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3.1 Before start-up

- Read the manual carefully and carry out the operations described below in compliance with the instructions specified.
- Periodic inspection and maintenance operations must be carried out as indicated in this manual and under the user's responsibility.

Important

- Only use original spare parts and accessories.
- The use of non-original parts, as well as voiding the warranty, affects the life and performance of the engine, and may be dangerous.
- Non compliance with the operations described in the following pages may result damage to the engine and vehicle on which it is installed, as well as to people and/or property.

3.2 Safety precautions

- 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 **Par. 3.4.3**.
- **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.

3.3 General remarks

3.2.1 Note for OEM

- When installing the **KDI** engines, always bear in mind that any variation to the functional systems may involve serious failures to the engine.
- Any improvement must be verified at **KOHLER** testing laboratories before application of the engine.
- In the event KOHLER does not approve the type of modification, KOHLER shall not be held responsible for any consequential operation anomalies that the engine may undergo and any damage the engine may cause to persons and things.
- 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.

3.2.2 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.
- Thoroughly wash and clean all the external parts of the engine before performing any operation, in order to avoid the accidental introduction of impurities/foreign bodies. Use only water and/or appropriate products to clean the engine. 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. Avoid directing the nozzle on electrical components, cable connections and sealed rings (oil seals etc). Thoroughly wash and clean the area surrounding the engine following the instructions provided by machine manufacturer.
- 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.

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1.3 Identification of the main internal components of the engine and operating reference (BASE CONFIGURATION)

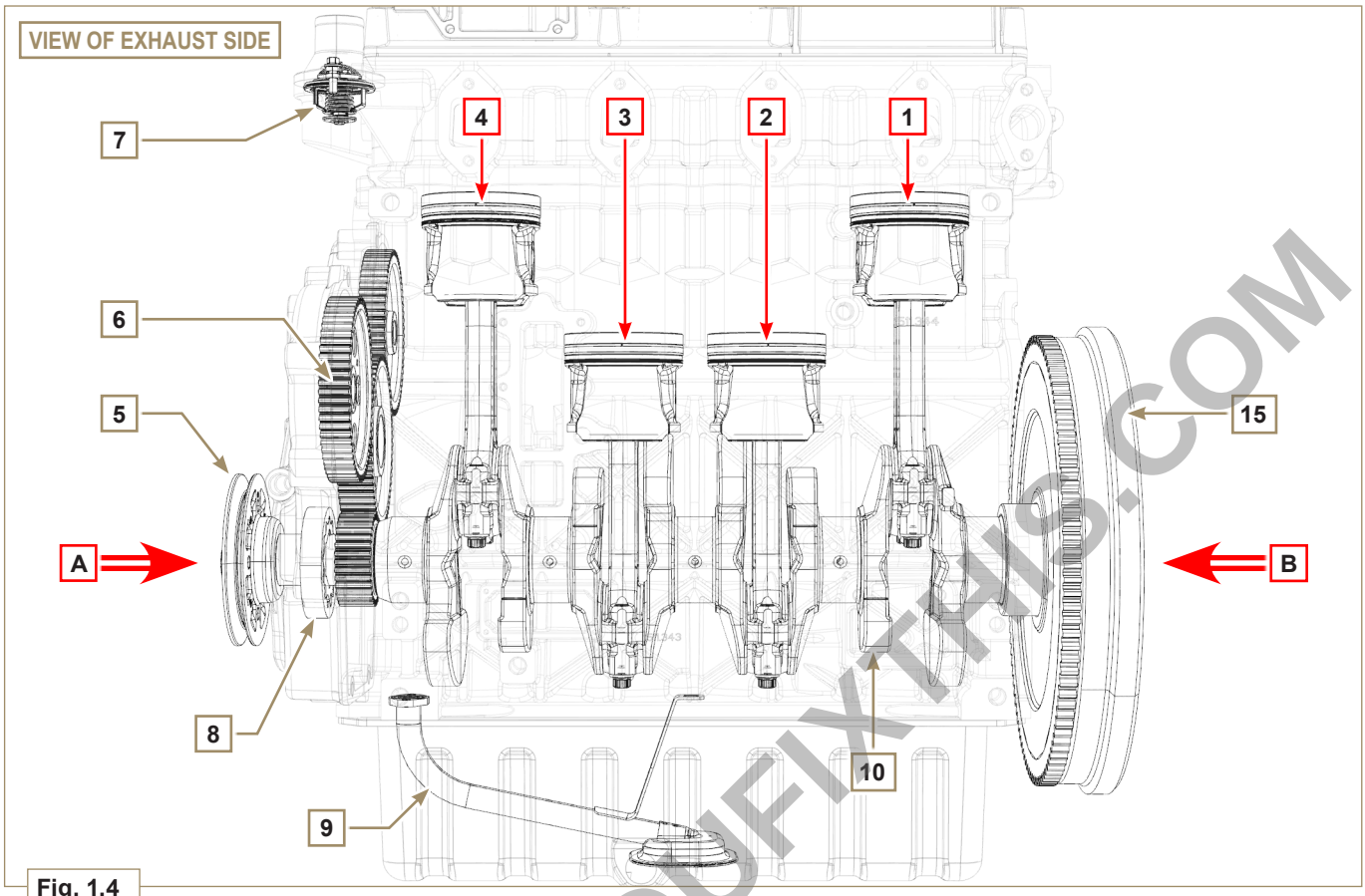


Fig. 1.4

The following chapters contain operating references in order to clearly understand the engine. This paragraph illustrates these references that may be recognised by means of some main internal components.

Should you need to execute complex operations, always consult this paragraph.

NOTE: it is advisable to keep this page visible during disassembly and assembly operations.

Tab. 1.1

REF.	DESCRIPTION
A ⇒	View of timing system side (2nd PTO)
B ⇒	View of flywheel side (1st PTO)
C ⇒	View of exhaust side
D ⇒	View of intake side
1	Cylinder/Piston N. 1 (KDI 1903 - KDI 2504)
2	Cylinder/Piston N. 2 (KDI 1903 - KDI 2504)
3	Cylinder/Piston N. 3 (KDI 1903 - KDI 2504)
4	Cylinder/Piston N. 4 (KDI 2504)
POS.	**DESCRIPTION**
5	Crankshaft pulley (2nd PTO)
6	Gear timing system
7	Thermostatic valve
8	Oil pump
9	Oil suction hose
10	Crankshaft
11	Exhaust manifold
12	Intake manifold
13	Camshaft
14	Gears adaptor for 3rd/4th PTO (optional)
15	Flywheel (1st PTO)
16	Injector

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6.1 Injector and injection pump replacement

Important

- Before proceeding with operation, carefully read **Par. 3.3.2**.
- Replace the high pressure pipes after two disassemblies.
- The injectors cannot be repaired but must be replaced.
- Seal all injection component unions as illustrated in **Par. 2.9.7** during disassembly.
- Always replace the gaskets after each disassembly.
- Handle the components as described in **Par. 2.18**.
- Refer to **Par. 1.3** for **operating references** when assembling and disassembling.

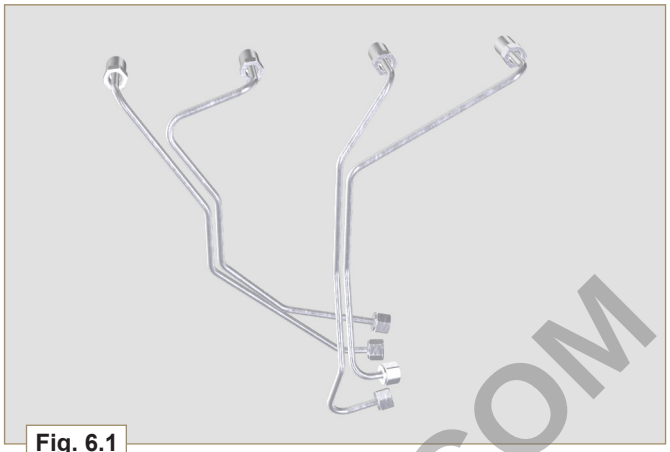


Fig. 6.1

6.1.1 Injection fuel pipes disassembly (injection pump/injectors)

1 - Undo the screws **A** and remove plate **B.**

2 - Remove the retainers **C** for the hoses **D.**

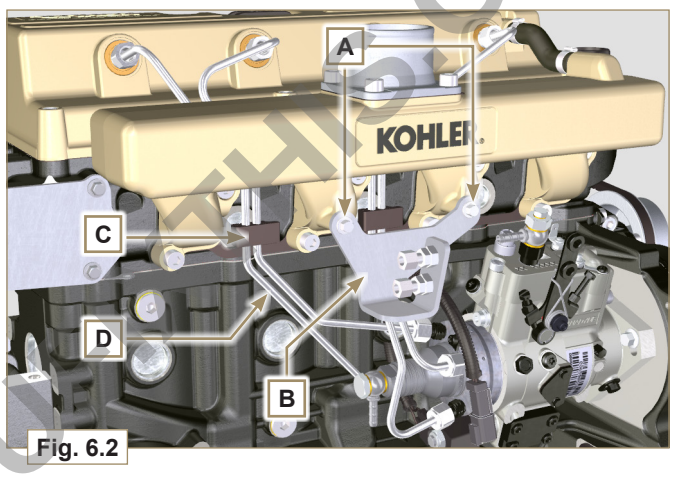


Fig. 6.2

3 - Undo the nuts **F**.

4 - Undo the nuts **E**.

5 - Remove the tube **D**.

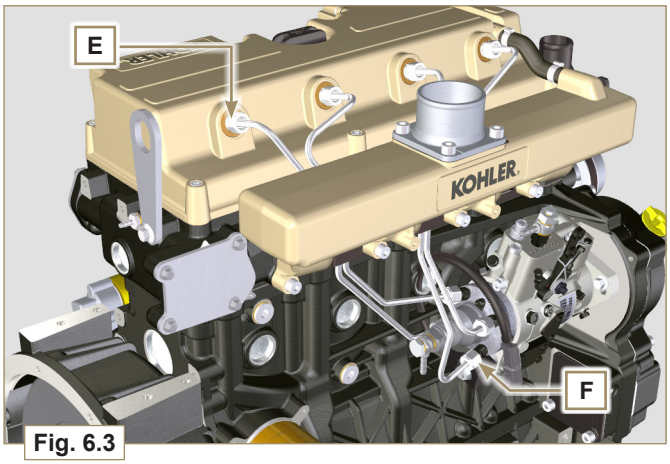


Fig. 6.3

6.1.2 Rocker arms cover disassembly

1 - Loosen clamp **G** and disconnect hose **H.**

2 - Undo the screws **L** and remove the rocker arm cap **M.**

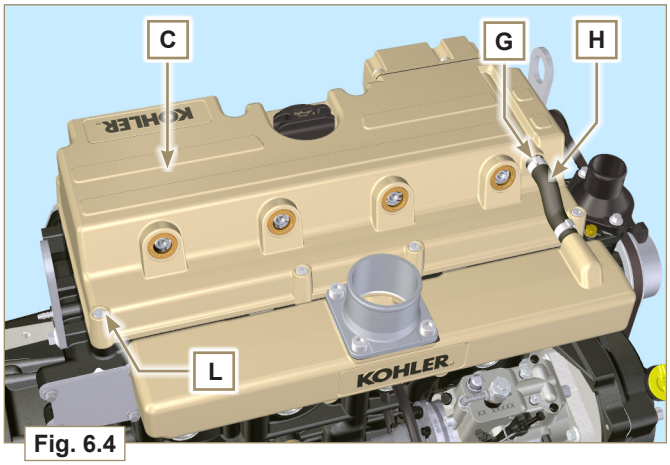


Fig. 6.4

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9.15 Tightening torques and the use of sealants

Tab. 9.4 * *Alternatively to the capscrew replacements, with "Dri-loc"*

BASE CONFIGURATION			
SHORT BLOCK			
Component	Thread (mm)	Torque (Nm)	Sealer
Breather room closing cover fastening capscrew (EXHAUST SIDE)	M6x1	10	
Lower crankcase fastening capscrew	**M12x1.25**	**3 Torque cycles**	
1st Cycle		40	
2nd Cycle		70	
3rd Cycle		120	
Lower crankcase fastening capscrew	**M8x1.25**	**2 Torque cycles**	
1st Cycle		20	
2nd Cycle		35	
Connecting rod screw	**M8x1**	**2 Torque cycles**	
1° Ciclo		40	
2° Ciclo		85	
Crankshaft gasket flange fastening capscrew	M6x1	10	Loctite 2701*
Closing cover fastening capscrew 3rd PTO	M8x1.25	25	Loctite 2701*
Idle gear lubr. hole cap closure	M14x1.5	30	Loctite 2701*
Coolant drain hole closing cap	M16x1.5	50	
OIL SUMP ASSEMBLY			
Component	Thread (mm)	Torque (Nm)	Sealer
Oil fumes tube	M12x1,5	15	Loctite 648
Oil suction hose fastening capscrew	M6x1	10	Loctite 2701*
Oil sump fastening capscrew	M8x1.25	25	
Oil drain cap	M18x1.5	35	
FLANGE ASSEMBLY (1ST PTO)			
Component	Thread (mm)	Torque (Nm)	Sealer
Flange bell fastening capscrew	M10x1,5	50	
Flywheel fastening capscrew	M12x1,25	140	
GEAR DISTRIBUTION			
Component	Thread (mm)	Torque (Nm)	Sealer
Intermediate gear gudgeon fastening screw	M8x1.25	25	
Camshaft gear control fastening capscrew	M10x1	100	
Fastening nut on fuel injection pump gear	M14x1.5	65	
ENGINE CYLINDER HEAD ASSEMBLY			
Component	Thread (mm)	Torque (Nm)	Sealer
Air bleeding cap	M6x1	8	
Lifting brace fastening capscrew	M8x1,25	25	
Injector manifold	M12x1	30	
Cylinder head fastening capscrew	**M12x1.25**	**6 Torque cycles**	
1st Cycle		40	
2nd Cycle		70	
3rd Cycle		100	
4th Cycle		90°	
5th Cycle		90°	
6th Cycle		90°	
Rocker arm gudgeon fastening capscrew	M8x1,25	25	
Rocker arm cover fastening capscrew	M6x1	10	

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* *Alternatively to the capscrew replacements, with "Dri-loc"*

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14.1 Possible causes and trouble shooting

IMMEDIATELY STOP THE ENGINE WHEN:

1 - Engine rpm increases and decreases suddenly without being able to control them;
2 - A sudden and unusual noise is heard;
3 - The colour of the exhaust fumes suddenly darkens or turns white;
4 - The oil pressure warning light or a Warning Lamp turns on during operation;
5 - The coolant temperature warning light turns on during operation.

Tab. 14.1 contains the possible causes of some failures, which may occur during operation.
Always perform these simple checks before removing or replacing any part.

Warning

- Search for a topic and the operations to carry out from the analytical index or chapter index found at the beginning of the manual.
- Do not carry out any checks or operations on the engine when it is running.

Tab. 14.1

POSSIBLE ANOMALIES ACCORDING TO THEIR SYMPTOMS

	POSSIBLE CAUSE	TROUBLES													
		Engine does not start	Engine starts and stops	No acceleration	Variable speed	Black smoke	White smoke	Low oil pressure	Oil level increase	Excessive oil consumption	Oil and fuel leaking out from the exhaust	Engine overheats	Inadequate performance	High noise level	The Warning Lamp switches on
FUEL CIRCUIT	Clogged fuel line	■	■	■	■								■		
	Clogged fuel filter	■	■	■	■		■						■		
	Air or water in the fuel system	■	■	■			■						■	■	
	The fuel tank cap air bleeding hole is clogged	■		■	■								■		
	Faulty fuel feeding pump														■
	No fuel	■	■												
ELECTRIC SYSTEM	Cable connection uncertain or incorrect	■													
	Faulty starting motor	■													
	Defective heater (optional)	■					■								
MAINTE-NANCE	Clogged air filter	■	■	■	■	■				■			■		
	Excessive idle operation						■			■	■				
	Incomplete run-in						■			■			■		
SETTINGS REPAIRS	Rings worn or sticking	■					■			■	■	■	■		
	Worn cylinder	■					■			■	■	■	■		
	Worn out valve guides						■			■	■	■			
	Badly sealed intake valve	■				■					■	■	■		
	Crankshaft/Connecting rod bearings worn out							■					■	■	
	Damaged cylinder head gasket	■			■		■		■	■		■	■		
	Defective timing system	■			■		■					■	■	■	

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2.1 Engine specifications

Tab. 2.1

MANUFACTURER SPECIFICATIONS AND OPERATION			
GENERAL INFORMATION	**UNIT OF MEASURE**	**KDI 1903 M**	**KDI 2504 M**
Operating cycle		diesel - 4-stroke	
Cylinders	No.	3	4
Bore x stroke	mm	88x102	
Displacement	cm^3	1861	2482
Compression ratio		17:1	
Intake		Atmospheric pressure	
Cooling		Liquid	
Crankshaft rotation (view from flywheel side)		Counterclockwise	
Combustion sequence		1-3-2	1-3-4-2
Timing System			
Valves per cylinder		4	
Timing System		Rods and rocker arms - Camshaft in the crankcase	
Tappets		Hydraulic	
Injection		Direct	
Engine dry weight	Kg	210	244
MAX inclination 30' continuous operation	α	25°	
MAX inclination 1' continuous operation	α	35°	
Volume of aspirated air (2600 rpm)	m^3/h	2.2	2.9
POWER AND TORQUE			
GENERAL INFORMATION	**UNIT OF MEASURE**	**KDI 1903 M**	**KDI 2504 M**
MAX. operating speed	Rpm	2600	
MAX. operating power (ISO TR 14396 - SAE J1995 - CE 97/68)	kW	31	41
Maximum torque (at 1500 rpm)	Nm	133	170
Admissible axial load on crankshaft	Kg	300	
CONSUMPTIONS			
GENERAL INFORMATION	**UNIT OF MEASURE**	**KDI 1903 M**	**KDI 2504 M**
Specific fuel consumption (best point)	g/kWh	210	
Oil consumption	%Fuel	< 0.05	
FUEL SUPPLY SYSTEM			
GENERAL INFORMATION	**UNIT OF MEASURE**	**KDI 1903 M**	**KDI 2504 M**
Type of fuel		Diesel UNI-EN590 - ASTM D975	
High-pressure fuel injection pump		STANADYNE - DB	
Fuel supply		Low pressure electric pump	
Fuel filter			
Filtering surface	cm^2	2300	
Degree of filtration	µm	5	
Maximum pressure at injection pump inlet	bar	0.2	

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10.1 Engine oil

Warning

• Before proceeding with operation, carefully read **Par. 3.3.2**.

1 - Loosen the oil filler cap **A** or the oil filler cap **C** if the cap **A** is not accessible.

2 - Add the type of oil recommended (**Par. 2.4**).

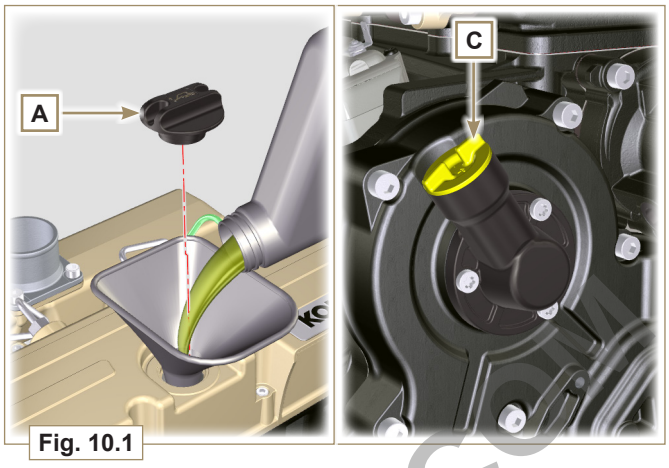


Fig. 10.1

3 - Remove the oil dipstick **B** and check that the level is up to but does not exceed the **MAX**.

Important

• Do not use the engine with the oil level below the minimum.

4 - If level is not at the **MAX.** level, fill up it again the oil dipstick **B** correctly.

5 - Re-tighten the cap **A** or **C**.

NOTE: See the **Par. 11.1** for the various configurations of the oil dipstick.

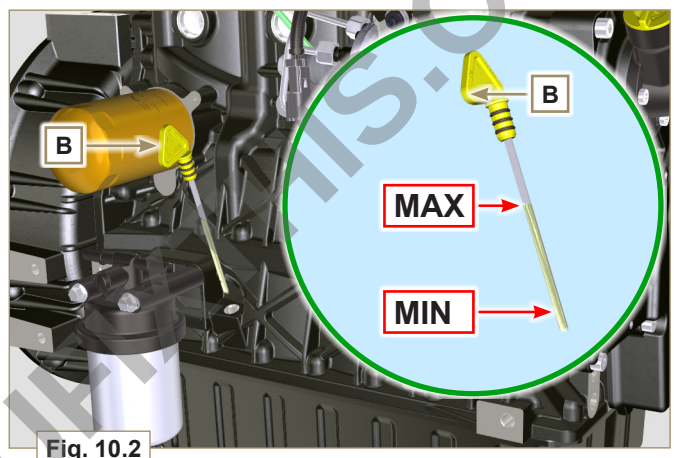


Fig. 10.2

10.2 Coolant

Warning

• Before proceeding with operation, carefully read **Par. 3.3.2**.

1 - Screw the cap. **G**, replacing the copper gasket. (Tightening torque of **50 Nm**).

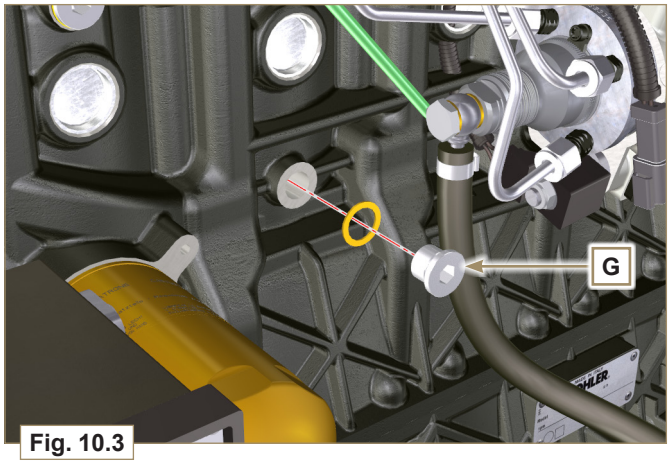


Fig. 10.3

2 - Tighten the cap **E**, replacing the copper gasket **D** (Tightening torque of **2 Nm**).

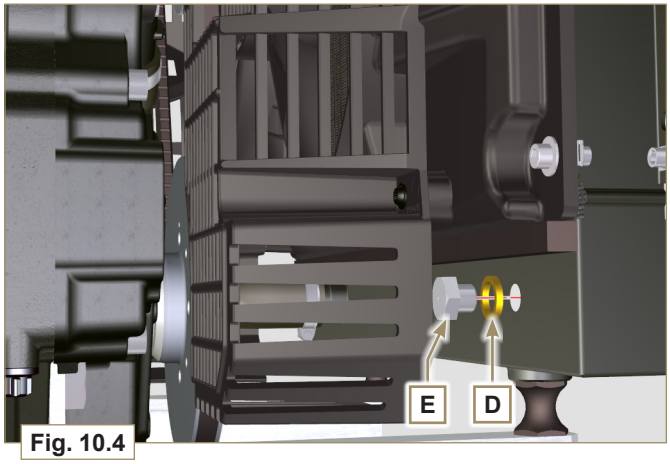


Fig. 10.4

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13.1 Information regarding specific tools

In **Tab 13.1 - 13.2** there is a list of all the specific tools that are required and approved to carry out operations of disassembly - assembly - regulations - settings - repairs on engine series **KDI M**, correctly and safely.

Warning

- **KOHLER** declines all responsibility for any damage to the engine, persons, or things caused by the use of different types of tools to those indicated in **Tab 13.1 - 13.2**, , where referred to them in the manual.

Tab. 13.1

SPECIAL TOOLS FOR DISASSEMBLY AND ASSEMBLY

"ST"	Picture/Draw	DESCRIPTION	PART NUMBER
ST_02		Crankshaft blocking tool	ED0014603860-S
ST_03		Piston protrusion - cylinder head surface injectors control tool	ED0014602980-S
ST_04		Injection pump gear puller	ED0014603680-S
ST_05		Spanner for capscrews Six nicks SN 8	ED0014603650-S
ST_06		Spanner for capscrews Six nicks SN 5	ED0014603640-S
ST_07		Tool for disassembling / reassembling valves	ED0014603720-S
ST_08		Tool for gasket valve stem	ED0014603660-S

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5.2 Engine oil

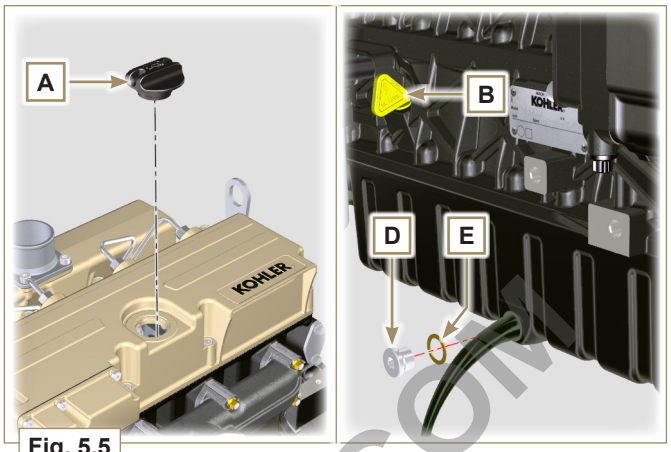


Fig. 5.5

Important

- Before proceeding with operation, carefully read **Par. 3.3.2**.
- The oil must be drained whilst the engine is hot, which requires particular care to prevent burns. Do not allow oil to come into contact with the skin because of the health hazards involved. It is recommended to use an oil suction pump via the oil dipstick hole B.

1 - Undo the oil filler cap **A**.

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 used oil disposal refer to the **Par. 3.6**).

5 - Perform the operations described in **Par. 6.6.**

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9.3.10 Crankshaft gasket flange

Important

- Check that the contact surface between the flange and the crankcase is free of grit and dirt.
- Always replace the gasket **M** after each assembly.

1 - Check that there are bushings **BT** on the crankcase **E** .

2 - Lubricate the oil seal lip **BU**.

3 - Position the gasket **BS** and flange **BV** on the crankcase **E** in correspondence with the bushings **BT**.

4 - Put **Loctite 243** on the **2** screws **BW** matching the bushings **BT**.

5 - Screw the fastening screws all the way in **BW** without tightening them.

6 - Tighten all the screws **BW** strictly following the tightening sequence indicated (tightening torque to **10 Nm**).

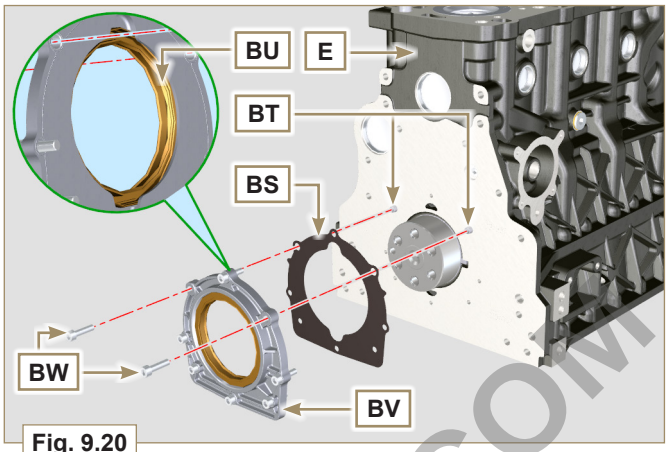


Fig. 9.20

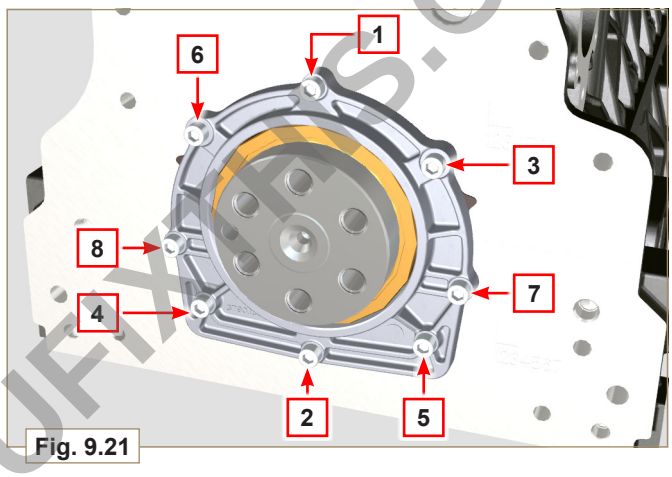


Fig. 9.21

9.3.11 Cover 3rd PTO

Important

- Replace capscrews **CA** with each assembly or alternatively apply **Loctite 2701** on the thread.

1 - Secure the cover **CB** with the screws **CA** inserting the gasket **CD** (tightening torque **25 Nm**).

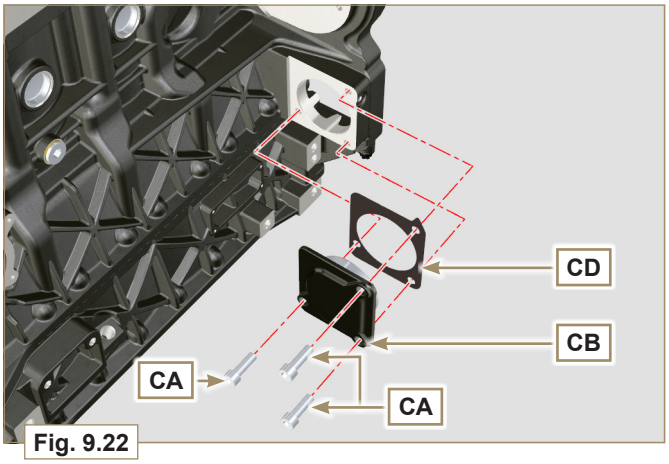


Fig. 9.22

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