

USE AND MAINTENANCE  
USO E MANUTENZIONE

# F SERIES

G-DRIVE ENGINES



# F34TE1W

## USE AND MAINTENANCE

## 1 GENERAL INFORMATION

Guarantee . . . . .	5
Spare parts . . . . .	5
Liability . . . . .	5
Safety . . . . .	5
Safety warnings symbols . . . . .	6
Engine technical data . . . . .	7
External view . . . . .	9
Identification plate . . . . .	13
Signs . . . . .	15

## 2 USE

Preliminary checks . . . . .	16
For proper use of the engine . . . . .	17
Interconnection control unit . . . . .	19
Special warnings . . . . .	23
Running in . . . . .	24

## 3 INSPECTION AND MAINTENANCE

Maintenance personnel . . . . .	25
Accident prevention . . . . .	25
Refilling . . . . .	26
Main characteristics of oil . . . . .	28
Coolant fluid filling . . . . .	29
Refuelling . . . . .	30
Programmed maintenance . . . . .	31
Requirements . . . . .	32
Check of water presence in pre-filter or in fuel filter (component not supplied by FPT) . . . . .	33
Check engine lubricant oil level . . . . .	34
Check engine coolant level . . . . .	36
Check tension and condition of ancillary belt . . . . .	37
Change engine lubricant oil . . . . .	39
Change engine lubricant oil filter . . . . .	41
Change fuel pre-filter . . . . .	43

Replace fuel filter . . . . .	44
Change air filter . . . . .	46
Clean the heat exchanger (radiator) . . . . .	47
Replacing the blow-by filter . . . . .	48
Change the ancillary belt . . . . .	51
Visually inspect turbocharger . . . . .	54
Visual inspection of the alternator . . . . .	55
Clean/replace radiator pressure cap . . . . .	56
Change engine coolant . . . . .	57
Move the engine . . . . .	58
Disposal of waste . . . . .	59
<b>4 LONG PERIOD OF INACTIVITY</b>	
Preparing the engine for a long period of inactivity . . . . .	60
Engine start-up after a long period of inactivity . . . . .	62
<b>5 ENGINE MALFUNCTIONS</b>	
Engine fault . . . . .	63
In the event of a fault: . . . . .	64
<b>6 BEHAVIOUR IN EMERGENCY</b>	
For personal safety . . . . .	65
SAE classification of oils in relation to the ambient temperatures of use of the engine/vehicle . . . . .	67



# 1 - GENERAL INFORMATION

## Guarantee

For the engine to perform at its best and to be covered by the FPT warranty, pay close attention to the instructions provided in this manual; failure to observe the instructions could invalidate the warranty.

## Spare parts

Always use original FPT spare parts. This will enable the engine to run as efficiently as it did originally.

The use of non-original spare parts not only invalidates the warranty, but also means that FPT cannot be held responsible in any way during the entire life cycle of the engine.

## Liability

The manufacturer shall be held responsible provided that the checks and maintenance work indicated and described in this manual are carried out; it shall therefore be necessary to provide proof that such maintenance work has been carried out. Non-routine maintenance work must be carried out by qualified technicians from workshops belonging to the FPT network, using the tools and equipment that have been specifically provided.

## Safety





The following information is intended to encourage caution when using the engine, so as to avoid damage to persons or property as a result of improper or incorrect behaviour.

- The engines must only be used for the purposes declared by the Manufacturer.
- Tampering, modifications and the use of non-original spare parts could adversely affect the proper operation of the engine and its safety during use; changes must not be made to the wiring and the units that equip the engine as well as its connections to external electrical networks.
- Pay attention to the engine's moving parts, those at a high temperature and the circuits with pressurised fluids; its electrical equipment is a source of electrical voltage and currents.
- The exhaust gas emitted by the engine is harmful to health.
- The engine must only be handled with suitable lifting devices and using the specific eyebolts provided on the engine.
- The engine must not be started and used before satisfying the safety requirements for the equipment in which it is installed and before ensuring compliance of the latter with the standards and local laws.
- The operations required for guaranteeing the best state of use and preservation of the engine must be carried out by personnel with proven experience using instruments considered appropriate by FPT.

Additional safety recommendations can be found in the CHECKS AND MAINTENANCE chapter.

## Safety warnings symbols

You will find these symbols on the following pages; follow the instructions to which they refer, for your own safety and that of your engine.

<p><b>Risk of injury:</b> failure to comply with these instructions can result in the risk of serious injury.</p>	
<p><b>Risk of serious damage to the engine:</b> the partial or total non-observance of these instructions could cause serious damage to the engine and may nullify the warranty.</p>	
<p><b>General risk:</b> combines the risks of both the signs described above.</p>	
<p><b>Safeguarding the environment:</b> indicates the correct behaviour so that vehicle use is as environmentally friendly as possible.</p>	

## Engine technical data

The technical code and the serial number are indicated on a data plate located in different parts of the engine depending on the model: flywheel housing, tappet cover, other.

Code	F34TE1W
Engine family	F5HFL464D*F019
Cycle	4-stroke diesel
Number and arrangement of cylinders	4, in line
Bore x stroke	<b>99 mm x 110 mm</b>
Total displacement	<b>3400 cm<sup>3</sup></b>
Air supply	Turbocharged
Injection type	Electronically controlled common rail
Compression ratio	16.5 : 1
Cooling	Liquid based
Direction of rotation of the engine	Anticlockwise (seen from flywheel side)
Control system	Electronic
Dry weight	<b>470 kg</b> (G-Drive configuration)

Electrical system	12 V
Battery capacity	–
Pick-up current	–
Starter motor maximum output	<b>4.2 kW</b>

Performance [gross] (*)		F34TE1W
Not emitted	Continuous Power (1)	<b>39.4 kW @ 1800 RPM</b>
	Prime Power (2)	<b>49 kW @ 1800 RPM</b>
	Stand-by Power (3)	<b>54 kW @ 1800 RPM</b>
Fan consumption	<b>2.2 kW @ 1800 RPM</b>	

Performance [net] (*)		F34TE1W
Not emitted	Continuous Power (1)	<b>37.2 kW @ 1800 RPM</b>
	Prime Power (2)	<b>46.8 kW @ 1800 RPM</b>
	Stand-by Power (3)	<b>51.8 kW @ 1800 RPM</b>
Performance conditions	Temperature °C Altitude a.s.l. m	<b>≤ 40</b> <b>≤ 1000</b>

(\*) Power at the flywheel in accordance with directive 97/68 CE (without fan), after **50 h** of operation, tolerance  $\pm 3\%$  fuel EN590;

Test in compliance with specification 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 Continuous power is that which a generating set is capable of delivering continuously for an unlimited number of hours per year, according to the specified maintenance intervals and under standard ambient conditions.

(2) Prime Power is the maximum power available with variable loads for a limited number of hours. The mean power delivered during a period

of **24 h** must not exceed **80%** of the prime power declared between the specified maintenance intervals and in standard ambient conditions. An overload of **10%** is permitted for **1 h** every **12 h** of operation.

(3) Stand-by power is the maximum power available for a period of 500 hours/year with a mean load factor of **90%** of the declared stand-by power. No type of overload is permitted for this.

---

#### General prescriptions

It is severely prohibited, under penalty of cancellation of the warranty and of the responsibilities of FPT, to change the characteristics indicated above.

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

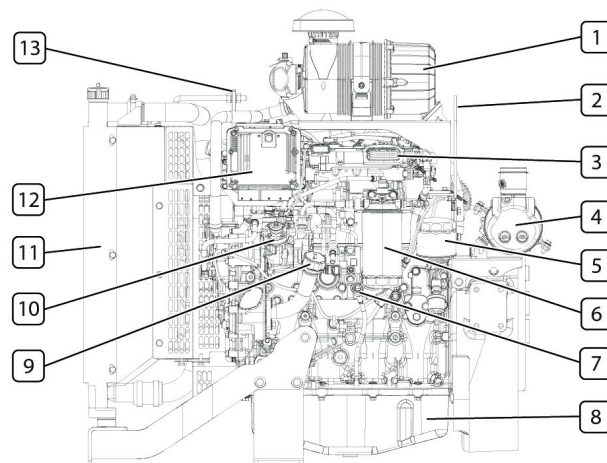
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## External view

### F34 (F5HFL464D\*F019)

1. Air filter
2. Lifting eyelet
3. Engine wiring
4. DOC+PM Cat
5. Oil filter
6. Fuel filter
7. Oil dipstick
8. Oil sump
9. Oil filling cap
10. Injection pump
11. Radiator
12. Engine controller
13. Lifting eyelet

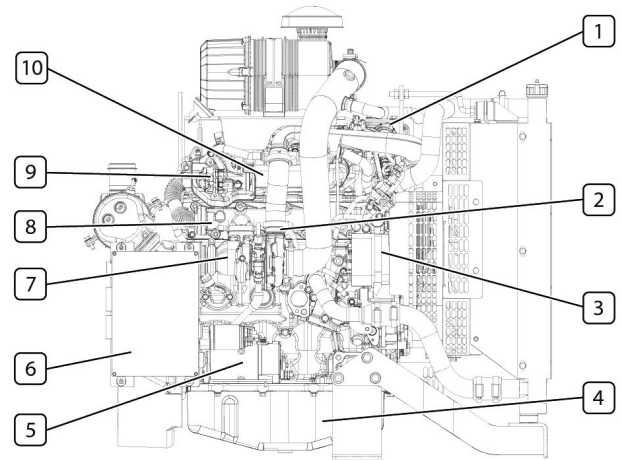


**NOTE:** The lifting eyelets are sized to move the engine only. It is not permitted to use these eyelets to lift the engine together with other parts

that make up the genset, for example single-phase / three-phase electric machines, lower crankcase, etc.

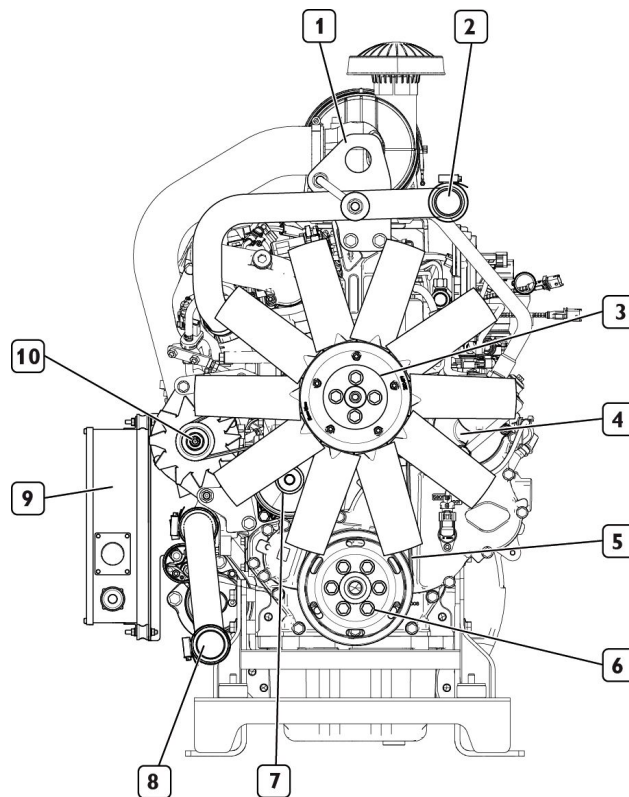
### F34 (F5HFL464D\*F019)

1. Throttle body
2. Turbocharger air outlet
3. Alternator
4. Oil sump
5. Starter motor
6. Interface control unit
7. Turbocharger
8. Exhaust manifold
9. EGR valve
10. EGR heat exchanger



**F34 (F5HFL464D\*F019)**

1. Lifting eyelet
2. Radiator inlet pipe
3. Fan
4. Blow-by filter
5. Auxiliary member belt
6. Crankshaft pulley
7. Water pump
8. Radiator outlet pipe
9. Interface control unit
10. Alternator

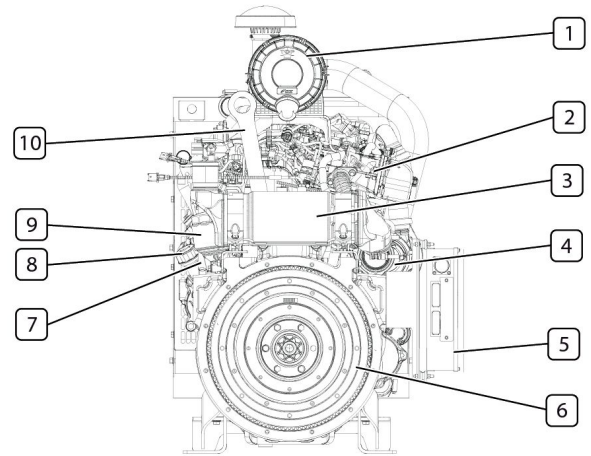


**NOTE:** The lifting eyelets are sized to move the engine only. It is not permitted to use these eyelets to lift the engine together with other parts

that make up the genset, for example single-phase / three-phase electric machines, lower crankcase, etc.

### F34 (F5HFL464D\*F019)

1. Air filter
2. Flow valve
3. DOC+PM Cat
4. Turbocharger
5. Interface control unit
6. Flywheel
7. Fuel filter
8. Oil filling cap
9. Oil filter
10. Lifting eyelet

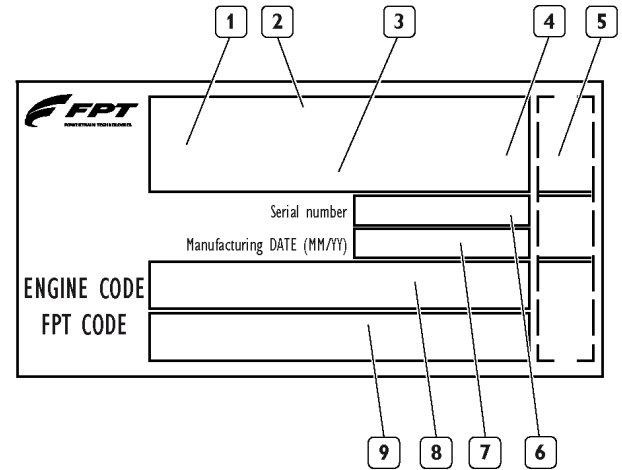


**NOTE:** The lifting eyelets are sized to move the engine only. It is not permitted to use these eyelets to lift the engine together with other parts

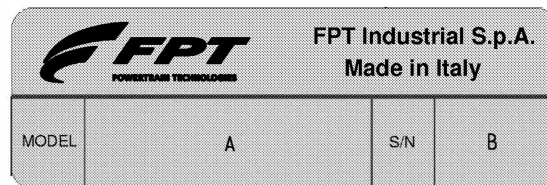
that make up the genset, for example single-phase / three-phase electric machines, lower crankcase, etc.

## Identification plate

1. FPT code
2. FPT code and bar code
3. Client Code with engine registration number
4. Client Code with date of manufacture (mm/yy)
5. Space for bar code
6. Engine serial number
7. Month and year of manufacture
8. Engine theoretical code
9. FPT code



- Box "A": Model
- Box "B": Engine serial number



## Signs

Some warning labels (below the description) are affixed to the engine.



Lifting point (only the engine).



Fuel filling cap  
(on the tank, if present).



Lubricant oil filling cap.



Lubricant oil level dipstick.



Risk of burns:  
Expulsion of pressurised hot water.



Risk of burns:  
Presence of parts at high temperature.



Risk of fire:  
Presence of fuel.



Risk of injury  
from moving parts:  
Presence of fans, pulleys, belts or other.

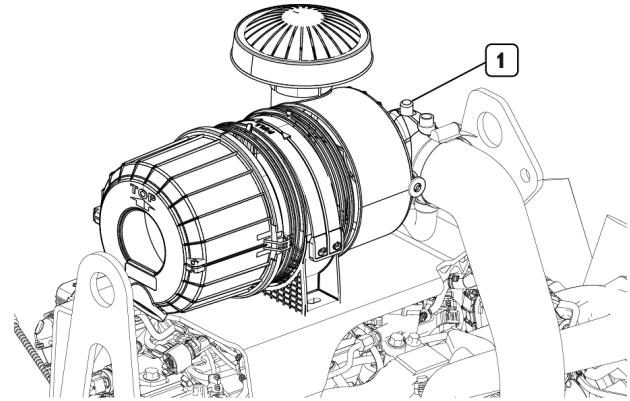


## 2 - USE

### Preliminary checks

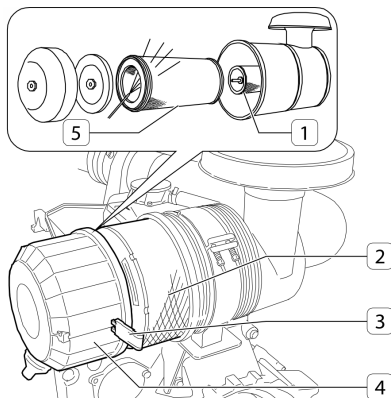
Before starting the engine each time:

- Check and top up the level of the technical fluids, if necessary (fuel, engine Oil and coolant).
- Make sure that the batteries are efficient and that the terminals are correctly connected.
- Check that the coolant and fuel circuit connectors are intact and there is no sign of any leaks. Check that the pipe collars are efficient.
- Make sure that the intake air filter is not clogged or blocked, also checking that the visual indicator **(1)** on the filter does not show the "red" signal. The air filter clogged visual indicator **(1)** shows when maintenance needs to be carried out and optimises filter operation. The sensor **(1)** stays in the blocked alarm position ("red") until it is reset.



If the air filter is clogged, ensure it is cleaned:

- Remove the air filter cover **(4)** after having released the two quick-closing hooks **(3)**.
- Remove the filter **(5)**. During this operation, take care to ensure that no dust enters the sleeve.
- Check there are no impurities present. If there are, clean the filter element as indicated below.
- Blow dehumidified compressed air on the filtering element, working from the inside out (maximum pressure **200 kPa**).
- Check the condition of the air filter before refitting it. Replace if there is any sign that it is broken or there are any tears.
- Check the condition of the gasket at its base.
- Some filter systems are fitted with a second filter element **(1)** which does not require cleaning.
- Position the filter **(5)** in its seat.
- Replace the cover **(4)** of the air filter and lock it in place using the two quick release hooks **(3)**.



#### Risk of damage

Do not use detergents or diesel to clean the air filter. Never strike the filter element with tools.



Make sure that the parts are fitted correctly. Incorrect assembly could cause the engine to take in unfiltered air, causing serious damage to 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

### For proper use of the engine

- Before starting the engine each time, check that the tank contains a sufficient amount of fuel.
- Avoid prolonging the duration of the start control.
- Follow the indications provided in the maintenance plan.
- During use, check periodically that:
  - the temperature of the engine coolant does not reach the alarm thresholds;
  - the oil pressure remains within the expected normal values;
- The speed and power values must comply with indications specified in the technical-commercial documentation.
- Particular attention must be paid to engines that equip the emergency generator sets for which frequent efficiency checks are required in order to ensure they start promptly whenever required.

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#### General prescriptions

If using in extremely dusty environments and on the basis of the final configuration of the current generator, soundproofed or without sound-proof casing, suitable protections are required for most sensitive components.



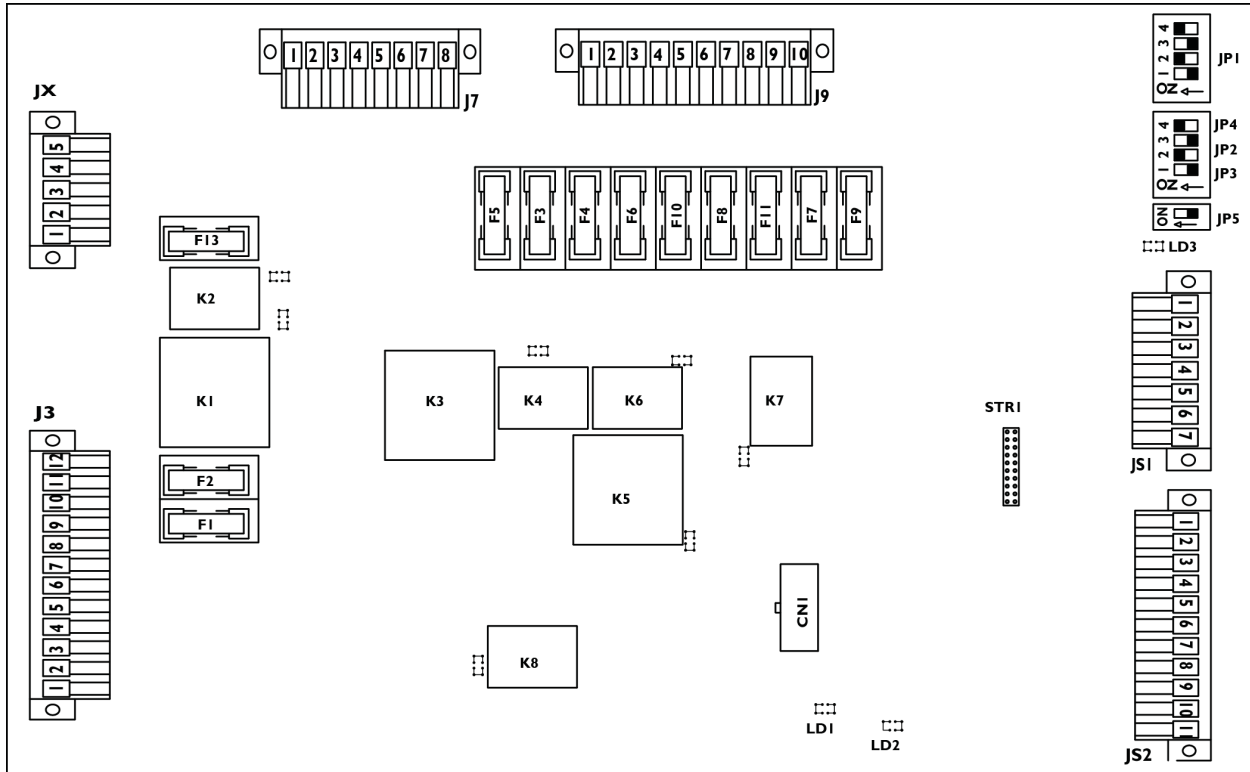
Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty

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## Interconnection control unit

To permit the correct electric operation of the control unit, a connection unit has been installed in the engine. The connection unit controls the engine's electronic control system and the power unit system.

Some information is provided below concerning its components and functions that are controlled by programming switches.



Remote-control switches

(K1) ATS auxiliary sensor

- (K2) After run B maintenance
- (K3) Main after run
- (K4) Starter motor
- (K5) SCR heating
- (K6) Fuel filter heating
- (K7) Fuel pre-filter heating
- (K8) Starter motor control
- (CN1) Diagnosis

Fuses

- (F1) Exhaust flap - **20 A** (yellow)
- (F2) NOx auxiliary sensor - NH3 - **20 A** (yellow)
- (F3) Control unit power supply - **30 A** (green)
- (F4) Ignition - **20 A** (yellow)
- (F5) ATS auxiliary sensor - **40 A** (orange)
- (F6) SCR heater - **20 A** (yellow)
- (F7) Battery positive - **5 A** (beige)
- (F8) Fuel pre-filter and filter heating - **15 A** (blue)
- (F9) Fuel pre-filter heating - **15 A** (blue)
- (F10) Positive on key switch - **10 A** (red)
- (F11) Low water level sender - **10 A** (red)
- (F13) Main after run - **5 A** (red)

**Selecting engine speed control and accessory functions**

Function programming described below is possible by switching the respective positions of the JP switches.

**(JP1) (Engine speed selection)**

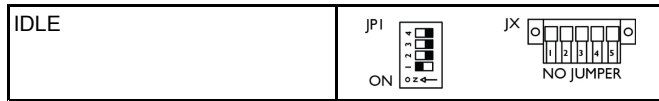
1500 RPM 50 Hz	
1800 RPM 60 Hz	
IDLE	

Select an engine speed of **1500 RPM**, **1800 RPM** or idle by acting directly on the JP inside the interface housing.

Correctly position the microswitches as indicated in the figure to set the required engine speed.

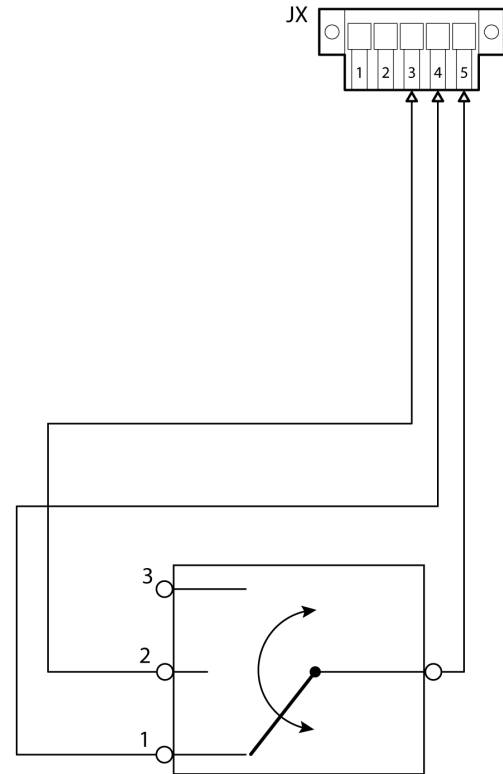
**(JP1) (Select an engine speed of 1500 rpm, 1800 rpm or idle) (+JX) (Three-position switch on the outside of the electric panel is the responsibility of the bodybuilder)**

1500 RPM 50 Hz		
1800 RPM 60 Hz		



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 details in the block wiring diagram.



Position 1: **1500 RPM**

Position 2: **1800 RPM**

Position 3: engine idle speed (pin 3 not connected)

### Select the diagnostics function

Diagnostic position	<p>JP2</p> <p>ON</p>
Operating position (prearranged)	<p>JP2</p> <p>ON</p>

### (JP3) Setting of cold start heating device (engine water heater)

Connected	<p>JP3</p> <p>ON</p>
Not connected (predefined)	<p>JP3</p> <p>ON</p>

### (JP4) Cold Start Lamp

Connected	<p>JP4</p> <p>ON</p>
Not connected (predefined)	<p>JP4</p> <p>ON</p>

### (JP5) CAN line setting

Connected	<p>JP5</p> <p>ON</p>
Not connected (predefined)	<p>JP5</p> <p>ON</p>

## Special warnings

### High coolant temperature

In the event of an excessive temperature or the signalling of the alarm, disengage the load and stop the engine in order to check the condition of the cooling circuit.

Also check and have the following checked:

- A. condition of the auxiliary members' belt;
- B. operation of the thermostatic valve;
- C. cleanliness of the heat exchanger (radiator).



#### 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

### Low lubricant oil pressure

Regularly check that the oil pressure remains within the normal values permitted. If the value is too low, check the oil level and top up if necessary following the instructions provided in the section **3-25**.

If the fault persists, contact the Technical Service Centre.

### Presence of water in the fuel filter

It is recommended to drain the water from the filters before the relative warning light turns on. Do not use the engine if the tank only contains the quantity of fuel kept as reserve; this condition promotes the formation of condensate and the intake of sludge or air, causing the engine to stop.



#### Contamination, fire

When refuelling, always make sure that no solid or liquid pollutants enter the fuel tank; remember that it is prohibited to smoke or use naked flames when refuelling.

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



#### Risk of burns

Never loosen the high pressure fuel circuit connectors.

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

## Power unit management

After stopping the engine, the control unit's microprocessor saves various parameters in the EEPROM memory, including the fault record, so that the data is available at the next engine start up.



#### Risk of damage

After turning the engine off using the key switch (key off), wait 120 seconds before intervening on the engine's electrical system and/or the power supply batteries. After "Key off" you must ensure there is power in order to be able to complete the AFTER-RUN procedure

Partial or complete non observance of these prescriptions can lead to serious damages to the vehicle

## Intake and exhaust circuit inefficiencies

Regularly check that the air inlet circuit is clean. The maintenance intervals indicated in the manual can vary depending on the conditions of use of the engine.

In particularly dusty environments, maintenance must be carried out at more frequent intervals than those indicated in the chapter **3-25**.





#### Risk of burns

Visually check that the exhaust circuit is not clogged or damaged, to prevent hazardous or toxic emissions inside the pipes.

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

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### Electrical start-up system irregularities

Periodically check, especially in winter, that the batteries are clean and in good working order. Carry out the checks and topping-up operations as indicated in the chapter **3-25**.

Should it be necessary to replace the batteries, always respect the capacity and minimum discharge current intensity requirements.

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#### General prescriptions

Contact a specialized workshop and check the battery and the efficiency of the charging system if the voltmeter shows a voltage below 11 V (for systems with a rated voltage of 12 V), or 22 V (for systems with a rated voltage of 24 V).

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

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#### Risk of skin irritation or allergic reactions

The batteries contain an acid solution that will burn the skin and corrode clothing; when checking them, always wear protective clothing, gloves and goggles.

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

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### Battery or alternator recharging faults

Periodically check the cleanliness, condition and correct tensioning of the drive belt.

---



#### Risk of injury:

The ancillary members are located under protective grilles. Their removal must be carried out only when the engine is not turning.

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

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### Running in

Thanks to the new engine technology, no running-in is required.

## 3 - INSPECTION AND MAINTENANCE

### Maintenance personnel

The engine control and maintenance operations described in the following chapter require training, experience and compliance with current safety regulations. For this reason, the following operations must be carried out by special technicians.

Checks in periods of use: by workshop personnel or if necessary by the genset operator.	
Periodic maintenance: by qualified personnel using suitable equipment and adequate means of protection.	
Extraordinary maintenance: by qualified personnel from Authorised Service Centres who have detailed technical information and specific equipment.	

The most qualified Service Centres are those included in the FPT Technical Service Network.

### Accident prevention

- Always wear safety footwear, gloves and suits.
- Do not wear loose clothing, rings, bracelets and/or necklaces near the engines or moving parts.
- Wear protective gloves and goggles while:
  - filling the batteries with acid solution
  - cleaning clamps and battery terminals
  - filling up with anti-corrosion and antifreeze fluids
  - changing or filling the lubricant oil (hot engine oil can cause burns. It is recommended to perform these operations only when their temperature is lower than **40 °C**).
  - the use of compressed air and/or pressurised steam jets.
- Mask with respirator and filter, compliant with current regulations, on the basis of the solvents used and their product safety sheets.
- All the maintenance operations are to be carried out with the engine off and after having checked that the temperature of the engine surfaces do not exceed **40 °C**.
- Wear a protective helmet if working in an area with suspended loads or overhead systems.
- Use protective creams for hands.
- Immediately replace wet gloves.
- Always keep the engine clean, removing spots of oil, diesel and coolant.
- Return oily rags to fire-proof containers.
- Do not leave foreign objects on the engine.
- On the basis of the safety sheets of the products handled, use PPE which is suitable for the aforementioned substances and compliant with current regulations.

- Use containers which are compliant with environmental and safety standards in force for the collection of spent liquids and fluids.

At the end of the maintenance interventions, make sure that all parts which have been removed are correctly refitted. Before starting the engine:

- restore all safety protections which were previously removed;
- check that no tools, equipment or other generic items used during maintenance have been left on the engine and/or in the engine compartment;
- Make sure that all necessary precautions are taken allowing the engine to be switched off immediately if it begins to malfunction.

These operations must be carried out by competent personnel, certified according to current regulations in force in the country of use of the unit and which differ depending on the type of connection to the distribution network.



**Risk of injury:**  
Do not carry out maintenance interventions with the power supply active: always check equipment grounding. During diagnostics and maintenance, make sure that your hands and feet are dry and if possible use isolating supports. Failure to comply with these prescriptions can result in the risk of serious injury



**Risk of electrocution**  
Before carrying out any maintenance, set the selector to OFF and disconnect the battery. This will prevent the emergency genset from activating unexpectedly. Failure to comply with these prescriptions can result in the risk of serious injury



**Risk of injury:**  
While carrying out checks and maintenance operations, strictly observe the requirements indicated by the Manufacturer of the power generator and installer of the electricity generation system, to ensure maximum safety for maintenance personnel. Failure to comply with these prescriptions can result in the risk of serious injury

## Refilling

Parts to be refilled	F5HFL464D*F019 litres (kg)
Coolant circuit (1)	-
Lubrication circuit (2) Total capacity (3)	— —
Periodic changes: engine sump at minimum level Sump at maximum level	6 L ( 5.28 kg) 8 L ( 7.04 kg)
Fuel tank (4)	-

(1) The quantities refer to the standard engine configuration. The coolant should comply with standard ASTM D-6210. Concentrated coolants should be used mixed **50%** with water. FPT recommends using original PETRONAS products, Parafu HT — Akcela Actifull OT/Ambra Actifull OT.

(2) Refer to the 'Main characteristics of the oil'; FPT recommends using original PETRONAS products.

(3) The amounts indicated refer only to the first fill of the engine, oil sump and filter.

(4) Fuel tank not supplied by FPT. Refer to the data supplied by the supplier/manufacturer of the genset. Only use fuel which meets the requirements of international standards ASTM D975 or EN 590. The Manufac-

turer of the genset is responsible for any information regarding fuel tank capacity as it is subject to variations based on the configuration of the genset itself.

The quantities indicated refer to the total capacity of the G-Drive including the capacity of the engine, radiator and pipes.

## Main characteristics of oil

Quantity of oil	SAE grade	Base stock	International specifications	Sulphur content in the fuel
Premium	10W-40	Semi-synthetic	API CJ-4 ACEA E6/E9	< 15 ppm
Cold climate	5W-30	Synthetic	API CJ-4 ACEA E6/E9	< 15 ppm

Quantity of oil	SAE grade	Base stock	International specifications	Sulphur content in the fuel
Not authorised	Monograde			

## Coolant fluid filling

To start the engine and if the coolant circuit needs to be filled with a significant amount of coolant, proceed as indicated below:

- Unscrew the plug **(1)** on the exchanger.
- Refill the engine and the heat exchanger until the cooling circuit has been completely refilled using fluids.
- With the coolant filler cap open, start the engine and let it idle for approx. **1 min.** This helps to fully expel the air in the cooling circuit.
- Stop the engine and top up with the required amount.



### General prescriptions

The failure to observe the aforesaid procedure does 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



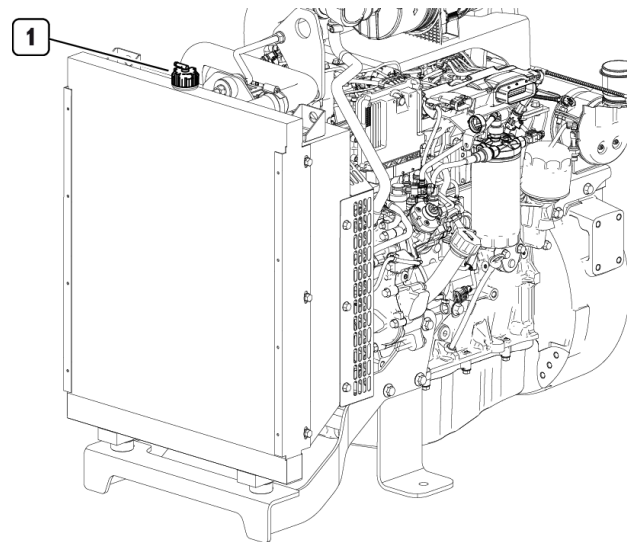
### Risk of burns

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



## Refuelling

Only use diesel that complies with the ASTM D975 or EN 590 standard and which is generally commercially available. Fuel additives are not recommended.

The use of additives can limit the warranty services offered for the equipment.

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Risk of burns

Pay maximum attention when refuelling, making sure that solid or liquid pollutants do not enter the tank; please remember that smoking is prohibited while refuelling.

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

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## Winter diesel


The degree of fluidity of the diesel oil can be reduced at low temperatures due to the separation of the paraffin. This results in the filters becoming clogged.


The ASTM D975 or EN590 specifications distinguish different classes of diesel fuel, identifying the characteristics of those that are best adapted to low temperatures.


Oil companies must respect these standards, which provide for the distribution of fuels adapted to the climatic and geographical conditions in various countries.

## Programmed maintenance

The frequencies indicated below take into account factors of use of different engine uses; the most suitable duration of the maintenance intervals for the different applications will be indicated by the maintenance personnel based on the use and operating conditions of the engine.

 Checks in periods of use	Frequency
Check for water in the fuel pre-filter (*)	Daily
Engine lubricant Oil level check	Daily
Engine coolant level check	Daily

 Planned maintenance	Frequency
Tension and condition check of auxiliary members' belt	<b>600 h</b>
Engine lubricant oil replacement	<b>600 h (2)</b>
Lubricant oil filter replacement	<b>600 h (2)</b>
Fuel pre-filter replacement (*)	<b>600 h (1)</b>
Replacing the fuel filter	<b>600 h (1)</b>
Clean heat exchanger (radiator)	<b>600 h</b>
Air filter replacement	<b>1200 h (2)</b>
Change Blow-by filter	<b>1800 h</b>

 Extraordinary maintenance	Frequency
Auxiliary members' belt replacement	<b>3000 h</b>
Turbocharger visual inspection	<b>1200 h</b>
Visual inspection of the alternator	<b>3600 h</b>
Clean/replace radiator pressure cap	<b>3600 h</b>
Engine coolant replacement	<b>3000 h (2)</b>

(\*) Component not supplied by FPT

1. Maximum period relating to the use of high quality fuel (specification ASTM D975 or EN 590); this is reduced in the event of fuel contamination and alarm signals caused by filter clogging and/or the presence of water in the pre-filter. The filter clogging signal indicates that the filter must be replaced. If the warning light of water present in the pre-filter does not go off after drainage, then the pre-filter must be replaced.
2. The frequency is a function of the environmental conditions and product wear/efficiency. After long periods of inactivity of the engine, carry out the checks before starting the engine. If the warning signal is given indicating that the filter is clogged, the filter must be replaced.

### General prescriptions

If using fuels with a sulphur percentage greater than 0.5%, the intervals for changing the engine oil, engine oil filter and blow-by filter must be halved or suitably modified; please refer to the FPT Service Network for support.

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 prescriptions

The operations indicated above require the use of specific equipment which will guarantee that the result is safe, effective and of a good quality. It is recommended that these operations are carried out by qualified personnel belonging to the FPT Service Network.

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

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## Requirements

- Do not disconnect the battery supply while the engine is running.
- Do not perform arc welding near the engine without first removing its electrical wiring.
- After performing all maintenance operations that require disconnection of the batteries, make sure the clamps have been securely reconnected on the poles.

- Do not use a battery charger to start the engine.
  - Do not paint the devices, components and electrical connectors of the engine equipment.
  - Electrically disconnect the battery/batteries before performing any electrical work.
  - Contact the Manufacturer before installing any electronic equipment.
- 



#### General prescriptions

Do not carry out operations which could change the calibration of the injection pumps. Calibration of the injection pump has been carried out during the engine system tests on the basis of use and final destination.

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

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## Check of water presence in pre-filter or in fuel filter (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

In the case of a high risk of refuelling with fuel polluted with foreign agents and water, the following check should be performed.

Proceed with the engine not running.

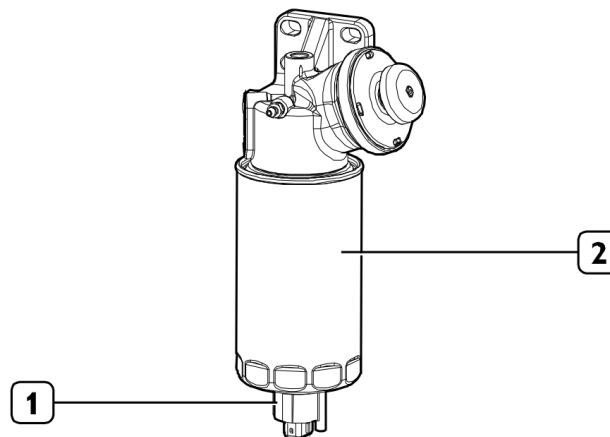
- Place a container for collecting liquids under the pre-filter **(2)**.
- Unscrew the plug **(1)** located at the bottom of the filter; in some fittings the plug includes the fuel water sensor.
- Drain the fluid until only fuel comes out.
- Fully re-tighten the plug manually.
- Dispose of the drained fluids according to current requirements.



### Contamination, fire

Clean the exhaust valve **(1)** before carrying out the operation in order to reduce the risk of system contamination.

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



## Check engine lubricant oil level



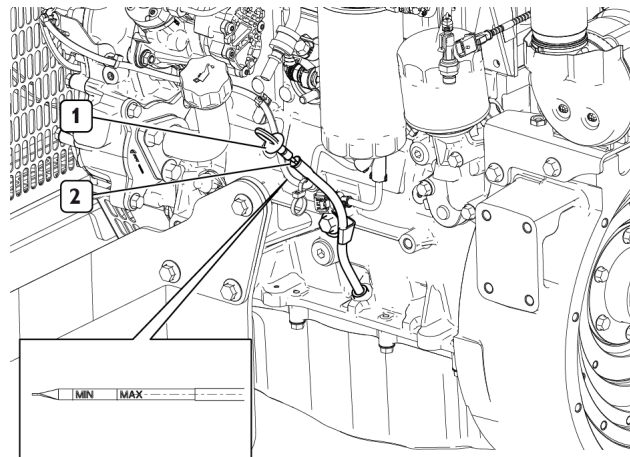
### Hazard warning

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

Only proceed with the engine stopped and at a low temperature, so as to avoid the risk of burning.

- Remove the dipstick **(1)** and check that the oil level is between the "MIN" and "MAX" limits.
- If it is difficult to assess the level of the oil, clean the dipstick **(1)** using a clean cloth and then put it back into its seat **(2)**. Remove the dipstick **(1)** again and check the level.



- If the level is low, top-up with the specified oil as indicated on the page **3-26**.
- Unscrew the plug **(1)** and introduce oil through the filler **(2)**.
- Use the dipstick **(3)** to check that the oil does not exceed the "MAX" level.

---

#### General prescriptions

Clean the oil plug before carrying out the operation to minimize the risk of contaminating the system.

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

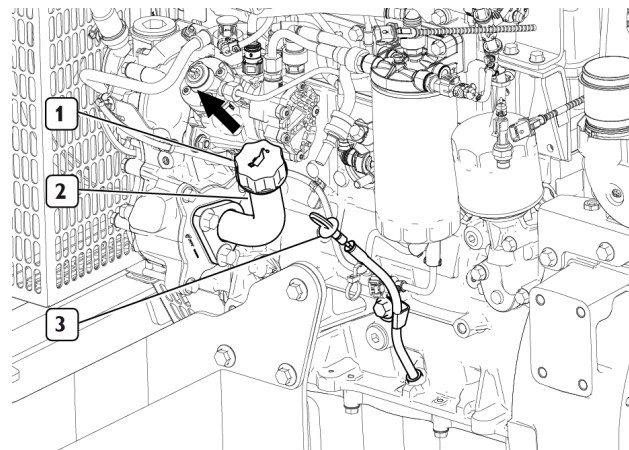


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#### Risk of damage

Make sure that the dipstick is inserted completely and that the oil filler cap is completely tightened in a clockwise direction.

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



## Check engine coolant level

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### 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

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### General prescriptions

Clean the oil cap before performing the operation so as to minimize the risk of contaminating the system.

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

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Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Remove the top-up plug **(1)** on the heat exchanger.
  - When the engine is cold, make sure that the level of the fluid in the exchanger is above the minimum level.
  - Top-up if necessary according to the indications provided in REFILLING **3-26**
- 



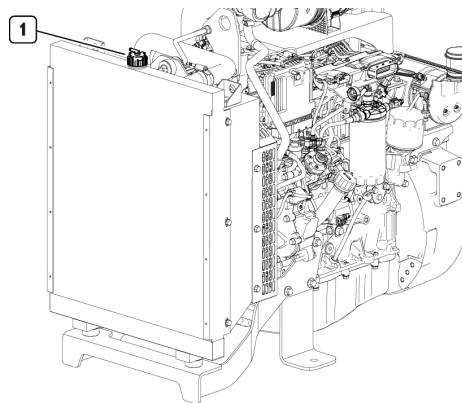
### General prescriptions

If refilling is required frequently, cooling circuit diagnostics need to be carried out.

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

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Refill the circuit, if necessary, ensuring that the fluid does not completely fill the internal volume of the exchanger. This is to accommodate any increase in volume caused by the rise in temperature.



### 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

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### 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

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## Check tension and condition of ancillary belt



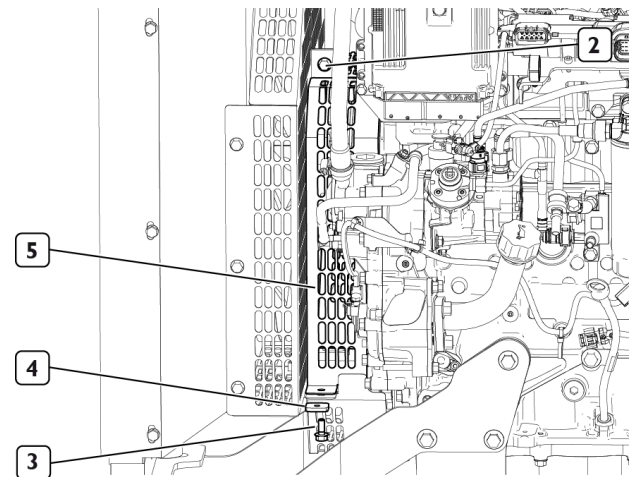
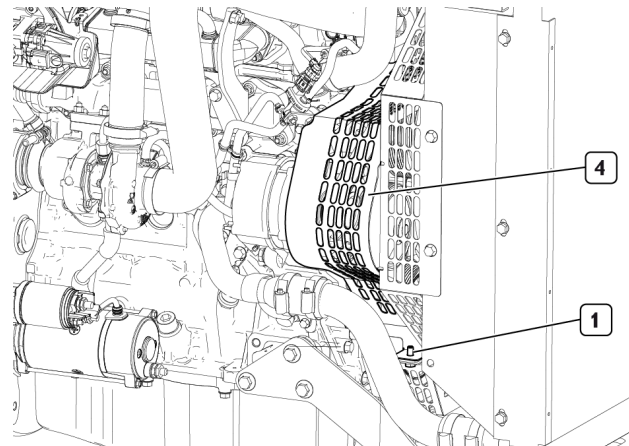
### Hazard warning

Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).

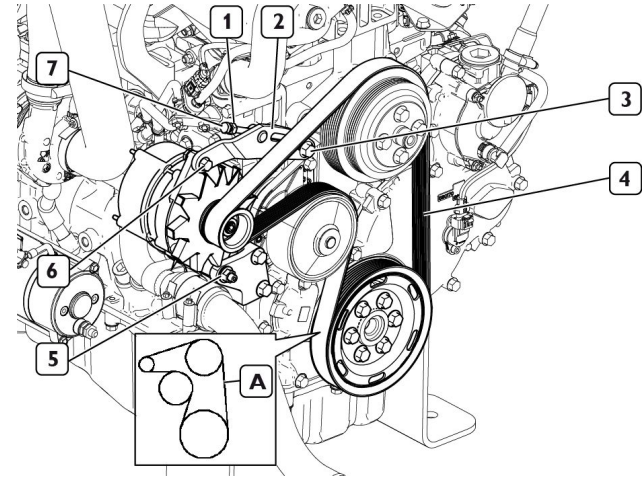
Failure to comply with these prescriptions can result in the risk of serious injury

Only proceed when the engine is not turning and is at low temperature so as not to run the risk of burns.

- Unscrew the screws **(1)**, **(2)** and **(3)** and remove the grille protecting the belt **(5)**.
- Recover the anti-vibration plugs **(4)**.
- Check that the belt is not worn, soiled with oil or fuel, or showing signs of tears. Otherwise replace the belt if necessary.



- Use the designated tool to check the tension of the auxiliary unit drive belt. The correct static tension of the auxiliary unit drive belt **(4)** must fall within the range indicated below:
- Static voltage (Value measured (N/rib/spam) / Control frequency (Hz) @ **23 +/- 5 °C**)  
Minimum (57/100)  
Nominal (75/115)  
Maximum (93/132)
- If necessary, regulate the tension of the belt **(4)** as described below.
- Loosen the bolt **(5)** anchoring the alternator to its lower mount and the screw **(3)** fastening the tensioning bracket to the crankcase.
- Proceed with tensioning the auxiliary drive belt **(4)** by tightening the adjustment screw **(7)** until the tensioning bracket **(2)** reaches the position of maximum adjustment extension available, as shown in the figure
- Fully rotate the crankshaft twice to ensure that the ancillary drive belt **(4)** has settled.
- Tighten the screw **(3)** fastening the tensioning bracket **(2)** to the crankcase to a torque of **50 N·m ± 5**
- Tighten the bolt **(5)** anchoring the alternator to its lower mount to a torque of **50 N·m ± 5**.
- Turn the adjustment screw **(7)** two full turns anti-clockwise, then tighten the relative locking nut **(1)** to a torque of **30 N·m ± 3**



**NOTE:** The static tension of the belt is measured in the intermediate point **(A)** of the branch between the crankshaft pulley and the fan drive pulley.

- Fit the protective grille correctly inserting the anti-vibration plugs. Screw in the fastening screws.

## Change engine lubricant oil



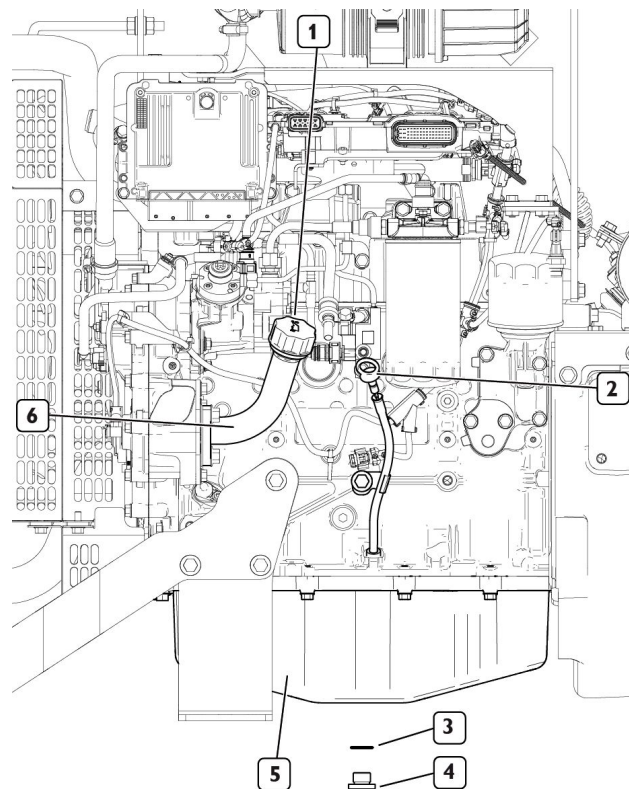
### Hazard warning

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

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Place a suitable container for catching oil below the engine lubricant oil drain plug **(4)**.
- In order to facilitate engine lubricant oil drainage, remove the oil dipstick **(2)** and remove the engine lubricant oil filler plug **(1)**.
- Drain the engine lubricant oil by removing the plug **(4)** from the oil sump.
- Wait for the oil sump **(5)** to drain completely then screw on the oil drain plug **(4)** again together with a new gasket **(3)**.
- Top-up through the filler pipe **(6)** using lubricant oil compliant with the indications on page **3-26**.
- Use the dipstick **(2)** to check that the level of engine lubricant oil does not exceed the "Max" limit.
- If it is difficult to perform the measurement, clean the dipstick **(2)** using a clean cloth without any loose threads, and re-fit the dipstick into its housing. Remove it again and check the level.
- Insert the dipstick and close the lubricant filler cap **(1)**.







General risk, general prescriptions

Eliminate the consumables and any materials in contact with them (for example, filters) in accordance with current regulations. The FPT Technical Service Network workshops are equipped for this purpose.

Correct behavior will ensure that vehicle is used as environmentally friendly as possible

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## Change engine lubricant oil filter



### Hazard warning

Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).

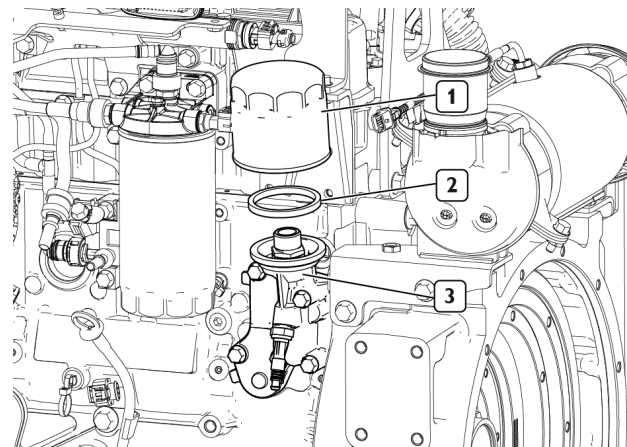
Failure to comply with these prescriptions can result in the risk of serious injury

The filter must be replaced when the lubricant oil is changed.

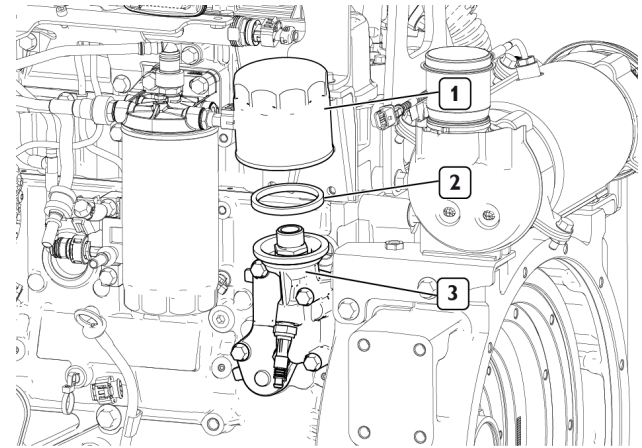
Only use filters with a filtering degree equal to the original filter (see the MAINTENANCE SCHEDULE on page **2-16**).

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Disconnect the connector **(3)** for the engine cable from the low oil pressure sensor **(2)**
- Position a container to collect the used oil below the filter mount **(1)**.
- Remove the low oil pressure sensor **(2)** from the filter mount **(1)**



- Use the specific tool to unscrew and remove the oil filter **(1)** from the filter mount **(3)** and recover the gasket **(2)**.
- Replace the oil filter **(1)** and the gasket **(2)**.
- Carefully clean the surfaces of the support that are in contact with the gasket **(2)**.
- Moisten the gasket **(2)** with a thin layer of oil and place it in its seat on the oil filter **(1)**.
- Manually tighten the oil filter **(1)** on the mount **(3)** until fit up against the gasket **(2)**.
- Using the specific tool, further tighten the oil filter **(1)** to a torque of **30 N·m ± 3**
- 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 filling the filtering cartridge.
- Fit the oil low pressure sensor onto the filter support and connect the engine cable connector to the oil low pressure sensor.



**Risk of injury:**

Given the high operating temperature of the engine, it is recommended that suitable protection is worn. The engine oil reaches extremely high temperatures: always wear protective gloves. Failure to comply with these prescriptions can result in the risk of serious injury



**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



#### 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

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#### General risk, general prescriptions

Eliminate the consumables and any materials in contact with them (for example, filters) in accordance with current regulations. The FPT Technical Service Network workshops are equipped for this purpose.

Correct behavior will ensure that vehicle is used as environmentally friendly as possible

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## Change fuel pre-filter

Component not supplied by FPT.

## Replace fuel filter



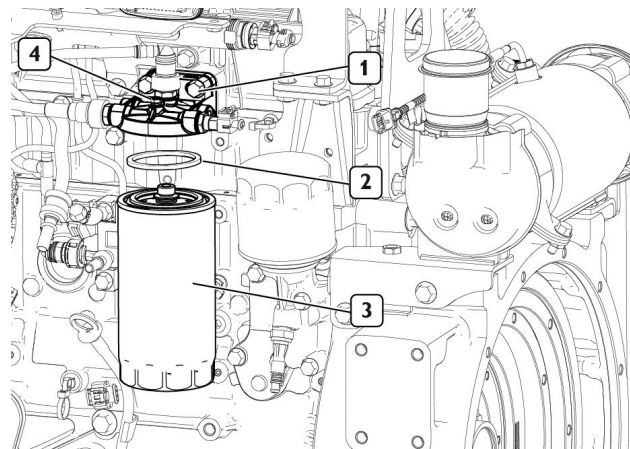
### Hazard warning

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

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Position a container to collect the diesel below the fuel filter **(3)**.
- Unscrew and remove the fuel filter **(3)** from the relative filter bracket **(1)** and recover the gasket **(2)**.
- Replace the fuel filter **(3)** and the gasket **(2)**.
- Moisten the gasket **(2)** of the fuel filter **(3)** with a thin layer of engine oil.
- Manually tighten the fuel filter **(3)** on the mount **(1)** until it fits up against the gasket **(2)**.
- Using the specific tool, further tighten the oil filter **(3)** to a torque of **20 N·m ± 3**
- After replacing the fuel filter **(3)** there may be oil bubbles in the fuel circuit.
- Bleed the residual air from the fuel filter **(3)** by loosening the breather screw **(4)** and connecting it to a suitable container with a transparent flexible pipe.
- Start the manual fuel pre-filter pump until the fuel leaving the breather screw is completely free of air bubbles.
- Tighten the breather screw **(4)**.
- Start the engine and let it run idle for a few minutes to remove any residual air.





**Risk of injury:**

During this operation, do not smoke or use naked flames. Do not breathe in vapours from the filter.

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

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**General prescriptions**

Do not fill the new fuel filter until it has been positioned on the support, to prevent any damaging impurities from entering the fuel circuit and injection system.

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

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**General risk, general prescriptions**

Eliminate the consumables and any materials in contact with them (for example, filters) in accordance with current regulations. The FPT Technical Service Network workshops are equipped for this purpose.

Correct behavior will ensure that vehicle is used as environmentally friendly as possible

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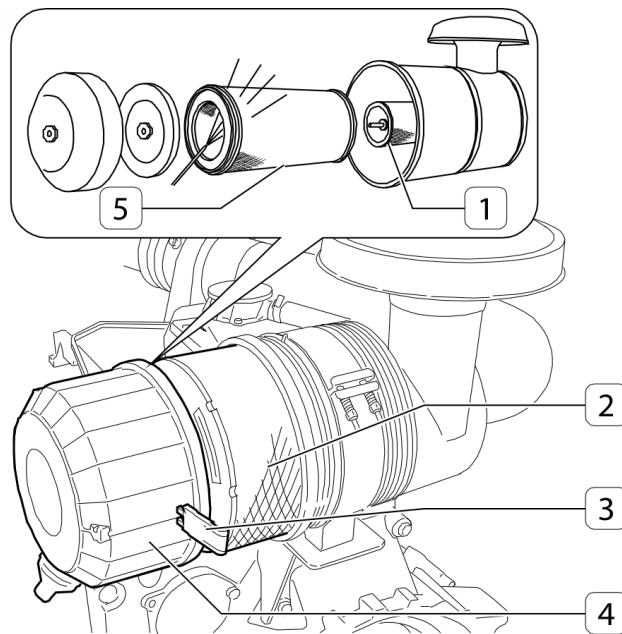
## Change air filter



**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

Only proceed when the engine is not running.

- Remove the air filter cover (4) after having released the two quick-closing hooks (3).
- Remove the filter (5). During this operation, take care to ensure that no dust enters the sleeve.
- Position the filter (5) in its seat.
- Replace the cover (4) of the air filter and lock it in place using the two quick release hooks (3).



**NOTE:** Make sure that the parts are fitted correctly. Incorrect assembly can cause the engine take in unfiltered air causing serious damage to the engine.  
Failure to observe these indications, fully or in part, can cause serious damage to the engine and can also invalidate the warranty where applicable

## Clean the heat exchanger (radiator)

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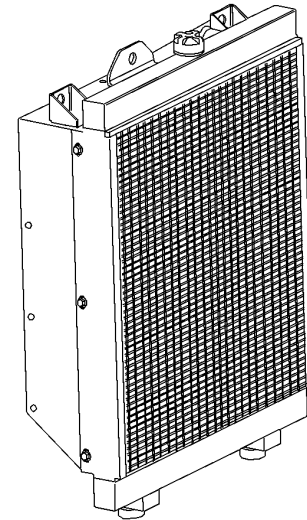
### Hazard warning

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

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The surfaces of the heat exchanger (radiator) come into contact with the outside air and can be subject to deposits and impurities. Clean as required with compressed air or steam.





## Replacing the blow-by filter



### Hazard warning

Before starting, make sure you have suitable PPE (gloves, shoes, glasses, overalls).

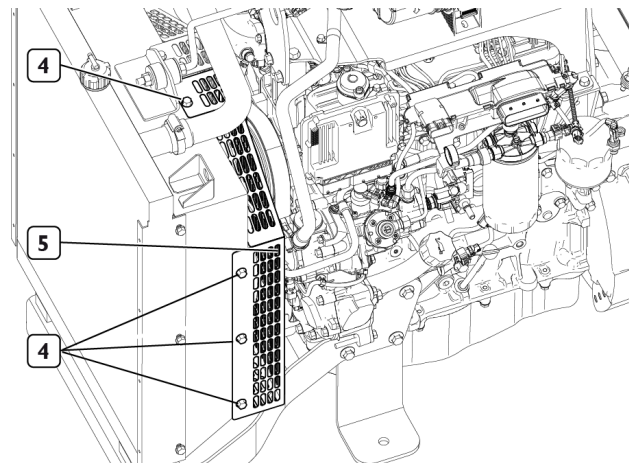
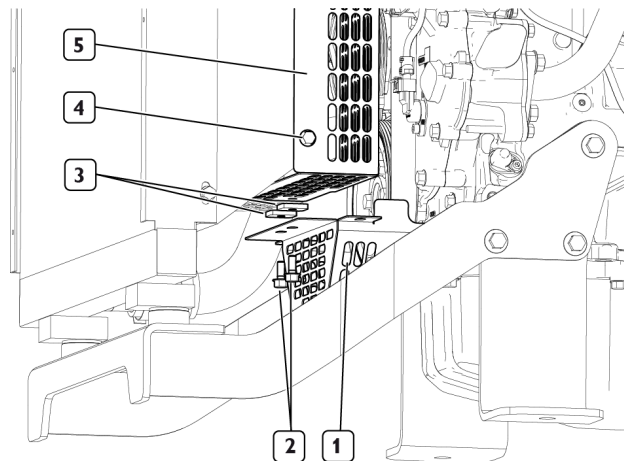
Failure to comply with these prescriptions can result in the risk of serious injury

The blow-by filter was devised and designed for collecting, filtering and condensing lubricant oil vapours.

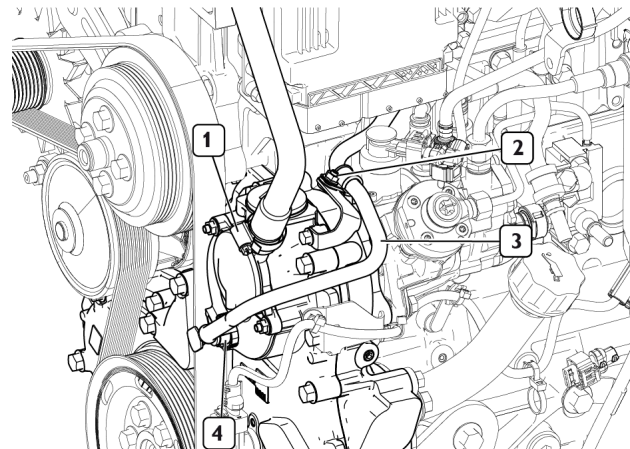
Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

Use a suitable container to collect the oil.

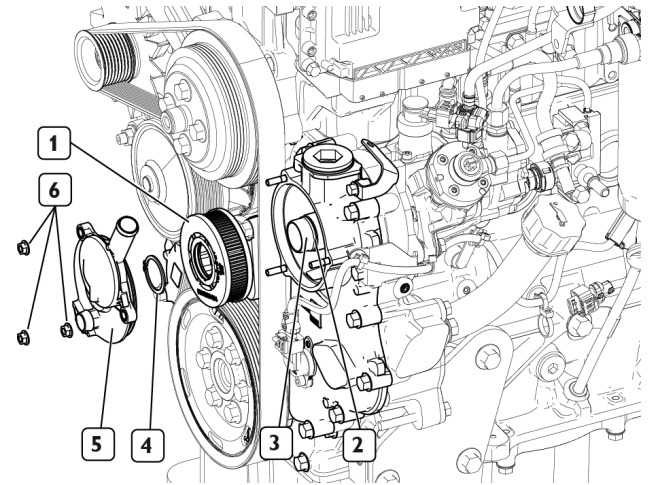
- Remove the belt guard \*(see paragraph 3-37)
- Unscrew the screws (2) and remove the lower guard (1)
- Recover the anti-vibration plugs (3).
- Unscrew the screws (4) and remove the fan guard (5).



- Loosen the nut **(2)**.
- Disconnect the fittings **(1) (4)**
- Remove the vapour recirculation pipe **(3)**.



- Unscrew the nuts **(6)** and remove the cover **(5)** of the blow-by filter, together with the diaphragm valve and breather pipe.
- Release the safety circlip **(4)** and remove the blow-by **(1)** filter from the threaded bush **(3)** and spindle **(2)**.
- Replace and install the new blow-by filter **(1)** on the spindle **(2)** with the threaded bushing **(3)** and secure it with the flexible circlip **(4)**.
- Fit the cover **(5)** of the blow-by filter with the diaphragm valve and breather pipe. Tighten the nuts **(6)** to a torque of **10 N·m ± 1**
- Fit the oil vapour recirculation pipe, connect the relative fittings and screw on the nut.
- Correctly position the guards inserting the anti-vibration plugs.
- Secure the guards with screws.



## Change the ancillary belt



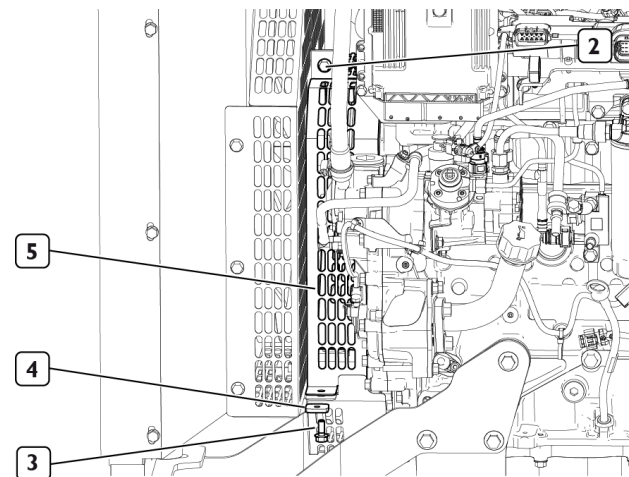
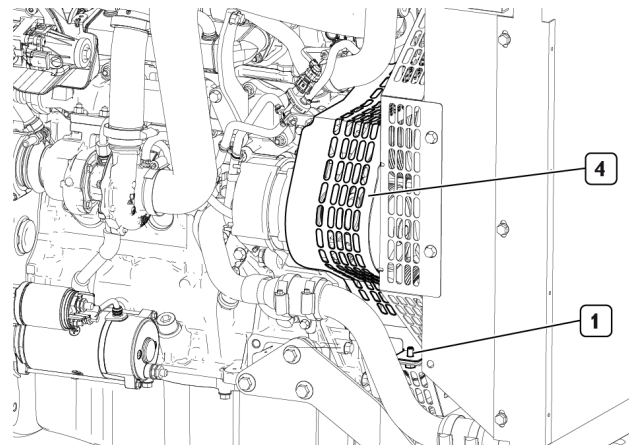
### Hazard warning

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

Only proceed with the operation when the engine is not in operation and is at a low temperature. This is to avoid the risk of burns.

- Unscrew the screws **(1)**, **(2)** and **(3)** and remove the grille protecting the belt **(5)**.
- Recover the anti-vibration plugs **(4)**.
- Check that the belt is not worn, soiled with oil or fuel, or showing signs of tears. Otherwise replace the belt if necessary.



- Loosen the bolt **(5)** anchoring the alternator to its lower mount and the screw **(3)** fastening the tensioning bracket to the crankcase.
- Loosen the locking nut **(1)** and unscrew the screw **(7)** adjusting the tensioning bracket **(2)** to loosen and remove the auxiliary drive belt **(4)**.
- Replace the auxiliary drive belt **(4)** with a new one.
- Make sure that all the components of the pulleys and the guide rollers are clean and free of wear or damage. If necessary, replace worn or damaged components.
- make sure that the pulleys and guide rollers are free of dirt and accumulations from the old belt.
- Fit the new auxiliary unit drive belt **(4)** inside the block of all the pulleys in the following order: crankshaft pulley, fan drive, alternator, water pump pulley. Make sure that the belt is centred on all the pulleys.
- Tension the auxiliary unit drive belt **(4)** by tightening the adjusting screw **(7)** until the tensioning bracket **(2)** reaches maximum extension as shown in the figure. The correct statistical value of the auxiliary unit drive belt **(4)** must be within the range indicated below.
- Static voltage (Value measured (N/rib/spam) / Control frequency (Hz))
  - Minimum (64/121)
  - Nominal (84/140)
  - Maximum (104/158)

- Fully rotate the crankshaft twice to ensure that the ancillary drive belt (4) has settled.
- Tighten the screw (3) fastening the tensioning bracket (2) to the crankcase to a torque of **50 N·m ± 5**.
- Tighten the bolt (5) anchoring the alternator to its lower mount to a torque of **50 N·m ± 5**.
- Turn the adjustment screw (7) two full turns anti-clockwise, then tighten the relative locking nut (1) to a torque of **30 N·m ± 5**



**Risk of damage**

Replace the ancillary belt if there is any sign of abrasion, cracks or tears, oil or fuel stains.

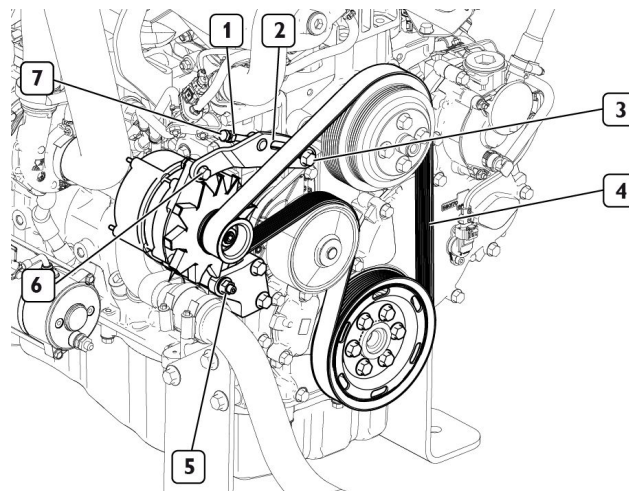
Failure to comply completely or partially with these requirements may result in the risk of serious damage to the engine and may even, on occasion, invalidate the warranty



**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



## Visually inspect turbocharger



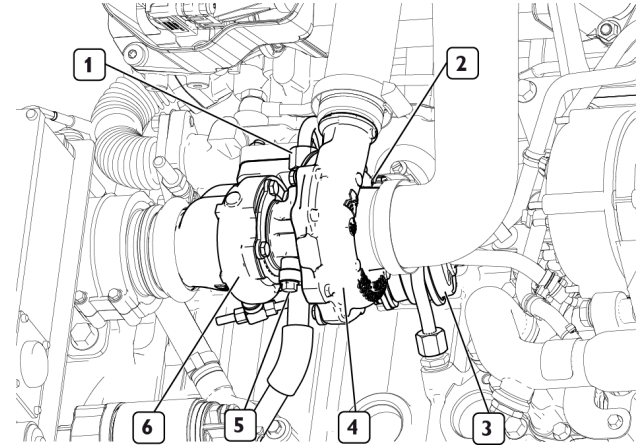
### Hazard warning

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

Only proceed when the engine is not running.

- Check for any cracks on the turbocharger.
- Visually check that the rotors of the turbine **(6)** and the compressor **(4)** and the relative inlet and outlet pipes are not clogged or damaged. Replace if they are.
- Check that none of the blades are bent or damaged in the rotors of the turbine **(6)** and the compressor **(4)**.
- Check the tightening of the fittings **(1)**, **(5)** and carry out a visual inspection to check for any oil leaks.
- In the event of any oil leaks, replace the gaskets of the fittings **(1)**, **(5)**.
- Check that there are no deposits of soot between the intake manifold and the turbocharger. Replace the turbocharger gasket if necessary.
- Check the turbocharger gasket for any signs of rupture or damage and replace it if necessary.
- Check the wastegate actuator (5) is fully tightened, lubricated and not deformed.
- Check that the wastegate valve pipes **(3)** are not clogged or damaged, otherwise replace them. Carry out a visual check and check for any air leaks.



## Visual inspection of the alternator

---



### 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

---

Only proceed when the engine is off.

- Visually check that the alternator is not damaged, otherwise replace it.
- Check there are no unusual noises while the engine is running.
- Check that the alternator fastening bolts are tightened.
- Inspect the battery cable connections on the rear side of the alternator. Make sure it is clean and tightened.



## Clean/replace radiator pressure cap

---



### 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

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### 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 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

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- Only open the pressurisation plug of the tank/radiator when the engine is cold.
- Remove the pressurisation plug from the tank/radiator and clean it carefully. Replace it if necessary.
- Replace the plug in its seat and screw it onto the tank/radiator.

## Change engine coolant



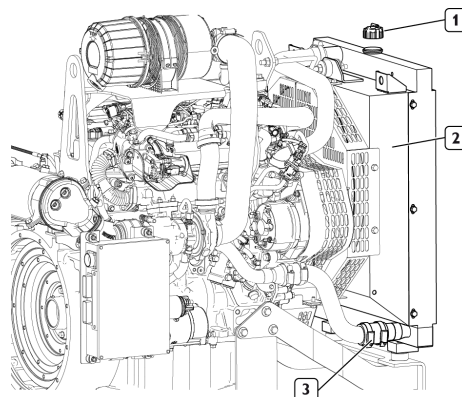
### Hazard warning

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

Only proceed when the engine is not running and is at low temperature in order to avoid the risk of burns.

- Place a container for collecting coolant below the heat exchanger (radiator) **(2)**.
- Remove the pressurisation cap from the expansion tank (if present).
- Loosen the fastening elements and remove the coupling sleeves **(3)** connecting the engine cooling circuit to the heat exchanger.
- Drain the coolant from the heat exchanger (radiator) **(2)** and wait until it is completely empty.
- When the refilling operation is complete, restore the cooling circuit paying careful attention to the tightness of the sleeves.
- Fill the engine and the heat exchanger until the coolant circuit is completely full, as indicated in the REFILLING table **3-26**. Do fill the expansion tank to the brim.
- With the coolant filler cap **(1)** open, start the engine and let it idle for approx. 1 minute. This helps to fully expel the air in the cooling circuit.
- Stop the engine and top up with the required amount.
- Make sure that when the engine is cold, the coolant level is a few centimetres below the refilling hole.
- If there is a level indicator with is outside of the heat exchangers, top up ensuring that the coolant does not overfill the internal volume of the exchanger. This is to allow the expansion of coolant volume if there is a temperature increase.



### General prescriptions

The failure to observe the aforesaid procedure does 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 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.

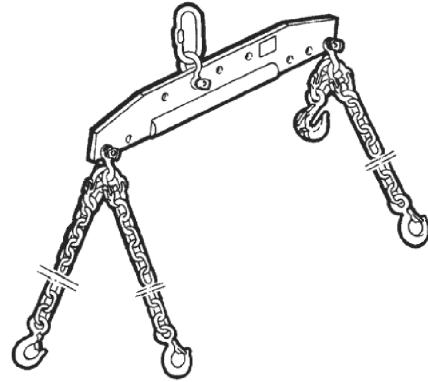
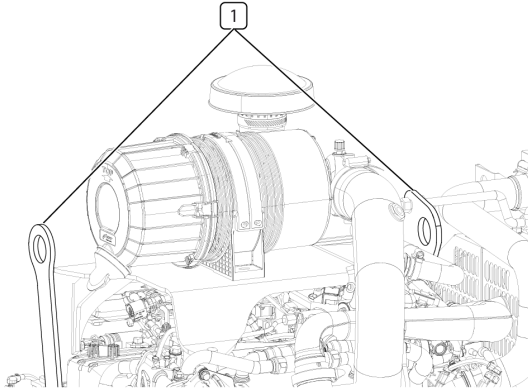


Failure to comply with these prescriptions can result in the risk of serious injury

## Move the engine

The operations necessary to disconnect and subsequently reconnect the engine must be carried out only by technicians from authorised Service Centres.

Use the lifting eyelets (1) indicated in the figure when moving the engine.



Using a suitable hoist, which conforms to standards and the weight capacity of the engine with radiator, connect it to the lifting eyelets on the engine. Adjust the hoist as required so that when the individual chains attached to the eyelets are tensioned, there is no rotation around the axles when lifting and moving the engine.

**NOTE:** for further details, please refer to the Service Manual.

**NOTE:** Do not lift the G-DRIVE assembly before removing the components coupled to the flywheel.

## Disposal of waste

The engine is composed of parts and elements that, if discarded, could cause environmental damage.

The materials listed below must be handed over to specialised Collection Centres:

- Starter batteries.

- Used lubricants.
- Mixtures of water and antifreeze.
- Filters.
- Additional cleaning materials (e.g. greasy or fuel-soaked cloths).

The laws in force in the various countries provide for severe penalties for lawbreakers.

## 4 - LONG PERIOD OF INACTIVITY

### Preparing the engine for a long period of inactivity

#### PREPARING THE ENGINE FOR A LONG PERIOD OF INACTIVITY

In the case of a planned period of inactivity that lasts longer than two months, to prevent the interior parts of the engine and some components of the injection system from oxidising, prepare the engine as follows:

1. Drain the lubricant oil from the sump after heating the engine.
2. Pour 30/M protective oil into the engine up to the "minimum" level indicated on the oil level dipstick. Start the engine and run it for approx. **5 min**.
3. Drain the fuel from the injection circuit, from the filter and from the injection pump channels.
4. Connect the fuel circuit to a tank containing CFB protective liquid ( ISO 4113) and introduce the liquid by pressurising the circuit and driving the engine for approx. **2 min**, after excluding injection system operation. The operation required can be completed by directly polarising terminal 50 of the electric starter motor with positive voltage equal to that of the nominal system voltage, using the designated conductor.
5. Nebulize the 30/M protective oil in a quantity of approx. **130 g ( 10 g** per litre of displacement) in the turbocharger intake inlet, during the engine turning operation described in the previous paragraph.
6. Close all of the engine's intake, discharge, ventilation and bleeding holes with plugs or seal them with adhesive tape.
7. Drain the residual 30/M protective oil from the sump, which can be used for an additional 2 preparations.
8. Place warning notices of ENGINE WITHOUT OIL on the engine and dashboard.

9. Drain the coolant if it was not mixed if necessary with antifreeze and corrosion inhibitors, positioning signs that this operation was performed.

In the case of prolonged inactivity, repeat these operations every 6 months, according to the following procedure:

- A. drain the 30/M protective oil from the sump;
- B. repeat the operations from point 2 to point 7.

To protect the external parts of the engine, spray OVER 19 AR protective liquid on the unpainted metal parts such as the flywheel, pulleys, etc., and do not spray it on belts, connector cables and electrical equipment.

## Engine start-up after a long period of inactivity

1. Drain residual protective oil from the sump.
2. Introduce lubricant oil into the engine of the type and quantity indicated in the table **3-26**
3. Drain the CFB protective fluid from the fuel circuit, operating as indicated at point 3 of the section **4-60**.
4. Remove the plugs and/or seals from the intake, discharge, ventilation and bleeder holes of the engine, restoring normal conditions of use. Connect the turbocharger inlet to the air filter.
5. Join the fuel circuits to the fuel tank of the genset, completing the operations as indicated in point 4 of the section **4-60**. During the refilling operations, connect the fuel return pipe to a container to prevent any residual CFB protective liquid from flowing into the tank.
6. Check and fill the engine with coolant as required, degassing if necessary.
7. Start the engine and let it idle until completely stabilised.
8. Check that the indications on the dashboard are plausible and that there are no alarm signals.
9. Stop the engine.
10. Remove the warning notices of ENGINE WITHOUT OIL from the engine and dashboard.

## 5 - ENGINE MALFUNCTIONS

### Engine fault

The electronic control unit which oversees the control and management of all engine operations is able to recognise a fault and adopt strategies which allow the vehicle still to be driven safely.

The event, signalled by activation of the EDC MALFUNCTION indicator light on the on-board control panels, causes the scheduled limitation of the supply, within certain limits, set according to the seriousness of the specific case.

In the case of temporary malfunctions the reduction in performance will remain in force until the engine is stopped.



## In the event of a fault:

### Malfunction in the recharging system

The electronic engine control units are programmed to increase the speed if the electrical system voltage reaches the values considered at the limit of efficiency. In that case, check the state of the battery or batteries and if necessary, have diagnostics performed for the system components.



General risk, general prescriptions

The electronic control unit of the engine adopts safety strategies using the genset once it has verified the conditions which could compromise engine integrity.

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

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General risk, general prescriptions

If these conditions occur, only continue driving if absolutely necessary and with extreme care.

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

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General risk, general prescriptions

Never leave the engine running idle for long periods of if the generator set is not in operation.

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

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## 6 - BEHAVIOUR IN EMERGENCY

### For personal safety

The user of the machine, manufactured according to safety regulations, following the instructions given in this manual and assisted by the indications on the engine labels, operates in safe conditions. In the event that incorrect behaviour causes accidents, immediately request the intervention of personnel specialised in first aid. The following instructions are provided to assist in the event of an emergency and while awaiting the arrival of the rescue team.

#### Engine fault

If proceeding with the engine in a faulty state, pay maximum attention to the manoeuvres and check that any people on-board are secured to secure grips.

#### Fire

Put out the fire using the designated devices and according to the methods indicated by the competent authorities (fire suppression equipment for some cars and vehicles has been made mandatory by current safety regulations).

#### Burns

- Put out the flames on the clothing of the burn victim by:
  - flooding with water;
  - use of powder extinguishers, without directing the jet towards the face;
  - covers or rolling the victim on the ground.
- Do not remove the shreds of clothing that adhere to the skin;
- If the burns are caused by liquids, quickly but carefully remove the clothing saturated with the hot liquid;
- Cover the burn with an anti-burn pack or with a sterile bandage.

#### Carbon monoxide (CO) poisoning

The carbon monoxide contained in the exhaust gas of the engine is dangerous not only because it causes poisoning but also because it forms an explosive mixture with the air. In closed environments, carbon monoxide is extremely dangerous as it can reach critical concentration levels in a very short space of time.

If aiding a poison victim in a closed room:

- Immediately ventilate the room to reduce the concentration of gas.
- When accessing the room, the rescue teams must hold their breath, not light flames, turn on lights or activate electric bells or telephones in order to prevent explosions.
- Bring the poison victim to safety in a ventilated room, or in the open air, placing the victim on his/her side if unconscious.

#### Electrocution

The 24V electrical system of the engine does not carry the risk of electrocution. However, in the event of a short circuit caused, for example, by a metal tool, there may be the risk of burns caused by the object overheating due to conduction of the electric current.

In that case:

- Remove the object that caused the short circuit using device that provide sufficient thermal insulation.
- If present, use the main switch to cut off the power supply.

#### Injuries and fractures

The seriousness of the cases and the specific nature of the interventions means that medical professionals must intervene.

- If the victim is bleeding, compress the injury externally until the rescue team arrives.

- If there is a possibility of fractures, do not move the affected part and transfer the injured person very carefully and only if absolutely necessary.

### **Corrosion**

Skin corrosion is caused by contact with substances with a high degree of acidity or basicity.

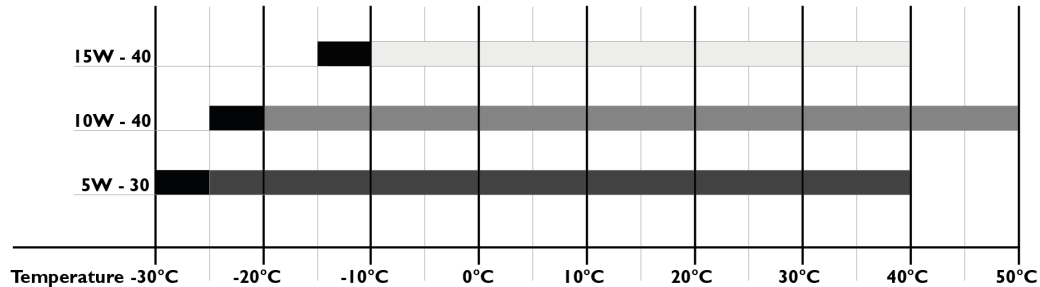
For personnel performing maintenance on electrical devices, this is typically caused by acid escaping from the batteries. In this case, act as follows:

- Remove the clothing saturated with the caustic substance.
- Wash thoroughly with running water, without spraying uninvolved parts.

If the eyes have been affected, either from the battery acid or from the lubricant oil or diesel: wash the eye with water for at least 20 minutes keeping the eyelids open so that the water flows onto the eyeball (move your eye in all directions to help the water move across the whole eye).

## SAE classification of oils in relation to the ambient temperatures of use of the engine/vehicle

The viscosity index to be used depends on the ambient temperature, as shown in the figure below:



■ A

- A. Installation of engine coolant heating system with heater on the crankcase is recommended

**NOTE:** Cold start capabilities are strongly correlated with the quality of the diesel.



	<b>A</b>	
Accident prevention . . . . .		25
	<b>C</b>	
Change air filter . . . . .		46
Change engine coolant . . . . .		57
Change engine lubricant oil . . . . .		39
Change engine lubricant oil filter . . . . .		41
Change fuel pre-filter . . . . .		43
Change the ancillary belt . . . . .		51
Check engine coolant level. . . . .		36
Check engine lubricant oil level . . . . .		34
Check of water presence in pre-filter or in fuel filter (component not supplied by FPT) . . . . .		33
Check tension and condition of ancillary belt . . . . .		37
Clean/replace radiator pressure cap. . . . .		56
Clean the heat exchanger (radiator) . . . . .		47
Coolant fluid filling . . . . .		29
	<b>D</b>	
Disposal of waste . . . . .		59
	<b>E</b>	
Engine fault . . . . .		63
Engine start-up after a long period of inactivity . . . . .		62
Engine technical data . . . . .		7
External view. . . . .		9
	<b>F</b>	
For personal safety . . . . .		65
For proper use of the engine . . . . .		17

**G**

Guarantee . . . . . 5

**I**

Identification plate . . . . . 13  
Interconnection control unit . . . . . 19  
In the event of a fault: . . . . . 64

**L**

Liability . . . . . 5

**M**

Main characteristics of oil . . . . . 28  
Maintenance personnel . . . . . 25  
Move the engine . . . . . 58

**P**

Preliminary checks . . . . . 16  
Preparing the engine for a long period of inactivity . . . . . 60  
Programmed maintenance . . . . . 31

**R**

Refilling . . . . . 26  
Refuelling . . . . . 30  
Replace fuel filter . . . . . 44  
Replacing the blow-by filter . . . . . 48  
Requirements . . . . . 32  
Running in . . . . . 24

**S**

SAE classification of oils in relation to the ambient temperatures of use of the engine/vehicle . . . . . 67  
Safety . . . . . 5  
Safety warnings symbols . . . . . 6  
Signs . . . . . 15  
Spare parts . . . . . 5

Special warnings . . . . . 23

**V**

Visual inspection of the alternator . . . . . 55

Visually inspect turbocharger . . . . . 54