

Marine Engines

Operator's manual

SK-60

SK-80

U_CTMTSK6080_EN
Revision 0

Presentation

Dear Customer,

We would like to thank you for choosing a Solé Advance product. We recommend that you read this manual carefully before carrying out any of the operations and keep it close at hand, near the engine, as it can be of great use in the future.

Our goal as a manufacturing company is that you enjoy our product, regardless of the use you make of it. The equipment manufactured in Solé Advance facilities is designed to offer the highest performance in the most demanding operating conditions.

The images, text and information contained in this manual are based on the product's features at the time of publication. Solé Advance reserves the right to modify this document without prior notice.

Table of contents

Safety precautions and instructions	6
Solé Advance warranty	10
Section 1 – Engine information	13
1.1. Engine identification.....	13
1.2. Engine parts identification	14
Section 2 – Transport, handling and storage.....	15
2.1. Reception.....	15
2.2. Transporting and handling the packed engine.....	15
2.3. Transporting and handling the unpacked engine.....	16
2.4. Storage of packed and unpacked engine	16
Section 3 – Installation	17
3.1. Angle of installation.....	17
3.2. Engine installation.....	17
Section 4 – Operation	18
4.1. Prestart checklist.....	18
4.2. Cranking the engine	18
4.3. Stopping the engine	19
4.4. Engine Operation at Low Temperatures.....	20
4.5. Winterization and Preservation	20
4.6. Maintenance during the storage	21
4.7. Restoration of Operational Conditions.....	21
Section 5 – Systems and scheduled maintenance	22
5.1. Operating description.....	22
5.2. Periodic maintenance schedule	22
5.3. General.....	24
Maintenance task. Screw tightening, fasteninat	24
Maintenance task. Valve clearance inspection.....	24
Maintenance task. Compression pressure inspection	25
5.4. Lubrication system	26
Oil specifications	26
Maintenance task. Oil filter change.....	26
Maintenance task. Oil level check.....	26
Maintenance task. Oil fill/change	27
.....	27
.....	27
5.5. Fuel system.....	27
Fuel specifications.....	27
Maintenance task. Fuel level inspection.....	27
Maintenance task. Fuel tank clean	27
Maintenance task. Water separator filter purge	27
Maintenance task. Fuel filter change.....	28
Maintenance task. Injection pump inspection.....	28
Maintenance task. Injector inspection	28
Maintenance task. Bleeding air from the fuel system	29
5.6. Cooling System	29

Coolant specifications	29
Maintenance task. Coolant check	29
Maintenance task. Coolant fill / change	30
Maintenance task. Seawater filter inspection	30
Maintenance task. Seawater pump impeller inspection	30
Maintenance task. Zinc anode inspection	31
5.7. Inlet and Exhaust System	31
Exhaust circuit description	31
Maintenance task. Air filter inspection	32
Maintenance task. Exhaust gas, noise and vibrations inspection	32
Exhaust system inspection points	33
Battery	33
Circuit protection	33
Maintenance task. Incandescent glow plug inspection	33
Maintenance task. Starter motor inspection	33
Maintenance task. Alternator belt tension inspection	34
Maintenance task. Battery level	34
Section 6 – Troubleshooting	35
Section 7 – Technical specifications	40
Section 8 – Tightening Troques	43
Section 9 – Overall dimensions	44
Section 10 - Instructions to Replace and Remove	47
Section 11 – Inspection prior to the delivery of propulsion engines	48
Section 12 - Maintenance log	50

Safety precautions and instructions

Solé Advance is concerned for your safety and your machine's condition. Safety Precautions and Instructions are one of the primary ways to call your attention to the potential hazards associated with our engine operation. Follow the precautions listed throughout the manual before and during operation and maintenance procedures for your safety, the safety of others and the performance of your engine.

Types of Safety Precautions:

⚠ WARNING

Indicates the presence of a hazard that can cause severe personal injuries, death or substantial property damages.

⚠ CAUTION

Indicates the presence of a hazard that will or can cause minor personal injury or property damages.

⚠ NOTICE

Communicates installation, operation and maintenance information that is safety related but not hazard related.

⚠ WARNING

Servicing the fuel system and combustible materials. A flash fire can cause severe injury or death



Do not smoke or permit flames or sparks near the fuel injection system, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks.

Catch fuels in an approved container when removing the fuel line or fuel system. Keep the fuel lines and connections tight and in good condition. Do not replace flexible fuel lines with rigid lines and use flexible sections to avoid fuel line breakage caused by vibrations.

Keep the compartment and the engine clean and free of debris to minimize the risk of fire.

⚠ WARNING



Servicing the air cleaner. A sudden backfire can cause severe injury or death.

Do not operate the engine with the air cleaner/silencer removed.

⚠ WARNING

Combustible materials. A fire can cause severe injury or death.



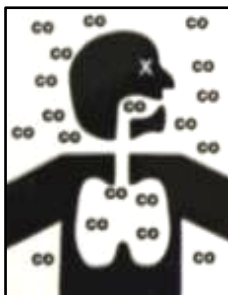
Engine fuels, fuel vapors and combustible materials are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher.

In case of fire do not open sound shield compartment and follow these instructions:

- Shut down engine(s)
- Continuously discharge entire contents of a halon or CO2 portable fire extinguisher (or other provision) immediately.

⚠ WARNING

Carbon monoxide (CO) can cause severe nausea, fainting or death.



Engine exhaust gases contains carbon monoxide gas. Carbon monoxide is an odourless, colourless, tasteless, no irritating gas that can cause death if inhaled for even a short time. Get fresh air and do not sit, lie down or fall asleep if anyone shows signs of carbon monoxide poisoning:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles. Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision. Stomachache, vomiting, nausea.

⚠ WARNING

Keep the area around the battery well ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.



Never allow battery fluid (battery contains sulfuric acid) to come in contact with clothing, skin or eyes. Always wear safety gloves and protective clothing when servicing the battery. If battery fluid contacts the eyes and/or skin, immediately flush the affected area with a large amount of clean water and obtain prompt medical treatment.

⚠ CAUTION



Moving parts. Keep hands, feet, hair, clothing and test leads away from the belts and pulleys when the engine is running. Replace guards, screens and covers before operating the engine.

⚠ CAUTION

Before working on the engine or connected equipment, disable the engine as follows:



Set the engine controller to OFF position.

- (1) Disconnect the power input from battery.
- (2) Disconnect the battery cables. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Follow these precautions to prevent the starting of the engine by engine controller, remote start/stop switch, or engine start command from a remote computer.

⚠ CAUTION



Never remove the cooler cap if the engine is hot. Steam and hot engine coolant will spurt out and seriously burn you. Allow the engine to cool down before you attempt to remove the cooler cap.

NOTICE

Read the engine operator's manual and understand it before operation and maintenance of the engine, to ensure that it continues operating practices and maintenance procedures.

Hearing protection. Use to avoid hearing loss when handling the motor.

NOTICE

1. The installer/operator of the engine has to wear suitable CLOTHING for the workplace and the situation; in particular, avoid loose clothes, chains, bracelets, rings and all accessories that could become entangled with moving parts.
2. The installer/operator of the engine has to wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task.
3. The area in which the operator is working has to be kept tidy and free of oil and other liquid spillages and solid waste (metal chips, etc.).

Engine labels

⚠ CAUTION - AVISO ⚠

- Over cranking can cause engine water ingestion.

Excesivos intentos de arranque pueden provocar entrada de agua en el motor.

If the engine does not start after several attempts to crank may cause water entering the engine. In this situation it is recommended:

- 1) Close the seacock.
- 2) Drain the water from the exhaust system in the water trap.
- 3) Do not try to restart the engine until the cause of the start fail is identified.

⚠ AVISO ⚠

El motor y/o el inversor se suministran sin ningún fluido en su interior. Consulte el manual para seguir el procedimiento de instalación y puesta en marcha.



The engine and the gearbox are supplied without any fluid inside. Consult the manual to follow the installation procedure and commissioning as well as the fluid capacity - coolant, oil and oil of gearbox -.

Read the engine operator's manual and understand it before any operation and maintenance of the engine, to ensure that it continues operating practices and maintenance procedures insurance.

⚠ CAUTION - AVISO - ATTENTION ⚠



Dangerous voltage. Operate the engine only when all guards and electrical panels are ready.

Hot parts, coolant and steam. Stop the engine and let it cool down before touching or removing any engine part.

Moving parts. Keep hands, feet, hair, clothing and test leads away from the belts and pulleys when the engine is running. Replace guards, screens and covers before operating the engine.

Heavy material. Engine is a heavy element, use the right tools for transportation and handling.

Do not use the motor as a step. Use it as a step can cause engine damage plus cause undesired operation.

CONNECT THE POSITIVE
CABLE HERE

CONECTE AQUÍ
EL CABLE POSITIVO



CONNECT THE NEGATIVE
CABLE HERE

CONECTE AQUÍ
EL CABLE NEGATIVO



Connection point of the battery cables to the engine. Red cable (positive) and black cable (negative).

⚠ NOTICE

Engine exhaust line installation label, above and below the waterline. See 5.7. Intake and exhaust system.

Solé Advance warranty

Read the manual and documents delivered with each engine before carrying out any of the operations or presenting any queries. The engine is supplied without any liquids. Ensure that the liquids used match the specifications contained in Solé Advance manuals.

The application of the conditions described in this document shall only be effective for engines or generator sets that have been invoiced after November 4, 2011.

Solé Advance limited warranty

Solé Advance guarantees that at the time of shipment all its engines and generator sets comply with the provided specifications and do not have any manufacturing defects.

The limited warranty provided by Solé Advance enters into force from the time of sale to the first end-purchaser or user of the engine or generator set. In the event that the product is not immediately delivered to the end-customer, the warranty shall enter into force 6 months after the date of sale. Any limited warranty period that has not elapsed can be transferred to the following purchaser (s).

Unless authorised otherwise by Solé Advance, the warranty periods are applied according to the time elapsed in months from the date of purchase or the limit of hours of operation (whichever occurs first) listed in the following table:

Limited warranty coverage periods				
Product	Pleasure		Work	
	Months	Hours	Months	Hours
Propulsion Engines	36	1000	12	2000
Generator Sets	36	1000	12	2000

Solé Advance extended warranty

Solé Advance an extended period of coverage for the following components: engine block, cylinder head, crankshaft, camshaft, flywheel housing, timing gear housing, timing gear, conrod.

Extended coverage periods				
Product	Pleasure		Work	
	Months	Hours	Months	Hours
Propulsion Engines	24	1500		
Generator Sets	24	1000		

Restrictions

Coverage:

- a) To validate the warranty is necessary fill and send the inspection prior to the delivery of propulsion engines or genset to Solé Advance through an official installer. See SECTION 12.
- b) The warranty covers any failure of the product under normal operating conditions caused by a defect in manufacturing.
- c) The warranty covers the labour costs necessary to replace and/or repair the defective original components, according to Solé Advance standards of excellence. The time covered for these operations is limited to 4 hours.
- d) The warranty covers reasonable costs of travel required to carry out the necessary operations. The travel distance is limited to 300 kilometres in conjunction to a travel time of 3 hours.

Excluded from coverage:

- a) If Solé Advance products are installed and used alongside other products not designed or manufactured by Solé Advance that affect their operation, the warranty shall apply exclusively to the Solé Advance products and shall not apply if the products from another manufacturer are inappropriate for use alongside Solé Advance products or are the cause of the failure or poor operation of our products.
- b) The warranty doesn't will be effective if don't filled correctly and send the inspection prior to the delivery of propulsion engines and genset to Solé through an official installer. SECTION 12.
- c) The warranty shall not apply if the revisions and maintenance services indicated in the User and Maintenance Manuals have not been adhered to properly. In case of implemented warranty, supporting document of the revisions and maintenance service should be exhibited, proving the requirements outlined in the manuals have been followed.
- d) Deterioration resulting from time of storage exceeding 6 months and/or storage conditions that do not comply with the procedures described in the User and Maintenance Manuals.
- e) Deterioration resulting from not complying with the procedure for winter storage while the engine is not in service, as described in the User and Maintenance Manuals.
- f) Faults due to negligence, lack of service, accidents, abnormal use and inadequate service or installation.
- g) Faults due to the use of components not manufactured or sold by Solé Advance.
- h) Faults due to electrical installations that do not comply with Solé Advance design specifications or are not expressly approved by Solé Advance.
- i) Faults due to the use of and operation with fuels, oils or lubricants that are not authorised by Solé Advance
- j) Faults due to water entering the cylinder(s) through the exhaust system.
- k) Faults in propulsion engines due to the use of a propeller that is inadequate for the load or application. We recommend contacting Solé Advance to consult the choice of the correct propeller(s).
- l) Failure for general omission of the procedures described in the User and Maintenance Manuals.
- m) Components subjected to normal operating wear and tear.
- n) Costs due to phone communications, loss of time or money, discomfort, launching, grounding, removal or replacement of vessel parts or materials because the design of the vessel makes it necessary to do so to access the engine, and damage and/or accidents caused as a result of a failure.

Responsibilities

Responsibilities of the manufacturer:

The obligations of Solé Advance are restricted to repairing the defective parts or, IF DEEMED APPROPRIATE BY Solé Advance, returning the amount of the purchase or replacing the parts to prevent poor operation resulting from defective materials or faults in the manufacture covered by the warranty.

Solé Advance reserves the right to modify the design of any of its products without taking on any obligation to modify a product that has been manufactured previously.

This manual, as well as technical documentation, manuals or pamphlets may undergo modifications without prior notice.

Responsibilities of the purchaser:

The purchaser shall be responsible for the care, operation and maintenance of the product in compliance with the contents of the User and Maintenance Manuals. The purchaser shall provide proof of all the maintenance services performed on the product. The costs of said services and that of the components and liquids replaced during said services shall be at the expense of the purchaser.

The maintenance operations described in this manual shall be performed during the Warranty Contract Periods (Limited and Extended Coverage) by an AUTHORISED Solé Advance DEALER. Non-compliance with this condition shall void the warranty in all its terms. In such an event, the materials (oil, filters, etc.) and labour involved shall be at the expense of the purchaser. The purchaser should keep the invoice of the work performed as proof.

If the service is not covered by the warranty, the purchaser must pay for all labour performed, the associated materials and any other expense related to the service.

All shipments of products or components sent by the purchaser for inspection and repair shall be paid in Advance by the purchaser.

After-sales service contact

Claims shall be presented during the warranty period to the nearest authorised Solé Advance dealer (see chart of Solé Advance Dealers), who shall take care the service covered by the warranty.

The purchaser must provide a proof of purchase and date of purchase by presenting the invoice to the authorized dealer for the purchase of the product served or a copy of it. Claims under warranty shall not be dealt with by the dealer until the date of purchase has been verified.

The following information must also be provided by the purchaser:

- a) Owner's name, address and contact telephone number.
- b) Product model and serial number.
- c) Number of service hours of the product.
- d) Detailed description of the problem.
- e) Information regarding any repair or installation performed by a service not included in the Solé Advance distribution network, as well as the services performed.

For an updated list of our distribution network, visit Dealers section in our web page www.solediesel.com

Or request this information by contacting Solé Advance

e-mail: info@soleadvance.com

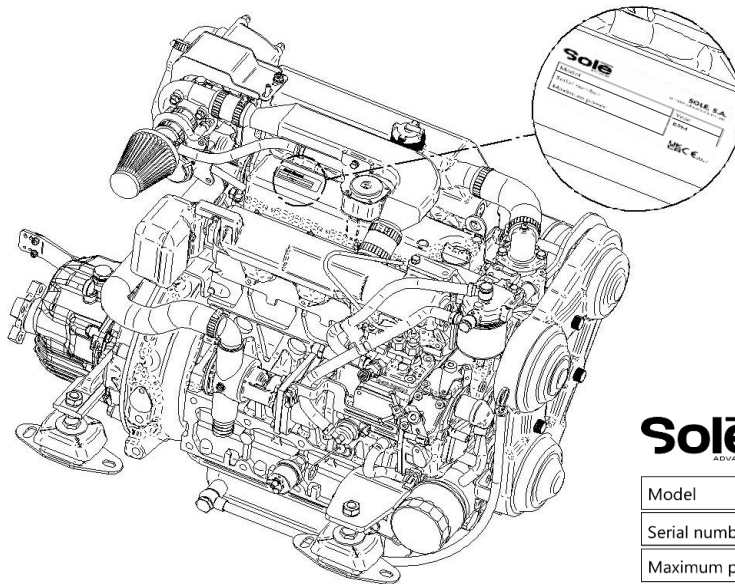
Phone: +34 93 775 14 00

Section 1 – Engine information

1.1. Engine identification

Identification label

The nameplate is located top of the rocker cover.



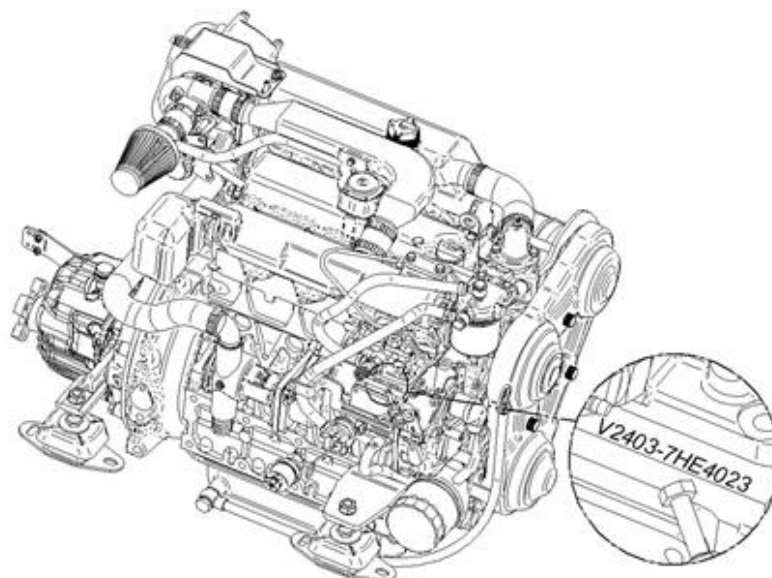
Sole
ADVANCE

SOLÉ, S.A.
info@soleadvance.com

UKCA E0057

Engine serial number

In addition, all engines are marked with the serial number on the block, on the fuel injection pump.



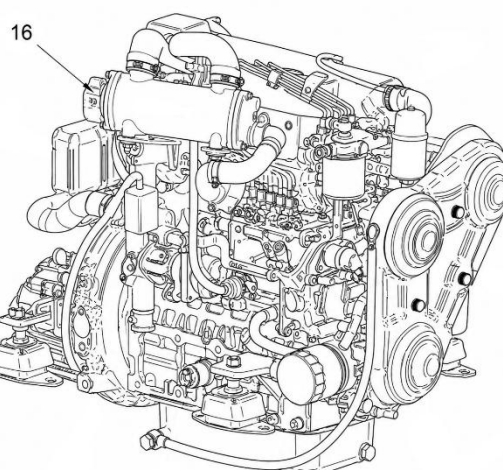
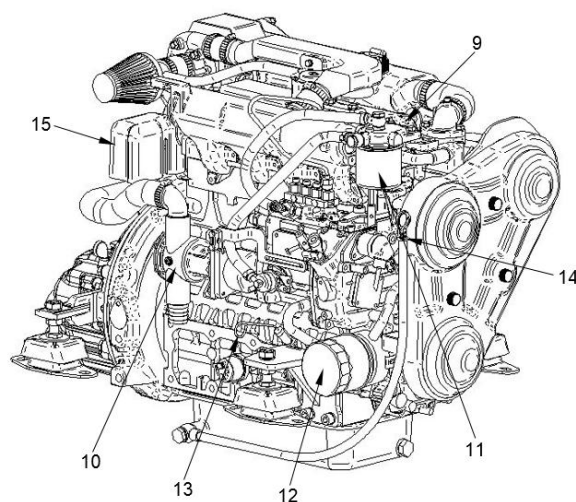
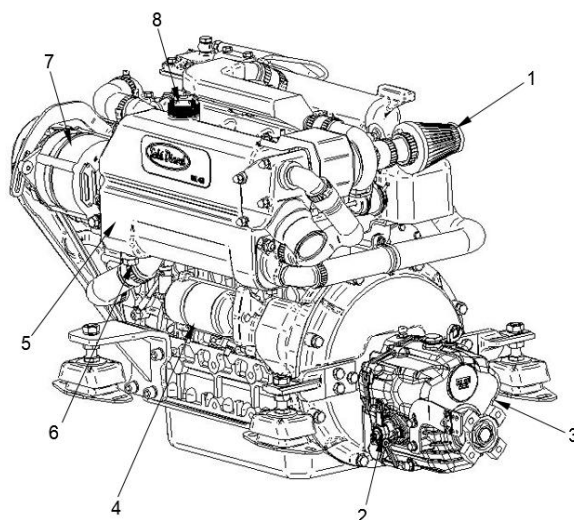
NOTICE

The standard engine can operate at temperatures between -18 °C and +45 °C.

1.2. Engine parts identification

PIECE	ELEMENT
1	AIR FILTER
2	GEARBOX CONTROL LEVER
3	GEARBOX
4	STARTER
5	COOLING SYSTEM
6	COOLING DRAIN PLUG
7	ALTERNATOR
8	COOLANT FILLER CAP
9	OIL FILLER CAP
10	SEA WATER PUMP
11	FUEL FILTER
12	OIL FILTER
13	OIL DIPSTICK
14	OIL DRAIN PLUG
15	RELAYS COVER
16	INTERCOOLER*

*Only SK-80



Section 2 – Transport, handling and storage

2.1. Reception

When the engine is delivered make sure that the packing has not been damaged during transport and that it has not been tampered with or that components inside the packing have been removed (see information marked on covers, bases and cartons).

Place the packed engine as close as possible to the place of installation and remove the packing material, checking that the goods supplied correspond to the order specifications.

⚠ NOTICE

If you notice damage or missing parts, inform Solé Advance S.A. after-sales departments and the carrier immediately and forward photographic evidence of the damage.

After inspecting the goods if you notice damage, write a reservation on the delivery note. Have the carrier countersign the note and advise Solé Advance S.A., preferably by mail (info@solediesel.com).

2.2. Transporting and handling the packed engine

When lifting and transporting the engine use EXCLUSIVELY a forklift or bridge crane of appropriate load capacity, with chains equipped with safety hooks suitable for lifting the load.

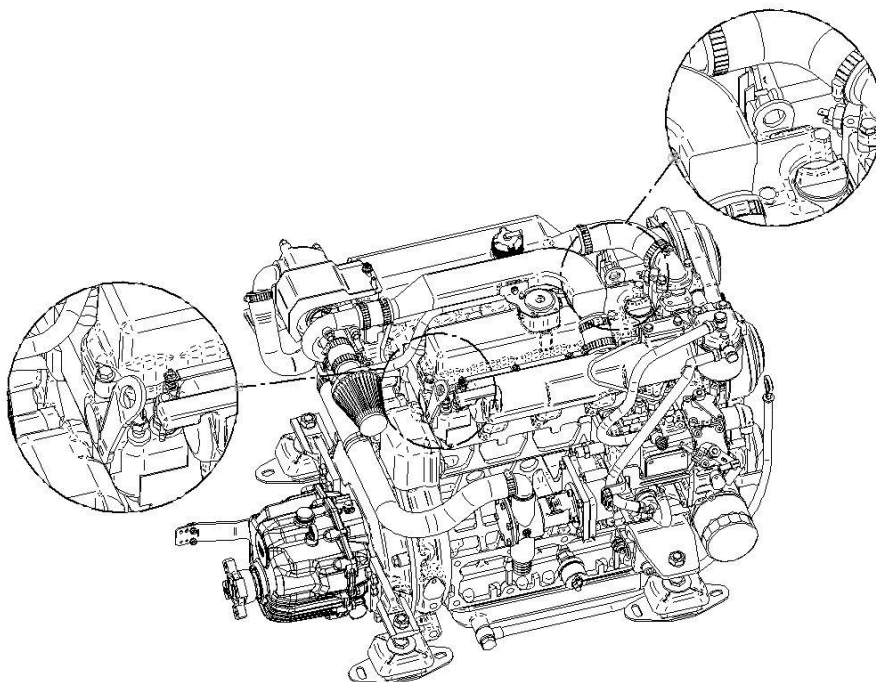
The use of any other system automatically invalidates the insurance guarantee against possible damage to the engine.

To unpack the engine, you must follow these steps:

1. Remove the cardboard crate.
2. Lift the engine using a forklift and suitable chains, which hook to the engine eyebolts.
3. Transfer the engine to the intended position of installation.
4. Remove the wooden base.
5. Begin installation operations.

2.3. Transporting and handling the unpacked engine

When the engine is unpacked and ready for transport, use EXCLUSIVELY the appropriate lifting eyebolts.



2.4. Storage of packed and unpacked engine

If the engine is left idle for prolonged periods, the client must check the possible conditions of conservation in relation to the place of storage.

If the engine is unused for prolonged periods and stored, observe all the relative technical specifications.

The treatment of the engine for storage is guaranteed for 6 months after the time of delivery.

⚠ NOTICE

If the user decides to start the engine after a long time period, this must be done in the presence of an authorized technic.

Section 3 – Installation

3.1. Angle of installation

Make sure the engine is installed on a level surface. Otherwise, the following angular operation maximum is permitted:

	Continuously	Temporary
SK-60 / SK-80	20°	30°

If the engine operates in these conditions, check section 5.4 Lubrication system.

3.2. Engine installation

Follow these steps to install the engine:

1. *FIX ENGINE.* See Section 10 Overall Dimensions and Section 8 Tightening torques.
2. *ENGINE COUPLING.* Couple the motor to the inverter, hydraulic pump, alternator or power extraction mechanism correctly.
3. *CONNECT EXHAUST OUTLET.* See Section 10 Overall Dimensions.
 1. *WET EXHAUST OUTLET.*
 2. *DRY EXHAUST OUTLET + SEAWATER OUTLET.*
4. *CONNECT SIPHON BREAKER.* (if installed) See Section 10 Overall Dimensions.
5. *CONNECT SEAWATER INLET.* See Section 10 Overall Dimensions.
6. *CONNECT FUEL INLET.* See Section 10 Overall Dimensions.
7. *CONNECT LEAK COOLANT OUTLET.* See Section 10 Overall Dimensions.
8. *FILL WITH OIL.* See 5.4 Lubrication System.
9. *FILL WITH COOLANT.* See 5.6 Cooling System.
10. *CHECK EACH PIPE CONNECTION* for oil or coolant leaks.
11. *PRIME THE FUEL SYSTEM.* See 5.5 Fuel System.
12. *CONNECT TO PANEL.* See the Panel operator's manual.
13. *CONNECT TO BATTERY.* Follow label battery connection into the engine.

▲ NOTICE

It is necessary to install a waterlock (supplied as accessory) in the exhaust system to avoid water ingestion (See section 5.7).

Section 4 – Operation

4.1. Prestart checklist

Follow these checks and inspections to ensure the correct engine operation. In addition, some checks require verification after unit starts.

AIR CLEANER: Check for a clean and installed air cleaner element to prevent unfiltered air from entering the engine.

AIR INLETS: Check for clean and unobstructed air inlets.

BATTERY: Check for tight battery connections.

COOLANT LEVEL: Check the coolant level according to coolant circuit capacity.

DRIVE BELTS: Check the belt condition and tension of the coolant pump and battery charging alternator belt.

EXHAUST SYSTEM: Check for exhaust leaks and blockages. Check the silencer and piping condition and check for tight exhaust system connections.

Check that the exhaust outlet is unobstructed.

FUEL LEVEL: Check the fuel level and keep the tank(s) full to ensure adequate fuel supply.

OIL LEVEL: Maintain the oil level below dipstick high mark and above dipstick low mark.

OPERATING AREA: Check for obstructions that could block the flow of admission air.

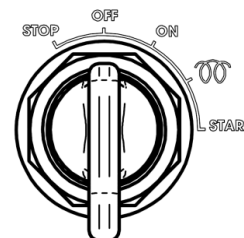
SEAWATER PUMP PRIMING: Prime the seawater pump before initial startup. To prime the pump:

- Close the seacock
- Remove the hose from the seawater-filter outlet
- Fill the hose and seawater pump with clean water
- Reconnect the hose to the water filter outlet
- Open the seacock

Confirm seawater pump operation on startup as indicated by water discharge from the exhaust outlet.

4.2. Cranking the engine

1. **TURN ON THE KEY POSITION.** To start all instruments with fuel pump.
2. **TURN THE KEY TO PREHEATING POSITION.** To heat the engine for a few seconds before the start.
3. **TURN THE KEY TO STARTER POSITION.** To feed the starter and start the engine.



! NOTICE

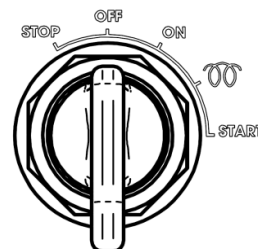
If the engine doesn't start after several attempts to start, may cause water entering in the engine. See warning label on the engine.

After starting up the engine, check the following points. If you find anything wrong, immediately stop the engine, and then investigate the cause.

1. Lubrication oil pressure should be from 0,2 to 0,4 MPa (2 to 4 kgf/cm²) (2,9 to 3,9 bar) at nominal speed.
2. Coolant temperature should be 75 to 85°C.
3. Oil temperature should be 60 to 95°C.
4. Check for leakage of oil, coolant and fuel.
5. Knocking should die away as coolant temperature rises. No other defective noise should be heard.
6. Check for exhaust colour and abnormal odors.

4.3. Stopping the engine

1. **REMOVE ENGINE LOAD.** Before turning off the engine, it must be freed of all charges (disengaged gearbox to neutral)
2. **TURN THE KEY TO STOP POSITION.** The key automatically returns to the OFF position. All instruments are off.
3. **CLOSE THE SEACOCK.**



NOTICE

If the needle of tachometer is marking counter rpm when the engine is off, turn the key back to ON and then OFF again.

The engine has a **MANUAL STOP** system. For it, follow the instructions below:

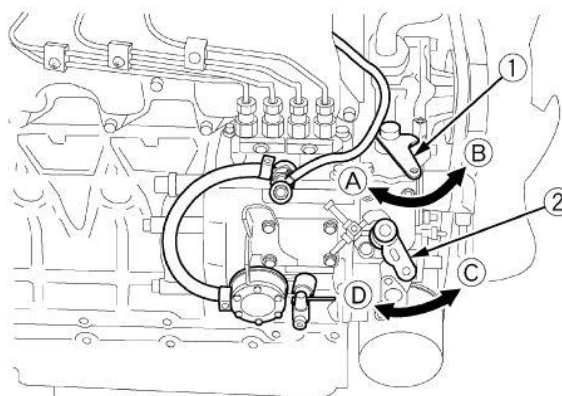
1. Move the speed control lever (2) and run the engine at idle.
2. Set the engine stop lever (1) to position (A).
3. With the contact key in the OFF position, remove the key. Don't keep the stop lever into the position (A) after stop the engine, so that it be prepared to the next start.

NOTICE

In engines with turbocharger, stop the engine after being warming for 5 minutes. If the engine stops suddenly after being working in an overloading state, the turbocharger could be damage.

The engine is equipped with a **MANUAL STOP system**. To stop the engine manually, follow the instructions below:

1. Move the speed control lever (2) back and allow the engine to run at idle speed.
2. Move the engine stop lever (1) to position (A).
3. With the ignition key in the OFF position, remove the key. Do not leave the stop lever in position (A) after stopping the engine, so that the engine is ready for the next start-up.



NOTICE

For turbocharged engines, stop the engine after allowing it to warm up/run at idle for 5 minutes. If the engine is stopped suddenly after operating under overload conditions, the turbocharger may be damaged.

4.4. Engine Operation at Low Temperatures

Whenever the atmospheric temperature drops below zero, the following series of circumstances occur:

- The cooling liquids may freeze.
- The oil becomes thicker.
- There is a drop in the voltage at the battery terminals.
- The inlet air temperature is low and the engine has difficulty in starting.
- The fuel loses fluidity.

To prevent the damage caused by low temperature operation, the engine should be prepared:

1. Use special low temperature coolant or suitable anti-freezing agent concentration.
2. Close the seawater cock, when the engine is stopped. Open the seawater filter cover and start the engine adding a mixture of freshwater and suitable anti-freezing agent concentration (see package labels) until the seawater circuit is filled completely. Stop the engine and replace the seawater filter cover. Before starting the engine again, open the seawater cock. Repeat this operation whenever the engine is used at temperatures below 0°C.
3. Use oil with suitable quality and viscosity. SAE 15W40 is recommended. Under extreme conditions contact with technical support.
4. Cover battery with an adequate material to protect it against the cold. Check that the battery is fully charged. It is also advisable to use a dielectric spray on the electrical connections.
5. When starting the engine, make sure that the glow plugs become hot enough.
6. If necessary, replace the diesel oil by a specified diesel oil type for low temperatures. The accumulation of impurities in the fuel tank could cause faulty firing.

▲ NOTICE

All engines not in use are subject to rusting and corrosion of machined surfaces that are not protected with a paint coating. The degree of corrosion depends on meteorological changes and climatic conditions. The following recommendations are therefore of a general nature but they will help prevent or reduce the risk of damage due to rusting.

4.5. Winterization and Preservation

If the boat is not going to be used for a long period of time or during the winter, certain tasks must be carried out to keep it in perfect operating condition. If there is no care, the inside parts can oxidize and cause damage on the engine. When the engine is stored, steps indicated below have to be followed:

1. Clean the outer surface of the engine.
2. Bleed the seawater circuit by filling it with fresh water. Fill the seawater circuit again with a mixture of fresh water and anti-freezing agent.
3. Remove the impeller from the seawater pump, clean it with fresh water and store it in place protected from moisture and sunlight.
4. Renew and refill the heat exchanger to the maximum level with a mixture of fresh water and anti-freezing agent.
5. Renew the oil in the engine.
6. Cover the air intake.
7. If the fuel tank is small, empty it completely and clean it; fill it up again with a mixture of diesel and anti-corrosion additive. Solé S.A. recommends DIECYL PLUS. Add one measure of this

additive for every 25 liters of diesel. On the other hand, if the fuel tank is large, add 1 liter of this additive for every 500 liters of diesel.

8. Clean and dry the area where the engine is installed.
9. Loosen the belts.
10. Apply dielectric spray on the electrical connection, disassemble the battery and charge it several times during the time it is not being used.
11. Apply moisture repellent spray on the motor.

4.6. Maintenance during the storage

During the long engine storage, it must be stored inside a ventilated area and free of humidity. When the engine stay stopped for 3 months or more, inside parts can be oxidize and lost the oil film. As a result, the engine could size up after the storage. To avoid this, the engine must work periodically during the storage.

Realize the following steps at least once per month:

1. In case that has a battery next to the engine, check the electrolyte level and fill it.
2. Start the engine during approximately 10 seconds.
3. Stop the engine for 1 minute. Repeat this action two or three times.
4. Be sure that oil pressure of the engine increase.
5. Get the engine work during 5 or 10 minutes without load, as maintenance operation.

4.7. Restoration of Operational Conditions

When starting up the engine again after winter lay-up, certain operations must be performed. Follow these steps:

1. Fill the fuel tank with clean diesel. The mixture of diesel oil and anti-corrosion additive in tank for winter lay-up can be used to operate the engine.
2. Check the fuel filter. If the filter is clogged, replace the filter.
3. Renew the oil in the engine.
4. Check the condition of coolant circuit's rubber hoses.
5. Reconnect the battery and apply a layer of neutral Vaseline to the battery terminals.
6. Remove the nozzle supports and clean them. If possible, verify the setting of the nozzles at a workshop. Then install the clean nozzles.
7. Connect the cooling and exhaust system. Open the seawater cock.
8. Verify whether there are any leaks in the fuel, coolant and oil systems.

Section 5 – Systems and scheduled maintenance

5.1. Operating description

Information of special tools required and basic safety precautions.

Disassembly:

- ✓ Use the correct tools and instruments. Serious injury or damage to the engine can result from using the wrong tools and instruments.
- ✓ Use an overhaul stand or work bench if necessary. Also, use assembly bins to keep the engine parts in order of removal.
- ✓ Lay down disassembled or cleaned parts in the order in which they were removed. This will save you time at reassembly.
- ✓ Pay attention to the marks on assemblies, components and parts for positions or directions. Put on your own marks, if necessary, to aid reassembly.
- ✓ Carefully check each part for faults during removal or cleaning. Signs of abnormal wear will tell if parts or assemblies are functioning improperly.
- ✓ When lifting or carrying heavy parts, get someone to help you if the part is too awkward for one person to handle. Use jacks and chain blocks when necessary.

Reassembly:

- ✓ Wash all engine parts, except oil seals, O-rings, rubber seals, etc. in cleaning solvent and dry them.
- ✓ Use only the correct tools and instruments.
- ✓ Use only good quality lubricating oils and greases. Be sure to apply a coat of oil, grease, or sealant to parts as specified.
- ✓ Use a torque wrench to tighten parts when specified tightening torques is required.
- ✓ Replace all gaskets and packing. Apply appropriate amount of adhesive or liquid gasket when required.

⚠ NOTICE

- ✓ Increase the frequency of maintenance in harsh duty conditions (frequent stops and starts, dusty surrounding, prolonged winter season, no-load running).
- ✓ Risk of burns during maintenance operations carried out when the engine is hot. Wear suitable safety clothing.
- ✓ It is strictly forbidden to clean the engine with compressed air.
- ✓ It is strictly forbidden to perform maintenance/cleaning operations in the presence of moving parts.
- ✓ Use gloves, overalls, etc. to protect the body from burns.

5.2. Periodic maintenance schedule

The maintenance and fault diagnostic procedures involve risks that may cause severe injury or even death. These procedures should therefore be carried out solely by qualified electrical and mechanical specialists. Before any maintenance and cleaning work, make sure that there are no moving parts, that the generator housing has cooled to ambient temperature, that the electricity generating set cannot be accidentally started up and that all procedures are strictly observed.

	Item to inspect	First 50 h	250 h	500 h / 1 year	750 h	1000 h / 2 years
GENERAL	Tightening torque	R	R	R	R	R
	Valve clearance			R		R
	Exhaust, noise and vibration		R	R	R	R
	Leaks	R	R	R	R	R
	Compression pressure					R
LUBRICATION	Engine oil	C	C	C	C	C
	Engine oil level	R	R	R	R	R
	Oil filter	C	C	C	C	C
FUEL	Fuel tank			R		R
	Fuel filter			C		C
	Water separator	R		C		C
	Injection pump					R
	Injector					R
	Glow plugs			R		R
	Coolant					C
COOLING	Coolant level	R	R	R	R	R
	Cooling circuit					L
	Water filter	R	R	R	R	R
	Raw water pump turbine		C	C	C	C
	Anode		C	C	C	C
	Air filter	R		C		C
INTAKE	Turbocharger					R
	Starter motor and alternator					R
ELECTRICAL	Belts	R		R		C
	Battery level	R	R	R	R	R
	Connections		R	R	R	R
			R	R	R	R
GEARBOX	Gearbox oil level	R	R	R	R	R
	Leaks		R	R	R	R
	Hydraulic gearbox oil filter	C / L				C / L
	Mechanical gearbox oil	C		C		C
	Hydraulic gearbox oil	C				C
	Tightening torque		R	R	R	R

C: Change / R: Check / L: Clean

5.3. General

Maintenance task. Screw tightening, fasteninat

For details of tightening troques see section 8 Troques.

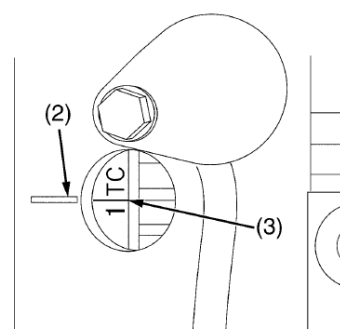
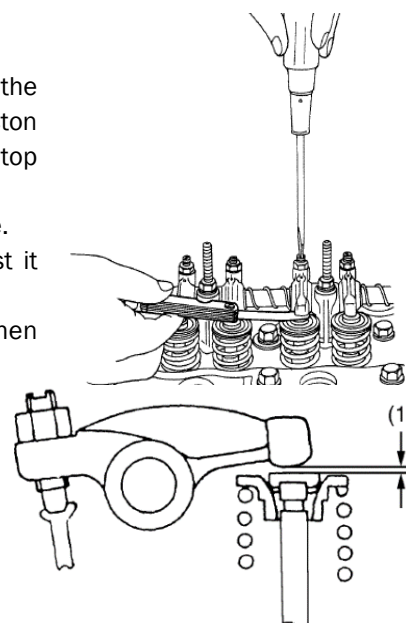
Maintenatance task. Valve clearance inspection

The rocker cover must be dismantled to check the valve clearance. This operation must be carried out when the engine is cold.

Item		Assembly Standard
Valve clearance (cold setting) SK-60 / SK-80	Inlet exhaust	0,18 to 0,22 mm

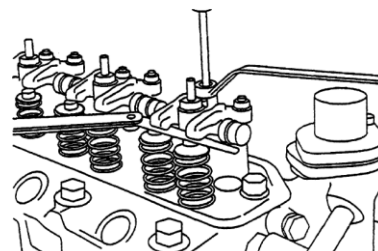
Inspection

1. Remove the cap from the cylinder head.
2. Align the "1TC" mark (3) on the steering wheel and the protuberance (2) of the housing. Make sure the No. 1 piston comes to the compression position or overlaps with the top dead center.
3. Examine the valve set clearance (1) with a thickness gauge.
4. If clearance is not within the factory specifications, adjust it with the set screw.
 - Valve clearance should be inspected and adjusted when the engine is cold.
 - The "1TC" mark on the steering wheel is only valid for cylinder No. 1. There is no "TC" mark for the other cylinders.
 - Align the "TC" mark with the protuberance (2) in the visor of the steering wheel housing. Piston # 1 is in the top dead center position at this time. Turn the steering wheel 0.26 rad (15 °) to see if the piston is in the position corresponding to the top dead center of your compression stroke or in the overlap position. Refer to the following table to adjust the valve set (1) again. (The piston is in the upper compression dead center when both the ADM and EXHAUST valves do not move. The piston is in the overlap position when both valves move.)
 - Turn the steering wheel 6.28 rad (360°) and align the "1TC" mark with the protuberance (2) correctly. Adjust the sets of the other valves, if necessary.
 - After turning the steering wheel in the anti-clockwise direction 2 or 3 times, check the valve set (1) again.
 - After adjusting the valve set (1), firmly tighten the set screw locking nut.



Adjusting

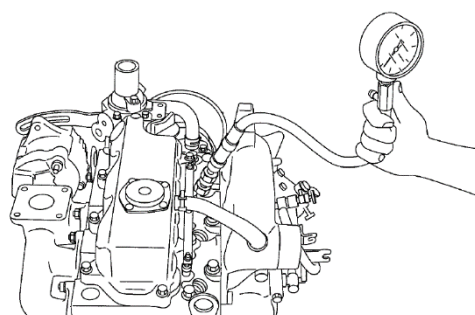
1. Loosen the lock nut of the adjusting screw. Adjust the clearance by turning the screw in either direction to the extent that the gauge is slightly gripped between the rocker arm and valve cap.
2. After adjusting the clearance, tighten the lock nut. Inspect the clearance again and make sure that it is correct.



Maintenance task. Compression pressure inspection

Start by:

1. Make sure the engine oil level, air cleaner, starting motor and battery are well-conditioned.
2. Start the engine and allow it to warm up thoroughly, until 50°C or more coolant temperature.



Measure the compression pressure on all cylinders:

1. Remove the injection nozzle from the cylinder head where the compression pressure is to be measured.
2. Attach the compression pressure gauge.
3. Disconnect the stop solenoid connector (the fuel supply shut off) and crank the engine by means of the starter, and read the compression pressure gauge indication when the engine is running at specified speed.
4. If the compression pressure is lower than repair limit, check the engine parts affected.

	Engine speed	Compression pressure	Repair limit	Máximum pressure difference between cylinders
SK-60 /SK-80	290 rpm	3,24 to 3,72 MPa 33,03 to 37,93 kgf/ cm ²	2,55 MPa 26 kgf/cm ²	10% or less

NOTICE

- It is not a good practice to measure the compression pressure on only few cylinders, and presume the compression on the remaining cylinders.
- Compression pressure varies with engine speed. Check engine speed when measuring the compression pressure.
- The compression pressure will be slightly higher in a new or overhauled engine due to new piston rings, valve seats, etc.

5.4. Lubrication system

Oil specifications

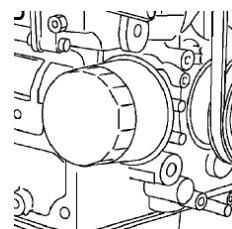
Use oil with 15W40 viscosity (this is an all-season oil for temperatures ranging between -15°C and +40°C) or select the most suitable oil viscosity for the atmospheric temperatures on which the engine is going to be operated. On the other hand, use oil quality no less than ACEA E5/E3 or API CH-4/SJ. Other engine oils may affect warranty coverage, cause internal engine components to seize and/or shorten engine life.

Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.

	Oil circuit capacity (l)
SK-60 / SK-80	7

Maintenance task. Oil filter change

The oil filter is located under inlet manifold of the engine. Remove oil filter with a belt wrench. When fitting a fresh oil filter, smear a small quantity of oil into the annular seal and firmly tighten it with the hand. When this operation is finished, start the engine and check oil is not leaking.

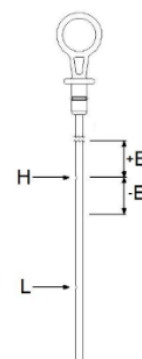


Maintenance task. Oil level check

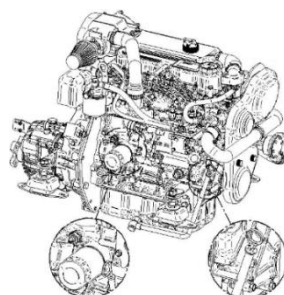
Check the oil level in the crankcase daily or before each start-up to ensure that the level is between the upper (Max mark) and lower (Min mark) lines on the dipstick. To check the oil level:

1. Remove the dipstick
2. Wipe the dipstick end
3. Reinsert inside the guide
4. Remove it again to see the oil level

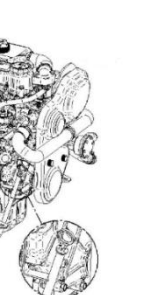
If the engine is fitted inclined, the oil dipstick must be modified to avoid problems of aspiration by the oil pump. See the table enclosed for modification level in dipstick. Decrease High level (H) to E on original oil dipstick.



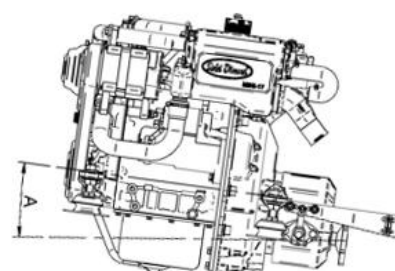
A	SK-60 / SK-80	
	Front	Side
4°	-17,2	-7,3
8°	-38,6	-11
12°	-63,5	-20
15°	-76,6	-27,6
20°	-88,8	-31



Varilla lateral



Varilla frontal



NOTICE

Do not operate the engine if the oil level is below the Min mark or above the Max mark. Be careful the oil dipstick marks refer to the engine as a horizontal position. Therefore, check the engine inclination when the oil level is verified.

Maintenance task. Oil fill/change

Oil must be changed with hot engine so as to be sure the oil is fully drained. The procedure is the following:

1. Drain the oil (follow steps below)
 - a. Stop the engine.
 - b. Disconnect the battery negative (-) terminal.
 - c. Remove the oil drain plug.
 - d. Connect the external oil pump to the end of the oil drain hose. Place the outlet of the pump into an oil collection container.
 - e. Allow time for the engine oil to drain completely.
2. Replace the oil filter.
3. Remove dipstick
4. Fill with oil according to oil capacity circuit.
5. Check for leaks.
6. Check oil level according to the oil level check procedure.

NOTICE

Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

5.5. Fuel system

Fuel specifications

Use ASTM diesel fuel No.2-D for the best engine performance, to prevent engine damage. Never use kerosene, heavy diesel fuel or biodiesel. It is essential to use clean and filtered diesel oil.

The use of diesel oil that not complies with the technical specifications may affect warranty coverage and cause serious damage in the injection system and internal engine components.

Maintenance task. Fuel level inspection

Periodically, it is necessary to check the fuel level to assure the operation of the engine. On top of that, if fuel pump sucks air when the fuel level is lower than pump suction, it could break.

Whenever possible, keep the fuel tank full. The temperature changes may cause condensation of the damp air present in the tank and this water accumulates at the bottom. It can cause an increase of corrosion or an impossibility of starting the engine if this water is aspirated by the fuel pump.

Maintenance task. Fuel tank clean

The fuel impurities could obstruct the suction pump. For this reason, drain out the content of the fuel tank to remove condensate and any foreign material. Then, wash the tank with fuel and refill it.

Maintenance task. Water separator filter purge

The fuel system must have a water separator filter (supplied as accessory) to avoid the inlet of water in the fuel circuit. According to the maintenance plan it is necessary to purge the filter to eliminate water periodically. This is the procedure:

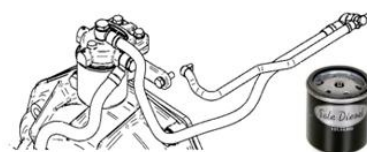
1. Loosen the bottom nut to eliminate water.
2. Shut it off again.
3. Check for any leakage.



Maintenance task. Fuel filter change

Procedure to change the fuel filter:

1. Remove fuel filter with a belt wrench.
2. Place a new fuel filter and firmly tighten it with the hand.
3. Prime the system.
4. When this operation is finished, start the engine and check that it is not leaking.



CAUTION

Wash hands after any contact with diesel fuel.

Maintenance task. Injection pump inspection

The injection pump is adjusted at factory and should never be adjusted carelessly. Such adjustment, whenever is required, shall be made by a SOLÉ ADVANCE licensed service shop, since a precision pump monitor and skill knowledge are required.

You must check:

- The presence of exhaust smoke color.

Procedure: quickly accelerate engine.

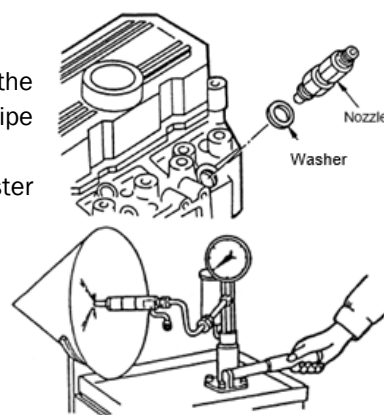
Criteria: no remarkably black smoke exhaust, and correct function of fuel cut-off solenoid

- Any leaks at the body injection pump or fuel lines

Maintenance task. Injector inspection

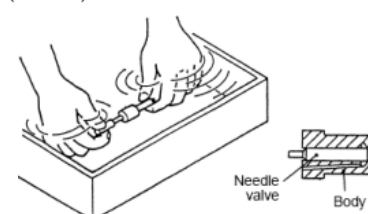
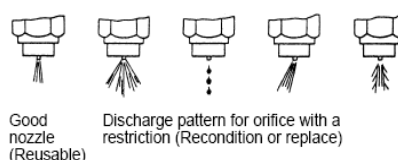
To check the injection pressure of injectors (opening pressure) you have to follow these steps:

1. Remove nozzle and washer.
2. Install the injection nozzle on the tester. Slowly operate the tester handle full strokes to bleed (remove) air from the pipe and nozzle.
3. Make a slow increase in pressure by operating the tester handle at a speed of more than one stroke per second while observing the pressure gauge.
4. The pressure gauge reading will slowly increase and, when the nozzle starts discharging fuel, it will go down fast. Take the gauge reading right then as the injection pressure.



Injection pressure 13,73 MPa (140 kgf/cm²)
SK-60 / SK-80

5. To adjust the injection pressure, increase or decrease the amount of shims fitted to the nozzle holder.
6. Look at the orifice discharge pattern (shape of discharge) when fluid begins to flow through the injection nozzle. The discharge must be finely and uniformly atomized. Any change is an indication of a bad nozzle.
7. If the nozzle is bad, remove the tip from the nozzle and wash needle valve and body in clean washing solution. And if the nozzle is still bad after the tip has been washed, replace the tip.
8. When installing the new tip, remove synthetic resin film from the tip and slide the needle valve in the body in clean diesel fuel to wash off inhibitor completely.
9. The washer shown on figure must be replaced.



⚠ WARNING

When testing the injection nozzle, keep its tip pointed away from the operator. Fuel from the orifices in the tip of the nozzle is under high pressure and can cause injury to the operator.

Maintenance task. Bleeding air from the fuel system

Prime the fuel system to bleed the air from the circuit. Trapped air in the fuel system can cause difficult starting and erratic engine operation. It is necessary to prime the system:

- ✓ Before starting the engine for the first time.
- ✓ After running out of fuel and adding fuel to the tank.
- ✓ After fuel system maintenance such as changing the fuel filter, draining the fuel/water separator, or replacing a fuel system component.

For this operation you have to follow these steps:

1. Loosen all the injection pipes.
2. Start the engine to drive out air in the injection pipes and nozzles automatically.
3. When fuel overflows from an injection pipe, tighten it up and wait until fuel overflows from another one. Repeat it until all injection pipes are tightened.
4. After bleeding, clean up fuel spillage.

⚠ CAUTION

When fuel overflows from the injection pipes, wipe thoroughly with a cloth. Spilled fuel is a fire hazard.

5.6. Cooling System

Coolant specifications

It is recommended use SOLÉ ADVANCE50% coolant or another coolant with similar specifications. On the other hand, distilled water with an anti-freezing agent is also suitable. The anti-freezing agent concentration according to operating conditions is specified in anti-freezing agent package labels. It is advisable select the anti-freezing agent concentration based on a temperature approx. 5°C under the actual atmospheric temperature.

	Coolant circuit capacity (L)	Other engine coolants may affect warranty coverage, cause an internal build-up of rust and scale and/or shorten engine life.
SK-60 / SK-80	8,5	

⚠ NOTICE

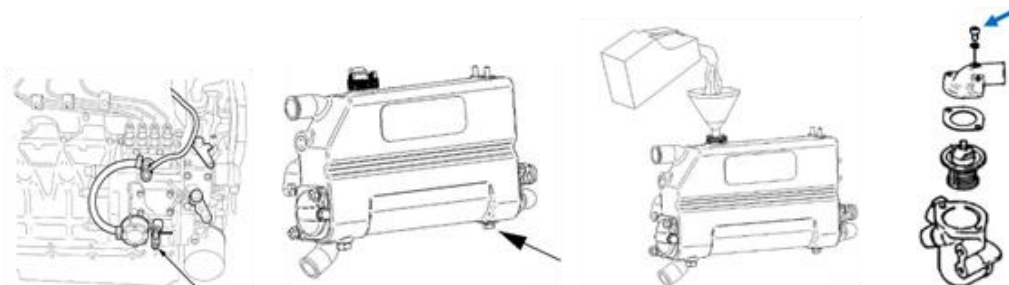
Never mix different types of coolants. This may adversely affect the properties of the engine coolant.

Maintenance task. Coolant check

Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank, the level must be approximately 3/4 full.

Maintenance task. Coolant fill / change

1. Drain off all the coolant by opening the two drain plugs, one in the heat exchanger and the other in the cylinder block.
2. Close the drain plugs.
3. Remove bleeding bolt of thermostat holder
4. Refill to the hole in the tank cap with coolant



Maintenance task. Seawater filter inspection

It is important to install a seawater filter (supplied as accessory) between seawater cock and the seawater pump to avoid that any impurity might clog the seawater circuit or seawater pump.

To clean this filter:

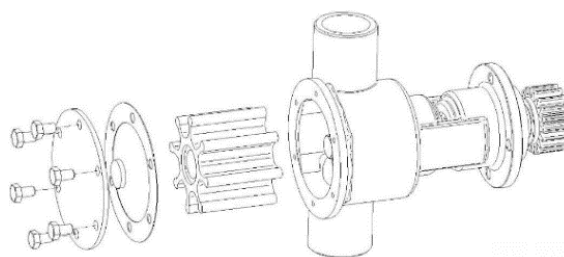
1. Loosen the wing nut.
2. Remove the filtering component.
3. Clean it.
4. Fit it again taking care that the cover is well seated on the o-ring.
5. Start the engine to check seawater leakages.



Maintenance task. Seawater pump impeller inspection

Seawater pump impeller is neoprene and cannot rotate dried. If operated without water, the impeller can be broken. It is important therefore that a spare impeller is always available. Impeller inspection and replacement procedure:

1. Close the seawater cock.
2. Remove the seawater pump cover plate.
3. Remove the impeller from the shaft.
4. Clean the housing.
5. Inspect the impeller for damaged, cranked, broken, missing or flattened vanes. The impeller vanes should be straight and flexible. If it is damaged replace with a new one.
6. Lubricate the impeller with soapy water before installation.
7. Install the impeller.

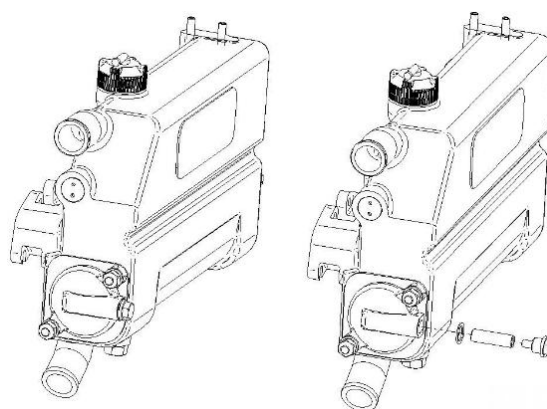


- During installation push and rotate the impeller in the same direction as the engine rotation until it is thoroughly seated in the impeller housing.
8. Inspect the cover plate and gasket for corrosion and/or damage. Replace components as necessary.
9. Lubricate the gasket with silicon grease and attach the gasket and cover plate to the seawater pump housing.
10. Open the seacock.
11. Start the engine and check for leaks.

Maintenance task. Zinc anode inspection

In order to avoid the corrosion produced by galvanic currents, the engine is fitted with a zinc anode located on the front lid of the coolant-seawater heat exchanger. Anticorrosion zinc anode inspection and replacement:

1. With the engine cooled, close the seacock, open the coolant drain plug and drain the coolant into a suitable container.
2. Remove the anticorrosion zinc anode (plug) from the heat exchanger.
3. Use a wire brush to remove the loose corrosion on the anticorrosion zinc anode.
4. Clean the threaded hole of the heat exchanger and coat the threads of anticorrosion zinc anode. Install the anticorrosion zinc anode into the heat exchanger.
5. Close the coolant drain plug and open the seacock. Refill the coolant circuit.
6. Start the engine and check for leaks at the anticorrosion zinc anode location. The pump is operating if the seawater flows from the exhaust outlet.



5.7. Inlet and Exhaust System

Exhaust circuit description

There are two possible installations of the exhaust system. You need to check the distance between water injection point and waterline to decide which type of installation you need. This information is specified in the following drawings.

The elements included in the drawing are essential for the correct engine operation:

- Waterlock (supplied as accessory) to prevent seawater from entering inside the engine when it stops.

To calculate the required collector capacity, we must follow the following formula:

$$C = \frac{\left(\frac{\pi}{4} D^2 * L\right)}{1000000} * 0.5$$

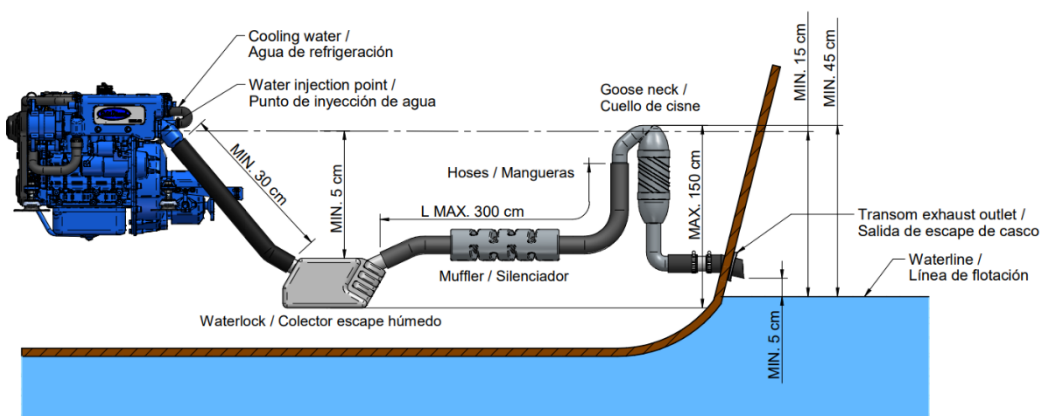
C = collector capacity (L)

D = Inside diameter of the tube (mm)

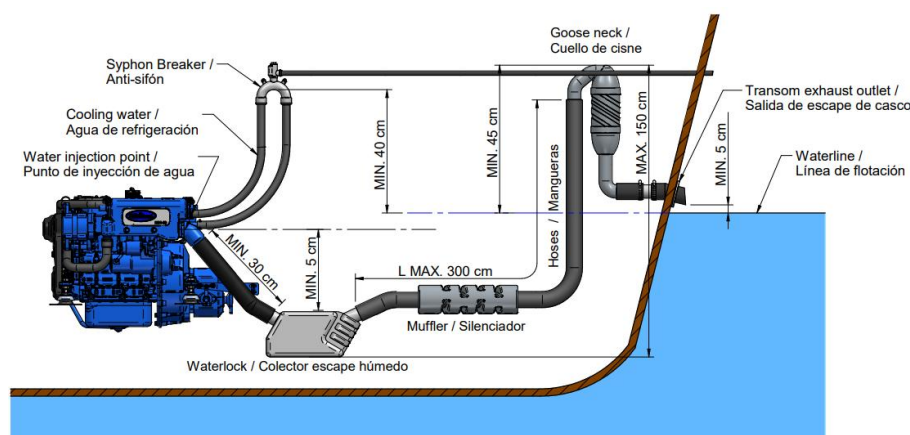
L = Tube length (mm)

- Goose neck (supplied as accessory)
- Siphon breaker (supplied as accessory) – needed in case there is less than 150 mm between the water injection point of wet exhaust and the waterline, or if the point of injection is below waterline.

Type 1 installation. When between water injection point of wet exhaust and waterline is minimum 150 mm.



Type 2 installation. When between water injection point of wet exhaust and waterline there is less than 150 mm or the point of injection is below waterline.



⚠ NOTICE

The wet exhaust is the engine's standard equipment. If you want dry exhaust, which is an optional equipment, contact with our dealers.

Maintenance task. Air filter inspection

Engine is provided with an intake air filter. Examine the element and housing for damage. Replace the complete air filter if necessary.

⚠ NOTICE

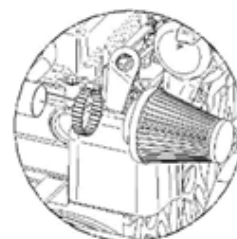
It is important to ensure that the combustion air is freely supplied and freely expelled from the area.

Maintenance task. Exhaust gas, noise and vibrations inspection

Inspect the exhaust system components for cracks, leaks and corrosion.

Exhaust system inspection points

1. Check the hoses for softness, cracks or dents. Replace the hoses as needed.
2. Check for corroded or broken metal parts and replace them as needed.
3. Check for loose, corroded or missing clamps. Tighten or replace the hose clamps and/or hangers as needed.
4. Check that the exhaust outlet is unobstructed.
5. Visually inspect the exhaust system for exhaust leaks. Check for carbon or soot residue on exhaust components. Carbon and soot residue indicate an exhaust leak. Seal leaks as needed.



Battery

The minimum recommended battery capacity is 100-120 Ah. However, this is a general reference value since it is related to the maximum current that can offer for starting the engine.

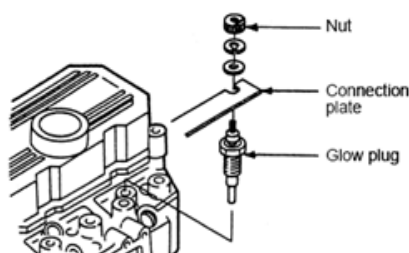
Circuit protection

The electrical installation of the engine has a fuse that protects all the electronics in case of overload or short circuit. It is located in the wire harness next to the starter motor.

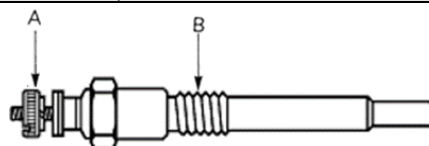


Maintenance task. Incandescent glow plug inspection

1. Loosen nuts, and then remove connection plate and glow plug.
2. If the glow plugs glow red when the positive (+) wire is connected to the portion A with the portion B grounded, the plug can be used.



Rated voltage - Current	12 V	10,5-9,7 A
SK-60 / SK-80		



Maintenance task. Starter motor inspection

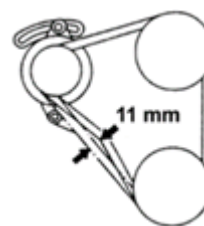
Starter motor:

1. Check if there is any impurity in pinion teeth.
2. Make sure that the pinion shaft turns freely when turned in the direction of driving (clockwise) and it is locked when turned in the opposite direction. If not, replace the overrunning clutch.



Maintenance task. Alternator belt tension inspection

Push the belt inward with thumb pressure exerted midway between the pulleys, as shown, to check the belt tension (deflection). If the tension is incorrect, loosen the adjusting bracket bolt and mounting bolt, and move the alternator in or out.



Item	Assembly Standard
V-belt deflection	10-12 mm

⚠ NOTICE

An excessive tension may cause a quick wear of the belt and alternator bearings. Otherwise, if the belt is excessively loose or has oil and insufficient load, it can cause the belt to skid.

⚠ CAUTION

Never adjust the belt tension with engine running or battery connected.

Maintenance task. Battery level

Battery requires a very careful handling and frequent checking. Proceed as shown below:

1. Keep battery dry and cleaned.
2. Check terminal cleanliness regularly. If dust is settled, terminals should be loosened, cleaned and smeared with a neutral grease layer.
3. Metal objects must not be placed over the battery.
4. Add distilled water if the level is out of range.

Section 6 – Troubleshooting

If a fault occurs in the engine, proceed as follows:

Within the period of warranty

- Contact to Sole Advance Official Service. See SOLÉ ADVANCE WARRANTY.

Outside the period of warranty

- Contact to Sole Advance Official Service. See SOLÉ ADVANCE WARRANTY.
- Stop the engine, determine the cause and repair it before continuing driving the motor.

ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS
MANUAL START FAILURE	ELECTRICAL SYSTEM (CC)	Power cable fuse (red).	Replace the fuse in the installation. If fuse blows again, check electrical system for overloads or short circuits.
		Discharged or empty battery.	Charge the battery or replace it with a new one.
		Loose or corroded battery connections.	Check the battery connections are correct, clean and tight.
		Faulty start/preheating relay.	Check and replace the preheating/start relay if necessary.
		Faulty starter motor	Check starter motor and replace it if necessary.
		Control panel start signal	Check the start signal from the controller (pink wire).
		Faulty stop solenoid (ETR).	Check stop solenoid and replace it if necessary.
	GENERAL	Low compression pressure.	Check the compression of each cylinder.
	LUBRICATION SYSTEM	Oil viscosity too high.	Check oil viscosity (according to Technical Specifications).
	FUEL SYSTEM	Faulty or clogged fuel pump.	Check the pump by verifying the fuel inlet and outlet of the pump. Replace it with a new one if necessary.
		Clogged fuel pipes	Check fuel pipes.
		Clogged fuel filter	Replace fuel filter.
		Faulty injection pump	Contact an Official Solé Diesel Service.
		Air in fuel system	Bleed fuel system.
		Dirty or faulty fuel injectors	Clean, test and/or replace fuel injector which is not operating properly.
		Fuel injection timing malfunction	Adjust fuel injection timing
		Empty fuel tank or closed fuel valve.	Add fuel and place fuel valve in open position.
		Dirty or clogged fuel tank.	Clean tank with proper products.
	INLET AND EXHAUST SYSTEM	Dirty or clogged air filter.	Replace the air filter element.

ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS
STARTS AND THEN STOPS	GENERAL	The fuel regulator is not operational.	Contact an Official Solé Diesel Service.
	FUEL SYSTEM	Faulty or clogged fuel pump	Check fuel pump inlet.
		Clogged fuel filter	Replace fuel filter.
		Air in fuel system	Bleed fuel system.
		Incorrect injection pump setting	Contact an Official Solé Diesel Service.
		Closed fuel outlet tap	Open the fuel outlet tap.
BLACK SMOKE	COOLING SYSTEM	Low cooling liquid level.	Check cooling liquid level and fill tank if necessary.
	ELECTRICAL SYSTEM (CC)	Faulty stop solenoid (ETR).	Check stop solenoid and replace it if necessary.
		Pressed emergency stop button.	Reset the emergency stop button position.
		Control panel start signal.	Check the start signal from the controller (yellow wire).
BLUE SMOKE	INLET AND EXHAUST SYSTEM	Dirty or clogged air filter.	Replace the air filter element.
	FUEL SYSTEM	Clogged fuel filter.	Replace fuel filter.
		Dirty or faulty fuel injectors.	Clean, test and/or replace fuel injector which is not operating properly.
LOW OIL PRESSURE	INLET AND EXHAUST SYSTEM	Incorrect injection pump setting.	Contact an Official Solé Diesel Service.
		Clogged air filter.	Replace the air filter element.
	GENERAL	Incorrect valve clearance.	Perform valve adjustment.
LOW OIL PRESSURE	LUBRICATION SYSTEM	LUBRICATION SYSTEM	Oil level too high.
		Faulty oil pump.	Contact our dealer
		Strangled oil pressure-relief valve.	Clean the valve and check its operation.
		Oil pressure too low.	Check oil level.
		Oil level too low.	Reset oil level. Inspect the engine for leaks.
		Faulty oil pressure valve.	Contact an Official Solé Diesel Service.
LOW OIL PRESSURE	LUBRICATION SYSTEM	Faulty pressure gauge, pressure sensor and/or pressure switch.	Check and/or replace elements.
		Engine tilt above allowable values.	Check the engine installation inclination. Reinstall the engine if necessary.

ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS
OIL PRESSURE TOO	LUBRICATION SYSTEM	Strangled oil pressure-relief valve	Clean the valve and check its operation.
		Faulty oil pressure valve	Contact an Official Solé Diesel Service.
		Oil level too high.	Reset oil level.
		Obstruction of oil lines.	Contact an Official Solé Diesel Service.
HIGH FUEL CONSUMPTION	GENERAL	Low compression pressure.	Check compression.
		Electrical overload.	Reduce electrical load.
		The regulator is not working properly.	Contact an Official Solé Diesel Service.
	FUEL SYSTEM	Fuel injection timing malfunction.	Adjust fuel injection timing
LOW POWER	INLET AND EXHAUST SYSTEM	Clogged air filter	Replace the air filter element.
	GENERAL	Incorrect valve clearance.	Perform valve adjustment.
		Clogged fuel filter.	Replace fuel filter.
		Dirty or faulty fuel injectors.	Clean, test and/or replace fuel injector which is not operating properly.
		Water in fuel system.	Clean fuel system with proper products. Inspect the source of the water inlet.
		Fuel injection timing malfunction.	Adjust fuel injection timing
	INLET AND EXHAUST SYSTEM	Clogged air filter	Replace the air filter element.
		Exhaust detonations	Inspect exhaust system. Replace exhaust system components that are not operational.
ENGINE OVERHEATING	GENERAL	Low compression pressure.	Check compression.
		Electrical overload.	Reduce electrical load.
	LUBRICATION SYSTEM	Faulty oil pump.	Contact an Official Solé Diesel Service.
		Oil viscosity too high.	Check oil specifications according to Technical Specifications.
		Oil level too low.	Reset oil level. Inspect the engine for leaks.

ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS
ENGINE OVERHEATING	COOLING SYSTEM	Faulty coolant water pump.	Check coolant pump (impeller, pump sealing).
		Plugged or restricted-pitch salt water tap.	Clean the tap, check if the salt water pump impeller is damaged.
		Faulty salt water pump.	Check sea water pump (impeller, pump sealing).
		Clogged water cooler.	Clean the water cooler.
		Low coolant level.	Restore normal coolant level for operation.
		Thermostat is not operational.	Replace the thermostat.
	INLET AND EXHAUST SYSTEM	Clogged air filter	Replace the air filter element.
FAULTY BATTERY CHARGE	ELECTRICAL SYSTEM (DC)	Discharged or empty battery.	Charge the battery or replace it with a new one.
		Loose or corroded battery connections.	Check the battery connections are correct, clean and tight.
		Faulty DC alternator regulator.	Replace alternator.
		DC alternator belt tension.	Check belt tension and change if necessary.

Section 7 – Technical specifications

Specifications

No. Of Strokes:	4	Number of cylinders:	4
Layout of cylinders:	In line	Cylinder diameter (mm):	87
Stroke (mm):	102,4	Total displacement (cc):	2434
Compression ratio:	22,5:1	Continuous power (kW):	39,6
Intermittent Power (kW):	44	Max RPM:	2700
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	850 (±50)
Intake system:	Turbocharged	Starting aid:	Glow plugs

Electrical system

Voltage (V):	12	Alternator (A):	120
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETR
Battery Cable Length (m):	1,5 m	Battery Cable Section (mm2):	70 mm2

Fuel system

Fuel type:	Diesel	Injection system:	Mechanical and indirect
Fuel standards:	Fueloil diesel ASTM	Injection pump type:	In line
Maximum suction head (m):	2	Governor type:	Mechanical
Injection Pressure (bar):	140	Maximum static head of return pipe (bar):	N/A
Firing order:	1-3-4-2	Injection timing (°):	9,25 Before TDC
Idle Consumption (g/kWh):	245	Consumption at 50 % (g/kWh):	245
Consumption At 75 % (g/kWh):	250	Consumption at 100 % (g/kWh):	272

Lubrication system

Lubrication type:	Forced circulation	Oil consumption at full load (g/kWh):	N/A
Minimum pressure at maximum RPM (kg/cm2):	3	Maximum pressure at maximum RPM (kg/cm2):	4,5
Minimum pressure at idle (kg/cm2):	1,2	Oil type:	SAE 15W40
Maximum oil temperature (°C):	103	Oil pan capacity (l):	6,5
Total circuit capacity (l):	7	Oil pressure switch (kg/cm2):	0,5

Cooling system

Coolant type:	Organic 50%, -38°C	Volume capacity of coolant circuit (l):	8,5
Coolant pump flow at maximum RPM (l/min):	85	Sea water pump flow at maximum RPM (l/min):	115,3 *
Maximum suction head of sea water (m):	N/A	Thermostat valve starts opening (°C):	71
Thermostat valve completely opened (°C):	85	Maximum sea water temperature (°C):	41
Heat to be extracted at 100 % load (kcal/h):	38693,25	Engine ratio/coolant pump RPM:	1,29

Installation data / Dimensions

Sea water hose inner diameter (mm):	32	Fuel feeding hose inner diameter (mm):	8
Fuel return hose inner diameter (mm):	5	Exhaust hose inner diameter (mm):	60**
Total length (mm):	875	Total width (mm):	640
Total height (mm):	730	Down Angle (RO):	20
Max. Intermittent inclination in operation (°):	30		

* The sea water pump flow has been obtained under zero aspiration height conditions. Besides, depending on the arrangement of the complete system (hoses, elbows, suction heads, etc.) this value can be lower.

** The diameter system will be calculated depending on each installation in case of a dry exhaust

Specifications

No. Of Strokes:	4	Number of cylinders:	4
Layout of cylinders:	In line	Cylinder diameter (mm):	87
Stroke (mm):	102,4	Total displacement (cc):	2434
Compression ratio:	22,5:1	Continuous power (kW):	50,3
Intermittent Power (kW):	55,9	Max RPM:	2700
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	850 (±50)
Intake system:	Turbocharged	Starting aid:	Glow plugs

Electrical system

Voltage (V):	12	Alternator (A):	120
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETR
Battery Cable Length (m):	1,5 m	Battery Cable Section (mm2):	70 mm2

Fuel system

Fuel type:	Diesel	Injection system:	Mechanical and indirect
Fuel standards:	Fueloil diesel ASTM	Injection pump type:	In line
Maximum suction head (m):	2	Governor type:	Mechanical
Injection Pressure (bar):	140	Maximum static head of return pipe (bar):	N/A
Firing order:	1-3-4-2	Injection timing (°):	9,25 Before TDC
Idle Consumption (g/kWh):	N/A	Consumption at 50 % (g/kWh):	257
Consumption At 75 % (g/kWh):	266	Consumption at 100 % (g/kWh):	281

Lubrication system

Lubrication type:	Forced circulation	Oil consumption at full load (g/kWh):	N/A
Minimum pressure at maximum RPM (kg/cm2):	3	Maximum pressure at maximum RPM (kg/cm2):	4,5
Minimum pressure at idle (kg/cm2):	1,2	Oil type:	SAE 15W40
Maximum oil temperature (°C):	103	Oil pan capacity (l):	6,5
Total circuit capacity (l):	7	Oil pressure switch (kg/cm2):	0,5

Cooling system

Coolant type:	Organic 50%, -38°C	Volume capacity of coolant circuit (l):	8,5
Coolant pump flow at maximum RPM (l/min):	85	Sea water pump flow at maximum RPM (l/min):	115,3 *
Maximum suction head of sea water (m):	N/A	Thermostat valve starts opening (°C):	71
Thermostat valve completely opened (°C):	85	Maximum sea water temperature (°C):	41
Heat to be extracted at 100 % load (kW):	47	Engine ratio/coolant pump RPM:	1,05

Installation data / Dimensions

Sea water hose inner diameter (mm):	32	Fuel feeding hose inner diameter (mm):	8
Fuel return hose inner diameter (mm):	5	Exhaust hose inner diameter (mm):	60**
Total length (mm):	875	Total width (mm):	610
Total height (mm):	665	Down Angle (RO):	20
Max. Intermittent inclination in operation (°):	30		

* The sea water pump flow has been obtained under zero aspiration height conditions. Besides, depending on the arrangement of the complete system (hoses, elbows, suction heads, etc.) this value can be lower.

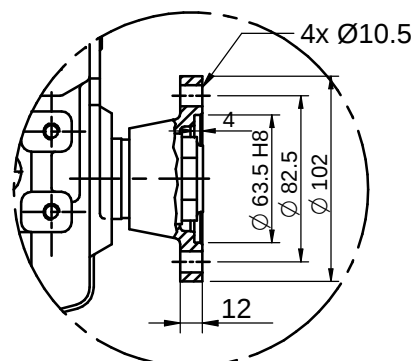
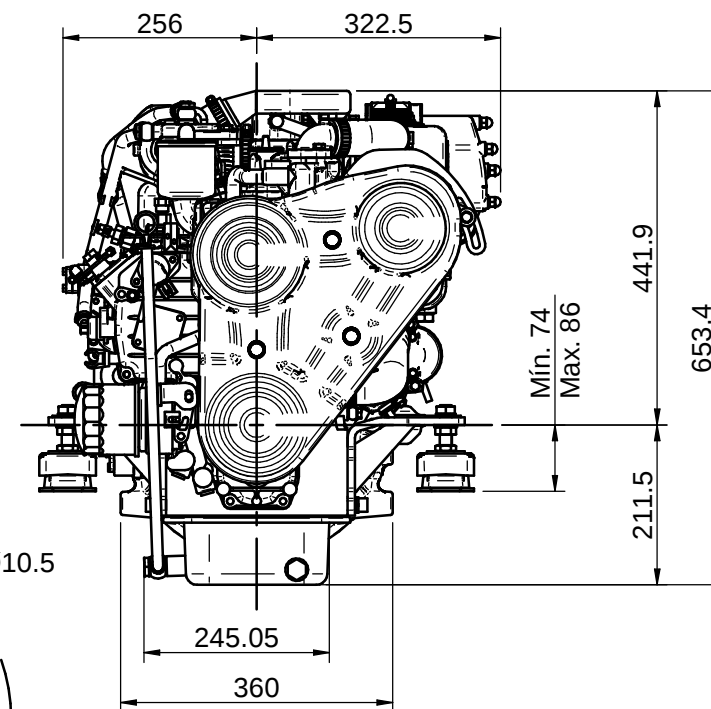
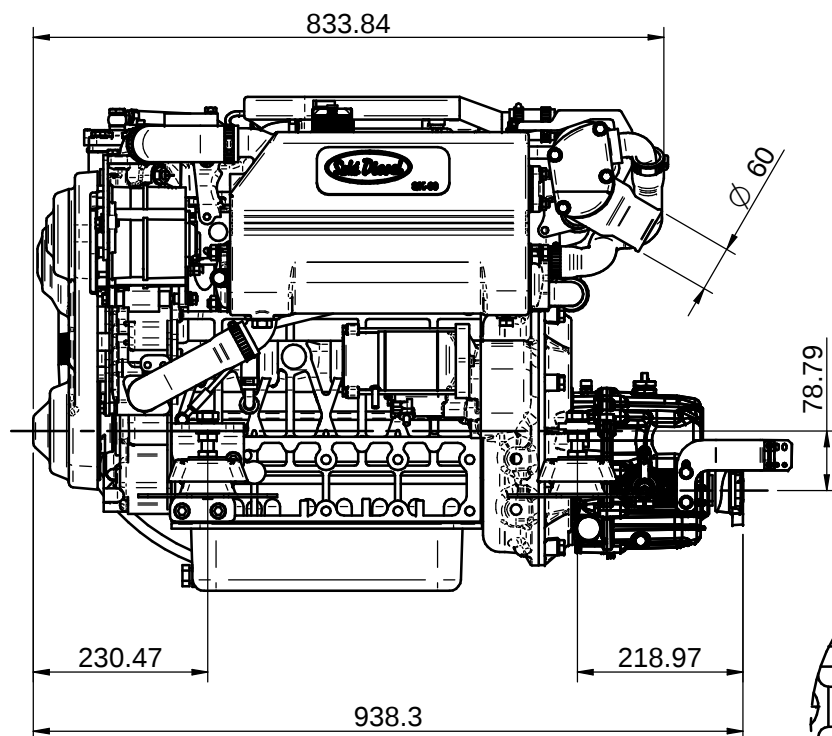
** The diameter system will be calculated depending on each installation in case of a dry exhaust

Section 8 – Tightening Troques

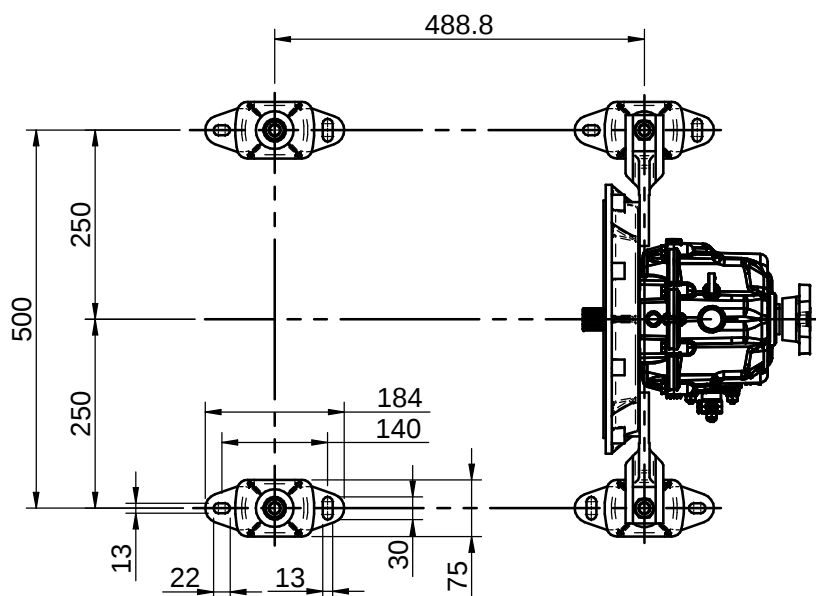
Important nuts and screws

TORQUE VALUES	THREAD	SK-60 / SK-80 N · m (kaf · m)
Bolt of cylinder head cover	M6	6,87 to 11,2 (0,7 to 1,15)
Bolt cylinder head	M11	93,2 to 98,0 (9,5 to 10,0)
Rocker support bolt	M8	24 to 27 (2,4 to 2,8)
Bolt 1 of bearing housing	M9	46 to 50 (4,7 to 5,2)
Bolt 2 of bearing housing	M10	69 to 73 (7,0 to 7,5)
Flywheel	M12	98.1 to 107 (10 to 11)
Connecting rod (old type)	M8	45 to 49 (4,5 to 5,0)
Connecting rod (new type)	M8	41 to 45 (4,1 to 4,5)
Idler gear shaft	M8	24 to 27 (2,4 to 2,8)
Drag pulley	M30	138 to 156 (14,0 to 16,0)
Housing bearing cover	M8	24 to 27 (2,4 to 2,8)
Glow plug	M10	20 to 24 (2,0 to 2,5)
Nozzle holder set (IDI)	M20	49 to 68 (5,0 to 7,0)
Nozzle holder clamp (IDI)	M10	26 to 29 (2,6 to 3,0)
Oil pressure switch	R 1/8	15 to 19 (1,5 to 2,0)
Pipe fastening nut of nozzle (IDI)	M12	25 to 34 (2,5 to 3,5)
Pipe fastening nut of nozzle (IDI)	M12	15 to 24 (1,5 to 2,5)
Retention nut of the overflow pipe set (IDI)	M12	20 to 24 (2,0 to 2,5)
Retention nut of the overflow pipe set (IDI)	M6	9,81 to 11,2 (1,0 to 1,15)
Camshaft stud bolt	M8	24 to 27 (2,4 to 2,8)
Body of high gear empty	M14	45 to 49 (4,5 to 5,0)
Alternator pulley nut	-	58,4 to 78,9 (5,95 to 8,05)
Starter terminal B	M8	5,9 to 11 (0,60 to 1,2)
Oil drain bolt	M14	34,3 to 44,1 (3,5 to 4,5)
Oil filter	-	10,8 to 12,7 (1,1 to 1,3)
Fuel filter	-	21.7 to 24.2 (2.21 to 2.47)
Exhaust elbow	M8	20,0 (2,0)
Plate	M8	20,41 (2,04)
Thermostat cover	M8	8 (2,04)
Engine brackets	M10	80 (8,15)
Cover of the water cooler element	M10	40,22 (4,02)
Standard Bolts	M6	7.85 to 9.80 (0.8 to 1.0)
	M8	14.7 to 21.6 (1.5 to 2.2)
	M10	17.6 to 24.5 (1.8 to 2.5)
	M12	29.4 to 41.1 (3.0 to 4.2)
Standard Studs	M8	4.9 to 5.8 (0.5 to 0.6)
	M10	12.7 to 14.7 (1.3 to 1.5)
Standard Plugs	NPTF 1/6	4.9 a 7.8 (0.5 a 0.8)
	PT 1/8	7.8 a 11.7 (0.8 a 1.2)
	PT 1/4	19.6 a 29.4 (2.0 a 3.0)
	NPTF 1/4	

Section 9 – Overall dimensions



Pletina Inv./Gbox flange



DATOS TÉCNICOS (TECHNICAL DATA)

Manguera agua salada (Sea water hose) : Ø32mm
 Manguera entrada combustible (Fuel hose intake): Ø8mm
 Manguera retorno combustible (Fuel return hose): Ø5mm

Especificaciones del producto pueden ser modificadas sin previo aviso
 (Product specifications are subject to change without notice)

MOTOR SK-60 INV. TMC-60P 2,00:1

SK-60 ENGINE, TMC-60P GBOX 2,00:1

MATERIAL	ACABADO	TRATAMIENTO	PRESENTACIÓN	ESCALA
DIBUJADO	VERIFICADO	GRADO PRECISIÓN	FECHA CREACIÓN	ÚLTIMA REVISIÓN
J.RODRÍGUEZ			02/06/2017	---

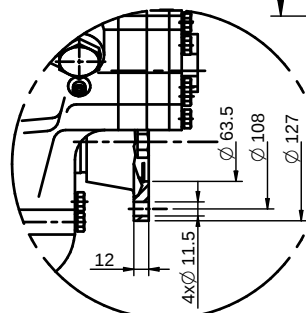
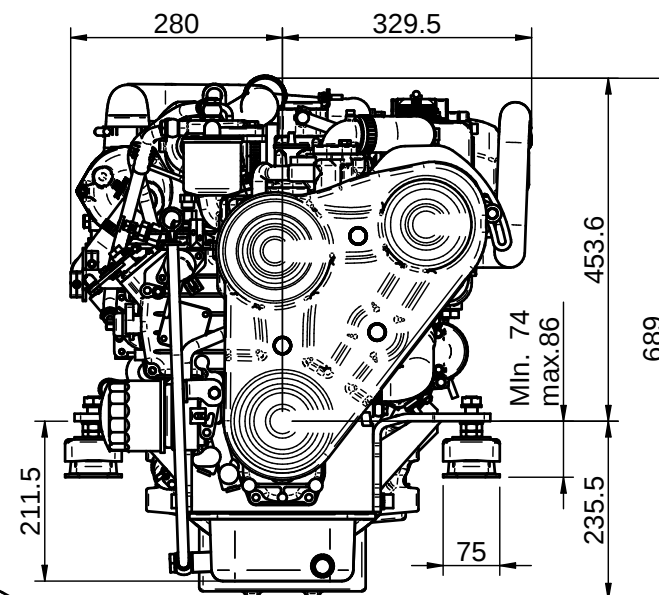
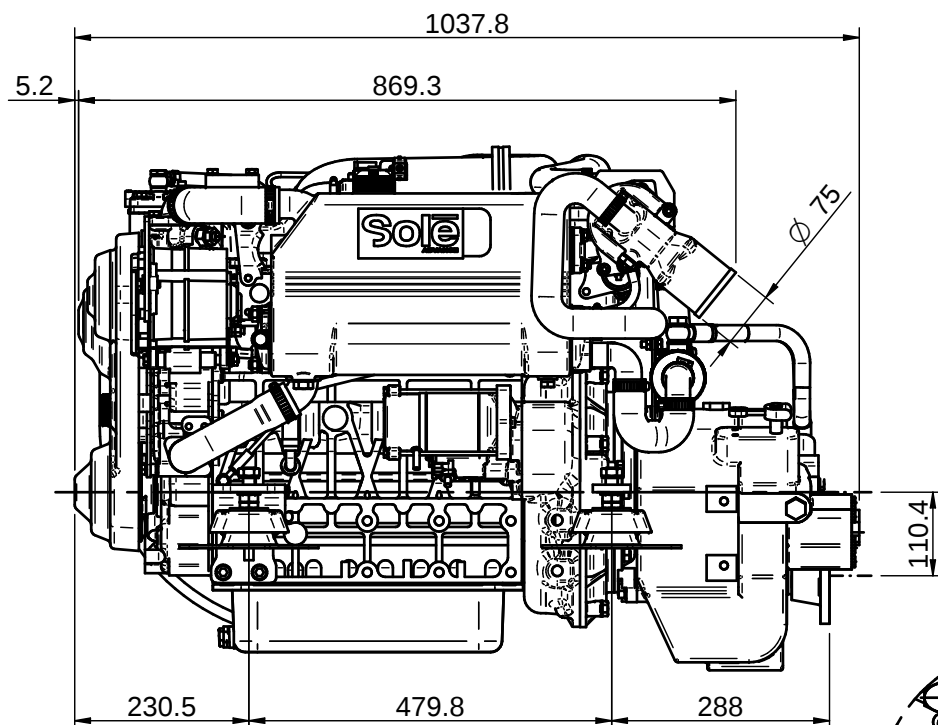


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REVISION HISTORY

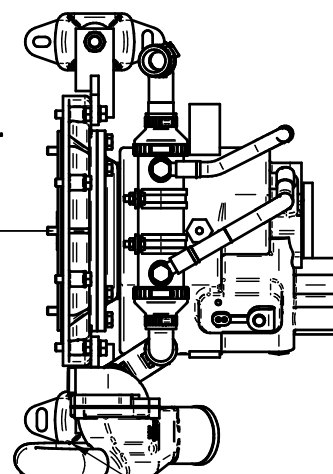
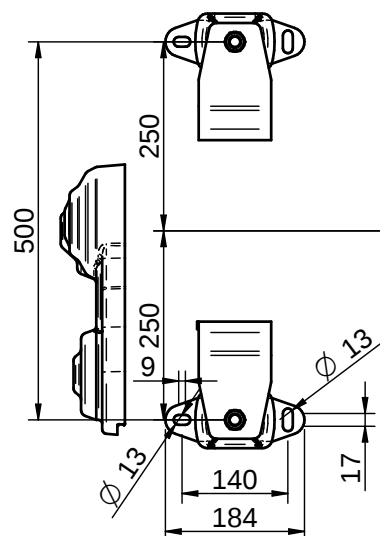
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Pletina Inv./Gbox flange

DATOS TÉCNICOS (TECHNICAL DATA)
Manguera agua salada (Sea water hose) : Ø32mm
Manguera entrada combustible (Fuel hose intake): Ø8mm
Manguera retorno combustible (Fuel return hose): Ø5mm

Especificaciones del producto pueden ser modificadas sin previo aviso
(Product specifications are subject to change without notice)



Suspensor
(Engine Mount)

Critical Dimensions		Limits for Nominal sizes (mm)		SK-80 ENGINE WITH TM-93 GEARBOX 2.09:1	
from	to	over	under	MOTOR SK-80 INV.TM-93 2.09:1	
0	6	30	100	MATERIAL	
0	6	30	100	FINISH	
0	6	30	100	TREATMENT	
0	6	30	100	Remove All Burrs. And Sharp Edges	
0	6	30	100	SCALE	
0	6	30	100	DRAWN	
0	6	30	100	MODIFIED	
0	6	30	100	CHECKED	
0	6	30	100	DRAWN DATE	
0	6	30	100	LAST DATE REV.	
0	6	30	100	P.IGLESIAS	
0	6	30	100	V.MIRAVET	
0	6	30	100	01/07/2025	
0	6	30	100	--	
0	6	30	100	Tolerance Class	
0	6	30	100	Medium	
0	6	30	100	Sole	
0	6	30	100	SOLE, S.A.	
0	6	30	100	1E030483	

Section 10 - Instructions to Replace and Remove

When you decide to replace the engine, please contact Solé Advance; will provide relevant instructions regarding the laws in force at the time. When disposing of the whole or parts of this engine, meets LAWS IN FORCE IN THE COUNTRY OF INSTALLATION.

For more information about the materials, they are made of the individual components of the engine, contact Solé Advan

Section 11 – Inspection prior to the delivery of propulsion engines

INSPECTION PRIOR TO THE DELIVERY OF PROPULSION ENGINES

Installer / Marina information				
Installer Company:			Installation Date:	
Contact Tel. no.:			E-mail:	
Owner's Information				
Name and surnames:				
Contact Tel. No. :			Email:	
Engine Information				
Engine model:				
Engine serial number:			Gearbox / Saildrive serial No. :	
Installation Information				
Machine chamber operating temperature:				°C
Angle of the engine (boat moored):				°
Maximum angle of the engine (navigation conditions):				°
Is the wet exhaust elbow above or below the floating line?			above	below
Propulsion Line Information				
Boat model:			Gearbox / Saildrive transmission ratio:	
Shaft diameter:		mm	Shaft length:	
			mm	
Propeller diameter:	mm/inches	Propeller pitch:	mm/inches	No. Of propeller blades:
Exhaus, Cooling and Fuel Line Information				
Int. Diameter of exhaust hose:	mm	Int. Diameter of sea water intake to the pump:	mm	
Int. Diameter of diesel intake:	mm			
Int. Diameter of diesel return intake:	mm			
Has an exhaust collector been installed?	YES NO	Has an air trap been installed?	YES NO	
Verifications Prior to Start-Up		V/x	Notes	
Correct engine alignment.				
Electrical installation connections.				
Engine oil level.				
Gearbox oil level.				
Coolant level and concentration.				
Control lever operation.				
Transmissions belts and belt tension.				
Airtight sea water cock.				
Verification of Engine No-Load Operations		V/x	Notes	
Unusual noises from the transmission.				
Oil pressure				
Bleed the fresh water cooling system				
Verify the instrument panel: normal indications and alarm operation.				
Water, oil and fuel leaks in the engine or transmission.				

INSPECTION PRIOR TO THE DELIVERY OF PROPULSION ENGINES

Verification of Engine Operating with Propeller Load	V/x	Notes
Verify maximum engine rpm at full load and with forward gear clutched. This test should be performed with the engine heated up. (If top rpm is not achieved contact Solé to inspect propeller dimensions).	rpm	
Engine rpm with engine idling and clutch out	rpm	
Engine output and gearbox operation. Verify operation of the Trolling valve, if applicable.		
Engine temperature and oil pressure.		
Information for the Owner	V/x	Notes
Delivery of the operator's manual and engine-related documents.		
Review of the engine operator's manual.		
Study the instruments panel functions and the engine control functions.		
Report the first revision date.		
Report the maintenance schedule indicated in the manuals.		

Sailing to new horizons

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