

Engine instructions manual

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GENERAL INFORMATION**INTRODUCTION**

Dear Client, we wish to thank you for purchasing an engine manufactured by VM MOTORI S.P.A.

Our Technical Assistance and Spare Part department has recently been strengthened to ensure even better service to all our Clients.

Only by using original spare parts and by relying on our specialised staff you can ensure the best performance to your engine.

Let us advise you to rely **EXCLUSIVELY** on our Technical Assistance and Spare Part Service for the maintenance of engines manufactured by VM MOTORI S.P.A.

If engines designed and built by VM MOTORI S.P.A. are repaired by unauthorised technicians, if the planned maintenance operations foreseen are not carried out, if **NON ORIGINAL** spare parts are used, if the coolants, engine oil and fuels used do not comply with the manufacturer's specifications, then any service or technical guarantee provided by VM MOTORI S.P.A. will immediately expire.

We are confident that you will understand the technical importance of this recommendation, which is mainly aimed at protecting our Clients from any unpleasant situation.

Please get in touch with us for any requirements.

Best regards.

QUALITY SYSTEM CERTIFICATE ISO 9001-QS 9000-ISO 14001

VM MOTORI S.P.A. has obtained the certification of its quality assurance regime in compliance with UNI EN ISO 9001 standards and with the even stricter prescriptions established by Ford, Chrysler and General Motors car manufacturer association under the QS-9000 Quality System Standard for the manufacture of Diesel engines. Moreover, its environmental management system has been certified against the ISO 14001 standard.

This is the result of a working plan which involves all company levels.

The quality and environmental policy, with a special focus on the continuous improvement principle, is an essential part of VM MOTORI S.P.A top management's strategy and it is being implemented in all company departments in accordance with internationally accepted quality and environmental management systems and while respecting the environment and the population.

Customer satisfaction, efficiency and personnel motivation, intended as a set of services rendered inside and outside the company, are the most important elements of the quality concept.

All VM MOTORI S.P.A. employees are committed to the achievement of quality and environmental policy goals.

Regular training ensures a suitable and constantly updated knowledge to VM MOTORI S.P.A. employees.

VM MOTORI S.P.A. considers quality as a dynamic process of continuous improvement in all activities to achieve the goals.

PURPOSE OF THE MANUAL

This manual is an essential part of the engine and it has been written by the manufacturer to provide all the information necessary to those who are authorized to interact with it throughout its expected life:

handlers, carriers, installers and users.

Besides adopting a good operation technique, the recipients of the information should carefully read it and apply it rigorously.

Spend some of your time reading this information to avoid any risk for people's health and safety as well as economic damage.

Keep this manual throughout the life of the engine in a place within easy reach, so that it is always at hand and you can consult it at all times.

Besides the actual installation of the engine, this manual may contain additional information which, however, will not hinder the general understanding.

The manufacturer reserves the right to make changes without any prior notice.

The relevance of certain parts of the manual and of some specifications is pointed out by a few symbols whose meaning is described below.



Danger - Attention

It indicates very dangerous situations which can seriously endanger people's health and safety if they are neglected.



Warning - Caution

It indicates that a correct behaviour should be adopted to avoid any risk for people's health and safety as well as any economic damage.



Important

It indicates some very important pieces of technical information which should not be neglected.

MANUFACTURER AND ENGINE IDENTIFICATION

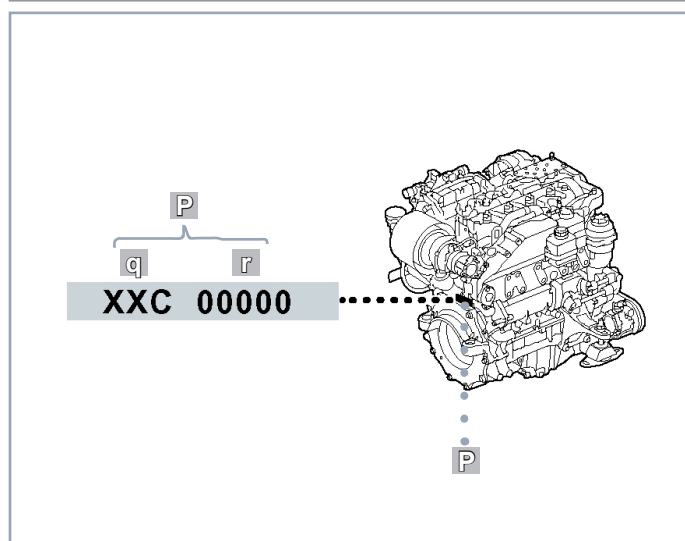
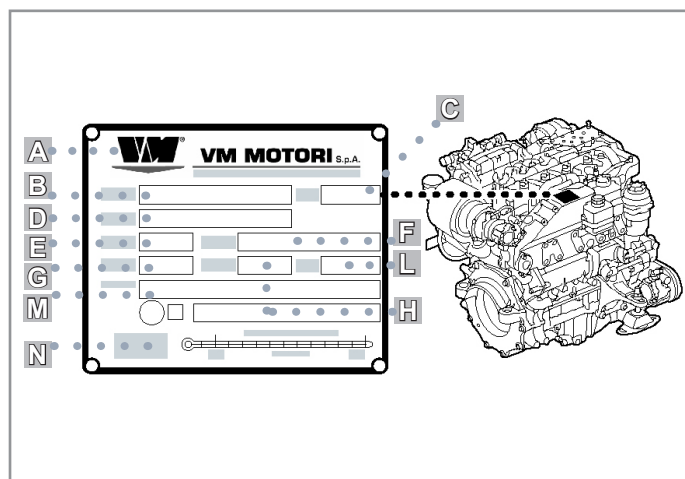
The identification plate shown is applied directly on the engine.

It contains all the references and indications needed for a safe operation.

- A) Manufacturer identification
- B) Serial number
- C) Weight
- D) Type
- E) Family
- F) Model
- G) Version
- H) Maximum power (kW)
- L) Maximum number of revolutions
- M) Homologation number
- N) Lubricating oil features
- P) Engine serial number (punched on the crankcase)
- q) Engine code
- r) Consecutive number

The table helps you to identify the model through the engine code.

Engine code	Engine model
75C	MR504LH
76C	MR504LS
77C	MR504LB
91C	MR504LX



PROCEDURE TO REQUEST TECHNICAL ASSISTANCE

Please state the data contained in the identification plate, the serial number, approximate hours of operation and the type of defect detected in every request of technical assistance for the engine.

In case of need, please apply to the manufacturer's Technical Assistance Service or to an authorised workshop (See attached documentation "Address booklet of assistance and spare part centres").

Further information are available in the website:

www.vmmotori.it, in the "Contacts – Request Info" section.

WARRANTY CONDITIONS

The warranty conditions are stated in the attached documentation (See "Warranty sheet").

ATTACHED DOCUMENTATION

The stated documentation is supplied to the client along with this manual.

- Wiring diagrams
- Address booklet of assistance and spare part centres
- Warranty sheet

TECHNICAL INFORMATION**ENGINE GENERAL DESCRIPTION**

Engines of model MR500 have been designed and built to be installed in vessels as inboard engines.

The engines are used to equip offshore vessels for professional and/or civil use.

The engines differ from each other in terms of power and performance (See "Specifications").

A few accessories are supplied with the engine (See "Standard components").

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MAIN COMPONENTS

A) Cooler: It cools down the coolant and the reversing gear oil through a heat exchange with seawater.

B) Cooler: It cools down the fuel through a heat exchange with seawater.

C) Cooler: It cools down the engine oil through a heat exchange with seawater.

D) Turbo device: Made up of a turbine which exploits a part of the exhaust gas energy to carry out the engine turbocharging.

E) Intercooler: It cools down the air needed for engine turbocharging through a heat exchange with seawater.

F) "waste-gate" valve: It controls the turbo device activation, depending on the pressure of the exhaust gases.

G) Wet exhaust gas sleeve: It cools down the exhaust gases through a heat exchange with seawater.

H) Air intake filter: It traps any impurity

J) Heat expansion valve: It adjusts the water temperature according to the engine working temperature

K) Electrolytic zinc: It absorbs the galvanic currents

L) Fuel filter: It traps any impurity

L1) Oil filter: It traps any impurity

M) Oil sump: It contains the engine lubrication oil

N) Electronic control unit: It controls the engine functions

P) Water pump: It feeds the freshwater cooling circuit

Q) Water pump: It feeds the seawater cooling circuit

R) High pressure injection pump: It feeds the injectors with fuel under pressure

S) Injector: injects fuel under pressure into the combustion chamber.

S1) Rail: stores pressurised fuel and distributes it to the injectors.

T) Transmission belt: It drives the service parts

T1) Belt tensioner: It keeps the belt constantly tensioned

U) Expansion chamber plug: It is used to refill the coolant. It is fitted with an overpressure valve set to 1,2 bars to drain any residual pressure.

V) Alternating current generator: It produces and regulates the electric system voltage

V1) Starter: It is used to start the engine

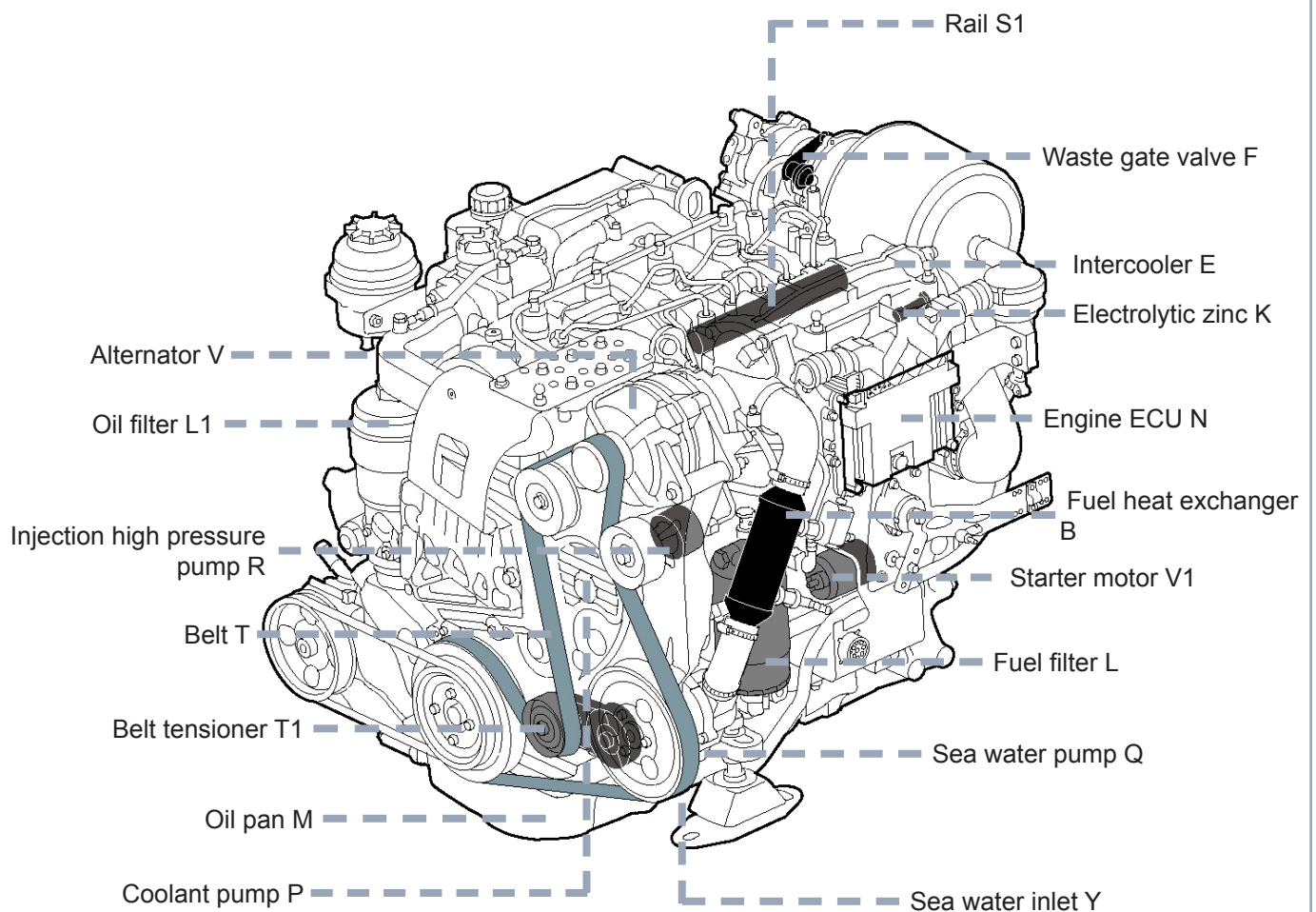
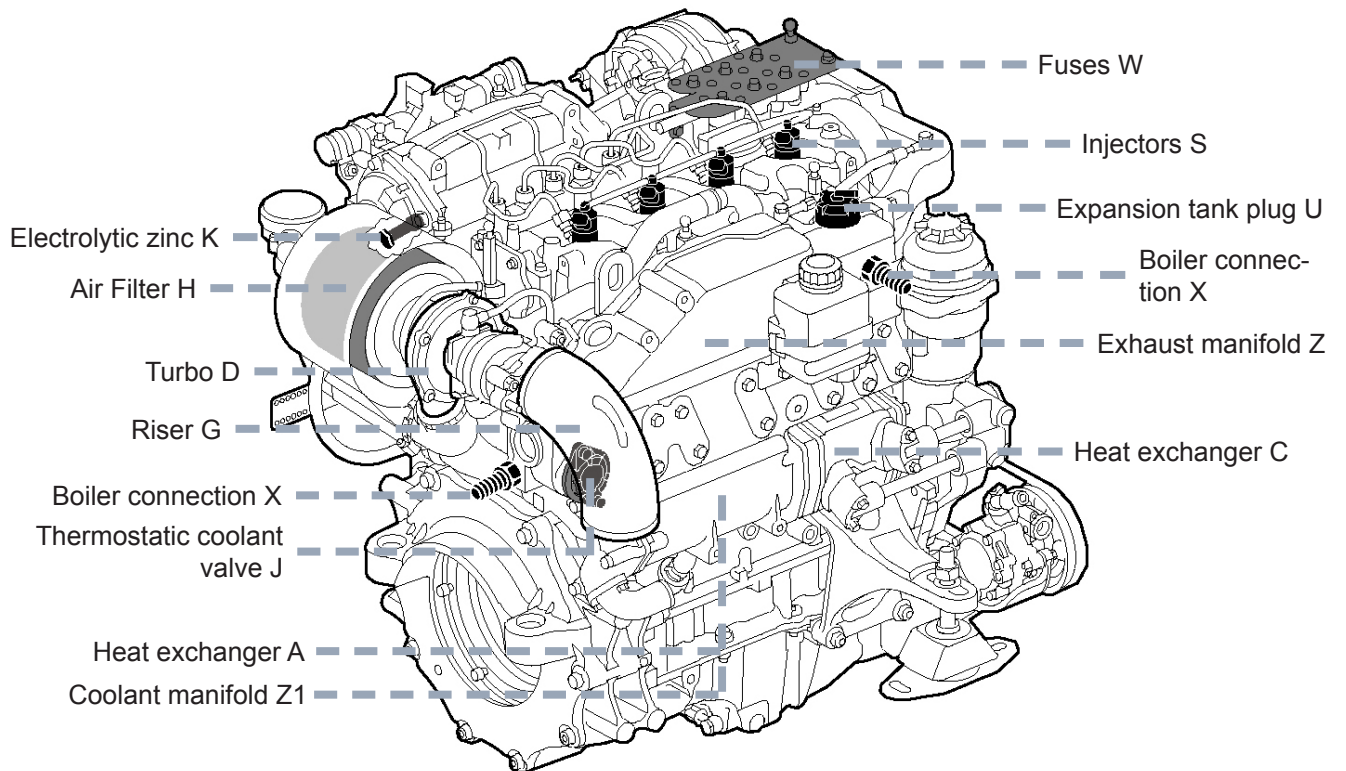
W) Fusebox: the engine is fitted with fuses protecting the electrical circuit, which trigger in the event of a current overload or shortcircuit, to prevent damage to the electrical components.

X) Boiler connection: It is used to connect the boat's rooms to the heating system.

Y) Seawater inlet: It collects seawater to cool down the engine

Z) Exhaust manifold: It is used to expel the combustion gases

Z1) Water manifold: It is used to collect the coolant from the heads



ENGINE ACCESSORIES

The following accessories are supplied with the engine

- 1) Oil change pump
- 2) Control board

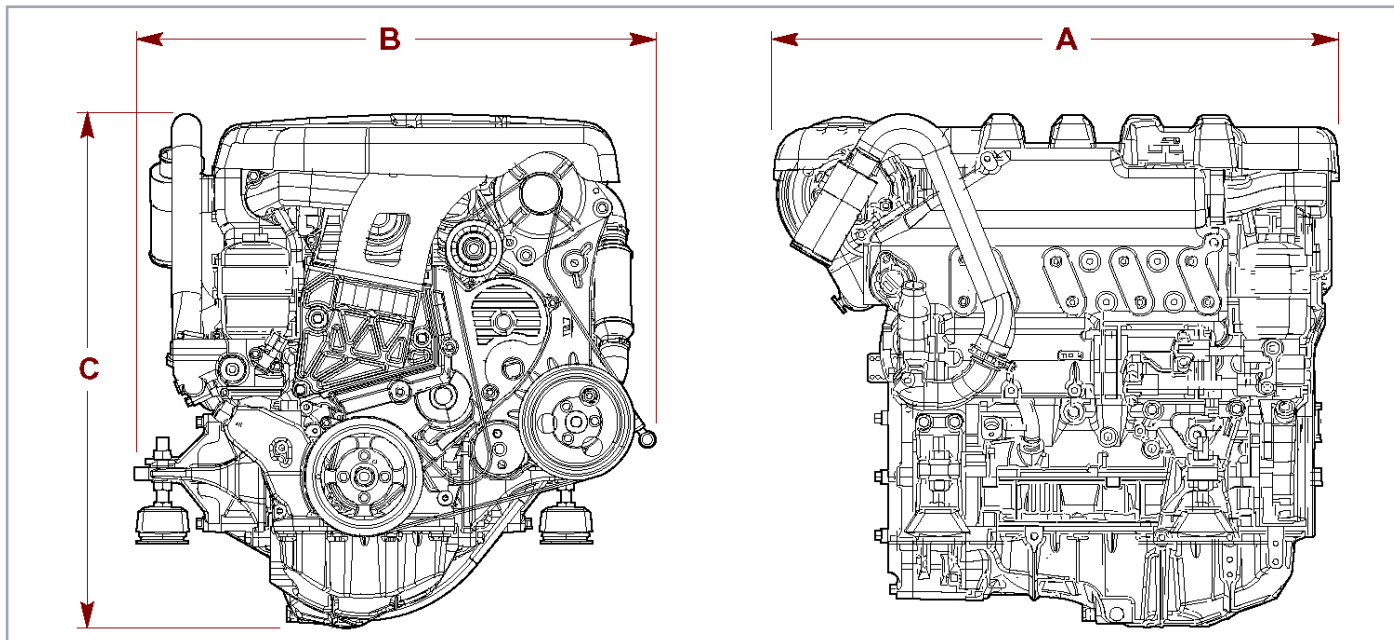
3) Extension cable connecting control board/engine wiring

- 4) Fuses

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SPECIFICATIONS

These technical data and specifications refer exclusively to standard VM MOTORI S.P.A. engines.



DIMENSIONS		
A	mm	605
B	mm	610
C	mm	720
GENERAL DATA		
Cycle		Four stroke diesel
Total displacement	litres	1,991
No. cylinders	no.	4
Bore and stroke	mm	83x92
Compression ratio		17,5:1
Air system		Turbocharged and inter-cooled circuit (Dry) air filter
Coolant system		Water circuit
Heat exchanger		Water/Water
Crankshaft rotation		Anticlockwise (observing the engine from the hand-wheel side)
Combustion sequence		1-3-4-2
Engine timing		No. 1 camshaft (SOHC), No. 4 valves per cylinder and hydraulic tappets
		Drive belt timing system
Minimum idling speed (standard engine)	rpm	700
Dry shipping weight of engine	Kg	250
Maximum permanent lengthwise inclination (with handwheel up)		20°
Maximum permanent lengthwise inclination (with handwheel down)		15°
Maximum permanent crosswise inclination		25°

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POWER AND TORQUE		
Maximum power	kW (CV) @ rpm	LB 115 HP (84.6 Kw) @ 3000 rpm LS 130 HP (95.6 Kw) @ 4000 rpm LH 150 HP (110 Kw) @ 4000 rpm LX 170 HP (125 Kw) @ 4000 rpm
Maximum torque	Nm (kgm) @ rpm	310 Nm @ 2400 rpm (LB) 310 Nm @ 2600 rpm (LS/LH/LX)
CONSUMPTION AT MAXIMUM POWER		
Specific oil consumption	g/CVh	/
FUEL SYSTEM		
Injection type		Common Rail direct injection
Fuel type	The engine has been designed to be powered by standard fuels available on the European market (according to specifications DIN EN 590). If it is to be powered by BIODIESEL fuels (according to specifications UNI EN14214), it can be mixed, up to 5%, with fuel available on the European market (according to regulation DIN EN 590).  Important: Do not use fuels with specifications other than those indicated.	
Fuel supply		Gear pump integrated in high pressure injection pump
Injector supply		High pressure injection pump
LUBRICATION SYSTEM		
Type of lubrication		Lubrificazione forzata
Circuit fuel supply		Rotor pump
Oil change including filter (standard sump)	litres	5,2
Oil quantity at minimum level (standard sump)	litres	3,2
Oil quantity at maximum level (standard sump)	litres	4,2
Oil pressure at minimum speed (with started engine)	bar	1 - 4
Alarm for oil pressure too low	bar	0,4
Oil cooling		Oil/water heat exchanger
FRESH WATER COOLING SYSTEM		
Total capacity of the cooling circuit	litres	7,7
Setting pressure of the expansion tank plug	bar	1,2
Coolant	50% demineralised or distilled water and 50% Petronas Paraflu Up, red colour (protective radiator fluid with monoethylene glycol and organic inhibitor formulation complying with AST M D 3306 type 1 Standards)	

ELECTRIC SYSTEM		
Electrical current voltage (rated)	V	12
Alternating current generator (nominal voltage)	V	14
Alternating current generator (nominal current)	A	110
Starter motor output	KW	2,0

SAFETY INFORMATION**SAFETY RULES****GB**

- During the design and construction phases, the Manufacturer paid special attention to the aspects which are liable to cause any risk for the safety and health of people interacting with the engine. Besides complying with the relevant legislation in force, he followed all the “rules for a good construction technique”. The purpose of this information is making users aware of the need to pay the utmost attention to prevent any risk. Caution is however imperative. Safety also depends on all the operators who interact with the engine.
- Read carefully the instructions contained in the manual supplied and those applied on the engine, in particular follow those concerning safety. Spend some of your time reading the instructions to avoid unpleasant accidents.
- Pay attention to the meaning of the symbols in the applied plates; their shape and colour have a specific meaning related to safety. Keep them visible and follow the stated information.
- Use the engine only for the tasks authorised by the manufacturer and do not tamper with any device to achieve a different performance from the intended one.
- The staff carrying out any type of intervention throughout the life of the engine should have precise technical skills, specific abilities and experiences acquired and acknowledged in this sector. The lack of these requirements may cause damages to people’s safety and health.
- All the installation phases should have been taken into account since the development of the initial project. The designer has to observe with the engine fixing points and the general indications provided by the manufacturer.
- Carry out the handling of the engine in compliance with the information stated directly on the engine, on the packaging and in the operating instructions supplied by the manufacturer.
- When lifting or transporting unpacked engines use means of appropriate load capacity which must be properly anchored.
- When lifting and transporting packaged engines, means of appropriate load capacity as stated on the packaging itself.
- Before carrying out other transfers, create the conditions required to guarantee stability and to prevent any engine part from being damaged.
- Before starting the installation, the installer has to implement a “safety plan” and to follow the designer’s indications. Do not make changes to the engine components for any reason.
- It is necessary to make sure that the installation area is fitted with all intake, fuel supply and exhaust connections.
- The manufacturer cannot be held responsible for any damage resulting from the misuse of the engine, from the failure to follow the indications contained in this manual and from any tampering with or change made without the manufacturer’s authorization.
- If appropriate, before using the engine for the first time, after gathering all the necessary information, simulate a few trial manoeuvres to identify the controls and their main functions, especially those related with starting and stop operations.
- Do not operate the engine in a closed and insufficiently ventilated environment; the exhaust fumes are harmful and can have serious consequences on people’s health.
- Do not keep using the engine if anomalies are detected and in particular if suspect vibrations occur.
- In case of anomaly, stop immediately the engine or reduce the speed as much as possible and reach the closest assistance centre.
- Start again the engine only when the normal operating conditions have been restored.
- Unless otherwise stated, all interventions should be carried out when the engine has been stopped, cooled down and the ignition key has been removed. Those authorized to carry out these interventions should follow all the precautions needed to guarantee the safety of the people involved, in compliance with the requirements laid down in the applicable legislation regarding safety at the workplace.
- Keep the equipment as much efficient as possible and carry out the scheduled maintenance operations established by the manufacturer. A good maintenance will ensure the highest performance, a longer working lifetime and a constant compliance with safety requirements.
- Replace any worn part with original spare parts. Use the oils and greases recommended by the manufacturer. All this will ensure the engine good operation and the prescribed safety level.
- Do not throw away any polluting material in the environment. Carry out their disposal in compliance with the relevant legislation in force.
- During all maintenance operations always use the individual protection clothing and/or devices indicated in the operating instructions supplied by the manufacturer and those provided by the applicable legislation concerning safety at the workplace.
- All maintenance operations should be carried out by using suitable and efficient equipment and tools.

SAFETY RULES FOR THE ENVIRONMENTAL IMPACT

Each organization is responsible for implementing procedures aimed at identifying, evaluating and controlling the environmental impact of its own activities (products, services, etc.).

The procedures to be followed to identify any significant environmental impact should take into account the following factors:

- Emissions in the atmosphere
- Discharged liquids
- Waste disposal
- Soil contamination
- Use of raw materials and natural resources.
- Local problems related to the environmental impact.

In order to reduce the environmental impact, the manufacturer provides below a few indications to be taken into account by all those who will interact with the engine throughout its expected life.

- All packaging components should be disposed of in accordance with the legislation in force in the country where disposal takes place.
- When installing the engine, ensure a suitable air renewal in the environment to protect the operators from a high concentration of harmful substances.
- During operation and maintenance, do not throw away polluting products (oils, greases, etc) in the environment and carry out the differentiated waste disposal according to the composition of the different materials and in compliance with the legislation in force. Electric and electronic components should be carried out as special waste.
- Keep the exhaust pipelines efficient to limit the noise level of the engine and to reduce atmospheric pollution.
- While decommissioning the engine, divide all the components depending on their chemical composition and dispose of them accordingly.

RESIDUAL RISKS

During the design and construction phases, the Manufacturer paid special attention to the aspects which are liable to cause any risk for the safety and health of people interacting with the engine.

Despite this, some potential and hidden risks still exist.

Danger of injuring your arms

Do not put your hands inside any moving part.

Danger of being burnt

Pay attention to hot surfaces

HANDLING AND INSTALLATION INFORMATION

RECOMMENDATIONS FOR HANDLING AND INSTALLATION

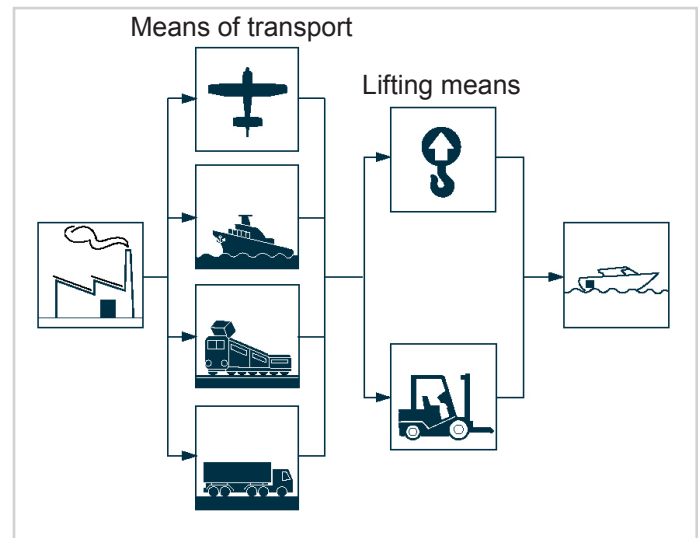
Carry out handling and installation following the information provided by the manufacturer and stated directly on the packaging and operating instructions.

Those authorized to carry out these operations should prepare, if necessary, a "safety plan" to protect and the safety of people directly involved.

PACKAGING AND TRANSPORT

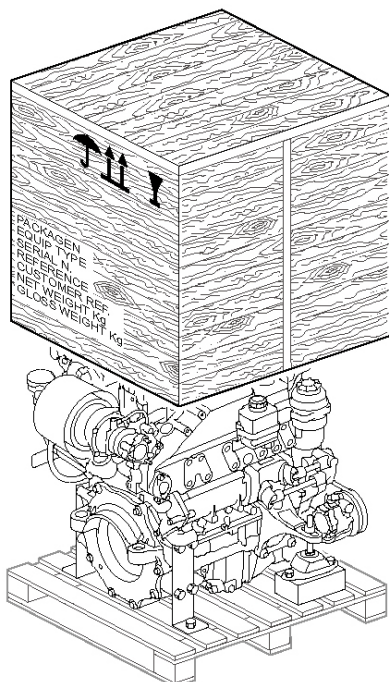
The packaging is also made according to the type of transport chosen to keep sizes as small as possible.

- By road
- By railway
- By sea
- By air

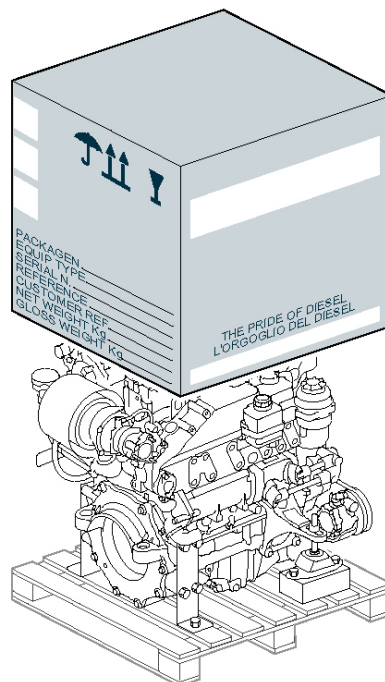


The engine can be transported with different types of packaging according to the destination, the transport system and preset technical-commercial specifications.

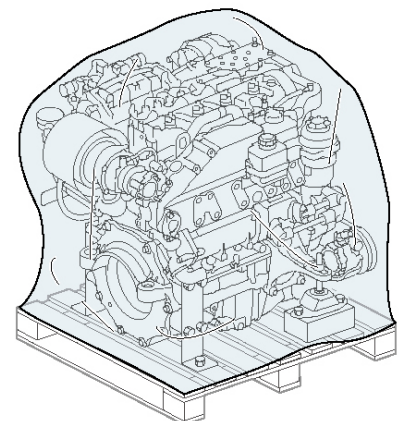
packaging with wooden case



packaging with cardboard box



packaging with cellophane

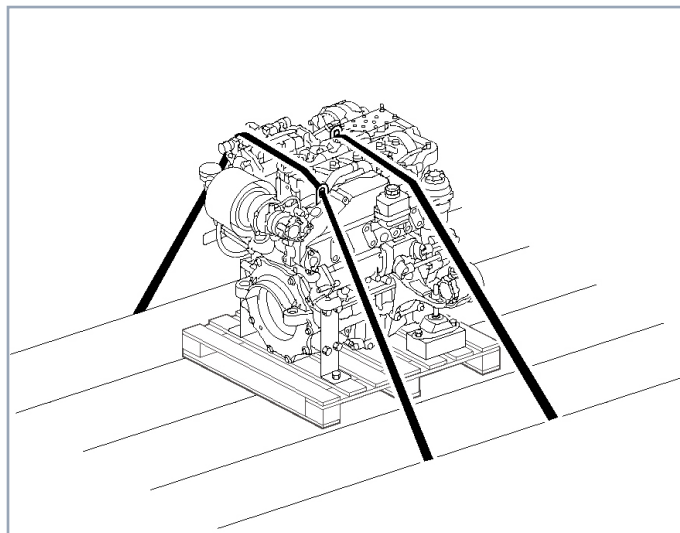


In order to guarantee the perfect conservation of all engine components, an “overseas” packaging should be used in case of maritime transport.

The packaging contains all the information needed to carry out the loading and unloading operations.

During transport, make sure the load is properly secured to the means of transport to avoid unexpected displacements.

When transporting the uncovered engine by road, use the lifting points provided to secure it steadily and prevent components from being damaged.



UNPACKING

Follow the procedure below.

1 -Remove the cover of the packaging.

The packaging includes a bag with all the relevant technical documentation and standard components.

2 -While unpacking, make sure the components are intact and their quantity is correct.

3 -Place the lifting device as shown in the figure.

4 -Loosen the screws (A) and disassemble the side supports (B).

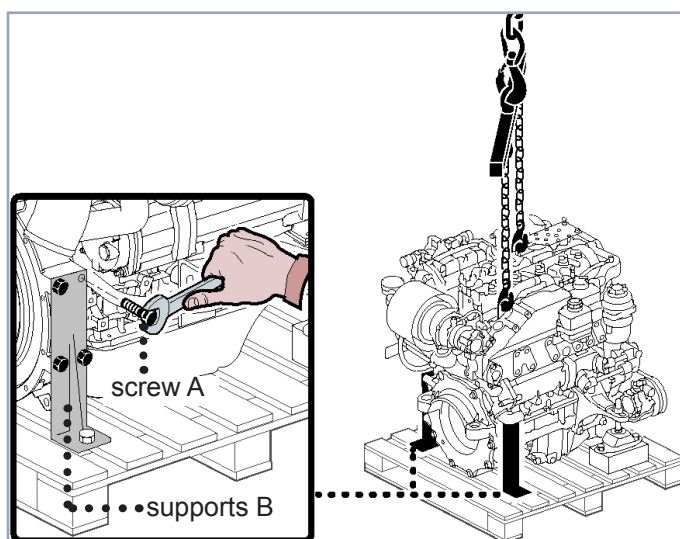
5 -Move the engine to the installation area.

If necessary, keep the material in case you need to pack the engine in the future.



Important:

In case of any damage or missing part, contact the manufacturer's Assistance Service to establish the procedure to be adopted. The packaging material should be suitably eliminated in compliance with the applicable legislation.



HANDLING AND LIFTING

Secure the engine with a lifting device (lifting beam) of appropriate capacity.



Warning - Caution

The angle formed by the lifting device chains must not exceed 5°, as shown in the figure.

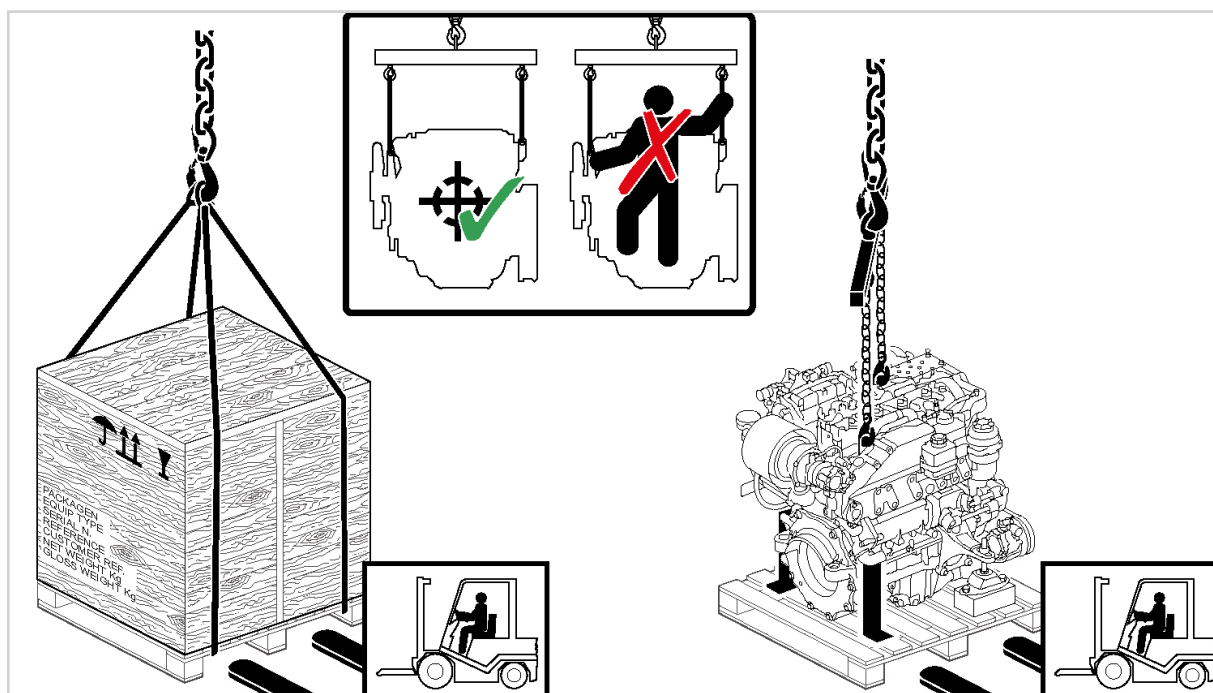
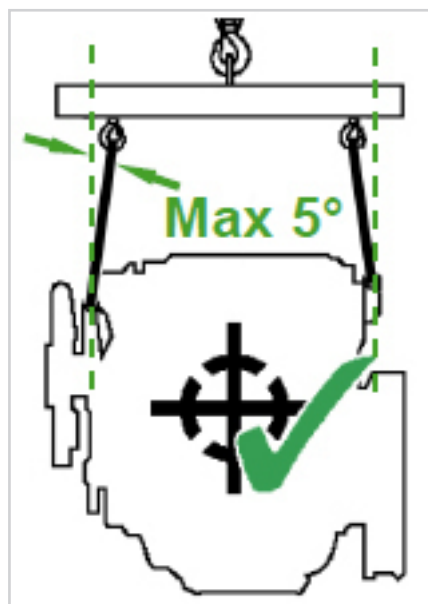
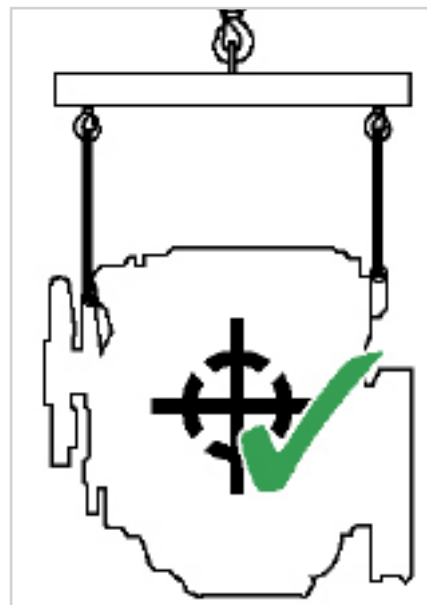
Hook the lifting device to the fixing points as shown in the figure.

Before carrying out the lifting, identify the barycentre position of the load.



Warning - Caution

The brackets of the fixing points have been designed to lift the engine only without any additional weight. Do not lift the engine using a different procedure from the prescribed one; otherwise, the warranty for damages will be invalidated.



ENGINE STORAGE

If the engine is left idle for prolonged periods, check the possible conditions of conservation in relation to the storage area and the type of packaging.

Avoid any environment exposed to dampness or to the inclemency of weather.

The manufacturer supplies the engine with a protection treatment which is valid for 6 months from the delivery date.



Warning - Caution:

The staff carrying out any type of intervention throughout the life of the engine should have precise technical skills, specific abilities and experiences acquired and acknowledged in this sector. The lack of these requirements may cause damages to people's safety and health.

VM Motori recommends that this protection procedure is only carried out by VM-authorized personnel.



Important:

– All packaging components should be disposed of in accordance with the legislation in force in the country where disposal takes place.

The protection procedure is only considered complete when all the following tasks have been performed:

- 1) protection against external corrosion
- 2) protection against internal corrosion
- 3) packaging and storage

This procedure is valid for the following engine situations:

- on a vehicle
- on a pallet

For engines on pallets, it is necessary to install the following accessories for engine start-up:

- battery
- fuel tank
- cooling radiator (for liquid-cooled engines only)
- command belt for the alternating current generator
- command belt for the water pump (for liquid-cooled engines only)

1) EXTERNAL PROTECTION

UNPAINTED SURFACES: the unpainted metal components and surfaces (for instance the engine handwheel) must be protected with "FL MECA FLUID / P118V" anticorrosion oil.

RUBBER COMPONENTS: unpainted manifolds and pipes must be protected with talcum powder. Check the tightening of the relative fixing clips.

DRIVE BELTS: after applying the internal protection, remove the belts and put them into storage. Protect the surfaces of the metal pulleys with "FL MECA FLUID / P118V" spray.

ENGINE OPENINGS: Seal all the engine openings, including the exhaust. Use cardboard, plywood or metal covers, making sure they do not leave behind any fragments of material. All the engine openings (e.g. air suction ducts or turbocharger air inlet) must be protected with covers or guards to prevent the entry of solids, liquids or dusts that delay the evaporation of the anticorrosion agents. Apply plugs to the fuel inlet and outlet pipes of the injection system.

BATTERY: Disconnect the battery. When it is fully charged, store it in a safe place. Before doing this, protect the terminals against corrosion by applying an anti-rust spray

2) INTERNAL PROTECTION

COMBUSTION CHAMBER: Remove the heating glowplugs from the head, check the piston is in its lowest stroke position (lower standstill point), then spray with Petronas PROT 30 M protective oil. Repeat the operation for the other cylinders, then reinstall the glowplugs.

TURBOCHARGER: Remove the inlet plug from the pipe that delivers oil to the turbocharger, and fill with Petronas PROT 30 M protective oil. Replace the inlet plug, applying the correct tightening torque.

ELECTRIC COMPONENTS: Apply anticorrosion spray to the electric contacts and connectors.

AIR SUCTION SYSTEM: check the air filter is in good condition, and no foreign bodies/liquids are present:

- If the air filter is damaged, replace it
- If there are any foreign bodies, remove them

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LUBRICATION SYSTEM: this procedure must be carried out together with the injection system protection procedure.

- Using the oil dipstick and check whether there is engine oil in the sump.
- Drain the oil from the sump.
- Fill the engine with Petronas PROT 30 M protective oil.
- Check the coolant level (for water-cooled engines only). The coolant mixture must be 50% demineralised or distilled water and 50% Petronas Paraflu Up (protective radiator fluid with monoethylene glycol and organic inhibitor formulation complying with ASTM D 3306 type 1 Standards).
- Start up the engine and run it until it reaches the right temperature for water-cooled engines (about 70°- 80°C); for air-cooled engines, run the engine for about 20 (twenty) minutes.
- With the engine up to temperature, carry on for about 5 minutes so that the system components are lubricated.
- Switch off the engine and wait for it to cool down.
- Drain the oil from the sump.
- Drain off the coolant.
- Check for any fluid leakage (and make any necessary repairs).
- Disconnect the engine from all the components used for the test.

INJECTION SYSTEM: this procedure must be carried out together with the lubrication system protection procedure.

- Make sure there are no deposits or sediments in the fuel tank.
- Prepare a mixture of diesel fuel complying with the DIN EN 590 specifications, and Petronas DIESEL TMF PLUS additive. The ratio must be at least 1:400 (1 litre of additive to 400 litres of fuel). If you use Biodiesel (complying with the UNI EN 14214 specifications), it must be mixed with diesel fuel up to 5%;



Important:

VM Motori, however, recommends the use of diesel without Biodiesel.



Important:

The use of any other fuel is forbidden.

- Fill the tank with this fuel mixture.
- Where relevant, check there is no interference between the radiator fan blades and the relative air duct.

Start up the engine and run it until it reaches the right temperature for water-cooled engines (about 70°- 80°C); for air-cooled engines, run the engine for about 20 (twenty) minutes.

- Drain the fuel tank.
- Check for any fluid leakage (and make any necessary repairs).
- Switch off the engine and wait for it to cool down.

SEAWATER SYSTEM (for marine engines and on-board auxiliary units only): this procedure must be carried out together with the injection system protection procedure.

- Connect the seawater intake of the seawater pump to an auxiliary tank containing a mixture of 40% freshwater and 60% Petronas Paraflu Up (protective radiator fluid with monoethylene glycol and organic inhibitor formulation complying with ASTM D 3306 type 1 Standards), making sure it seeps out from the drainage point.
- Check for any fluid leakage (and make any necessary repairs).
- Switch off the engine and wait for it to cool down.
- Disconnect the engine from all the components used for the test

3) STORAGE CONDITIONS

- Engines on pallets

After applying the anticorrosion protection, the engine must be placed in a dry, well-ventilated environment and adequately covered. The covering must be applied in such a way that air can circulate around the engine, preventing the formation of condensation.

- Engines on vehicles

The vehicle must be stored so as to minimise exposure to atmospheric agents

START-UP

- Engines on pallets

Remove the covers and protective elements applied to the engine openings (for instance, air suction ducts or turbo-charger air inlet, exhaust gas ducts or turbocharger guard).

Check there is no damage to the external engine components; make any necessary repairs.

Clean the throats of the metal belt pulleys, using a suitable solvent. Install the service belts

Check the rubber tubes and manifolds are in good condition, and check the tightening of the relative fixing clips; if they are damaged, replace them.

All surfaces and components protected with "FL MECAFLUID / P118 V" protective oil can be cleaned with a suitable solvent.

Check the level of the fluids: engine oil and coolant. Top up if necessary.

- Engines on vehicles

Check there is no damage to the external engine components; make any necessary repairs.

Clean the throats of the metal belt pulleys, using a suitable solvent. Install the service belts.

Check the rubber tubes and manifolds are in good condition, and check the tightening of the relative fixing clips; if they are damaged, replace them.



Important:

Nothing needs to be done to remove the internal protection (either for engines on pallets or on vehicles).

INSTALLATION DESIGN

In order to ensure the highest performance while protecting people, the product itself and the environment, a full project has to be developed before carrying out the installation.



Important:

The design phase should take into account the technical data of the engine (see "Technical data") and all the risks which may occur during its expected lifetime, from installation to disposal.

During the design and installation phase, it is a good idea to consult the installation manual drawn up by VM MOTORI S.P.A. as this contains the installation guidelines.

Further information are available in the website: www.vmmotori.it, in the "Contacts – Request Info" section.

OPERATING INFORMATION

RECOMMENDATIONS FOR USE AND OPERATION

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The engine has been designed and manufactured to satisfy all the operating conditions indicated by the manufacturer.

Tampering with any device to achieve a different performance from the intended one can entail risks for people's safety and health as well as economic damages.

CONTROL BOARD DESCRIPTION

A) Pressure gauge: It indicates the engine oil pressure

B) Warning light (red): It signals that the engine oil pressure is low. When indicator lights up the beeper is triggered.

C) Voltmeter: It indicates the battery voltage

D) Warning light (red): It signals a malfunction in the alternating current generator or battery. When indicator lights up the beeper is triggered.

E) Thermometer: It indicates the temperature of the freshwater coolant

F) Warning light (red): It signals that the temperature of the freshwater coolant is too high. When indicator lights up the beeper is triggered.

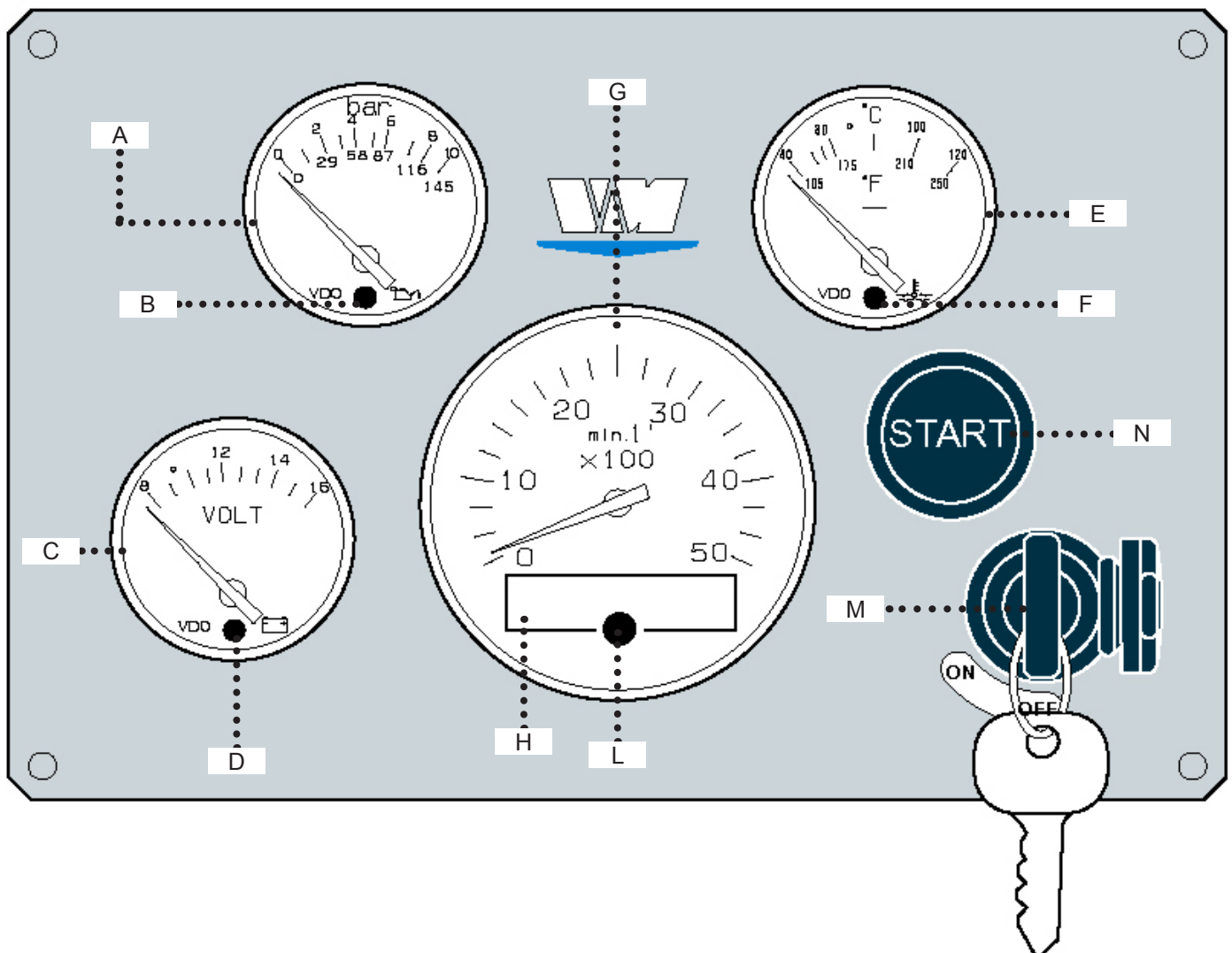
G) Rev counter and hour counter: It indicates the number of engine revolutions and the actual hours of functioning

H) Digital display: in the presence of operating malfunctions, this displays the values detected by the instruments, the error identification codes and the relevant description.

L) Button: used to show the malfunctions on display in sequence.

M) Key switch: used to turn the power supply to the control panel on and off.

N) Pushbutton: It is used to start the engine.



RECOMMENDATIONS FOR USE

The engine is delivered by the factory in the running order. However, during operation the following indications should be observed:

- 1 -During running-in (first 50 working hours) and throughout the engine lifetime, carry out the maintenance in compliance with the intervals established by the manufacturer (see "Engine maintenance")
- 2 -If the engine is not used regularly, start it after each month of inactivity and run it at minimum speed until the operating temperature (70÷80°C) is reached.
- 3 -Avoid using the engine at the highest speed for prolonged periods during running- in.
- 4 -When starting the engine for the first time, run it at no-load for a few minutes and make sure that the oil pressure value matches the one stated in the table (see "Specifications" - "Lubrication circuit").

5 -Properly pre-heat the engine when using it at low temperatures. When using

the engine at low temperatures (lower than -10°C), fill it with winter-type fuel.

6 -Use oils and lubricants with suitable features (viscosity grade, specifications and operating temperature) (see "Recommended lubricants").

7 -If the alarm signal, which can be acoustic and/or visible on the control panel according to the type of installation, is triggered while the engine is running, the electronic management system may switch the engine to emergency operation, with automatic restriction of performance levels..



Important

If the alarm signal is triggered, contact a VM MOTORI S.P.A. service centre.

OPERATING THE ENGINE UNDER SPECIFIC CONDITIONS

The engine performance is affected by fuel temperature, the temperature and relative humidity of incoming air and altitude.

When using the engine at high altitudes and high air and fuel temperatures, the output is reduced.

For further information contact a VM MOTORI S.P.A. assistance centre.

ENGINE IGNITION AND TURNING OFF

Follow the procedure below.

Starting the engine

- 1 -Insert the key (T) and turn it clockwise to position ON.
- 2 -Press button (N) to start the engine and then release the button.
- 3 -Run the engine at a minimum speed during the heating phase.



Important

Light-up of (red) indicator lights and/or the sounding of a beeper indicate the presence of a fault. In these conditions, turn the engine off immediately, then identify and eliminate the cause of the fault.

If the indicator lights are still on and/or the beeper still sounds when the engine is turned on again, turn the engine off immediately and contact one of the manufacturer's authorised service centres.

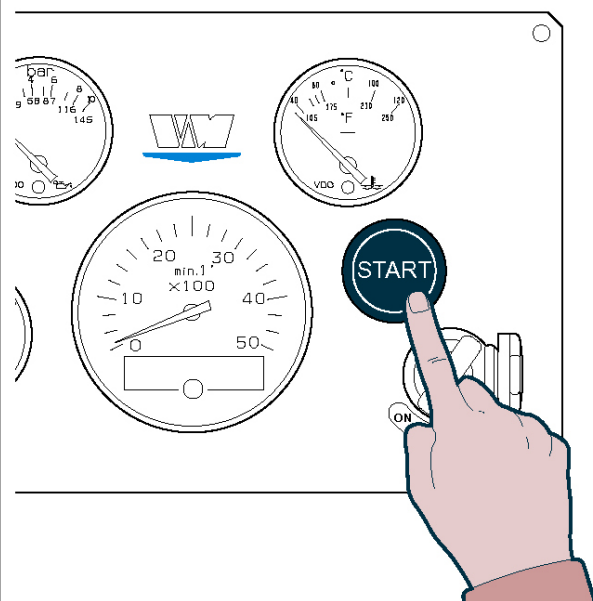
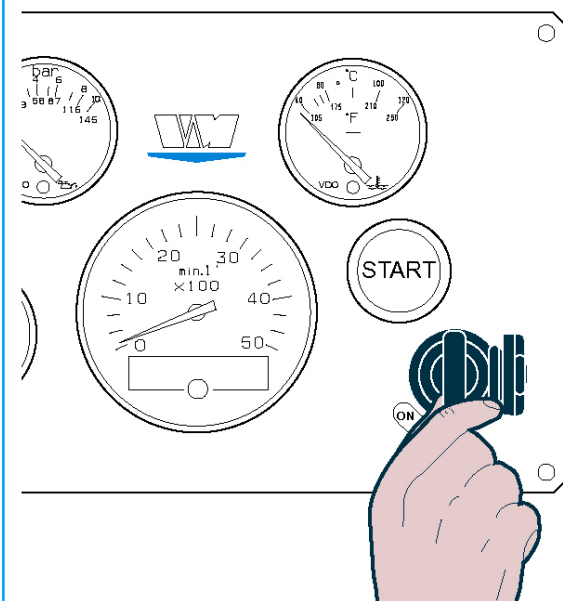
Turn the engine off

- 4 -Run the engine at minimum idling speed for 1-2 minutes.
 - 5 -Turn the ignition key (T) anticlockwise (pos. OFF) to turn off the engine.
- All the warning lights go off.
- 6 -Remove the ignition key and store it in a safe place known only to those in charge.



Important

In the case of turbocharged engines, before switching the engine off it should be run at minimum idle speed for a few minutes in order to avoid damaging the turbocharger.



REFUELLING

During refuelling, make sure the fuel does not contain any residue; in this case use specific filters.

Avoid using fuel mixed with water or other substances which may damage the engine.

The engine has been designed to be powered by standard fuels available on the European market (according to specifications DIN EN 590). If it is to be powered by BIODIESEL fuels (according to specifications UNI EN14214), it can be mixed, up to 5%, with fuel available on the European market (according to regulation DIN EN 590).



Danger - Attention

All fuels are inflammable. Any fuel leaking or dropping on hot surfaces and electric components can cause fires. Do not smoke when refuelling or nearby any filling station..



Important

Do not use fuels with specifications other than those indicated.

MAINTENANCE INFORMATION

RECOMMENDATIONS FOR MAINTENANCE

Keep the equipment as much efficient as possible and carry out the scheduled maintenance operations established by the manufacturer.

A good maintenance will ensure the highest performance, a longer operating lifetime and a constant compliance with safety requirements.


Warning - Caution

Unless otherwise stated, all interventions should be carried out when the engine has been stopped, cooled down and the ignition key has been removed.

Those authorized to carry out these interventions should follow all the precautions needed to guarantee the safety of the people involved, in compliance with the requirements laid down in the applicable legislation concerning safety at the workplace..

ENGINE MAINTENANCE

The maintenance operations are subdivided into:

- Maintenance during running-in (first 50 hours)
- Routine maintenance (after running-in) The frequency stated in the “ routine maintenance” table should be applied to engines which are used regularly.

Some lubricants or components lose their characteristics over time even if the engine is left idle for long periods; therefore, maintenance intervals should be established considering that these parts need to be replaced not only on the basis of their hours of operation but of ageing as well.

The approximate maximum time during which the chemical-physical characteristics of a few components or lubricants are maintained is stated below.

- 1 year – Lubricant oil
- 1 year - Fuel filter cartridge
- 2 years - Cartridges, air and oil filter
- 2 years – Coolant
- 2 years – Transmission belt (type POLY-V)

Maintenance during running-in table (first 50 hours)

Frequency(5)	Component	Type of intervention	Intervention procedures	Reference
Every 10 hours	Engine oil	Level control	Top up, if necessary	See “Engine oil level control”
	Coolant	Level control	Top up, if necessary	See “Engine coolant level check”
After the first 50 hours (at the end of running- in)	Engine oil (1)	Replacement		See “Engine oil change”
	Oil filter (2)	Replacement		See “Oil filter cartridge replacement”

Routine maintenance table (after running-in)

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Frequency(5)	Component	Type of intervention	Intervention procedures	Reference
Every 10 hours	Engine oil (1)	Level control	Top up, if necessary	See "Engine oil level control"
	Coolant (3)	Level control	Top up, if necessary	See "Engine coolant level check"
Every 50 hours	Electrolytic zinc	Integrity control	Replace, if necessary	See "Electrolytic zinc replacement"
Every 100 hours	Seawater pump impeller	Integrity control	Replace, if necessary	
Every 300 hours	Transmission belt (2)	Replacement		See "Belt replacement"
	Seawater pump impeller(1)	Replacement		Apply to an authorised workshop
	Engine oil (1)	Replacement		See "Engine oil change"
	Oil filter (2)	Replace the cartridge		See "Oil filter cartridge replacement"
	Air filter (2)	Replacement		See "Inlet air filter replacement"
	Fuel filter(1)	Replacement		See "Fuel filter replacement"
	Fuel circuit unions	Check tightening		See "Control screw tightening and union sealing"
	Electrolytic zinc	Replacement		See "Electrolytic zinc replacement"
Every 500 hours	Heat exchangers (engine oil, fresh water) (4)	Cleaning		Apply to an authorised workshop
	Intercooler(4)	Cleaning		Apply to an authorised workshop
Every 600 hours	Coolant (3)	Replace		See "Coolant replacement"

- (1) Even if the engine has not been run for the prescribed period, it is equally necessary to carry out the replacement at least once per year.
- (2) Even if the engine has not been run for the prescribed period, it is equally necessary to carry out the replacement at least once every 24 months.
- (3) If the engine has not been in operation for the length of time indicated, the heat exchangers must still be cleaned at least once every 5 years.
- (4) If an hour counter is not available, the frequency of the interventions should be calculated on the basis of a calendar day: one calendar day corresponds to 12 hours of operation.

PERIODIC MAINTENANCE OPERATION RECORD SHEET



Important

For each maintenance operation, fill in the sheet, so as to keep a trace of the operations performed and therefore establish the most suitable methods for future operations.

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(1) Indicate the total number of working hours.

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Date	Hrs (1)	Type of maintenance performed	Signature and stamp of workshop

Date	Hrs (1)	Type of maintenance performed	Signature and stamp of workshop



Date	Hrs (1)	Type of maintenance performed	Signature and stamp of workshop

MAINTENANCE WHEN THE ENGINE IS LEFT IDLE

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If the boat where the engine is installed is left idle for a long time, it is necessary to carry out some maintenance work to preserve the engine's maximum efficiency conditions.

If the engine is not used for short periods of time, carry out the following interventions:

- 1 -Make sure the electric contacts are working properly and, if necessary, protect them with an anti-oxidant spray.
- 2 -Check the charge of the battery and the liquid level.
- 3 -If necessary, carry out the scheduled maintenance work (see "Engine maintenance").

It is advisable to start the engine bringing it to the operating temperature (70÷80°C) at least once per month.

The engine must be started once per month if it is installed for emergency purposes.

If the engine is left idle for prolonged periods, carry out the engine protective treatment to guarantee its efficiency for 6 months and to avoid continuous control and maintenance interventions. If the engine is not used for a further period of time, check the need to repeat the protective treatment for other 6 months (see "Engine Storage").

MAINTENANCE IN CASE OF ENGINE INACTIVITY

After a period of inactivity, it is necessary to carry out a few maintenance interventions before starting the engine again to ensure its maximum efficiency conditions.

- Check the charge of the battery and the liquid level.
- Make sure the electric contacts are intact and properly working.
- Carry out the operation diagnosis of the engine (see "Diagnosis of failures").
- Check the oil level, and, if necessary, top up or replace it according to the established intervals (see "Routine maintenance table (after running-in)").
- Replace the oil filter according to the established intervals (see "Routine maintenance table (after running-in)").
- Check the coolant level, and if necessary, top up or replace it according to the established intervals (see "Routine maintenance table (after running-in)").
- Replace the fuel filter according to the established intervals (see "Routine maintenance table (after running-in)").
- Replace the air filter according to the established intervals (see "Routine maintenance table (after running-in)").
- Tension again the transmission belt (see "Method for tightening or loosening the belt").
- Check the tightening of the hydraulic unions (see "Control screw tightening and union sealing").
- Check the integrity of the impeller of the seawater pump (see "Routine maintenance table (after running-in)").
- Check the integrity of the electrolytic zinc (see "Routine maintenance table (after running-in)").
- Use a cloth soaked in a degreasing product to remove the external protective treatment.
- Start the engine and run it at minimum speed for a few minutes (see "Engine ignition and turning off").
- If no anomalies are detected, bring the engine to its operating temperature (70÷80°C).
- Turn off the engine and check again the engine oil and coolant level.

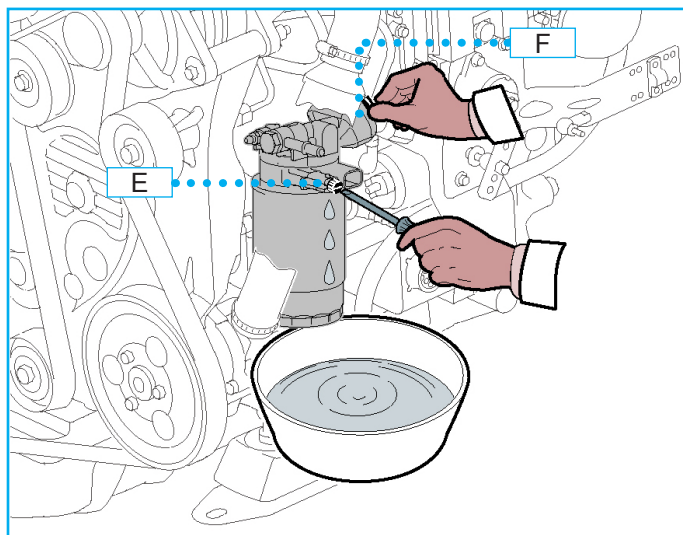
CHECKS AND CONTROLS

The information needed to carry out all maintenance, check and control operations which do not require the replacement of mechanical components are provided below.

FUEL SUPPLY CIRCUIT BLEEDING

Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Prepare a container of appropriate capacity.
- 4 -Loosen the screw (E).
- 5 -Operate the pump (F) manually to eliminate air from the circuit.
- 6 -Check that a flow of clean fuel containing no air bubbles is coming out of the bleeder screw (E).
- 7 -Tighten the screw (E).
- 8 -Wipe out the fuel residues before starting the engine.



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Important

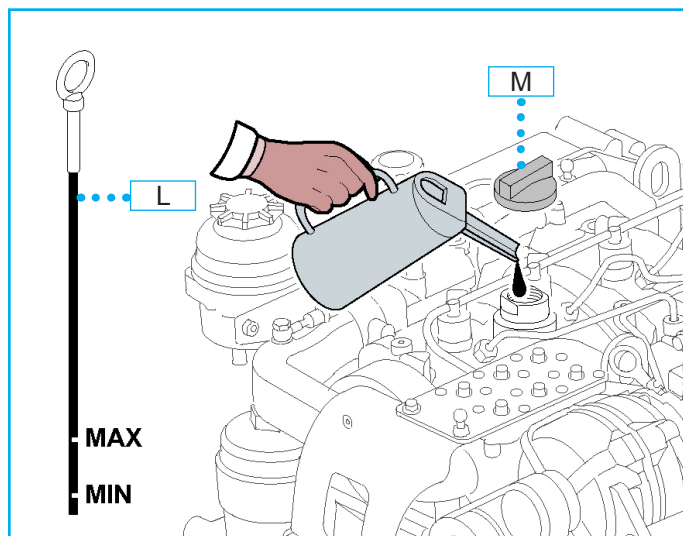
When bleeding the fuel circuit, make sure that you do not drain all the fuel contained in the filter. If you do, remove the filter, fill it with fuel, replace it and bleed again.

CONTROL SCREW TIGHTENING AND UNION SEALING

Follow the procedure below.

- 1 -Start the engine and run it at minimum speed for a few minutes.
- 2 -Run the engine at normal speed until the operating temperature ($70\div 80^{\circ}\text{C}$) is reached.
- 3 -Turn off the engine and let it cool down.

- 4 -Make sure the fixing screws of the main parts are tightened properly.
- 5 -Check the union sealing on the fuel supply circuit.
- 6 -Check the tightening of the clamps.
- 7 -Check any fluid leaks.



ENGINE COOLANT LEVEL CHECK

Follow the procedure below.

- 1 -Start the engine and bring it to the operating temperature ($70\div 80\text{ }^{\circ}\text{C}$).
- 2 -Turn off the engine and remove the ignition key.
- 3 -Let the engine cool down properly.
- 4 -Unscrew the load plug (P).

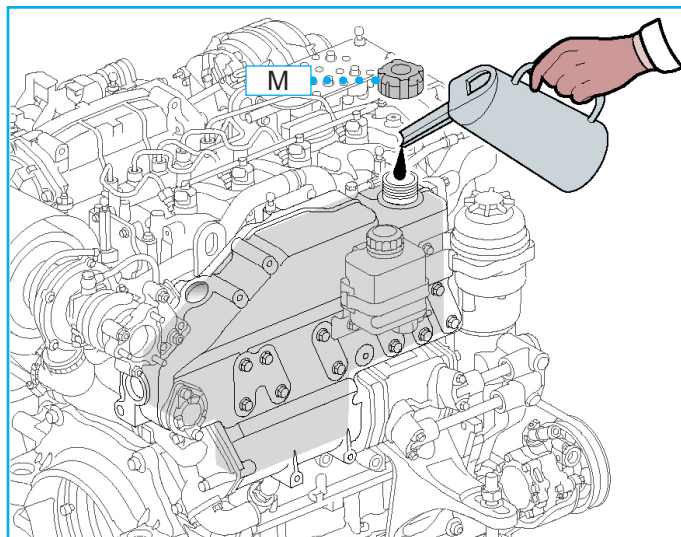
**Warning - Caution**

Open the plug gently to drain the pressure.

- 5 -Top up, if necessary, from plug (P). As for the liquid quantity and type, see "Specifications".

**Important**

The liquid level should be included between the minimum and maximum notches printed on the expansion chamber.

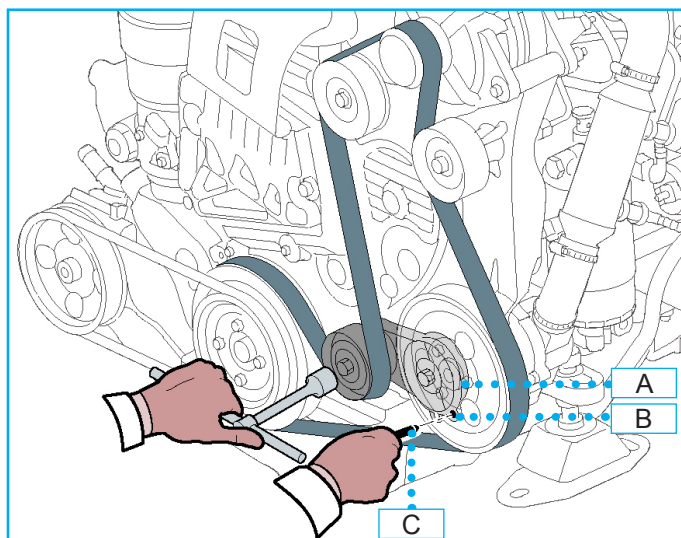
**METHOD FOR TIGHTENING OR LOOSENING THE BELT**

Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Loosen the belt by moving the tensioner (A) until the holes (B) match and block it with pin (C).
- 4 -Tension the belt by moving the tensioner (A), remove the pin (C) and release it..

**Warning - Caution**

To tighten the belt, it must be correctly positioned in the housings on each of the pulleys (see "Belt replacement").



ENGINE OIL CHANGE

Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Prepare a container of appropriate capacity. As for the oil quantity, see "Specifications".
- 4 -Unscrew the load plug (M).
- 5 -Unscrew the plug (Q).
- 6 -Insert the pump (R) and screw it to pipe.
- 7 -Operate manually the pump to transfer all the oil into the container.
- 8 -Pour the new oil until it reaches the correct level on the dipstick (see "Engine oil level control")
- 9 -Disconnect the pump.
- 10 -Screw again the plug (Q).
- 11 -Screw again the load plug (M).
- 12 -Start the engine and bring it to the operating temperature (70÷80 °C).
- 13 -Check for any oil leaks
- 14 -Turn off the engine and check the oil level (see "Engine oil level control").



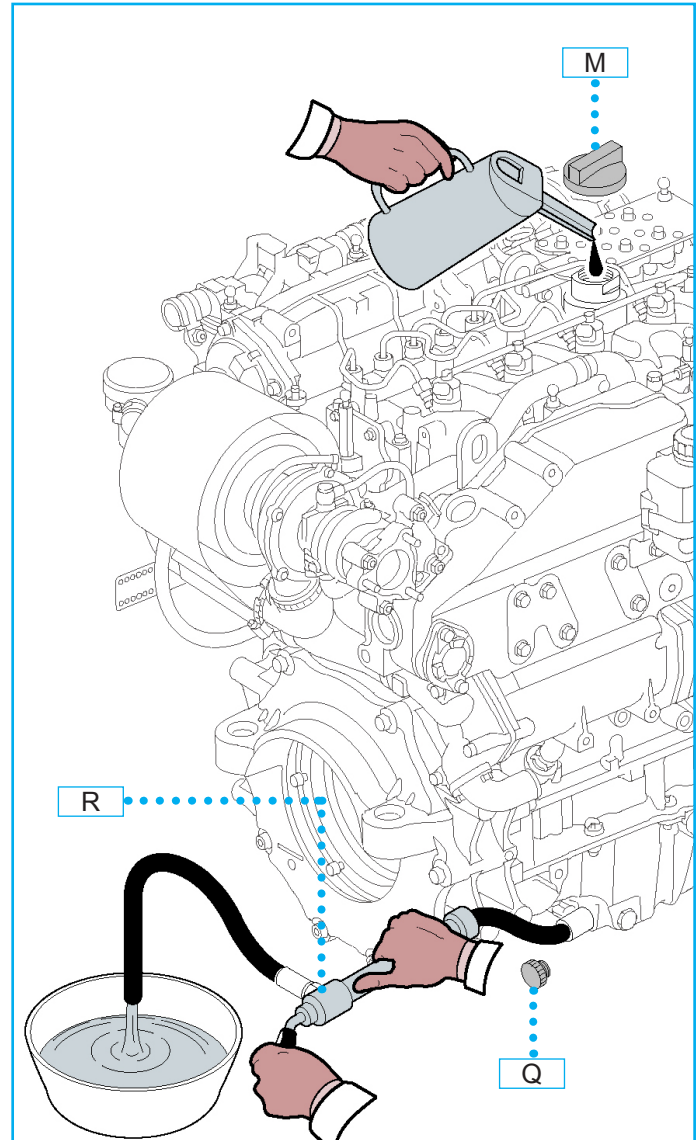
Warning - Caution

In the event of oil leaks, check the level periodically to evaluate the extent of the leak. If the amount is excessive, contact one of the manufacturer's authorised service centres.



Important

Do not throw the oil in the environment but carry out its disposal in compliance with legislation in force in the country where it is used. Use the oils and lubricators recommended by the manufacturer (see "Recommended lubricants").



COOLANT REPLACEMENT

Follow the procedure below.

1 -Start the engine and run it at minimum speed for a few minutes.

The cooling circuit reaches the operating pressure.

2 -Turn off the engine and remove the ignition key.

3 -Let the engine cool down adequately to avoid being burnt.

4 -Prepare a container of appropriate capacity.

As for the liquid quantity, see "Specifications".

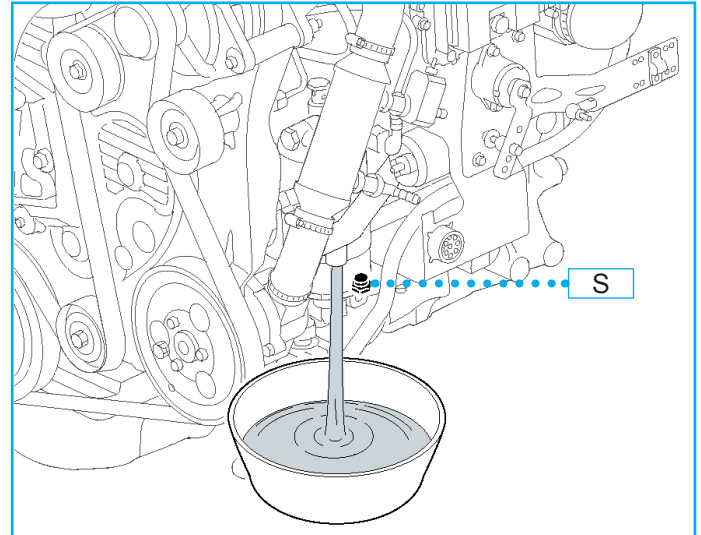
5 -Unscrew the plug (S).

6 -Let the liquid flow into the container.

7 -Screw again the plug (S).

8 -Unscrew the plug (P).

9 -Pour in the new liquid.



Important

The coolant level must be as shown in the figure. As for the liquid quantity and type, see "Specifications".

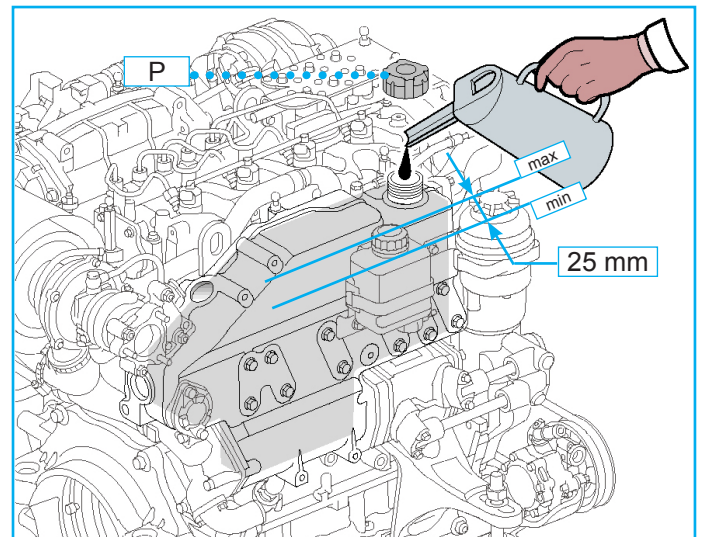
Only use coolants that comply with the manufacturer's specifications.

10 -Screw again the plug (P).

11 -Turn the engine on and leave it running at minimum speed for a few minutes until it reaches working speed (70÷80°C).

12 -Turn off the engine and let it cool down properly.

13 -Check the coolant level and, if necessary, carry out topping-up (See "Engine coolant level check").



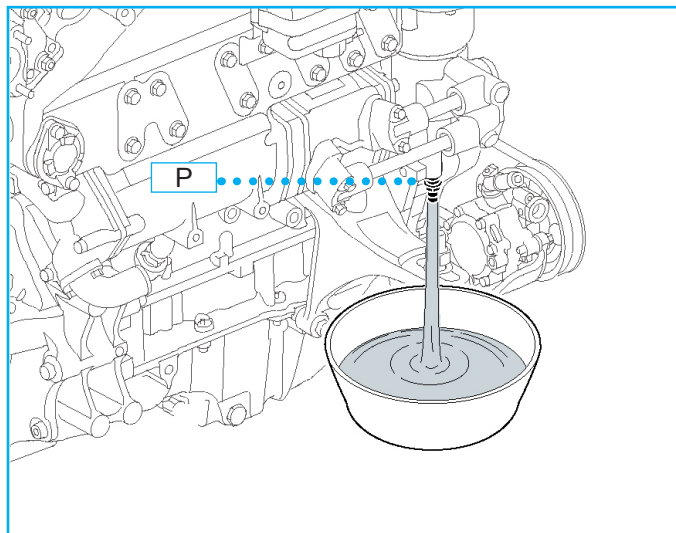
Important

Do not throw away any polluting material in the environment. Carry out their disposal in compliance with the relevant legislation in force.

SEAWATER CIRCUIT EMPTYING

Follow the procedure below.

- 1 -Prepare a container of appropriate capacity.
- 2 -Unscrew the plug (P1).
- 3 -Let water flow into the container.
- 4 -Screw again the plug (P1).

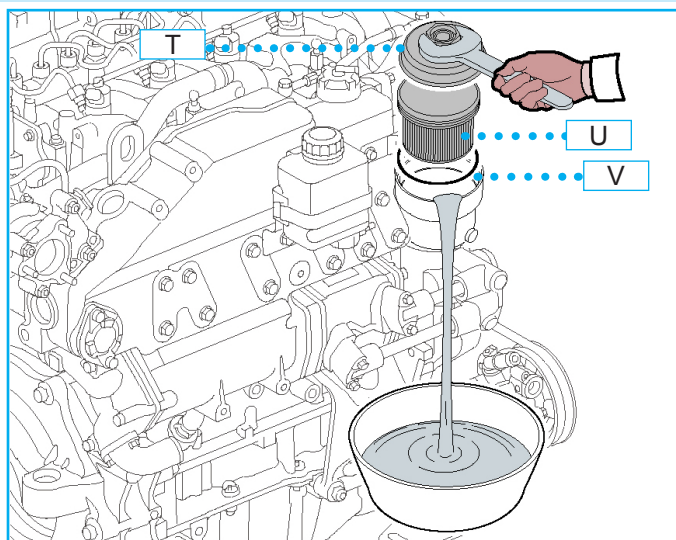


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OIL FILTER CARTRIDGE REPLACEMENT

Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Prepare a container to collect any leak.
- 4 -Unscrew the cover (T).
- 5 -Replace the cartridge (U).
- 6 -Check the conditions of gasket (V) and, if necessary, replace it.
- 7 -Screw up the cap (T).



Important

Tighten the cap to a tightening torque of 25 Nm.

- 8 -Turn the engine on and leave it running at minimum speed for a few minutes until it reaches working speed (70÷80°C).
- 9 -Check for any oil leaks



Warning - Caution

In the event of oil leaks, check the level periodically to evaluate the extent of the leak. If the amount is excessive, contact one of the manufacturer's authorised service centres.



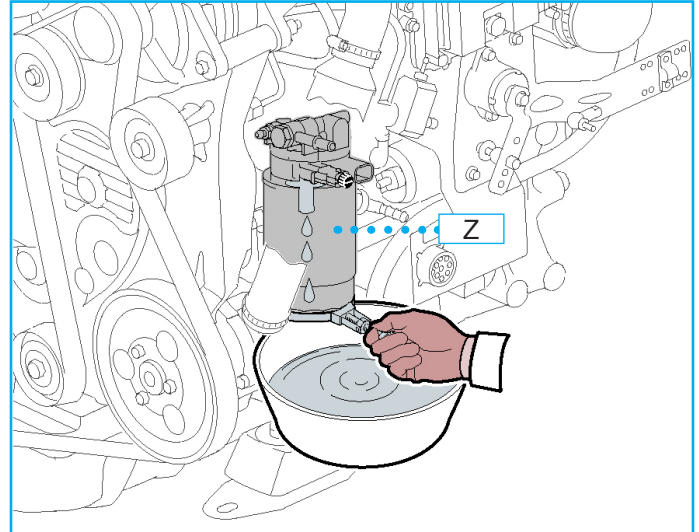
Important

Do not throw away any polluting material in the environment. Carry out their disposal in compliance with the relevant legislation in force.

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Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Prepare a container to collect any leak.
- 4 -Remove the filter (Z) using the tool provided.
- 5 -Fill the new filter with the fuel from the filter being replaced.
- 6 -Lubricate the gasket of the new filter before mounting it.
- 7 -Fit the new filter using the tool provided.
- 8 -Bleed air from the fuel supply circuit (See "Fuel supply circuit bleeding")
- 9 -Turn the engine on and check for any fuel leaks.



Warning - Caution

In the event of fuel leaks, identify and eliminate the cause. If the problem persists, contact one of the manufacturer's authorised service centres.



Important

Do not throw away any polluting material in the environment. Carry out their disposal in compliance with the relevant legislation in force.

RECOMMENDED LUBRICANTS

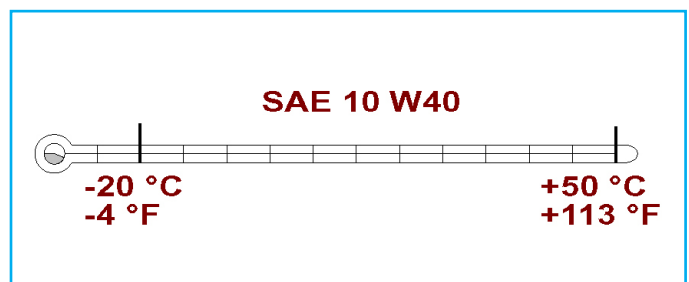
The lubricant recommended by VM MOTORI S.P.A. is: Q8 HD SPECIAL 10W-40 for operating temperatures from -20°C to +50°C..

Oils of different brands can be used provided that they have the following features:

- Viscosity grade: SAE 10 W - 40
- Minimum specifications:

ACEA A3/B4

API CF



Important

It is advisable not to mix oils with different characteristics.

INFORMATION ABOUT FAILURES

TROUBLESHOOTING

The information below are provided to facilitate the identification and solution of possible anomalies and failures which may occur during operation.

Some of these problems can be solved by the user, while

others require specific technical skills or abilities, therefore they should be exclusively dealt with by qualified technicians with extensive experience in the specific sector of intervention.

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Problem	Cause	Remedy
During the ignition phase the control board and the engine do not start.	Flat battery	Recharge or replace battery
	Fuse "triggered"	Reset the fuse (see "Reset fuses")
	The electric cables are disconnected or they do not guarantee continuity	Check the electric connections
	Failure of engine revolution sensor	Replace the sensor Apply to an authorised workshop
The engine does not start	Presence of air in the fuel supply circuit	Carry out bleeding (see "Fuel supply circuit bleeding")
	Dirty or faulty injectors	Clean or replace injectors Apply to an authorised workshop
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it Apply to an authorised workshop
	Failure of the start control	Replace the start control Apply to an authorised workshop
	Fuse "triggered"	Reset the fuse (see "Reset fuses")
The starter motor runs idle	The engine starting relay is not connected correctly or is faulty	Replace the relay Apply to an authorised workshop
	Electromagnet failure	Check the starter motor Apply to an authorised workshop
The starter motor is not running	Flat battery	Recharge or replace battery
	Interrupted electric connection	Check the electric connections
	Worn brushes	Replace the worn brushes Apply to an authorised workshop
	Fuse "triggered"	Reset the fuse (see "Reset fuses")

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Problem	Cause	Remedy
The engine stops after ignition	Presence of air in the fuel supply circuit	Carry out bleeding (see "Fuel supply circuit bleeding")
	Clogged fuel filter	Replace filter (see "Inlet air filter replacement")
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it Apply to an authorised workshop
	The electric cables are disconnected or they do not guarantee continuity	Check the electric connections
The engine does not reach the operating speed	Clogged fuel filter	Replace filter (see "Fuel filter replacement")
	Presence of air in the fuel supply circuit	Carry out bleeding (see "Fuel supply circuit bleeding")
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it Apply to an authorised workshop
	Dirty or faulty injectors	Clean or replace injectors Apply to an authorised workshop
	Clogged air filter	Clean or replace the filter (see "Inlet air filter replacement")
	Overload	Reduce the load
Emission of black smoke from the exhaust pipe	Dirty or faulty injectors	Clean or replace injectors Apply to an authorised workshop
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it Apply to an authorised workshop
	Faulty turbocharging turbine	Replace the turbine Apply to an authorised workshop
Light emission of white smoke from the exhaust pipe	Oil level too high	Adjust the oil level
	Worn segments	Check compression Apply to an authorised workshop
	Worn valve guideways	Check wear Apply to an authorised workshop

Problem	Cause	Remedy
Abundant emission of white smoke from the exhaust pipe	Burnt gasket head	Apply to an authorised workshop
	Engine overheating. Clogged coolers	Clean the coolers. Apply to an authorised workshop
	Clogged seawater filter	Clean or replace the filter
	Worn seawater pump impeller	Replace the impeller. Apply to an authorised workshop
	Broken or worn belt	Replace the belt (see "Belt replacement")
	Failure of water temperature sensor	Replace the sensor. Apply to an authorised workshop
The pressure gauge shows a too low engine oil pressure and the corresponding warning light comes on	Failure of pressure gauge	Check or replace the pressure gauge. Apply to an authorised workshop
	Oil level too low	Adjust the oil level (see "Engine oil level control")
	Oil pump failure	Check or replace the pump. Apply to an authorised workshop
	Faulty sensor	Check and, if appropriate, replace the sensor. Apply to an authorised workshop
The coolant temperature warning light comes on	Coolant too low	Adjust the engine coolant level (see "Engine coolant level check")
	Stucked overpressure valve of the load plug	Replace the plug with 1 bar valve
	Worn or faulty seawater pump impeller	Replace the impeller. Apply to an authorised workshop
	Freshwater pump failure	Check the pump and, if necessary, replace it. Apply to an authorised workshop
	Broken or worn belt	Replace the belt (see "Belt replacement")
Excessive noise	Dirty or faulty injectors	Clean or replace injectors. Apply to an authorised workshop
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it. Apply to an authorised workshop
	The injection pump timing is not adjusted correctly	Adjust pump timing. Apply to an authorised workshop
Output reduction	Clogged fuel filter	Replace filter (see "Fuel filter replacement")
	Presence of air in the fuel supply circuit	Carry out bleeding (see "Fuel supply circuit bleeding")
	The injection pump is set incorrectly or is faulty	Adjust the pump or replace it. Apply to an authorised workshop
	Dirty or faulty injectors	Clean or replace injectors. Apply to an authorised workshop
	Clogged air filter	Clean or replace the filter (see "Inlet air filter replacement")
	Clogged seawater pump impeller	Clean the impeller. Apply to an authorised workshop
	Insufficient accelerator stroke	Adjust the accelerator stroke
The battery warning light comes on	The alternating current generator does not charge the battery	Check and, if appropriate, replace the alternating current generator. Apply to an authorised workshop
The oil pressure warning light comes on	Engine oil pressure too low	Apply to an author

RESET FUSES

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The engine is equipped with safety fuses, which cut out to prevent damage to the electrical components.

In the event of malfunctions due to triggering of a fuse, the cause (overload or short circuit current) must be eliminated before the fuse is reset.



Important

If the problem persists, contact a VM MOTIRI S.P.A. service centre.

Follow the procedure below.

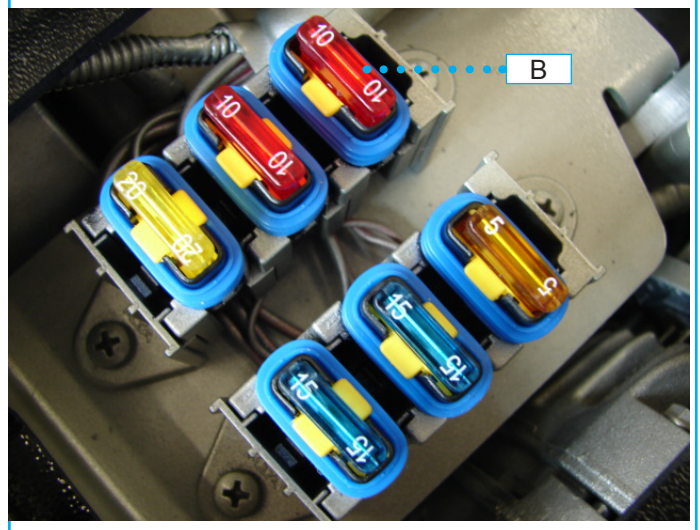
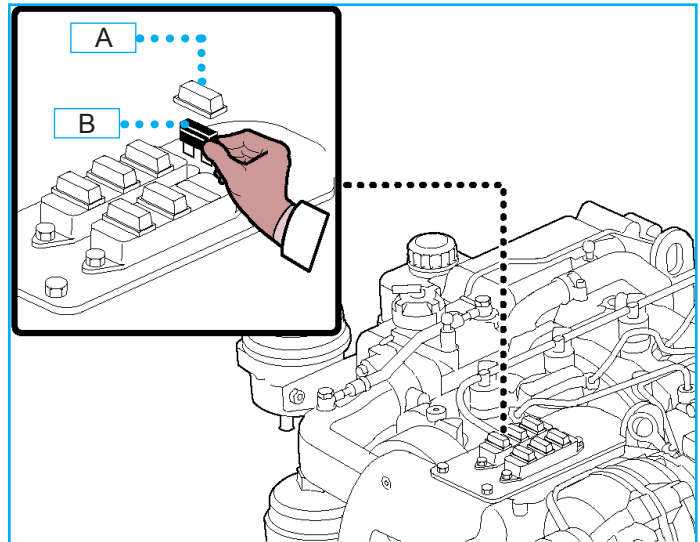
- 1 -Remove all the fuse guards (A).
- 2 -Extract the fuses (B) (one at a time) and check them for damage.



Warning - Caution

To avoid errors when returning the fuses to their places, always check fuses one at a time, replacing them if necessary with a new fuse that has the same characteristics (type, amperage, etc.).

- 3 -When all the fuses have been checked and replaced, fit the respective guards (A) with care.



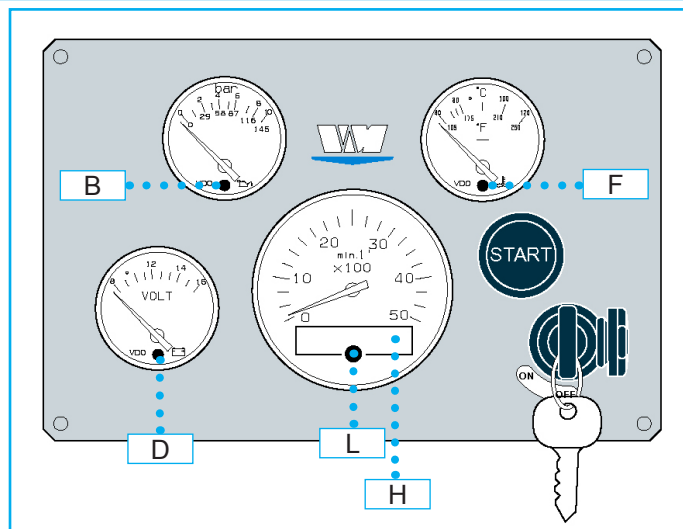
DIAGNOSIS OF FAILURES

- The engine is fitted with a self-diagnosis system that allows any operating malfunctions to be identified, by means of indicators (B-D- F) and/or activation of an acoustic signal.
- In the presence of operating malfunctions, the display (H) shows the values detected by the instruments, the error identification codes and the relevant description.
- Button (L) serves to show the malfunctions on display in sequence.



Important

In the event of malfunctions, turn the engine off immediately, contact one of the manufacturer's authorised service centres and provide them with the information shown on the display.



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READING ERROR CODES

In case of malfunction, the display (H) visualises the presence of error codes.

In the case of one or more error codes, the display shows the following caption:

DTC

Photo 1 represents the presence of 6 malfunctions that have occurred.

While holding down the button (L) you can see the first error code "SPN". Photo 2 represents the presence of the error code SPN 628.

By pressing the button (L) again you can see the errors later.

Refer to the table "Error Codes List" to identify the description of the error code.

Photo 1

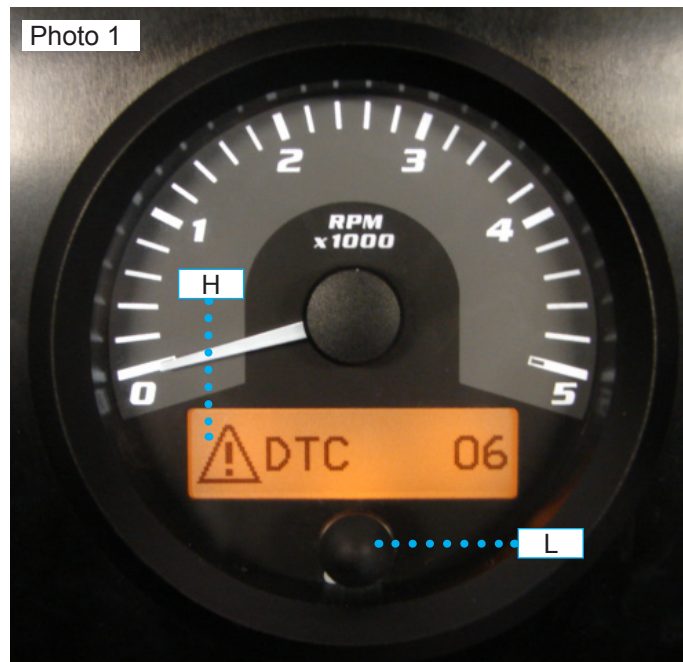
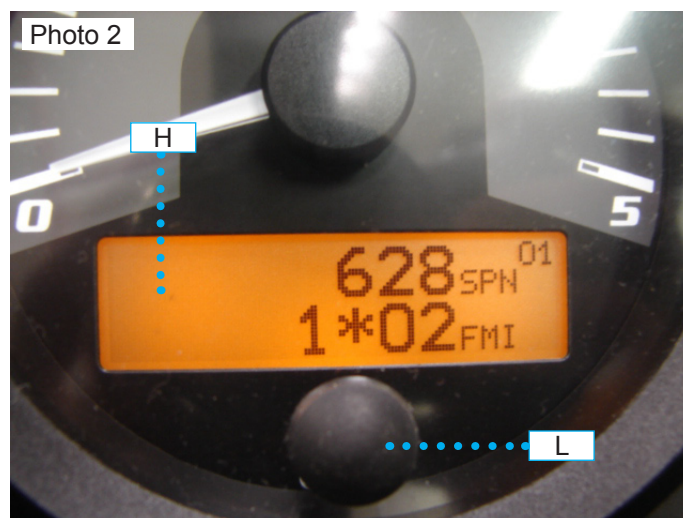


Photo 2



ERROR CODES LIST

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SPN Description

0 Immobilizer Key not Correct
0 Rail Pressure Signal Offset Control Error
0 EGR Radiator Bypass Actuator Malfunction
0 NO Description
27 Malfunctioning of EGR Exhaust Gas Recirculation Actuator
27 Malfunctioning of EGR Exhaust Gas Recirculation Actuator
27 Excessive flow of EGR Exhaust Gas Recirculation or Malfunctioning Air Inlet System
27 Insufficient flow of EGR Exhaust Gas Recirculation
81 DPF Particulate Filter - Low System Efficiency
81 DPF Particulate Filter - Filter Disassembled or Defective
81 DPF Particulate Filter - Non Plausible Differential Pressure
81 DPF Particulate Filter - Active Engine Protection
84 Vehicle Speed Sensor Malfunction
84 NO Description
91 Synchronization Error of Accelerator Pedal Position Sensors
91 Accelerator Pedal Position Error - Sensor 1
91 Accelerator Pedal Position Error - Sensor 2
91 Position of Accelerator/Brake not plausible
91 NO Description
97 Actuator Malfunction of Water Level in Gas Oil
97 Circuit Malfunction of Water Sensor in Gas Oil
97 Detection of Water in Gas Oil
100 Alarm for Low Engine Oil Pressure
100 Alarm for Critical Engine Oil Pressure
100 Signal Error from Engine Oil Pressure Sensor
102 Overfeeding Pressure Alarm
102 Overfeeding Pressure Sensor Error
105 Intake Air Temperature Sensor Alarm
105 Intake Air Temperature Sensor Error
108 DPF Particulate Filter - Non Plausible Differential Pressure
108 Atmospheric Pressure Sensor Error
110 Engine water Temperature Alarm
110 Engine Water Sensor Error
110 Engine water Sensor Malfunction
131 DPF Particulate Filter - Filter Disassembled or Defective
131 DPF Particulate Filter - Non Plausible Differential Pressure
131 DPF Particulate Filter - Active Engine Protection
131 DPF Particulate Filter - Defective Differential Pressure Sensor
132 Plausibility Error of Air Flow Signal
132 Interval Error of Battery Voltage Signal Check
132 Signal Error of Air Flow of Reference
157 Rail Pressure Error during Rail Pressure Check from Pressure Regulator
157 Error of Maximum Pressure Limiting Valve PRV Rail

164 Error of Rail Pressure Signal
168 Battery Voltage Error
172 Air Temperature Signal Duty Cycle Error
172 NO Description
173 Exhaust Gas Temperature Sensor Error - Bank 1 - Position 1
174 Gas oil Temperature Sensor Error
175 Engine Oil Temperature Alarm
175 Signal Error from Engine Oil Temperature Sensor
177 NO Description
190 Engine Overspeed Alarm
190 Crankshaft rpm Sensor Error
228 Camshaft/Crankshaft Position Sensor Error
518 NO Description
527 Cruise Control Circuit Malfunction
527 NO Description
574 NO Description
581 NO Description
597 Brake Signal Error
598 Clutch Signal Error
604 Gearbox Control unit - Neutral gearbox indicator light malfunctioning
624 Circuit Malfunction of System indicator light
629 Engine ECU - Performance Error of Injection Control Module A
629 Engine ECU - Performance Error of Injection Control Module B
629 Engine ECU Injector Activation Time Limit Check Error
629 Engine ECU RPM Signal Redundancy Check Error
629 Engine ECU Internal Communication Error - SPI
629 Engine ECU EEPROM Internal Memory Error
629 Engine ECU Internal Supply Voltage Error
629 Engine ECU Injector Deactivation Redundancy Test Error during Initialization
629 Engine ECU Processor Restart Abolished
629 Engine ECU Processor Restart Locked
629 Engine ECU Analogue/Digital Convertor Error
629 Verification Error of TPU Processor Activation Time
629 Internal Error of Engine ECU Controller/Processor
629 Internal Error of Communication between Processor and Control Module
630 Plausibility Error of the Dataset Variant Coding
633 Analogue/Digital Channel Error of PCV Fuel Flow Adjustment Valve Control
633 PWM Circuit Malfunction of PCV Fuel Flow Adjustment Valve Control
634 Intake Butterfly Valve Actuator Error
634 Circuit Malfunction of TVA Intake Butterfly Valve Actuator
639 NO Description
641 High Overfeeding Pressure Conditions
641 Low Overfeeding Pressure Conditions
641 Circuit Malfunction of Overfeeding Pressure Control Actuator Solenoid

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651 Cylinder 1 - Injector Circuit Malfunction Alarm
651 Cylinder 1 - Injector Circuit Malfunction Specific Error
651 Injector Opening Time Calibration Error
652 Cylinder 2 - Injector Circuit Malfunction Alarm
652 Cylinder 2 - Injector Circuit Malfunction Specific Error
652 Injector Opening Time Calibration Error
653 Cylinder 3 - Injector Circuit Malfunction Alarm
653 Cylinder 3 - Injector Circuit Malfunction Specific Error
653 Injector Opening Time Calibration Error
654 Cylinder 4 - Injector Circuit Malfunction Alarm
654 Cylinder 4 - Injector Circuit Malfunction Specific Error
654 Injector Opening Time Calibration Error
655 Cylinder 5 - Injector Circuit Malfunction Alarm
655 Cylinder 5 - Injector Circuit Malfunction Specific Error
655 Injector Opening Time Calibration Error
656 Cylinder 6 - Injector Circuit Malfunction Alarm
656 Cylinder 6 - Injector Circuit Malfunction Specific Error
656 Injector Opening Time Calibration Error
657 Injector Circuit Malfunction Alarm
657 Injector Circuit Malfunction Specific Error Bank 1
658 Injector Circuit Malfunction Alarm
658 Injector Circuit Malfunction Specific Error Bank 2
675 Glowplugs Indicator Light Malfunction
676 Glowplugs GCU Control Unit Relay Malfunction
676 Cylinder 1 Glowplug Circuit Malfunction
676 Cylinder 2 Glowplug Circuit Malfunction
676 Cylinder 3 Glowplug Circuit Malfunction
676 Cylinder 4 Glowplug Circuit Malfunction
676 Cylinder 5 Glowplug Circuit Malfunction
676 Cylinder 6 Glowplug Circuit Malfunction
676 NO Description
676 Glowplugs Control Unit
677 Plausibility Error Terminal Signal T15
677 Plausibility Error Terminal Signal T50
677 Circuit Malfunction of Starter Motor Command Relay
679 Error of Valve Limiting Maximum Pressure PRV Rail
680 NO Description
723 Camshaft Phase Sensor Error
767 Transmission Gear Reverse Switch Error
835 Engine Oil Pressure Indicator Light Malfunction
859 Circuit Malfunction of Gas oil Filter Heater Relay
898 NO Description
970 NO Description
976 NO Description

977 Circuit Malfunction of Fan Relay 1
977 Circuit Malfunction of Fan Relay 2
977 Circuit Malfunction of Fan Relay 3
977 NO Description
979 Malfunction of PTO Switch
1079 Supply Voltage Check Error Sensors 1
1079 Supply Voltage Check Error Sensors 2
1079 Supply Voltage Check Error Sensors 3
1109 NO Description
1137 Error Checking the Plausibility of the Exhaust Gas Temperature Sensor - Position
1137 Exhaust Gas Temperature Sensor Error - Bank 1 - Position 1
1138 Error Checking the Plausibility of the Exhaust Gas Temperature Sensor,Position 2
1138 Sensor Error of Exhaust Gas Temperature - Bank 1 - Position 2
1139 NO Description
1213 Circuit Malfunction of MIL Indicator light
1213 NO Description
1347 Malfunction of Pressure Regulator Solenoid PWM Control Circuit
1347 NO Description
1351 Circuit Malfunction Air Conditioned Relay
1484 Gearbox Control unit - Solenoid Circuit Error
1484 Gearbox Control unit - Error Checking the Pressure Switch
1484 Gearbox Control unit - Relay Error
1484 Gearbox Control unit - Turbine Speed Sensor Error
1484 Gearbox Control unit - Pressure Switch Function Test Failure
1484 Gearbox Control Unit - Torque Value of Converter Out of Range
1484 Gearbox Control Unit - Switch Valve Blocked
1484 Generic Error of TCU Gearbox Control unit
1484 Internal Error of TCU Gearbox Control unit
1484 Internal Error of TCU Gearbox Control unit Gear Ratio Incorrect
1484 NO Description
1485 Relay Main Control Error
1680 Auxiliary Heater Circuit Malfunction

INFORMATION ABOUT COMPONENT REPLACEMENT

RECOMMENDATIONS FOR PART REPLACEMENT

Before carrying out any replacement, activate all safety devices and evaluate the need to inform the personnel working on the engine or nearby. In particular, place proper signs in the nearby areas and keep away all devices which, once activated, may represent a source of unexpected danger and risk for people's safety and health. When necessary, replace the worn components, and use original spare parts only.

The manufacturer cannot be held responsible for damages to people or components resulting from the use of non original spare parts and from repairs carried out without the authorisation of the manufacturer.

When requesting spare parts, always contact your nearest VM MOTORI S.P.A. spare parts dealer (see "Enclosed documentation": Spare parts and service centre address booklet) and indicate the engine's serial number (see "Manufacturer and engine identification").

BELT REPLACEMENT

Follow the procedure below.

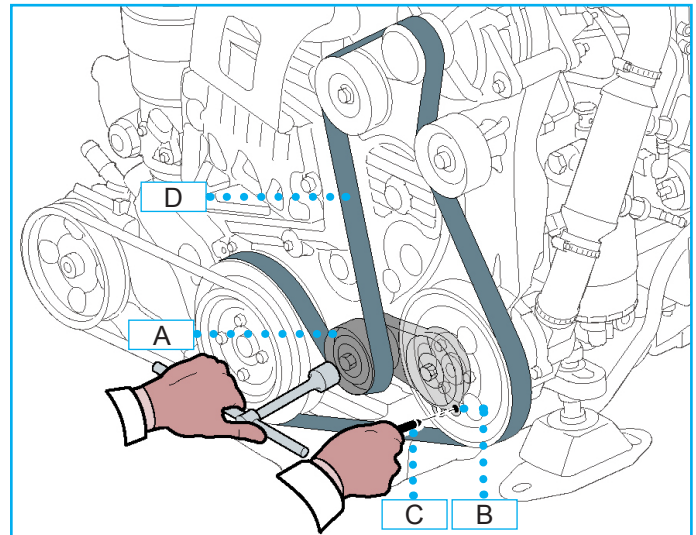
- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Loosen the belt by moving the tensioner (A) until the holes (B) match and block it with pin (C).
- 4 -Remove the belt (D) and replace it.
- 5 -Tension the belt by moving the tensioner (A), remove the pin (C) and release it.



Important

Before restarting the engine, make sure there are no tools or other material left near the moving parts. Do not throw away any replaced part in the environment.

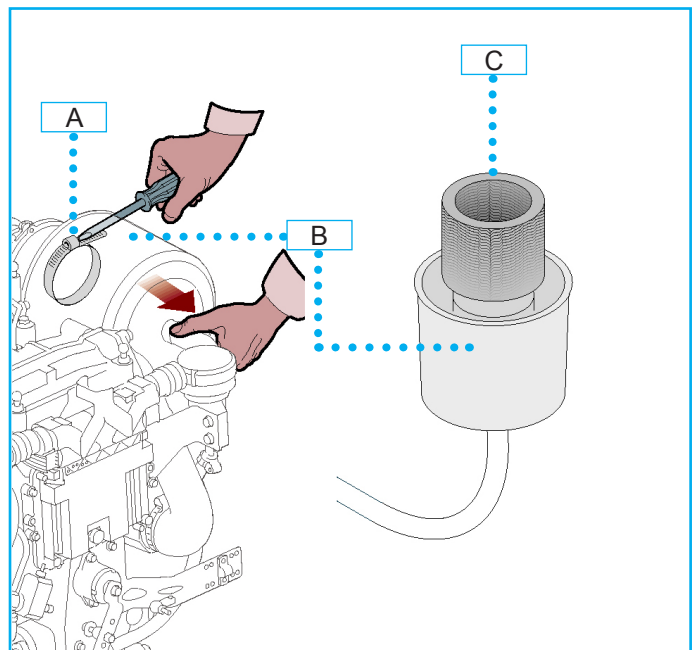
Carry out their disposal in compliance with the relevant legislation in force.



INLET AIR FILTER REPLACEMENT

Follow the procedure below.

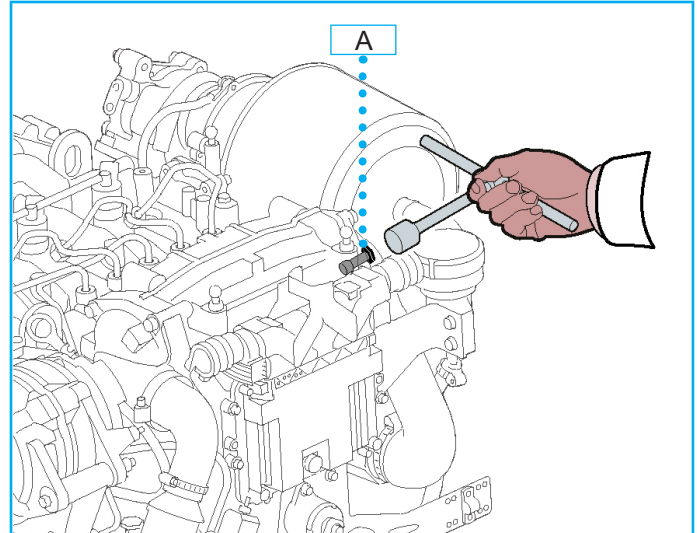
- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Loosen hose clamp (A) and remove the filter (B).
- 4 -Extract sponge (C) and replace it.
- 5 -Replace the filter (B) and fix it using the hose clamp (A).



ELECTROLYTIC ZINC REPLACEMENT

Follow the procedure below.

- 1 -Turn off the engine and remove the ignition key.
- 2 -Let the engine cool down adequately to avoid being burnt.
- 3 -Unscrew the nut and replace the electrolytic zinc (A).



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ENGINE DISPOSAL

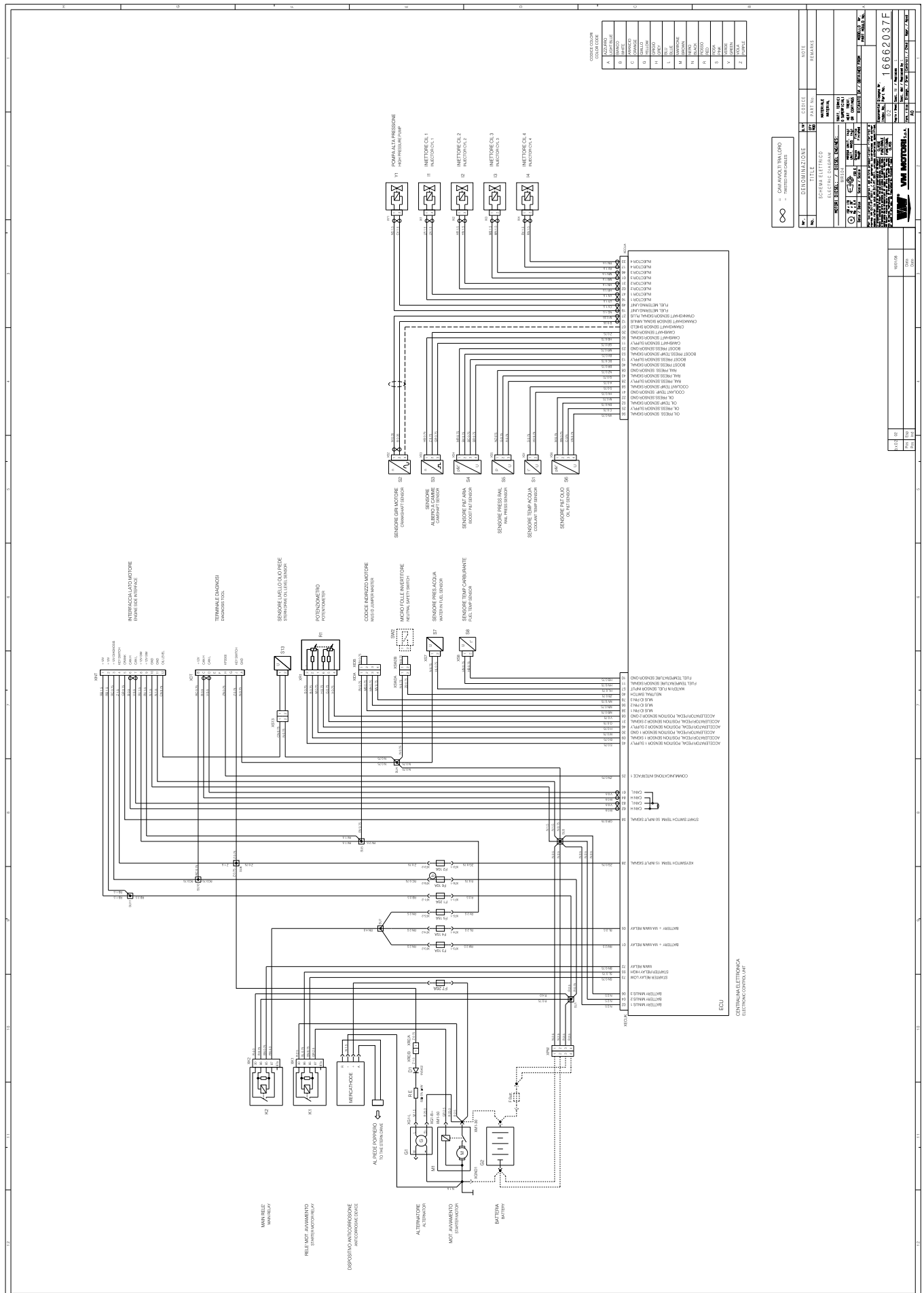
This operation should be carried out by experienced operators, in compliance with the legislation in force concerning safety at the workplace.

Do not throw away non bio-degradable products and non ferrous components (rubber, PVC, resins, etc.).

While decommissioning the engine, divide all the components depending on their chemical composition and dispose of them accordingly.

ELECTRICAL SYSTEM

ENGINE ELECTRICAL DIAGRAM



ELECTRICAL DIAGRAM - INSTRUMENTS DASH PANEL

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