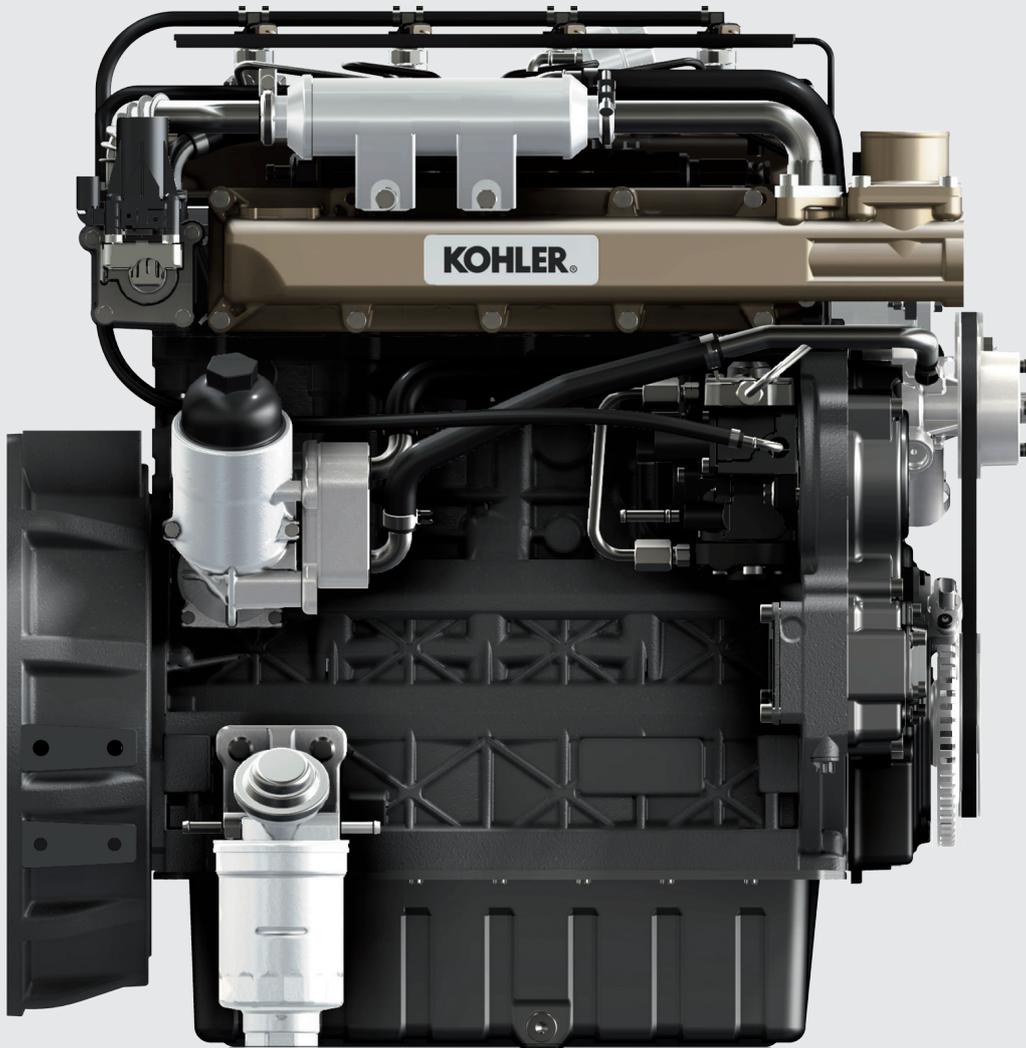


KDI 1903TCR - KDI 2504TCR

OWNER MANUAL

KOHLER® Diesel KDI



KOHLER®

REGISTRATION OF MODIFICATIONS TO THE DOCUMENT

Any modifications to this document must be registered by the drafting body, by completing the following table.

Drafting body	Code document	Model N°	Edition	Revision	Date issue	Date Review	Written by	Endorsed
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The online manuals are provided with hyperlinks which direct you to each individual chapter. By clicking on;

- The analytic index titles you can go directly to the selected subject.
- The blue underlined words you can go directly to a paragraph, a table or a picture.
- The chapter titles (headings) you come back automatically to the chapter initial page.
- The paragraph titles the best script size for reading is displayed.
- There are multimedia videos recognizable by the icon "play"  (only on manual in digital version).
- Clicking next to the bottom page number you come back to the analytic index.

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Manual's purpose

- This manual contains the instructions needed to carry out proper use and maintenance of the engine, therefore it must always be available, for future reference when required.
- This manual is an integral part of the engine, in the event of transfer or sale, it must be attached to it.
- Safety pictograms can be found on the engine and it is the operator's responsibility to keep them in a perfectly visible place and replace them when they are no longer legible.
- Information, description and pictures in this manual reflect the state of the art at the time of the marketing of engine.
- However, development on the engines is continuous. Therefore, the information within this manual is subject to change without notice and without obligation.
- **KOHLER** reserves the right to make, at any time, changes in the engines for technical or commercial reasons.
- These changes do not require **KOHLER** to intervene on the marketed production up to that time and not to consider this manual as inappropriate.
- Any additional section that **KOHLER** will deem necessary to supply some time after the main text shall be kept together with the manual and considered as an integral part of it.
- The information contained within this manual is the sole property of **KOHLER**. As such, no reproduction or replication in whole or part is allowed without the express written permission of **KOHLER**.

Glossary and Definitions

The paragraphs, tables and figure are divided into chapter with their progressive numbers.

Ex: **Par. 1.3** - chapter 1 paragraph 3.

Tab. 2.4 - chapter 2 table 4.

Fig. 4.5 - chapter 4 figure 5.

The references of the objects described in the text and in figure and number are indicated by letters, which are always and only related to the paragraph you are reading unless there are specific references to other figures or paragraphs.

The figure are based on model 2504 TCR, where necessary the version 1903 TCR is illustrated.

All data, measurements and relevant symbols are shown in the table below.

DATA	MEASUREMENT	SYMBOL	EXAMPLE
Distance	millimeter	mm	1 mm
Torque	newton-meter	Nm	1 Nm
Force	newton	N	1 N
Mass	Kilogram	Kg	1 kg
Volume	cubic centimeter	cm ³	1 cm ³
Pressure	pascal	Pa	1 Pa
Volume	liter	L	1 L
Angle	Degree	α	1°
Power	kiloWatt	kW	1 kW
Temperature	centigrade degree	°C	1°C

Emission-Related Installation Instructions

Failing to follow the instructions in the applications guidebook when installing a certified engine in a piece of nonroad equipment violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

OEM must apply a separate label with the following statement: "ULTRA LOW SULFUR FUEL ONLY" near the fuel inlet.

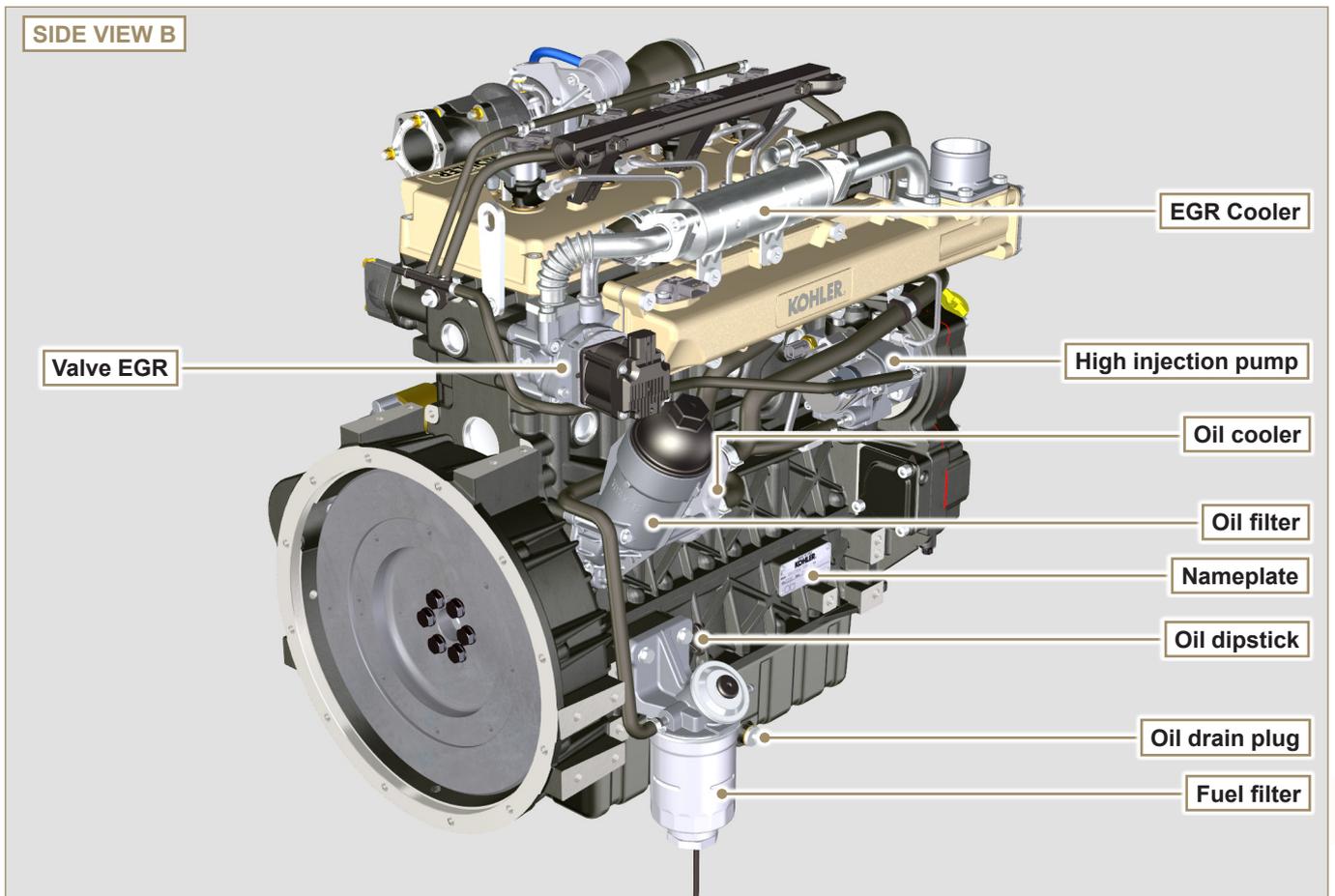
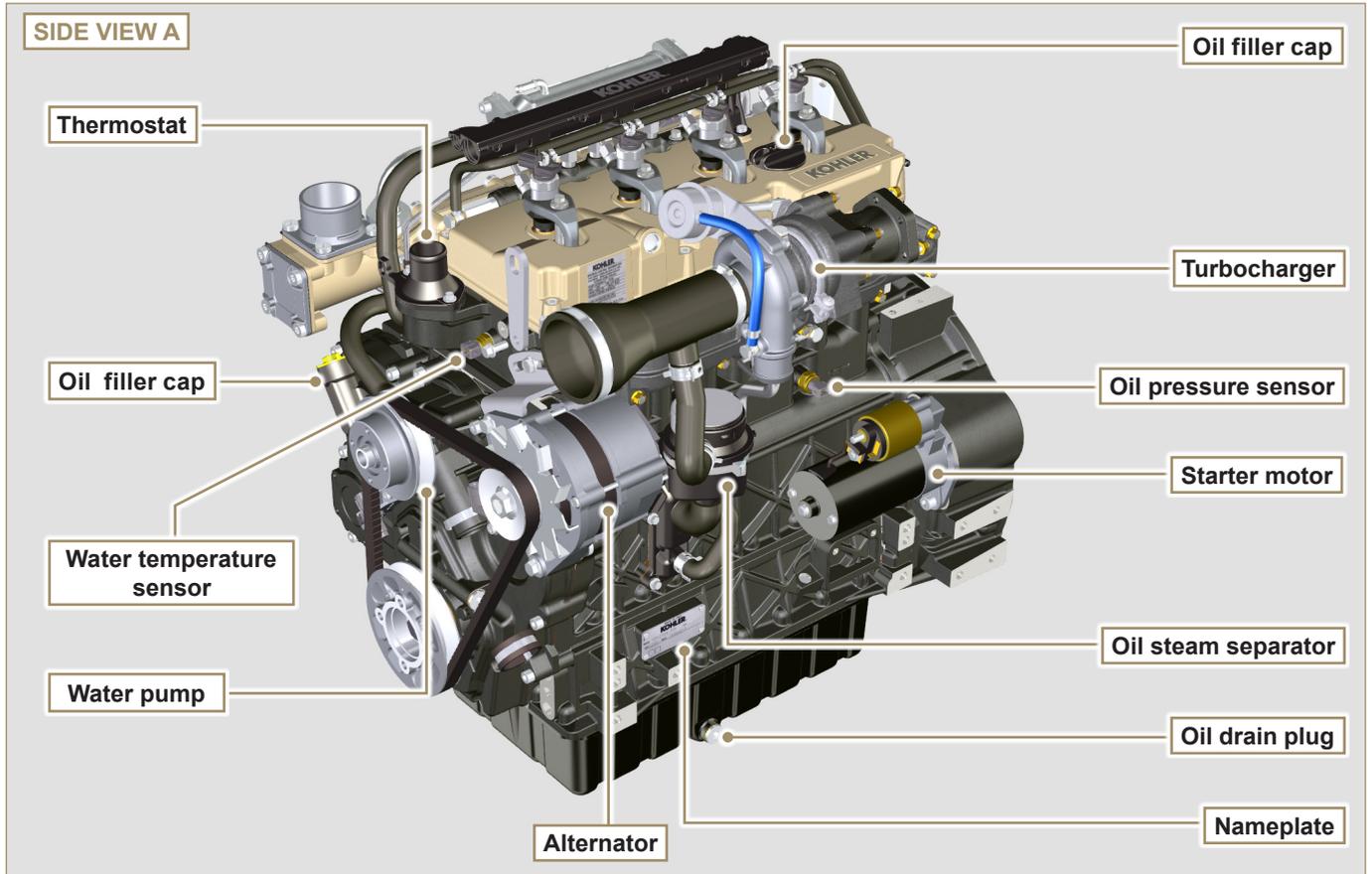
Ensure you are installing an engine appropriately certified for your application. Constant speed engines may only be installed on constant speed equipment for constant speed operation.

If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

Service request

- Authorized service centers can be found in the service handbook (received with the product purchased).
- The complete and updated list of authorized Kohler Co. service centers can be found on our web site: <http://www.lombardinigroup.it/dealer-locator>.
- If you have any questions regarding your warranty rights and responsibilities or the location of the nearest **Kohler Co.** authorized service location, you should contact **Kohler Co.** at 1-800-544-2444 or access our website at www.kohlerengines.com (USA and North American).

Engine component identification



Manufacturer and motor identification data

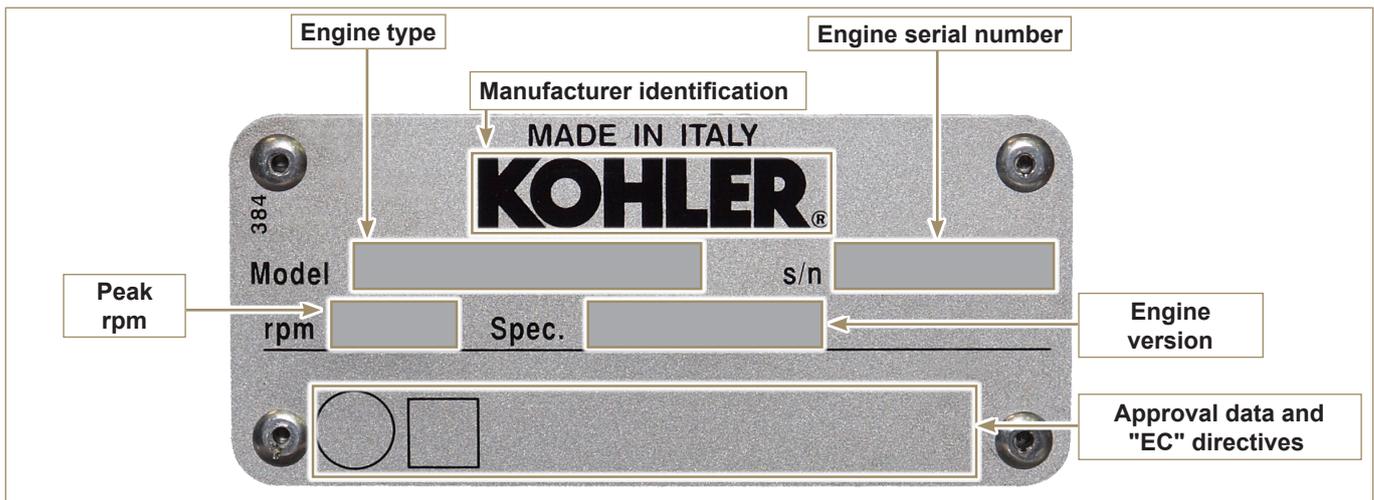
The nameplate motor identification is find side A or side B.



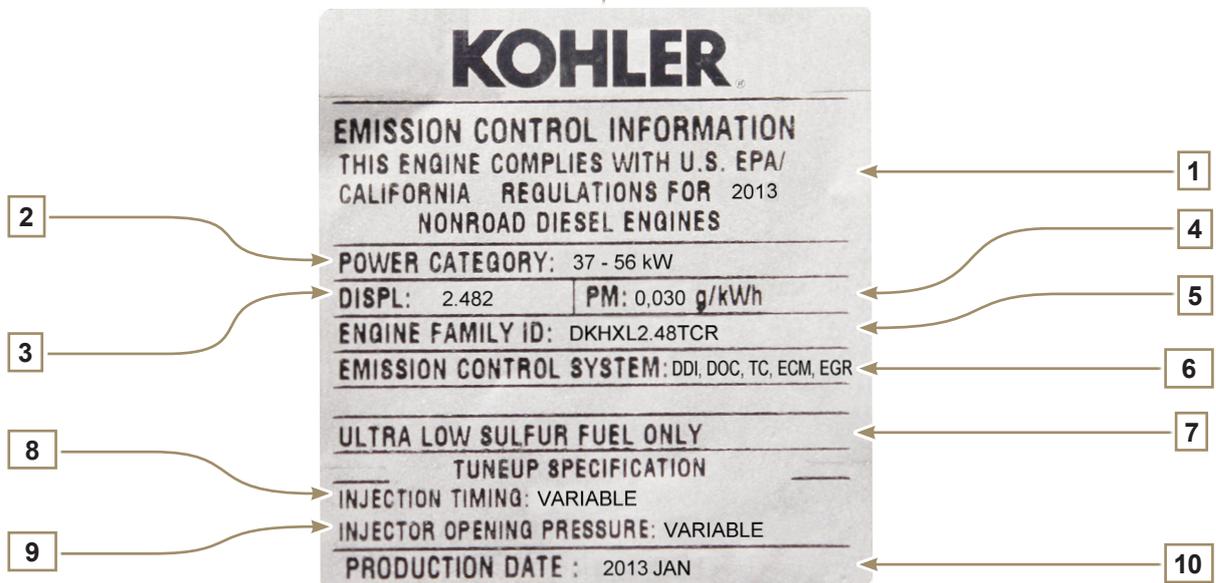
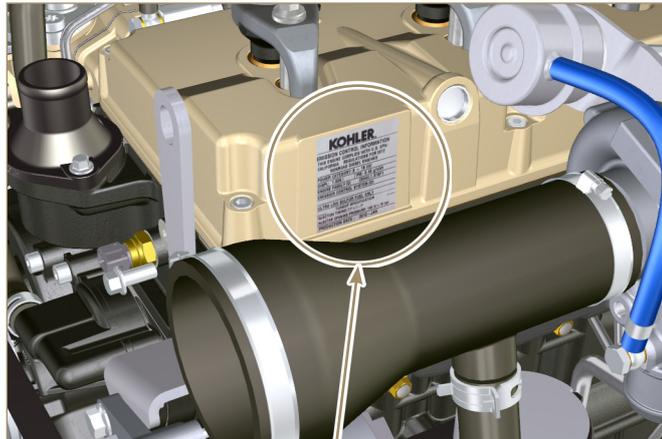
SIDE VIEW A



SIDE VIEW B



Label for EPA rules



POS.	DESCRIPTION
1	Model year in compliance with the rules
2	Power category (kW)
3	Engine displacement (L)
4	Particulate emission limit (g/kWh)
5	Engine family ID
6	Emission Control System = ECS
7	Fuel with low sulphur content
8	Injection timing (*BTDC)
9	Injector opening pressure (bar)
10	Production date (example: 2013.JAN)

1.1. General description of the engine

- 4-stroke, in-line cylinders Diesel engine;
- Liquid-cooling system;
- 4 valves per cylinder with hydraulic tappets;
- Turbocharger with Waste-gate valve;
- Direct injection.

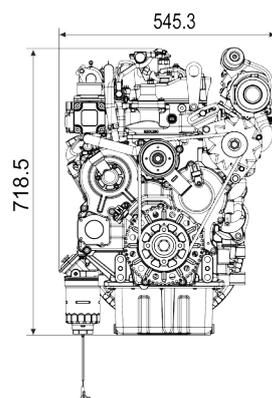
1.2 Engine specifications

Tab. 1.1

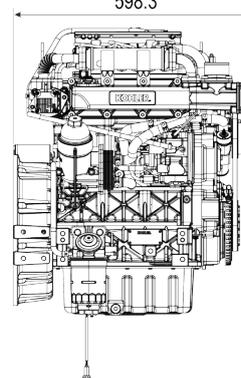
TECHNICAL DATA		UNIT OF MEASURE		
ENGINE TYPE			KDI 1903 TCR	KDI 2504 TCR
CYLINDERS		n.	3	4
BORE		mm	88	
STROKE		mm	102	
DISPLACEMENT		cm ³	1861	2482
MAX INCLINATION DURING OPERATION (even in combined)		degree	30° max. 30 minutes	
		degree	35° max 1 minute	
OIL CAPACITY (MAX level.) including oil filter	standard version	L	7.5	9.75
	with dynamic balancer (optional)	L		7
DRY WEIGHT		Kg	233	267

1.3 Engine dimensions (mm)

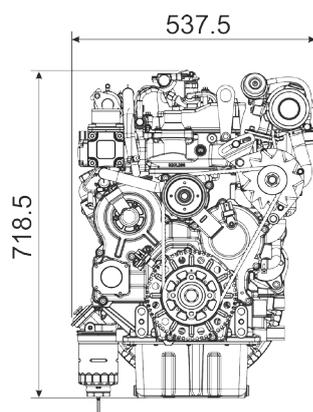
KDI 1903 TCR



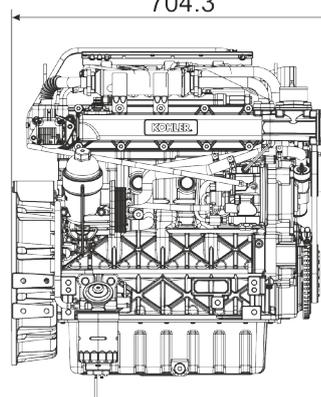
598.3



KDI 2504 TCR



704.3



1.4 Oil



Important

- The engine may be damaged if operated with improper oil level.
- Do not exceed the MAX level because a sudden increase in engine rpm could be caused by its combustion.
- Use only the recommended oil to ensure adequate protection, efficiency and service life of the engine.
- The use of lubricants other than recommended may shorten the engine life.
- Viscosity must be appropriate to the ambient temperature to which the engine is to be exposed (**Par. 1.4.1**).

1.4.1 SAE oil classification

- In the SAE classification, oils are identified according to viscosity without considering any other qualitative characteristic.



Danger

- Prolonged skin contact with the exhausted engine oil can cause cancer of the skin.
- If contact with oil cannot be avoided, thoroughly wash your hands with soap and water as soon as possible.
- For the exhausted oil disposal, refer to [Par. 5.6 DISPOSAL and SCRAPPING](#).

- The code is made up of two numbers. The first number refers to the viscosity when cold, for use during winter ("W"= winter), while the second number is for viscosity at high temperatures.

Tab. 1.2

RECOMMENDED OIL			
VISCOSITY	SAE	5W-30 / 10W-40	LOW S.A.P.S.
WITH SPECIFICATIONS	API	CJ4	
	ACEA	E6 - E9	

N. B.: Low S.A.P.S. technology (fuel with low Sulphate, Phosphorous, Sulphur content) keeps catalyst in working conditions. The presence of sulfate, phosphorus and sulfur ashes causes with time the catalyst clogging and its consequent inefficiency.

CLASSIFICATION	DESCRIPTION ACEA SPECIFICATION
E6	Long drain LOW S.A.P.S.
E9	Long drain MID S.A.P.S.

1.5 Fuel



Important

- Use the same type of diesel fuel as used in cars (EN 590 for E.U. - ASTM D975-09B regulation - S 15 for U.S). Use of other types of fuel could damage the engine. Do not use dirty diesel fuel or mixtures of diesel fuel and water since this will cause serious engine faults.



Warning

- Clean fuel prevents the fuel injectors from clogging. Immediately clean up any spillage during refuelling.
- Never store diesel fuel in galvanized containers (i.e. coated with zinc). Diesel fuel and the galvanized coating react chemically to each other, producing flaking that quickly clogs filters or causes fuel pump and/or injector failure.

1.5.1 Fuel for low temperatures

- When operating the engine in ambient temperatures lower than 0 degrees C, use suitable low temperature fuel normally available from fuel distributors and corresponding to the specifications of [Tab. 1.3](#) pag. 12.
- These fuels reduce the formation of paraffin in diesel at low temperatures.
- When paraffin forms in the diesel, the fuel filter becomes blocked interrupting the flow of fuel.

1.5.2 Biodiesel fuel

- Fuels containing 10% methyl ester or B10, are suitable for use in this engine provided that they meet the specifications listed in the **Tab. 1.3**.
- **DO NOT USE** vegetable oil as a biofuel for this engine.
- Any failures resulting from the use of fuels other than recommended will not be warranted.

Tab. 1.3

FUEL COMPATIBILITY								
	Compatible		Certification emission		Warranty coverage		Engine waste	
	yes	no	yes	no	yes	no	yes	no
EN 590, DIN 51628 - Military NATO fuel F-54 (S=10 ppm)								
No 1 Diesel (US) - ASTM D 975-09 B - Grade 1-D S 15 (S=15 ppm)								
No 1 Diesel (US) - ASTM D 975-09 B - Grade 1-D S 500 (S=500 ppm)					(1)			
No 2 Diesel (US) - ASTM D 975-09 B - Grade 2-D S 15								
No 2 Diesel (US) - ASTM D 975-09 B - Grade 2-D S 1500					(1)			
ARCTIC (EN 590/ASTM D 975-09 B)	(2)							
High sulfur fuel < 5000 ppm (<0.5%)					(1)			(1)
High sulfur fuel > 5000 ppm (<0.5%)					(3)			(3)
High sulfur fuel > 10000 ppm (>1%)								
Civil Jet Fuels Jet A/A1								
Civil Jet Fuels Jet B								
Bio Fuels (EN14214)	(4)		(4)		(4)			(4)

(1) Except for catalyst clogged and EGR.

(3) Except for catalyst clogged and EGR.
Shorter oil change intervals.

(2) Without adding oil.

(4) Max. 10% in fuel.

1.5.3 Emission-Related Installation Instructions

Failing to follow the instructions in the applications guidebook when installing a certified engine in a piece of nonroad equipment violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

OEM must apply a separate label with the following statement: "ULTRA LOW SULFUR FUEL ONLY" near the fuel inlet.

Ensure you are installing an engine appropriately certified for your application. Constant speed engines may only be installed on constant speed equipment for constant speed operation.

If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

1.6 Coolant recommendation

Tab. 1.4

TECHNICAL SPECIFICATIONS	
50% ETHYLENEGLYCOL e 50% WATER	
50% PROPYLENE GLYCOL e 50% WATER	
ANTIFREEZE	TYPE
BASF	G05 G30 G33 G34 G40 G48 G50
VW	G13 G12++
ARTECO	XLC XLI LONG LIFE COOLANT FREECOR SPC FREECOR DSC
TEXACO	AFC XLC
REVKOGEL	2000
PARAFLU	F02
CCI	LLC L255A LLC A432

1.7 Battery recommendation

Battery not supplied by Kohler

RECOMMENDED BATTERIES	
AMBIENT TEMPERATURE	BATTERY TYPE
from 0°C to -15°C	90 Ah/20 h - 450 A/DIN 90 Ah/20 h - 885 A/EN 90 Ah/20 h - 855 CCA/SAE
from -15°C to -25°C	110 Ah/20 h - 500 A/DIN 110 Ah/20 h - 980 A/EN 110 Ah/20 h - 950 CCA/SAE

2.1 Safety information

- The intended use of the engine is in conformity with the machine on which it is mounted.
- Any use of the machine other than that described cannot be considered as complying with its intended purpose as specified by **KOHLER**.
- **KOHLER** declines all responsibility for any change to the engine not described in this manual made by unauthorized **KOHLER** personnel.
- A proper use of the engine, a strict observance of the rules listed below and the rigorous application of all these precautions will avoid the risk of accidents or injuries.
- Those who carry out the use and maintenance on the engine must wear the safety equipment and the accident-prevention guards.
- **KOHLER** declines all direct and indirect liability for failure to comply with the standards of conduct contained in this manual.
- **KOHLER** cannot consider every reasonably unforeseeable misuse that may cause a potential danger.

2.2 General remarks

2.2.1 Note for OEM

- When installing the **KDI** engines, always bear in mind that any variation to the functional systems may result in serious failures to the engine.
- Any improvement must be verified at **KOHLER** testing laboratories before application of the engine.
- In case the approval to a modification is not granted, **KOHLER** shall not be deemed responsible for any consequential failures or damages to the engine.
- The engine may only be assembled on a machine by personnel specifically trained by **KOHLER** and who work in compliance with the existing documentation.
- The engine has been built to the specifications of a machine manufacturer, and it is his responsibility to ensure that all necessary action is taken to meet the essential and legally prescribed health and safety requirements. Any use of the machine other than that described cannot be considered as complying with its intended purpose as specified by **KOHLER**, which therefore declines all responsibility for accidents caused by such operations.

2.2.2 Note for end user

- The following indications are dedicated to the user of the machine in order to reduce or eliminate risks concerning engine operation and the relative routine maintenance work.
- The user must read these instructions carefully. Failure to do this could lead to serious danger for his personal safety and health and that of any persons who may be in the vicinity of the machine.
- On starting, make sure that the engine is as horizontal as possible, unless the machine specifications differ.
- Make sure that the machine is stable to prevent the risk of overturning.
- The engine must not operate in places containing inflammable materials, in explosive atmospheres, where there is dust that can easily catch fire unless specific, adequate and clearly indicated precautions have been taken and have been certified for the machine.
- To prevent fire hazards, always keep the machine at least one meter from buildings or from other machinery.
- Children and animals must be kept at a due distance from operating machines in order to prevent hazards deriving from their operation.
- Fuel and oil are inflammable. The tank must only be filled when the engine is off. Before starting, dry any spilt fuel.
- Make sure that no soundproofing panels and the ground or floor on which the machine is standing have not soaked up any fuel.
- Fuel vapour is highly toxic. Only refuel outdoors or in a well ventilated place.
- Do not smoke or use open flames when refuelling.
- During operation, the surface of the engine can become dangerously hot. Avoid touching the exhaust system in particular.
- Before proceeding with any operation on the engine, stop it and allow it to cool.
- Always open the radiator plug or expansion chamber with the utmost caution, wearing protective garments and goggles.
- The coolant fluid is under pressure. Never carry out any inspections until the engine has cooled.
- If there is an electric fan, do not approach the engine when it is still hot as the fan could also start operating when the engine is at a standstill.



Important

- This operation should be carried out with vacuum pump.
- The oil must be drained whilst the engine is hot. Particular care is required to prevent burns. Do not allow the oil to come into contact with the skin because of the health hazards involved.
- During operations that involve access to moving parts of the engine and/or removal of rotating guards, disconnect and insulate the negative wire (-) of the battery to prevent accidental short-circuits and to stop the starter motor from being energized.
- Check belt tension only when the engine is off.

- Fully tighten the tank cap each time after refuelling. Do not fill the tank right to the top but leave an adequate space for the fuel to expand.
- To start the engine follow the specific instructions provided in the engine and/or machine operating manual. Do not use auxiliary starting devices not originally installed on the machine (e.g. Startpilot).
- Before starting, remove any tools that were used to service the engine and/or machine. Make sure that all guards have been refitted.
- Do not mix fuel with elements such as oil or kerosene. Failure to comply with this prohibition will cause the non-operation of the catalyst and non-observance of the emissions declared by **KOHLER**.
- Pay attention to the temperature of the oil filter when the filter itself is replaced.
- Only check, top up and change the coolant fluid when the engine is off and reached the ambient temperature. Coolant fluid is polluting, it must therefore be disposed of in the correct way.
- Do not use air and water jets at high pressures on cables, connectors and injectors.



Important

- Only use the eyebolts **A** installed by **KOHLER** to move the engine (**Fig. 2.1**).
- The angle between each lifting chain and the eyebolts shall not exceed 15° inwards.
- The correct tightening of the lifting screws is 25Nm.
- Do not interpose spacers or washers between the eyebolts and engine head.
- Provided that the above requirements are met, if the lifting eyebolts are subject to permanent deformation (inwards), all subsequent lifting operations must be performed in order to prevent them from bending in the opposite direction.

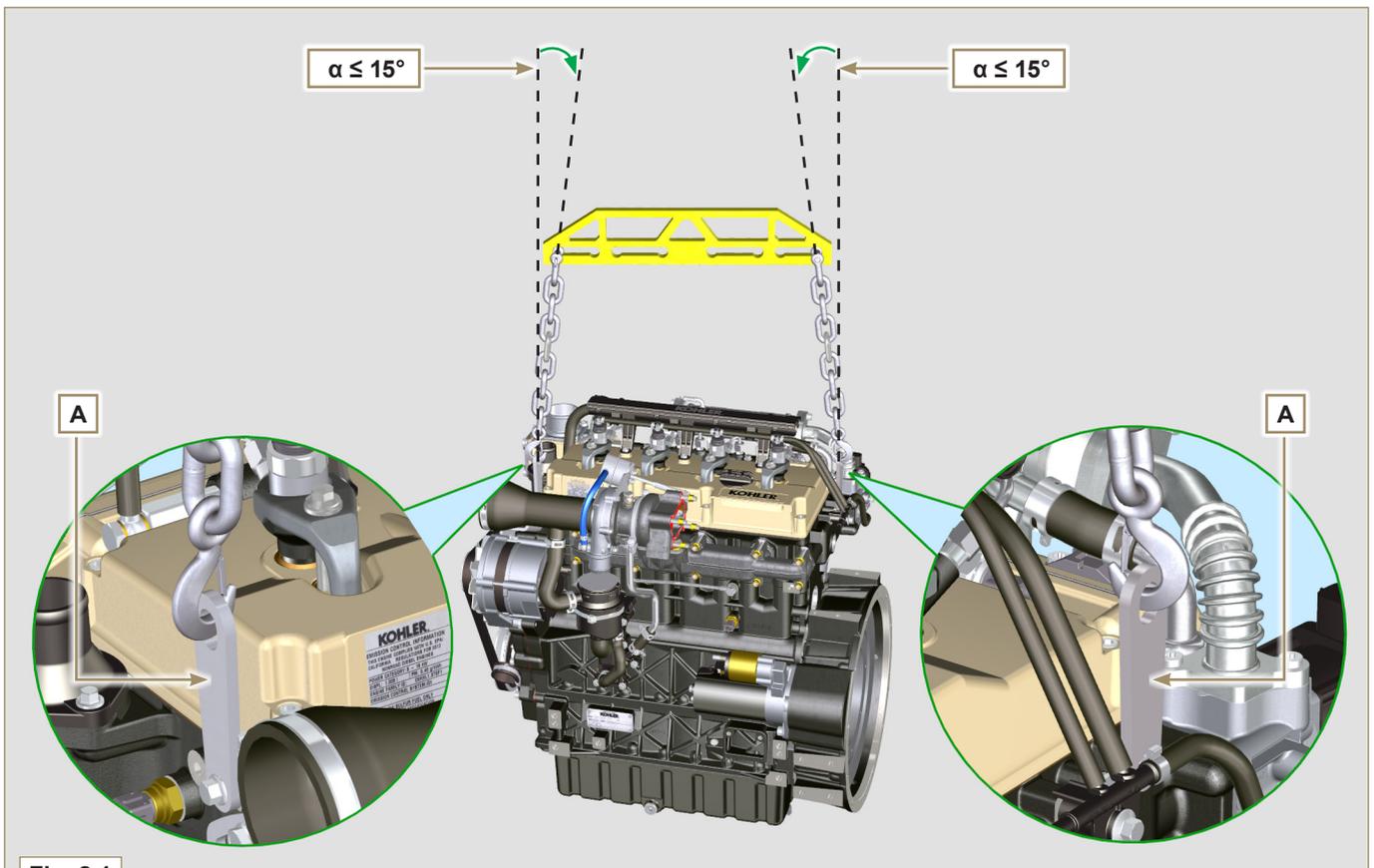


Fig. 2.1

2.3 Safety signal description

- To ensure safe operation please read the following statements and understand their meaning.
- Also refer to your equipment manufacturer's manual for other important safety information.

- This manual contains safety precautions which are explained below.
- Please read them carefully.



Read the Operation and Maintenance handbook before performing any operation on the engine.



Use protective gloves before carrying out the operation.



Hot Parts.
Danger of burns.



Use protective glasses before carrying out the operation.



Presence of rotating parts.
Danger of jamming or cutting.



Use sound absorbing protections before carrying out the operation.



Presence of explosive fuel.
Danger of fire or explosion.



Lifting point.



Presence of steam and pressurized coolant.
Danger of burns.



Electrical shock.
Danger of severe scalding or death.



Danger

- This indicates situations of grave danger which, if ignored, may seriously threaten the health and safety of individuals.



High pressure fluid.
Danger of fluid penetration.



Important

- This indicates particularly important technical information that should not be ignored.



Lethal Exhaust Gases.
Danger of poisoning or death.



Warning

- This indicates that failure to comply with it can cause minor damage or injury.

2.4 Information and safety signals

	ACCIDENTAL START
 	Accidental Starts can cause severe injury or death.
<i>Before working on the engine or equipment, disconnect the battery negative (-) wire.</i>	

	HOT PARTS
	Hot Parts can cause severe burns.
<i>Engine components can get extremely hot from operation. Do not touch engine while operating or just after stopping. Never operate the engine with heat shields or guards removed.</i>	

	ROTATING PARTS
	Rotating Parts can cause severe injury.
<i>Stay away while engine is in operation. Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.</i>	

	LETHAL EXHAUST GASES
	Carbon Monoxide can cause severe nausea, fainting or death.
<i>Avoid inhaling exhaust fumes and never run the engine in a closed building or confined area. Carbon monoxide is toxic, odorless, colorless, and can cause death if inhaled.</i>	

	ELECTRICAL SHOCK
	Electrical Shock can cause injury.
<i>Do not touch wires while engine is running.</i>	

	HIGH PRESSURE FLUID RISK OF PUNCTURE
	High Pressure Fluids can puncture skin and cause severe injury or death.
<i>Do not work on fuel system without proper training or safety equipment. Fluid puncture injuries are highly toxic and hazardous. If an injury occurs, seek immediate medical attention.</i>	

	EXPLOSIVE FUEL
	Explosive fuel can cause fires and severe burns.
<i>Fuel is flammable and its vapours can ignite. Store fuel only in approved containers, in well ventilated, unoccupied buildings. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use fuel as a cleaning agent.</i>	

	EXPLOSIVE GAS
	Explosive Gas can cause fires and severe acid burns.
<i>Charge battery only in a well ventilated area. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Batteries produce explosive hydrogen gas while being charged. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries. Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion.</i>	

CALIFORNIA WARNING - DECLARATION 65	
<i>Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.</i>	

2.5 Safety and environmental impact

Every organisation has a duty to implement procedures to identify, assess and monitor the influence of its own activities (products, services, etc.) on the environment. Procedures for identifying the extent of the impact on the environment must consider the following factors:

- Liquid waste.
- Waste management.
- Soil contamination.
- Atmospheric emission.
- Use of raw materials and natural resources.
- Regulations and directives regarding environmental impact.

In order to minimise the impact on the environment, **KOHLER** now provides a number of indications to be followed by all persons handling the engine, for any reason, during its expected lifetime.

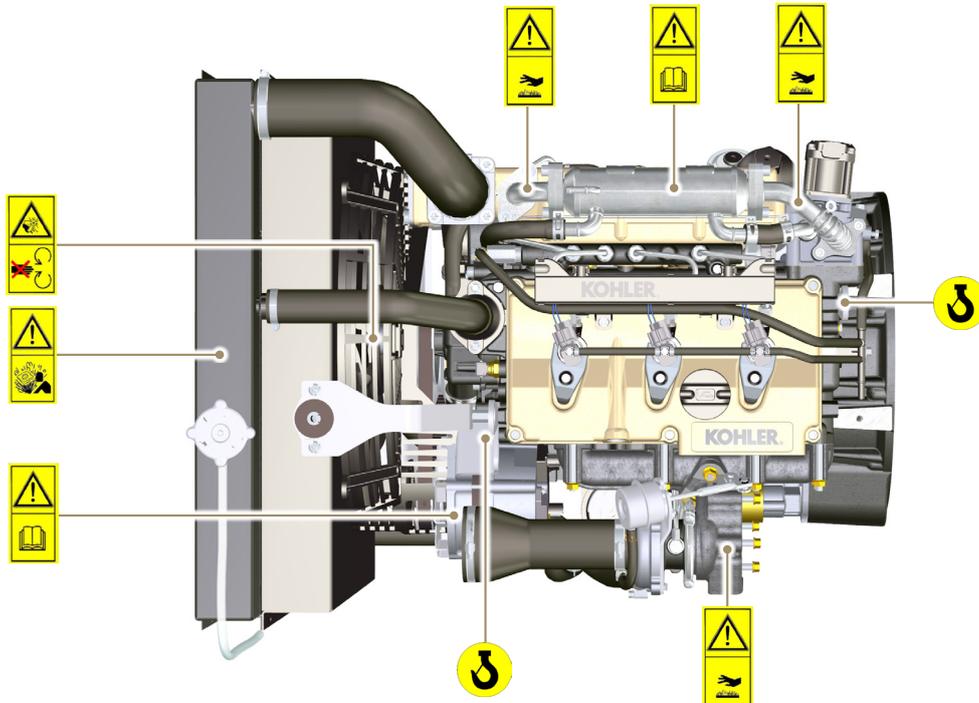
- All packaging components must be disposed of in accordance with the laws of the country in which disposal is taking place.
- Keep the fuel and engine control systems and the exhaust pipes in efficient working order to limit environmental and noise pollution.
- When discontinuing use of the engine, select all components according to their chemical characteristics and dispose of them separately.

2.6 Safety precautions

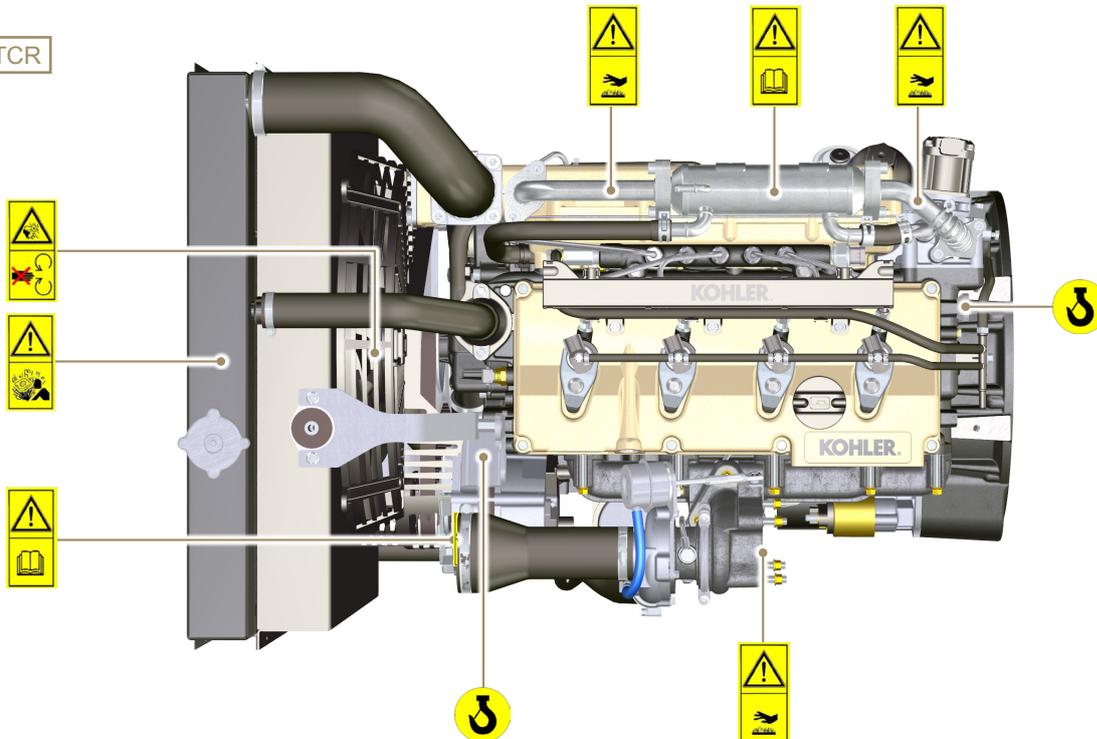
- Check the good condition of safety signals.
- The user must replace them with original ones if they are deteriorated and illegible. Ask for new safety signals to the manufacturer.
- Position them as shown in **Par. 2.7**.
- Clean with a cloth, water and soap.

2.7 Location of safety labels on engine

KDI 1903 TCR



KDI 2504 TCR



3.1 Pre-start check

- Read carefully the following pages and carry out the operations described below in accordance with the instructions specified.
- Increase the frequency of maintenance operations in heavy working conditions (engine starts but stops, very dusty and hot environments, etc...).



Important

- Non compliance with the operations described in the following pages involves the risk of damages to the engine and vehicle on which it is installed as well as personal and/or property damage.

3.2 Running-in period

NOTE: For the first 50 hours of engine operation, it is advisable not to exceed 75% of the maximum power supplied.

3.3 Starting and turning off

3.3.1 Starting

- 1 - Check the level of the engine oil, fuel and coolant and fill if necessary ([Par. 3.5](#) and [Par. 3.6](#)).
- 2 - Put the ignition key in the ignition switch (if supplied).
- 3 - Turn the key to **ON** position.
- 4 - Turn the key beyond the **ON** position and release it when the engine starts (the key will return into ON position automatically).



Important

- Do not actuate the starter for more than 15 seconds at a time. If the engine does not start, wait for one minute before repeating attempt.
- If engine does not start after two attempts see [Tab. 6.1](#) and [Tab. 6.2](#), to locate the cause.

3.3.2 After starting



Warning

- Make sure that all the warning lights on the control panel are off when the engine is running.
- 1 - Run at minimum speed for a few minutes according to table (except constant speed engine).

AMBIENT TEMPERATURE	TIME
≤ -20°C	2 minutes
from -20° C to -10°C	1 minutes
from -10° C to -5° C	30 seconds
from -5° C to 5° C	20 seconds
≥ 5° C	15 seconds

3.3.3 Turning off

- 1 - Do not turn off the engine when it is running at the maximum rotation speed (except constant speed engine).
- 2 - Before turning it off, keep it idle at minimum speed for about 1 minute.
- 3 - Turn the key to **OFF** position.

3.4 Refuelling



Danger

- Fill the engine off.
- The only approved fuels are those listed in [Tab. 1.3](#) pag. 12.
- In those countries where diesel has a high sulphur content, it is advisable to lubricate the engine with a high alkaline oil or alternatively to replace the lubricating oil recommended by **KOHLER** more frequently.
- To avoid explosions or fire outbreaks, do not smoke or use open flames during the operations.
- Fuel vapours are highly toxic. Only carry out the operations outdoors or in a well ventilated place.
- Keep your face well away from the fuel fill to prevent harmful vapours from being inhaled.
- Dispose of fuel in the correct way and do not litter as it is highly polluting.
- When refuelling, it is advisable to use a funnel to prevent fuel from spilling out. The fuel should also be filtered to prevent dust or dirt from entering the tank.

Do not overfill the fuel tank. Leave room for the fuel to expand.

NOTE: At the first fuelling or if the tank was empty [bleeding the fuel system \(Par. 5.4 point 8\)](#).

3.5 Oil filling



Important

- For safety precautions see [Par. 1.4](#).

- 1 - Loosen the oil filler cap **A** or the oil filler cap **C** if the cap **A** is not accessible.
- 2 - Add the type and amount of oil recommended ([Tab. 1.1](#) and [Tab. 1.2](#)).

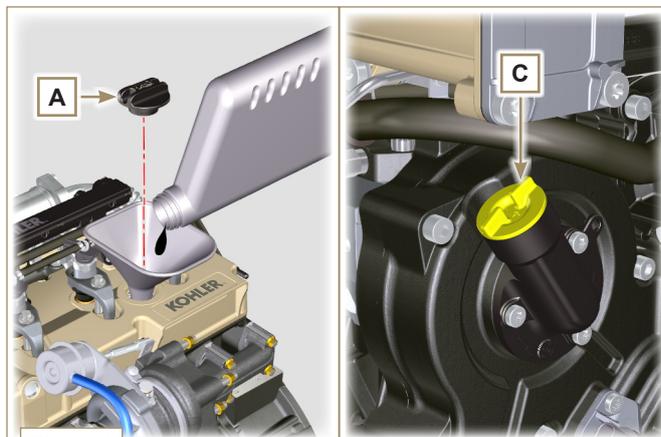


Fig. 3.1

- 3 - Before checking oil engine needs to be level.
- 4 - Remove the oil dipstick **B** and check that the level is up to but does not exceed the **MAX**.
- 5 - If level is not at the **MAX**. level, add additional oil.
- 6 - Re-tighten the cap **A** or **C**.

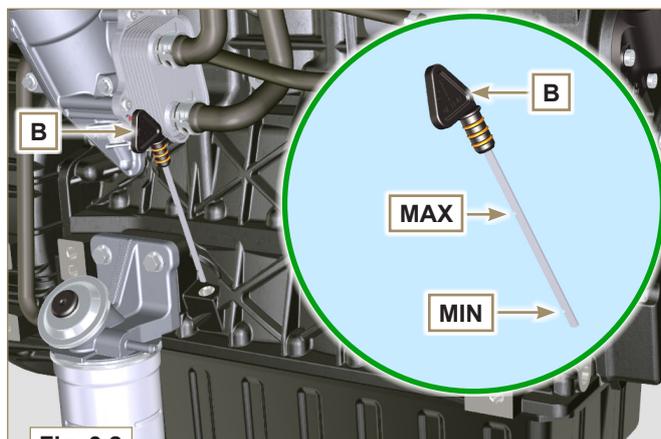


Fig. 3.2

3.6 Coolant filling



Warning

- An anti-freeze protection liquid (ANTIFREEZE) - mixed with decalcified water - must be used.
- The freezing point of the refrigerant mixture depends on the amount concentration in water.
- As well as lowering the freezing point, the antifreeze also raises the boiling point.
- A 50% mixture is recommended to ensure a general level of protection prevents the formation of rust, galvanic currents and calcium deposits.

NOTE: Before proceeding with any operation on the engine, stop it and allow it to cool.



Warning

- Presence of steam pressurized coolant danger of burns.
- 1 - Loosen the cap **A** and fill the radiator with coolant composed of:
50% ANTIFREEZE and 50% decalcified water.
 - 2 - Top liquid up until the pipes inside the radiator are covered by about 5 mm.
Do not overfill the radiator, but leave room for the coolant to expand.
 - 3 - For engines equipped with expansion tank, pour in fluid until reaching the max level mark.
 - 4 - Bleeding the cooling circuit as indicated in the [Par. 4.8](#).
 - 5 - Re-tighten the cap **A**.
 - 6 - After a few hours of operator, stop the engine and allow the liquid to cool returns to a ambient temperature and check the coolant level again.

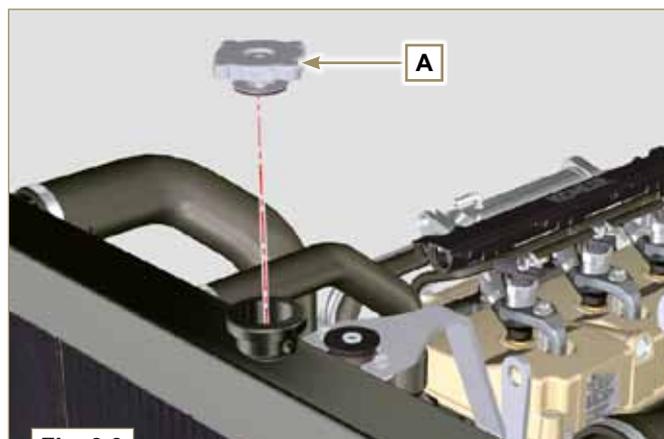


Fig. 3.3

4.1 Useful information about maintenance

- This chapter shows all operations described in the **Tab. 4.1** and **Tab. 4.2** if you have the skills appropriate may be directly carried out by the user.
- Periodic inspection and maintenance operations must be carried out as indicated in this manual and are the responsibility of the user.
- Failure to comply with these service and maintenance intervals increases the risk of technical damage to the engine. Any non compliance makes the warranty become null and void.
- In order to prevent personal and property damage read carefully the instructions listed below before proceeding with any operation of the engine.



Warning

- Inspections must be made when the engine is off and cold.
- Place engine on level surface to ensure accurate measurement of oil level.
- Before starting, to avoid spillages of oil make sure that:
 - the oil dipstick is inserted correctly;
 - also check that:
 - oil drain plug and
 - oil filler cap are tightened firmly.

4.2 Periodic maintenance

The intervals of preventive maintenance in **Tab. 4.1** and **Tab. 4.2** refer to the engine operating under normal operating conditions with fuel and oil meeting the recommended specifications.

Tab. 4.1

CLEANING AND CHECKING							
OPERATION DESCRIPTION	PERIOD (HOURS)						PAR.
	10	250	500	1000	1500	5000	
Engine oil level							4.3
Coolant level / Check of the radiator heat-exchanger surface ⁽²⁾							4.8 4.6
External cartridge dry-type air filter ⁽²⁾							4.5
Radiator heat-exchange surface and Intercooler ⁽²⁾							4.6
Alternator belt tension ⁽⁵⁾							4.9
Rubber hose (intake air / coolant)							4.7
Fuel hose							--

Tab. 4.2

REPLACEMENT							
OPERATION DESCRIPTION	PERIOD (HOURS)						PAR.
	10	250	500	1000	1500	5000	
Engine oil ⁽¹⁾							5.1
Oil filter cartridge ⁽¹⁾							5.2 5.3
Fuel filter cartridge ⁽¹⁾							5.4
Alternator Poly-V belt	Alternator V belt ⁽³⁾⁽⁶⁾						--
	Not heavy environmental condition ⁽⁶⁾						--
	Heavy environmental condition ⁽⁶⁾						--
Coolant ⁽⁶⁾							--
Intake manifold hose (air filter - intake manifold) ⁽⁶⁾							--
Coolant hoses ⁽⁶⁾							--
Dry air cleaner external cartridge ⁽²⁾⁽⁶⁾	After 6 checks with cleaning The replacement must be carried out by authorized KOHLER workshops						5.5
Fuel line hose	The replacement must be carried out by authorized KOHLER workshops						

(1) - In case of low use: 12 months.

(2) - The period of time that must elapse before checking the filter element depends on the environment in which the engine operates.
The air filter must be cleaned and replaced more frequently under very dusty conditions.

(3) - In case of low use: 36 months.

(4) - In case of low use: 24 months.

(5) - Not Poly-V type.

(6) - The replacement must be carried out by authorized **KOHLER** workshops.

4.3 Oil level check

- 1 - Remove the oil dipstick **B** and check that the level is up to **MAX**.
- 2 - Pour in recommended oil until reaching the **MAX** level mark.
- 3 - Reinstall the oil dipstick **B** completely.
- 4 - Re-tighten the cap **A** and/or **C** (Fig. 4.2).

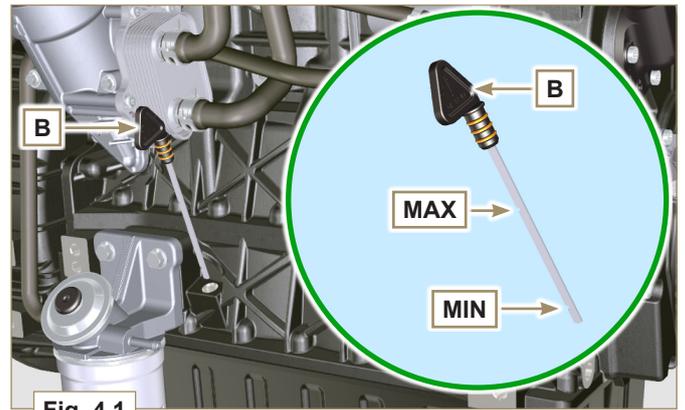


Fig. 4.1

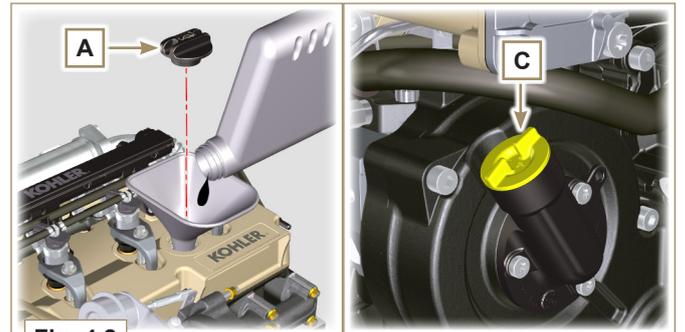


Fig. 4.2

4.4 Oil dipstick on cylinder head

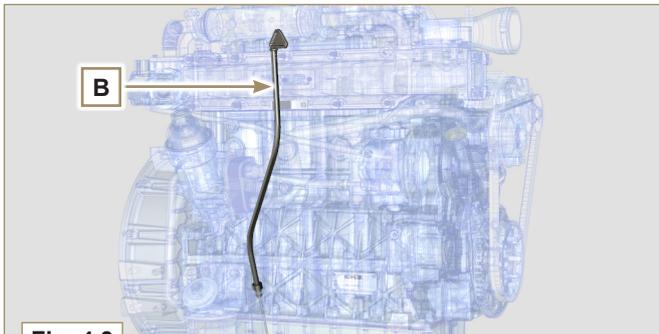


Fig. 4.3

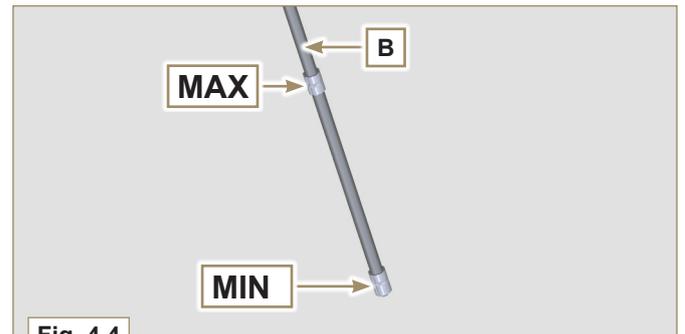


Fig. 4.4

4.5 Air filter check

NOTE: Components not necessarily supplied by KOHLER.

- 1 - Release the two clasps **F** of the cover **A**.
- 2 - Remove the cartridges **B** and **G**.
- 3 - Remove the cap **C**.
- 4 - Clean the inside components **A**, **C** and **D** with a damp cloth.
- 5 - **Do not use compressed air**, repeatedly tap the front side **E** on a flat surface.



Important

- When the cartridge **G** is dirty, **do not clean it but replace cartridges **B** and **G****.
- 6 - Reinstall:
 - cartridges **G** and **B**.
 - the cap **C**.
 - the cover **A** checking the right tightness of clasps **F**.

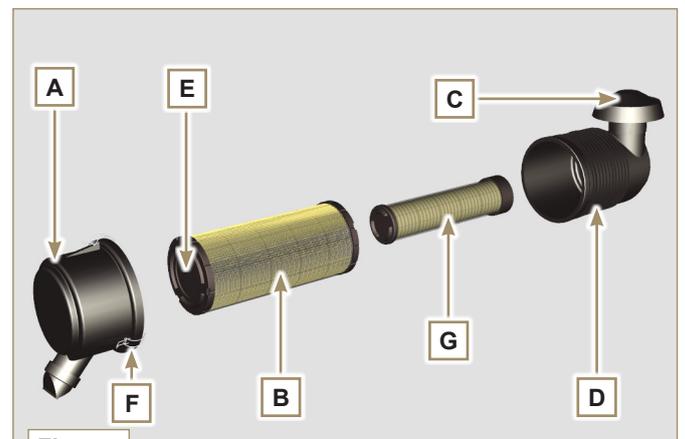


Fig. 4.5



Danger

For safety precautions see [Cap. 2](#).

4.6 Check of the radiator heat-exchanger surface

NOTE: Component not necessarily supplied by KOHLER.



Important

- Wear safety goggles when using compressed air.
- The radiator heat-exchange surface must be cleaned on both sides.

- 1 - Check the radiator heat-exchange surface **D**.
- 2 - Clean the surface with a brush soaked in special detergent if it is clogged.

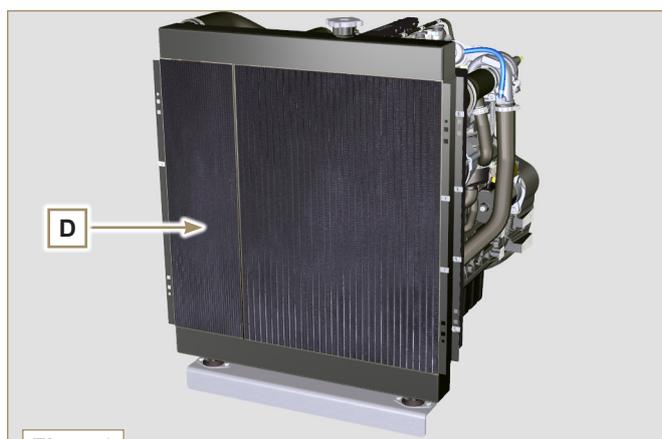


Fig. 4.6

4.7 Rubber hoses check

The check is carried out by exerting a slight deflection or bending along the pipe and near the hose clamps.

Components must be replaced if they have clear signs of cracks, tears, cuts, leaks and do not retain a certain degree of elasticity.



Important

- If hoses are damaged contact an authorized KOHLER workshop.

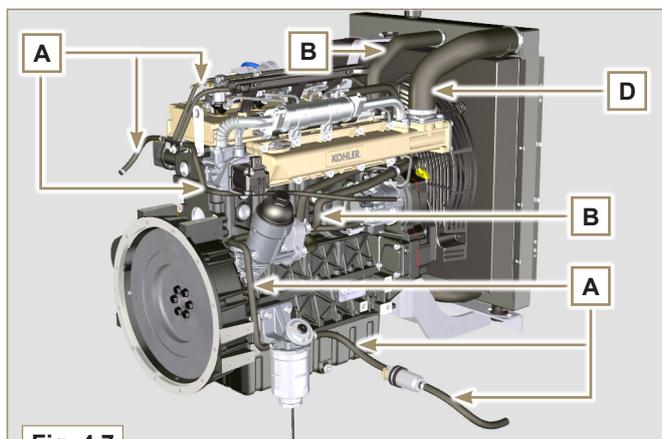


Fig. 4.7

- 1 - Check that the:

- Fuel system hoses **A** are intact.
- Cooling circuit hoses **B**.
- Vent system pipes **C**.
- Air system ducts **D**.
- Oil return circuit hose **E**.

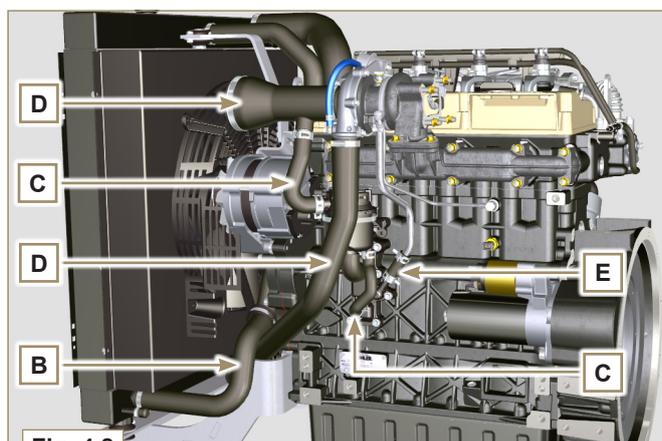


Fig. 4.8

4.8 Check coolant level

NOTE: Before proceeding with any operation on the engine, stop it and allow it to cool.



Warning

- Presence of steam pressurized coolant danger of burns.

NOTE: Component not necessarily supplied by KOHLER.

- 1 - Start the engine without the radiator cap **A**.
- 2 - Top liquid up until the pipes inside the radiator are covered by about 5 mm.
- 3 - Top up if necessary.
- 4 - Do not overfill the radiator, but leave room for the coolant to expand.
- 5 - Reinstall radiator cap **A**.
- 6 - For engines equipped with expansion tank (**B**), check that the fluid is until reaching the max level mark.

NOTE: For coolant filling see [Par. 3.6](#).



Warning

- Before starting make sure that the radiator cap and cap, if present, are installed correctly to avoid spillage of liquid or vapour at high temperatures.

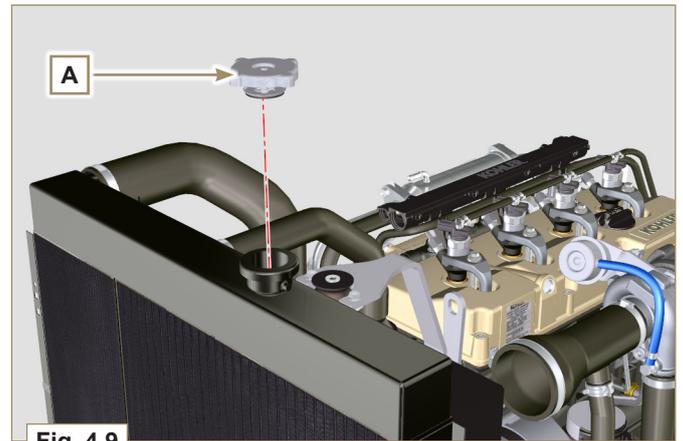


Fig. 4.9

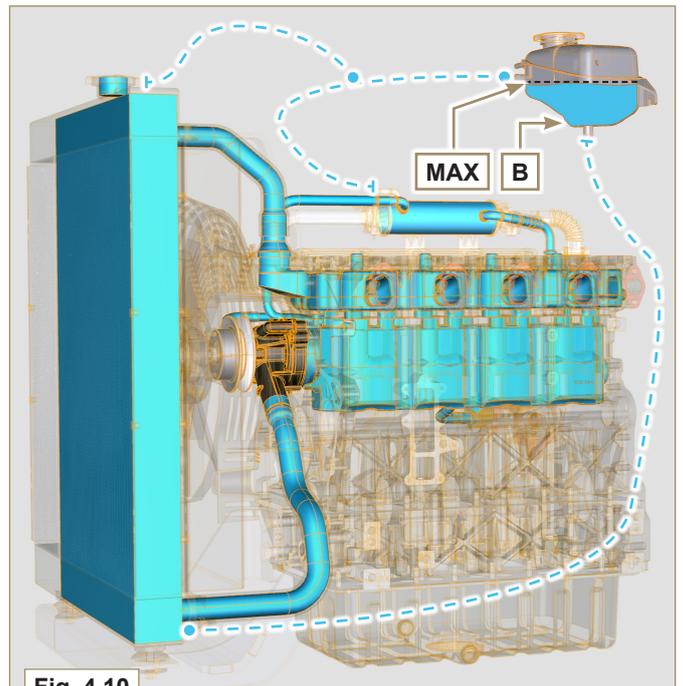


Fig. 4.10

4.9 Check and setting alternator standard belt tension

4.9.1 Check

- 1 - Check the belt **A** condition, if worn out or deteriorated, **replace it**.
- 2 - Check by the appropriate tool that at point **p** the tension value is between **80** and **85 Hz**.

Using the tool **F** (DENSO BTG-2 or a similar one) shown in the picture, it is possible to check the corresponding value in Newtons, which should be between **350** and **450 N**.

Should the correct tool not be available, the belt tension can be checked by applying a force in the direction of arrow **G** of approx' 10kg on the point **p**. When correctly tensioned the belt must show a movement of less than 10 mm.

If not adjust it.

4.9.2 Adjustment

- 1 - Loosen the fastening bolts **B** and **C**.
- 2 - Pull the alternator outwards (in direction of the arrow **D**), to tension the belt.
- 3 - Tension the belt tightening the bolts **B** and **C**.
- 4 - Tighten bolts **B** and **C** in sequence with a torque wrench **E** (tightening torque of **40 Nm**).
- 5 - Check by the appropriate tool that at point **p** the tension value is between **80** and **85 Hz**.

Using the tool **F** (DENSO BTG-2 or a similar one) shown in the picture, it is possible to check the corresponding value in Newtons, which should be between **350** and **450 N**.

Should the correct tool not be available, the belt tension can be checked by applying a force in the direction of arrow **G** of approx' 10kg on the point **p**. When correctly tensioned the belt must show a movement of less than 10mm.

Let the engine run for some minutes, then let it cool down at ambient temperature and repeat the operations **2**, **3**, **4** and **5** in case the belt tension results out of the above mentioned values.

NOTE: Contact **KOHLER** authorised workshops for replacement.

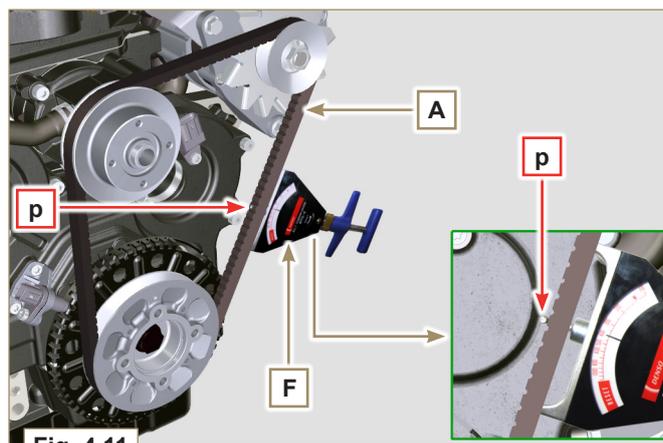


Fig. 4.11

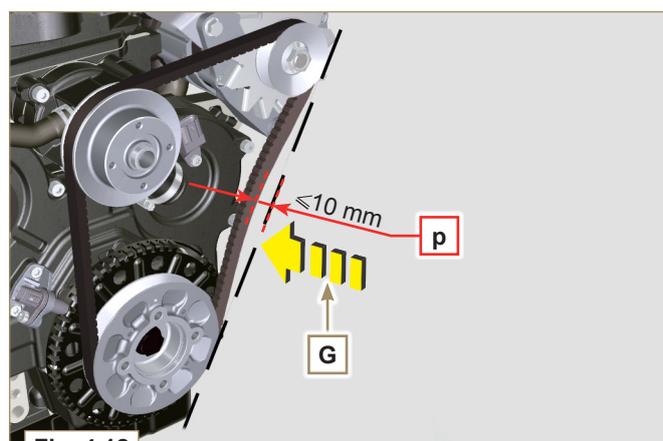


Fig. 4.12

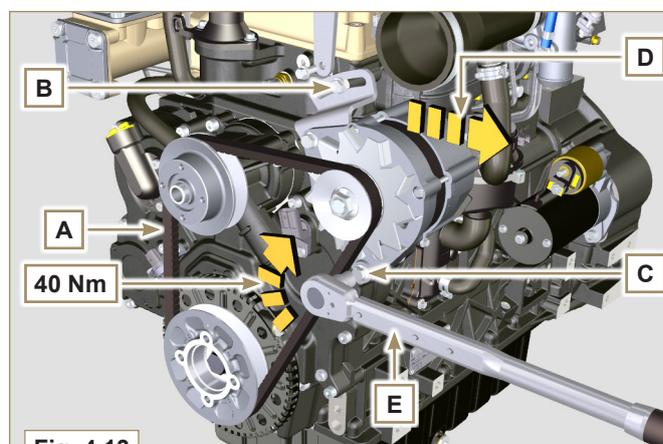


Fig. 4.13

4.10 Check Poly-V alternator belt

NOTE: The poly-v belt is not adjustable.

- 1 - Check the belt **A** condition, if worn out or deteriorated, **replace it**.

NOTE: Make sure that the ribs of the belt **G** are inserted correctly into the grooves of the pulleys **A** (as shown in **D1** and **D2**).

- 2 - Start the engine and run it for some minutes, then turn off it, and let it cool down at ambient temperature. Check by the appropriate tool that at point **p** the tension value is between **149** and **196 Hz**.

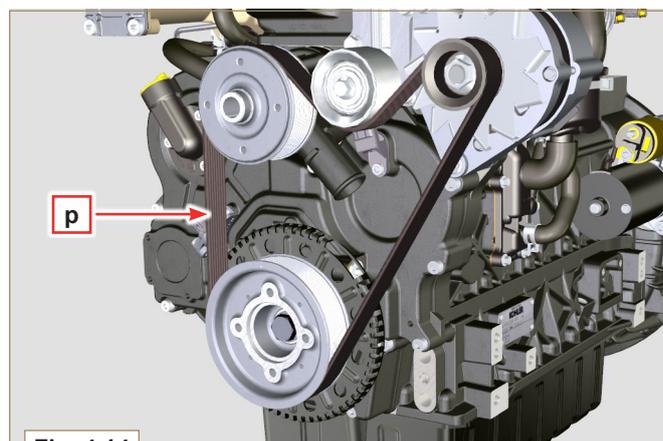


Fig. 4.14

NOTE: If the poly-v belt tension results out of the above mentioned values contact **KOHLER** authorised workshops for replacement.

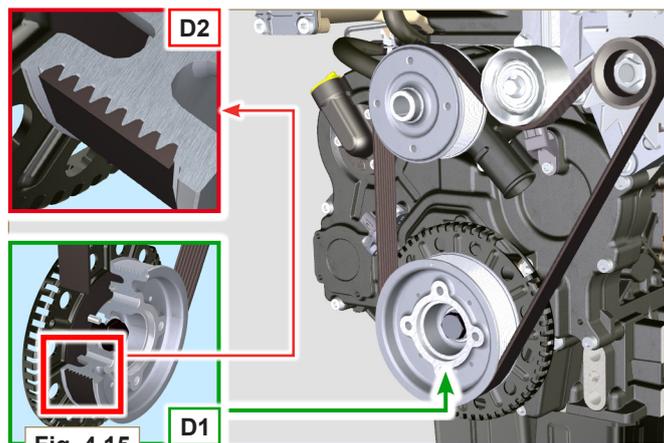


Fig. 4.15

4.11 Control water filter cartridge fuel

NOTE: When turn on lights on control water filter cartridge fuel see [Par. 5.4](#).

- 1 - Gently loosen the wing screw **A** without removing it.
- 2 - Drain the water if present.
- 3 - Re-tighten the wing screw **A** as soon as the fuel begins to flow.

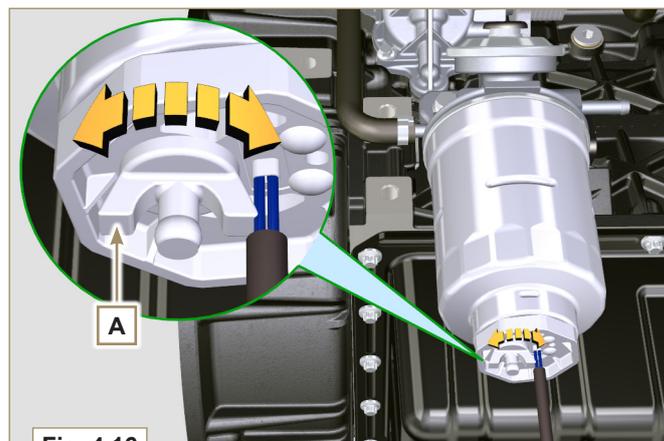


Fig. 4.16

4.12 Product preservation



Important

- If the engines are not to be used for 6 months, they must be protected by carrying out the operations described in Engine storage (up to 6 months) (**Par. 4.13**).
- If the engine is still not in use after the first 6 months, it is necessary to carry out a further operation to extend the protection period (more than 6 months) (**Par. 4.14**).
- If the engine is not to be used for an extended period, the protective treatment procedure must be repeated within 24 months of the previous one.

4.13 Engine storage up to 6 months

Before storing the engine check that:

- The environments are not humid or exposed to bad weather. Cover the engine with a proper protective sheet against dampness and atmospheric contaminants.
- The place is not near electric panel.
- Avoid storing the engine in direct contact with the ground.

4.14 Engine storage over 6 months

Follow the steps described in Par. 4.13.

- 1 - Engine oil replacement ([Par. 5.1](#)).
- 2 - Refuel with fuel additives for long storage.
The following additives are recommended:
DEFA Fluid Plus (Pakelo Lubricants),
Diesel Treatment (Green Star),
Top Diesel (Bardhal),
STP® Diesel Fuel Injector Treatment.
- 3 - With expansion tank:
make sure that the coolant is up to the **maximum** level.
- 4 - Without expansion tank:
Top liquid up until the pipes inside the radiator are covered by about 5 mm.
Do not overfill the radiator, but leave room for the fuel to expand.
- 5 - Start the engine and keep it idle at minimum speed for 2 minutes.
- 6 - Bring the engine to 3/4 of the **maximum** speed for 5÷10 minutes.
- 7 - Turn off the engine.
- 8 - Completely empty the fuel tank.
- 9 - Spray SAE 10W-40 on the exhaust and intake manifolds.
- 10 - Seal the exhaust and intake ducts to prevent foreign bodies from entering.

- 11 - When cleaning the engine, if using a pressure washer or steam cleaning device, avoid directing the nozzle on electrical components, cable connections and sealed rings (oil seals etc).

If cleaning engine with a pressure washer or steam cleaner, it is important to maintain a minimum distance of at least 200mm between the surface to be washed and the nozzle - avoiding absolutely electrical components such as alternators, starter motors and engine control units (ECU).

- 12 - Treat non-painted parts with protective products.

- 13 - Loosen the alternator belt [Par. 4.9](#).

If the engine protection is performed according to the suggestions indicated no corrosion damage should occur.

4.15 Engine starting after storage

- 1 - Remove the protective sheet.
- 2 - Use a cloth soaked in degreasing product to remove the protective treatment from the external parts.
- 3 - Inject lubricating oil (no more than 2 cm³) into the intake ducts.
- 4 - Adjust the alternator belt tension ([Par. 4.9](#)).
- 5 - Refill the tank with fresh fuel.
- 6 - Make sure that the oil and the coolant are up to the **maximum** level.
- 7 - Start the engine and keep it idle at minimum speed for a two about minutes.
- 8 - Bring the engine to 75% of **maximum** rated speed for 5 to 10 minutes.
- 9 - Stop the engine while the oil is still hot ([Par. 5.1](#)), discharge the protective oil in a suitable container.



Warning

- Over time, lubricants and filters lose their properties, so it is important consider whether they need replacing, also based on the criteria described in [Tab. 4.2](#).
- 10 - Replace the filters (air, oil, fuel) with original spare parts.
 - 11 - Pour new oil ([Par. 3.5](#)) up to the **maximum** level.
 - 12 - Empty the cooling circuit completely and pour in the new coolant up to the **maximum** level ([Par. 3.6](#)).



Danger

Disconnect the negative wire (-) from the battery to avoid accidental engine starting.

5.1 Engine oil replacement



Important

- Place engine on level surface to ensure accurate measurement of oil level.

NOTE: Perform this operation with warm engine, to get a better fluidity of the oil and get a full discharge of oil and impurities contained in it.

- 1 - Loosen the oil filler cap **A** (Fig. 5.1).
- 2 - Remove the oil dipstick **B**.
- 3 - Remove the oil drain plug **D** and the gasket **E** (the oil drain plug is on both sides of the oil sump).
- 4 - Drain oil in an appropriate container.
(For the exhausted oil disposal, refer to [Par. 5.6 DISPOSAL](#) and [SCRAPPING](#)).
- 5 - Replace gasket **E**.
- 6 - Tighten the drain oil plug **D** (tightening torque at 35 Nm).

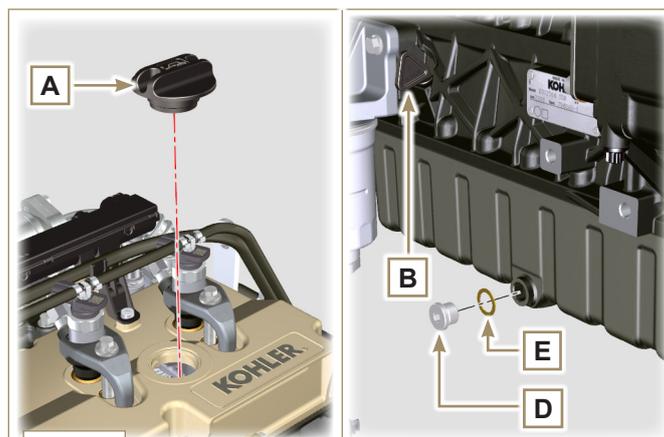


Fig. 5.1

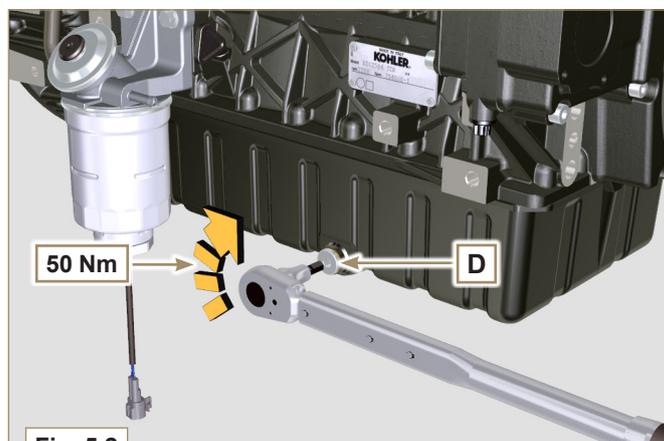


Fig. 5.2

- 7 - Add the type and amount of oil recommended ([Tab. 1.1](#) and [Tab. 1.2](#)).

- 8 - If the plug **A** is not accessible, use the oil filler cap **C**.



Important

- Do not exceed the MAX level on the dipstick.

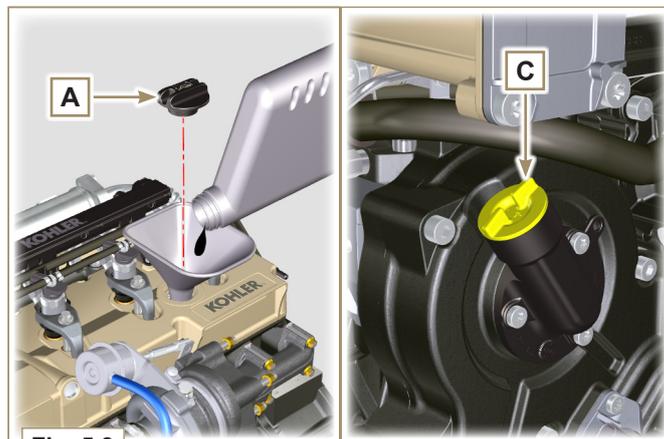
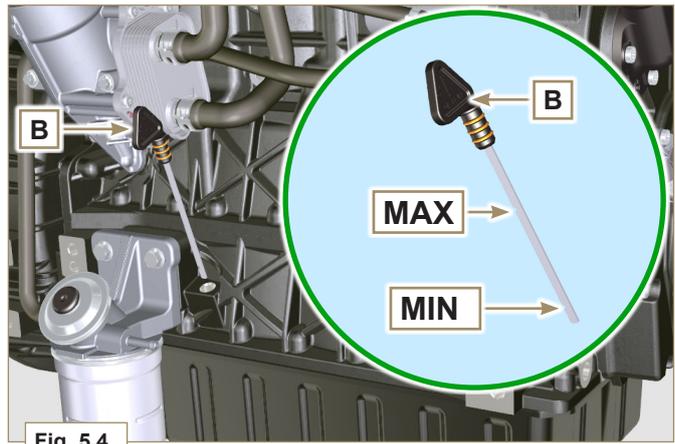


Fig. 5.3

- 9 - Fit and remove the oil dipstick **B** to check the level.
Pour in fluid until reaching the **MAX** level mark.
- 10 - Upon completion, reinstall the oil dipstick **B** completely.
- 11 - Tighten the cap **A** or **C**.



Warning

Oil filter cartridge replacement (Par. 5.2) and fuel filter replacement ([Par. 5.4](#))

In case of low use replace it 12 months.
For disposal of oil filter cartridge and fuel filter refer
to [Par. 5.6 DISPOSAL](#) and [SCRAPPING](#).

5.2 Oil filter cartridge replacement

- 1 - Loosen the cap **A**.
- 2 - Remove the cap **A** as well as the oil cartridge **B** from the oil filter support.

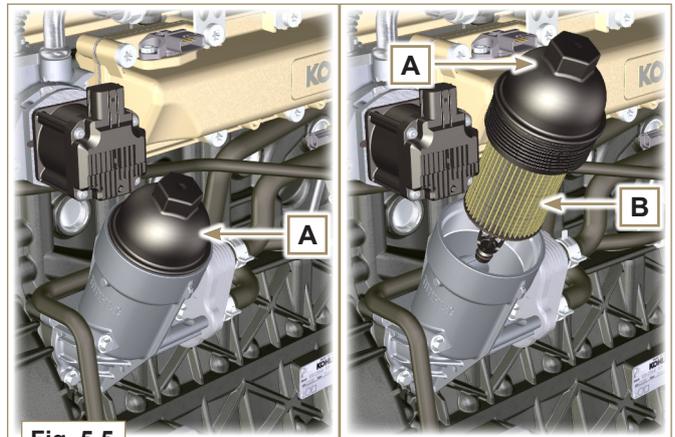


Fig. 5.5

- 3 - Remove and replace the oil cartridge **B** with a new one.
Remove and replace the gaskets **C**, **D** and **E** with new ones.

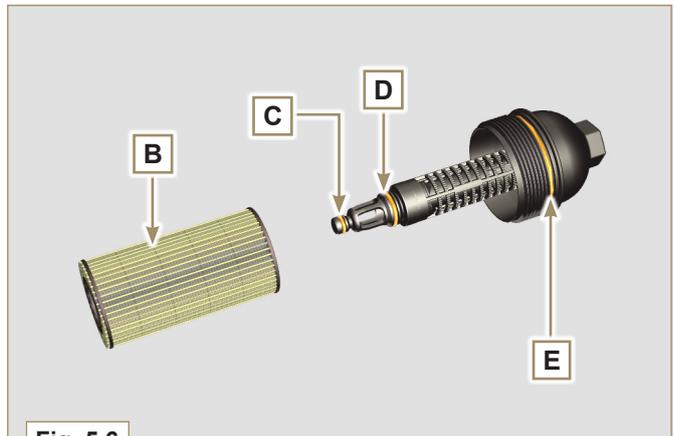


Fig. 5.6

- 4 - Fit and tighten the cover **A** on the oil filter support **F**, tightening it with a torque wrench **G** (tightening torque of 25 Nm).

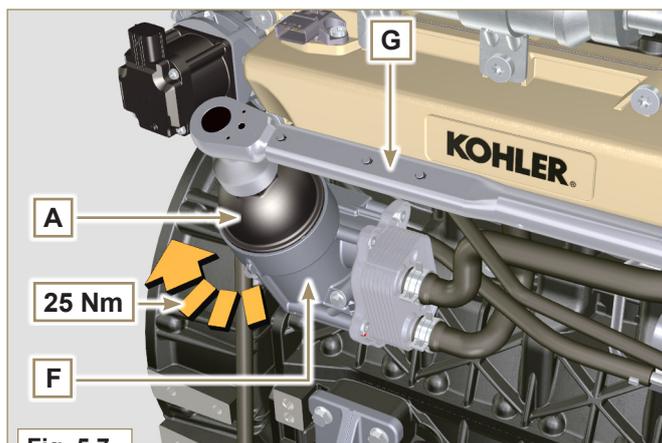


Fig. 5.7

NOTE: Click on the icon (▶) to play the procedure.



5.3 Remote oil filter cartridge replacement (optional)

- 1 - Unscrew and remove the cartridge **A** using the appropriate wrench.
- 2 - Lubricate the gasket and screw on the new cartridge **A** using the appropriate wrench.

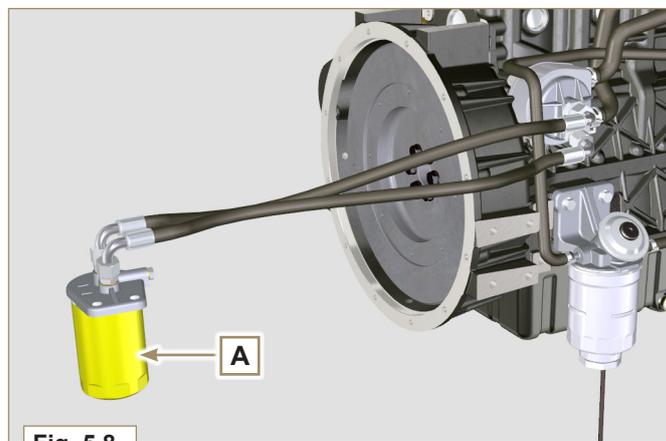


Fig. 5.8

5.4 Fuel filter cartridge replacement

- 1 - Disconnect the cable **A** of the water presence sensor **C**.
- 2 - Remove the water presence sensor **C** from its cartridge **B**.
- 3 - Loosen the cartridge **B** using the appropriate wrench **F** (Fig. 5.10).
- 4 - Lubricate the gasket **D** of the new cartridge **B**.

Important

- Do not fill the new cartridge **B** with fuel.
- 5 - Tighten the new empty cartridge **B** (Fig. 5.10) on the diesel fuel filter support **E** using the special wrench **F** (tightening torque of **17 Nm**).
 - 6 - Tighten the water presence sensor **C** on the new cartridge **B** (tightening torque of **5 Nm**).
 - 7 - Reconnect the cable **A** of the water presence sensor **C**.

NOTE: Bleeding.

- 8 - Push repeatedly the button **G** in order to fill the circuit.

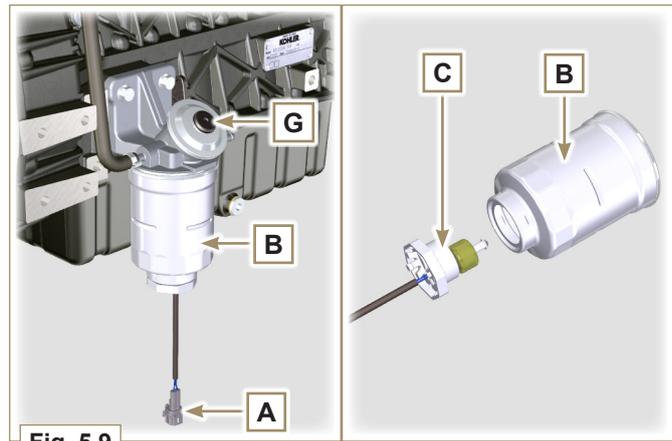


Fig. 5.9

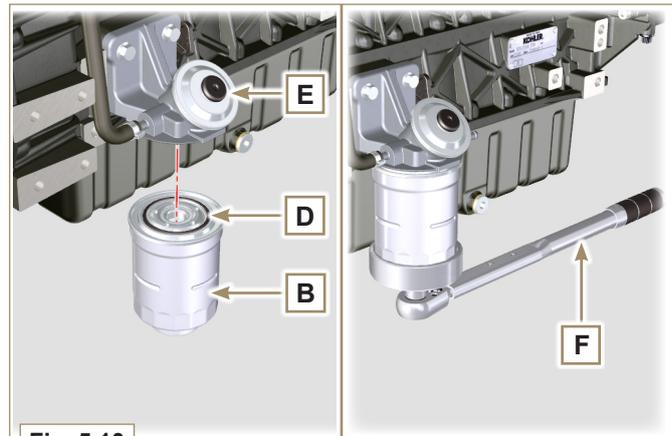


Fig. 5.10

NOTE: Click on the icon () to play the procedure.



5.5 Air filter cartridge replacement

NOTE: Component not necessarily supplied by KOHLER.

- 1 - Release the two fastenings **F** of the cover **A**.
- 2 - Remove the cartridges **B** and **G**.
- 3 - Reinstall:
 - the new cartridges **B** and **G**.
 - the cover **A** checking the right tightness of fastenings **F**.

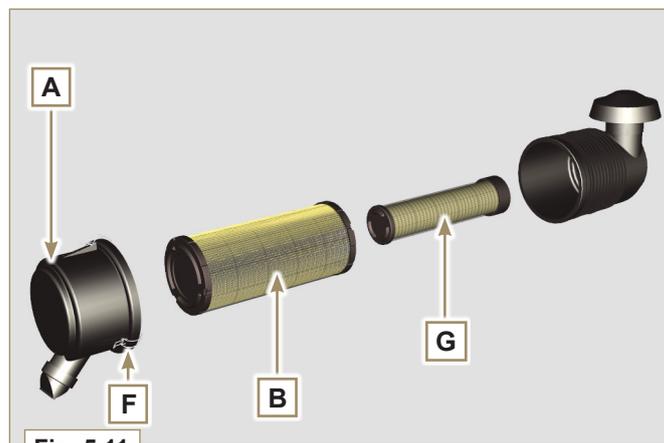


Fig. 5.11

5.6 Disposal and scrapping

- In case of scrapping, the engine shall be disposed of in appropriate locations, in conformity with the law in force.
- Before scrapping, it is necessary to separate the rubber or plastic parts from the rest of the components.
- The parts only composed of plastic material, aluminium and steel can be recycled if collected by the appropriate centers.
- Waste oil must properly be recycled and disposed of in the correct way to safeguard the environment. According to the laws in force, it is classified as hazardous waste, therefore it must be collected by the appropriate centers.

6.1 Useful information about failures

- This chapter contains information about the problems that may appear during engine operation with its causes and trouble shooting **Tab. 6.2**.
- In some cases, you shall turn off the engine immediately to avoid further damage **Tab. 6.1**.

Tab. 6.1

THE ENGINE MUST BE IMMEDIATELY TURNED OFF WHEN	
1	Warning RED light turn on
2	The oil pressure indicator light turns on while running
3	The engine rpms suddenly increase and decrease
4	A sudden and/or unusual noise is heard
5	Colour the exhaust fumes suddenly darkens

Tab. 6.2

TROUBLES	POSSIBLE CAUSE	SOLUTION	PAR.
Warning YELLOW light turn on	Engine ECU has detect a malfunctions	Contact KOHLER authorised workshops	--
The engine does not start	Sulphated battery terminals corroded	Clean the battery terminals	--
	Battery voltage too low	Recharge the battery or replace it	--
	Low fuel level	Refuel	3.4
	Frozen fuel	Contact KOHLER authorised workshops	--
	Clogged fuel filter	Replace with a new filter	5.4
	Air suction in fuel system	Contact KOHLER authorised workshops	--
	Clogged air filter	Replace with a new filter	5.5
	Clogged pipes	Contact KOHLER authorised workshops	--
	Open fuse	Replace with a new fuse; if the problem persists, contact KOHLER authorised workshops	--
	Intake or exhaust system clogged	Contact KOHLER authorised workshops	--
Engine starts but stops	Inefficient electrical connections	Clean the electrical contacts; if the problem persists, contact KOHLER authorised workshops	--
	Sulphated battery terminals	Clean the battery terminals	--
	Clogged fuel filter	Replace with a new filter and clean the tank	--
	Clogged fuel pipes	Contact KOHLER authorised workshops	--
RPM instability at idle speed	Clogged fuel pipes	Contact KOHLER authorised workshops	--
Low idle speed	Clogged fuel pipes	Contact KOHLER authorised workshops	--
	Poor quality fuel	Clean the tank and refuel with quality fuel	1.5
Blue smoke	High oil sump level	Replace the engine oil; if the problem persists, contact KOHLER authorised workshops	--
	Clogged air filter	Replace with a new filter	5.5
Excessive fuel consumption	Clogged air filter	Replace with a new filter	5.5
	High oil sump level	Replace the engine oil; if the problem persists, contact KOHLER authorised workshops	--
Engine lost its initial performance	Clogged air filter	Replace with a new filter	5.4
	Clogged fuel pipes	Contact KOHLER authorised workshops	--
	Cheap fuel	Clean the tank and refuel with quality fuel	--
	High oil sump level	Replace the engine oil; if the problem persists, contact KOHLER authorised workshops	--
Slow acceleration	Clogged fuel filter	Replace the fuel filter	5.4
Engine jerking	Clogged fuel pipes	Contact KOHLER authorised workshops	--
Engine overheats	Insufficient coolant level	Fill up to the level	3.6
	High oil sump level	Replace the engine oil; if the problem persists, contact KOHLER authorised workshops	--
	Clogged radiator	Clean the radiator; if the problem persists, contact KOHLER authorised workshops	--

- In the event that the solutions proposed in **Tab. 6.2** do not eliminate the trouble, contact a **KOHLER** authorized workshop.

CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT YOUR WARRANTY RIGHTS AND OBLIGATIONS

- **The Californian Air Resources Board and Kohler Co.** are pleased to explain **the emission control system warranty** on your 2013 engine.
- In California, new heavy-duty off-road engines must be designed, built and equipped to meet the State's stringent anti-smog standards.
- **Kohler Co.** must warrant the emission control system on your engine for the time period listed below provided there has been no abuse, neglect or improper maintenance of your engine.
- Your emission control system may include parts such as the fuel-injection system and the air induction. Also included may be hoses, connectors and other emission related assemblies. system.
- Where a warrantable condition exists, **Kohler Co.** will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE

- Your off-road diesel engine emission control system is covered under warranty for a period of five (5) years or 3,000 hours, whichever occurs first, beginning on the date the engine or equipment is delivered to an ultimate purchaser for all constant speed engines with maximum power $19 \leq kW < 37$ and rated speed less than 3,000 rpm, all variable speed engines with maximum power $19 \leq kW < 37$ and all variable or constant speed engines with maximum power greater than 37 kW.
- Your off-road diesel engine emission control system on variable or constant speed engines with maximum power less than 19 KW and constant speed engines with maximum power $19 \leq kW < 37$ and rated speed equal to or greater than 3,000 rpm is covered under warranty for a period of two (2) years or 1,500 hours, whichever occurs first.
- If any emission related part on your engine is defective, the part will be repaired or replaced by **Kohler Co.**

OWNER'S WARRANTY RESPONSIBILITIES

- As the heavy-duty off-road engine owner, you are responsible for the performance of the required maintenance listed in your **Kohler Co.** owner's manual.
- **Kohler Co.** recommends that you retain all receipts covering maintenance on your heavy-duty off-road engine.
- **Kohler Co.** cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all recommended scheduled maintenance.
- As the heavy-duty off-road engine owner, you should however be aware that **Kohler Co.** may deny you warranty coverage if your heavy-duty off-road engine or emission control related component has failed due to abuse, neglect, improper maintenance or unapproved modifications.
- Your engine is designed to operate on commercial diesel fuel (No. 1 or No. 2 low sulfur or ultra low sulfur diesel fuel) only.
- Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.
- Requirements for emission directive in force in the Californian State.
- You are responsible for initiating the warranty process.
- The Air Resources Board suggests that you present your heavy-duty off-road engine to a **Kohler Co.** dealer as soon as a problem exists.
- The warranty repairs should be completed by the dealer as expeditiously as possible.
- Please review the document titled, "**Kohler Co.** Federal and California Emission Control Systems Limited Warranty Off-Road Diesel Engines", for complete details of your heavy-duty off-road engine warranty.
- If you have any questions regarding your warranty rights and responsibilities or the location of the nearest Kohler Co. authorized service location, you should contact **Kohler Co.** at 1-800-544-2444 or access our website at www.kohlerengines.com (USA and North American).
- The complete and updated list of authorized **Kohler Co.** service centers can be found on our web site: <http://www.lombardinigroup.it/dealer-locator>.



Area with horizontal dotted lines for taking notes.

Translated from the original manual in Italian language.

Data reported in this issue can be modified at any time by KOHLER.

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