

# Marine diesel engines

Operator's manual

SDZ-165

SDZ-205

SDZ-280

SDZ-280R

### Introduction



# Introduction Presentation

Dear Customer,

First of all, we would like to thank you for choosing a Solé Diesel 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 Diesel 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 Diesel reserves the right to modify this document without prior notice.

# **Table of contents**



### **Table of contents**

Introduc	ction	3
Table of	of contents	4
Safety p	precautions and instructions	6
Solé Die	esel warranty	9
Section	n 1 – Engine information	12
1.1.	Engine Identification	12
1.2.	Engine parts identification	
Section	n 2 – Transport, handling and storage	13
2.1.	Reception	13
2.2.	Transport and handling the packed engine	13
2.3.	Transporting and handling the unpacked Engine	
2.4.	Storage of packed and unpacked engine	
Section	n 3 - Installation	
3.1.	Angle of installation	
3.2.	Engine Installation	
	n 4 - Operation	
4.1.	Prestart checklist	
4.2.	Cranking the engine	
4.3.	Stopping engine	
4.4. 4.5.	Engine operation at low temperatures	
4.5. 4.6.	Maintenance during the storage	
4.7.	Restoration of operational conditions	
	n 5 - Systems and scheduled maintenance	
5.1.	Safety and prevention	
5.2.	Periodic maintenance schedule	
5.3.	General	
	aintenance task. Screw tightening, fastening	
Ма	aintenance task. Valve clearance inspection	21
Ма	aintenance task. Compression pressure inspection	22
5.4.	Lubrication system	24
	rcuit description	
Oil	l specifications	24
Ma	aintenance task. Oil filter change	24
	aintenance task. Oil level check	
Ma	aintenance task. Oil fill/Change	
5.5.	Fuel system	
	rcuit description	
	el specifications	
	aintenance task. Fuel level inspection	
	aintenance task. Fuel tank clean	
	aintenance task. Water separator filter purge	
	aintenance task. Fuel filter change	
	aintenance task. Injection pump inspectionaintenance task. Bleeding air from the fuel system	
5.6.	Cooling system	28

# **Table of contents**



Coolant specifications	29
Maintenance task. Coolant check	29
Maintenance task. Coolant fill/change	29
Maintenance task. Seawater filter inspection	29
Maintenance task. Zinc anode inspection	30
5.7. Inlet and exhaust system	30
Exhaust circuit description	30
Maintenance task. Air filter inspection	31
5.8. Electrical system	33
Control Panel	33
Battery	34
Circuit protection – Fuse	35
Relays	35
Maintenance task. Starter inspection	35
Maintenance task. Alternator belt tension inspection	35
Maintenance task. Battery level	36
Section 6 - Troubleshooting	37
Section 7 - Technical specifications	42
Section 8 – Tightening torques	47
Section 9 – Wiring diagrams	48
Section 10 - Overall dimensions	51
Section 11 - Instructions to Replace and Remove	56
Section 12 - Inspection prior to the delivery of propulsion engines	57
Maintenance log	59

# Safety precautions and instructions



### Safety precautions and instructions

Solé Diesel 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:

### **AWARNING**

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

### **ACAUTION**

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

### ANOTICE

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

### AWARNING

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.



### AWARNING

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

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



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.



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

# Safety precautions and instructions





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.

### AWARNING

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.

### **ACAUTION**



**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.

### ACAUTION

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.



### **ACAUTION**

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.

### **ANOTICE**

**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.

### **ANOTICE**

- 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.).

### Safety precautions and instructions



### **Engine labels**

### A CAUTION - AVISO A

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
- 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 fluído 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

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.



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.



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



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

### **Solé Diesel Warranty**



### **Solé Diesel 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 Diesel 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 Diesel limited warranty

Solé Diesel 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 Diesel enters into force from the time of sale to the firs end-purchaser or user of the engine or generator ser. 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 authorized otherwise by Solé Diesel, 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	Ple	asure	Work		
Product	Months Hours		Months	Hours	
Propulsion Engines	36	1000	24	2000	
Generators sets	36	1000	24	2000	

### Solé Diesel extended warranty

Solé Diesel 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					
Draduet	Plea	asure	Work		
Product	Months Hours		Months	Hours	
Propulsion Engines	24	1500	-	-	
Generators sets	24	1500	-	-	

### **Solé Diesel Warranty**



### **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 Diesel through an official installer. See SECTION 12.
- b) The warranty covers any failure of the product under normal opera- ting 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 Diesel standards of excellence. The time period covered for these operatio- ns 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 kilome- tres in conjunction to a travel time of 3 hours.

#### **Excluded from coverage:**

- a) If Solé Diesel products are installed and used alongside other products not designed or manufactured by Solé Diesel that affect their operation, the warranty shall apply exclusively to the Solé Diesel products and shall not apply if the products from another manufacturer are inappropriate for use alongside Solé Diesel 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 fill 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) Faults due to negligence, lack of service, accidents, abnormal use and inadequate service or installation
- f) Faults due to the use of components not manufactured or sold by Solé Diesel.
- g) Faults due to electrical installations that do not comply with Solé Diesel design specifications or are not expressly approved by Solé Diesel.
- Faults due to the use of and operation with fuels, oils or lubricants that are not authorised by Solé Diesel.
- i) Faults due to water entering the cylinder(s) through the exhaust system.
- j) Faults in propulsion engines due to the use of a propeller that is inadequate for the load or application. We recommend contacting Solé Diesel to consult the choice of the correct propeller(s).
- k) Failure for general omission of the procedures described in the User and Maintenance Manuals.
- I) Components subjected to normal operating wear and tear.
- m) 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.

### **Solé Diesel Warranty**



### Responsibilities

### Responsibilities of the manufacturer:

The obligations of Solé Diesel are restricted to repairing the defective parts or, IF DEEMED APPROPRIATE BY SOLÉ DIESEL, 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 Diesel 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 DIESEL 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 authorized Solé Diesel dealer (see chart of Solé Diesel 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 Diesel 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 Diesel at: Phone: +34 93 775 14 00

e-mail: info@solediesel.com

# **Engine information**

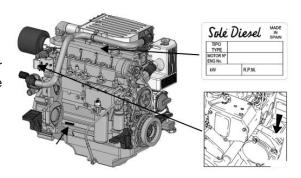


### **Section 1 - Engine information**

### 1.1. Engine Identification

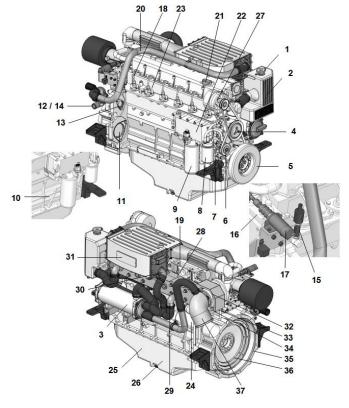
Identification label and serial number:

The nameplate is located on top of the rocker cover. In addition, all engines are marked with the serial number on the governor.



### 1.2. Engine parts identification

PART	ELEMENT
1	Coolant filler plug
2	Expansion tank
3	Exchanger assy
4	Cooler pump
5	Crankshaft dumper
6	Fuel feed pump
7	Fuel inlet
8	Fuel filter
9	Oil filter
10	Oil dipstick
11	РТО
12	Seawater pump
13	PTO Case
14	Seawater inlet
15	Fuel return valve
16	Governor
17	Stop solenoid
18	Fuel tubes
19	Air vent tube
20	Intercooler seawater inlet tube
21	Oil filler plug
22	Oil cooler
23	Injection pumps
24	Starter assy
25	Oil pan
26	Manual oil pump
27	DC alternator
28	Exhaust manifold



29	Seawater inlet to exchanger tube
30	Intercooler seawater outlet
31	Intercooler (SDZ-165 / SDZ-280)
32	Turbocharger
33	Turbocharger coolant tube
34	Turbocharger oil return tube
35	Flywheel housing (SAE 3")
36	Flywheel (SAE 11 ½")
37	Exhaust elbow

# Transport, handling and storage



### **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.



If you notice damage or missing parts, inform SOLÉ 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 S.A., preferably by mail (info@solediesel.com).

### 2.2. Transport 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 create.
- 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.

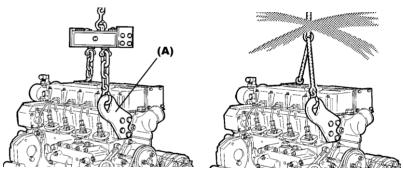


# **Transport, handling and storage**



### 2.3. Transporting and handling the unpacked Engine

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



### 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.



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

### Installation



### **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	Temporaly
SDZ-165	10°	30° (Max. 30 min.)
SDZ-205	10°	30° (Max. 30 min.)
SDZ-280	10°	30° (Max. 30 min.)
<b>SDZ-280R</b>	10°	30° (Max. 30 min.)

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.
  - i. Wet exhaust outlet
  - ii. Dry exhaust outlet + Seawater outlet
- 4. Connect siphon breaker. (if installed) See Section 10 Overall Dimensions and section 5.7 Inlet and exhaust system.
- 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 control panel. See the Panel Control Operator's Manual.
- 13. Connect to the battery. Follow label battery connection into the engine.



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

### **Operation**



### **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.



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.

- Lubrication oil pressure should be from 0,19 to 0,44 MPa (2 to 4,5 kgf/cm2) at nominal speed.
- 2. Coolant temperature should be 75 to 90°C.
- 3. Oil temperature should be 120°C.

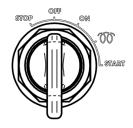
### **Operation**



- 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 odours.

### 4.3. Stopping 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.





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

### 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.
- 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.



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.

### **Operation**



### 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. Follow the steps indicated below carefully:

- 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 has to 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 to 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 during 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. Safety and prevention

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.



- ✓ 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.
- $\checkmark\quad\text{It is strictly forbidden to clean the engine with compressed air.}$
- ✓ 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.



	Intervals								
	Inspection Item	Daily	1st 20h-50h	Every 200h	Every 400h	Every 800h	Every year	Every 2 years	Winter storage and Preservation
	Screw tightening, fastening.		I		I				
	Engine block.								CL
General	Valve clearance.				I				
	Exhaust gas, noise and vibrations.	- 1							
	Compression pressure.					I			
Lubrication	Genset oil.	- 1	С	С			С		С
system*	Oil filter.		С	С					
	Fuel level.	- 1							
	Fuel tank.							CL	E/CL/I
	Fuel filter.				С				
Fuel System	Water separator filter (if applicable).		E		С				
	Injection pump.					1			
	Injector.					1			
	Purge the feed system.							I	
	Coolant.	1						С	С
	Sea water circuit								I/CL
Cooling system	Water filter	- 1	CL	CL					
Cooming System	Sea water cock	- 1							
	Sea water pump impeller.			I/C	I				I/CL
	Anode			I/C					
Intake system	Air filter.		I		С			С	I
	Instruments.	I							
Electrical	Starter and alternator.				I				
system	Belt.		İ		1	С			I
System	Battery level		I	I		С			
	Main alternator - electrical insulation.					I			I

 $<sup>\</sup>mbox{*}$  Use oil with 15W40 viscosity and no less than ACEA E5 or API CH-4/SJ quality.

I: Inspect, adjust or fill. E: Empty. C: Change. CL: Clean.



### 5.3. General

Solé Diesel offers, for these engine models, the several Pack, consult on the web.

- Welcome pack.
- On board pack.
- Maintenance pack 50 hours.
- Maintenance pack 1600 hours.
- Maintenance pack 3000 hours.

### Maintenance task. Screw tightening, fastening

For details of tightening torques see Section 8 Torques.

### Maintenance task. Valve clearance inspection

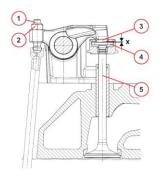
The rocker cover must be dismounted to check the valve clearance. This operation must be carried out when the engine is cold.

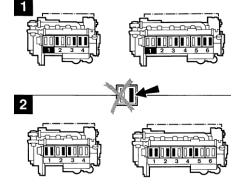
Item		Assembly standard
Value elegrance (cold cotting)	Inlet	0,3 mm
Valve clearance (cold setting)	Exhaust	0,5 mm

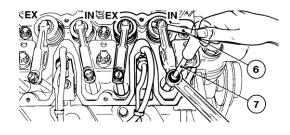
### **Inspection** (without pressure washer)

Do these operations in an authorised Sole Diesel Service. Before adjusting valve clareance, allow the engine to cool for at least 30 minuts. The oil temperature should be below 80°C.

- 1. Loosen ventilation valve and swing it to the side.
- 2. Remove the cylinder head cover.
- Position the crankshaft as shown in the following image. Check the valve clearance of the cylinders marked in black.







4. Check valve clareance (X) between rocker arm and tappet contact face (2) and valve steam (3) with a feeler gauge (6). There should only be slight resistance when feeler blade is inserted.

### Adjust valve clearance

- 1. Release locknut (2).
- 2. Regulate the adjustement screw (1) by using a screwdriver (7) so that alter tightening the locknut (4), correct valve clearance (X) is achieved.
- 3. Check and adjust the valve clearance on all remaining cilindres
- 4. Reinstall cylinder head with a new gasket if is necessary



5. Swing ventilation valve into position and fasten.

#### Crankshaft - Position 1

Turn crankshaft until both valves in cylinder no. 1 overlap (exhaust valve about to close, inlet valve about to open). Adjust clearance of valves marked in black on photo. Mark respective rocker arm with chalk to show that adjustment has been carried out.

#### Crankshaft - Position 2

Turn crankshaft one full revolution (360°). Adjust clearance of valve marked in black on photo. After the adjustment, the rocking nut should be well tightened while the adjusting screw is locked so that it does not rotate. NOTE: The adjustment of the valve play must be made after the cylinder head screws are again tightened.

#### Inspection (with pressure washer)

- 1. Loosen ventilation valve and swing it to the side.
- 2. Remove the cylinder head cover.
- 3. Do these operations in an authorized Sole Diesel Service. Before adjusting valve clareance, allow the engine to cool for at least 30 minutes. The oil temperature should be below 80°C.
- 4. Turn crankshaft until both valves in cylinder n°. 1 overlap (exhaust valve about to open).
- 5. Locate the crankshaft as showed in the photo of the last page.
- 6. If is necessary to adjust the clearance, do as the following:

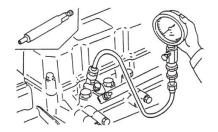
#### Adjust valve clearance

- 1. Release locknut (2).
- 2. Fix the tool (6) on the adjustment screw (1) and adjust the clearance as the following griten:
  - a. Fix the magnet.
  - b. Turn the feeler gauge of the tool (1). After, turn  $90^{\circ}/150^{\circ}$  at the back. IN =  $90^{\circ}$  / EX =  $150^{\circ}$ .
  - c. Tightening the locknut (2), using a torque tool (torque 20 Nm).
- 3. Repeat the check and adjust the clearance in every cylinder.
- 4. Reinstall cylinder head with a new gasket if is necessary.
- 5. Swing ventilation valve into position and fasten.

### 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.
- 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.



Model	Pressure
85 GTC / 100 GTAC	3,0 to 3,8 MPa (30,6 to 38,7 kgf/cm²)
115 GTC / 120 GTAC	3,0 to 3,8 MPa (30,6 to 38,7 kgf/cm²)
165 GTC / 180 GTAC	3,0 to 3,8 MPa (30,6 to 38,7 kgf/cm²)



- 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 genset speed. Check genset speed when measuring the compression pressure.
- The compression pressure will be slightly higher in a new or overhauled genset due to new piston rings, valve seats, etc.
- The compression measurement is advised only as a comparison measure between all cylinders of the same engine. If differences greater than 15% are verified, it is advisable to look for the cause, disassembling the affected cylinder unit.

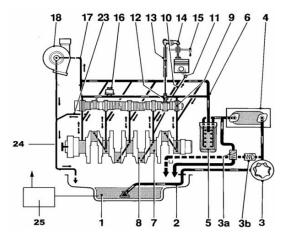


### 5.4. Lubrication system

### Circuit description

The lubrication circuit is forced by the trochoid gear pump, and it is composed of the following elements.

PIECE	ELEMENT
1	Oil pan
2	Scroop
3	Oil pump
3a	Valve, flow control
3b	Valve, máximum pressure
4	Engine oil cooler
5	Oil filter
6	Oil pipe
7	Crankshaft bearing
8	Conecting rod bearing
9	Camshaft bearing
10	Cooling cylinder pipe
11	Cooling cylinder pipe
12	Tappet
13	Rod cooling rocker
14	Rocker
15	Pipe to oil pan
16	Oil pressure sender
17	Pipe to turbo charger
18	Turbocharger
23	Pipe to oil pan
24	Pipe from turbocharger to oil
	pan
25	Oil suction pump



MODEL	CAPACITY(L)
85 GTC / 100 GTAC	14
115 GTC / 120 GTAC	14
165 GTC / 180 GTAC	23

\*Including filter change (0,5l)

- The mínimum oil pressure in all lubrication system is **0,1 kg/cm<sup>2</sup>**.
- Oil pressure at idling speed: 0,8 kg/cm².
- Oil pressure at operating speed (max. RPM): 4,5 kg/cm².

### Oil specifications

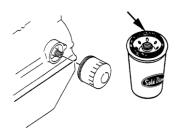
Use oil with 15W40 viscosity (this is an all-season oil for temperatures ranging between -15°C and +40°C) or select the most suitable oil viscosity for the atmospheric temperatures on which the engine is going to be operated. On the other hand, use oil quality no less than ACEA E5/E3 or API CH-4/SJ.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



### 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.

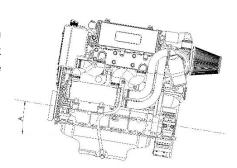




### Maintenance task. Oil level check

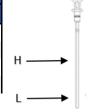
Check the oil level in the crankcase daily or before each start-up to ensure that the level is between the upper (Max mark) and lower (Min mark) lines on the dipstick. To check the oil level:

- 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 genset is fitted inclined, the oil dipstick must be modified to avoid problems of aspiration by the oil pump. See the attached table to check the position of the maximum level mark (H) and minimum level (L). The check should be done by taking the measurement from the lower end of the dipstick.

Inclination	85 GTC / 100 C/ 115 GTC / 120 GTAC / 165 GT /180 GTAC	
(A)	Min. (L)	Max. (H)
<b>4</b> °	10,5	24,5
6°	5	21
8°	2	15
<b>10°</b>	-	12



Units expressed in: mm

H: oil dipstick maximum level.

L: oil dipstick minimum level.



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.

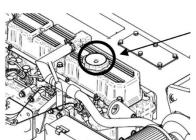
### Maintenance task. Oil fill/Change

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 dipstick.
  - 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 external oil pump. Do not insert oil 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.



Never overfill. Overfilling may result in white exhaust smoke, genset overspeed or internal damage. It is important to remove the dipstick to let the air out of the engine while it is being filled with oil, otherwise, bubbles may be created that make oil overflow to the outside.



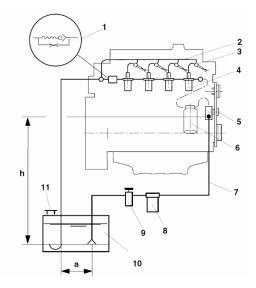


### 5.5. Fuel system

### Circuit description

The fuel system is based on a fuel feed pump and an in-line mechanical injection pump.

PIECE	ELEMENT
1	Circuit compensation valve
2	Return fuel tube
3	Nozzle
4	Injection pump
5	Fuel pump
6	Fuel filter
7	Fuel hose
8	Fuel filter (water separator)
9	Valve
10	Fuel tank
11	Breather tank



MODEL	INJECTOR NUMBER
85 GTC / 100 GTAC	4
115 GTC / 120 GTAC	4
165 GTC / 180 GTAC	6



The dimension "a" will be the maximum possible. Mount the inlet and return as far apart as possible. Distance "a"> 300 mm. Do not exceed height "h". "H"  $\leq$  1500 mm.

### 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 does not comply 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 aspired 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. Close the water tap.
- 2. Unscrew the bleed screw to remove water.
- 3. Unscrew the filter housing together with the O-ring and remove them.
- 4. Clean all the elements, specifically the sedimentation chamber. Change the filter if necessary.
- 5. Assemble the elements again. Check that it does not leak.

### Maintenance task. Fuel filter change

Procedure to change the fuel filter:

- 1. Close the fuel supply valve.
- 2. Disconnect fuel pipes from the fuel filter.
- 3. Remove fuel filter with a bell kev.
- 4. Place a new fuel filter.
- 5. Reconnect fuel pipes from the fuel filter.
- 6. Open the fuel supply valve.

7.

Once finished with this operation, start the genset and check for oil leaks.



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 workshop authorized by SOLÉ DIESEL, since a precision pump monitor and skill knowledge are required.

You must check:

- The presence of exhaust smoke colour. Quickly accelerate the genset. If the engine does not produce black or dark-hued exhaust smoke, the pump is working properly.
- Any leak in the injection pump body or in the fuel lines.

### Maintenance task. Injector inspection

This operation requires special tools and must be performed made by workshop authorized by SOLÉ DIESEL.

### 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 must follow these steps:

- 1. Loosen all injection pipes.
- 2. Start the engine to blow air into the injection lines and injectors automatically.
- 3. When the fuel overflows from one injection pipe, tighten it and wait for the fuel to come out of another. Repeat until all injection lines are tight.
- 4. After draining, clean up fuel spill.

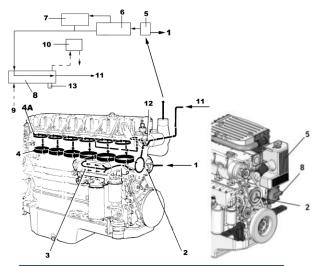
When fuel overflows from the injection pipes, wipe thoroughly with a cloth. Spilled fuel is a fire hazard.

### 5.6. Cooling system

The engine cooling system is based on coolant circulation controlled by centrifugal pump with thermostatic control and heat exchanger, where the coolant is refrigerated by sea water. Moreover, the exhaust manifold is cooled also by sea water.

#### **COOLANT CIRCUIT DESCRIPTION**

PIECE	ELEMENT
1	
2	Freshwater pump
3	Oil cooler
4	Cooling circuit, cylinders
4A	Cooling circuit, cylinder head
5	Expansion tank
6	Exhaust manifold cooled
7	Turbo charger
8	Heat exchange, anti-freeze
9	Pipe, seawater
10	Elbow, wet exhaust
11	Pipe, inlet freshwater pump
12	Thermostat
13	Boiler kit (optional)

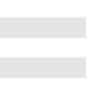


Model	Capacity (L)
85 GTC / 100 GTAC	17,5
115 GTC / 120 GTAC	17,5
165 GTC / 180 GTAC	23

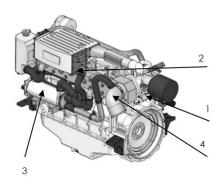
Thermostatic valve			
Initial opening	83°C		
Final opening	98°C		

### **COOLANT CIRCUIT DESCRIPTION**

PIECE	ELEMENT
1	Seawater pump
2	Intercooler <sup>1</sup>
3	Heat exchanger
4	Exhaust elbow









### Coolant specifications

It is recommended use SOLÉ DIESEL 50% 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.

Other engine coolants may affect warranty coverage, cause an internal build-up of rust and scale and/or shorten engine life.



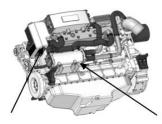
Never mix different types of coolants. This may adversely affect the properties of the engine coolant.

### 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



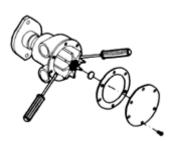




### Maintenance task. Seawater filter inspection

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.
- Inspect the impeller for damaged, cranked, broken, missing or flattened vanes. The impeller vanes should be straight and flexible.
- 6. If it is damaged replace with a new one.
- 7. Lubricate the impeller with soapy water before installation.
- 8. Install the impeller. During installation push and rotate the impeller in the same direction as the genset rotation until it is thoroughly seated in the impeller housing.



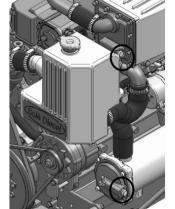


- 9. Inspect the cover plate and gasket for corrosion and/or damage. Replace components as necessary.
- 10. Lubricate the gasket with silicon grease and attach the gasket and cover plate to the seawater pump housing.
- 11. Open the seacock.
- 12. Start the genset and check for leaks.

### Maintenance task. Zinc anode inspection

In order to avoid the corrosion produced by galvanic currents, the genset 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 genset 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 genset 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 = collector capacity (L)

D = Inside diameter of the tube (mm)

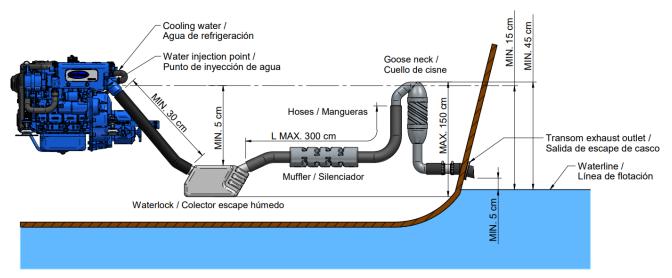
 $C = \frac{\left(\frac{\pi}{4}D^2 * L\right)}{1000000} * 0.5$ 

L = Tube length (mm)

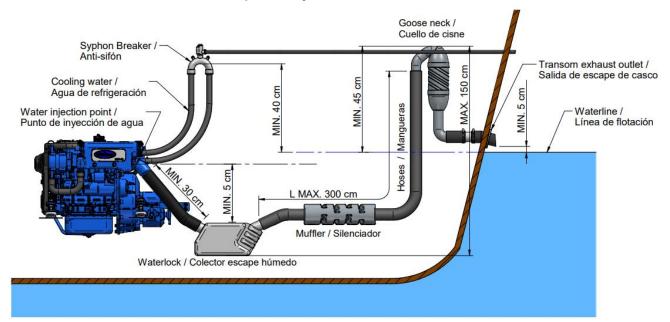
- Goose neck (supplied as accessory)
- Siphon breaker (supplied as accessory) needed in case there is less than 150 mm between the water injection point of wet exhaust and the waterline, or if the point of injection is below waterline.



# Type 1 installation. When between water injection point of wet exhaust and waterline is minimum 150 $\,\mathrm{mm}$



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.

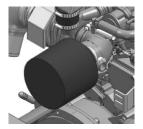


### **ANOTICE**

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.



**ANOTICE** 

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



### Maintenance task. Turbocharger cleaning and inspection

#### **Turbocharger maintenance**

To extend turbocharger life and efficiency, some basically important are given below:

- Inspect for possible oil leaks in the inlet and outlet ducts, as well as inside the turbo. A
  lack of lubrication or the appearance of oily residue could lead to shaft seizure and
  premature seal wear.
- Maintain the correct condition of the air filter to prevent particles from entering the turbocharger and damaging the turbine blades.

### ANOTICE

In the event of oil leaks, vibrations or abnormal noise, it is advisable to stop the engine immediately. Preventive maintenance can avoid costly and unexpected repairs.



The turbocharger is an element that works at very high temperatures. Any inspection or repair work carried out on it must be done with the engine stopped and cold.

### Turbocharger cleaning

- 1. Loosen the ventilation pipe from the air intake and remove the air filter together with the air intake.
- 2. Loosen the screws on the compressor housing and remove it carefully.
- 3. Immerse complete assy in petrol (gasoline) untill all dirt is disolved.
- 4. Clean the housing and compressor Wheel from scoot, by using a plastic brush or scraper.
- 5. Wipe and dry in air making sure that the oil ducts are perfectly clean (it is better not to use steam wich might damage the bearings and the shaft).
- 6. Make sure that the intake air filter is perfectly clan.



After the turbocharger disassembly, before the crank, be sure to prime the engine with oil to prevent turbo damage from dry running.

### Maintenance task. Exhaust gas, noise, and vibrations inspection

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

#### Exhaust system inspection points

- Check the hoses for softness, cranks 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.



### 5.8. Electrical system

### **Control Panel**

You can find all information related to the control panel in Control Panel Operator's Manual of your engine.

### Sensors and switches

#### Coolant temperature sensor:

- Operating voltage: 6-24V

Operating current: <85mA, Pmax<0.25W

Operating temperature: -40°C to +120°C

Measuring range: -40°C to +120°C

- Absolute max. value: 130°C, max. 1 min.

Protection: BODY IP 67

- Tightening torque: Max. 20Nm

Function table		
Temperature (°C)	Resistance (ohm)	Tolerance (ohm)
40	287.4	±32.8
60*	134	±13.5
80	69.1	±6.5
90*	51.2	±4.3
100*	38.5	±3.0
120	22.7	±2.2

\*Test point

### Oil pressure sensor:

Operating voltage: 6-24V

- Operating current: >20mA, <85mA, Pmax<0.25W

Operating temperature: -20°C to +100°C

Measuring range: 0 – 10 BAR

- Absolute max. value: 30 BAR, max. 2 seconds.

Protection: BODY IP 67

Tightening torque: Max. 20Nm

Function table		
Pressure (BAR)	Resistance (ohm)	Tolerance (ohm)
0	10	+3/-5
2	52	±4
4	88	±4
6	124	±5
8	155	±5
10	184	+20/-10

#### Coolant temperature sensor specifications (two pole)

Operating voltage: 6-24V

- Operating current: <85mA, Pmax<0.25W

Operating temperature: -40°C to +120°C

- Measuring range: -40°C to +120°C

Absolute max. value: 130°C, max. 1 min.

- Protection: BODY IP 67

- Tightening torque: Max. 20Nm

Fu	Function table		
Temperature	Resistance	Tolerance	
(°C)	(ohm)	(ohm)	
40	287.4	±32.8	
60*	134	±13.5	
80	69.1	±6.5	
90*	51.2	±4.3	
100*	38.5	±3.0	
120	22.7	±2.2	

\*Test point



#### Oil pressure sensor (two pole):

Operating voltage: 6-24V

- Operating current: >20mA, <85mA, Pmax<0.25W

- Operating temperature: -20°C to +100°C

Measuring range: 0 – 10 BAR

- Absolute max. value: 30 BAR, max. 2 seconds.

Protection: BODY IP 67

- Tightening torque: Max. 20Nm

Function table		
Pressure (BAR)	Resistance (ohm)	Tolerance (ohm)
0	10	+3/-5
2	52	±4
4	88	±4
6	124	±5
8	155	±5
10	184	+20/-10

#### **TEMPERATURE SWITCH:**

Operating voltage: 12-24VOperating power: 5W

- Operating temperature: ≤100°C ±4°C (OPEN CIRCUIT), ≥100°C±2°C (CLOSE CIRCUIT)

### **OIL PRESSURE SWITCH:**

Operating voltage: 12VOperating power: 5W

- Operating pressure: 0.98bar (CLOSE CIRCUIT)

### **TEMPERATURE SWITCH (TWO POLE)**

Operating voltage: 6-24VOperating power: Max 100W

- Operating temperature: 96°C ±3°C (CLOSE CIRCUIT)

### OIL PRESSURE SWITCH (TWO POLE):

Operating voltage: 6-24VOperating current: <0.5A</li>

Operating pressure: 0.4bar±0.15bar (CLOSE CIRCUIT)

### Battery

The minimum recommended battery capacity is 80 Ah. However, this is a general reference value since it is related to the maximum current that can offer for starting the engine.

The connection of the battery for a standard engine:

• Positive battery is connected to the starter.

• Negative battery is connected to the relay support.

The connection of the battery for an earth isolated engine.

Positive battery is connected to the starter.

Negative battery is connected to the bipolar relay.

Genset model	Battery capacity (Ah) 24 V
SDZ-165	90
SDZ-205	90
SDZ-280	100
SDZ-280R	100

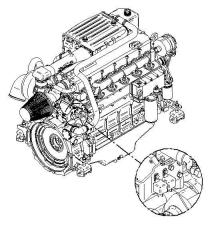


### Circuit protection - Fuse -

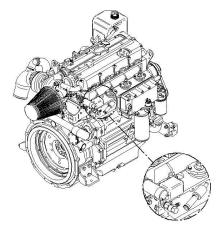
The electrical installation of the engine has a fuse that protects all the electronics in case of overload or short circuit. It is located in the wire harness next to the starter motor.

### Relays

The relays of the electrical installation are located inside the electrical protective box where it is shown in the follow image.



Engine with standard installation



Engine with earth isolated installation

### Maintenance task. Starter inspection

### STARTER:

- 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.

Element Assembly Standard
V-belt deflection 12 mm



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.

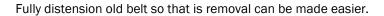


Never adjust the belt tension with engine running or battery connected.



### Maintenance task. V-belt replacement

In the event that replacement of the belt (s) is required, carry out the following procedure:



### Fuel pump

- To adjust the belts, loosen the screws (1) and (2). Push the fuel pump (3) to the left until the belt is correctly tensioned. Tighten the screws.
- 2. To change the belts. Loosen the screws (1) and (2). Push the fuel pump (3) to the right. Remove the belt and replace it with a new one. Push the fuel pump (3) to the left until the belt is correctly tensioned. Tighten the screws.

#### Alternator

- To adjust, loosen the screw (2). Push the alternator belt pulley (1) to the right until the belt is correctly tensioned. Tighten the screws.
- 2. To change the belt. Remove the belt for the fuel pump. Loosen the screw (2). Push the alternator belt pulley (1) to the left and remove the belt. Replace it with a new one. Push the alternator belt pulley (1) to the right until the correct belt tension. Tighten the screw (2).
- 2. When the belt is unfitted, check the condition of the pulley recesses, they shall be dry and clean. Its cleanliness is performed with soap water (never use petrol, gas oil or similar products).
- 3. Fit the belt taking care the belt insertion is made with the hand but without damaging it and if required pace it with a tool at least without any cutting edges since otherwise the belt could be damaged and its life shortened.
- 4. The belt shall be tensioned such as is previously explained.



Always change a belt that appears worn or is cracked. Belts working in pairs be replaced together.

### 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 Solé Diesel Official Service. See SOLÉ DIESEL WARRANTY
- Outside the period of warranty
  - Contact to Solé Diesel Official Service. See SOLÉ DIESEL WARRANTY.
  - Stop the engine, determine the cause and repair it before continuing driving the motor.



ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS
		Power cable fuse (red).	Replace the fuse in the installation. If fuse blows again, check electrical system for overloads or short circuits.
	ELECTRICAL SYSTEM (CC)	Discharged or empty battery. Loose or corroded battery connections. Faulty start/preheating relay. Faulty starter motor	Charge the battery or replace it with a new one. Check the battery connections are correct, clean and tight. Check and replace the preheating/start relay if necessary. Check starter motor and replace it if necessary.
	GENERAL	Control panel start signal Faulty stop solenoid (ETR). Low compression pressure.	Check the start signal from the controller (pink wire).  Check stop solenoid and replace it if necessary.  Check the compression of each cylinder.
		Oil viscosity too high.	Check oil viscosity (according to Technical Specifications).
MANUAL START FAILURE		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.
TAILORE		Clogged fuel pipes Clogged fuel filter	Check fuel pipes. Replace fuel filter.
		Faulty injection pump Air in fuel system	Contact an Official Solé Diesel Service. 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. Dirty or clogged fuel tank.	Add fuel and place fuel valve in open position. 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
	GENERAL	The fuel regulator is not operational.	Contact an Official Solé Diesel Service.
	FUEL SYSTEM	Faulty or clogged fuel pump Clogged fuel filter Air in fuel system Incorrect injection pump setting Closed fuel outlet tap	Check fuel pump inlet. Replace fuel filter. Bleed fuel system. Contact an Official Solé Diesel Service. Open the fuel outlet tap.
STARTS AND THEN STOPS	COOLING SYSTEM	Low cooling liquid level.	Check cooling liquid level and fill tank if necessary.
	ELECTRICAL SYSTEM (CC)	Faulty stop solenoid (ETR). Pressed emergency stop button. Control panel start signal.	Check stop solenoid and replace it if necessary. Reset the emergency stop button position. Check the start signal from the controller (yellow wire).
	INLET AND EXHAUST SYSTEM	Dirty or clogged air filter.	Replace the air filter element.
BLACK SMOKE	FUEL SYSTEM	Clogged fuel filter.  Dirty or faulty fuel injectors.  Incorrect injection pump setting.	Replace fuel filter. Clean, test and/or replace fuel injector which is not operating properly. Contact an Official Solé Diesel Service.
	INLET AND EXHAUST SYSTEM	Clogged air filter.	Replace the air filter element.
	GENERAL	Incorrect valve clearance.	Perform valve adjustment.
BLUE SMOKE	LUBRICATION SYSTEM	Oil level too high.	Check the lubrication oil level and reset it.
LOW OIL PRESSURE	LUBRICATION SYSTEM	Faulty oil pump. Strangled oil pressure-relief valve. Oil pressure too low. Oil level too low.	Contact our dealer Clean the valve and check its operation. Check oil level. Reset oil level. Inspect the engine for leaks.
		Faulty oil pressure valve. Faulty pressure gauge, pressure sensor and/or pressure switch.	Check the engine installation inclination. Rejectall the engine if
		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 Faulty oil pressure valve Oil level too high. Obstruction of oil lines.	Clean the valve and check its operation. Contact an Official Solé Diesel Service. Reset oil level. Contact an Official Solé Diesel Service.	
HIGH FUEL CONSUMPTION	GENERAL FUEL SYSTEM	Low compression pressure. Electrical overload. The regulator is not working properly. Fuel injection timing malfunction.	Check compression.  Reduce electrical load.  Contact an Official Solé Diesel Service.  Adjust fuel injection timing	
CONCOMIT HON	INLET AND EXHAUST SYSTEM	Clogged air filter	Replace the air filter element.	
	GENERAL	Incorrect valve clearance.	Perform valve adjustment.	
	FUEL SYSTEM	Clogged fuel filter.  Dirty or faulty fuel injectors.	Replace fuel filter.  Clean, test and/or replace fuel injector which is not operating properly.	
LOW POWER	FUEL SYSTEM	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  Exhaust detonations	Replace the air filter element.  Inspect exhaust system. Replace exhaust system components that are not operational.	
	GENERAL	Low compression pressure. Electrical overload.	Check compression.  Reduce electrical load.	
ENGINE OVER HEATING	LUBRICATION SYSTEM	Faulty oil pump. Oil viscosity too high. Oil level too low.	Contact an Official Solé Diesel Service. Check oil specifications according to Technical Specifications. Reset oil level. Inspect the engine for leaks.	



ENGINE FAILURE	SYSTEM	PROBABLE CAUSES	RECOMMENDED ACTIONS	
		Faulty coolant water pump.	Check coolant pump (impeller, pump sealing).	
	COOLING SYSTEM	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).	
ENGINE OVER HEATING		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.	
		Discharged or empty battery.	Charge the battery or replace it with a new one.	
FAULTY BATTERY	ELECTRICAL SYSTEM (DC)	Loose or corroded battery connections.	Check the battery connections are correct, clean and tight.	
CHARGE		Faulty DC alternator regulator.	Replace alternator.	
		DC alternator belt tension.	Check belt tension and change if necessary.	

## **Technical specifications**



### **Section 7 - Technical specifications**

### **SDZ-165**



Specifications			
No. Of Strokes:	4	Number of cylinders:	4
Layout of cylinders:	In line	Cylinder diameter (mm):	108
Stroke (mm):	130	Total displacement (cc):	4764
Compression ratio:	17,5:1	Continuous power (kW):	106,2
Intermittent Power (kW):	118	Max RPM:	2300
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	750 (±50)
Intake system: Turbocharged		Starting aid:	Fuel supercharged

Electrical system			
Voltage (V):	24	Alternator (A):	55
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETS
Battery Cable Length (m):	5 m	Battery Cable Section (mm2):	50 mm2

Fuel system			
Fuel type:	Diesel	Injection system:	Mechanical and direct
Fuel standards:	Fueloil diesel ASTM	Injection pump type:	Individual
Maximum suction head (m):	1,3	Governor type:	Mechanical
Injection Pressure (bar):	275	Maximum static head of return pipe (bar):	0,5
Firing order:	1-3-4-2	Injection timing (°):	N/A Before TDC
Idle Consumption (g/kWh):	211	Consumption at 50 % (g/kWh):	212
Consumption At 75 % (g/kWh):	203	Consumption at 100 % (g/kWh):	211,52

Lubrication system			
Lubrication type:	Forced circulation	Oil consumption at full load (g/kWh):	6,35
Minimum pressure at maximum RPM (kg/cm2):	0,8	Maximum pressure at maximum RPM (kg/cm2):	4,5
Minimum pressure at idle (kg/cm2):	0,3	Oil type:	SAE 15W40
Maixmum oil temperature (°C):	120	Oil pan capacity (I):	13
Total circuit capacity (I):	14	Oil pressure switch (kg/cm2):	0,3

Cooling system			
Coolant type:	Organic 50%, -38°C	Volume capacity of coolant circuit (I):	17,5
Coolant pump flow at maximum RPM (I/min):	170	Sea water pump flow at maximum RPM (I/min):	161,2 *
Maximum suction head of sea water (m):	2,5	Thermostat valve starts opening (°C):	83
Thermostat valve completely opened (°C):	95	Maximum sea water temperature (°C):	32
Heat to be extracted at 100 % load (kcal/h):	86844,85	Engine ratio/coolant pump RPM:	0,82

Installation data / Dimensions			
Sea water hose inner diameter (mm):	42	Fuel feeding hose inner diameter (mm):	12
Fuel return hose inner diameter (mm):	12	Exhaust hose inner diameter (mm):	90**
Total length (mm):	862	Total width (mm):	665
Total height (mm):	935	Down Angle (RO):	10
Max. Intermittent inclination in operation (°):	30		

<sup>\*</sup> 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.

<sup>\*\*</sup> The diameter system will be calculated depending on each installation in case of a dry exhaust

### **SDZ-205**



Specifications			
No. Of Strokes:	4	Number of cylinders:	6
Layout of cylinders:	In line	Cylinder diameter (mm):	108
Stroke (mm):	130	Total displacement (cc):	7146
Compression ratio:	17.5:1	Continuous power (kW):	129,5
Intermittent Power (kW):	143,9	Max RPM:	2300
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	750 (±50)
Intake system:	Turbocharged	Starting aid:	Fuel supercharged

Electrical system			
Voltage (V):	24	Alternator (A):	55
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETS
Battery Cable Length (m):	5 m	Battery Cable Section (mm2):	70 mm2

Fuel system			
Fuel type:	Diesel	Injection system:	Mechanical and direct
Fuel standards:	Fueloil diesel ASTM	Injection pump type:	Individual
Maximum suction head (m):	1,3	Governor type:	Mechanical
Injection Pressure (bar):	272,9	Maximum static head of return pipe (bar):	0,5
Firing order:	1-5-3-6-2-4	Injection timing (°):	N/A Before TDC
Idle Consumption (g/kWh):	220	Consumption at 50 % (g/kWh):	225
Consumption At 75 % (g/kWh):	226	Consumption at 100 % (g/kWh):	228

Lubrication type:Forced circulationOil consumption at full load (g/kWh):6,9Minimum pressure at maximum RPM (kg/cm2):0,8Maximum pressure at maximum RPM (kg/cm2):4,5Minimum pressure at idle (kg/cm2):0,3Oil type:SAE 15W40Maixmum oil temperature (°C):101Oil pan capacity (I):22,5Total circuit capacity (I):23Oil pressure switch (kg/cm2):0,3	Lubrication system			
Minimum pressure at idle (kg/cm2):     0,3     Oil type:     SAE 15W40       Maixmum oil temperature (°C):     101     Oil pan capacity (I):     22,5	Lubrication type:	Forced circulation	Oil consumption at full load (g/kWh):	6,9
Maixmum oil temperature (°C): 101 Oil pan capacity (I): 22,5	Minimum pressure at maximum RPM (kg/cm2):	0,8	Maximum pressure at maximum RPM (kg/cm2):	4,5
	Minimum pressure at idle (kg/cm2):	0,3	Oil type:	SAE 15W40
Total circuit capacity (I): 23 Oil pressure switch (kg/cm2): 0,3	Maixmum oil temperature (°C):	101	Oil pan capacity (I):	22,5
	Total circuit capacity (I):	23	Oil pressure switch (kg/cm2):	0,3

Cooling system			
Coolant type:	Organic 50%, -38°C	Volume capacity of coolant circuit (I):	23
Coolant pump flow at maximum RPM (I/min):	170	Sea water pump flow at maximum RPM (I/min):	161,2 *
Maximum suction head of sea water (m):	2,5	Thermostat valve starts opening (°C):	83
Thermostat valve completely opened (°C):	95	Maximum sea water temperature (°C):	32
Heat to be extracted at 100 % load (kcal/h):	109200,95	Engine ratio/coolant pump RPM:	0,62

Installation data / Dimensions			
Sea water hose inner diameter (mm):	42	Fuel feeding hose inner diameter (mm):	12
Fuel return hose inner diameter (mm):	12	Exhaust hose inner diameter (mm):	125**
Total length (mm):	1146	Total width (mm):	640
Total height (mm):	942	Down Angle (RO):	10
Max. Intermittent inclination in operation (°):	30		

<sup>\*</sup> 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.

<sup>\*\*</sup> The diameter system will be calculated depending on each installation in case of a dry exhaust

### **SDZ-280**



Specifications			
No. Of Strokes:	4	Number of cylinders:	6
Layout of cylinders:	In line	Cylinder diameter (mm):	108
Stroke (mm):	130	Total displacement (cc):	7146
Compression ratio:	17.5:1	Continuous power (kW):	180
Intermittent Power (kW):	200	Max RPM:	2300
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	750 (±50)
Intake system:	Turbocharged with inte	Turbocharged with interco <b>Starting aid:</b>	

Electrical system			
Voltage (V):	24	Alternator (A):	55
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETS
Battery Cable Length (m):	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:	Individual
Maximum suction head (m):	1,3	Governor type:	Electronical
Injection Pressure (bar):	275	Maximum static head of return pipe (bar):	0,5
Firing order:	1-5-3-6-2-4	Injection timing (°):	N/A Before TDC
Idle Consumption (g/kWh):	220	Consumption at 50 % (g/kWh):	208
Consumption At 75 % (g/kWh):	212	Consumption at 100 % (g/kWh):	234

Lubrication type: Forced circulation Oil consumption at full load (g/kWh):	7.00
2 constitution at tall load (5) Kirthy	7,02
Minimum pressure at maximum RPM (kg/cm2): 0,8 Maximum pressure at maximum RPM (kg/cm2):	4,5
Minimum pressure at idle (kg/cm2): 0,8 Oil type:	SAE 15W40
Maixmum oil temperature (°C): 130 Oil pan capacity (I):	22,5
Total circuit capacity (I): 23 Oil pressure switch (kg/cm2):	0,3

Cooling system			
Coolant type:	-	Volume capacity of coolant circuit (I):	23
Coolant pump flow at maximum RPM (I/min):	170	Sea water pump flow at maximum RPM (I/min):	161,2 *
Maximum suction head of sea water (m):	2,5	Thermostat valve starts opening (°C):	83
Thermostat valve completely opened (°C):	95	Maximum sea water temperature (°C):	32
Heat to be extracted at 100 % load (kcal/h):	147034,35	Engine ratio/coolant pump RPM:	0,82

Installation data / Dimensions			
Sea water hose inner diameter (mm):	42	Fuel feeding hose inner diameter (mm):	12
Fuel return hose inner diameter (mm):	12	Exhaust hose inner diameter (mm):	125**
Total length (mm):	1146	Total width (mm):	690
Total height (mm):	974	Down Angle (RO):	10
Max. Intermittent inclination in operation (°):	30		

<sup>\*</sup> 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.

<sup>\*\*</sup> The diameter system will be calculated depending on each installation in case of a dry exhaust

### **SDZ-280R**



Specifications			
No. Of Strokes:	4	Number of cylinders:	6
Layout of cylinders:	In line	Cylinder diameter (mm):	108
Stroke (mm):	130	Total displacement (cc):	7146
Compression ratio:	17.5:1	Continuous power (kW):	129
Intermittent Power (kW):	143	Max RPM:	1600
Rotation (viewed from flywheel side):	Counterclockwise	Idle RPM:	750 (±50)
Intake system:	Turbocharged with inte	erco Starting aid:	Supercharger

Electrical system			
Voltage (V):	24	Alternator (A):	55
Minimum Battery Capacity (Ah):	99	Engine shut off system:	ETS
Battery Cable Length (m):	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:	Individual
Maximum suction head (m):	1,3	Governor type:	Electronical
Injection Pressure (bar):	275	Maximum static head of return pipe (bar):	0,5
Firing order:	1-5-3-6-2-4	Injection timing (°):	N/A Before TDC
Idle Consumption (g/kWh):	220	Consumption at 50 % (g/kWh):	218
Consumption At 75 % (g/kWh):	207,5	Consumption at 100 % (g/kWh):	208

Lubrication system			
Lubrication type:	Forced circulation	Oil consumption at full load (g/kWh):	7,02
Minimum pressure at maximum RPM (kg/cm2):	0,8	Maximum pressure at maximum RPM (kg/cm2):	4,5
Minimum pressure at idle (kg/cm2):	0,8	Oil type:	SAE 15W40
Maixmum oil temperature (°C):	130	Oil pan capacity (I):	22,5
Total circuit capacity (I):	23	Oil pressure switch (kg/cm2):	0,3

Cooling system			
Coolant type:	-	Volume capacity of coolant circuit (I):	23
Coolant pump flow at maximum RPM (I/min):	170	Sea water pump flow at maximum RPM (I/min):	161,2 *
Maximum suction head of sea water (m):	2,5	Thermostat valve starts opening (°C):	83
Thermostat valve completely opened (°C):	95	Maximum sea water temperature (°C):	32
Heat to be extracted at 100 % load (kcal/h):	147034,35	Engine ratio/coolant pump RPM:	0,82

Installation data / Dimensions						
Sea water hose inner diameter (mm):	42	Fuel feeding hose inner diameter (mm):	12			
Fuel return hose inner diameter (mm):	12	Exhaust hose inner diameter (mm):	125**			
Total length (mm):	1146	Total width (mm):	690			
Total height (mm):	974	Down Angle (°):	10			
Max. Intermittent inclination in operation (°):	30					

<sup>\*</sup> 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.

<sup>\*\*</sup> The diameter system will be calculated depending on each installation in case of a dry exhaust

# **Tightening torques**



### **Section 8 – Tightening torques**

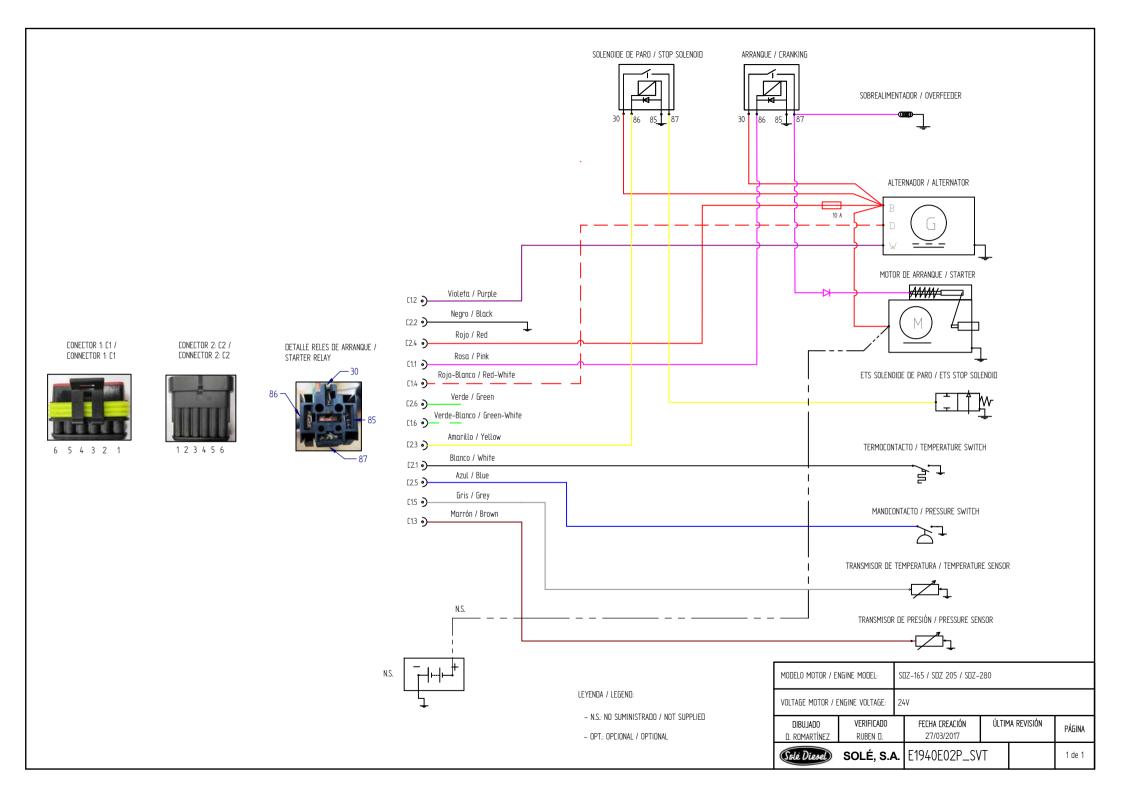
Important nuts and screws:

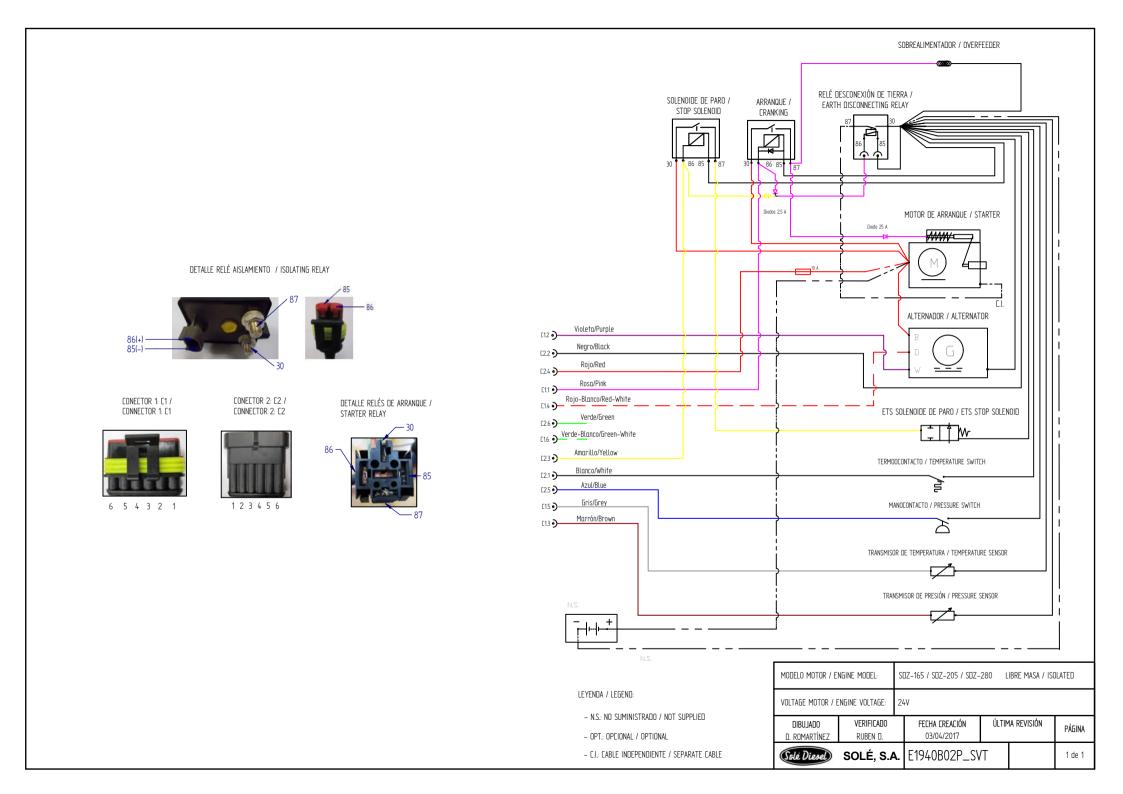
Volozos do envloto	SDZ-165 / 205 / 280 / 280R			
Valores de apriete	N-m	kgf-m		
	1st Phase 30	1st Phase 3		
Cylinder head bolt	2nd Phase 80	2nd Phase 8		
	Retighten 90°	Retighten 90°		
Overal selection all and beating	40 to 50	4 to 5		
Crankshaft pulley bolts	Retighten 60°	Retighten 60°		
Main bearing caps	50	5		
Connecting rod caps	30	3		
Flywheel bolt (30-45 mm)	20 to 30	2 to 3		
Flywheel bolt (50-85 mm)	30 to 40	3 to 4		
Oil pan draing plug	50	5		
Oil pan bolts (steel)	21 to 23	2,1 to 2,3		
Oil pan bolts (foundry)	29 to 31	2,9 to 3,1		
Oil discharge valve	40 to 44	4 to 4,4		
Valve locknut	22	2,2		
Intention who to take the common	1st Phase 5	1st Phase 0,5		
Injection pipe to injection pump	2nd Phase 28,5	2nd Phase 2,85		
Sensors and switches	18 to 20	1,8 to 2		
Starter motor nut (terminal B)	28 to 30	2,8 to 3		
Rocker cover bolts	9 to 10	0,9 to 1		
Oil pump set bolt	8 to 9	0,8 to 0,9		
Oil cooler set bolt	20	2		

## **Wiring diagrams**



### **Section 9 - Wiring diagrams**

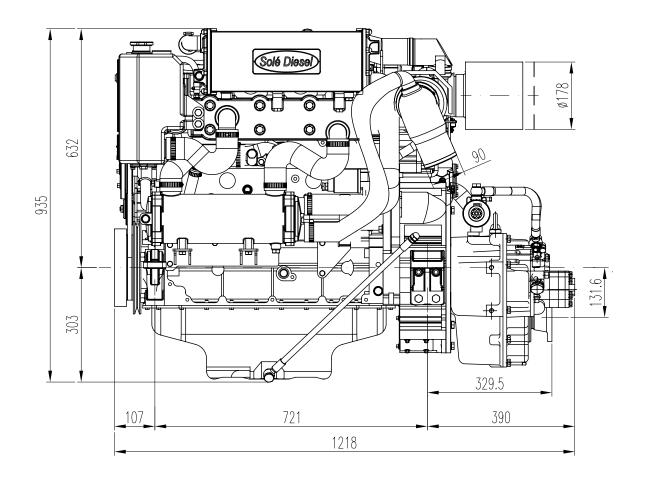


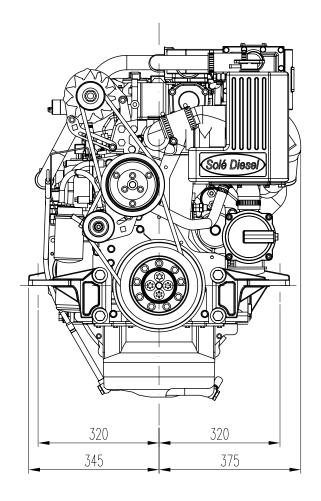


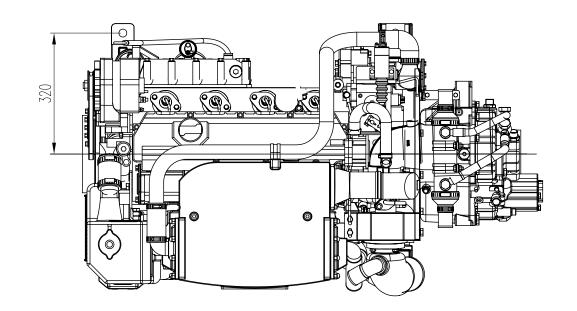
### **Overall dimensions**

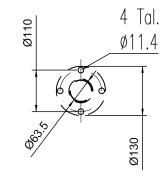


### **Section 10 - Overall dimensions**



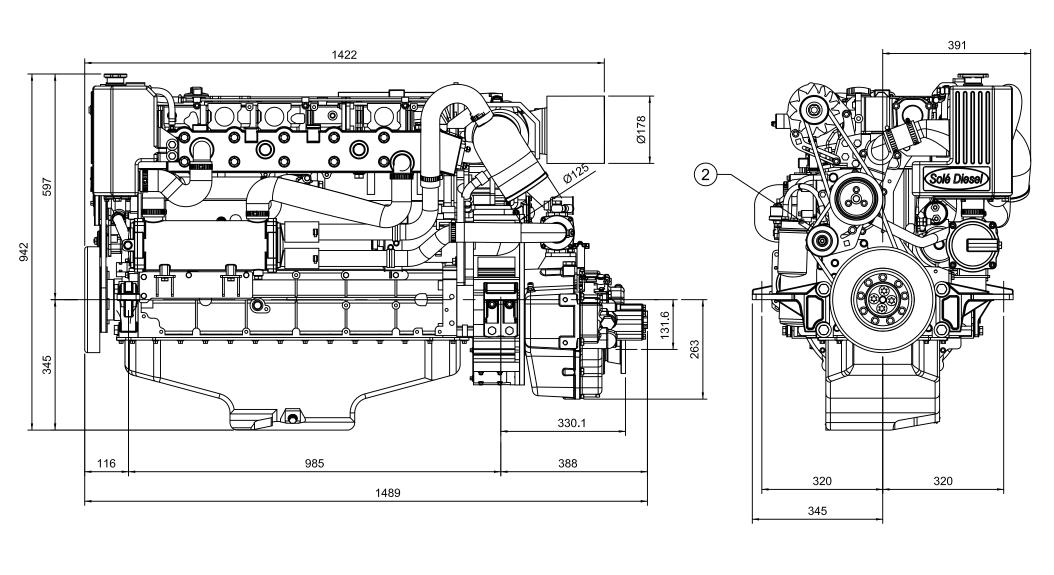


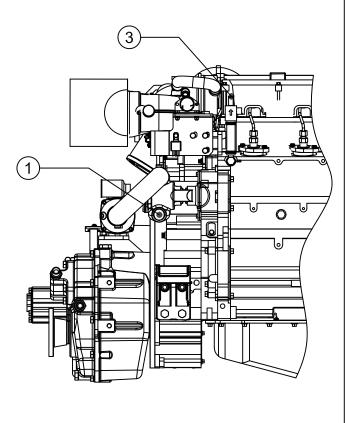


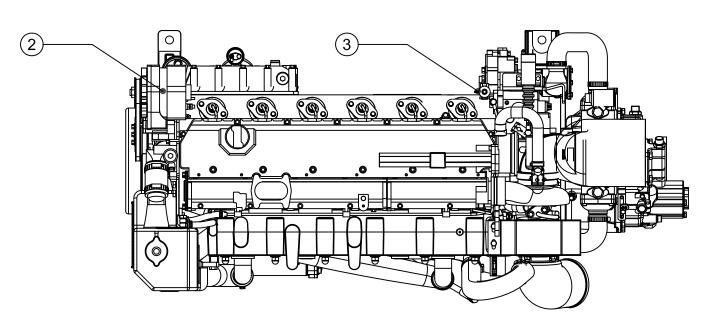


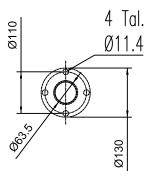
ACOPLAMIENTO INVERSOR GEARBOX COUPLING

SD-165 con II	NVERSOR TM-17	0				C
SD-165 with T	M-170 GEARBO	<b>X</b>				D AUTODESK•
MATERIAL	TRACTAME	NT	ACABAT	PRESENTA	CIÓ	ESCALA 1:10
DIBUIXAT A. ORTI	VERIFICAT	Tol. GENERAL	DATA CRE 13-06-2		ULTIM	A REVISIÓ
<b>50</b>	IL IÉ, S	3. <b>A</b> .				









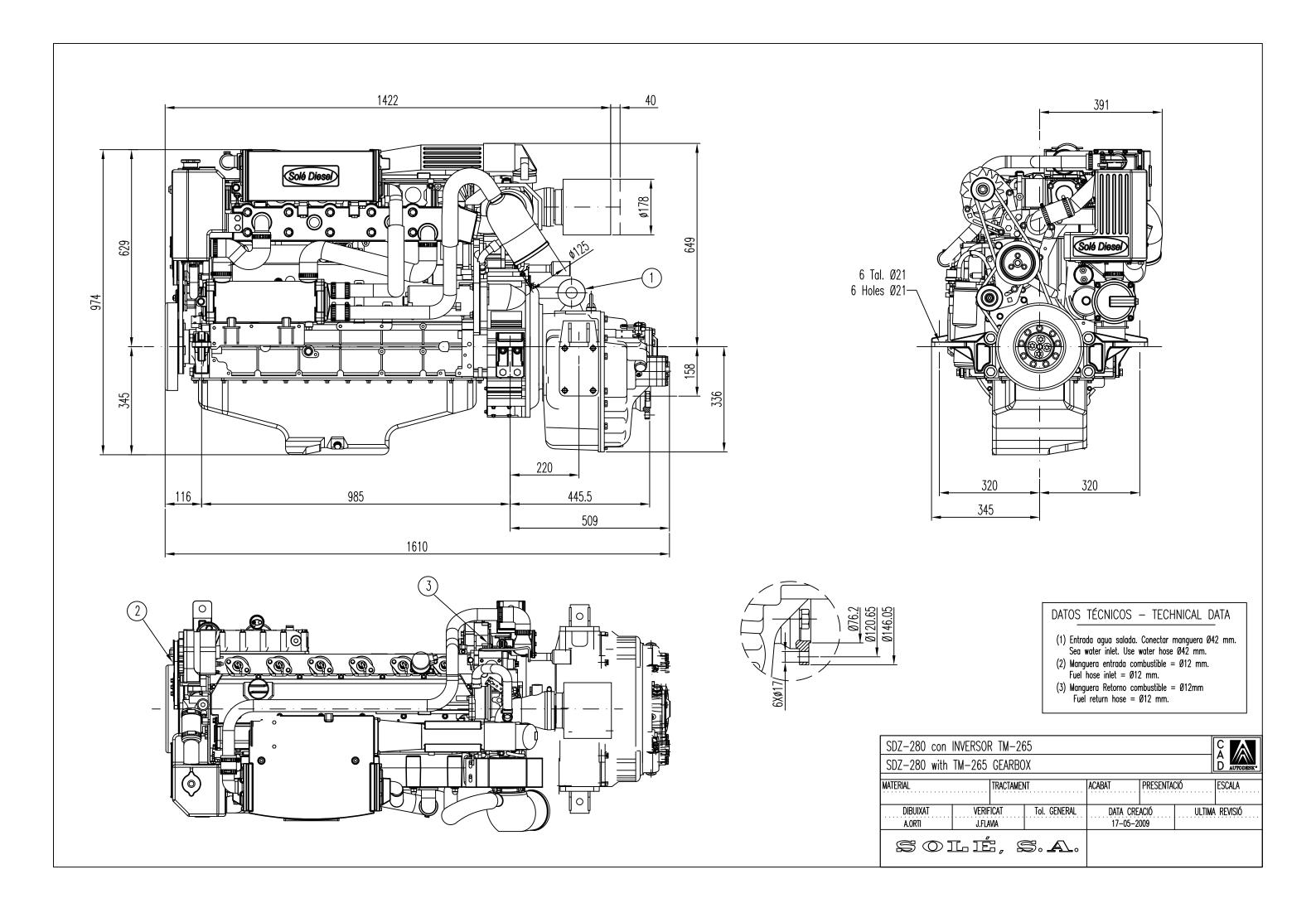
ACOPLAMIENTO INVERSOR GEARBOX COUPLING

#### DATOS TÉCNICOS — TECHNICAL DATA

- (1) Entrada agua salada. Conectar manguera Ø38 mm. Sea water inlet. Use water hose Ø38 mm.
- (2) Manguera entrada combustible = Ø12 mm. Fuel hose inlet = Ø12 mm.
- (3) Manguera Retorno combustible = Ø12mm Fuel return hose = Ø12 mm.

SDZ-205 con	INVERSOF	R TM-17	70				Ç
SDZ-205 with	TM-170	GEARBO	Χ				D AUTODESK*
			_			٠.٠	
MATERIAL		TRACTAMEN	NI .	ACABAT	PRESENTA	CIO	ESCALA
DIBUIXAT	VERIF	TCAT	Tol. GENERAL	DATA CRE	ACIÓ	ULTIMA	revisió
A. ORTI	S. UB	ACH		03-02-2	.011		
			≈ •				
<b>S</b> O	ع لے صا	5, S	⋽. <b>A</b> L.				

Motor base / Engine based: BF6M1013E DEUTZ



# Inspection prior to the delivery Sole Diesel of propulsion engines



# Inspection prior to the delivery Sole Diesel of propulsion engines



#### **Section 11 - Instructions to Replace and Remove**

When you decide to replace the engine, please contact SOLÉ S.A.; 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 S.A.

# Inspection prior to the delivery Side Diesel of propulsion engines



### Section 12 - Inspection prior to the delivery of propulsion engines

INSPECTION PRICE	R TO THE DELIVER	RY OF PRO	OPULSION	N ENGINE	s		
Installer / Marina i	nformation						
Installer Company:			Installation	n Date:			
Contact Tel. no.:			E-mail:				
Owner's Informatio	n						
Name and surnames:							
Contact Tel. no.:			Email:				
Ingine Information							
Engine model:							
Engine serial number:			Gearbox / S	Saildrive se	rial nº.:		
Installation Informa	ntion						
Machine chamber ope							°C
Angle of the engine (bo							0
Maximum angle of the		ditions):					0
Is the wet exhaust ebow above or below the floating line?					above		below
Propulsion Line Info	ormation						
·				Saildrive tra	nsmission ra	atio:	
			Shaft lengt				mm
Propeller diameter:	mm/inches	Propeller p	N° Of propeller			eller	
Exhaus, Cooling an	d Fuel Line Informa	tion					
Int. Diameter of exhaus			Int. Diamet	er of sea wa	ater intake to	o the	
Int. Diameter of diesel	intake:		pump:			mm	
Int. Diameter of diesel	return intake:	mm					
Has an autoust sallest	or book installed?	YES	Han an airt	as an air trap been installed?			YES
Has an exhaust collect	or been installed?	NO	Has an air	trap been in	stalled?		N0
Verifications Prior t	to Start-Up			V/x		Notes	
Correct engine alignme				,			
Electrical installation of	onnections.				1		
Engine oil level.					1		
Gearbox oil level.					1		
Coolant level and conc	entration.				1		
Control lever operation	١,				1		
Transmissions belts and belt tension.					1		
Airtight sea water cock							
Verification of Engi	ine No-Load Operati	ons		V/x		Notes	
Unusual noises from th				,			
Oil pressure				1			
Bleed the fresh water cooling system					1		
Verify the instrument p	anel: normal indication	s and alarm	operation.		]		
Water, oil and fuel leaks in the engine or transmission.							

# Inspection prior to the delivery Stee Diesel of propulsion engines



#### INSPECTION PRIOR TO THE DELIVERY OF PROPULSION ENGINES

Verification of Motor 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 inverter operation. Verify operation of the Trolling valve, if applicable.		
Engine temperature and oil pressure.		
Information for the Owner	V/x	Notes
Delivery of the instrucions manual and engine-related documents.		
Review of the engine instrucions manual.		
Study the instruments panel functions and the engine control functions.		
Report the first revision date.		
Report the maintenance schedule indicated in the manuals.		

# **Maintenance log**



### **Maintenance log**

DATE	HOURS	DESCRIPTION	SERVICE NAME

# **Maintenance log**



-		
-		
-		
-		



#### MARINE DIESEL ENGINES - GENSETS - PROPELLERS - ACCESSORIES

C-243 b, km  $2\cdot08760$  Martorell (Barcelona) Tel. +34 93 775 14 00 · Fax +34 93 775 30 13 www.solediesel.com · info@solediesel.com

#### Follow us:









© Copyright 2019 Solé Diesel. All rights reserved. Texts and specifications are subject to change without notice and without any obligation or liability whatsoever.



U\_CTMT165280\_EN Revision 0 03/2022