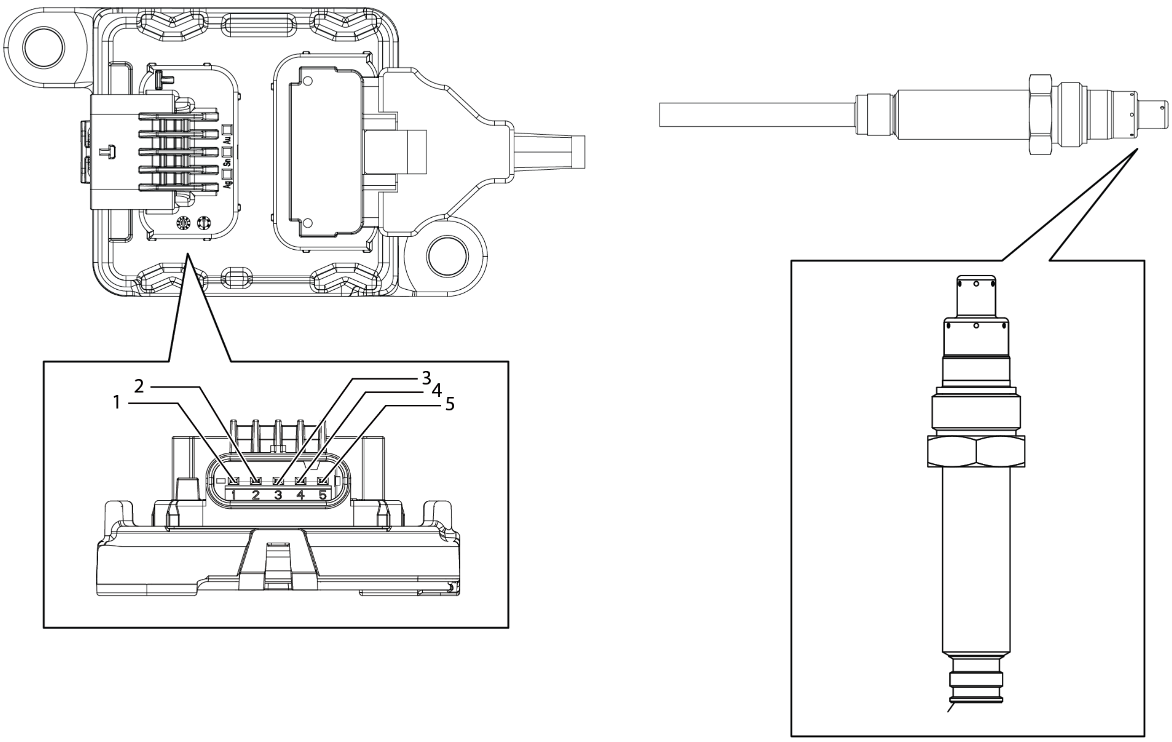
Sensor characteristics

(T)	(RS)	(V0)
- 40 °C	**170,2 Ω**	**0,727 V**
- 20 °C	**185,6 Ω**	**0,783 V**
0 °C	**201,1 Ω**	**0,837 V**
25 °C	**220,1 Ω**	**0,902 V**
50 °C	**239,0 Ω**	**0,964 V**
100 °C	**276,4 Ω**	**1,083 V**
150 °C	**313,2 Ω**	**1,193 V**
200 °C	**349,5 Ω**	**1,295 V**
250 °C	**385,1 Ω**	**1,390 V**
300 °C	**420,2 Ω**	**1,479 V**
350 °C	**454,7 Ω**	**1,563 V**
400 °C	**488,6 Ω**	**1,641 V**
450 °C	**521,9 Ω**	**1,715 V**
500 °C	**554,6 Ω**	**1,784 V**
600 °C	**618,3 Ω**	**1,910 V**
700 °C	**679,7 Ω**	**2,023 V**
800 °C	**738,7 Ω**	**2,124 V**

507435 NOX DETECTION SENSOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Nitrogen oxide detecting sensor



267935 1

1. Positive
2. Ground
3. L CAN line
4. H CAN line
5. Spare

The NOx sensor detects the amount of nitrogen oxide present in the exhaust gas entering and exiting the catalytic converters.

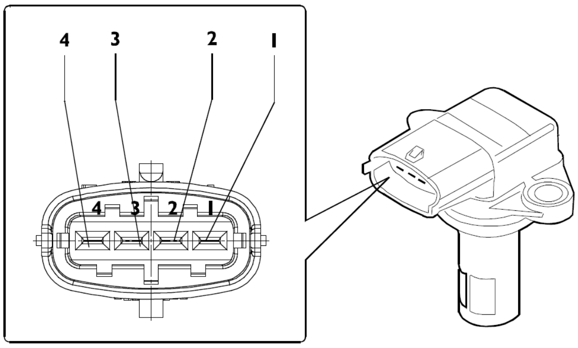
Based on this information the engine control unit regulates the amount of AdBlue to be injected and also measures the efficiency of the catalytic converters on the basis of the humidity of the filter inlet air.

NOx SENSOR CHARACTERISTICS	VALUE
Ambient temperature for electronics:	**- 40 – +105 °C** (**+105 – +115 °C** permitted for **10 min**)
Cable temperature:	**230 °C** permitted for **100 h**
Sensor tightening torque	**50 +/- 10 N·m**

507436 HUMIDITY SENSOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

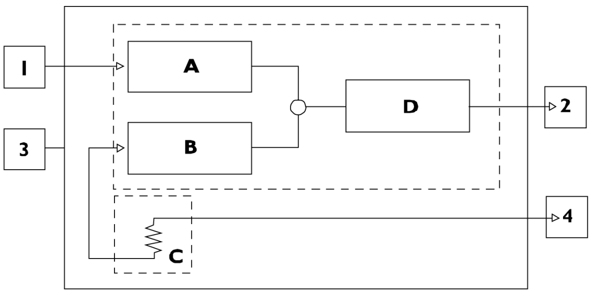
Temperature and humidity sensor



125531A 1

1. Fuelling
2. Percent of Humidity
3. Ground
4. Temperature

Located on the air filter outlet duct, its job is to send the temperature and percentage of humidity in the intake air to the control unit in order to calculate nitrogen oxide emissions.



223113 2

1. Power supply VDC
2. Percent of Humidity
3. Ground
4. NTC temperature

A. Reference oscillator
B. Sensor oscillator
C. Sample frequency generator
D. Low pass amplifier filter

HUMIDITY SENSOR SPECIFICATIONS	VALUE
Power supply Voltage	**5 +/- 0,25 V** DC
Current absorption (max)	**10 mA**

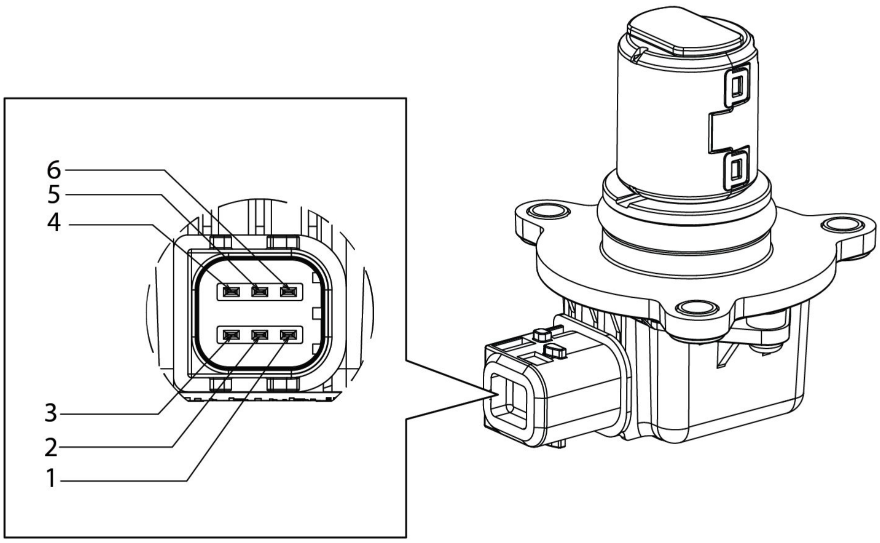
HUMIDITY SENSOR SPECIFICATIONS	VALUE
Operating range	**0 – 100%**RH %
Output impedance	**70 Ω**
Isolation resistance	**1 MΩ** at **500 V**

CHARACTERISTICS OF TEMPERATURE SENSOR	VALUE
Operating temperature range	**-40 – 125 °C**
Resistor at **25 °C**	NTC **2,186 +/- 1% kΩ**
Maximum power at **25 °C**	**100 mW**

507442 UREA QUALITY SYSTEM - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

"UQS" Urea quality sensor (Urea Quality Sensor)



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The quality sensor allows the concentration of urea in the AdBlue in the tank to be measured.

The concentration of urea in the AdBlue is considered optimal when it reaches **32.5%**. If a value outside of the permitted range is recorded by the sensor, the control unit will launch the INDUCEMENT procedure.

AdBlue module connector pin-out

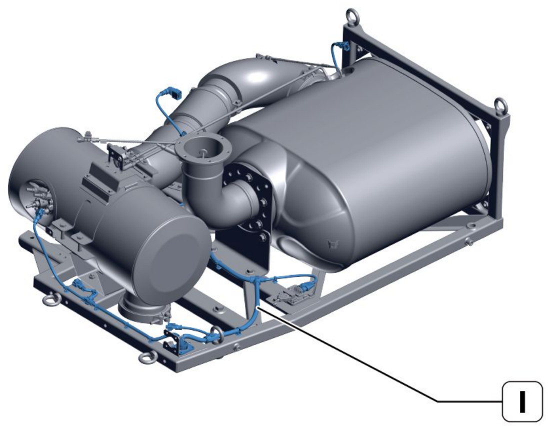
Ref.	Description
1	—
2	–
3	Supply **(Vcc)**
4	High CAN line
5	Low CAN line
6	Ground

5074 AD-BLUE SYSTEM - Disassemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Quantity	Step	Value
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.75x25		**80 +/- 8 N·m**
Bracket for exhaust gas outlet pipe from SCRoF to the ATS frame	2 screws M12x1.75x30		**80 +/- 8 N·m**
Diesel oxidation catalyst bracket (DOC)	4 screws M10 x 1.5 x 60		**66.5 +/- 6.5 N·m**
NOx sensor control unit		2 screws M8 x 1.25 x 55	**22.5 +/- 2.5 N·m**
		2 screws M8 x 1.25 x 20	**22.5 +/- 2.5 N·m**

1. Disconnect the electrical connections of the sensors and remove the ATS system wiring **(1)** releasing it from the anchoring eyelets.



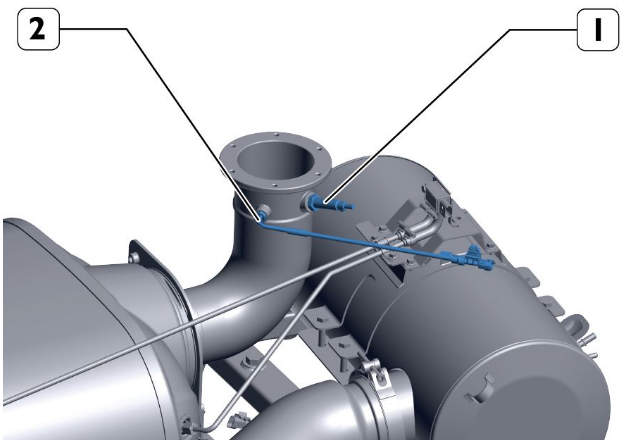
267496 1

2. Unscrew and remove the SCRoF outlet NOx sensor **(1)**.

Description	Step	Value
NOx sensor	1 fitting M20x1.5	**50 +/- 10 N·m**

3. Unscrew and remove the SCRoF outlet exhaust gas temperature sensor **(2)**.

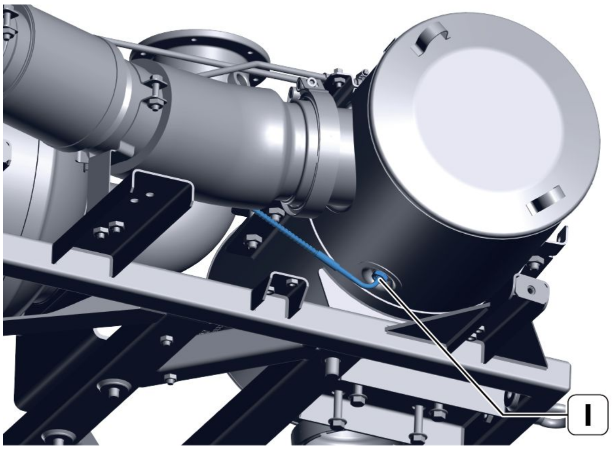
Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**



267497 2

4. Unscrew and remove the DOC outlet exhaust gas temperature sensor **(1)**.

Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**



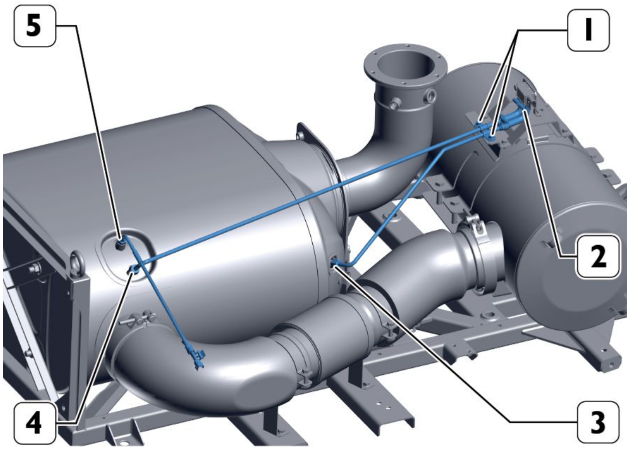
267498 3

5. Unscrew and remove the SCRoF inlet exhaust gas temperature sensor **(5)**.

Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**

6. Unscrew the fittings **(3)**, **(4)** on the SCRoF side, unscrew the bracket screws **(1)**, loosen the collars **(2)** and remove the rigid pipes of the differential pressure inlet.

Description	Quantity	Value
Bracket for pressure inlet hose clip	4 screws M6 x 1 x 16	**13.5 +/- 1.5 N·m**



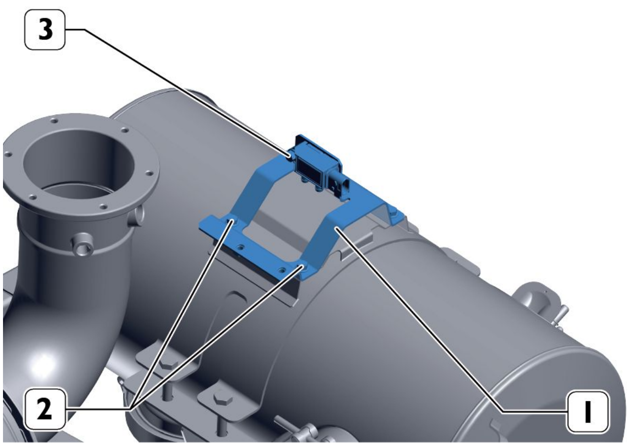
267499 4

7. Unscrew the screw **(3)** and remove the differential speed sensor.

Description	Quantity	Value
Differential pressure sensor	1 screw M6 x 1 x 16	**9 +/- 1 N·m**

8. Undo the four screws **(2)** and remove bracket **(1)**.

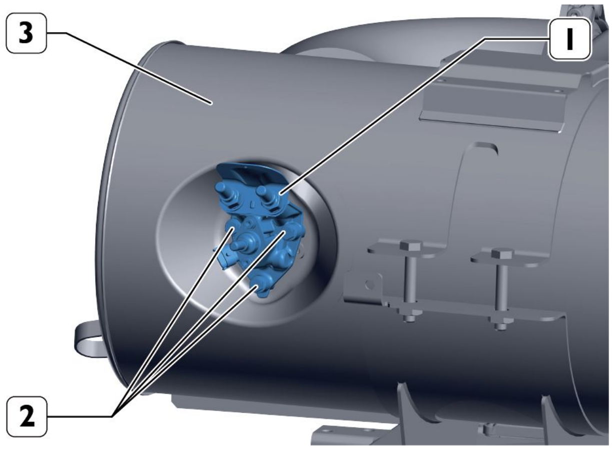
Description	Quantity	Value
Upper Diesel Oxidation Catalyst bracket (DOC)	4 screws M6 x 1 x 12	**13.5 +/- 1.5 N·m**



267500 5

9. Unscrew the screws **(2)** and remove the urea dosing module **(1)** from the DOC **(3)**.

Description	Quantity	Value
AdBlue dosing module	3 screws M6x1x35	**13.5 +/- 1.5 N·m**



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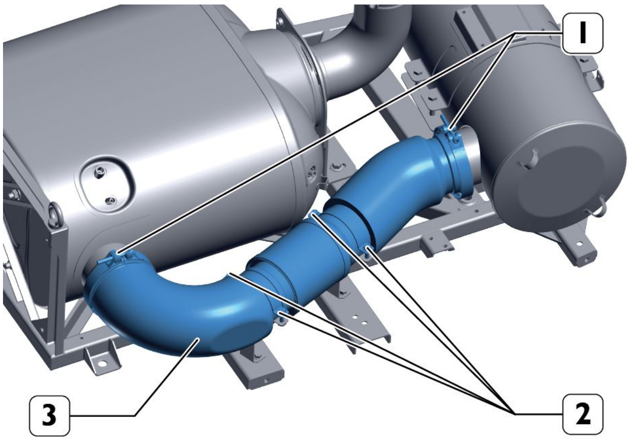
10. Open the V-clamp on the SCRoF side and the DOC **(1)** side, unscrew the bracket screws **(2)**, disconnect and remove the exhaust gas pipe between the DOC and SCRoF **(3)**.

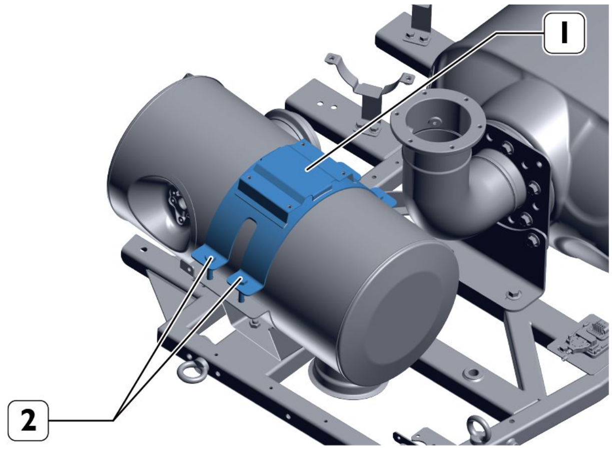
Description	Quantity	Value
Exhaust gas pipe hose clip between DOC and SCRoF	4 screws M8 x 1.25 x 35	**22.5 +/- 2.5 N·m**
Exhaust gas pipe bracket between DOC and SCRoF	4 screws M8 x 1.25 x 16	**22.5 +/- 2.5 N·m**



267502 7

11. Unscrew the screws **(2)** and remove the upper supporting bracket of the DOC **(1)**.

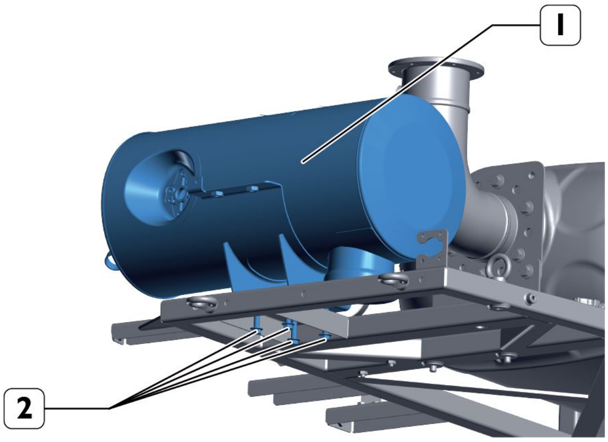
Description	Quantity	Value
Diesel oxidation catalyst bracket (DOC)	4 screws M10 x 1.5 x 60	**66.5 +/- 6.5 N·m**



267503 8

12. Unscrew the screws **(2)** and remove the DOC module **(1)** with the relative lower support.

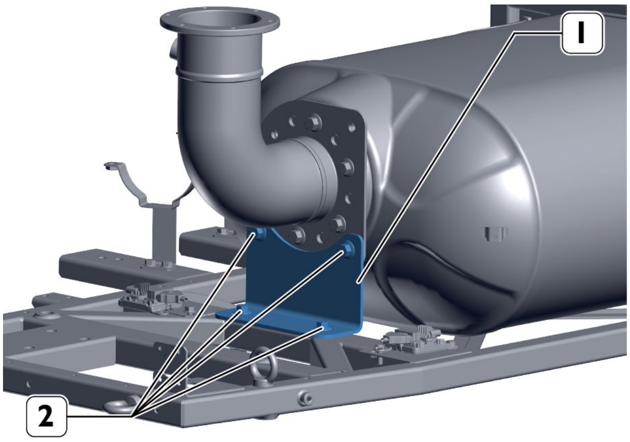
Description	Quantity	Value
Diesel oxidation catalyst (DOC)	4 screws M10x1.5 x25	**66.5 +/- 6.5 N·m**



267504 9

13. Unscrew the screws **(2)** and remove the lower fastening bracket of the SCRoF **(1)**.

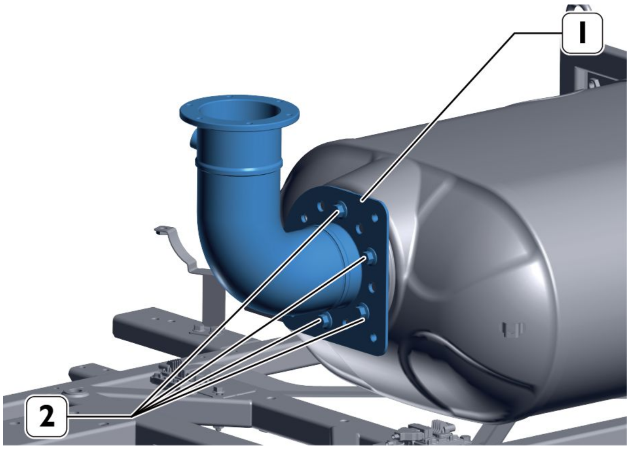
Description	Quantity	Value
Bracket for exhaust gas outlet pipe from SCRoF to the ATS frame	2 screws M12x1.7 5x30	**80 +/- 8 N·m**
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.7 5x25	**80 +/- 8 N·m**



267505 10

14. Unscrew the screws **(2)** and remove the exhaust gas outlet pipe from the SCRoF **(1)** complete with the gasket.

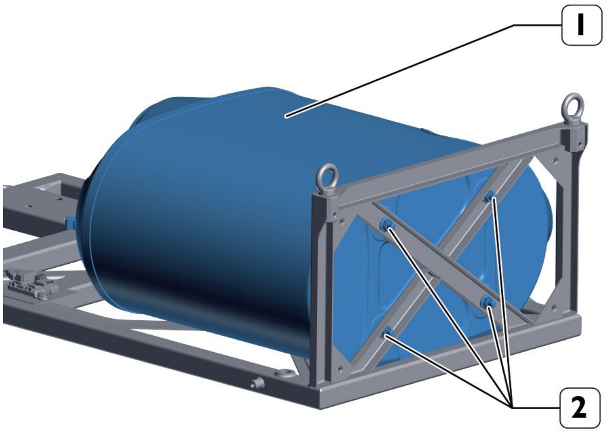
Description	Quantity	Value
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.7 5x25	**80 +/- 8 N·m**



267506 11

15. Unscrew the nuts **(2)** and remove the SCRoF module **(1)**.

Description	Quantity	Value
Selective catalytic reduction (SCRoF)	4 nuts M12 x 1.75	**80 +/- 8 N·m**



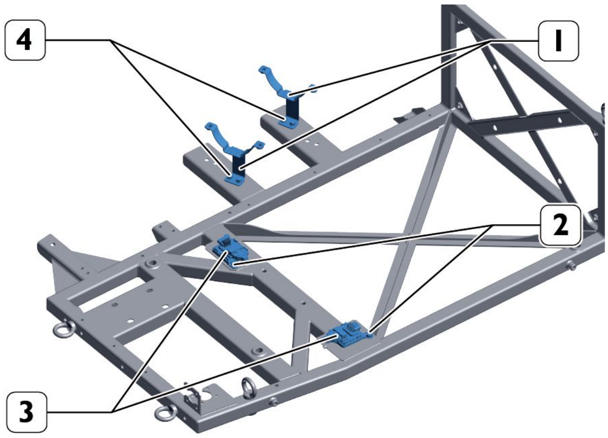
267507 12

16. Unscrew the screws **(2)** and remove the control units of the NOx sensors **(3)**.

Description	Step	Value
NOx sensor control unit	2 screws M8 x 1.25 x 55	**22.5 +/- 2.5 N·m**
	2 screws M8 x 1.25 x 20	**22.5 +/- 2.5 N·m**

17. Unscrew the screws **(4)** and remove the brackets **(1)**.

Description	Quantity	Value
Exhaust gas pipe bracket between DOC and SCRoF	4 screws M8 x 1.25 x 16	**22.5 +/- 2.5 N·m**



267508 13

5074 AD-BLUE SYSTEM - Service instruction - Forced regeneration procedure

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Risk of damage
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.
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

Risk of injury:
Before carrying out the procedure, ensure you are wearing suitable PPE. Proceed in accordance with accident prevention standards.
Failure to comply with these prescriptions can result in the risk of serious injury

Before proceeding with the forced regeneration, observe the information provided in the warnings.

General warnings

- During forced regeneration the surfaces of the unit components, particularly the ATS system components and the engine will reach extremely high temperatures.
- Check that the unit is in a safe area, namely that it is suitably isolated from other equipment and means.
- Only carry out forced regeneration in the open air.
- Make sure that there is no flammable material in the area where the work is carried out.
- Delimit the area around the genset. Make sure there is at least **2 m** free space around the unit paying particular attention to exhaust gas outlets into the atmosphere.

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

- Place safety signs on the unit indicating maintenance in progress as required by legislation in force in the country where you are working.
- Ensure that PPE is used as required by the legislation in force in the country.
- The forced regeneration of the exhaust gas after-treatment device is a procedure which must always be carried out by the Assistance Network and can only be activated via a diagnostics tool (PT-Box) or the dedicated CAN message (CMBC1).
- The regeneration phase requires an automatic warm up phase
- When regeneration is complete, the engine will undergo a cold down phase of approximately **1500 RPM**.

Risk of damage
The procedure can last a maximum of 50 minutes including the heating phase.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

- Contact the parent company if you have any queries.

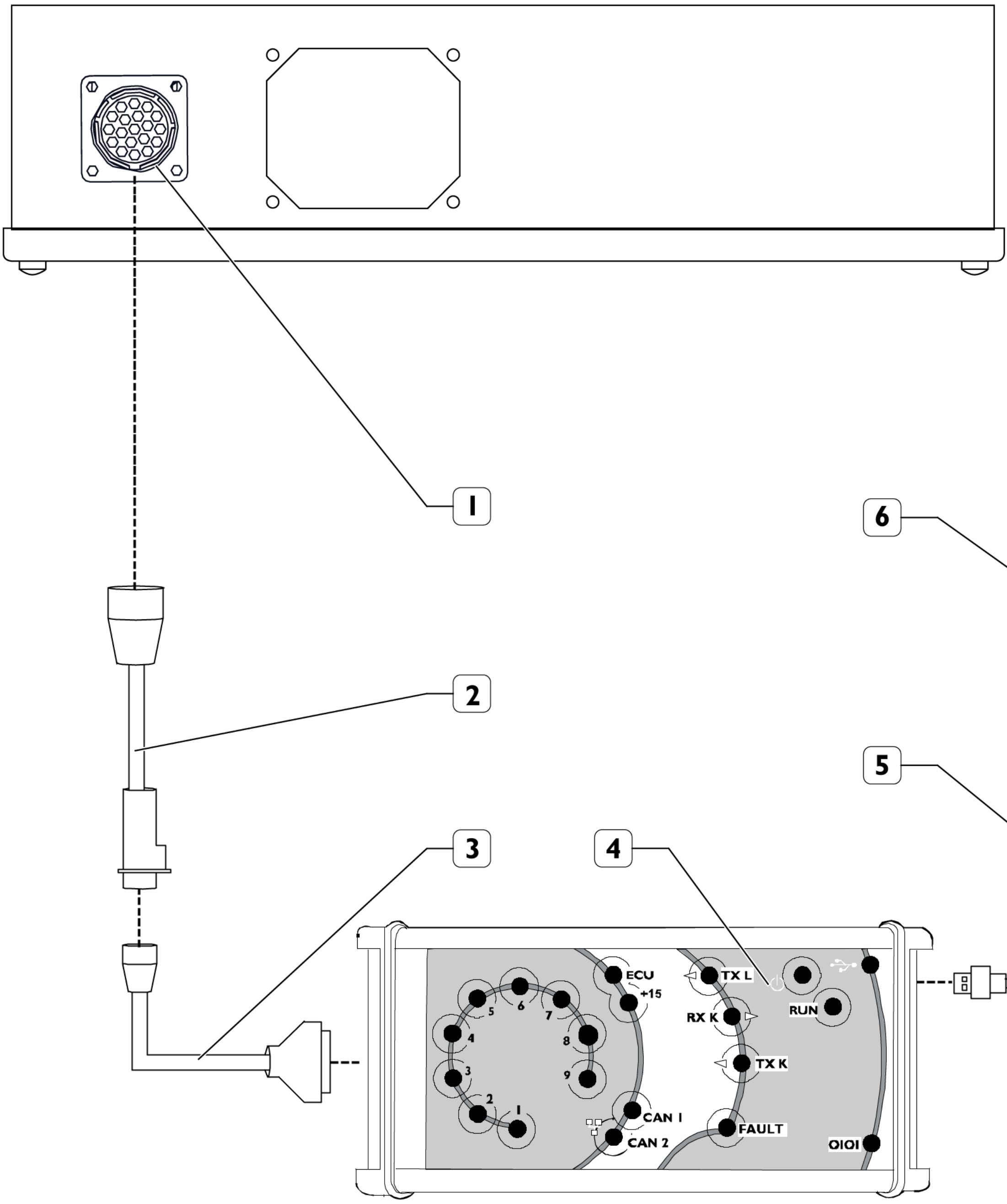
Specific warnings for the gensets

- Isolate the genset from the electrical distribution line acting on the phase disconnecting switches - phase general switches.
- Open the access doors on the sound-proof unit to facilitate engine compartment aeration.

Connections

1. Check that the unit is switched off from the electrical panel . Check that the power supply switch of the unit is set to "OFF" and/or the control panel is off.
   - Current generator units: isolate the unit from the three-phase system of the distribution network using the disconnection switches. Apply suitable mechanical stops to the disconnecting switches in compliance with the legislation in force in the country where you are working.
   - Affix signs as required by legislation in force in the country where you are working to the electrical panel. These signs must show that maintenance of the unit is in progress.

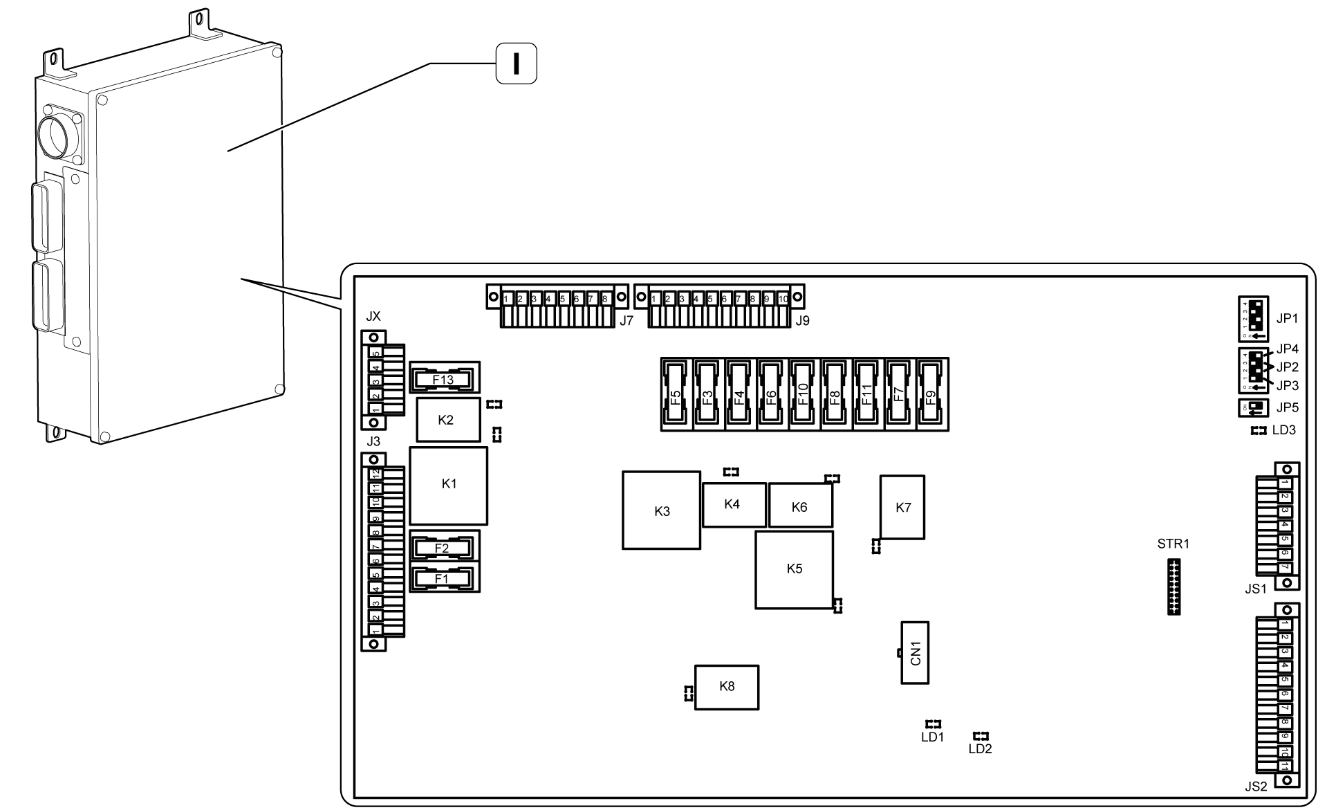
   To carry out forced regeneration of the ATS system connect the PT-BOX diagnostic instrument to the interface case as indicated below.



268543 1

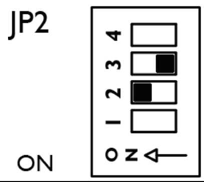
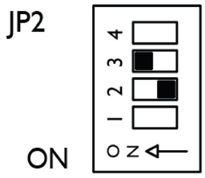
1. 19-pin engine diagnostics socket - 2. 19 - 30 pin adapter cable - 3. PT-BOX 30-pin cable — 4. PT-BOX — 5. USB cable for PT-BOX connection — 6. USB port for PC

2. Remove the front cover **(1)** of the interface case to access the board.



268551 2

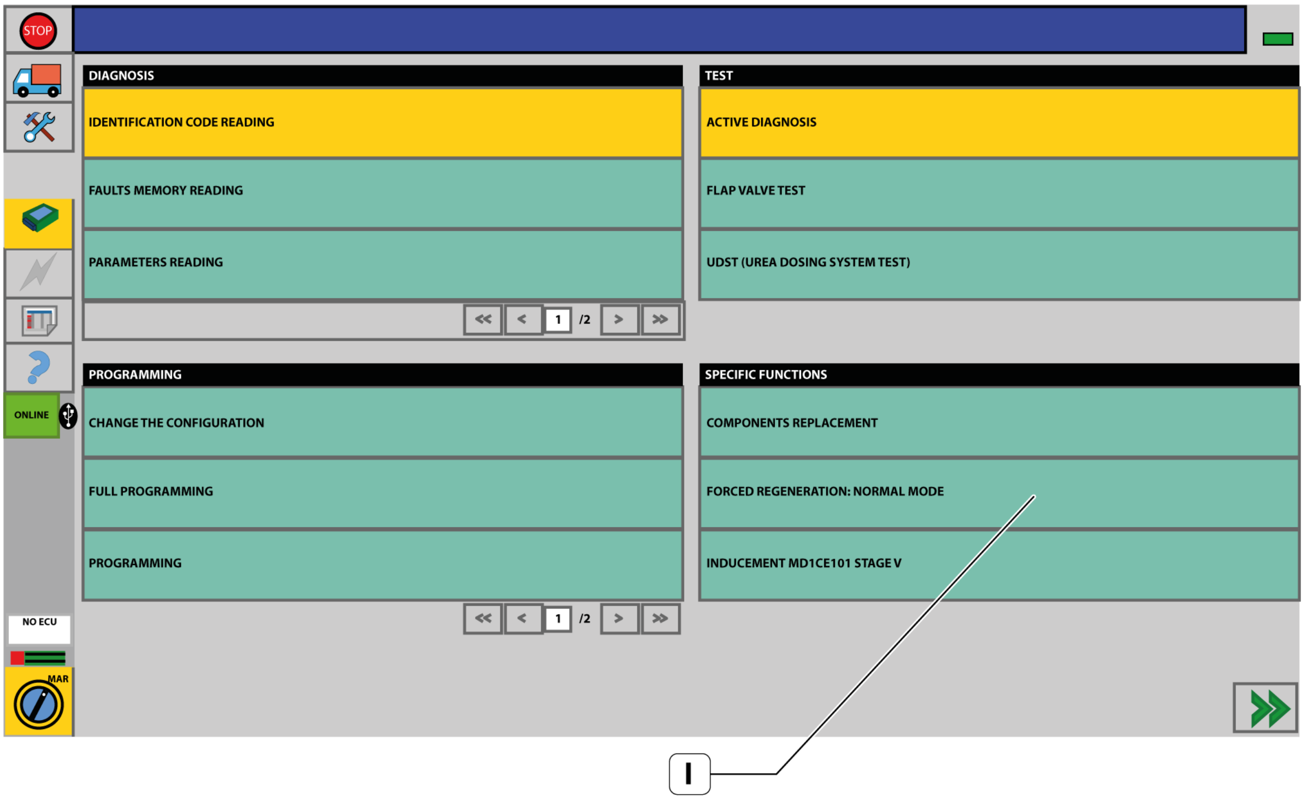
Set the unit to diagnostics mode by acting on the JP2 microswitches.

Diagnostic position	
Operating position (prearranged)	

3. Start the diagnostic tool (PT-BOX) and follow the step-by-step instructions to select the forced regeneration procedure of the ATS system.

   The PT-BOX groups all of its functions into four of its sub-menus.

   - "Diagnostics" menu
   - "Programming" menu
   - "Test" menu
   - "Specific functions" menu



268552 3

To launch the forced regeneration, select the function **(1)** highlighted in the figure and follow the step-by-step instructions as indicated by the diagnostic instrument.

5074 AD-BLUE SYSTEM - Service instruction - Forced regeneration procedure

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Risk of damage
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.
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

Risk of injury:
Before carrying out the procedure, ensure you are wearing suitable PPE. Proceed in accordance with accident prevention standards.
Failure to comply with these prescriptions can result in the risk of serious injury

Before proceeding with the forced regeneration, observe the information provided in the warnings.

General warnings

- During forced regeneration the surfaces of the unit components, particularly the ATS system components and the engine will reach extremely high temperatures.
- Check that the unit is in a safe area, namely that it is suitably isolated from other equipment and means.
- Only carry out forced regeneration in the open air.
- Make sure that there is no flammable material in the area where the work is carried out.
- Delimit the area around the genset. Make sure there is at least **2 m** free space around the unit paying particular attention to exhaust gas outlets into the atmosphere.

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

- Place safety signs on the unit indicating maintenance in progress as required by legislation in force in the country where you are working.
- Ensure that PPE is used as required by the legislation in force in the country.
- The forced regeneration of the exhaust gas after-treatment device is a procedure which must always be carried out by the Assistance Network and can only be activated via a diagnostics tool (PT-Box) or the dedicated CAN message (CMBC1).
- The regeneration phase requires an automatic warm up phase
- When regeneration is complete, the engine will undergo a cold down phase of approximately **1500 RPM**.

Risk of damage
The procedure can last a maximum of 50 minutes including the heating phase.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

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- Contact the parent company if you have any queries.

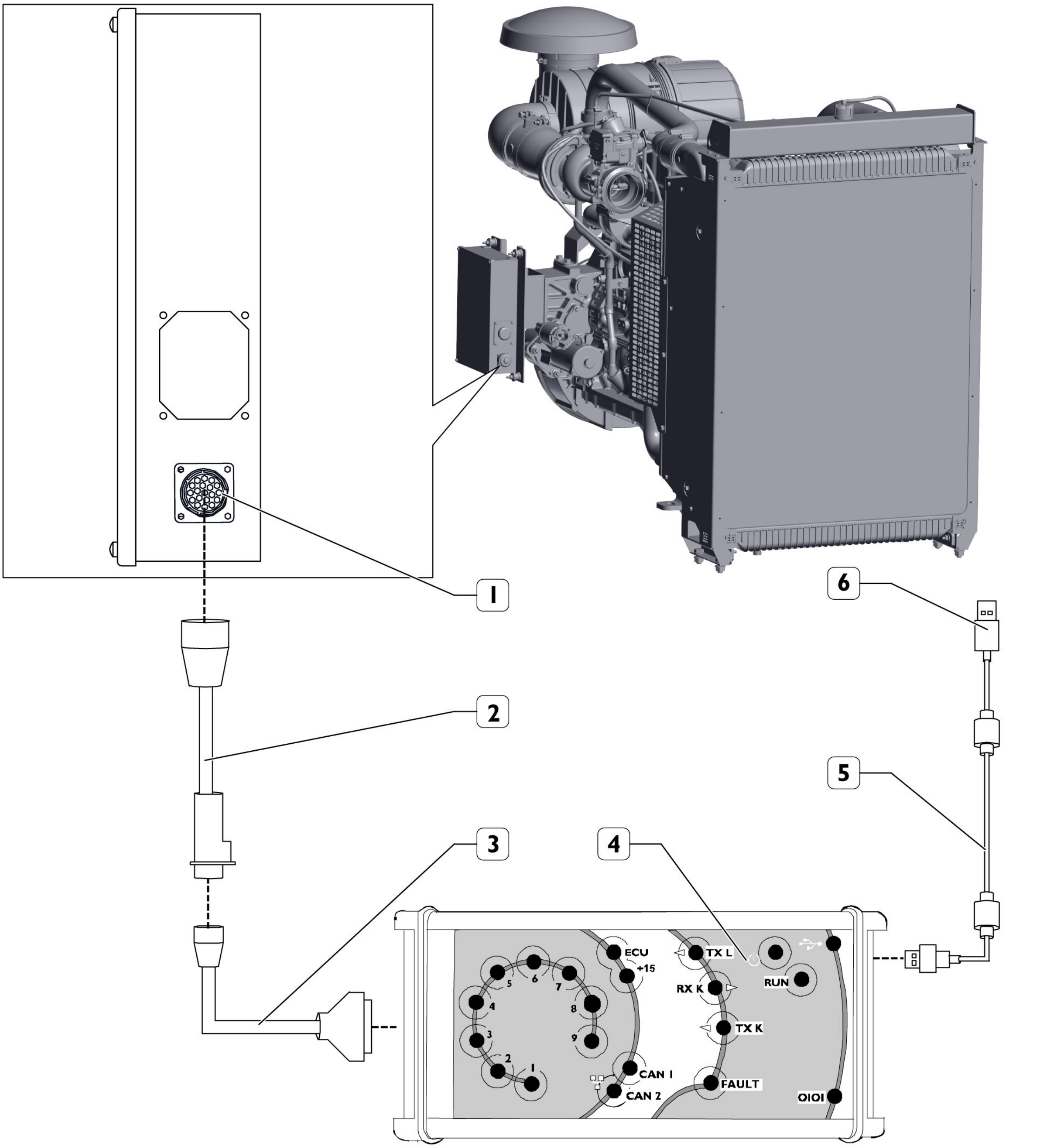
Specific warnings for the gensets

- Isolate the genset from the electrical distribution line acting on the phase disconnecting switches - phase general switches.
- Open the access doors on the sound-proof unit to facilitate engine compartment aeration.

Connections

1. Check that the unit is switched off from the electrical panel . Check that the power supply switch of the unit is set to "OFF" and/or the control panel is off.
   - Current generator units: isolate the unit from the three-phase system of the distribution network using the disconnection switches. Apply suitable mechanical stops to the disconnecting switches in compliance with the legislation in force in the country where you are working.
   - Affix signs as required by legislation in force in the country where you are working to the electrical panel. These signs must show that maintenance of the unit is in progress.

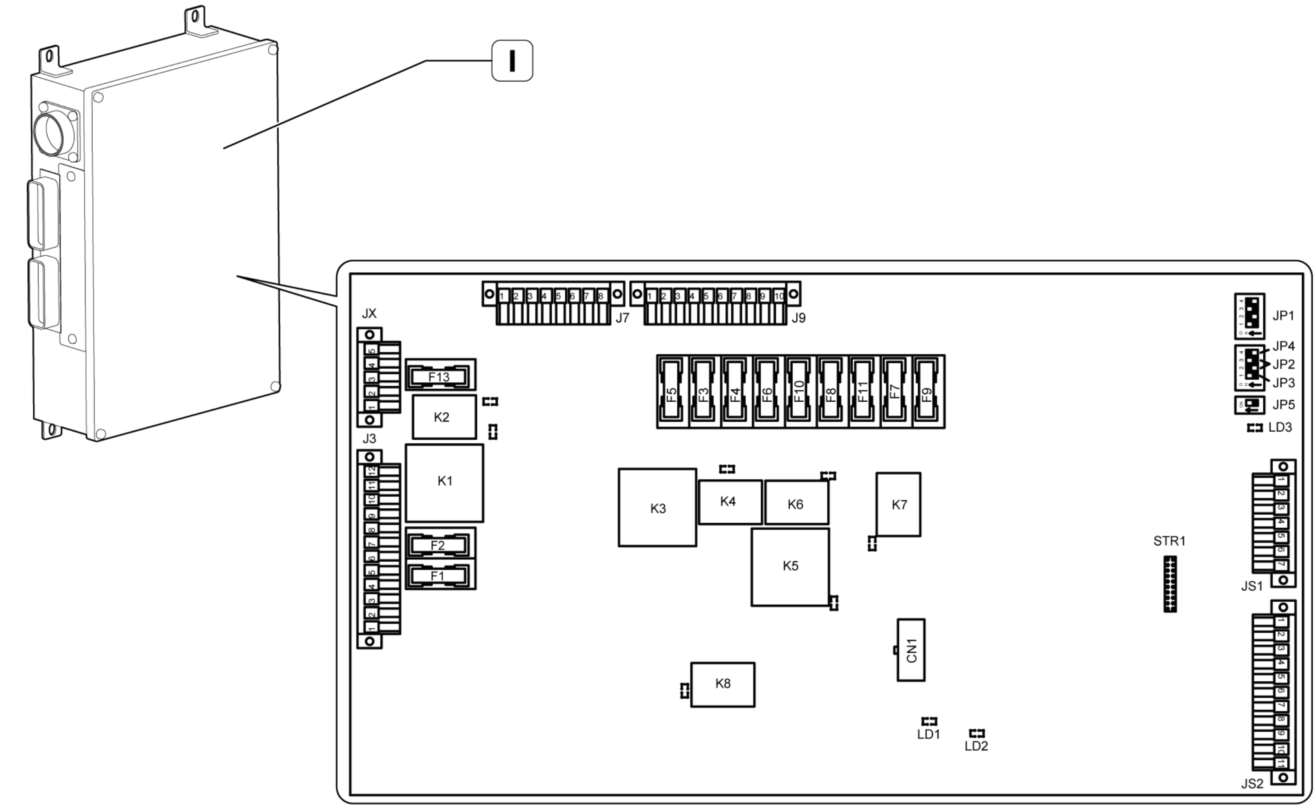
   To carry out forced regeneration of the ATS system connect the PT-BOX diagnostic instrument to the interface case as indicated below.



268542 1

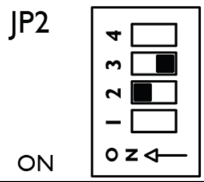
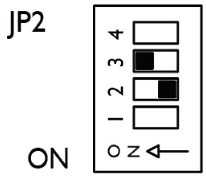
1. 19-pin engine diagnostics socket - 2. 19 - 30 pin adapter cable - 3. PT-BOX 30-pin cable — 4. PT-BOX — 5. USB cable for PT-BOX connection — 6. USB port for PC

2. Remove the front cover **(1)** of the interface case to access the board.



268551 2

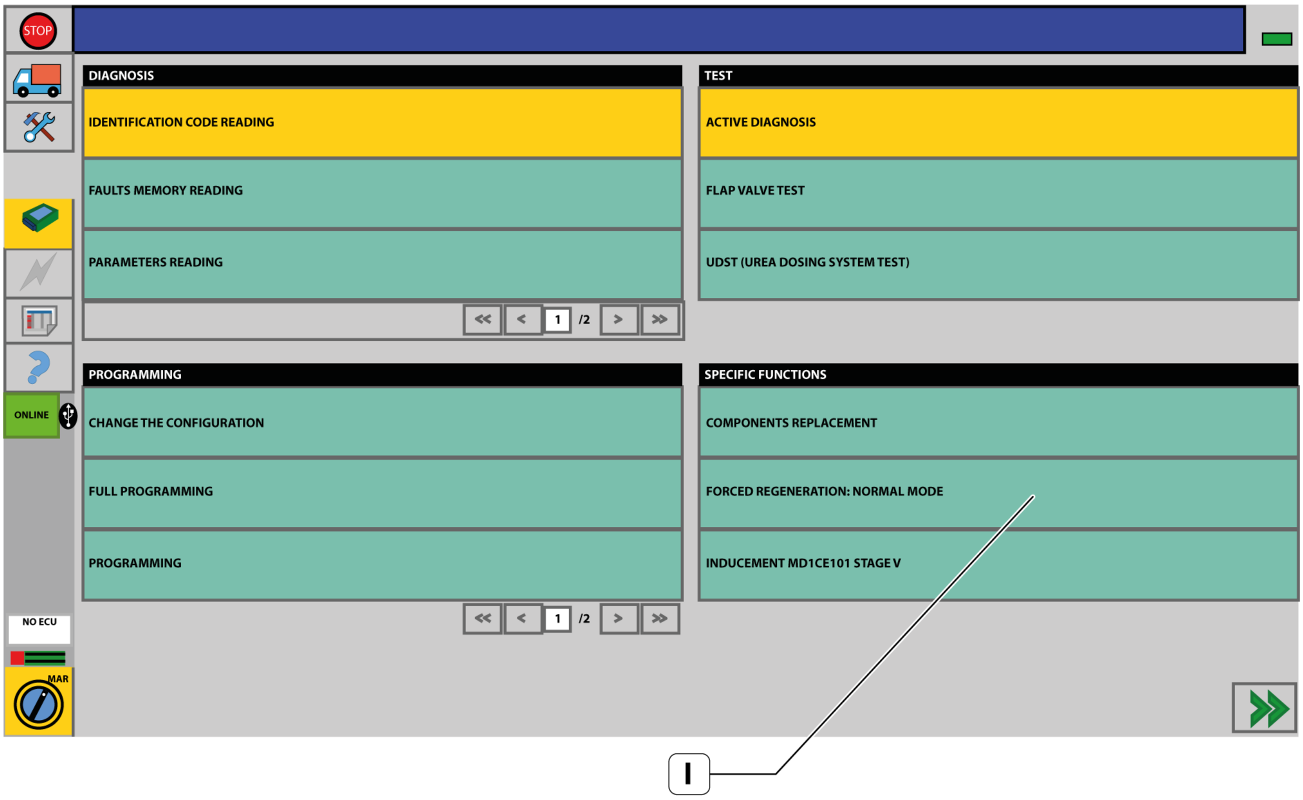
Set the unit to diagnostics mode by acting on the JP2 microswitches.

Diagnostic position	
Operating position (prearranged)	

3. Start the diagnostic tool (PT-BOX) and follow the step-by-step instructions to select the forced regeneration procedure of the ATS system.

   The PT-BOX groups all of its functions into four of its sub-menus.

   - "Diagnostics" menu
   - "Programming" menu
   - "Test" menu
   - "Specific functions" menu



268552 3

To launch the forced regeneration, select the function **(1)** highlighted in the figure and follow the step-by-step instructions as indicated by the diagnostic instrument.

5074 AD-BLUE SYSTEM - Assemble

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

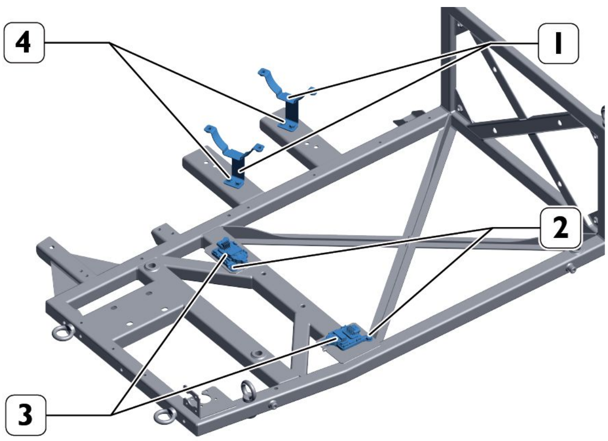
Description	Quantity	Step	Value
AdBlue dosing module	3 screws M6x1x35		**13.5 +/- 1.5 N·m**
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.75x25		**80 +/- 8 N·m**
Bracket for exhaust gas outlet pipe from SCRoF to the ATS frame	2 screws M12x1.75x30		**80 +/- 8 N·m**
Bracket for pressure inlet hose clip	4 screws M6 x 1 x 16		**13.5 +/- 1.5 N·m**
Diesel oxidation catalyst bracket (DOC)	4 screws M10 x 1.5 x 60		**66.5 +/- 6.5 N·m**
Diesel oxidation catalyst (DOC)	4 screws M10x1.5x25		**66.5 +/- 6.5 N·m**
Differential pressure sensor	1 screw M6 x 1 x 16		**9 +/- 1 N·m**
Exhaust gas pipe bracket between DOC and SCRoF	4 screws M8 x 1.25 x 16		**22.5 +/- 2.5 N·m**
Exhaust gas pipe hose clip between DOC and SCRoF	4 screws M8 x 1.25 x 35		**22.5 +/- 2.5 N·m**
Exhaust gas temperature sensor		1 fitting M10	**45 +/- 4.5 N·m**
NOx sensor		1 fitting M20x1.5	**50 +/- 10 N·m**
NOx sensor control unit		2 screws M8 x 1.25 x 55	**22.5 +/- 2.5 N·m**
		2 screws M8 x 1.25 x 20	**22.5 +/- 2.5 N·m**
Selective catalytic reduction (SCRoF)	4 nuts M12 x 1.75		**80 +/- 8 N·m**
Upper Diesel Oxidation Catalyst bracket (DOC)	4 screws M6 x 1 x 12		**13.5 +/- 1.5 N·m**

1. Fit the brackets **(1)** and tighten the screws **(4)** to the specified torque.

Description	Quantity	Value
Exhaust gas pipe bracket between DOC and SCRoF	4 screws M8 x 1.25 x 16	**22.5 +/- 2.5 N·m**

2. Replace the control units of the NOx sensors **(3)** in their seats and tighten the screws **(2)** to the specified torque.

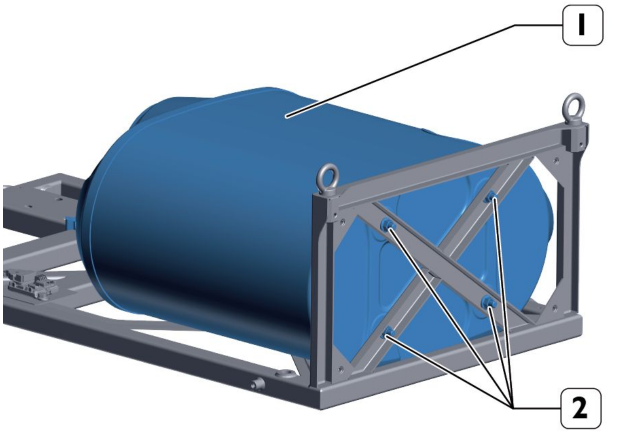
Description	Step	Value
NOx sensor control unit	2 screws M8 x 1.25 x 55	**22.5 +/- 2.5 N·m**
	2 screws M8 x 1.25 x 20	**22.5 +/- 2.5 N·m**



267508 1

3. Install the SCRoF module **(1)** and tighten the nuts **(2)** to the specified torque.

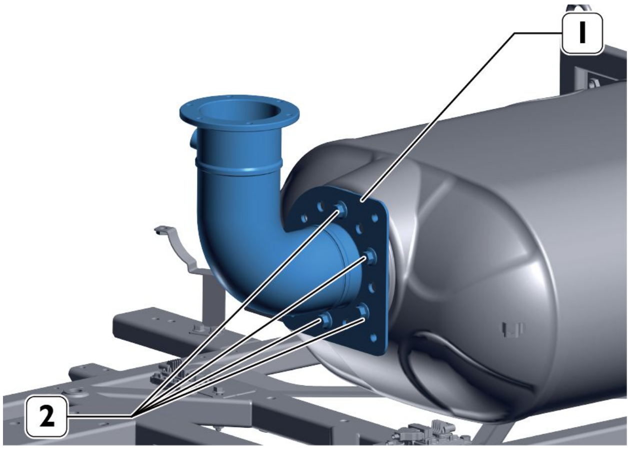
Description	Quantity	Value
Selective catalytic reduction (SCRoF)	4 nuts M12 x 1.75	**80 +/- 8 N·m**



267507 2

4. Install the exhaust gas outlet pipe from the SCRoF **(1)** complete with the gasket and tighten the screws **(2)** to the specified torque.

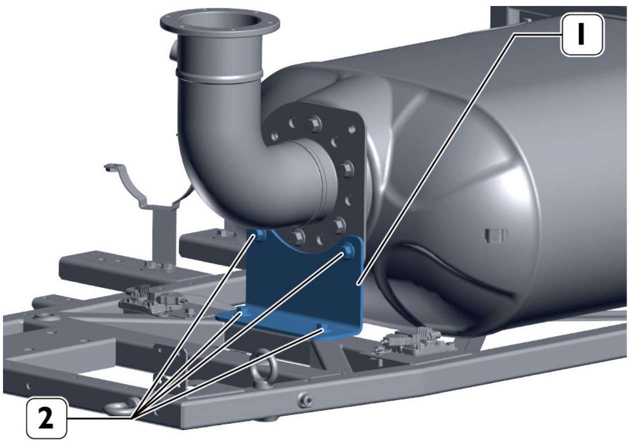
Description	Quantity	Value
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.7 5x25	**80 +/- 8 N·m**



267506 3

5. Install the lower fastening bracket of the SCRoF **(1)** and tighten the screws **(2)** to the specified torque.

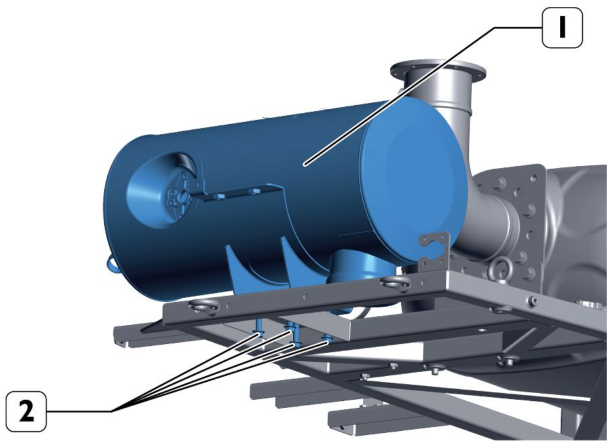
Description	Quantity	Value
Bracket for exhaust gas outlet pipe from SCRoF to the ATS frame	2 screws M12x1.7 5x30	**80 +/- 8 N·m**
Bracket for exhaust gas outlet pipe from SCRoF	2 screws M12x1.7 5x25	**80 +/- 8 N·m**



267505 4

6. Place the DOC module **(1)** in its seat complete with the relative lower support and tighten the screws **(2)** to the specified torque.

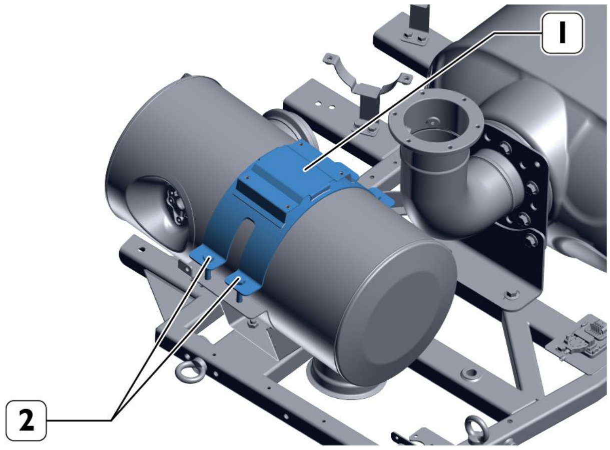
Description	Quantity	Value
Diesel oxidation catalyst (DOC)	4 screws M10x1.5 x25	**66.5 +/- 6.5 N·m**



267504 5

7. Install the supporting bracket of the DOC **(1)** and tighten the screws **(2)** to the specified torque.

Description	Quantity	Value
Diesel oxidation catalyst bracket (DOC)	4 screws M10 x 1.5 x 60	**66.5 +/- 6.5 N·m**



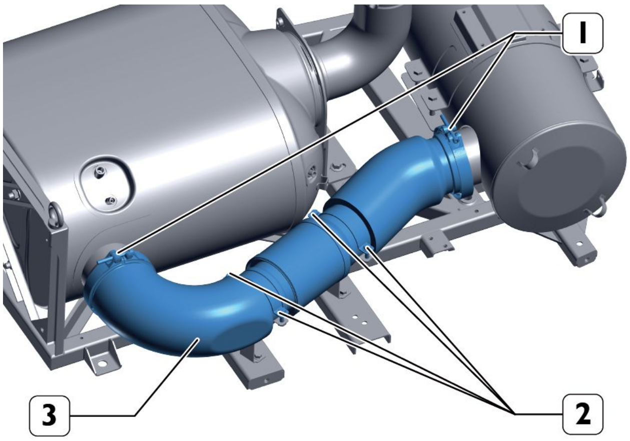
267503 6

8. Install the exhaust gas pipe between the DOC and SCRoF **(3)**, tighten the bracket **(2)** screws to the specified torque.

Description	Quantity	Value
Exhaust gas pipe bracket between DOC and SCRoF	4 screws M8 x 1.25 x 16	**22.5 +/- 2.5 N·m**

9. Tighten the V-clamp on the SCRoF side and the DOC side **(1)** to the specified torque.

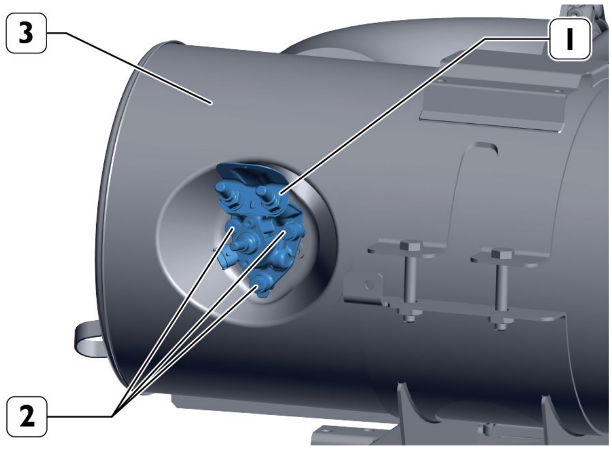
Description	Quantity	Value
Exhaust gas pipe hose clip between DOC and SCRoF	4 screws M8 x 1.25 x 35	**22.5 +/- 2.5 N·m**



267502 7

10. Install the urea dosing module **(1)** on the DOC **(3)** and tighten the screws **(2)** to the specified torque.

Description	Quantity	Value
AdBlue dosing module	3 screws M6x1x35	**13.5 +/- 1.5 N·m**



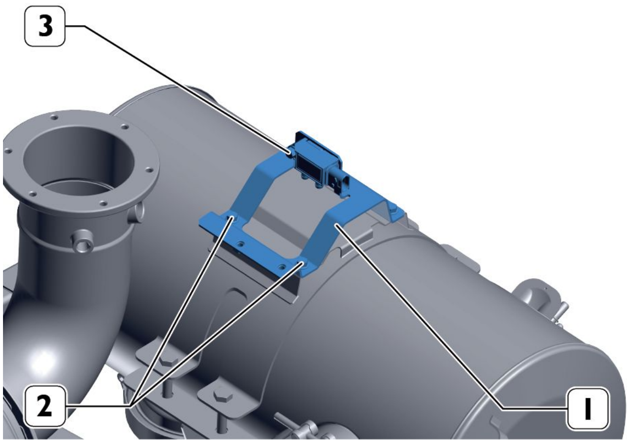
267501 8

11. Fit the bracket **(1)** and tighten the four screws **(2)** to the specified torque.

Description	Quantity	Value
Upper Diesel Oxidation Catalyst bracket (DOC)	4 screws M6 x 1 x 12	**13.5 +/- 1.5 N·m**

12. Install the differential pressure sensor and tighten the screw **(3)** to the specified torque.

Description	Quantity	Value
Differential pressure sensor	1 screw M6 x 1 x 16	**9 +/- 1 N·m**



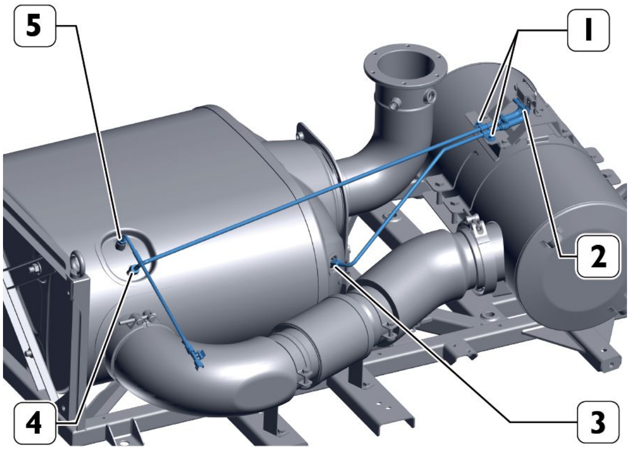
267500 9

13. Install the rigid pipes of the differential pressure inlet and tighten the fittings **(3)**, **(4)** on the SCRoF side. Close the collars **(2)** and tighten the bracket screws **(1)** to the specified torque.

Description	Quantity	Value
Bracket for pressure inlet hose clip	4 screws M6 x 1 x 16	**13.5 +/- 1.5 N·m**

14. Install and tighten the SCRoF inlet exhaust gas temperature sensor **(5)**.

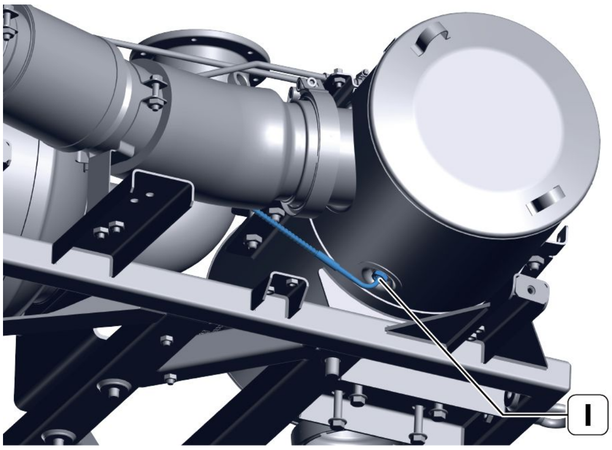
Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**



267499 10

15. Install and tighten the DOC outlet exhaust gas temperature sensor **(1)**.

Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**



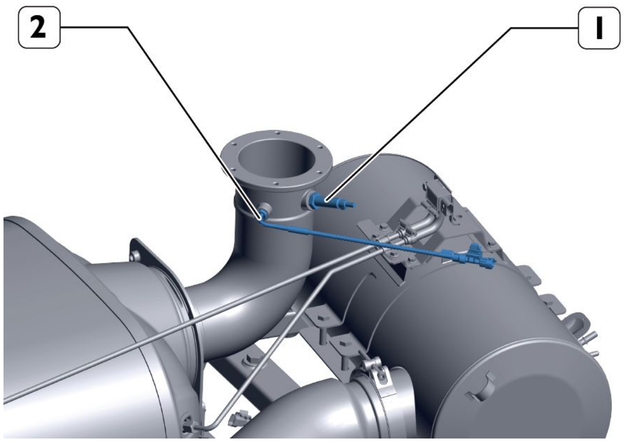
267498 11

16. Install and tighten the SCRoF outlet NOx sensor **(1)**.

Description	Step	Value
NOx sensor	1 fitting M20x1.5	**50 +/- 10 N·m**

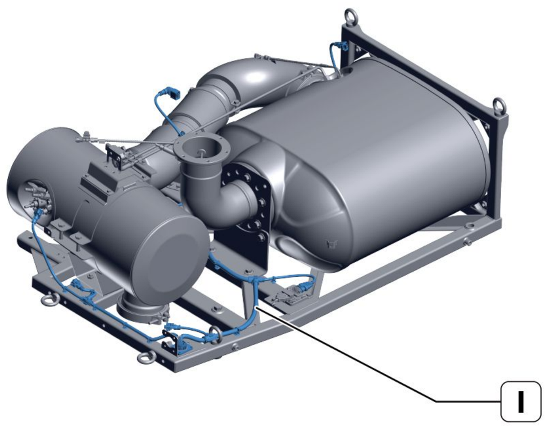
17. Install and tighten the SCRoF outlet exhaust gas temperature sensor **(2)**.

Description	Step	Value
Exhaust gas temperature sensor	1 fitting M10	**45 +/- 4.5 N·m**



267497 12

18. Reposition the ATS system wiring **(1)** securing it with the anchoring eyelets and connect the electrical connections of the sensors.



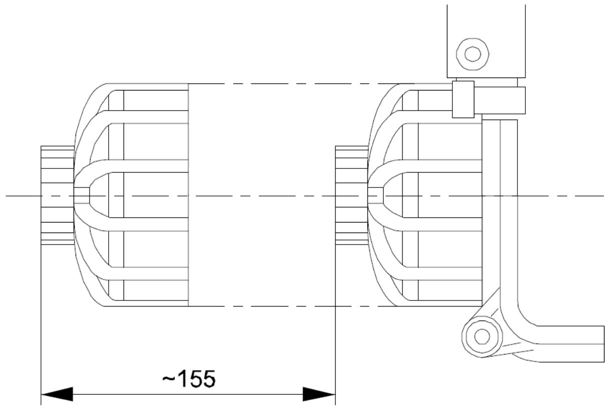
267496 13

507413 AD-BLUE FILTER - Replace

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

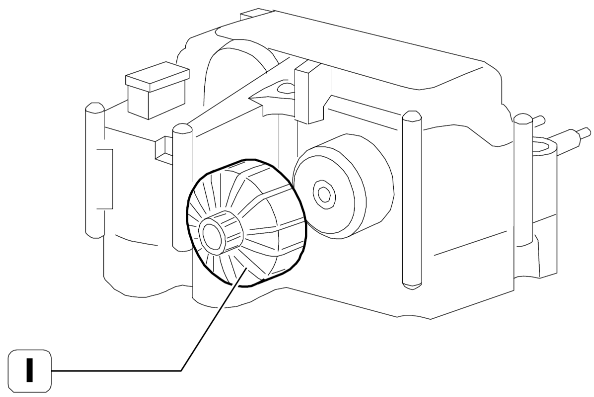
AdBlue filter removal

NOTE: *While installing the Supply Module on the vehicle, take into account the minimum opening required for replacing the filter. The minimum value is approximately* ***155 mm****.*



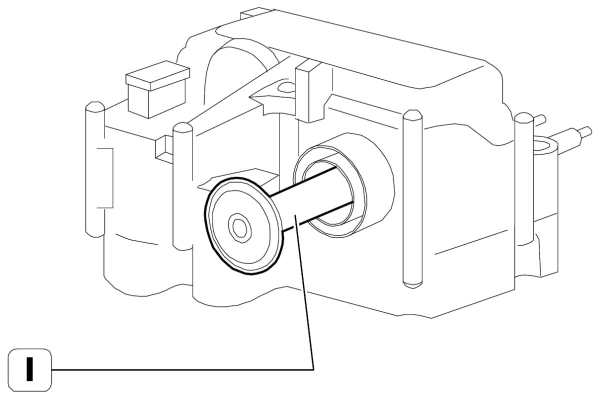
185435A 1

1. Unscrew and remove the filter cover **(1)**.



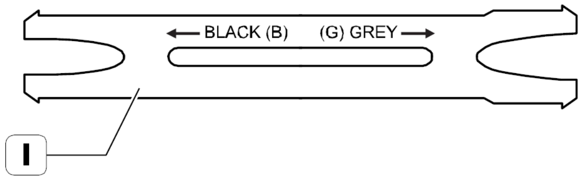
185428A 2

2. Remove the equalizing element **(1)**.



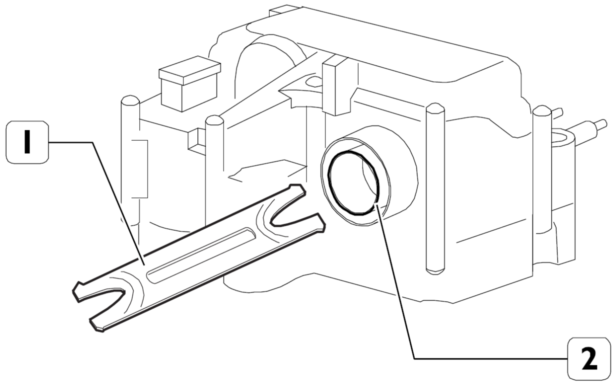
185429A 3

3. On the basis of the colour of the filter, insert the correct part of the tool **(1)** into the filter.



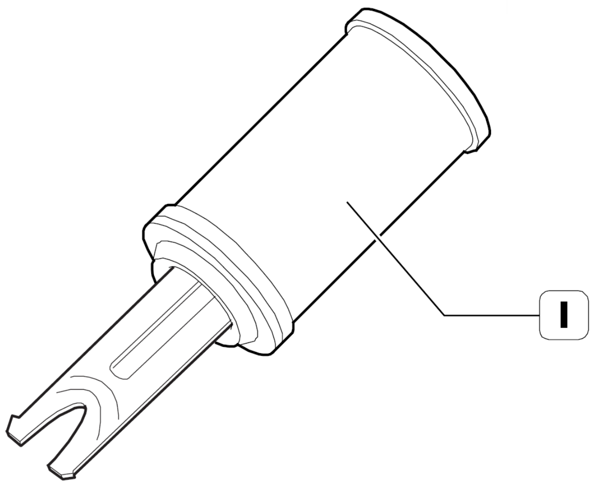
185430A 4

4. Insert the specific tool **(1)** until a click is heard indicating that the filter **(2)** has been completely engaged.



185431A 5

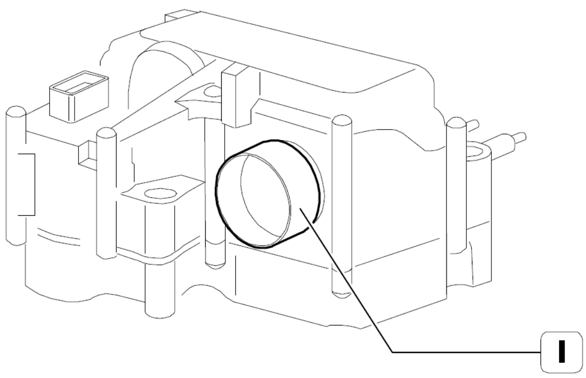
5. Remove the filter **(1)**.



185432A 6

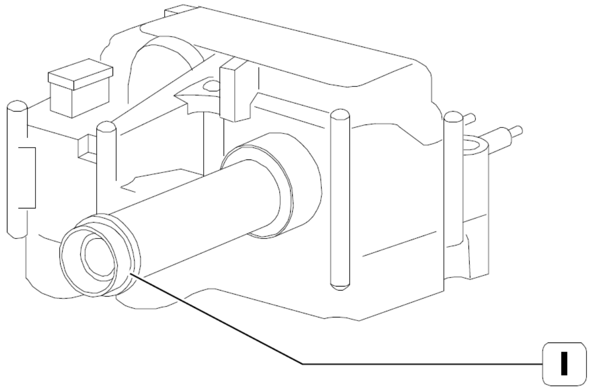
Installation

6. Thoroughly clean the contact surface **(1)** with water.



185433A 7

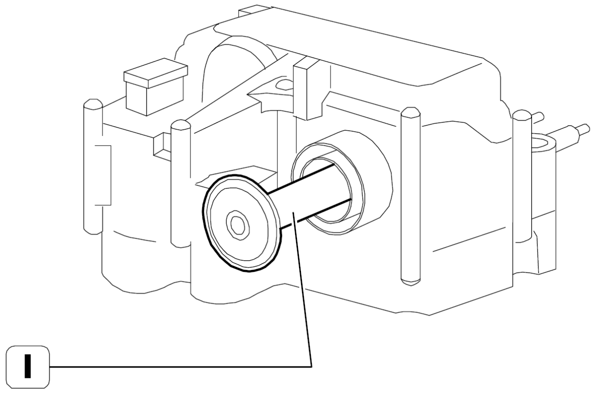
7. Moisten the gaskets and insert the new filter **(1)**.



185434A 8

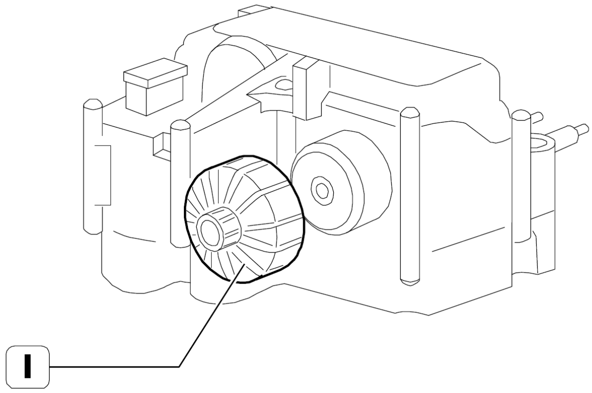
8. Insert the new equalising element **(1)**.

NOTE: *Make sure that the filter cover and the contact surface of the supply module show no signs of being cracked or damaged. Replace any damaged elements.*

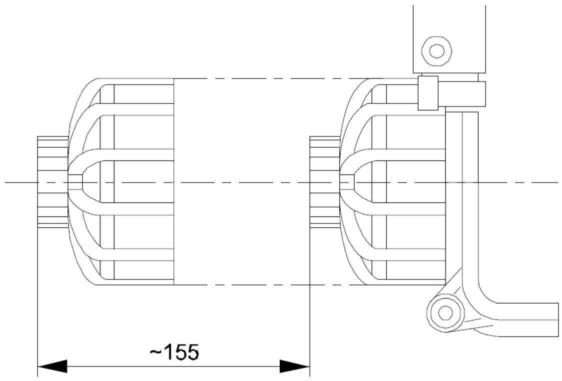


185429A 9

9. Thoroughly clean the filter cover **(1)**.
10. Fit the filter cover and tighten to torque of **20 +/- 5 N·m**.



185428A 10



185435A 11

NOTE: *During installation of the supply module, bear in mind the minimum clearance for replacing the filter.*

*The minimum distance is approximately **155 mm**.*

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CHASSIS - 50

(*) See content for specific models

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ELECTRICAL COMPONENTS - 76

(*) See content for specific models

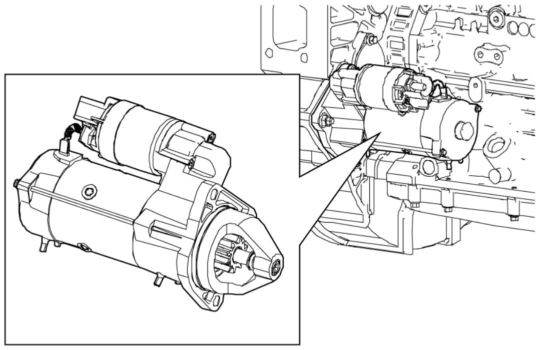
(*) See content for specific models

(*) See content for specific models

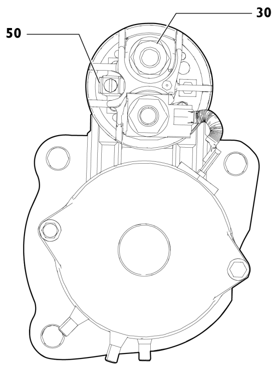
760810 COMPLETE STARTER MOTOR - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

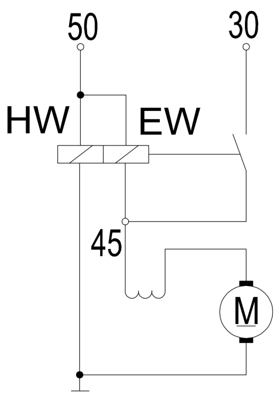
Electric starter motor



215011 1



215012 2



165899 3

The starter motor runs the engine, gaining its inertia and friction, and bringing it to a certain number of revolutions such as to initiate the formation of the mixture required for combustion and then the autonomous movement of the engine.

The movement is transmitted by a DC electric motor, powered by the battery, via an engagement pinion which rotates the sprocket formed on the engine flywheel.

Due to a free wheel engagement, the pinion turns off when the main engine rotates faster than the starter motor.

A relay energized by the current of the starter motor engages the pinion by means of a fork.

The starter motor included is a translation type and starts by means of the pinion, with relay housed directly above the starter motor.

Ignition is usually controlled via the ignition switch on the control panel and provides a positive voltage to the relay located on the starter motor.

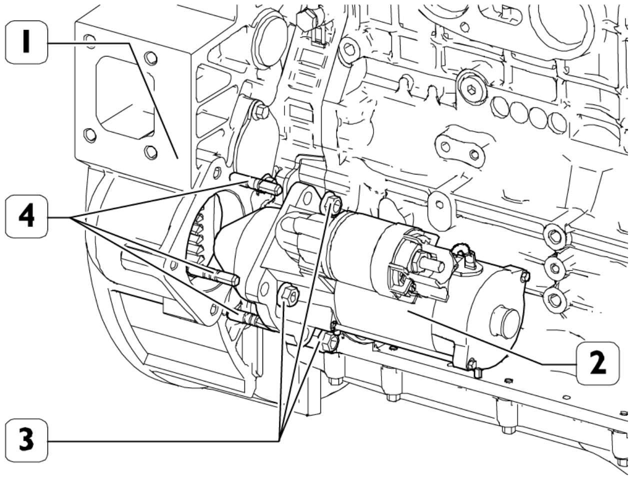
Technical specifications:	
Type	BOSCH XH87-M
Nominal voltage	**24 V**
Power rating	**4 kW**
Number of pins	4
Direction of rotation	clockwise (seen from the side of the flywheel)
Battery capacity	min. **44 A·h** - max. **110 A·h**
Discharge current (EN 50342)	min. **357 A** - max. **765 A**

760810 COMPLETE STARTER MOTOR - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Disconnect the electrical connections of the starter motor.
2. Ensure that the electric starter motor **(2)** is suitably supported.
3. Unscrew the fastening nuts **(3)** and remove the electric starter motor **(2)**.
4. Unscrew the studs **(4)** from the flywheel housing **(1)**.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**



215015 1

760810 COMPLETE STARTER MOTOR - Install

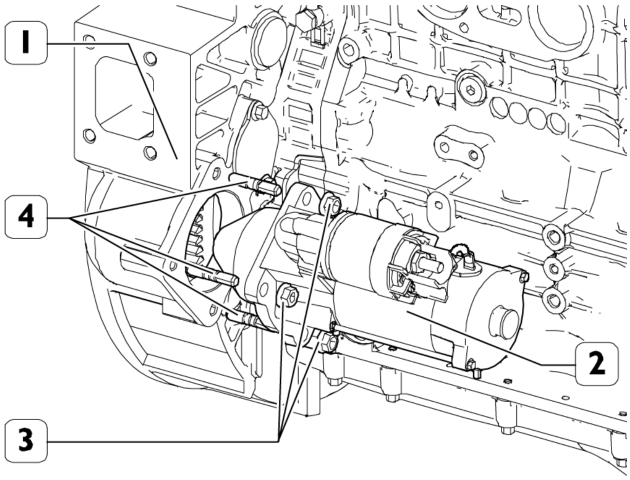
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**

1. Screw in the studs **(4)** and fit the electric starter motor **(2)** into the flywheel housing **(1)**. Tighten the fastening nuts **(3)** to the specified torque.

Description	Step	Value
Electric starter motor	3 screws M10 x 1.5 x 50	**43 +/- 6 N·m**
	3 nuts M10 x 1.5	**43 +/- 6 N·m**

2. Connect the electrical connections of the starter motor.

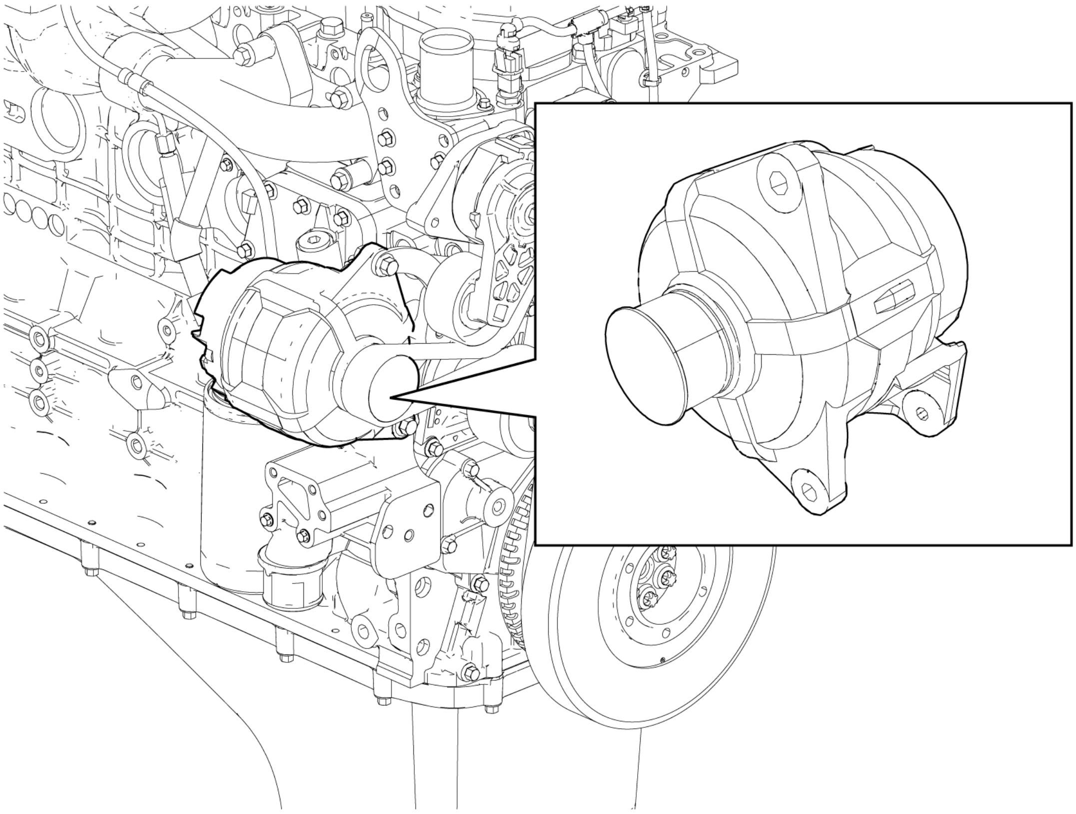


1

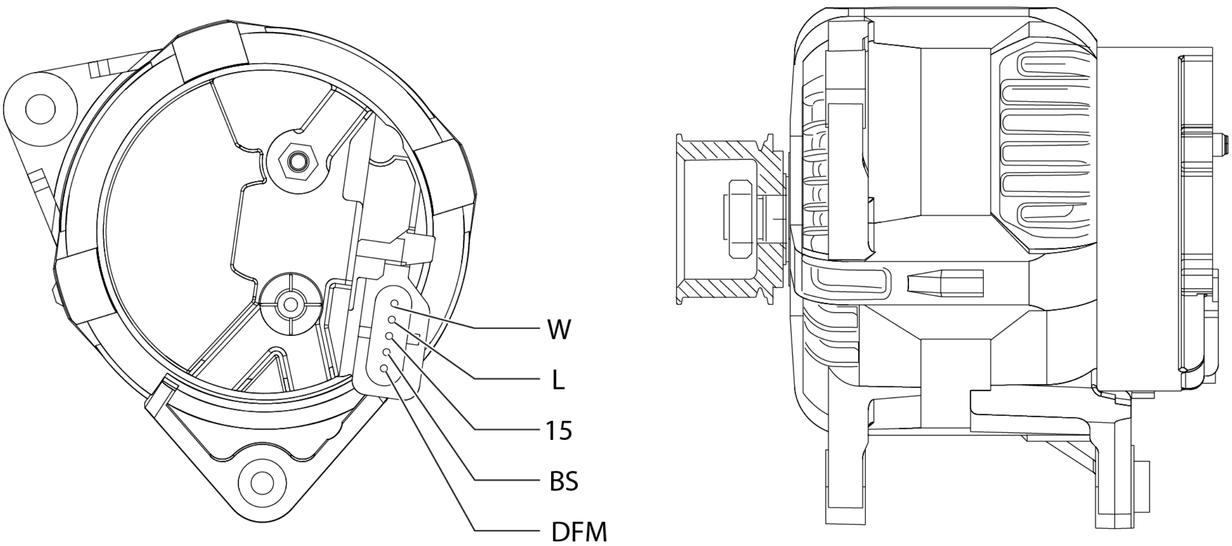
760310 ALTERNATOR ASSEMBLY - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

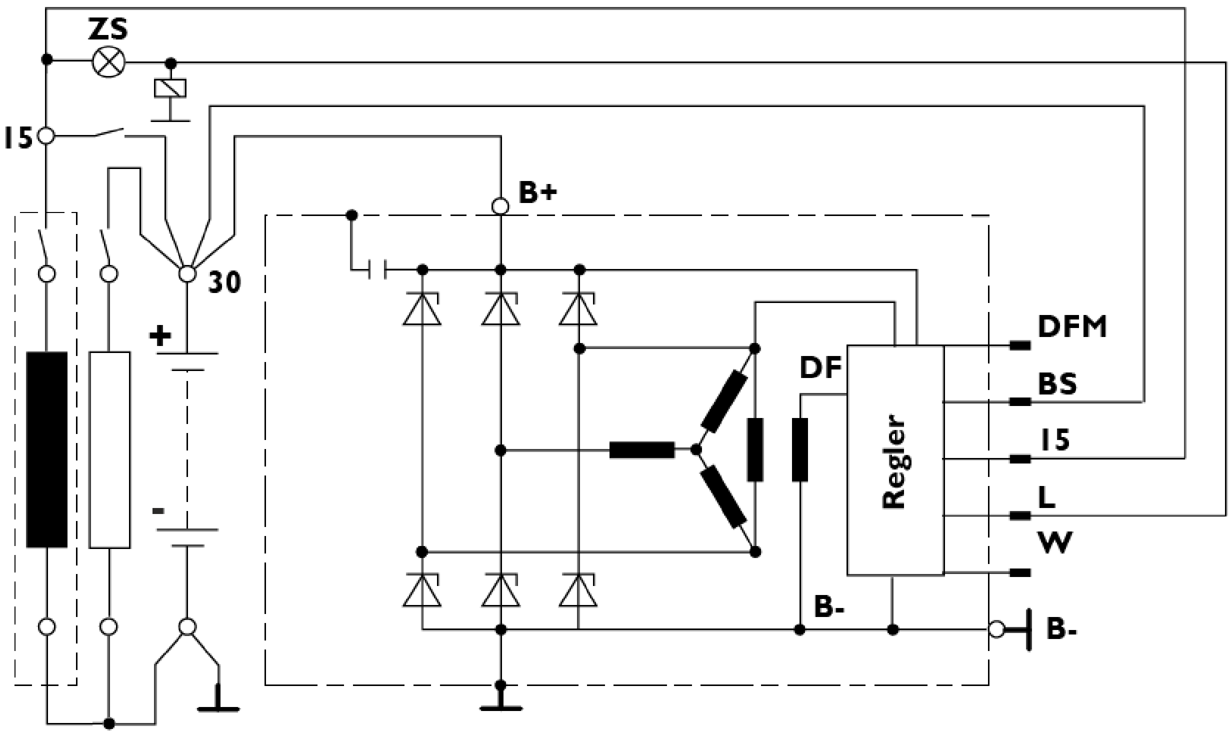
Alternator



215009 1



215010A 2



215008A 3

It is frontally located on the right-hand side of the engine and is controlled by the auxiliary members' belt.

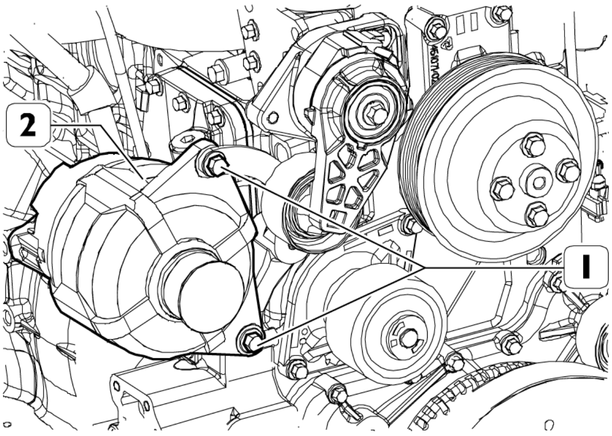
Technical specifications	
Type	BOSCH NCB1
Nominal voltage	**28 V**
Rated current	**70 A** at **6000 RPM 35 A** at **1800 RPM**
Stand-by current consumption	≤ **1 mA**
Maximum continuous rotation velocity	≤ **12000 m^{-1}**
Operating temperature range	**-40 – 110 °C**
Weight	**6,5 kg**
Direction of rotation:	clockwise

760310 ALTERNATOR ASSEMBLY - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Disconnect the electrical connections of the alternator.
2. Remove the auxiliary members' belt as described in the procedure **WATER PUMP DRIVE BELT - Remove (54.34)**.
3. Unscrew the screws **(1)** and disconnect the alternator **(2)**.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**



166099 1

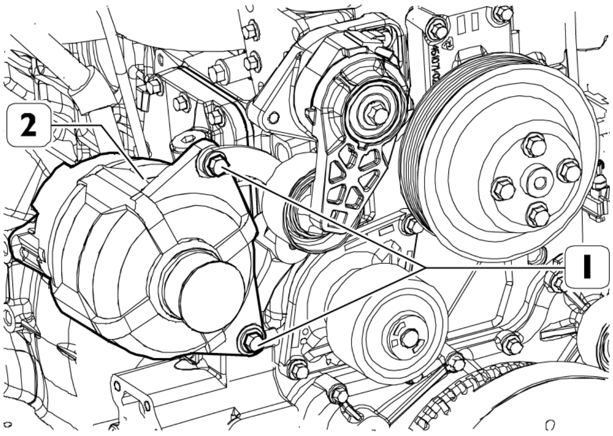
760310 ALTERNATOR ASSEMBLY - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Prior operation:
RADIATOR GRILLE - Remove (50.60)
Prior operation:
RADIATOR - Remove (50.60)
Prior operation:
FAN - Remove (54.34)
Prior operation:
WATER PUMP DRIVE BELT - Remove (54.34)

1. Disconnect the electrical connections of the alternator.
2. Unscrew the screws **(1)** and disconnect the alternator **(2)**.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**



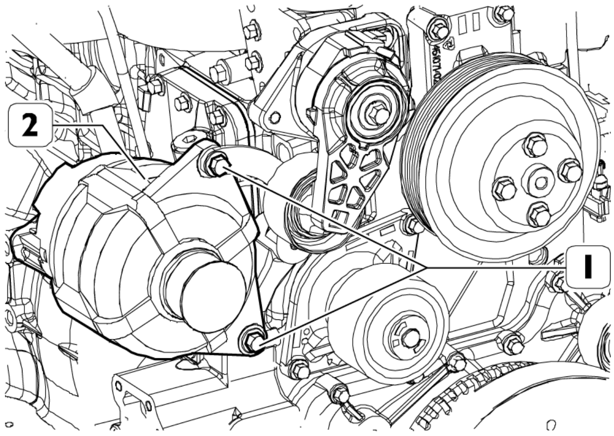
166099 1

760310 ALTERNATOR ASSEMBLY - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

1. Place the alternator **(2)** in position, fasten the screws **(1)** and tighten them to the specified torque.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**



166099 1

2. Fit the auxiliary members' belt as described in the procedure **WATER PUMP DRIVE BELT - Install (54.34)**.
3. Connect the electrical connections.

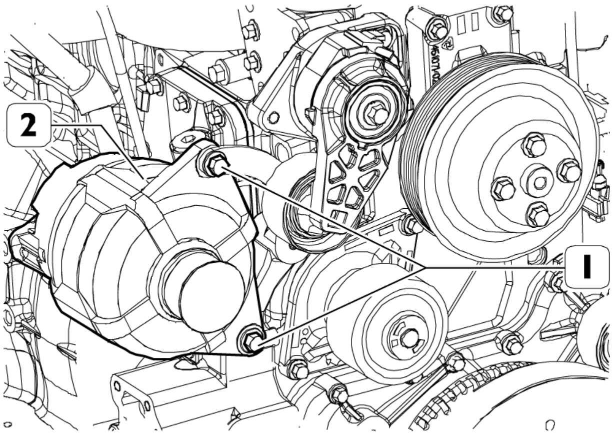
760310 ALTERNATOR ASSEMBLY - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**

1. Place the alternator **(2)** in position, fasten the screws **(1)** and tighten them to the specified torque.

Description	Step	Value
Alternator	1 screw M10 x 1.5 x 110	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 20	**43 +/- 6 N·m**
	1 screw M10 x 1.5 x 30	**43 +/- 6 N·m**



166099 1

2. Connect the electrical connections.

Next operation:
WATER PUMP DRIVE BELT - Install (54.34)
Next operation:
FAN - Install (54.34)
Next operation:
RADIATOR - Install (50.60)
Next operation:
RADIATOR GRILLE - Install (50.60)

764251 ENGINE OIL PRESSURE GAUGE SENDER - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Oil pressure and temperature sensor

This component is identical to the air pressure/temperature sensor.

It measures the temperature and pressure of the engine oil.

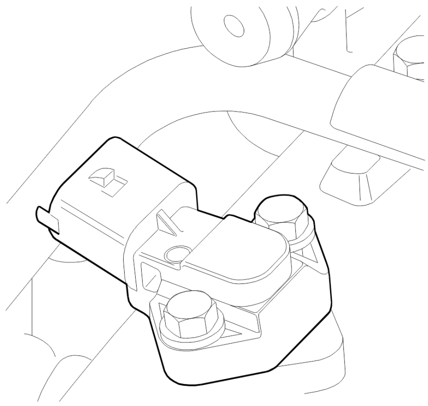
It measures the engine oil temperature and pressure.

It is connected to the control unit at pins 23H - 14H - 29H - 31h.

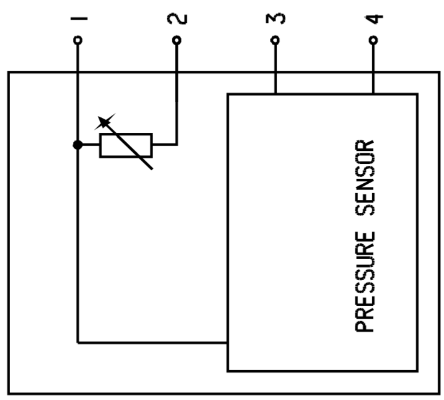
It is powered at **5 V**. The signal detected is transmitted to the MD1 control unit, which itself controls the indicator on the instrument panel (low pressure warning light and indicator).

The oil temperature is not shown by any of the instruments and is only used by the control unit.

Pin 23H - 29H	Temperature
Pin 14H - 31H	Pressure



50324 1



50344_1 2

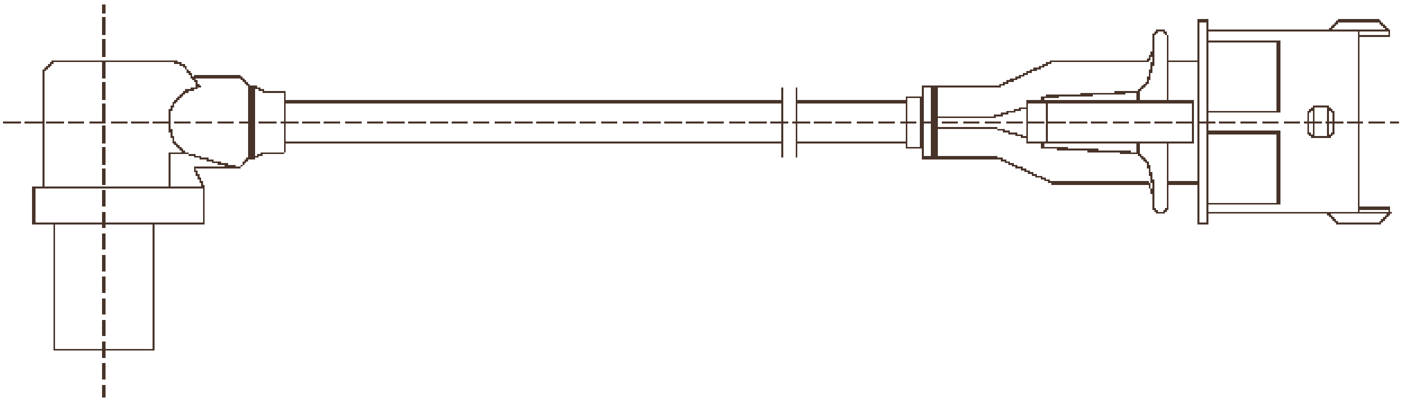
Ref.	Description	Control unit PIN
		Oil
1	Mass	23H
2	NTC signal (temperature)	14H
3	Power supply (**+ 5 V**)	29H
4	Oil pressure signal	31H

764263 REV.COUNTER SENDER - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

This inductive sensor is located on the left front of the engine. It generates signals obtained by the magnetic flow lines which close through the openings of a phonic wheel fitted to the crankshaft.

It is connected to the control unit at pins 17H - 18H - 19H. The sensor resistance value is ~ **900 Ω**.



50319 1

Ref.	Description	Control unit PIN
1	Signal	17H
2	Signal	18H
3	Shield	19H

764264 TIMING GEAR SPEED SENDER - Overview

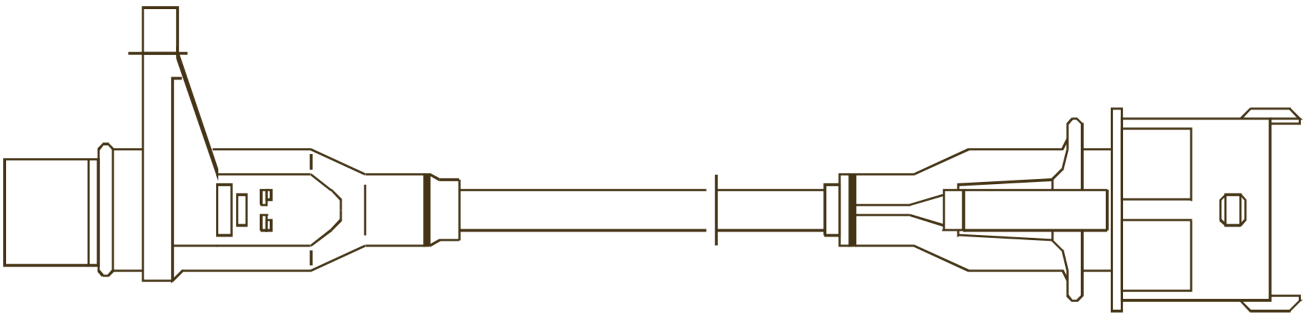
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Timing sensor

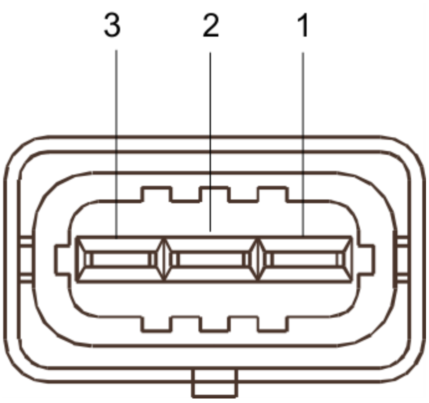
This inductive type sensor is located on the rear left part of the engine. It generates signals obtained from magnetic flow lines which close through the holes on the gear fitted onto the camshaft. The signal generated by this sensor is used by the ECU as the injection timing signal.

Although similar to the flywheel sensor, they are NOT interchangeable since it has a different outer shape.

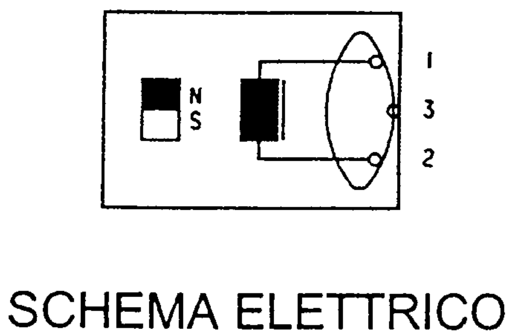
It is connected to the control unit at pins 38H - 39H - 40H. The sensor resistance value is ~ **900 Ω**.



50320 1
Timing sensor



50342 2
Connector connection



50288 3

Ref.	Description	Control unit PIN
1	Signal	39H
2	Signal	40H
3	Shield	38H

764274 ENGINE WATER TEMPERATURE SWITCH - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

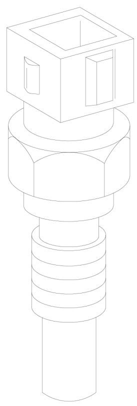
Coolant temperature sensor

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.

The same signal is used by the control unit to manage the temperature gauge on the dashboard.

It is connected to the control unit at pins 2H — 10H.

Its resistance at **20 °C** is approximately **2.5 kΩ**.



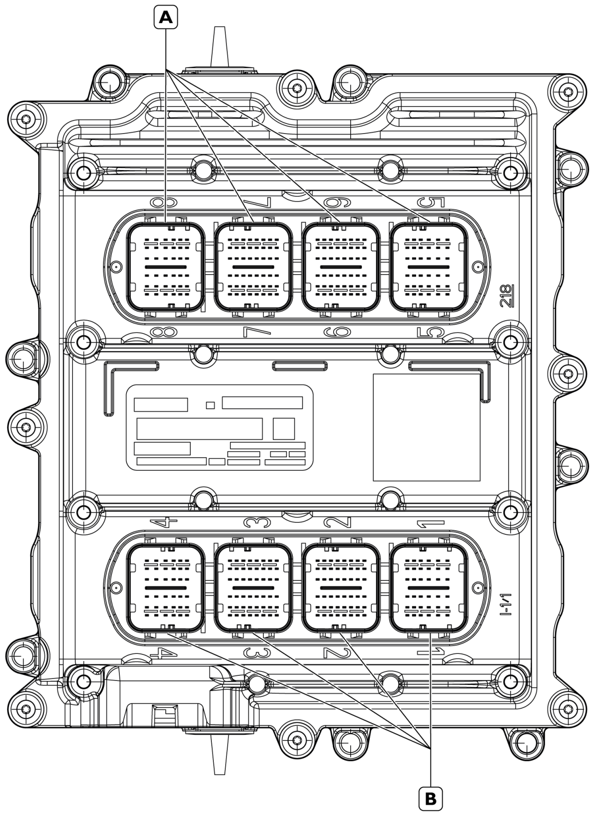
107471 1

Ref.	Description	Control unit PIN
1	Ground	10H
2	Temperature Signal	2H

766161 ENGINE CONTROL UNIT - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

MD1 CONTROL UNIT



265685 1

The control unit is mounted on the left-hand side of the engine and is connected to eight connectors:

A. four connectors for the engine cable (injector and sensor connector);

B. four connectors for the chassis cable.

The control unit is a "flash EPROM" type control unit that can be reprogrammed from outside without manipulating the hardware.

The ECU processes the signals from the sensors by applying software algorithms and controls the actuators (especially the electro-injectors and pressure regulator).

It records, in the non-volatile memory area, the information on the engine parameters originally set or acquired during engine operation.

After having stopped the engine, the engine stop request is processed by the control unit and is compared with the vehicle speed. Once the engine has stopped, the Afterrun procedure is launched i.e. the engine control unit microprocessor transfers some data from the main memory (volatile) to the non-volatile erasable and rewritable memory(EEprom) including the fault log, so that they are available at the next engine start (Run up).

Risk of damage
After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the “Key off”, the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

766161 ENGINE CONTROL UNIT - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

MD1CE101 ENGINE CONTROL UNIT FUNCTIONS

The BOSH MD1CE101 electronic control unit manages the following main functions:

- Engine control and management (ECM)
- Fuel injection system
- Electrical components (sensors and valves)
- DNOx 2.2 / 6HD exhaust management

It also enables:

- Interface with other on-board electronic systems (if present)
- Diagnostics

Fuel injection system

The fuel metering is calculated in relation to:

- Accelerator position;
- engine speed;
-

The outcome may be corrected in relation to:

- temperature of the diesel and pre-injection diesel pressure (DIESEL DENSITY);
- water temperature;
- water temperature following this strategy:
  - When cold, the engine encounters greater resistance in operating: there is greater mechanical friction, the oil is still very viscous, the various clearances are not yet optimised.
  - In addition to this, injected fuel tends to condense on the still cold metallic surfaces.
  - The fuel supply for a cold engine is therefore greater than for a warm one.

or to avoid:

- noise;
- smoke emissions;
- overloading;
- overheating.

The delivery can be modified in the case of:

- engine brake actuation
- Serious defects involving load reduction or engine stop;
- intervention of the ANTI-POLLUTION devices: Δp sensor, NOx sensor, NH3 sensor.

Once the control unit has determined the mass of the introduced air and measured its pressure and temperature, it calculates the corresponding fuel load needed to inject into the cylinder (mg. per delivery). It also takes diesel temperature into account (density).

The fuel load calculated in this way is converted into crank degrees i.e. injection advance and lifespan.

Injection advance electronic control

The advance (starting moment, expressed in degrees) may be different from one injection to the next, and in a differentiated manner from one cylinder to another, and is calculated, similarly to the flow rate, on the basis of engine load (accelerator pedal position, engine speed and introduced air).

The advance is appropriately corrected:

- in phases of acceleration;
- according to the coolant temperature;

and to obtain:

- lower emissions, noise and overloading
- better vehicle acceleration.

When starting the engine, a high degree of advance is used based on water temperature.

the feedback from the start of delivery is supplied by the change in impedance of the injector solenoid valve.

Engine control and management (ECM)

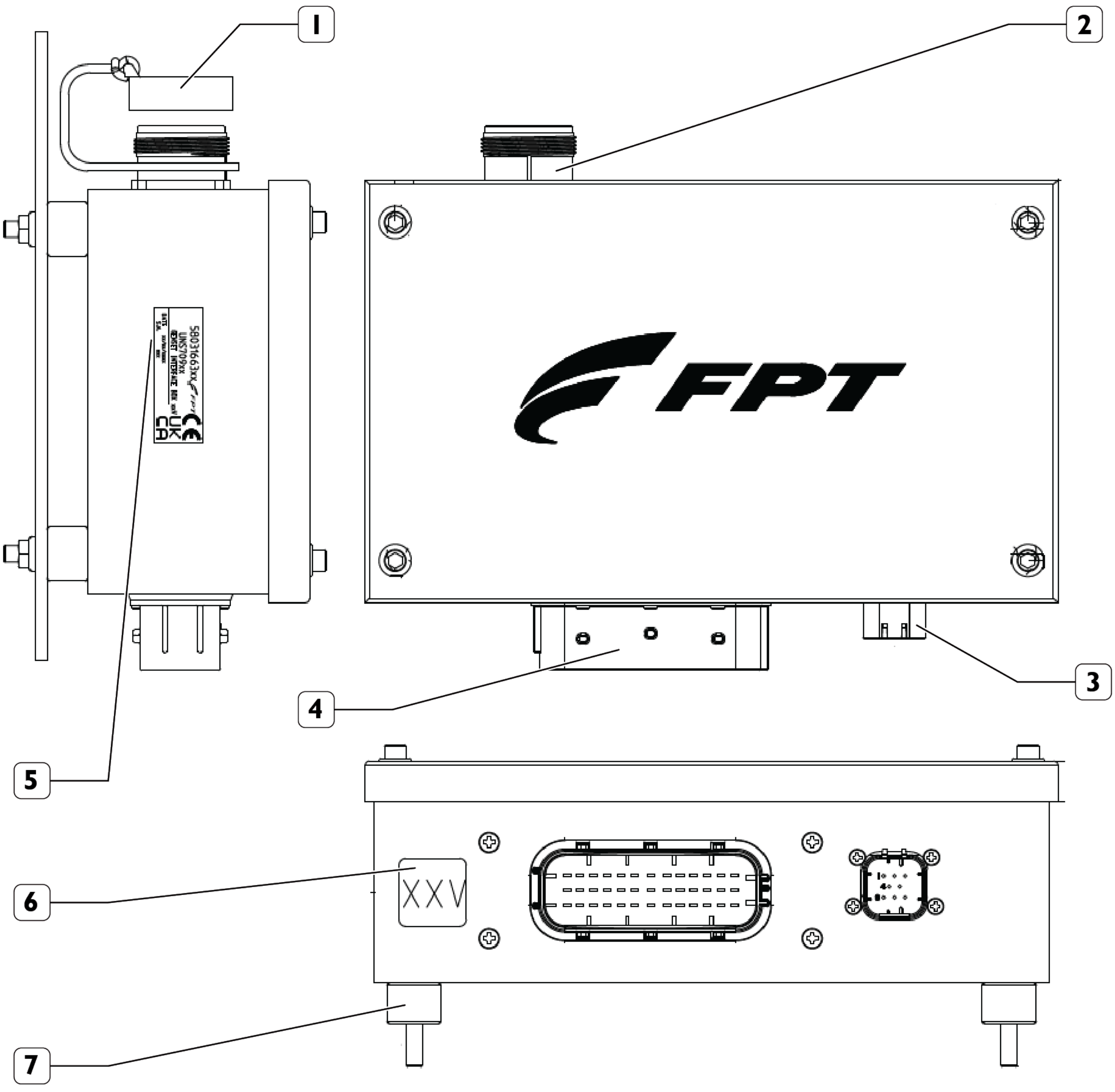
In order to manage the engine, the control unit has the following main functions:

- Torque and speed management; it stores the torque and speed limit and evaluates it together with the signal received from the sensors.
- Idle speed adjustment;
- Engine start-up; During the initial driven engine revolutions, the timing and recognition signals are synchronised for cylinder no.1 (flywheel sensor and camshaft sensor). Upon ignition, the signal of the accelerator pedal that arrives is ignored. The delivery of the diesel upon ignition is set exclusively based on the temperature of the water by means of a specific map. When the control unit detects engine speed and flywheel acceleration which indicate that the engine is running and is no longer driven by the starter motor, it re-enables the accelerator pedal signal.
- Engine speed regulator; the control unit controls the engine speed at all engine speeds, and particularly when the engine is running at idle and at maximum speed.
- Engine brake; activation of the engine brake.
- Cut-off; this is the function which interrupts fuel delivery in deceleration.
- Safety conditions; De-rating in the event of the engine overheating, injection is modified, reducing the delivery to a varying degree, in proportion to the temperature reached by the coolant. The control unit considers the oil temperature in the case of a water temperature sensor failure.
- Idle speed increment in the event of an accumulation of HC; when there are applications in which the engine remains idle for a long period of time, there is an accumulation of HC (unburnt hydrocarbons) in the exhaust. If certain conditions are met, such as idle engine speed with accumulation of HC target of 1st level and the engine in a safe condition, it increases the minimum speed to allow the combustion of the HC.
- SCRoF regeneration; the engine control unit estimates the status of the SCRoF (in terms of particulate accumulation) using the SCRoF sensor indicating difference in pressure, the temperature sensors and the engine condition. If it is clogged, the regeneration procedure is launched.
- Risk of damage
  After switching off the engine using the key switch (Key off), wait for 10 minutes before acting on the electrical system of the engine and/or the power supply batteries. After the “Key off”, the power supply must be ensured in order for the AFTER-RUN procedure to be completed.
  Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

  Stopping the vehicle; the engine stop request is processed by the control unit and is compared with the vehicle speed. Once the engine has stopped, the Afterrun procedure is launched i.e. the engine control unit microprocessor transfers some data from the main memory (volatile) to the non-volatile erasable and rewritable memory(EEprom) including the fault log, so that they are available at the next engine start (Run up).

766160 CONNECTION UNIT - Overview - SGS

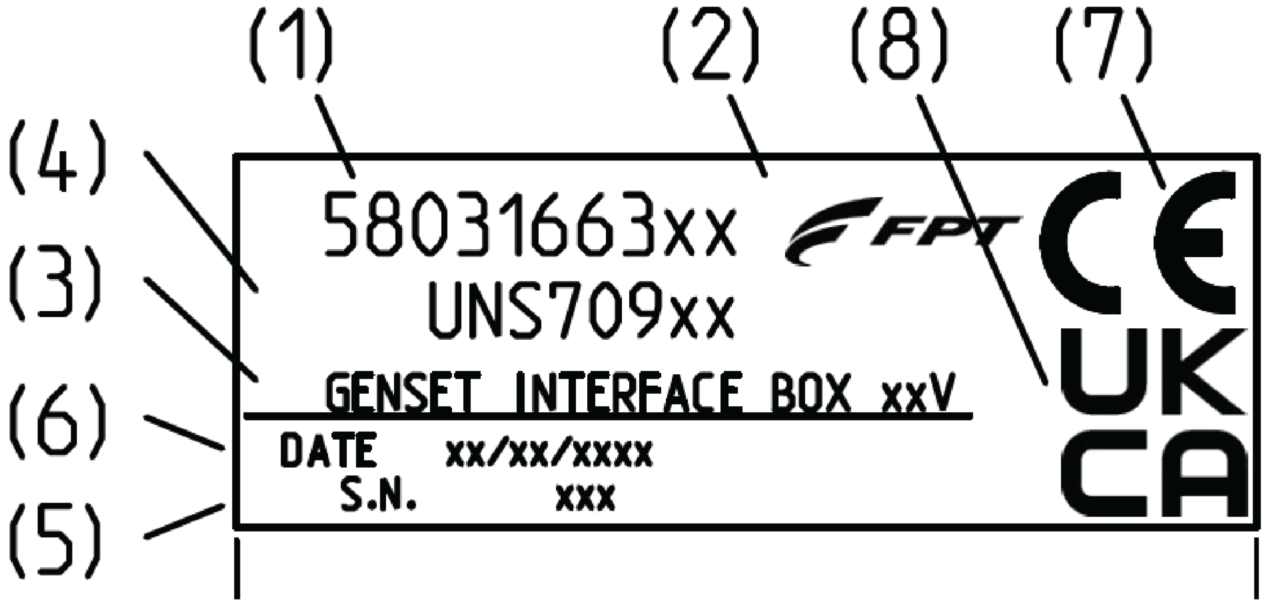
INTERFACE BOX



311882 1

1. Diagnostics tool connector protection
2. Diagnostics tool connector
3. Power generator control panel connector
4. Connector to the MD1 electronic control unit
5. Identification nameplate
6. Voltage indication nameplate (12V/24V)
7. Vibration damper

Identification nameplate



311881 2

1. Code FPT
2. Make FPT
3. Description of the device
4. Supplier code
5. Supplier's serial number
6. Date
7. CE certification
8. UKCA certification

Fuses

REFERENCE	DESCRIPTION	SIZE
(1)	Battery (12V /ECM alimentazione)	**(20A)**
(2)	Battery (12V /ECM alimentazione)	**(20A)**
(3)	Heater UREA	**(20A)**
(4)	Sensor power supply ATS	**(20A)**
(5)	Fuel pre-filter heater power supply	**(15A)**
(6)	Fuel filter heater power supply	**(15A)**
(7)	Exhaust gas throttle power supply	**(20A)**
(8)	Ignition	**(20A)**

Technical specifications

CHARACTERISTIC	NOMINAL
Casing material	Aluminium 5754
Overall dimensions	**250 x 150 x 80 mm**
Fuel supply (12V)	**9 – 16 V**
Fuel supply (24V)	**18 – 36 V**
Operating temperature	**-30 – +70 °C**
Weight	**2 kg**
Certifications	RoHS compliant — CE — UKCA

Engine control system

The main parts of the engine control system are:
● Engine control module (ECM)
● Fuel injection system (FIS)
● Electrical and electronic components (sensors and actuators)
● DEF (DeNOx 2.2/6HD) dosing system

The connection unit is an electronic device connected between the power generator control panel and the engine control unit ECM. Its main function is to control the following functions of the power generator:
● Generator operation at **50 Hz** or **60 Hz**, through the selection between the 2 engine speeds respectively of **1500 RPM** and **1800 RPM**. It is possible to set the engine speed at idle under special circumstances through the command from MSS or from the CAN line of the vehicle.
● Identify and report engine faults or alarms via diagnostic lamp.
● Actuating relays for certain engine functions such as engine starting, fuel heating and SCR heater operation.
Engine speed regulation can be achieved in 2 ways:
1. Via MSS through a specific wiring connecting the interface control unit to the engine control unit
2. Through TSC1-VE (MD1) messages on the vehicle CAN sent to the engine control unit via the control panel.

ATTENTION: *Selection between the 2 configurations does not require changes to the dataset*

The interface control unit allows connecting telemetry and data acquisition devices to support fleet control tests and field mission profile. These devices connected to the diagnostic wiring allow enabling (maintaining the standard conditions) only the line 250kbit/s CAN (H0 & L0); If the use of line 1000kbit/s CAN (H1 & L1) is required, further changes to the wiring must be implemented.

Installation

The connection unit is designed to be fitted in any part of the engine support chassis, but it is recommended to position it so that it will not become wet by any type of fluid. It is recommended not to weld the control unit to the engine support chassis but rather use anti-vibrating devices. The temperature of the area around the connection unit must not exceed 70°C. The connection unit must be easily accessible in order to:
● Ensure easy access to the wiring harness between the interconnection box and the engine control unit.
● Easily connect the diagnostic system.

Operation

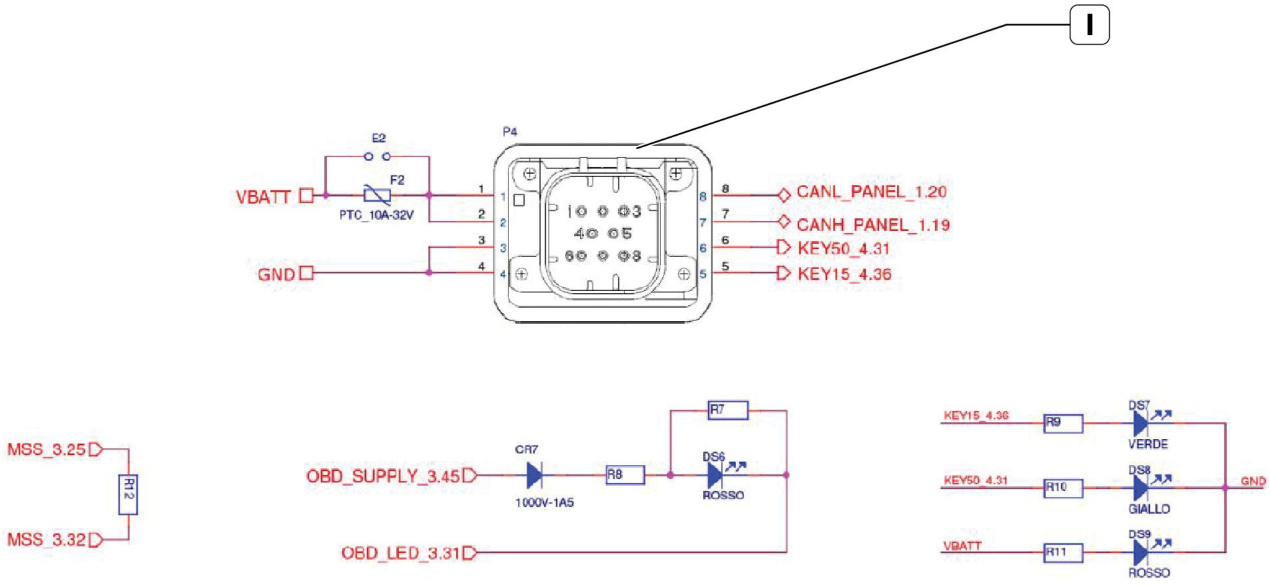
The wiring between the connection unit and the engine control unit has resistors which are used for configuring the multiple state switch or Multiple State Switch (MSS) of the engine control unit at idle speed, usually 1500 rpm (50Hz). or at 1800 rpm (60Hz). Select the suitable wiring to set the correct speed and frequency of the engine.
In the 3 positions of the MSS multi-switch, if there is an external request to change the engine speed via CAN, this has priority over speed regulation via MSS.

ATTENTION: *If the genset needs to operate at idle, it is MANDATORY to check that the alternator is electrically disconnected*

ATTENTION: *If the engine speed is controlled by the external controller (MSS), each CAN message sent from the control panel requires the same value as the engine speed parameter set with the external controller (MSS) to avoid speed regulation anomalies.*

Connectors

Power generator control panel connector

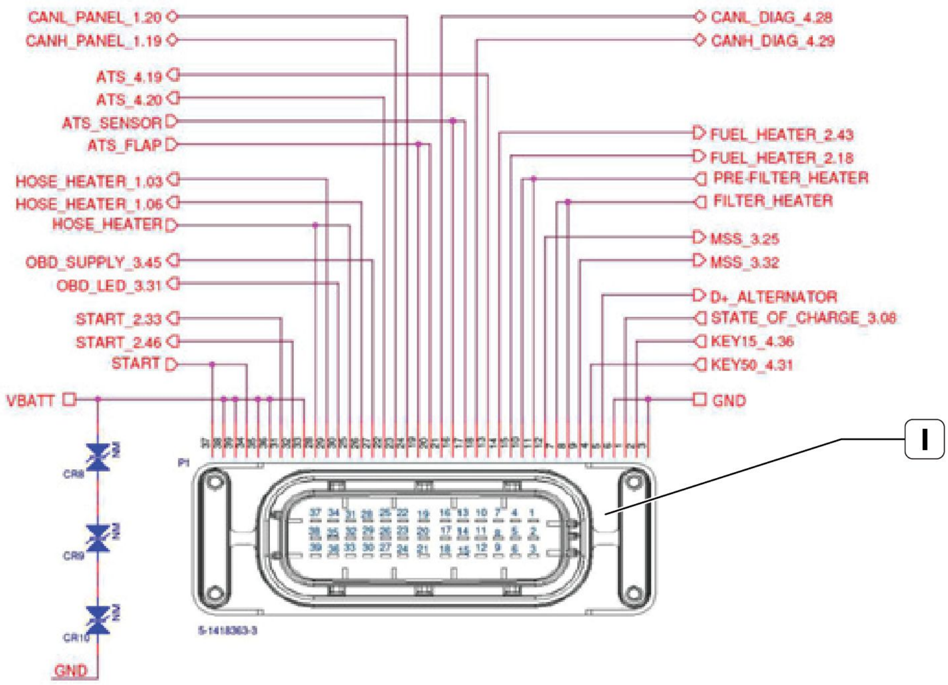


311876 3

(1): Connector to the power generator control panel (8 pins)

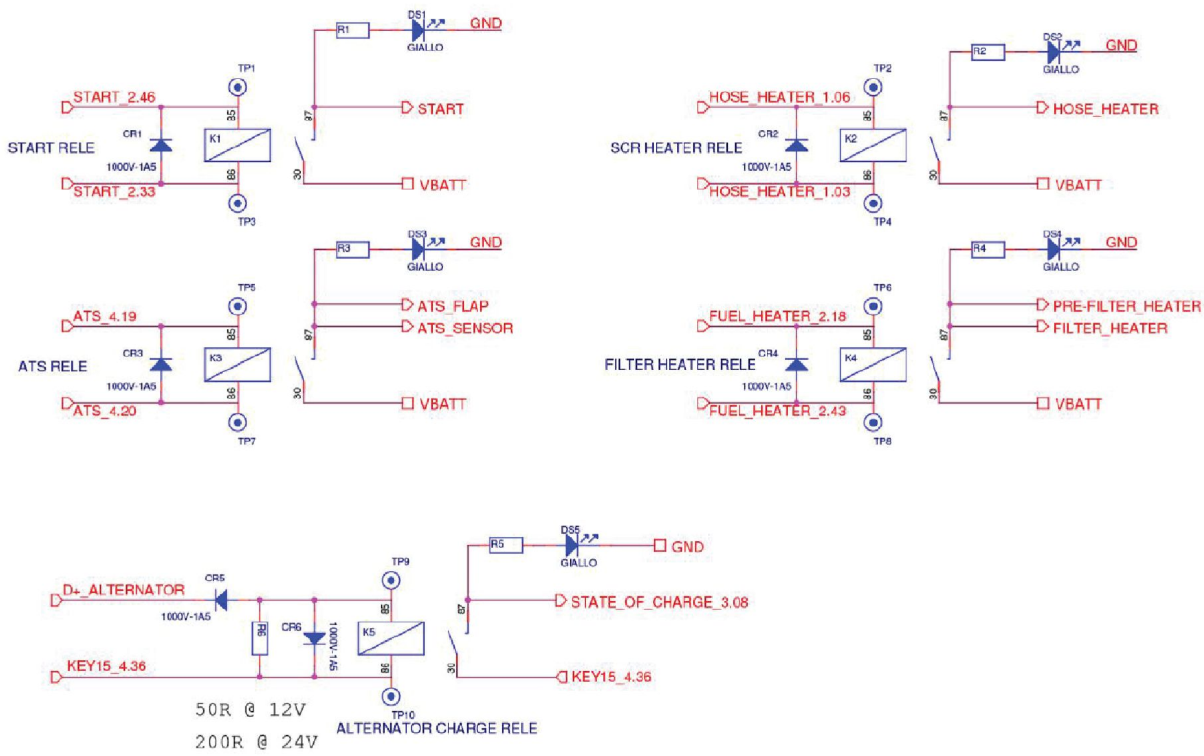
PIN	FUNCTION
(1)	Key 30 (+ batt)
(2)	Key 30 (+ batt)
(3)	- Batt
(4)	- Batt
(5)	Key 15
(6)	Key 50 (cranking)
(7)	Panel CAN (250 or 500 kbps) High
(8)	Panel CAN (250 or 500 kbps) Low

Connector to the MD1 engine control unit



311875 4

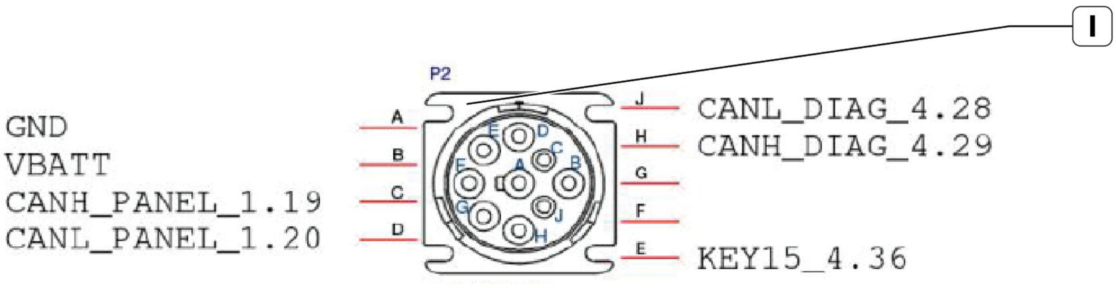
(1): Connector to the MD1 (39 pins)engine control unit

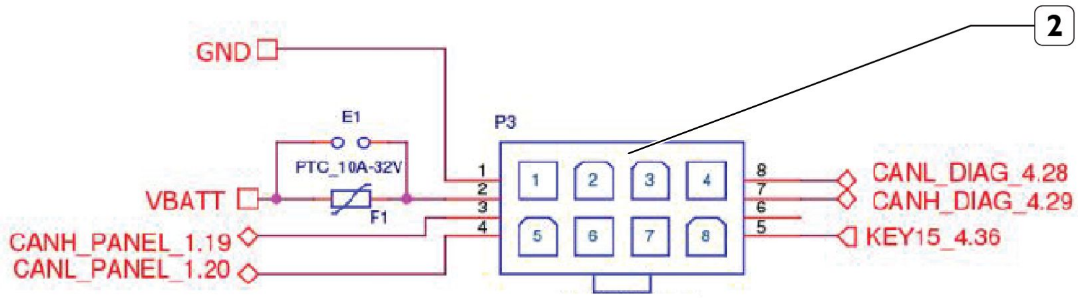


311877 5

Connector to the MD1 (39 pins)engine control unit

Connector to the diagnostics system



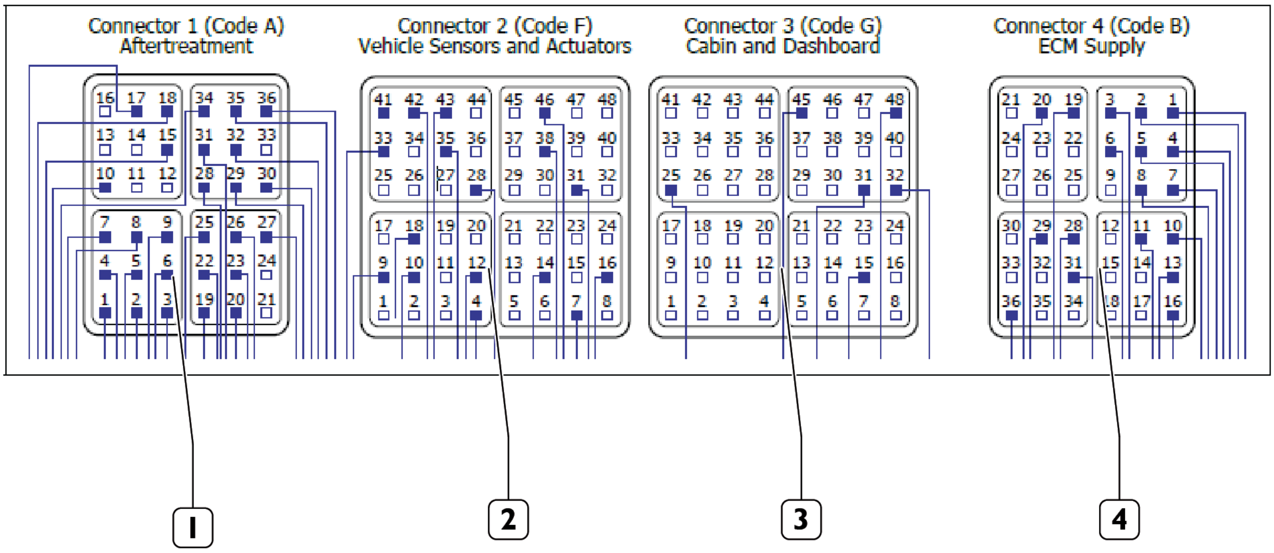


311878 6

(1,2): Connector to the diagnostics system (9 pin)

PIN	FUNCTION
(A)	- Batt
(B)	+ Batt
(C)	Panel CAN (250 or 500 kbps) High
(D)	Panel CAN (250 or 500 kbps) Low
(E)	Key 15
(F)	—
(G)	—
(H)	Diagnostic CAN (1 Mbps) High
(J)	Diagnostic CAN (1 Mbps) Low

Connector to the MD1engine control unit



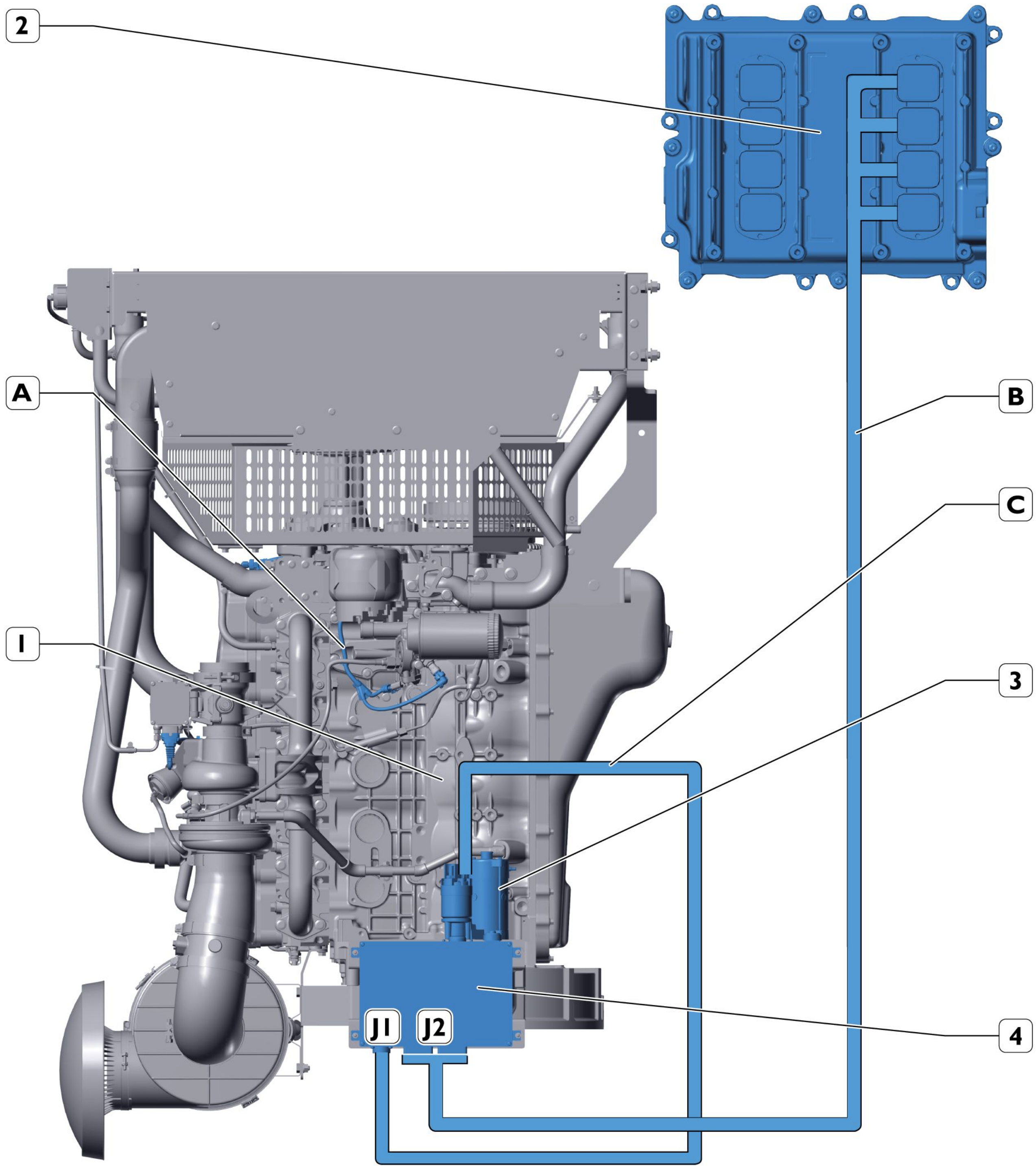
311879 7

Connector to the MD1engine control unit

Connector	Wiring
Connector 4 (36 pins)	(Code B): Fuel supply ECM
Connector 3 (48 pins)	(Code G): Cab and control panel
Connector 2 (48 pins)	(Code F): Sensors and actuators on the vehicle
Connector 1 (36 pins)	(Code A): ATS

766160 CONNECTION UNIT - Overview

INTERFACE HOUSING

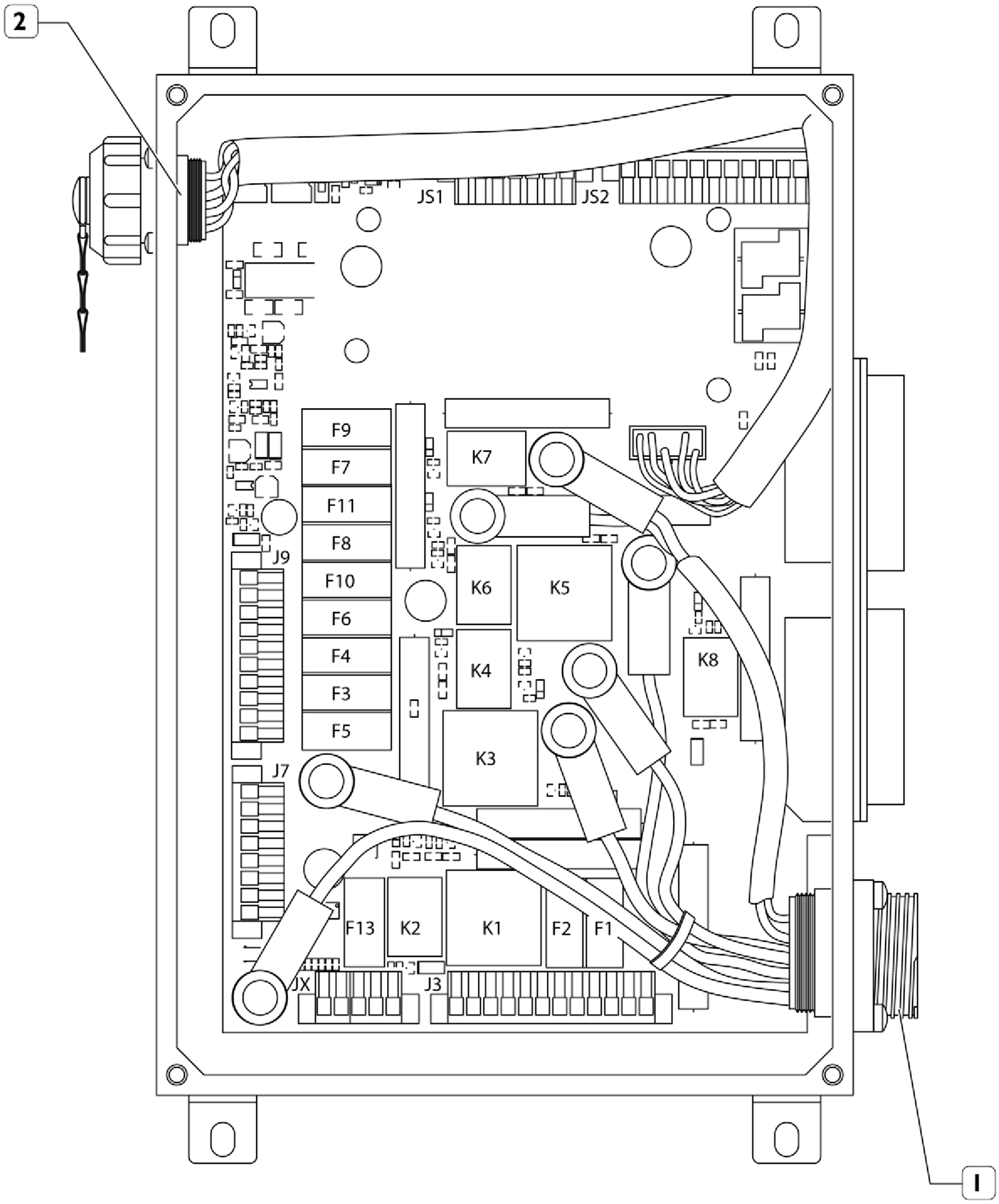


267989 1

A. Engine cable
B. Wiring from interface housing to engine control unit
C. Cable from interface housing to starter motor

1. Engine
2. MD1 electronic control unit (engine left-hand side)

3. Starter motor
4. Interface box



258618 2

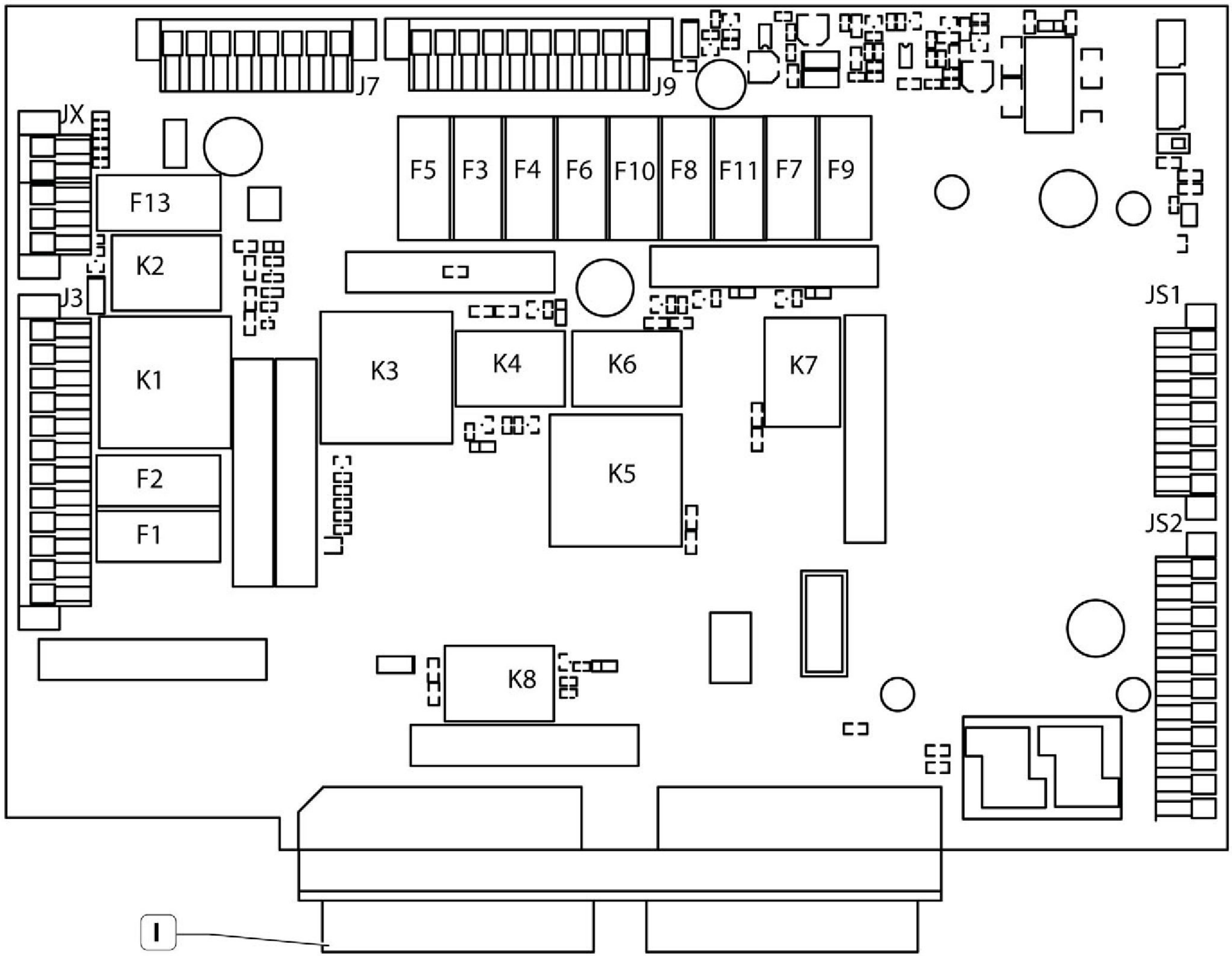
1. Connector J1
2. Diagnostic Connector

INTERFACE HOUSING

In order to allow for the proper electrical operation of the control unit, an interconnection unit was installed in the engine.

The connection unit controls the electronic control system of the engine and the power unit system.

Indications of its components and functions are provided below. These are controlled by the programming switches.



258623 3

1. Connector J2

Remote-control switches

A. K1. ATS auxiliary sensor

B. K2. Keeping B After run

C. K3. Main After run

D. K4. Starter motor

E. K5. SCR heating

F. K6. Fuel filter heating

G. K7. Fuel pre-filter heating

H. K8. Starter motor control

I. CN1. Diagnostics

Fuses

A. F1. Exhaust flap - **20 A** (yellow)

B. F2. NOx - NH3 - **20 A** sensor auxiliary (yellow)

C. F3. Control unit power supply - **30 A** (green)

D. F4. Start up - **20 A** (yellow)

E. F5. ATS auxiliary sensor - **40 A** (orange)

F. F6. SCR heater - **20 A** (yellow)

G. F7. Battery positive - **5 A** (beige)

H. F8. Fuel filter and pre-filter heating - **15 A** (blue)

I. F9. Fuel pre-filter heating - **15 A** (blue)

J. F10. Positive on key switch - **10 A** (red)

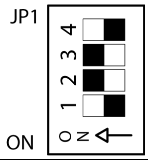
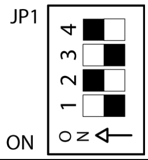
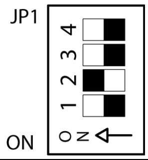
K. F11. Low water level sender - **10 A** (red)

L. F13. Main after run - **5 A** (red)

Selection of accessory functions and engine speed

Function programming described below is possible by switching the respective positions of the JP switches.

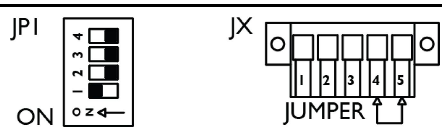
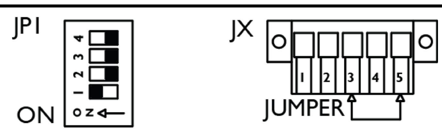
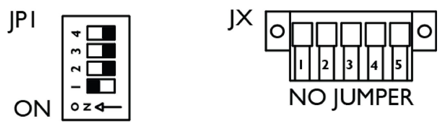
(JP1) (Engine speed selection)

1500 RPM 50 Hz	
1800 RPM 60 Hz	
Minimum	

Select an engine speed of **1500 RPM**, **1800 RPM** or idle, acting directly on the internal JP at the interface housing.

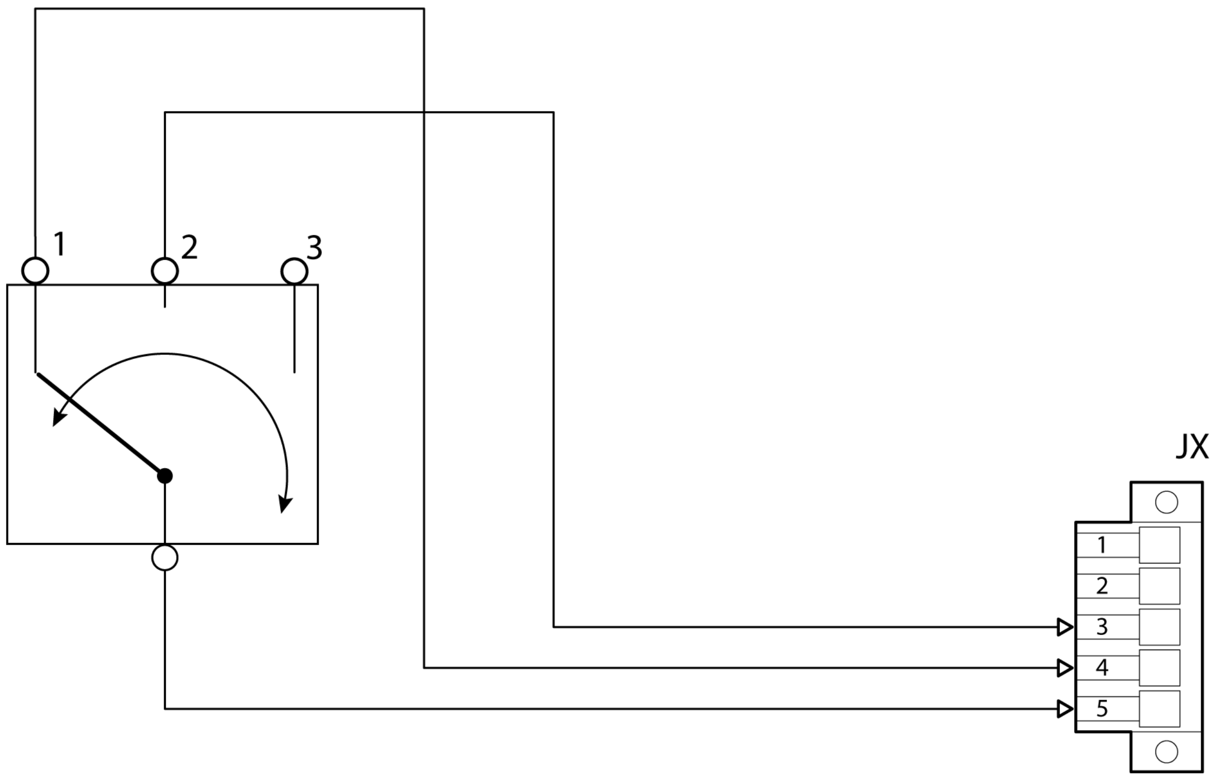
Position the micro switches as shown in the figure to set the desired engine speed.

(JP1) (select an engine speed of 1500 rpm, 1800 rpm or idle) (+ JX) (External three-position switch on the electrical panel is the responsibility of the bodybuilder)

1500 RPM 50 Hz	
1800 RPM 60 Hz	
Minimum	

There is the possibility of using an external three-position switch to select an engine speed of **1500 RPM**, **1800 RPM** or idle.

In this case, after having positioned the micro switches as indicated below, connect the switch at pins 3, 4, and 5 of the JX connector. See the block wiring diagram.



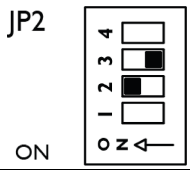
265713 4

Position 1: **1500 RPM**

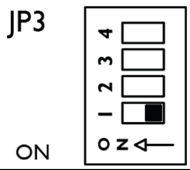
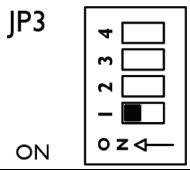
Position 2: **1800 RPM**

Position 3: engine idle speed (pin 3 not connected)

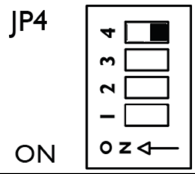
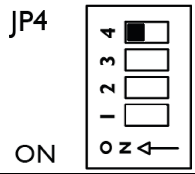
Selecting the diagnostic function

Diagnostic position	
Operating position (prearranged)	

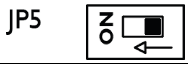
(JP3) Setting the cold start heating device (engine water heater)

Connected	
Not connected (predefined)	

(JP4) Cold start warning light

Connected	
Not connected (predefined)	

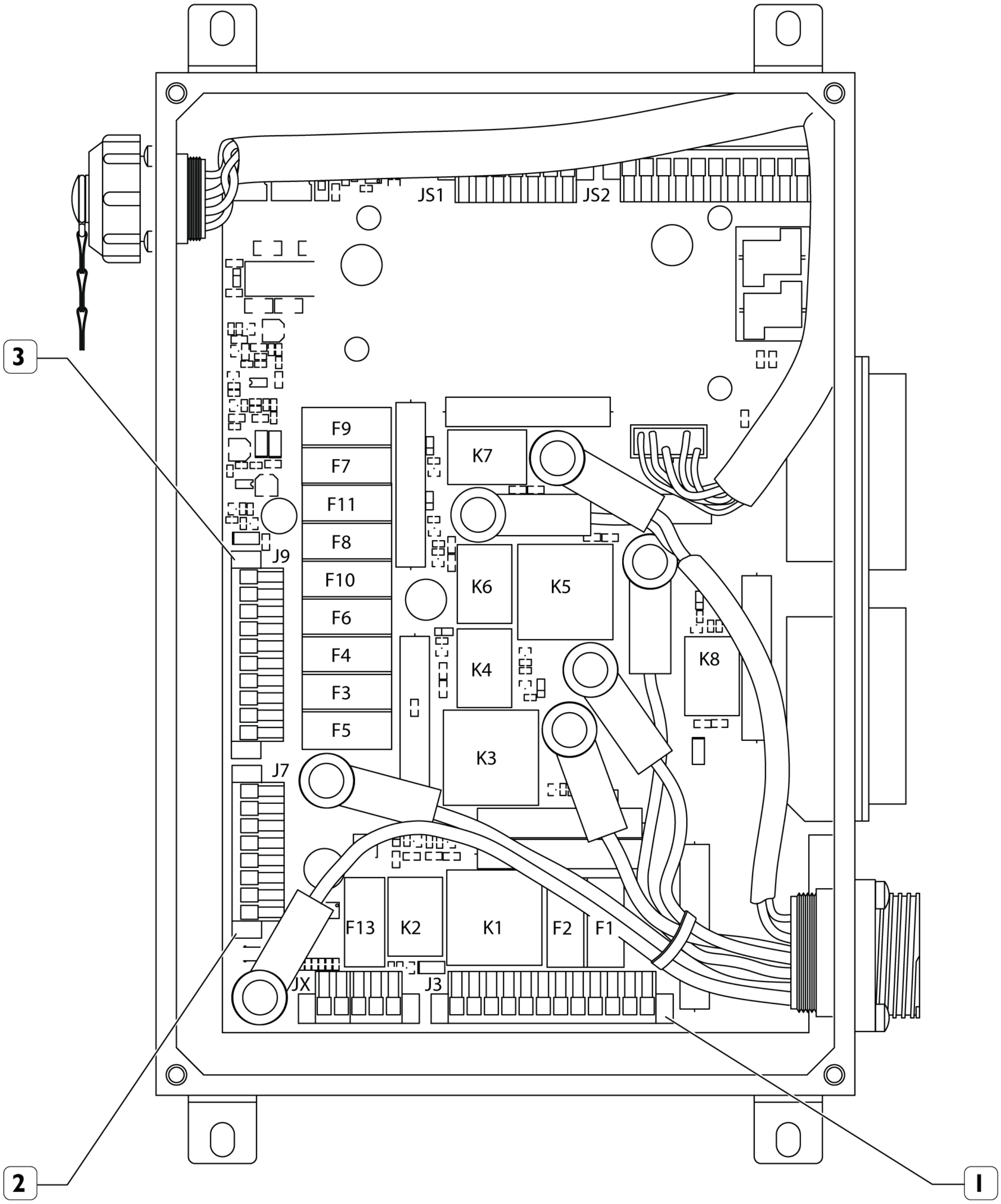
(JP5) CAN line setting

Connected	
Not connected (predefined)	

Interface connectors for control panel (responsibility of the bodybuilder)

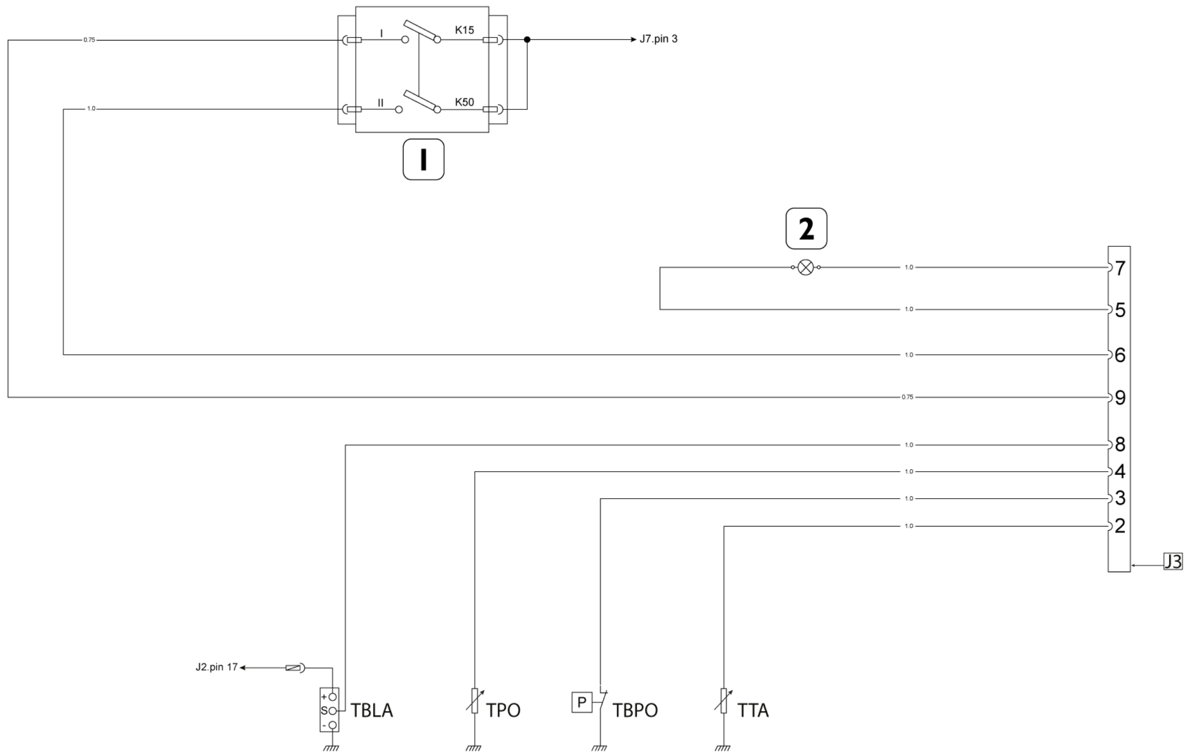
The connectors of the interface arranged with the signals necessary for the complete machine control panels, dedicated to the manufacturer of the current generator, are called J3, J7, and J9.

The signals indicated in the tables below are available on these connectors.


JS1
JS2
F9
F7
F11
F8
F10
F6
F4
F3
F5
K7
K6
K5
K4
K3
K8
J9
J7
F13
K2
K1
F2
F1
JX
J3
3
2
1

259595 5

Topographic diagram - Connector J3

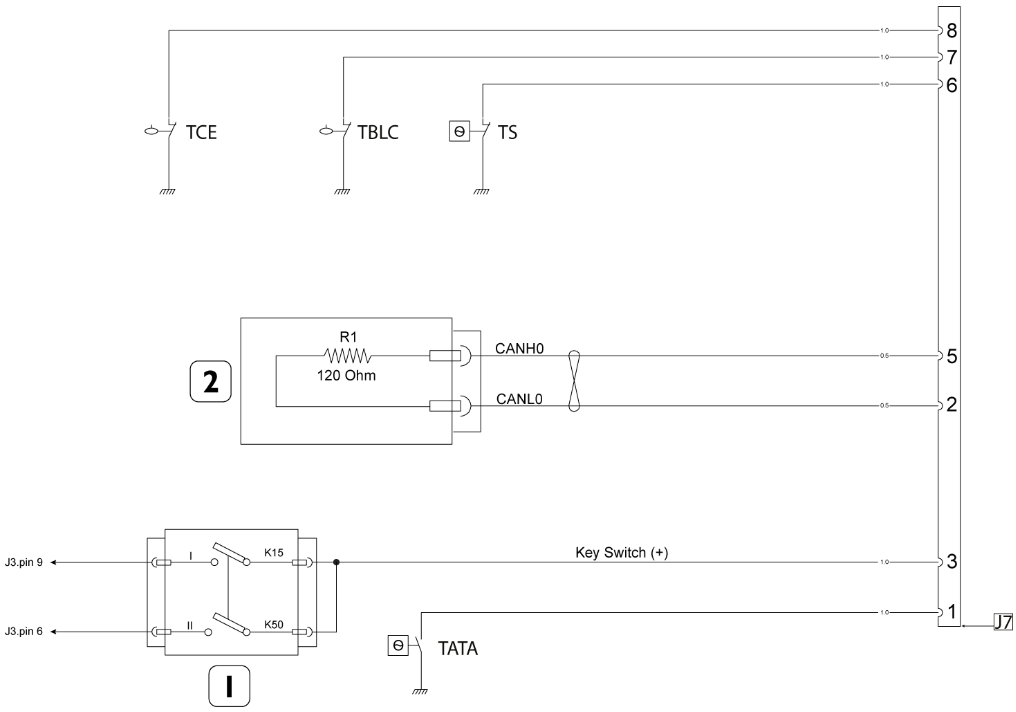


268544 6

TBLA. Low water level sender - TPO. Low oil level sender - TBPO. Low oil pressure sender - TTA. Water temperature sender
(1) Key switch - (2) Battery charge lamp (from alternator)

Pin	Function
1	Spare
2	Coolant temperature sensor
3	Low engine oil pressure signal
4	Engine oil pressure sensor
5	Battery charging lamp (from alternator)
6	Engine starting control
7	Battery charging lamp (from alternator)
8	Low coolant level signal
9	Positive under key
10	Spare
11	Spare
12	Spare

Topographic diagram - Connector J7

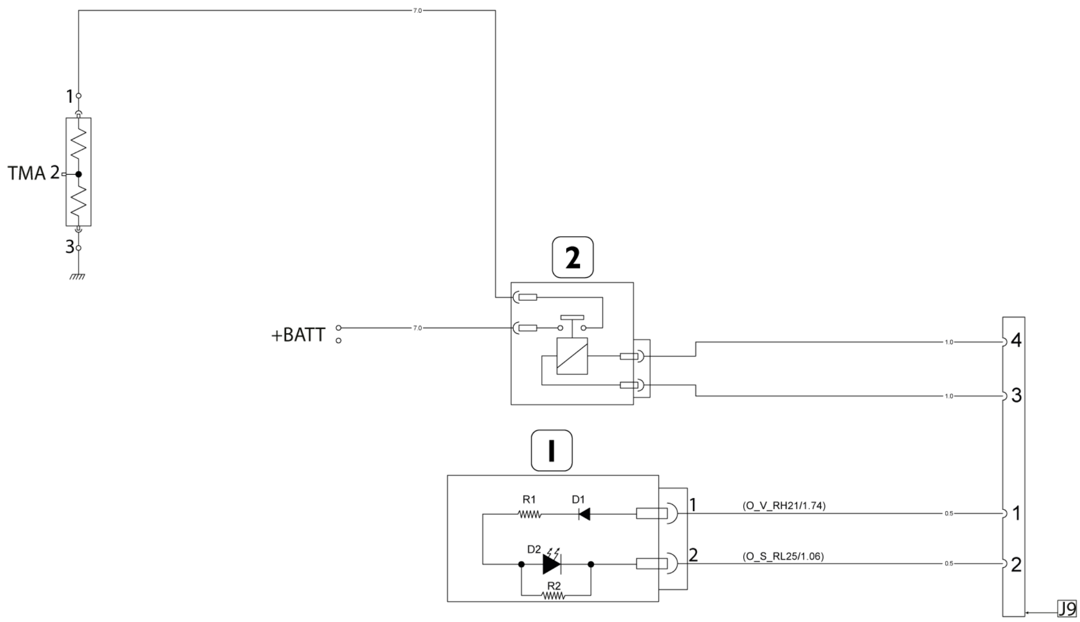


268545 7

TATA. High water temperature sender - TCE. Empty fuel sender - TBLC. Low fuel level sender - TS. Water heater thermostat
(1) Key switch - (2) CAN line resistor

Pin	Function
1	High coolant temperature signal
2	L CAN line
3	Battery positive from key switch
4	Spare
5	H CAN line
6	Thermostatic switch for pre-heating
7	Low fuel level signal
8	No fuel signal

Topographic diagram - Connector J9



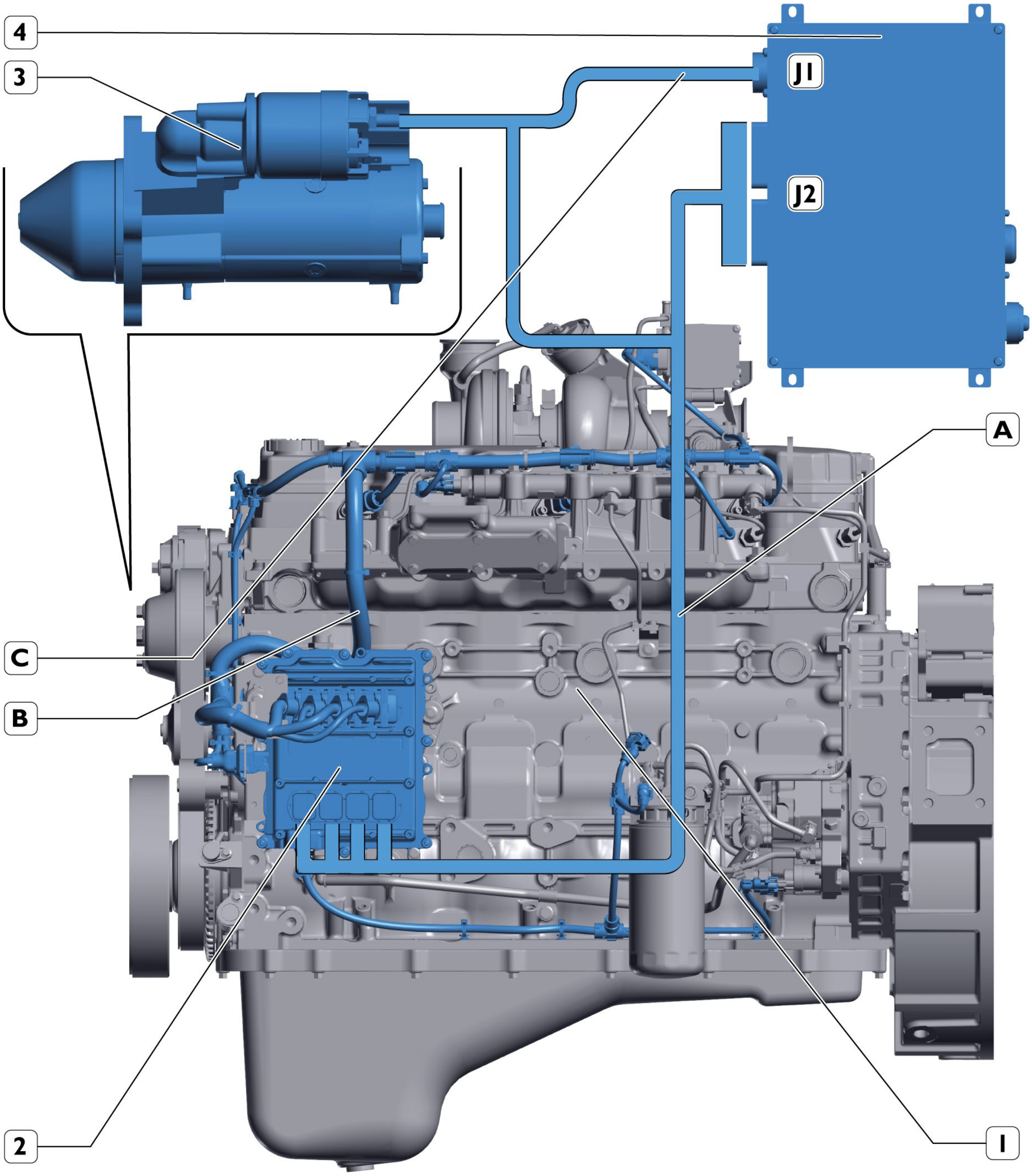
268546 8

TMA. Thermostarter - +BATT. Battery positive
(1) Cold start LED - (2) Grid heater

Pin	Function
1	Positive signal for cold start lamp switching on
2	Return signal for cold start lamp switching on
3	Signal for preheating relay coil (Grid heater)
4	Signal for preheating relay coil (Grid heater)

766160 CONNECTION UNIT - Overview

INTERFACE HOUSING COMPONENT PROVIDED SEPARATELY

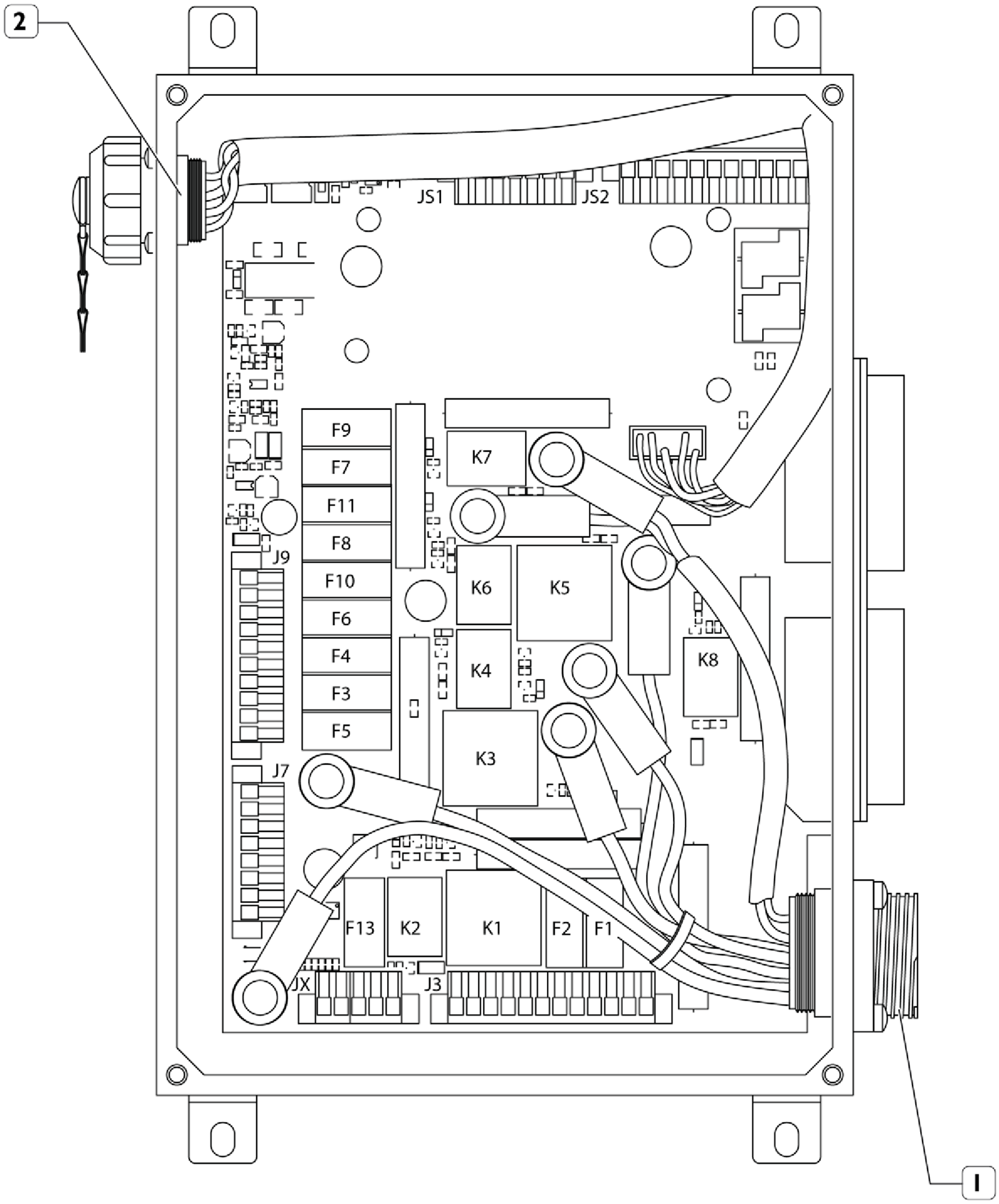


268540 1

A. Wiring from interface housing to engine control unit (responsibility of the bodybuilder)
B. Engine cable
C. Cable from interface housing to starter motor (responsibility of the bodybuilder)

1. Engine
2. electronic control unit MD1

3. Starter motor
4. Housing interface (responsibility of the bodybuilder)



258618 2

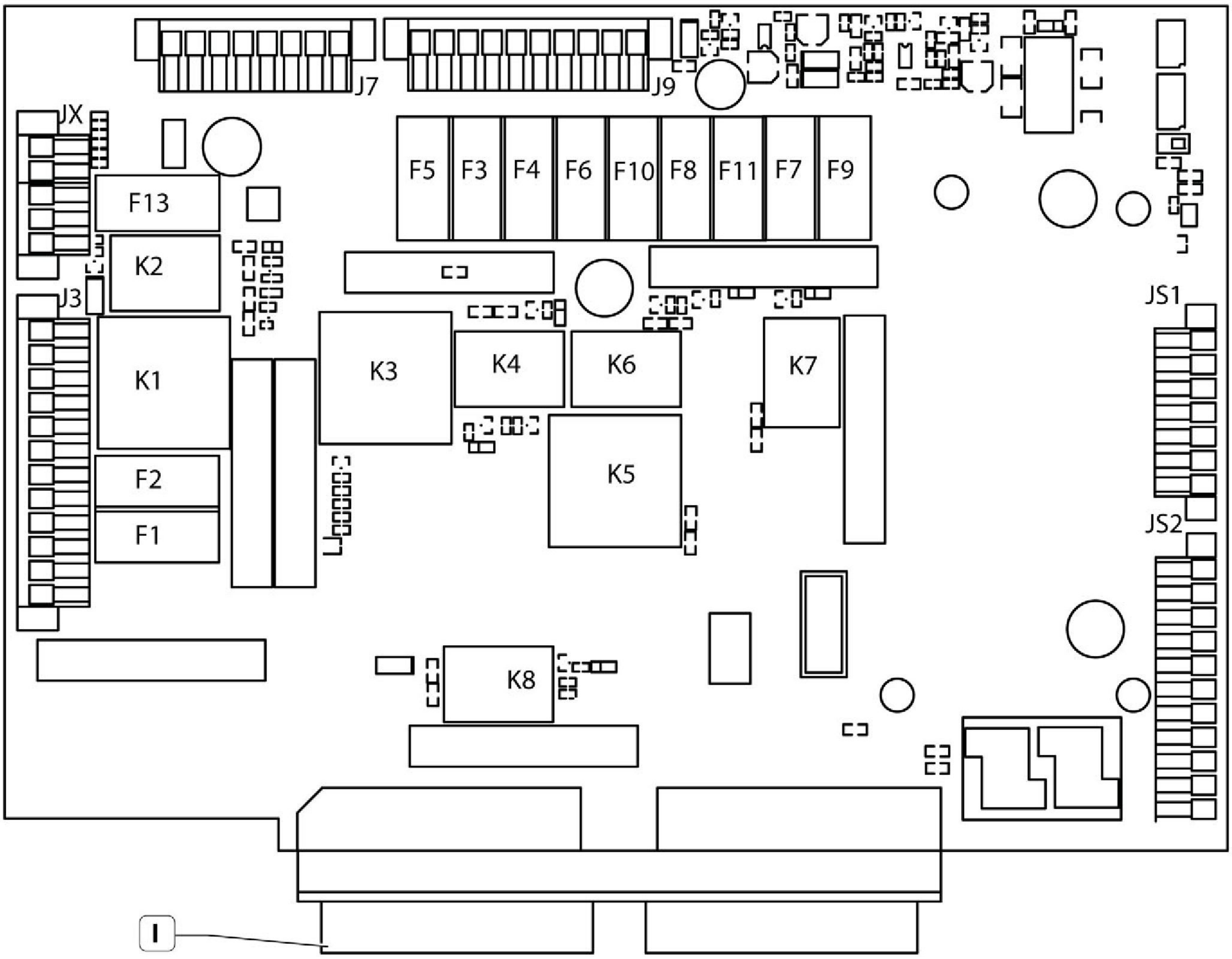
1. Connector J1
2. Diagnostic Connector

INTERFACE HOUSING

In order to allow for the proper electrical operation of the control unit, an interconnection unit was installed in the engine.

The connection unit controls the electronic control system of the engine and the power unit system.

Indications of its components and functions are provided below. These are controlled by the programming switches.



258623 3

1. Connector J2

Remote-control switches

A. K1. ATS auxiliary sensor
B. K2. Keeping B After run
C. K3. Main After run
D. K4. Starter motor
E. K5. SCR heating
F. K6. Fuel filter heating
G. K7. Fuel pre-filter heating
H. K8. Starter motor control
I. CN1. Diagnostics

Fuses

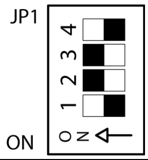
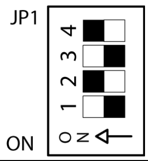
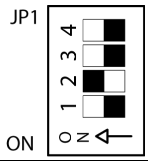
A. F1. Exhaust flap - **20 A** (yellow)
B. F2. NOx - NH3 - **20 A** sensor auxiliary (yellow)
C. F3. Control unit power supply - **30 A** (green)
D. F4. Start up - **20 A** (yellow)
E. F5. ATS auxiliary sensor - **40 A** (orange)

F. F6. SCR heater - **20 A** (yellow)
G. F7. Battery positive - **5 A** (beige)
H. F8. Fuel filter and pre-filter heating - **15 A** (blue)
I. F9. Fuel pre-filter heating - **15 A** (blue)
J. F10. Positive on key switch - **10 A** (red)
K. F11. Low water level sender - **10 A** (red)
L. F13. Main after run - **5 A** (red)

Selection of accessory functions and engine speed

Function programming described below is possible by switching the respective positions of the JP switches.

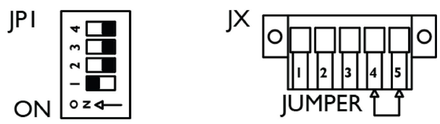
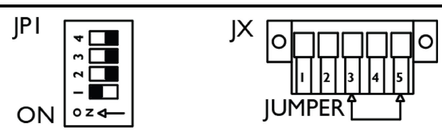
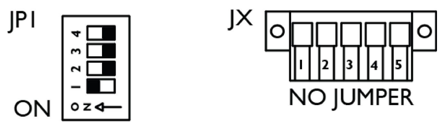
(JP1) (Engine speed selection)

1500 RPM 50 Hz	
1800 RPM 60 Hz	
Minimum	

Select an engine speed of **1500 RPM**, **1800 RPM** or idle, acting directly on the internal JP at the interface housing.

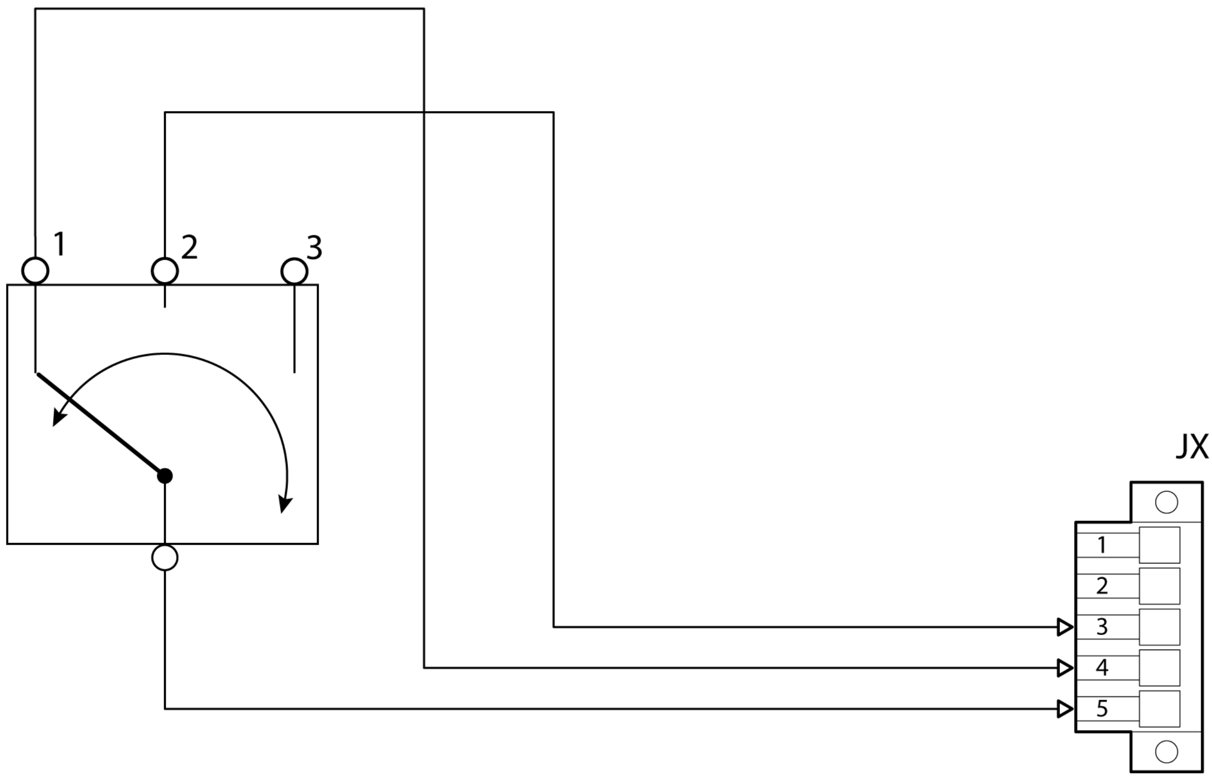
Position the micro switches as shown in the figure to set the desired engine speed.

(JP1) (select an engine speed of 1500 rpm, 1800 rpm or idle) (+ JX) (External three-position switch on the electrical panel is the responsibility of the bodybuilder)

1500 RPM 50 Hz	
1800 RPM 60 Hz	
Minimum	

There is the possibility of using an external three-position switch to select an engine speed of **1500 RPM**, **1800 RPM** or idle.

In this case, after having positioned the micro switches as indicated below, connect the switch at pins 3, 4, and 5 of the JX connector. See the block wiring diagram.



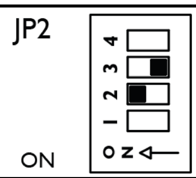
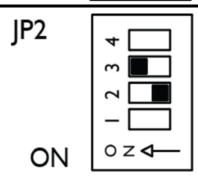
265713 4

Position 1: **1500 RPM**

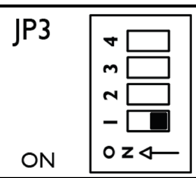
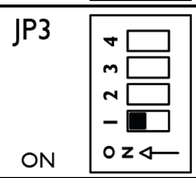
Position 2: **1800 RPM**

Position 3: engine idle speed (pin 3 not connected)

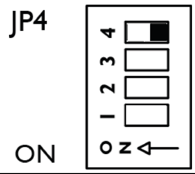
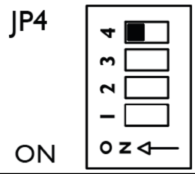
Selecting the diagnostic function

Diagnostic position	
Operating position (prearranged)	

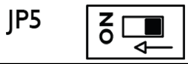
(JP3) Setting the cold start heating device (engine water heater)

Connected	
Not connected (predefined)	

(JP4) Cold start warning light

Connected	
Not connected (predefined)	

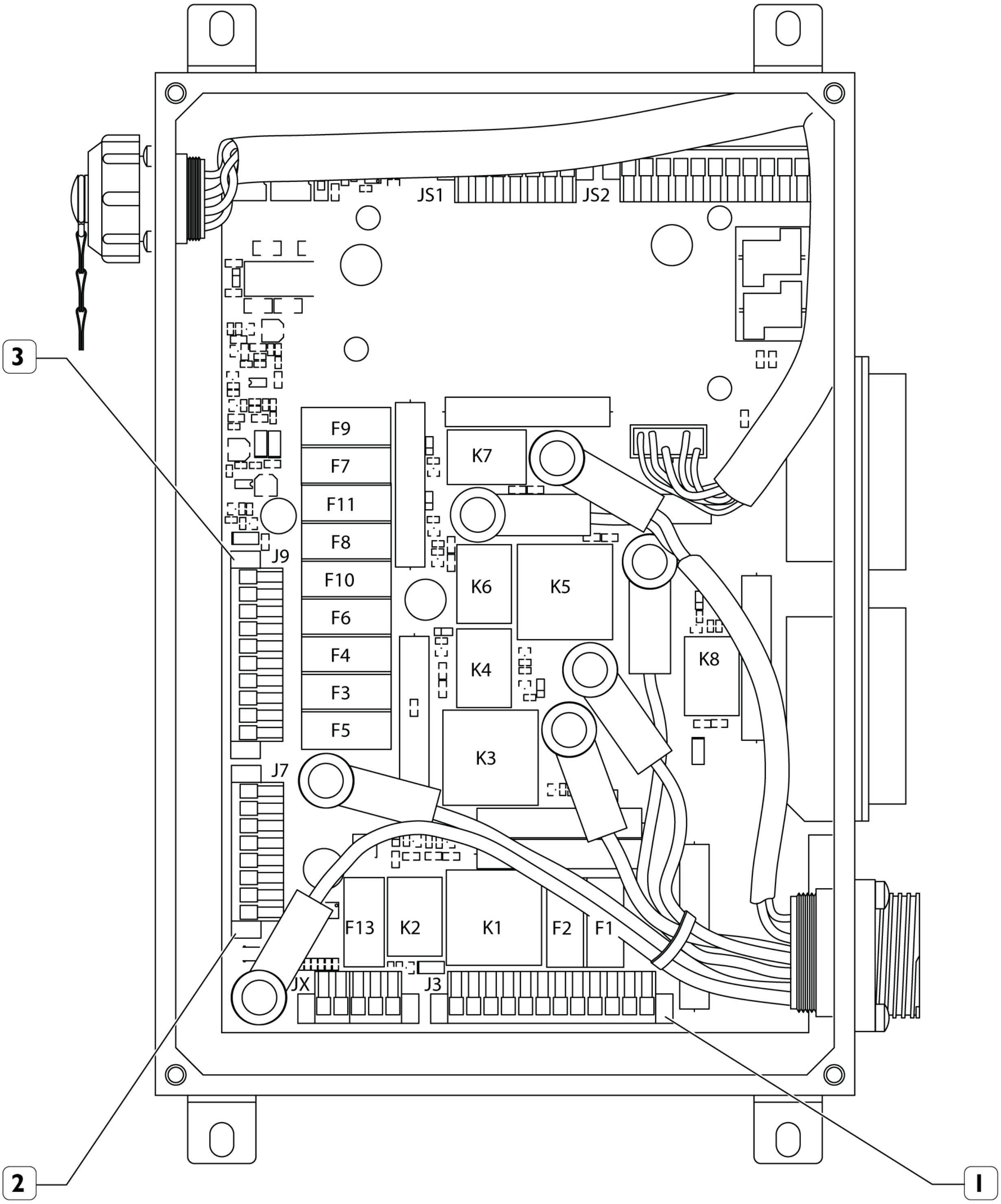
(JP5) CAN line setting

Connected	
Not connected (predefined)	

Interface connectors for control panel (responsibility of the bodybuilder)

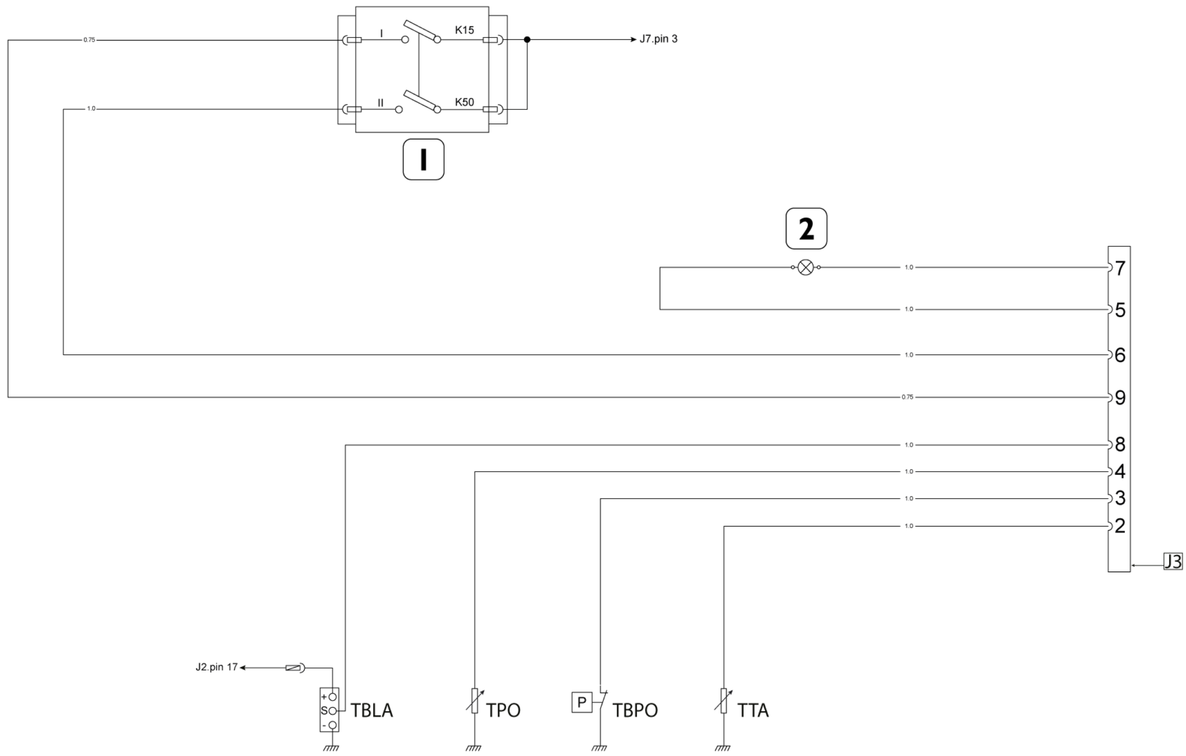
The connectors of the interface arranged with the signals necessary for the complete machine control panels, dedicated to the manufacturer of the current generator, are called J3, J7, and J9.

The signals indicated in the tables below are available on these connectors.


JS1
JS2
3
J9
F9
F7
F11
F8
F10
F6
F4
F3
F5
K7
K6
K5
K4
K3
K8
J7
F13
K2
K1
F2
F1
JX
J3
2
1

259595 5

Topographic diagram - Connector J3

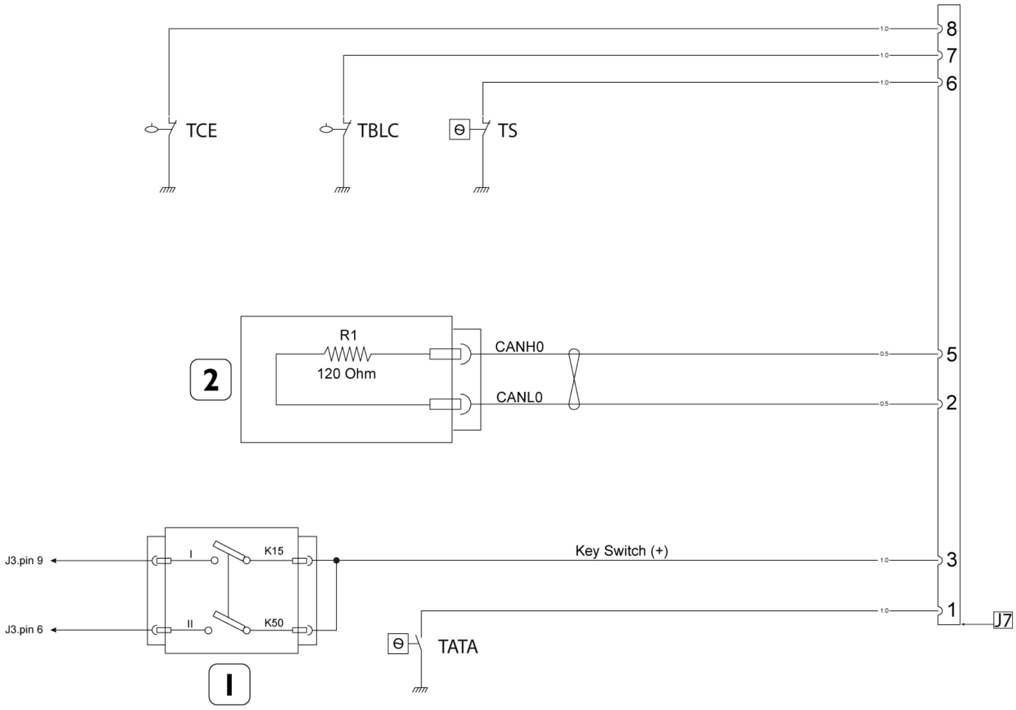


268544 6

TBLA. Low water level sender - TPO. Low oil level sender - TBPO. Low oil pressure sender - TTA. Water temperature sender
(1) Key switch - (2) Battery charge lamp (from alternator)

Pin	Function
1	Spare
2	Coolant temperature sensor
3	Low engine oil pressure signal
4	Engine oil pressure sensor
5	Battery charging lamp (from alternator)
6	Engine starting control
7	Battery charging lamp (from alternator)
8	Low coolant level signal
9	Positive under key
10	Spare
11	Spare
12	Spare

Topographic diagram - Connector J7

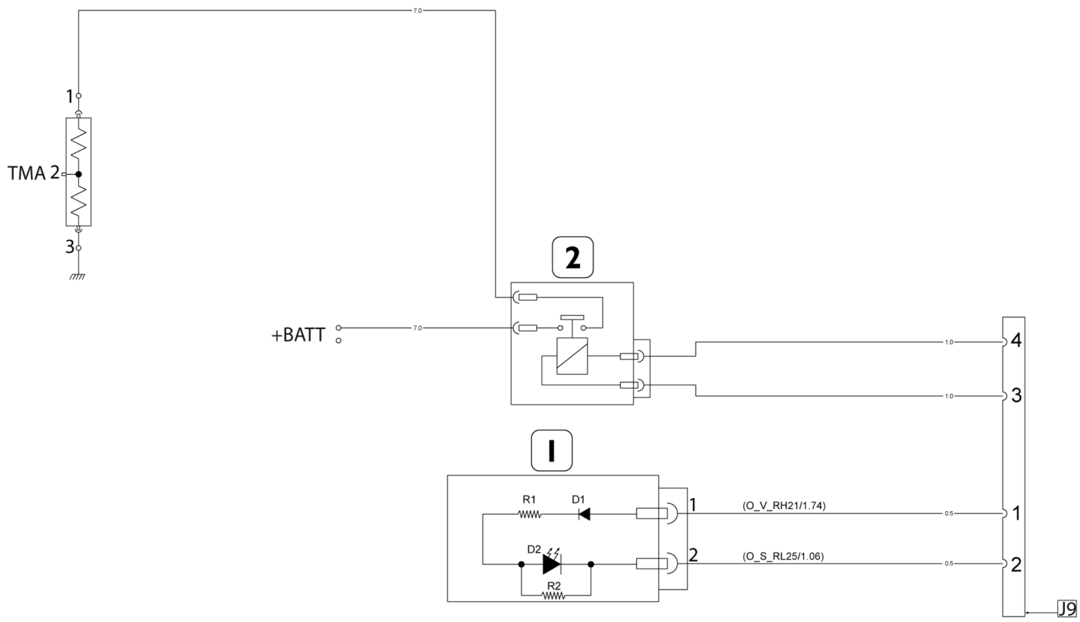


268545 7

TATA. High water temperature sender - TCE. Empty fuel sender - TBLC. Low fuel level sender - TS. Water heater thermostat
(1) Key switch - (2) CAN line resistor

Pin	Function
1	High coolant temperature signal
2	L CAN line
3	Battery positive from key switch
4	Spare
5	H CAN line
6	Thermostatic switch for pre-heating
7	Low fuel level signal
8	No fuel signal

Topographic diagram - Connector J9



268546 8

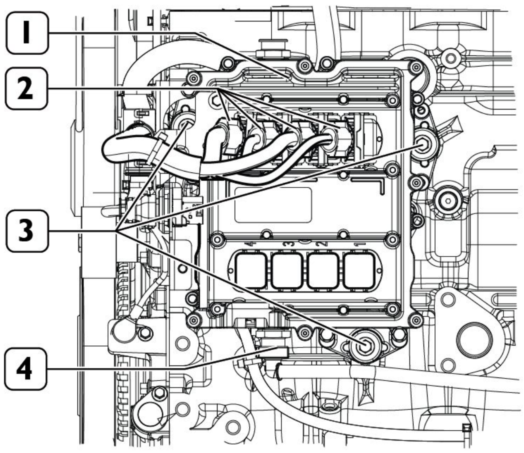
TMA. Thermostarter - +BATT. Battery positive
(1) Cold start LED - (2) Grid heater

Pin	Function
1	Positive signal for cold start lamp switching on
2	Return signal for cold start lamp switching on
3	Signal for preheating relay coil (Grid heater)
4	Signal for preheating relay coil (Grid heater)

766161 ENGINE CONTROL UNIT - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Disconnect the engine cable **(2)** from the control unit **(1)**, as described in the procedure **ENGINE CABLES - Remove (76.91)**.
2. Position a suitable container to catch any fuel.
3. Disconnect the retainer and remove the low-pressure fuel pipe that connects the fuel pre-filter to the heat exchanger of the engine management control unit.
4. Disconnect the retainer **(4)** and remove the low-pressure fuel pipe connecting the engine control unit heat exchanger to the mechanical pump, as described in the procedure **PIPES - Remove (54.20)**.
5. Unscrew the supporting screws **(3)** and remove the ECU **(1)** together with the heat exchanger.



265947 1

Description	Step	Value
Engine Controller Module	3 screws M8 x 1.25 x 45	**14 N·m**

766161 ENGINE CONTROL UNIT - Install

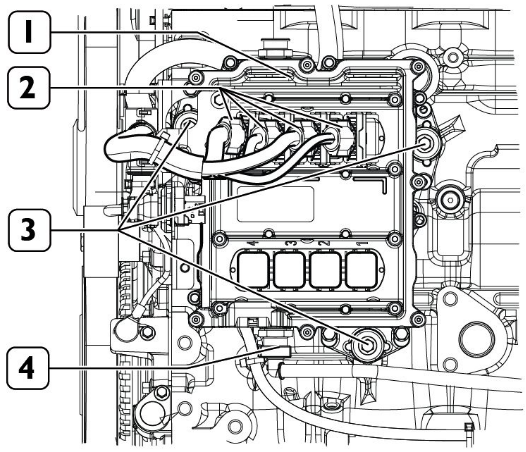
Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Description	Step	Value
Engine Controller Module	3 screws M8 x 1.25 x 45	**14 N·m**

1. Fit the ECU **(1)** including the heat exchanger, on the crankcase and tighten the supporting screws **(3)** to the prescribed torque.
2. Connect the low-pressure fuel pipe connecting the engine control unit heat exchanger to the mechanical pump using the retainer **(4)**, as described in the procedure **PIPES - Install (54.20)**.
3. Connect the low-pressure fuel pipe that connects the fuel pre-filter to the engine management control unit using the retainer.
4. Connect the engine cable **(2)** to the control unit **(1)**, as described in the procedure **ENGINE CABLES - Install (76.91)**.

NOTE: *It is recommended that the elastic support elements are replaced.*

Description	Step	Value
Engine Controller Module	3 screws M8 x 1.25 x 45	**14 N·m**



265947 1

762010 BATTERY - Visual inspection

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

Check that the battery terminals and cable terminals are clean, well tightened and protected by Vaseline.

In the event of dirty cable clamps and battery terminals:

1. Loosen the nut and remove the terminal from the negative terminal (marked with a "-").
2. Loosen the nut and remove the terminal from the positive terminal (marked with a "+").
3. Use a metal brush or fine grade sand paper to clean the cable terminals and the battery terminals until they are shiny.
4. Smear the cable terminals with Vaseline and insert them onto the battery terminals making sure that the positive pole is connected first, followed by the negative pole, and then tighten each terminal.

Check the wear and corrosion of the cables and terminals. If they are damaged, they must be replaced. Visually check the condition of the battery. Neither the terminals nor the body must be damaged, otherwise they must be replaced.

762010 BATTERY - Check

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Check/top-up electrolyte level in batteries (component not supplied by FPT)

Hazard warning
Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).
Failure to comply with these prescriptions can result in the risk of serious injury

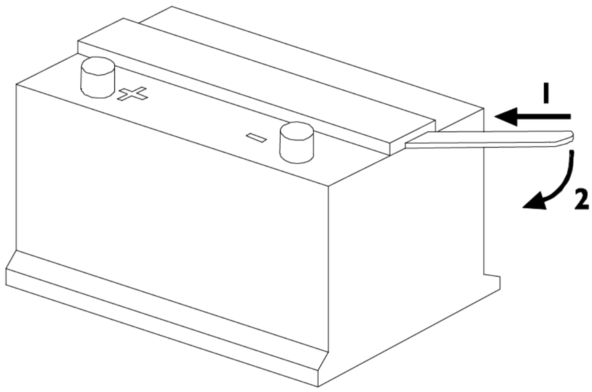
1. Place the batteries on a flat surface and proceed as follows.
2. Visually check that the level of the electrolyte is between the "Min" and "Max" levels; if there are no references, check that the electrolyte covers the lead plates inside the elements.
3. Only use distilled water to top up the elements whose level is below the minimum.
4. To charge the battery, contact specialised personnel.
5. If, with the engine running, there is a voltage of less than **22 V**, check the efficiency of the battery recharging system.
6. On this occasion, make sure that the poles and terminals are clean, correctly blocked and protected with petroleum jelly.

NOTE: *If all the battery elements need to be topped-up with a significant amount of distilled water, contact specialised technical personnel to carry out a diagnostics check on the efficiency status of the battery and the charging system.*

7. Risk of damage
The batteries contain sulphuric acid which is highly caustic and corrosive. Always wear gloves and protective glasses while topping up. If possible, ensure that the check is carried out by specialised personnel.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

Risk of burns
Do not smoke or bring open flames near the batteries during the check and make sure that the room in which the work is performed is suitably ventilated.
Failure to comply with these prescriptions can result in the risk of serious injury and serious damages to the vehicle

8. Some batteries have a single cover for all of the inspection plugs.
9. To access the elements, use a lever as shown in the figure.

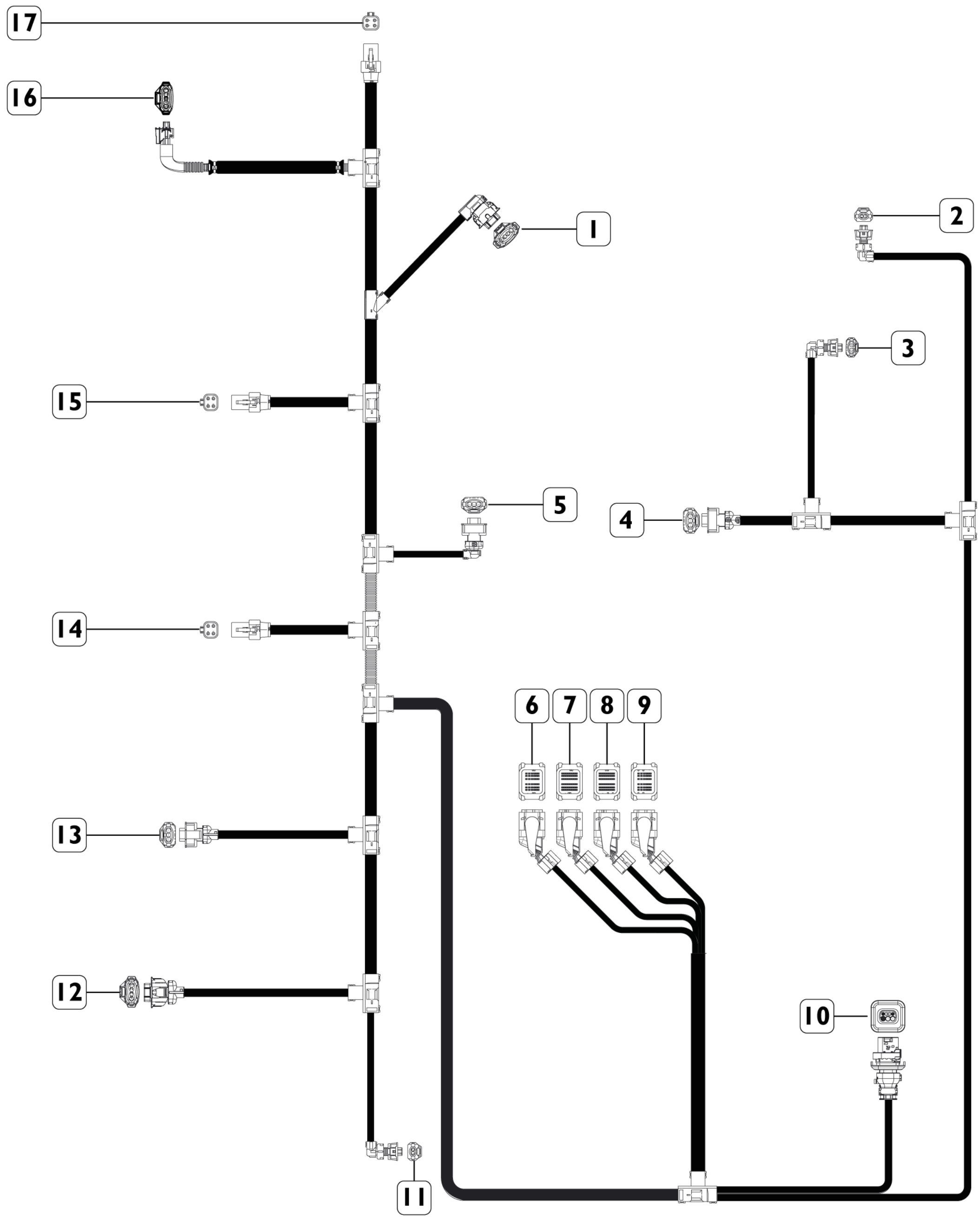


225112 1

769140 ENGINE CABLES - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

ENGINE CABLE DIAGRAM



265717 1

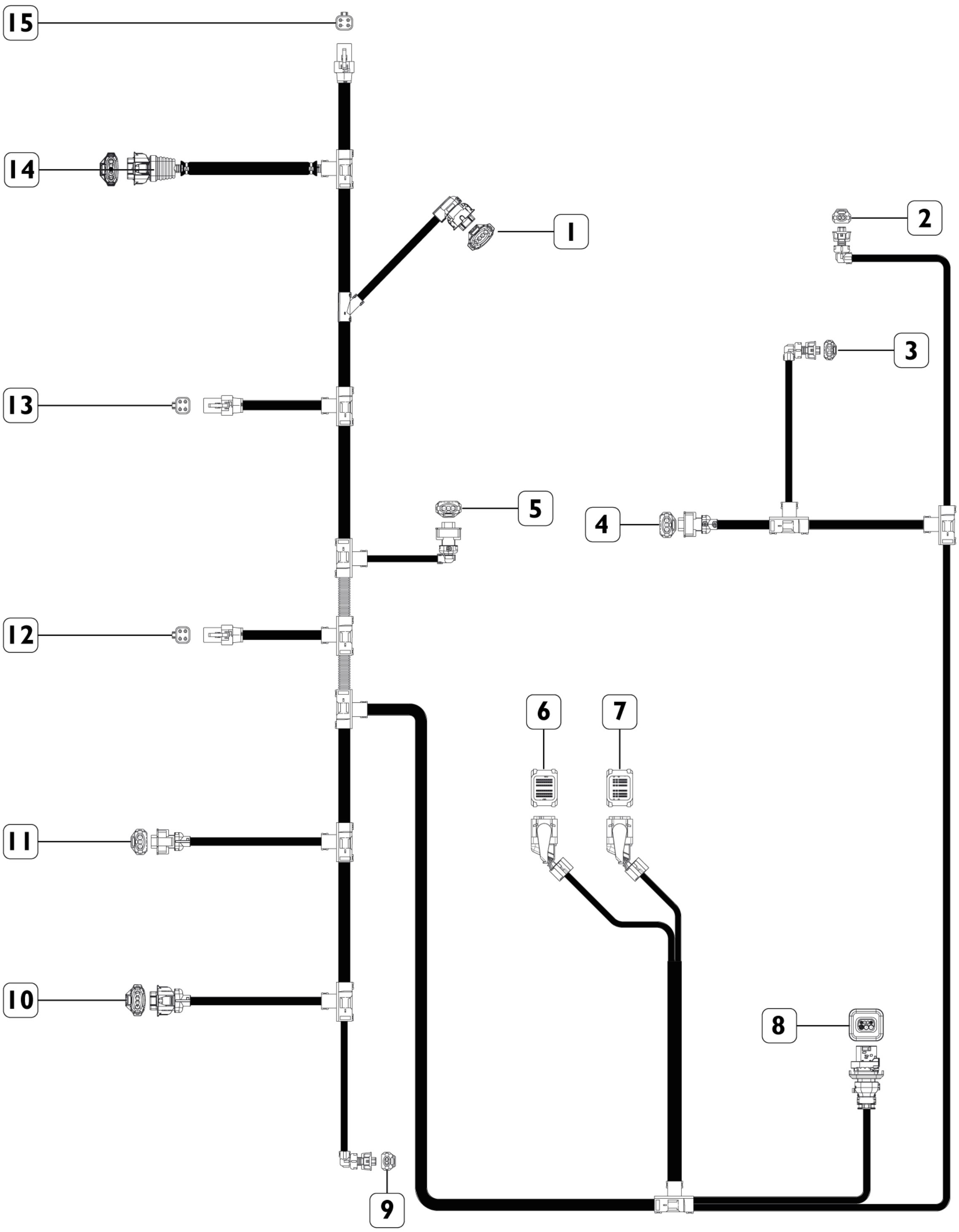
1. Boost air pressure and temperature sensor
2. MPROP (Fuel pressure valve at the rail)
3. Fuel temperature sensor
4. Timing sensor
5. Rail pressure sensor
6. Connector 5 to Control unit (code C)
7. Connector 6 to Control unit (code H)

8. Connector 7 to Control unit (code I)
9. Connector 8 to Control unit (code D)
10. In-line connector (R7)
11. Coolant temperature sensor
12. Oil temperature and pressure sensor
13. Engine speed sensor
14. Injectors of cylinders 1 and 2
15. Injectors of cylinders 3 and 4
16. Exhaust flap
17. Injectors of cylinders 5 and 6

769140 ENGINE CABLES - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

ENGINE CABLE DIAGRAM



265718 1

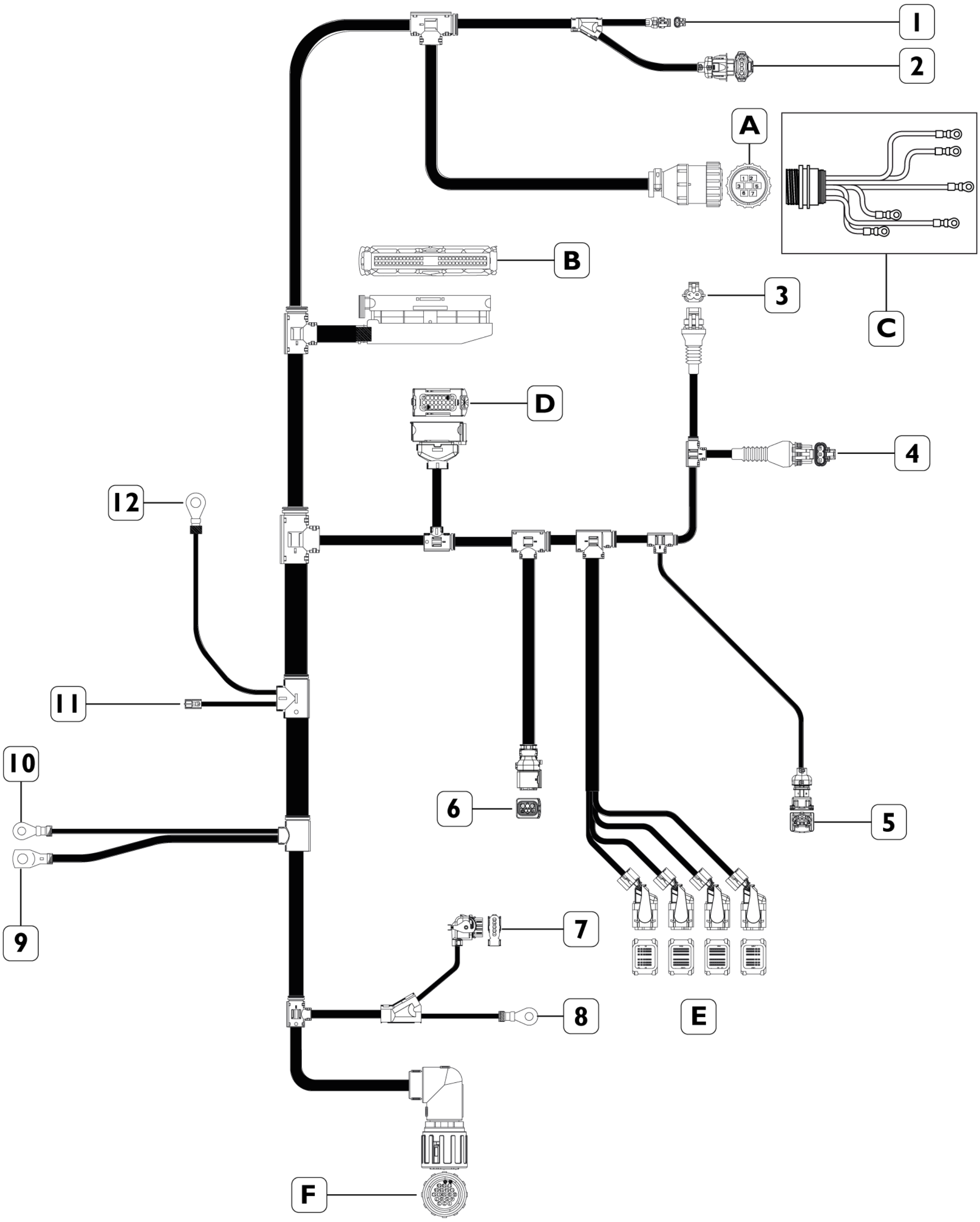
1. Air temperature and pressure sensor
2. Fuel metering unit

3. Fuel temperature sensor
4. Timing sensor
5. Rail pressure sensor
6. Connector 6 to Control unit (code H)
7. Connector 8 to Control unit (code D)
8. In line connector (R7)
9. Coolant temperature sensor
10. Oil temperature and pressure sensor
11. Rpm sensor
12. Injectors of cylinders 1 and 2
13. Injectors of cylinders 3 and 4
14. Exhaust flap
15. Injectors of cylinders 5 and 6

769140 ENGINE CABLES - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

WIRING FROM ENGINE INTERFACE



265719 1

A. Connector J1

B. Connector J2

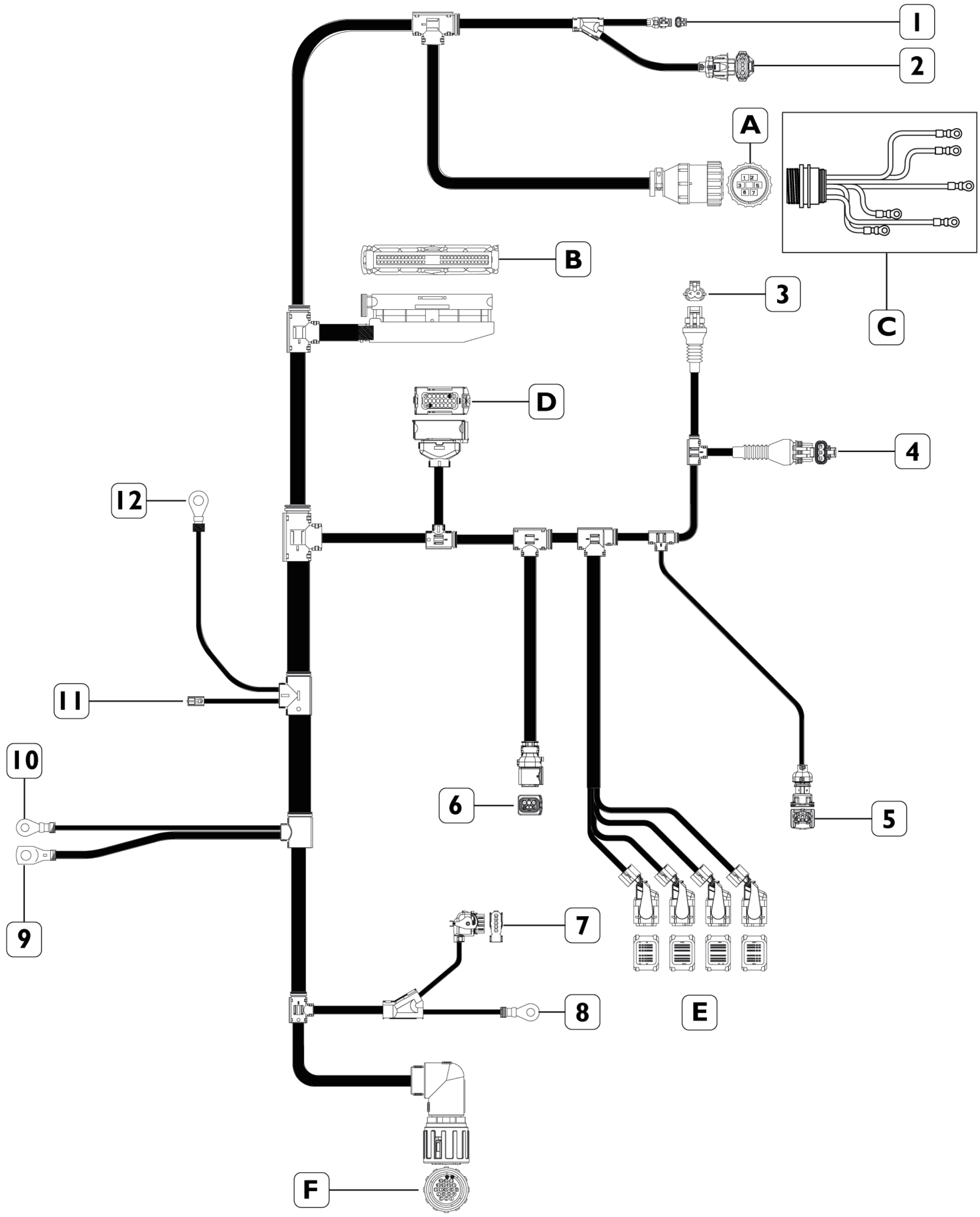
C. Interface control unit
D. Connector X1 (to ATS system components)
E. control unit MD1
F. Connector R1 (to ATS system)

1. Air filter clogged sensor
2. Ambient temperature and humidity sensor
3. Fuel filter heater
4. Fuel pre-filter heater
5. Sender for water in fuel
6. Exhaust flap
7. Alternator
8. Alternator (B+)
9. Battery positive
10. Battery negative
11. Starter motor (avv.)
12. Starter motor (pos.)

769140 ENGINE CABLES - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

WIRING FROM ENGINE INTERFACE



265719 1

A. Connector J1

B. Connector J2

C. Interface control unit
D. Connector X1 (to ATS system components)
E. control unit MD1
F. Connector R1 (to ATS system)

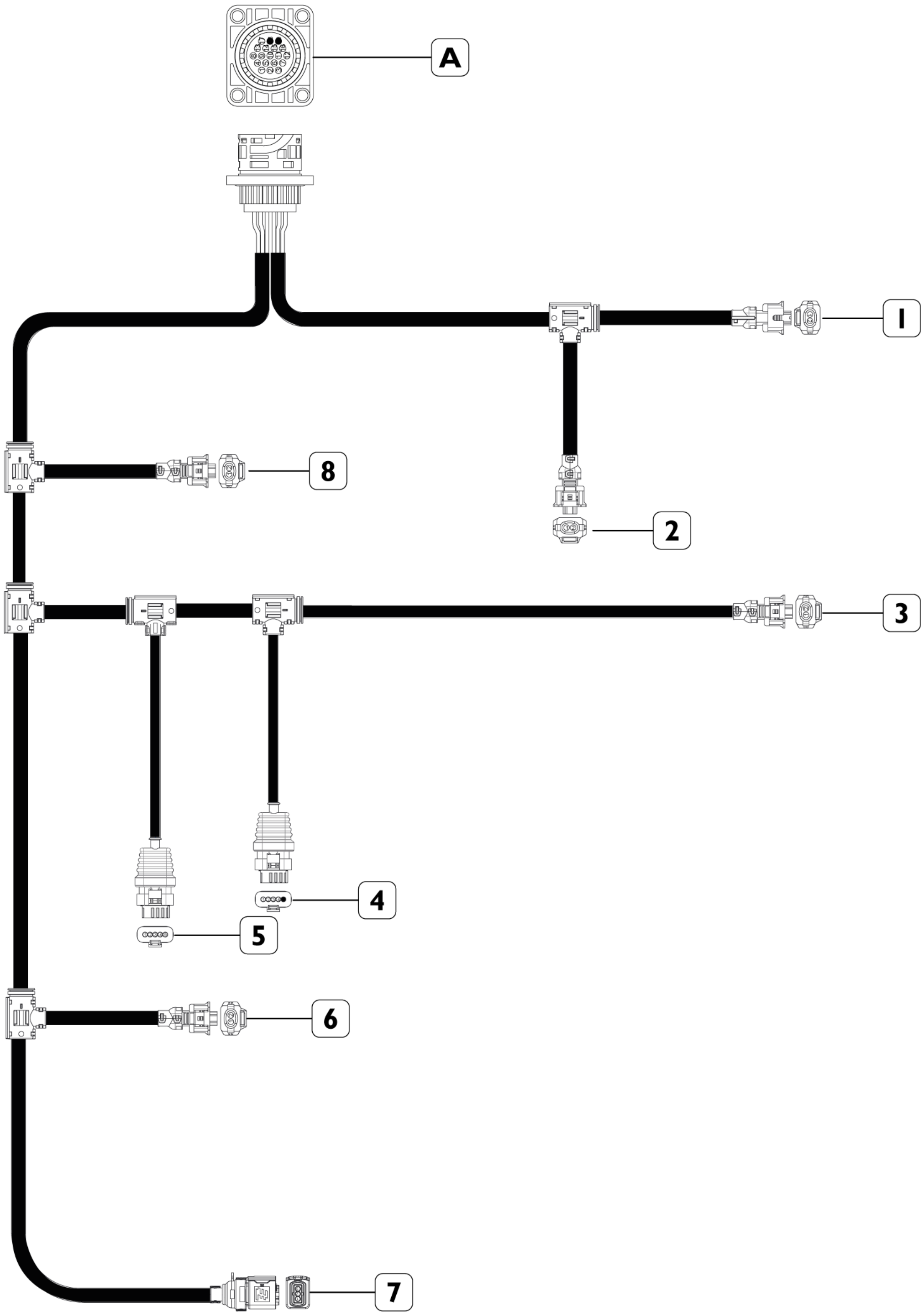
NOTE: *The clamp connecting ATS components downstream of connector R1 is the responsibility of the bodybuilder.*

1. Air filter clogged sensor
2. Ambient temperature and humidity sensor
3. Fuel filter heater
4. Fuel pre-filter heater
5. Sender for water in fuel
6. Exhaust flap
7. Alternator
8. Alternator (B+)
9. Battery positive
10. Battery negative
11. Starter motor (avv.)
12. Starter motor (pos.)

769140 ENGINE CABLES - Overview

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

ATS SYSTEM WIRING



265724 1

A. Connector R1 (to interconnection cable)

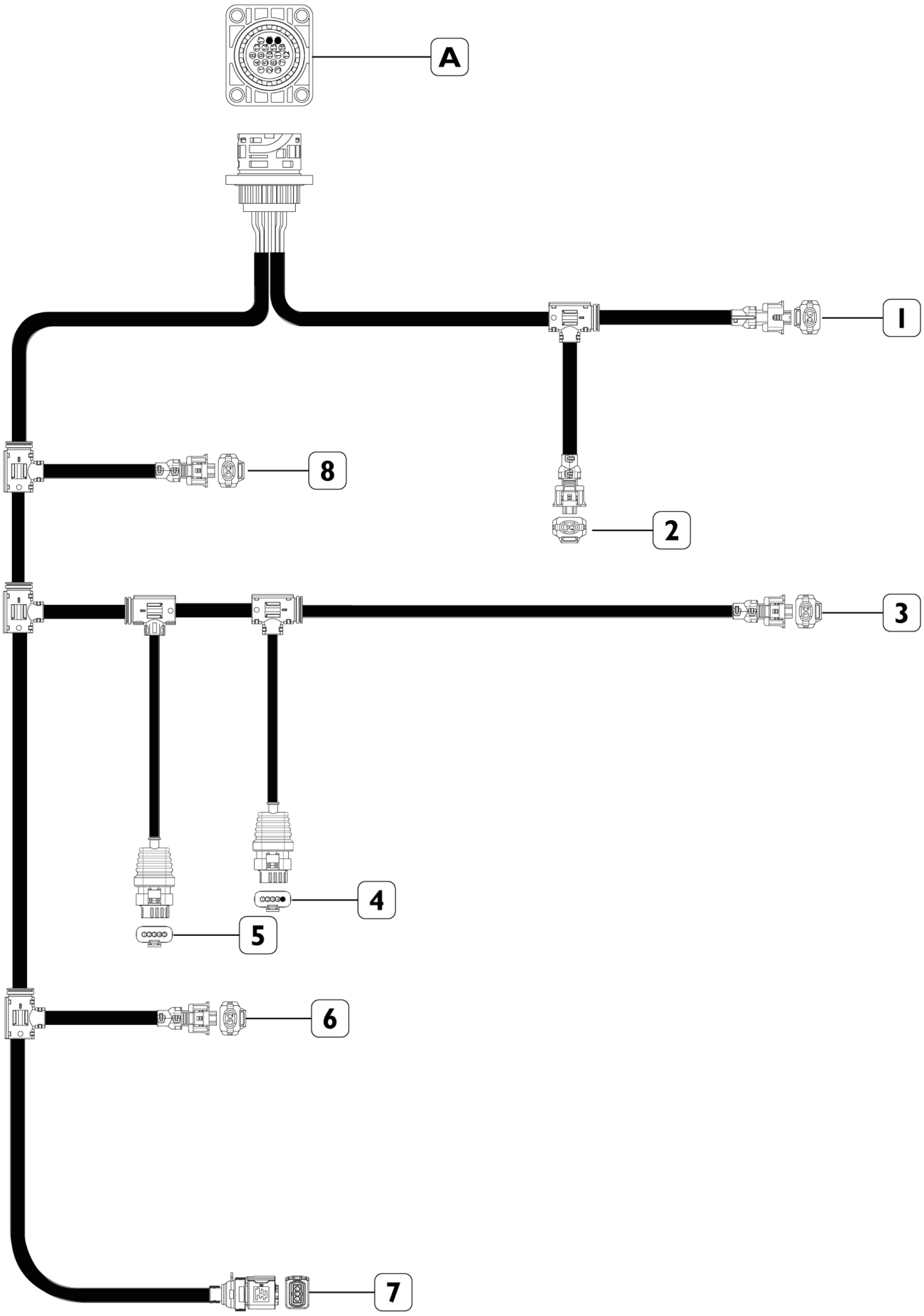
1. DEF dosing module

2. Temperature sensor downstream of DOC
3. Temperature sensor upstream of SCRoF
4. NOx sensor downstream of SCRoF.
5. NOx sensor upstream of DOC
6. Temperature sensor downstream of SCRoF
7. Differential pressure sensor SCRoF
8. Temperature sensor upstream of DOC

769140 ENGINE CABLES - Overview

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

ATS SYSTEM WIRING



265724 1

A. Connector R1 (to interconnection cable)

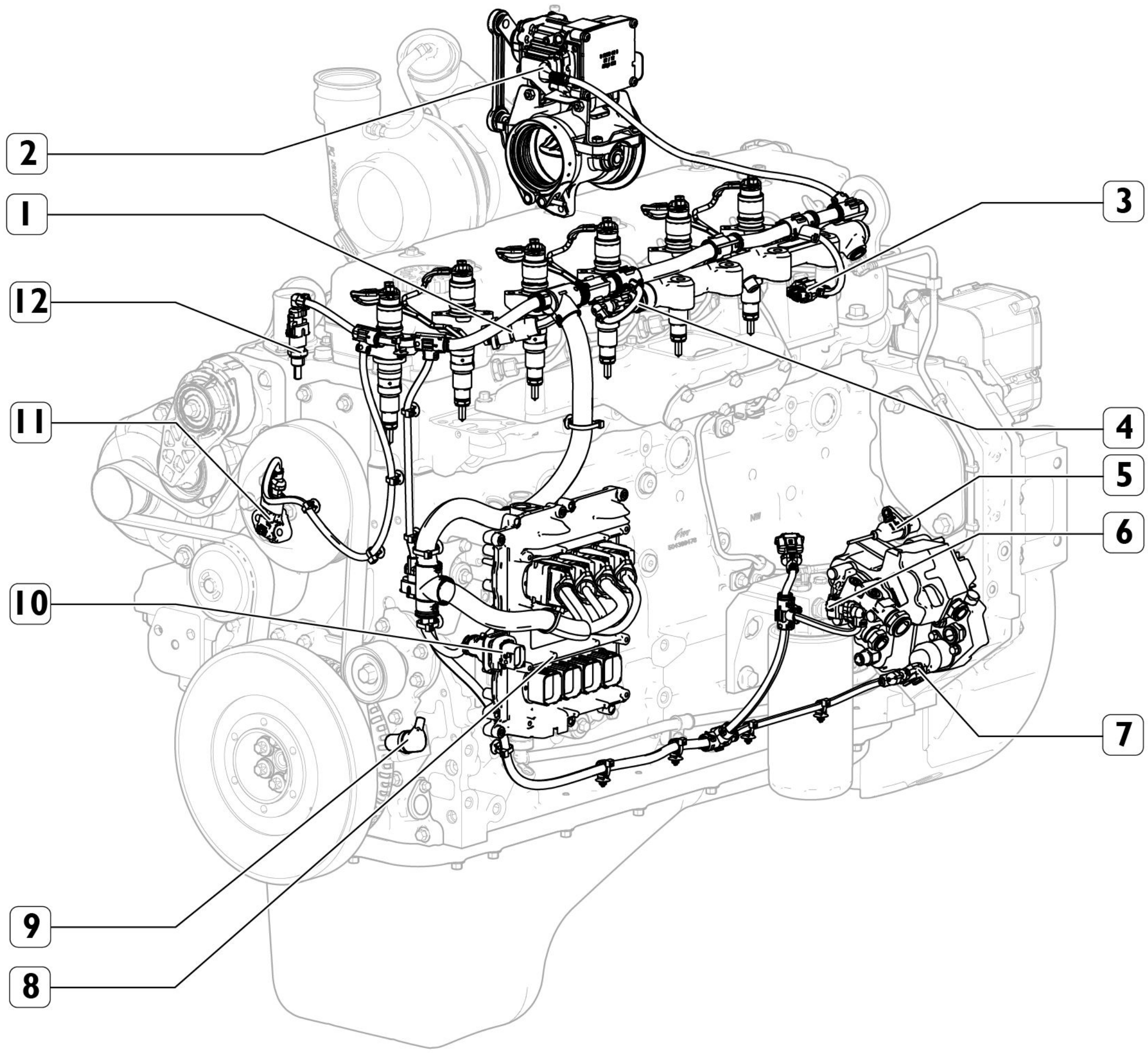
NOTE: *The clamp connecting ATS components downstream of connector R1 is the responsibility of the bodybuilder.*

1. DEF dosing module

2. Temperature sensor downstream of DOC
3. Temperature sensor upstream of SCRoF
4. NOx sensor downstream of SCRoF
5. NOx sensor upstream of DOC
6. Temperature sensor downstream of SCRoF
7. Differential pressure sensor SCRoF
8. Temperature sensor upstream of DOC

769140 ENGINE CABLES - Remove

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL



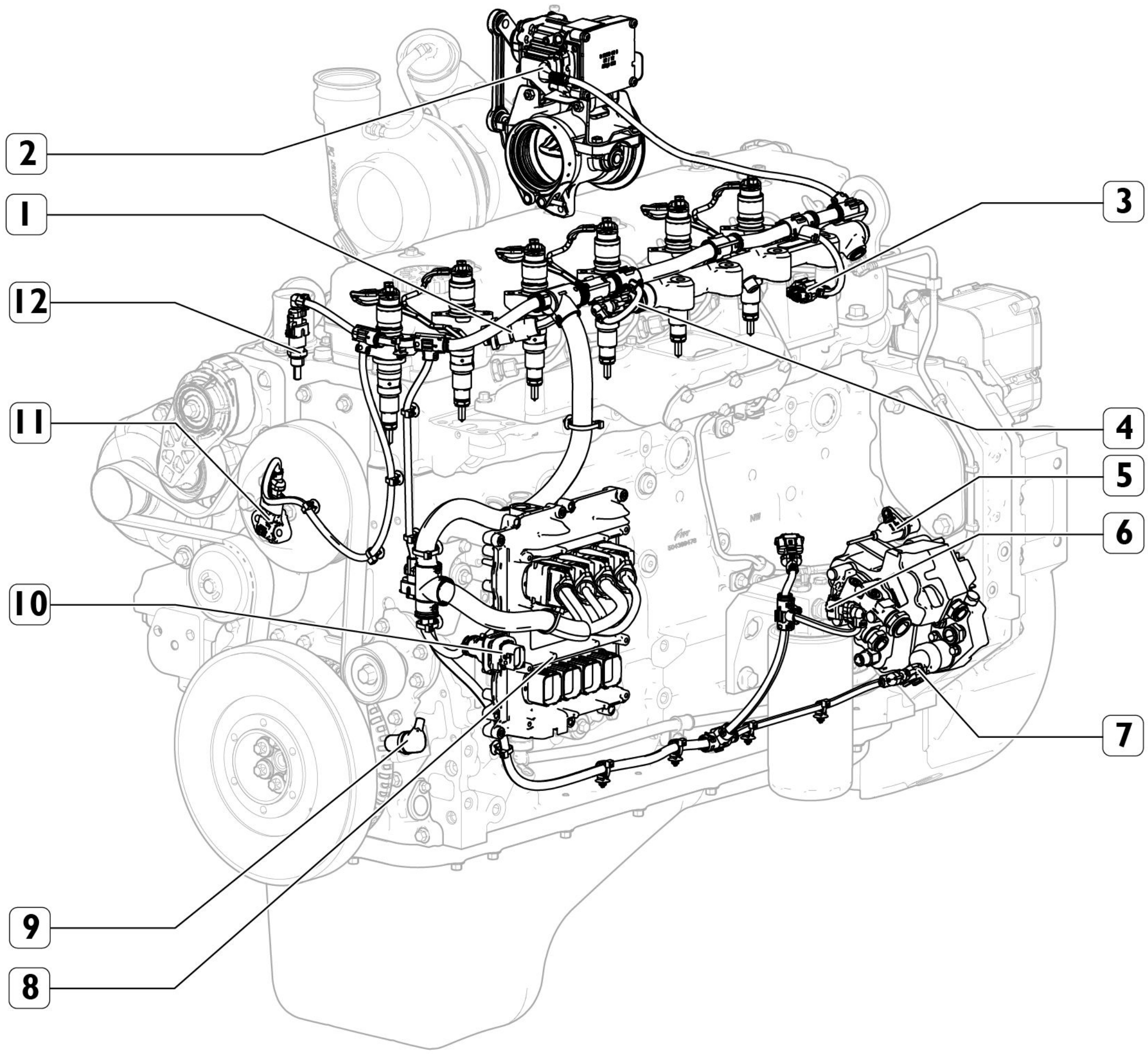
265939 1

(1) Injector connections - (2) Motorised throttle valve actuator connector (Exhaust valve) - (3) Supercharging pressure and air temperature sensor - (4) Rail pressure sensor - (5) Camshaft timing segment speed sensor - (6) Fuel temperature sensor - (7) Fuel high pressure pump dosing unit - (8) ECU17CV41 engine control unit - (9) Crankshaft rpm incremental speed sensor - (10) On-line connector - (11) Engine oil temperature and pressure sensor - (12) Coolant temperature sensor

1. Remove the engine cable by unplugging it from the control unit **(8)**, from the motorised throttle valve actuator connector **(2)**, and from all the sensors and transmitters to which it is connected.
2. Open the clips fastening the engine cable to the crankcase and remove the cable.

769140 ENGINE CABLES - Install

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL



265939 1

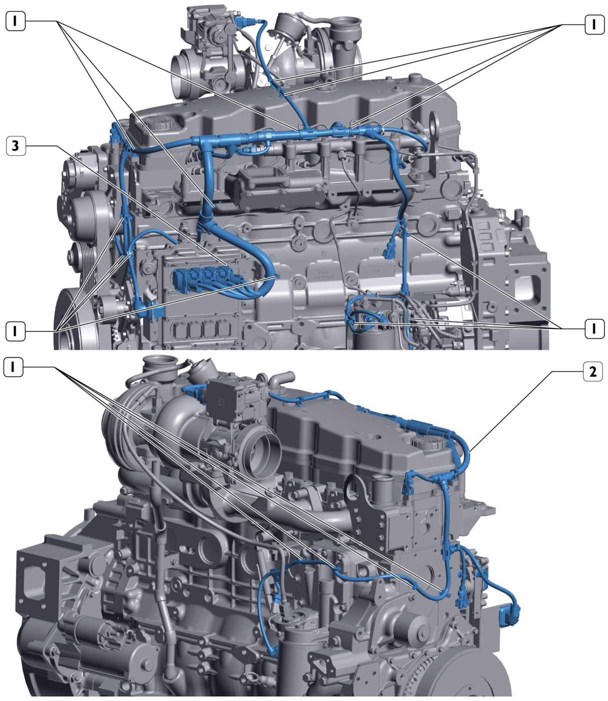
(1) Injector connections - (2) Motorised throttle valve actuator connector (Exhaust valve) - (3) Supercharging pressure and air temperature sensor - (4) Rail pressure sensor - (5) Camshaft timing segment speed sensor - (6) Fuel temperature sensor - (7) Fuel high pressure pump dosing unit - (8) ECU17CV41 engine control unit - (9) Crankshaft rpm incremental speed sensor - (10) On-line connector - (11) Engine oil temperature and pressure sensor - (12) Coolant temperature sensor

1. Correctly position the engine cable and close the cable retaining clamps to the crankcase.
2. Connect the engine cable to the control unit **(8)**, to the motorised throttle valve actuator connector **(2)**, and to all the sensors and transmitters indicated in the electrical equipment section.

769140 ENGINE CABLES - Remove

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Disconnect the connectors **(3)** from the engine control unit.
2. Disconnect all the connectors between the engine cable **(2)** and the sensors.
3. Remove the engine cable **(2)**, removing the 16 retaining clips **(1)**.

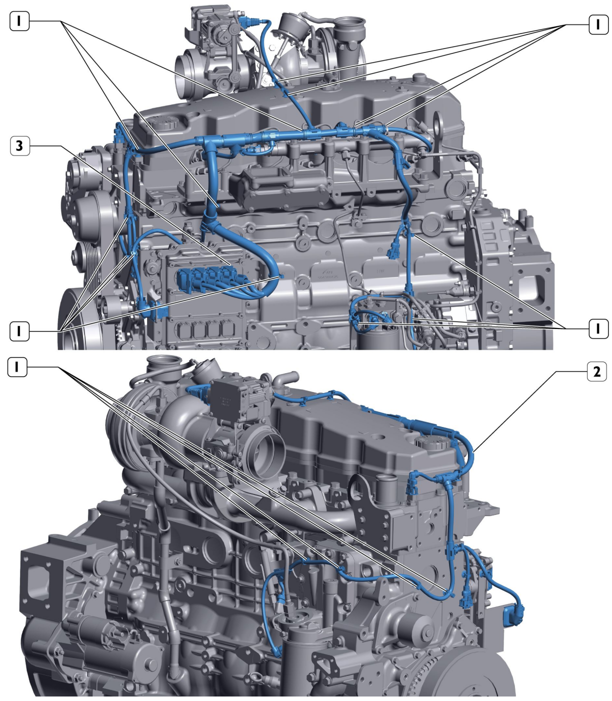


267987 1

769140 ENGINE CABLES - Install

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Correctly position the engine cable **(2)** securing it to the engine using the 16 anchoring plugs **(1)**.
2. Connect the connectors **(3)** to the engine control unit.
3. Connect all the connectors between the engine cable **(2)** and sensors.

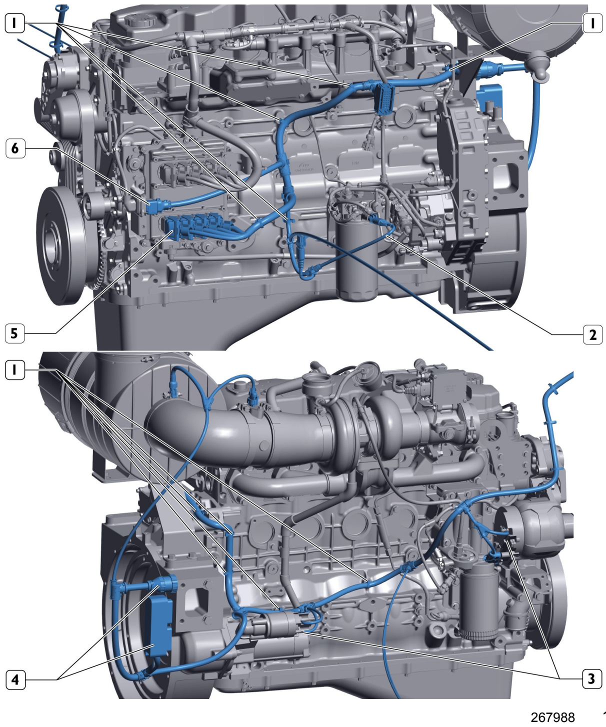


267987 1

769140 ENGINE CABLES - Remove Interconnection cable

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Disconnect connectors J1 and J2 **(4)** from the interface control unit.
2. Disconnect the connectors **(5)** from the engine control unit.
3. Disconnect the connector **(6)** from the engine cable.
4. Disconnect all the connectors between the interface cable **(2)** and sensors.
5. Remove the connections between the interface cable **(2)** and the starter motor and the alternator **(3)**.
6. Remove the interface cable **(2)** removing the 9 anchoring plugs **(1)**.

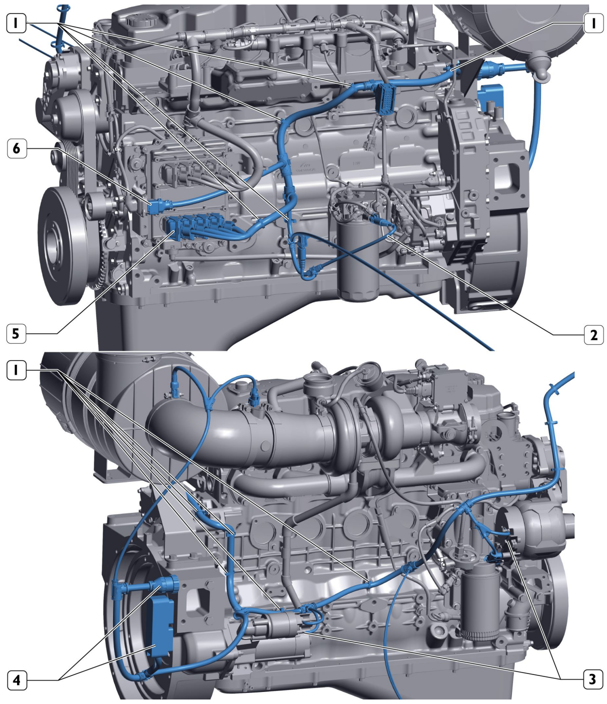


1

769140 ENGINE CABLES - Install Interconnection cable

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

1. Correctly position the interface cable **(2)** securing it to the engine using the 9 anchoring plugs .
2. Secure the connections between the interface cable **(2)** and the starter motor and the alternator **(3)**.
3. Connect all the connectors between the interface cable **(2)** and the sensors.
4. Connect the connector **(6)** to the engine cable.
5. Connect the connectors **(5)** to the engine control unit.
6. Connect the connectors J1 and J2 **(4)** to the interface control unit.



267988 1

ELECTRICAL COMPONENTS - 76

(*) See content for specific models

(*) See content for specific models

Contents

INSPECTIONS, ADDITIONAL SERVICES - 29

(*) See content for specific models

295401 PREPARATIONS - Overview - PT-BOX diagnostic tool and connection to the engine

Product	Configuration
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

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.

With the use of computerized FPT instruments, it is also possible to establish two-way communication with the control unit which, not only provides error code analysis, but also a memory scan in order to obtain any further information required to trace the origin of the fault.

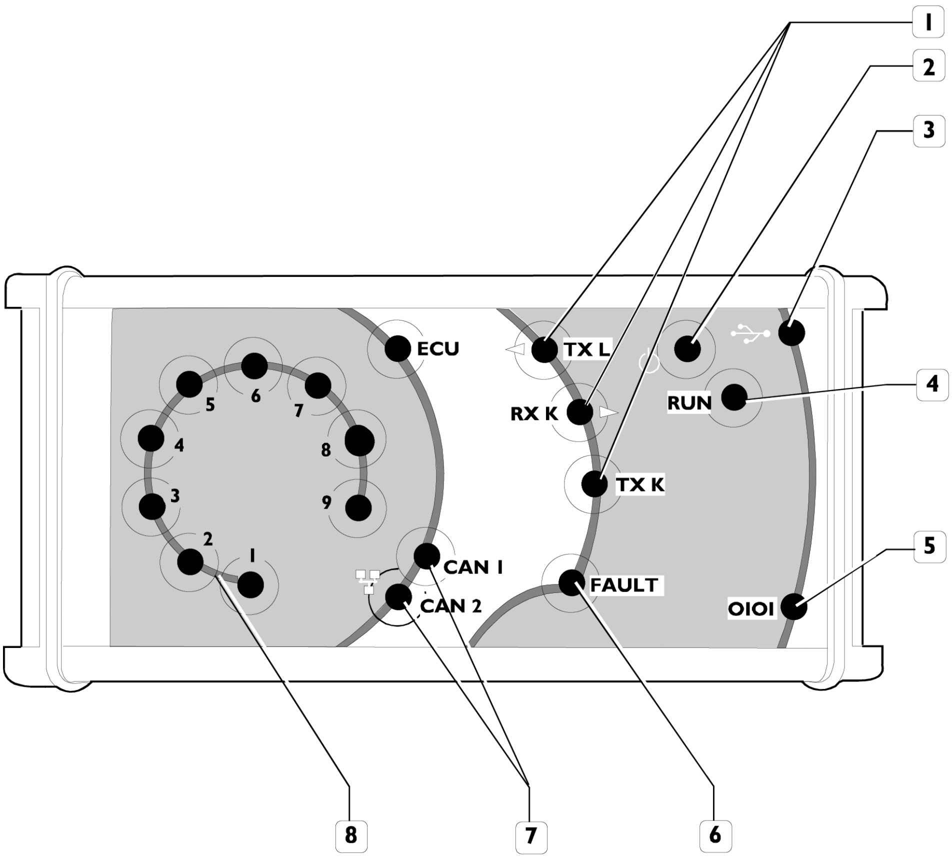
Each time a problem arises and is confirmed, the electronic control unit should be consulted using one of the methods indicated. The diagnostic investigation can then be carried out using the available evidence and measurements, in order to obtain an overview of the operating conditions, after which 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 ECU 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 diagnostics cool from a connector to a Personal Computer.



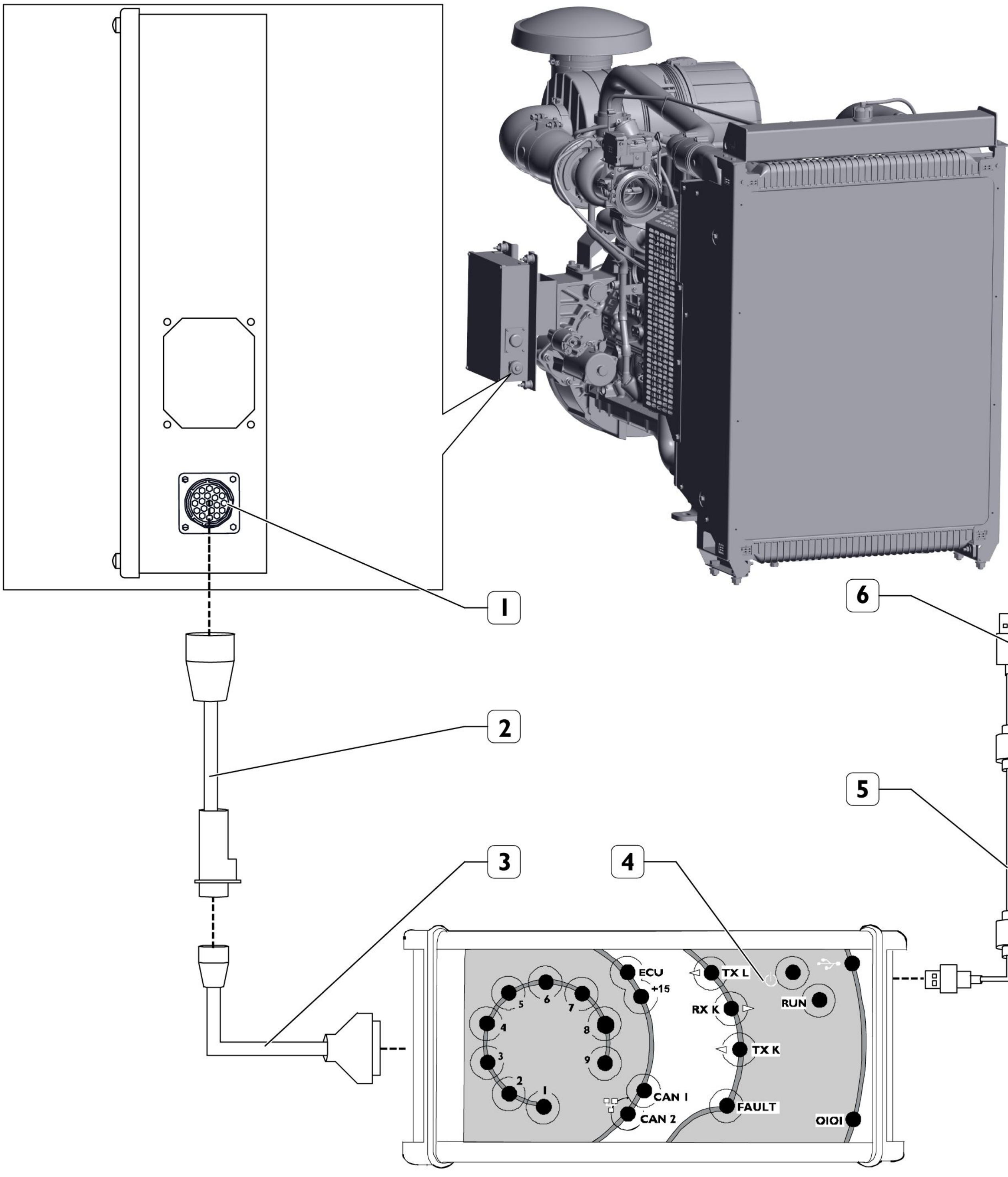
1

(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 identification code, reading fault memories, reading parameters, wiping fault memories and reading the "Flight Recorder" memory;
- Active diagnosis: functional tests of 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-Plus diagnostics instrument to the connector for engine diagnostics



(1) 19-pin engine diagnostic socket - (2) 19 - 30 pin adapter cable - (3) 30 pin cable PT-BOX - (4) PT-BOX - (5) USB connection cable for PT-BOX - (6) USB socket for PC - Panasonic Toughbook

295401 PREPARATIONS - Overview - PT-BOX diagnostic tool and connection to the engine

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL

Introduction

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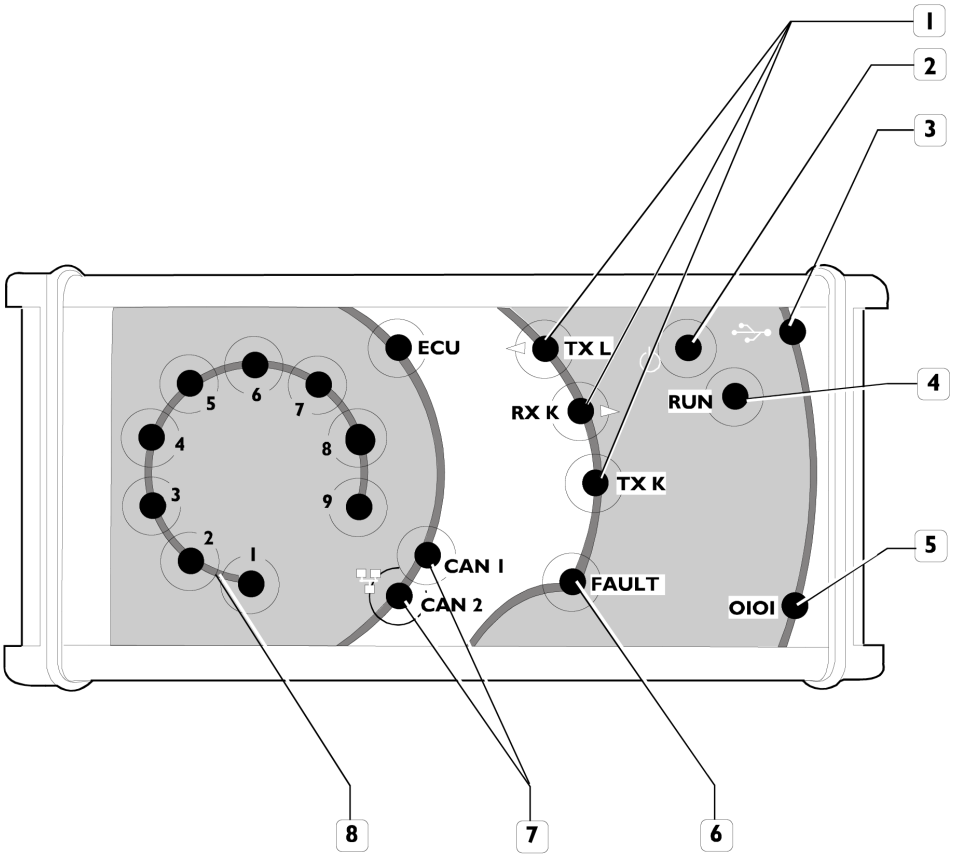

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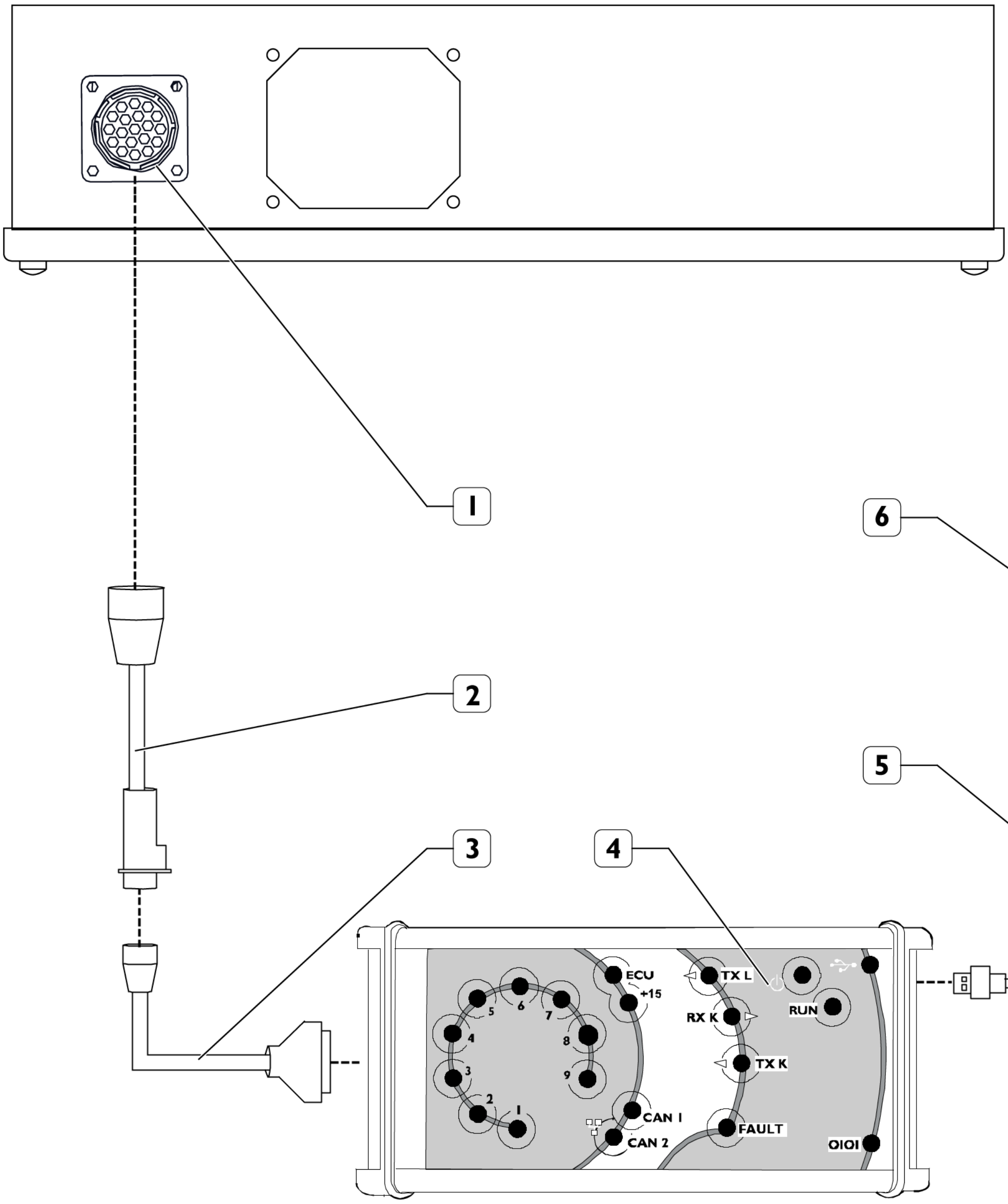
Connection of PT-Plus diagnostics instrument to the connector for engine diagnostics



268543 2

(1) 19-pin engine diagnostic socket - (2) 19 - 30 pin adapter cable - (3) 30 pin cable PT-BOX - (4) PT-BOX - (5) USB connection cable for PT-BOX - (6) USB socket for PC - Panasonic Toughbook

295401 PREPARATIONS - Check - PT-BOX diagnostic tool and accessories

Product	Configuration
F4HGE615C F4HGE615C*V001	ALL
F4HGE615D F4HGE615D*V001	ALL
N67TEVP N67TEVP01.00	ALL
N67TEVP N67TEVP02.00	ALL
N67TEVP N67TEVP05.00	ALL
N67TEVP N67TEVP06.00	ALL

Tool / Material	
30-pin to 19-pin adapter (component of 99327282)	99368555
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
PT-Plus diagnostic tool (F)	99327240
PT-Plus diagnostic tool (I)	99327210
Prepaid card (component of 99327282)	99327301
USB cable with EMI filter (1.8 m.) for ECI (replacement for E.A.SY.)	99327018
USB cable with EMI filter (4.5 m.) for ECI (replacement for E.A.SY.)	99327019
Vehicle communication cable with 32-pin socket (0.42 m.) 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	
PT-Plus diagnostic tool (I)	99327210
PT-Plus diagnostic tool (F)	99327240
Diagnostic interface with prepaid card ((compose of: 99327017, 99327018, 99327019, 99327037, 99327046, 99327301, 99368555)	99327282
Prepaid card (component of 99327282)	99327301
USB cable with EMI filter (1.8 m.) for ECI (replacement for E.A.SY.)	99327018
USB cable with EMI filter (4.5 m.) 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
Vehicle communication cable with 32-pin socket (0.42 m.) for ECI (replacement for E.A.SY.)	99327017
30-pin to 19-pin adapter (component of 99327282)	99368555

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(*) See content for specific models

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	COMPLETE SUPPLY PUMP - Check	77.3 / 22
	OVER PRESURE VALVE - Pressure test	77.5 / 31
99322205 [Assemblies overhaul revolving stand (bearing capacity 1000 daN, torque 120 daNm)]	ENGINE - Disassemble	54.1 / 50
	ENGINE - Assemble	54.1 / 123
99327017 [Vehicle communication cable with 32-pin socket (0.42 m.) for ECI (replacement for E.A.SY.)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327018 [USB cable with EMI filter (1.8 m.) for ECI (replacement for E.A.SY.)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327019 [USB cable with EMI filter (4.5 m.) for ECI (replacement for E.A.SY.)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327037 [Cap for autodiagnosis for ECI (replacement for E.A.SY.)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327046 [Connector 99327037 power supply cable with cigarette lighter socket (EASY Light spare part)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327210 [PT-Plus diagnostic tool (I)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327240 [PT-Plus diagnostic tool (F)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327282 [Diagnostic interface with prepaid card ((compose of: 99327017, 99327018, 99327019, 99327037, 99327046, 99327301, 99368555)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
99327301 [Prepaid card (component of 99327282)]	PREPARATIONS - Check - PT-BOX diagnostic tool and accessories	29.1 / 8
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99340056 [Tool to remove crankshaft rear gasket]	ENGINE - Disassemble	54.1 / 65
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Genuine	Reference	PAGE
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