Fischer Panda

Manual

Description of the generator and operation manual

Marine Generator
Panda 4000s PMS SCB
Panda 4000s PMS FCB
230 V - 50 Hz / 3,8 kW

Super silent technology

Fischer Panda GmbH

Panda_4000s_PMS_SCB_FCB_eng.R02 22.9.09

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Revision	**Page**
Panda 4000s FCB added	

Table of contents

Table of contents

Table of contents

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since 1977	since 1978	since 1988	since 1988	since 1988
Icemaster GmbH	**Fischer Marine Generators**	**Conclusion Fischer - Icemaster GmbH**	**100 % water cooled Panda generators**	**Panda Vehicle Generators**

Fischer Panda

FISCHER GENERATORS have been manufactured since 1978 and are a well-known brand for first class diesel generators with especially effective sound-insulation.

Fischer has been one of the leading manufacturers in respect of quality and know-how during this period.

FISCHER, as the worldwide manufacturer of modern marine diesel generators, developed the Sailor-Silent series for example and produced a GFK sound-insulated capsule as early as 1979 and the basis for new generator technology.

The companies Fischer and Icemaster amalgamated under the direction of Icemaster in 1988, in order to concentrate on the development of new products. Production was moved to Paderborn.

The amalgamation of the two qualified companies led to the development of a complete new programme within a short space of time. The generators developed at that time set new technological standards worldwide.

The generators became more efficient and powerful than other generators in the same nominal performance range, because of the improved cooling. Panda generator demonstrated its superiority in several tests by renowned institutes and magazines during the past years. The patented VCS (voltage Control System) means it can meet all demands including motor speed. The start-booster (ASB) means Panda generators meet the highest demands in respect of voltage stability and starting values. A Panda generator, with the same drive motor, produces 15 % more effective output than the majority of conventional generators. This superiority in efficiency also ensures a fuel saving to the same extent.

The 100% water-cooled Panda generators are currently manufactured in the performance range from 2 to 100 kW in various versions. Fast running motors are preferred for performances up to approx. 30 kW (nominal speed 3000 rpm). The heavier slow runners are preferred for the higher range. The fast running generators have proved themselves many times for many uses, that they meet the demands in quality of yachts and vehicles, and offer space and weight saving of 50 % compared to slow running generators.

In addition to the Panda series, Fischer Panda also supply the super compact high-tech sound-insulated battery charging generators from the DC/AC Panda AGT series, which is a very interesting solution for the production of mobile power.

The HTG-alternators ensure that a charging rate of 285 amps is achieved that was scarcely thought possible for this compact construction. This alternator replaces a separate shipboard generators (constant 230 volts AC with up to 3500 kW from the main machine)

Safety first symbols

These symbols are used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use unit.

	This danger symbol refers to toxic danger and draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in severe personal injury or loss of life.
	Dieses Gefahrensymbol bezieht sich auf elektrische Gefahr und weist auf spezielle Warnungen, Anweisungen oder Verfahren hin, die - wenn sie nicht beachtet werden - einen elektrischen Schlag ergeben können, der Personenschäden oder den Verlust des Lebens zur Folge haben kann.
	This warning symbol draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in damage or destruction of equipment
	Warning sign: Danger of fire
	Prohibitation: Do not smoke
	Prohibitation: Fire and open flames prohibited
	Prohibitation: Turn on / start operation prohibited

	Danger warning: Automatic start. generator can be started by an external signal
	Danger warning: High voltage / danger by electricity - Danger for life
	Danger warning: Danger for life and/or equipment
	Danger warning: Harmfull if accumulate
	Danger warning: Electric shock
	Danger warning: Keep hand and body away from rotating parts
	Danger warning: Risk of explosion
	Danger warning: Hot surface

	Danger warning: Danger carrosive material - contermination of persons possible
	Instruction: Wear personal protective equipment (PPE)
	Instruction: Read the manual instructions
	Instruction: Wear protective glasses
	Instruction: Wear safety gloves
	Instruction: Be mindful of enviroment and the ecology

Tools

This symbols are used throughout this manual to show which tool must be used at maintenance or installation.	
	Spanners X = required size
	Hook wrench for oil filter
	Screw driver, for slotted head screws and for recessed head screws
	Multimeter, multimeter with capacitor measuring
	Socket wrench set
	Hexagon wrench keys

Manufacturer declaration in accordance with the machine guideline 98/37/EG

Manufacturer declaration in accordance with the machine guideline 98/37/EG

The generator has been developed in such a way, that all assembly groups correspond to the CE guidelines. If machine guideline 98/37/EG is applied, then it is forbidden to start the generator, until it has been ascertained that the system into which the generator is to be integrated, also corresponds to the machine guideline regulation 98/37/EG. This includes the exhaust system, cooling system and electrical installation.

The evaluation of "protection against contact" must be carried out when installed, in conjunction with the respective system. This includes correct electrical connections, a safe ground wire connection, foreign body and humidity protection, protection against humidity due to excessive condensation, as well as overheating through appropriate and inappropriate use in its installed state. The responsibility lies with those who undertake installation of the generator in the final system.

Customer registration and garantie

Use the advantages of the customer registration:

- Thus you receive to extended product informations, which are sometimes safety-relevant
- you receive, if necessarily free Upgrades

Far advantages:

By your full information Fischer Panda technicians can give you fast assistance, since 90% of the disturbances result from errors in the periphery.

Problems due to errors in the installation can be recognized in the apron.

Technical Support per Internet: info@fischerpanda.de

Attention, Important Directions regarding Operation!

1. The installation certificate must be completed when taken into use, and certified by a signature.
2. The installation certificate must be despatched within two weeks of use to Fischer Panda.
3. The official guaranty confirmation will be completed by Fischer Panda after receipt and sent to the customer.
4. A guaranty must be shown to make any claims.

Claims against the guaranty will not be accepted of the above said instructions are not, or only partially, carried out.

Safety instructions - Safety first!

Safe operation

Careful operation is your best assurance against an accident. Read and understand this manual carefully before operating the engine. All operators, no matter how much experience they may have, should read this and other related manuals befor operating the generator or any equipment attached to it. It is the owner´s obnligation to provide all operators with this information and instruct them on safe operation.

Observe safety instructions

Read and understand carefully this manual and „Labels at the engine“ before attempting to start and operate the generator. Learn how to operate and work safely. Know how your equipment and its limitations. Always keep the generator in good condition. Do not modify the generator Unauthorized Modifikations to the generator may impair the function and/or the safety and affect generator life.

Wear safe clothing and Personal Protective Equipment PPE

Do not wear loose, torn or bulky clothing around the maschine that may catch on working controls and prejections or into fans, pulleys ond other moving parts causing personal injury.

Use additional safety items-PPE, e.g. safety protection, safety googles, gloves , ect.

Do not operate the generator or any equipment attached to it while under the influence of alcohol, medication, or other drugs, or while fatigued.

Do not wear radio or music headphones while operating the generator.

Cleanness protect

Keep the engine and surrounding clean.

Be shure to stop the generator before cleaning. Keep the generator clean and free of accumulated dirt, grease and trash to avoid fire. Store flammable liquids in proper containers and cabinets away from sparks and heat. Check for and repair leaks immidiately.

Safe handling of fuel and lubricants - Keep away from fire

Always stop the generator befor refueling and/or lubrivating. Do not smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.

Refuel at a well ventilated and open place. When fuel and/or lubrication are spilled, refuel after letting the generator cool down.

Do not mix gasoline or alkohol with diesel fuel. The mixture can couse a fire or severe generator damage.

Do not use unapproved containers e.g. buckets, bottles, jars. Use approved fuel starrage containers and dispensers.

Exhaust gases and fire prevention

Generator exhaust fumes can be very harmful af allowed to accumulated. Be sure to run the engine in a well ventilated location and where there are no people or livestock near the engine.

Check the Generator and all pipes and hoses regularly of leaks and repair them imidiatly.

The exhaust gas and the engine can be very hot during and after operation very hot. To prevent a fire, do not expose dry gras, moved gras, or any other combustible material to exhaust gas or the hot generator surface.

o prevent a fire, do not short electrical cables. Check regularly all electrical cables and wires. Uncoated wires and loose connections can cause electrical shock, electrical short circuit and fire.

The generator should be integrated in the local fire protecting system.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Cautions against burns and battery explosion

To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, ect. during operation and after the engine has been shut down. Coolant system can be under pressure, Open the coolant system only, when the generator is colled down. Wear „Personal Protective Equipment „.

Be shure that the coolant system is closed and all hose clamps are tightend before operating the generator.

.The battery (Starter battery and AGT battery bank) presents an explosive hazard. When the battery is being charged, hydrogen and oxigen gasses are extremly explosive. Do not use or charge a battery if its fluid level is below the lower mark. Otherwise, the component parts may deteriorate earlier than expected, which may shorten the the service life or cause an explosion. Immediatly, add distilled water until the fluid level is between the lower and the upper marks.

.Keep sparks and open flames away from the battery, especially during charging. Do not strike a match near the battery.

Do not check the battery charge by placing a metal object across the terminals. Use a Voltmeter or a hydrometer.

Do not charge a frozen battery. There is a riosk of explosion. When frozen, warm the battery up to at least 16℃.(61℉).

Keep hands away from rotating parts

Operate the generator with closed sound cover capsul only.

Be shure to stop the generator befor checking or adjusting the belt tension.

Keep your hands and body away from rotating parts, such as the cooing fan, V-Belt, fan drive belt, ra´w water pump drive belt, pulley or Flywheel.

Do not operate the generator without safety guards. Install safety guards securly before operation.

Anti-Freeze and Disposal of Fluids

Anti-freeze contains poison. Wear rubber gloves to avoid personal injuri. In case of contact with skin, whash it off immideately.

Do not mix different types of Anti-freeze. The mixture can produce chemical reactioncausing harmful substances. Use approved or genuine Fischer Panda Anti-freeze.

Ne mindful of the enviroment and the ecology. Before draining any fluids, determine the correct way to dispose of them. Observe the relevant enviromental protection regulations when disposing of oil, fuel, coolant, breakfluid, filters and batteries.

When drainin g fluids from the generator, place a siutable container underneath the generator body.

Do not poor waste onto the ground, down a drain, or into any water source. Disposal of waste fluids according to the environmental regulations.

Conducting safety checks and maintenance

Disconnect the battery from the generator before conducting service. Put a „DO NOT OPERATE“ tag on the remote control panel to avoid accidental starting. Disconnect any automatic starter device, e.g. battery monitor to prevent automatic starting.

To avoid sparks from an accidental short circuit always disconnect the battery´s ground cable (-) first and connect it last. be shure that the generator is stopped and cooleed down when conducting daily and periodic maintaenance, service and cleaning.

Always use the apprppirate tools and fixtures. Verify that they are in good conditions before performing any service work. Make shure you understand how to use them before service.

Keep first aid kit and fire extinguisher handy at all times.

Warning and caution labels

Keep warning and caution labels clean and free from obstructing material.

Clean warning and caution labels with soap and water, dry with a soft cloth.

Replace damaged or missing warning and caution labels with new labels.

Safety Instructions concerning operating the generator

The electrical installations may only be carried out by trained and qualified personnel!

The generator must not be taken into use with the cover removed.

If the generator is being installed without a sound insulation capsule, then make sure, that all rotating parts (belt-pulley, belts etc) are covered and protected so that there is no danger to life and body!

If a sound insulation covering will be produced at the place of installation, then well-placed signs must show that the generator can only be switched on with a closed capsule.

All servicing-, maintenance or repair work may only carried out, when the motor is not running.

There is full current in the AC control box when the generator is running. It must therefore be ensured that the control box is closed and cannot be touched when the generator is running.

Do not work in an ambient, where there are explosives. Working on an electrical system in an ambient where there are flammable gases is dangerous.

Electrical voltages above 48 volts (battery chargers greater than 36 volts) are always dangerous to life). The rules of the respective regional authority must be adhered to. Only an electrician may carry out installation of the electrical connections for safety reasons.

Ground Wire:

The generator, is "earthed" as series (centre and ground are connected together in the generator terminal box by a bridge). This is an initial ground fuse, which offers protection, as long as no other measures are installed. Above all, it is conceived for the delivery and possible test run.

This "neutralisation" (Protective Earthing Neutral - PEN) is only effective, if all parts of the electrical system are commonly "earthed" to a common potential. The bridges can be removed, if this is necessary for technical reasons and another protective system has been setup.

Safety Instructions concerning working on the generator

The battery must always be disconnected, if work on the generator or electrical system is to be carried out, so that the generator cannot be unintentionally started. **It is not allowed to disconnect the battery during operation!** After the generator has been stopped, the battery can be disconnected!

Switch off all load when working on the generator

All load must be disconnected, in order to avoid damages to the devices. In addition the semi conductors in the AC control box must be disconnected in order to avoid the boat capacitors being activated. The minus pole of the battery ought to be removed.

Safety Instructions concerning operating the generator

Safety Instructions concerning the capacitors

Capacitors are required to run the generator. These have two varying functions:

A) The working capacitors

B) The (Booster) capacitors

Both Groups are located in a separate AC-Control box.

Capacitors are electrical stores. There could be a residual of high electrical current at the contacts for a period disconnection from the circuit. The contacts may not be touched for safety reasons, If the capacitors are to be exchanged or checked, and then a short circuit between the contacts should be made so that the stored energy is discharged.

If the generator is switched off in the normal manner, the working capacitors are automatically discharged by means of the windings. The booster capacitors are discharged by means of internal discharge resistors.

All capacitors must be short-circuited before work is carried out on the AC-Control box for safety reasons.

Safety Instructions concerning the cables

Cable Type

It is recommended is that the cable used be UL 1426 (BC-5W2) compliant, with Type 3 stranding (ABYC Section E-11)

Cable Size

The cable size must be selected taking into account the amperage, voltage and conductor length (from the positive power source connection to the electrical device and back to the negative power source connection.

Cable Installation

It is recommended that a self draining wire loom classified as V-2 or better in accordance with UL 94 be installed in the section of the cable routed in the interior of the sound capsule. Care should be taken to avoid hot surfaces such as the exhaust manifold or engine oil drain bolt and routed clear of any possible sources of chafing.

Recommend starter battery size

Battery

Warning:

Do not use Gel-Cel batteries, because the regulation voltage is high for this type of batteries.

Do not use large batterybanks as a starting battery. The generator must have a dedicated starter battery (maximum size group 24).

Recommend starter battery size (if model not shown - please see engine manual)

Panda 6000 -8000	12V, 28AH equivalent		Panda 18	12V, 65AH equivalent
Panda 9000-14000	12V, 36AH equivalent		Panda 24-30	12V, 70AH equivalent
Panda 16	12V, 52AH equivalent		Panda 33-42	12V, 100 to 120AH equivalent

Attention !! Check before installation if the starter battery voltage correspond with the generator start system.

f.e. 12V starter battery for 12V start system

f.e. 24V starter battery for 24V start system

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	5 Safety steps to follow if someone is the victim of electrical shock	
1	Do not try to pull or grab the individual.	
2	Send for help as soon as possible.	
3	If possible, turn off the electrical power.	
4	If you cannot turn off the electrical power, pull, push, or lift the person to safety using a wooden pole, rope, or some nonconductive material.	
5	After the injured person is free of contact with the source of electrical shock, move them a short distance away and immediately start necessary first aid procedures.	

WHEN AN ADULT STOPS BREATHING

WARNING

DO NOT attempt to perform the rescue breathing techniques provided on this page, unless certified. Performance of these techniques by uncertified personnel could result in further injury or death to the victim.

1 Does the Person Respond?

Tap or gently shake victim.

Shout, "Are you OK?"

2 Shout, "Help!"

Call people who can phone for help.

3 Roll Person onto Back.

Roll victim toward you by pulling slowly.

4 Open Airway.

Tilt head back, and lift chin.

Shout, "Are you OK?"

5 Check for Breathing.

Look, listen, and feel for breathing for 3 to 5 seconds.

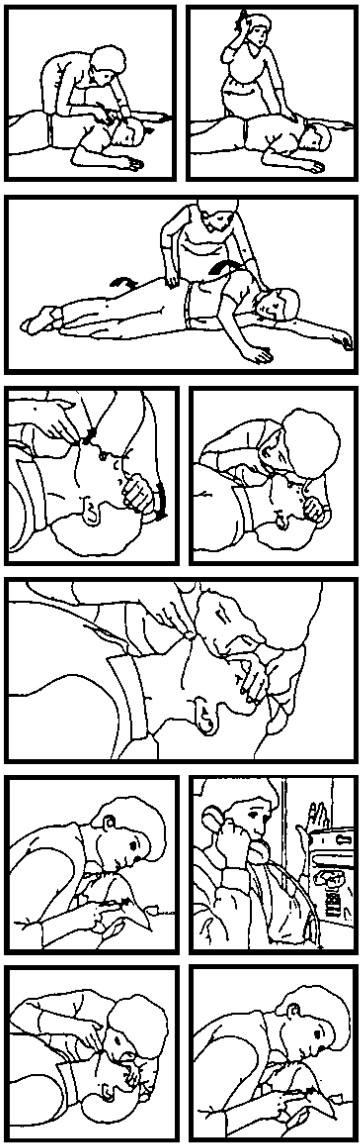
6 Give 2 Full Breaths.

Keep head tilted back.

Pinch nose shut.

Seal your lips tight around victim's mouth.

Give 2 full breaths for 1 to 1½ seconds each.



7 Check for Pulse at side of Neck.

Feel for pulse for 5 to 10 seconds.

8 Phone EMS for Help.

Send someone to call an ambulance.

9 Begin Rescue Breathing.

Keep head tilted back.

Lift chin.

Pinch nose shut.

Give 1 full breath every 5 seconds.

Look, listen, and feel for breathing between breaths.

10 Recheck Pulse Every Minute.

Keep head tilted back.

Feel for pulse for 5 to 10 seconds.

If victim has pulse, not breathing, continue rescue breathing. If no pulse, begin CPR.

A. The Panda Generator

A.1 Type plate at the Generator

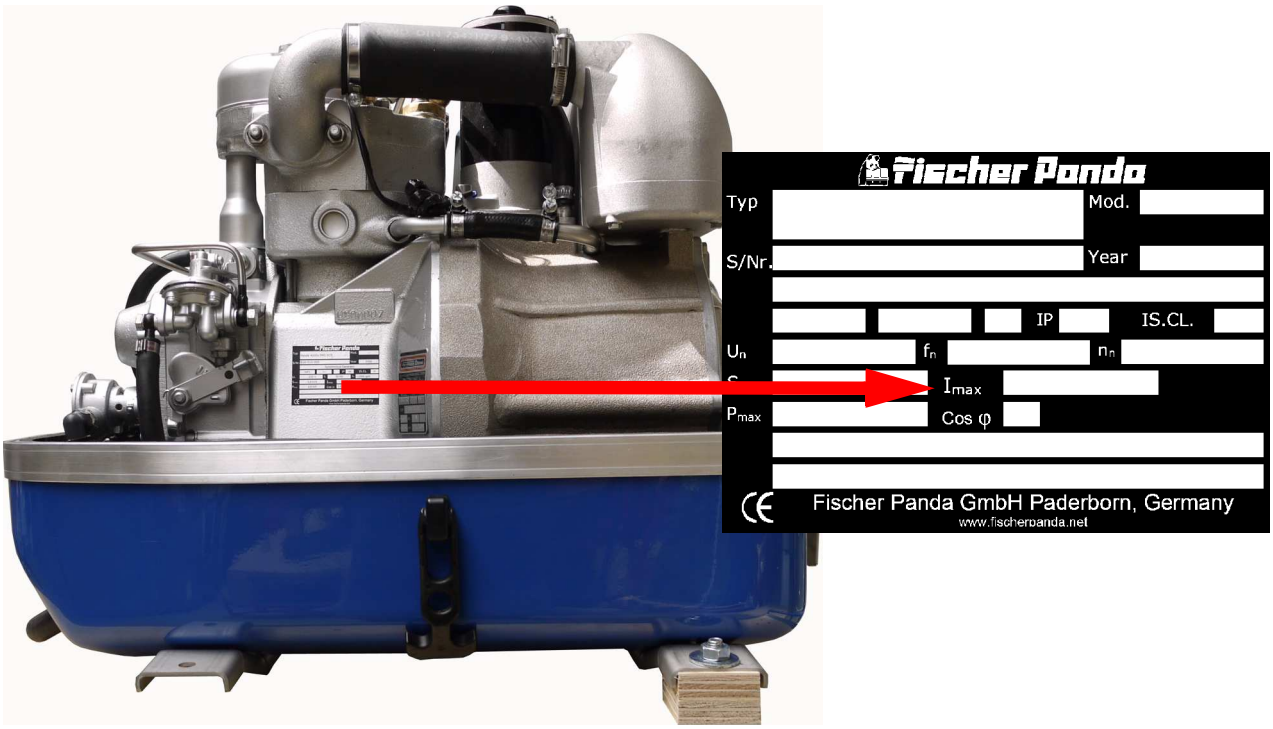


Fig. A.1-1: Type plate at the generator - Picture shows 4000s SCB

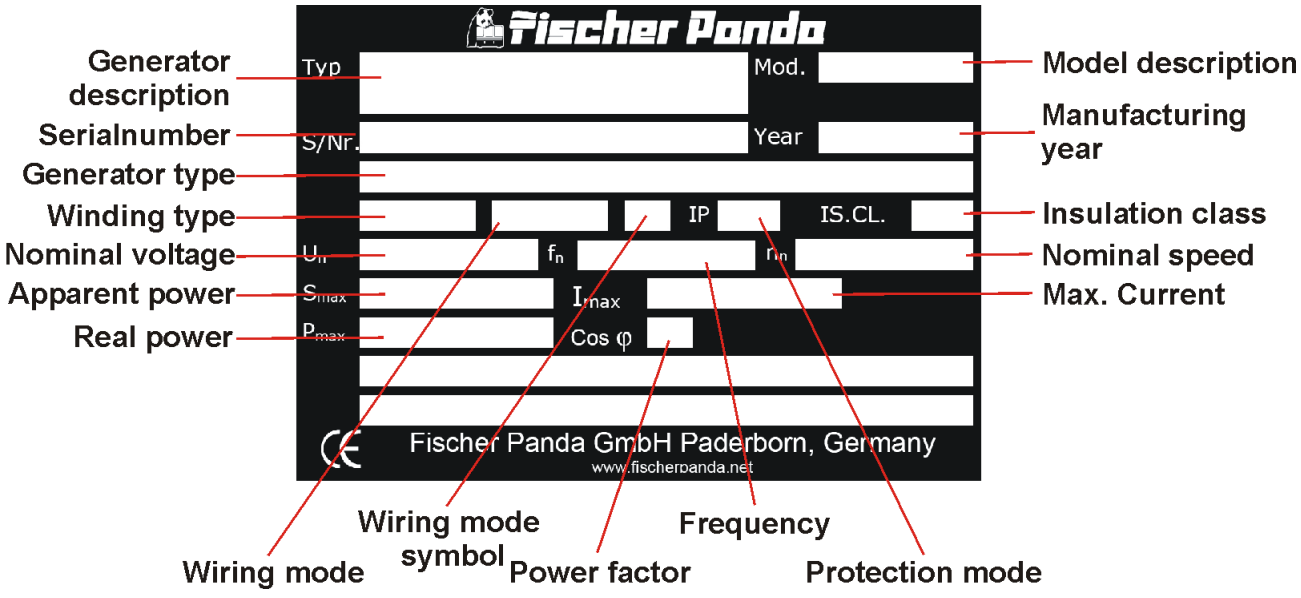
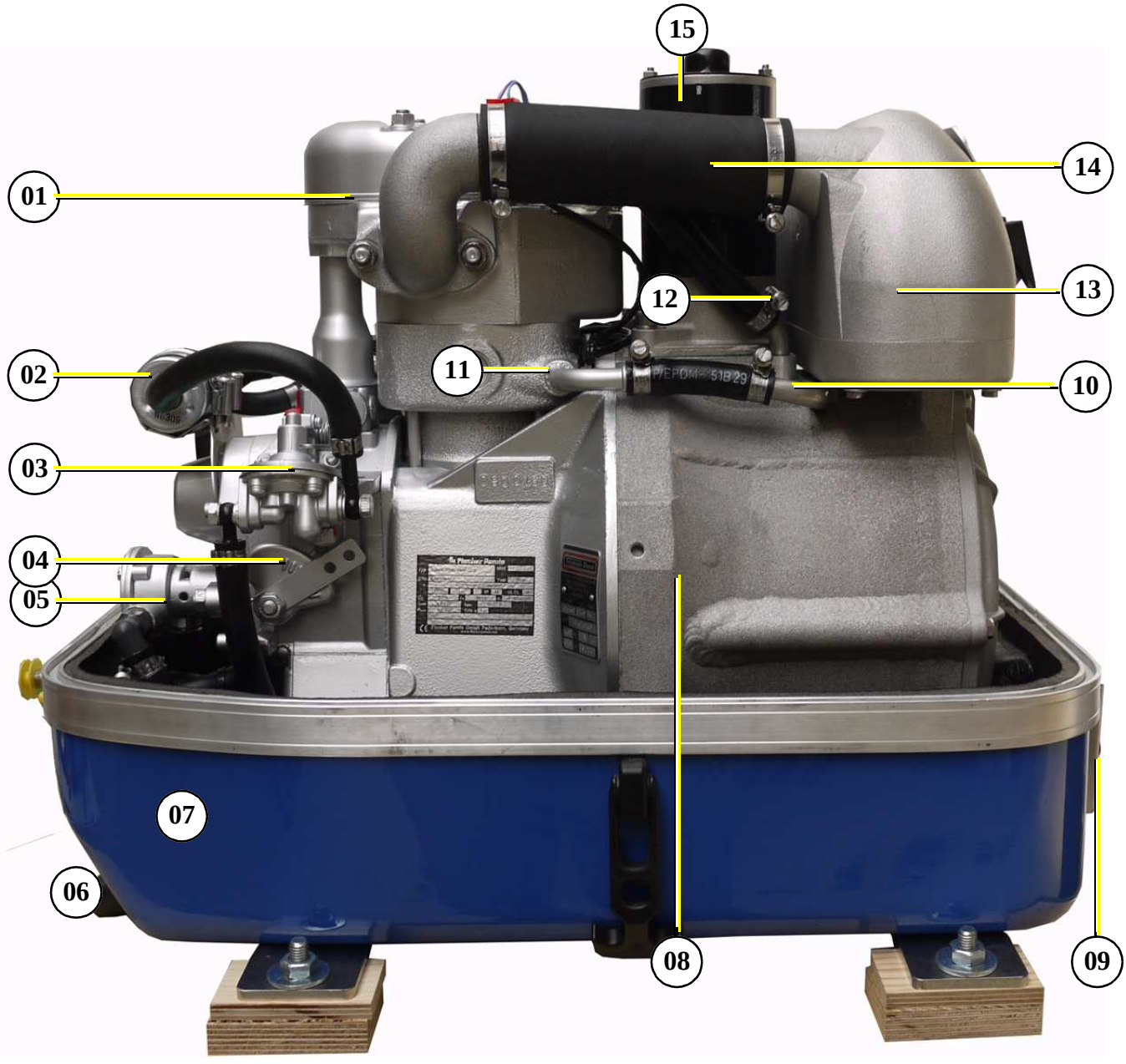


Fig. A.1-2: Discription type plate

A.2 Description of the Generator 4000s SCB PMS

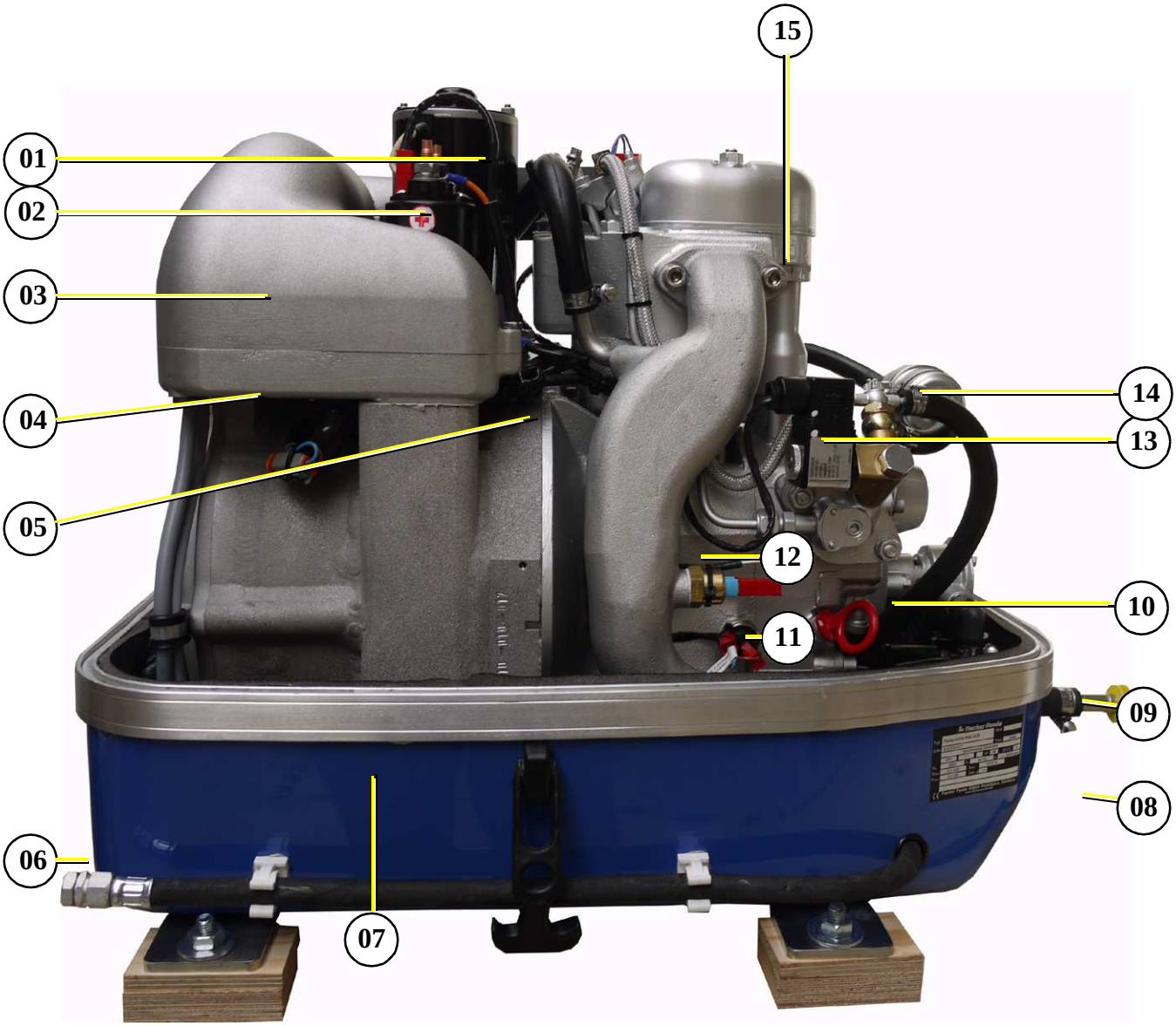
A.2.1 Right Side View 4000s SCB PMS



01) Cylinder head
02) Fuel filter
03) Mechanical fuel pump
04) Speed adjust lever
05) Raw water pump
06) Connection hose for cooling circle ventilation valve
07) Sound cover base part
08) Generator housing with coil
09) Combustian air intake
10) Cooling water out at winding
11) Cooling water in at engine
12) Cooling water bypass from winding out to engine out
13) Generator power terminal box and airfilter housing
14) Air suction hose
15) Starter motor

Fig. A.2.1-1: Right side view

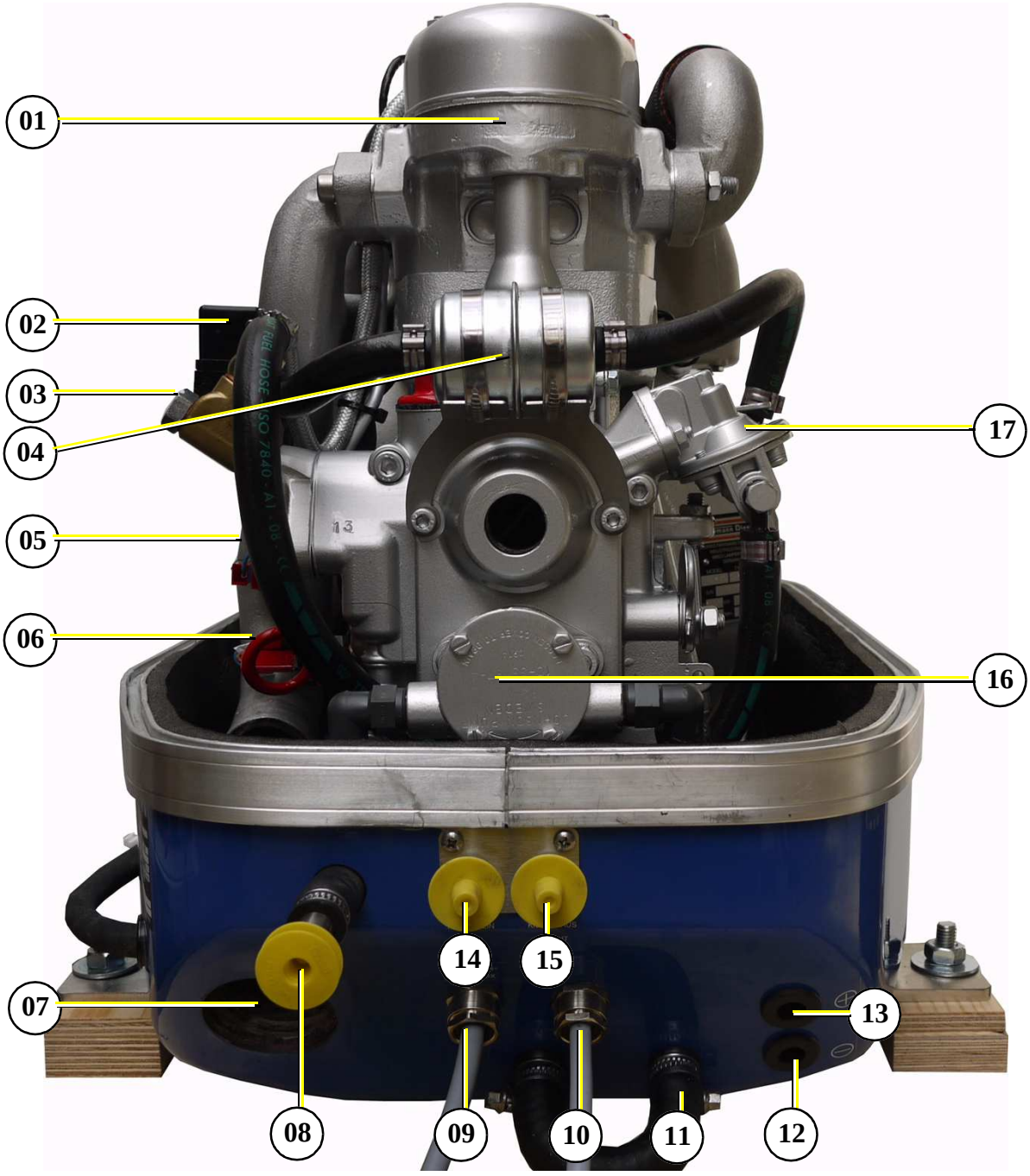
A.2.2 Left Side View 4000s SCB PMS



01) Starter motor
02) Solenoid switch for starter motor
03) Generator power terminal box and airfilter housing
04) Circuit breaker 015A
05) Plug for optional electrical fuel pump
06) Oil drain hose
07) Sound cover base part
08) Cable for load and remote control panel
09) Raw water in
10) Oil dipstick
11) Oil pressure switch
12) Thermo switch exhaust elbow
13) Fuel solenoid valve
14) Fuel filter
15) Cylinder head

Fig. A.2.2-1: Left side view

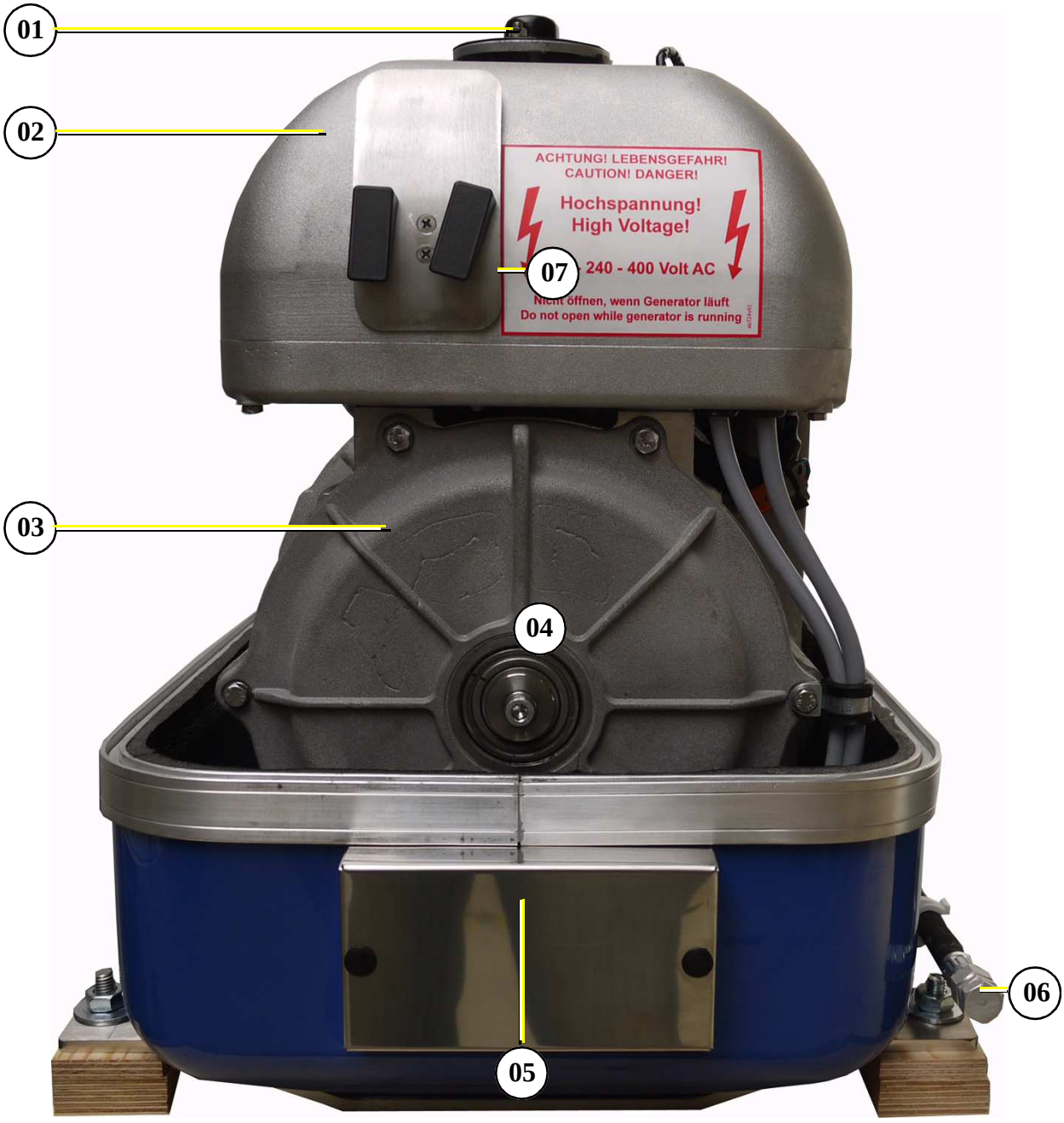
A.2.3 Front View 4000s SCB PMS



01) Cylinder head
02) Fuel solenoid valve
03) Ventilation screw solenoid valve
04) Fuel filter
05) Water cooled exhaust elbow
06) Engine oil dipstick
07) Passage exhaust hose
08) Cooling water in
09) Cable for load
10) Cable for control panel
11) Connection hose for cooling circle ventilation valve
12) Passage for battery cable (-)
13) Passage for battery cable (+)
14) Connection fuel IN
15) Connection fuel OUT
16) Raw water pump
17) Fuel pump

Fig. A.2.3-1: Front view

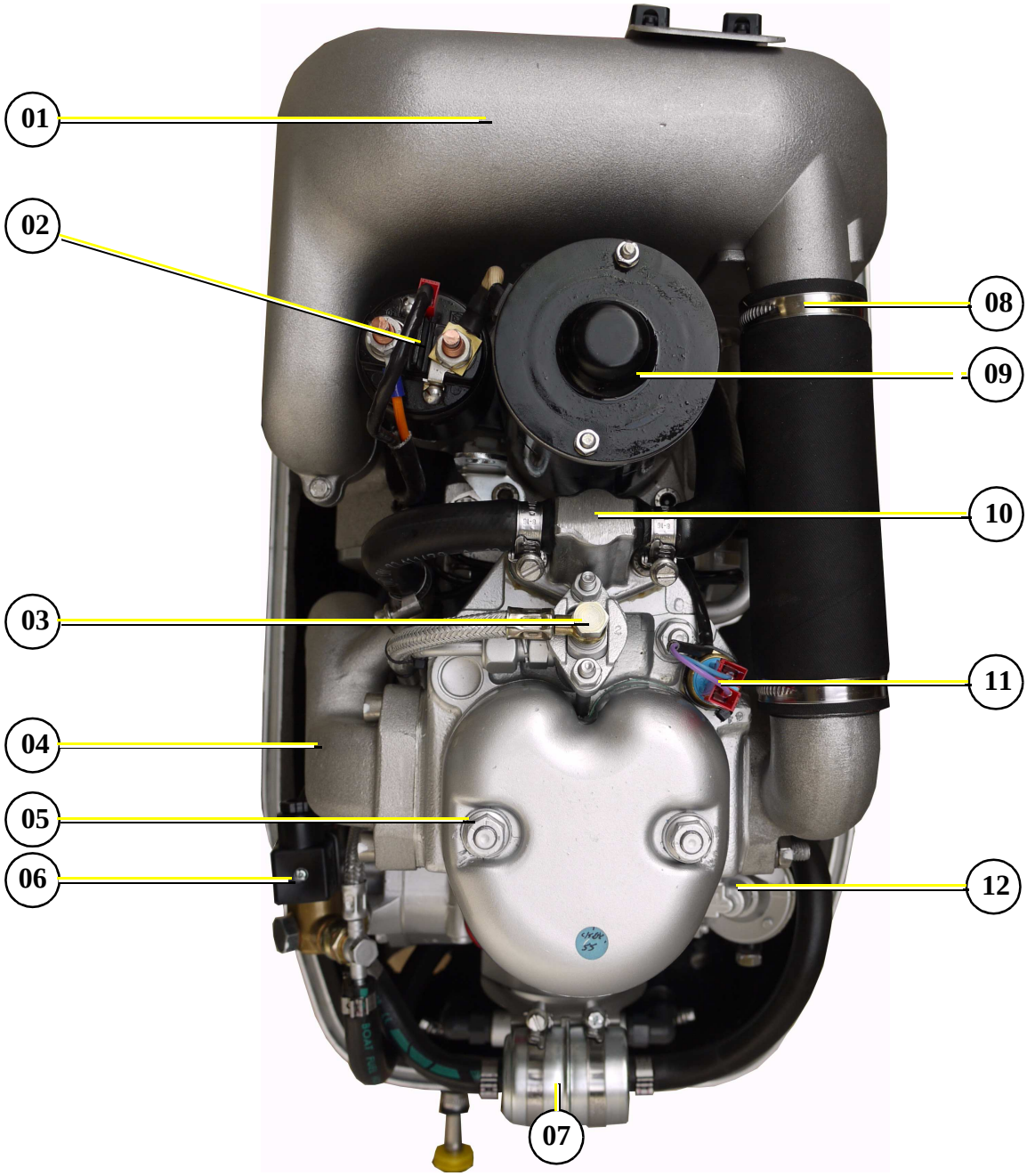
A.2.4 Back View 4000s SCB PMS



01) Starter motor
02) Generator power terminal box and airfilter housing
03) Front plate
04) Ball bearing
05) Air inlet
06) Oil drain hose
07) Air filter holder

Fig. A.2.4-1: Back view

A.2.5 View from above 4000s SCB PMS

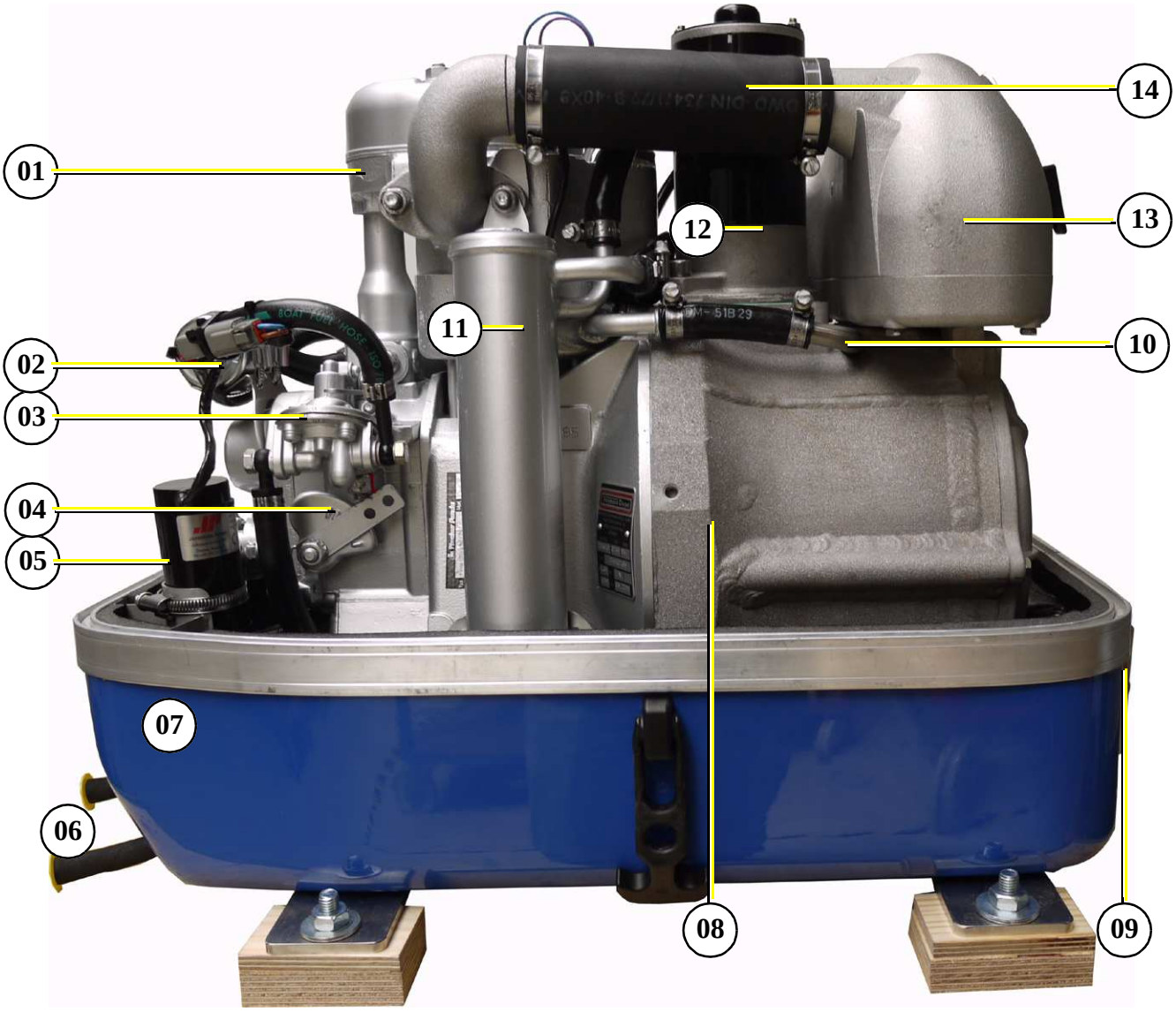


01) Generator power terminal box and airfilter housing
02) Solenoid switch for starter motor
03) Injection nozzle
04) Water-cooled exhaust elbow
05) Cylinder head
06) Fuel solenoid valve
07) Fuel filter
08) Air suction hose
09) Starter motor
10) Cooling water connection block
11) Thermo-switch cylinder head
12) Fuel pump

Fig. A.2.5-1: View from above

A.3 Description of the Generator 4000s FCB PMS

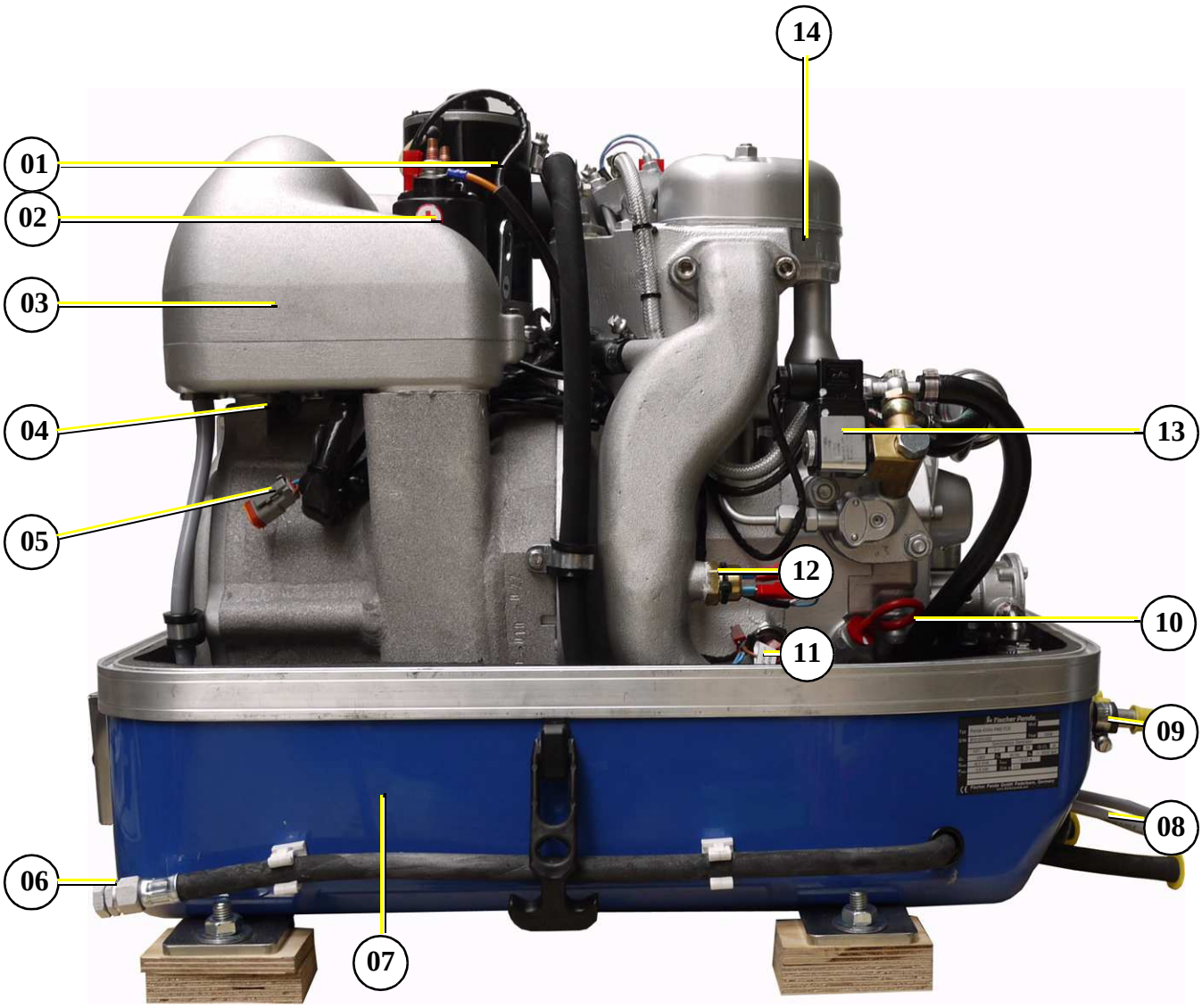
A.3.1 Right Side View 4000s FCB PMS



01) Cylinder head
02) Fuel Filter
03) Mechanical fuel pump
04) Speed adjust lever
05) Fresh water pump
06) Connection hose for cooling circle ventilation valve
07) Sound cover base part
08) Generator housing with coil
09) Combustian air intake
10) Cooling water out at winding
11) Heat exchanger
12) Starter motor
13) Generator power terminal box and airfilter housing
14) Air suction hose

Fig. A.3.1-1: Right side view

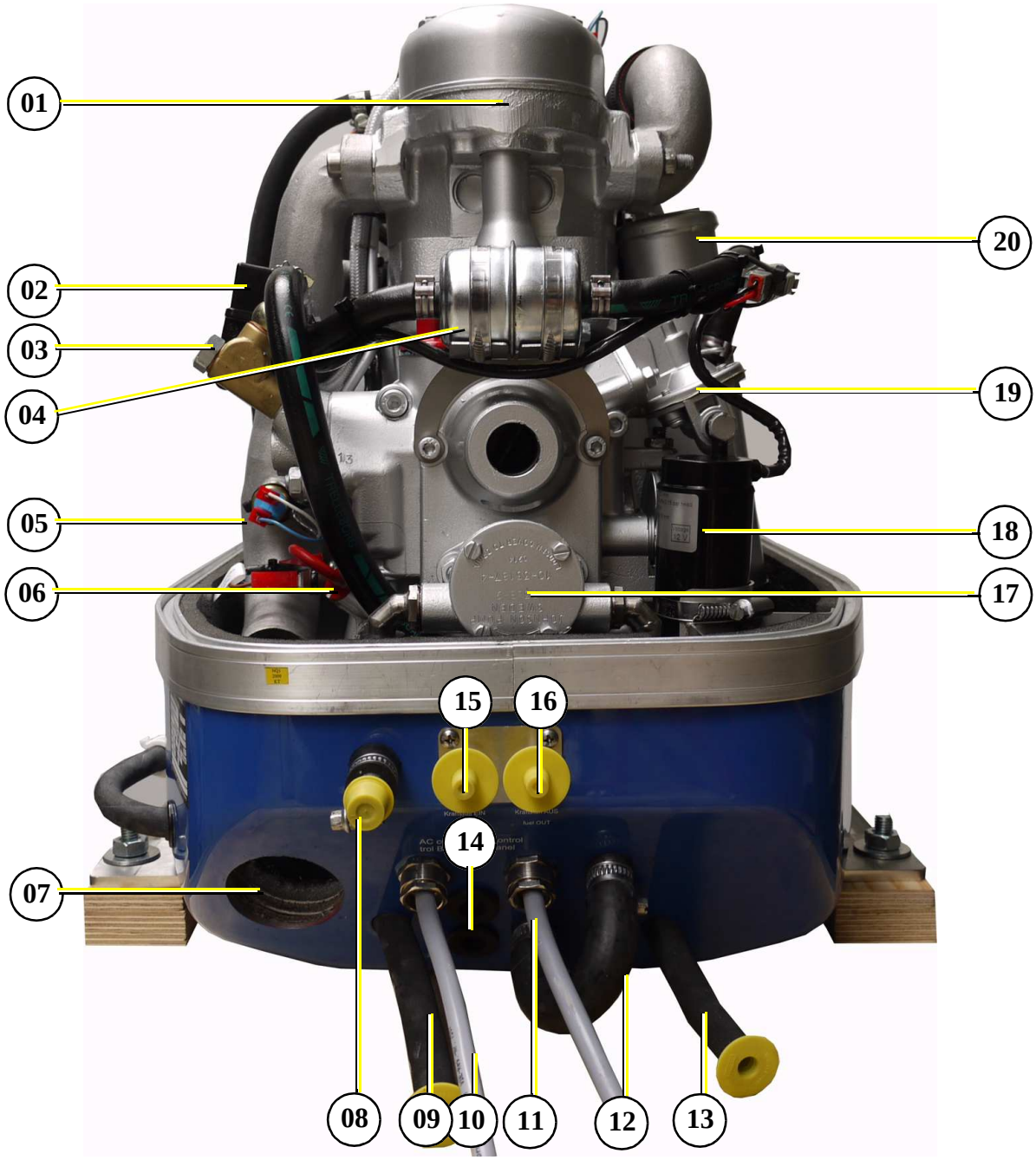
A.3.2 Left Side View 4000s FCB PMS



01) Starter motor
02) Solenoid switch for starter motor
03) Generator power terminal box and airfilter housing
04) Circuit breaker 015A
05) Plug for optional electrical fuel pump
06) Oil drain hose
07) Sound cover base part
08) Cable for load and remote control panel
09) Raw water in
10) Oil dipstick
11) Oil pressure switch
12) Thermo switch exhaust elbow
13) Fuel solenoid valve
14) Cylinder head

Fig. A.3.2-1: Left side view

A.3.3 Front View 4000s 4000s FCB PMS



01) Cylinder head
02) Fuel solenoid valve
03) Ventilation screw solenoid valve
04) Fuel filter
05) Water cooled exhaust elbow
06) Engine oil dipstick
07) Passage exhaust hose
08) Cooling water in
09) Connection hose for external expension tank
10) Cable for load
11) Cable for control panel
12) Connection hose for cooling circle ventilation valve
13) Connection hose for external expension tank
14) Passage for battery cable (-) AND (+)
15) Connection fuel IN
16) Connection fuel OUT
17) Raw water pump
18) Fresh water pump
19) Fuel pump
20) Heat exchanger

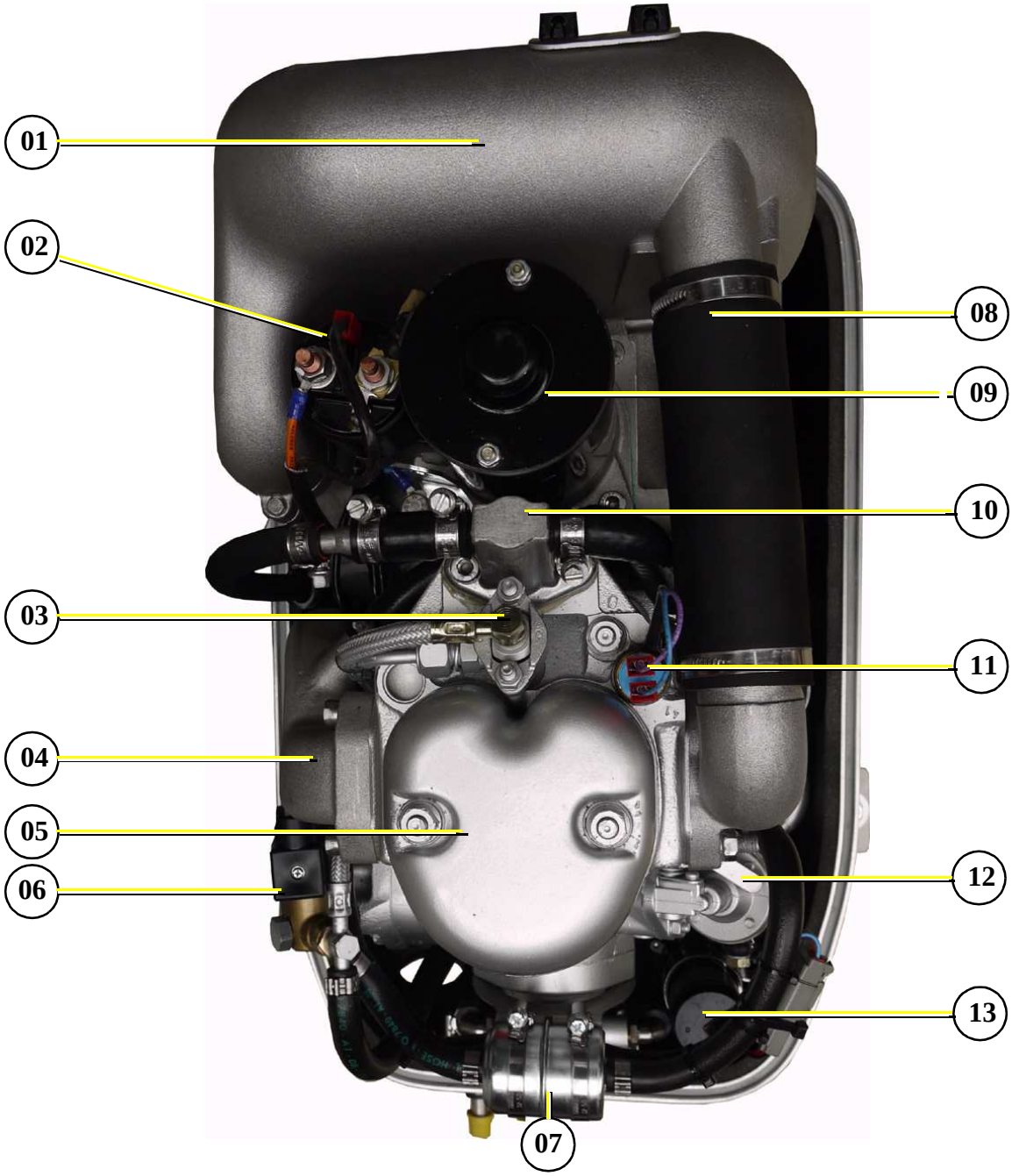
Fig. A.3.3-1: Front view

A.3.4 Back View 4000s FCB PMS

01) Starter motor
02) Generator power terminal box and airfilter housing
03) Air filter holder
04) Front plate
05) Ball bearing
06) Air inlet
07) Oil drain hose

Fig. A.3.4-1: Back view

A.3.5 View from above 4000s FCB PMS



01) Generator power terminal box and airfilter housing
02) Solenoid switch for starter motor
03) Injection nozzle
04) Water-cooled exhaust elbow
05) Cylinder head
06) Fuel solenoid valve
07) Fuel filte
08) Air suction hose
09) Starter motor
10) Cooling water connection block
11) Thermo-switch cylinder head
12) Fuel pump
13) Fresh water pump

Fig. A.3.5-1: View from above

A.4 Details of Functional Units

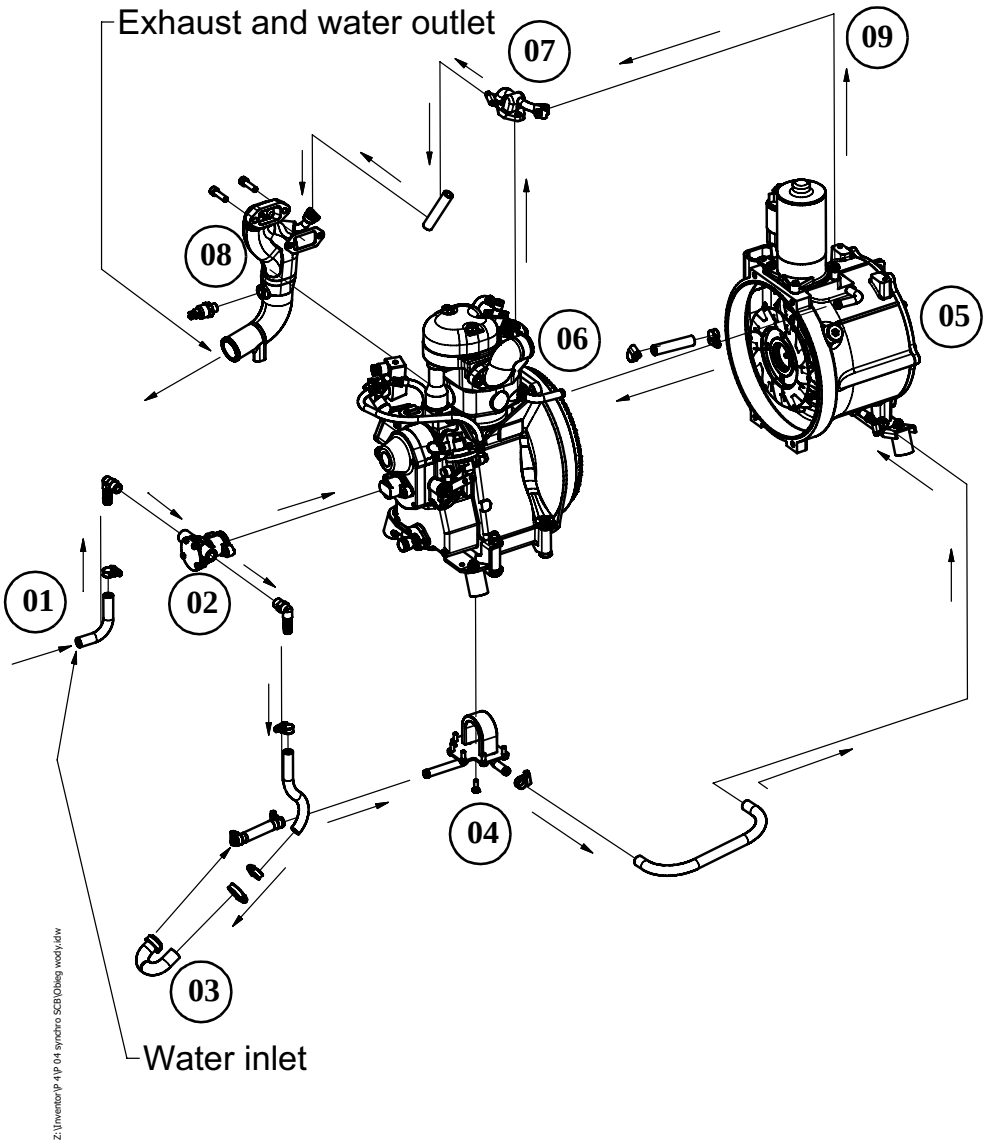
A.4.1 Remote Control Panel - see Remote Control Panel Datasheet

Remote Control Panel

The remote control panel is necessary to control the generator and to evaluate the motor/generator properties. The generators will automatically cutout, if it does not run as required. The generator may not be run without the remote control panel.

A.4.2 Components of Cooling System (Raw water) 4000s SCB

One circle system



01) Cooling water in (raw water in)
02) Raw water pump
03) Connection hose for cooling circle ventilation valve
04) Oil cooler (heat exchanger)
05) Generator housing with coil
06) Cooling water in at engine
07) Water connection block (cooling water out at engine)
08) Water cooled exhaust elbow
09) Bypass between generator housing and cooling water connection block

Raw water intake

The diagram shows the supply pipes for the generator. The connection neck for the raw water connection is shown on the right hand side. The cross-section of the intake pipe should be nominally larger than the generator connection.

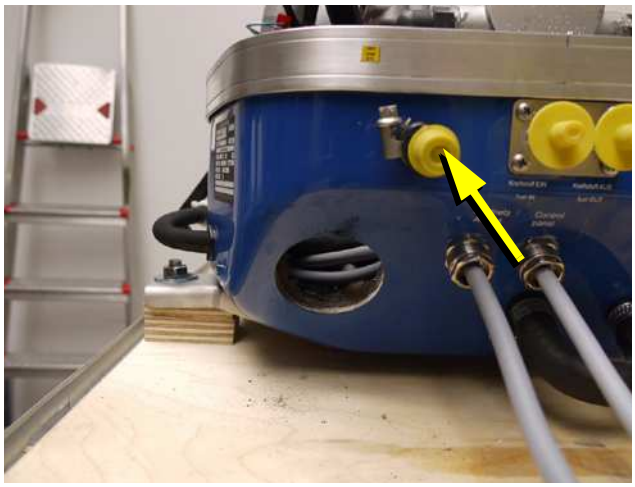


Fig. A.4.2-1: Raw water intake

Raw water impeller pump

The raw water pump is fitted with a rubber impeller. This pump is self-inductive. If, for example, you forget to open the sea valve, then you must expect the impeller to be destroyed after a short period of time. It is recommended to store several impellers on board as spare parts.

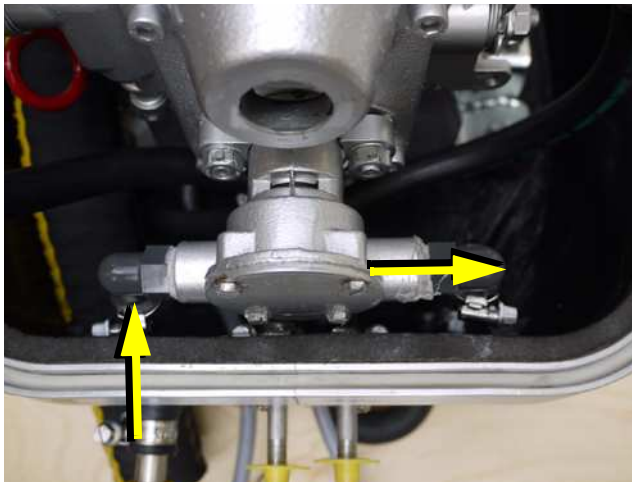


Fig. A.4.2-2: Raw water impeller pump

Ventilation valve

An appropriate ventilation line must be installed, if the danger exists that the generator can stand only briefly by movements of the ship below the waterlinie. For this generally a hose line is prepared at the generator housing. The two pipe unions are bridged by a hose shaped part, which can be removed.

The raw water flows then through the oil cooler, which is mounted under the engine.

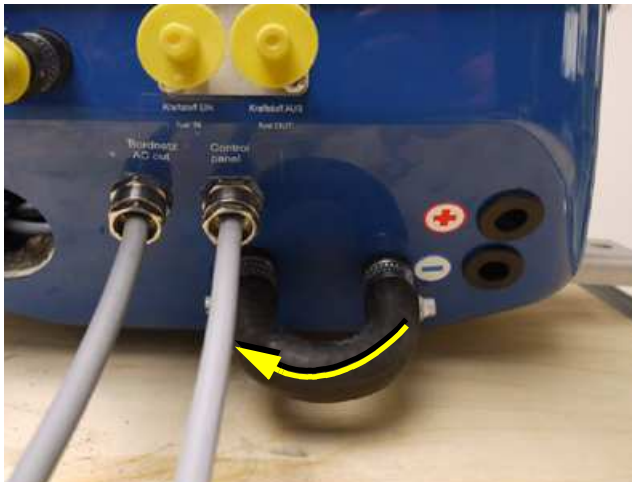


Fig. A.4.2-3: Connection external ventilation valve

Generator housing

The water in is at the bottem of the Generator housing. The water out is at the top of the generator.

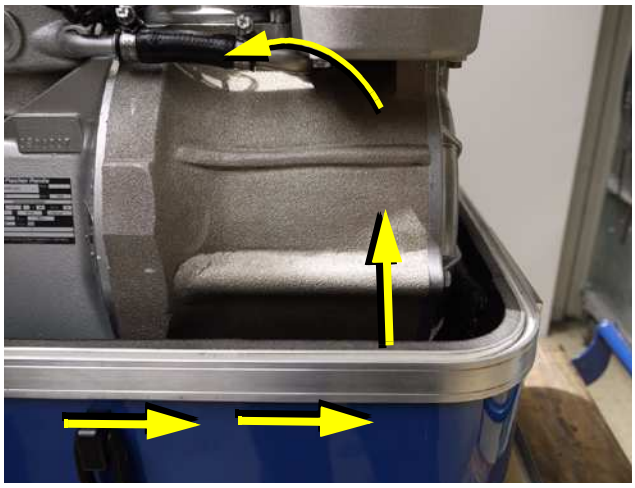


Fig. A.4.2-4: Generator housing

Engine in

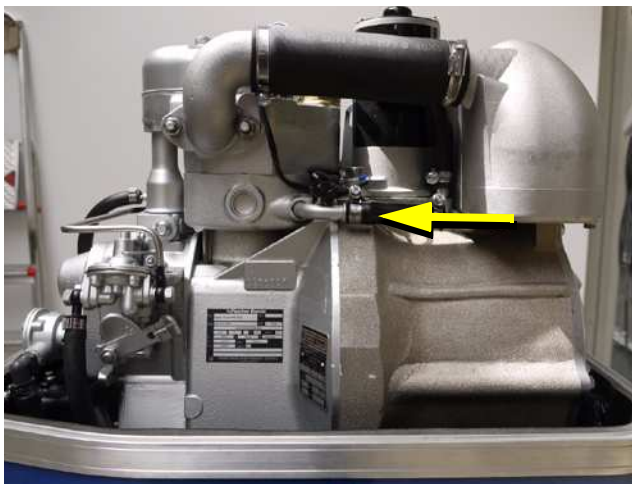


Fig. A.4.2-5: Engine in

Engine out (water connection block)

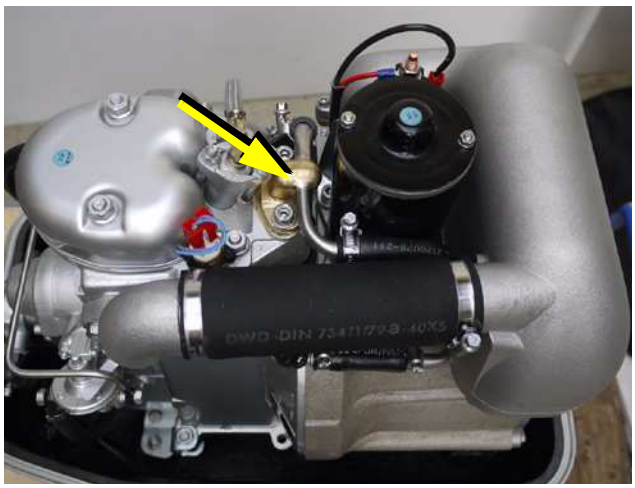


Fig. A.4.2-6: Engine out

Injection Port Raw Water

The point of introduction (point of injecting) for the raw water cooled exhaust system of the marine generator is at the exhaust elbow. The exhaust elbow must be checked regularly carefully for traces by corrosion.

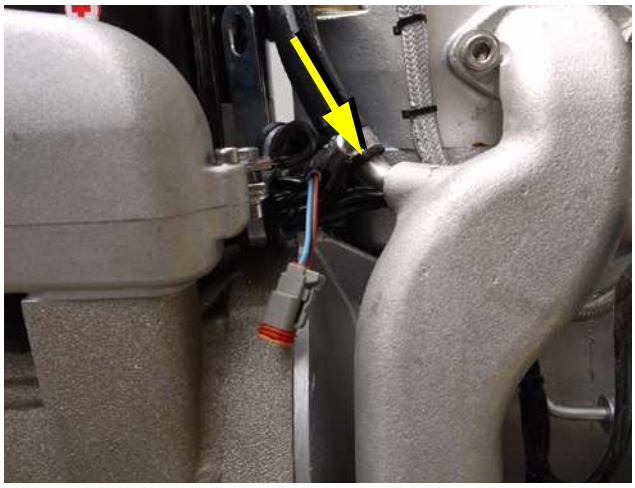


Fig. A.4.2-7: Injection raw water

Raw Water Output

The raw water discharges together with the exhaust.

Fig. A.4.2-8: Raw water output

Bypass

There is a bypass from the generator housing to the water connection block.

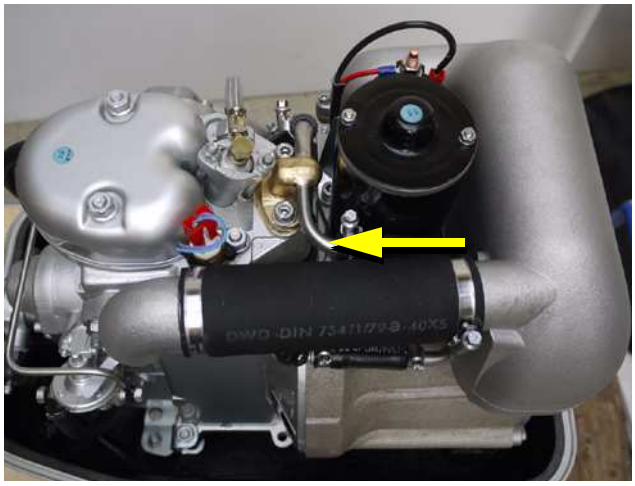
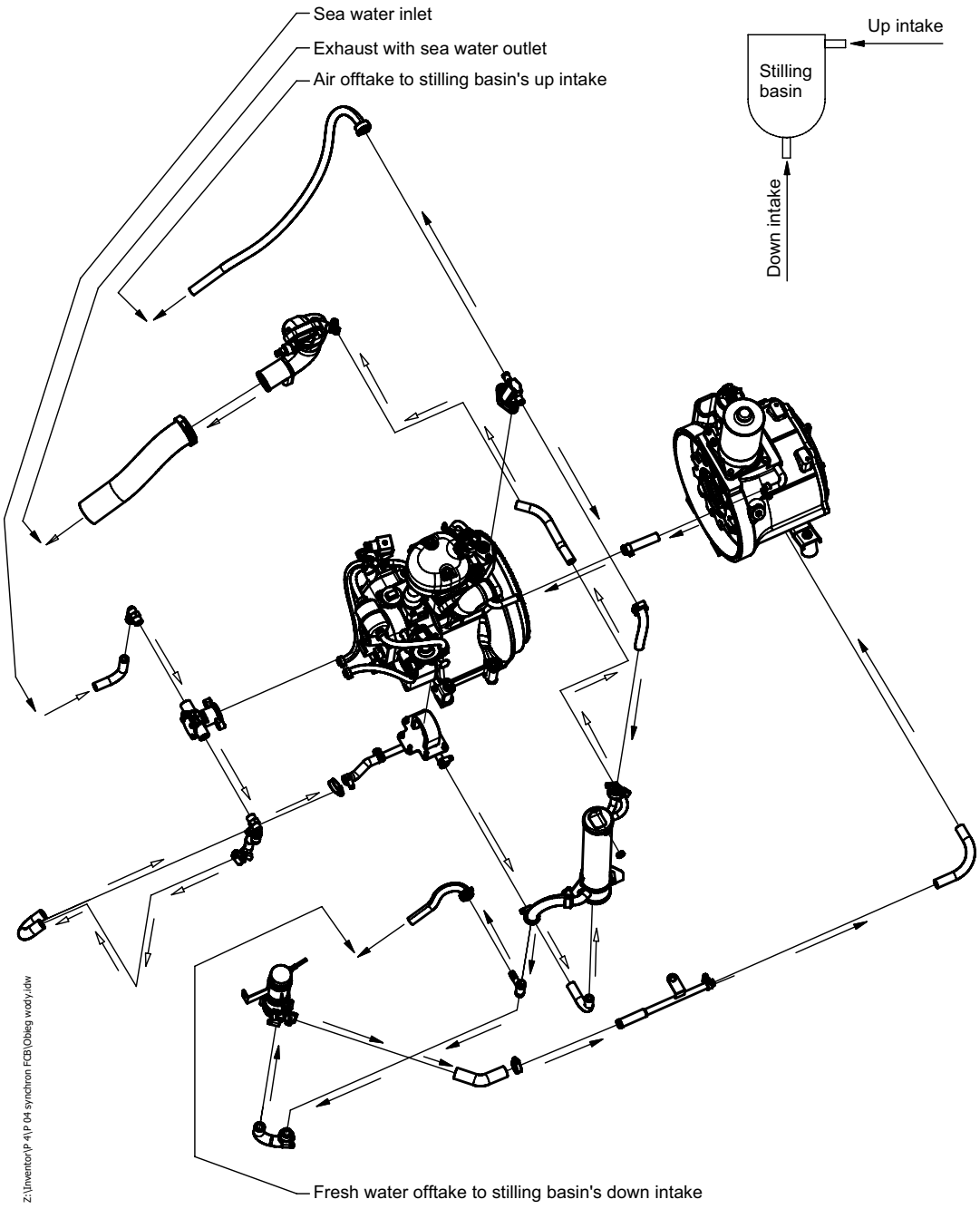


Fig. A.4.2-9: Bypass

A.4.3 Components of Cooling System (Raw water + Fresh water) 4000s FCB

Two circle system



01) Cooling water in (raw water in)
02) Raw water pump
03) Connection hose for cooling circle ventilation valve
04) Oil cooler (heat exchanger)
05) Generator housing with coil
06) Cooling water in at engine
07) Water connection block (cooling water out at engine)
08) Water cooled exhaust elbow
09) Bypass between generator housing and cooling water connection block

A.4.3.1Components of Cooling System (Raw water) 4000s FCB

Raw water intake

The diagram shows the supply pipes for the generator. The connection neck for the raw water connection is shown on the right hand side. The cross-section of the intake pipe should be nominally larger than the generator connection.

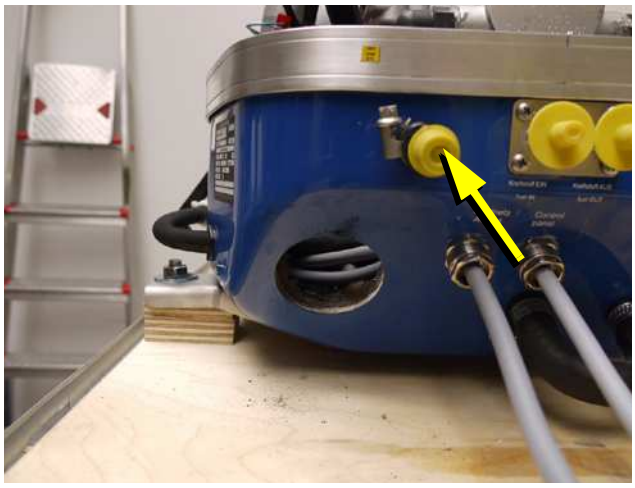


Fig. A.4.3-1: Raw water intake

Raw water impeller pump

The raw water pump is fitted with a rubber impeller. This pump is self-inductive. If, for example, you forget to open the sea valve, then you must expect the impeller to be destroyed after a short period of time. It is recommended to store several impellers on board as spare parts.

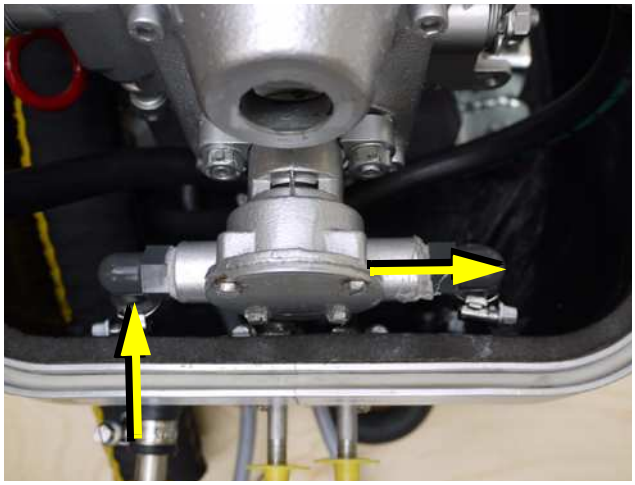


Fig. A.4.3-2: Raw water impeller pump

Ventilation valve

An appropriate ventilation line must be installed, if the danger exists that the generator can stand only briefly by movements of the ship below the waterlinie. For this generally a hose line is prepared at the generator housing. The two pipe unions are bridged by a hose shaped part, which can be removed.

The raw water flows then through the oil cooler, which is mounted under the engine.

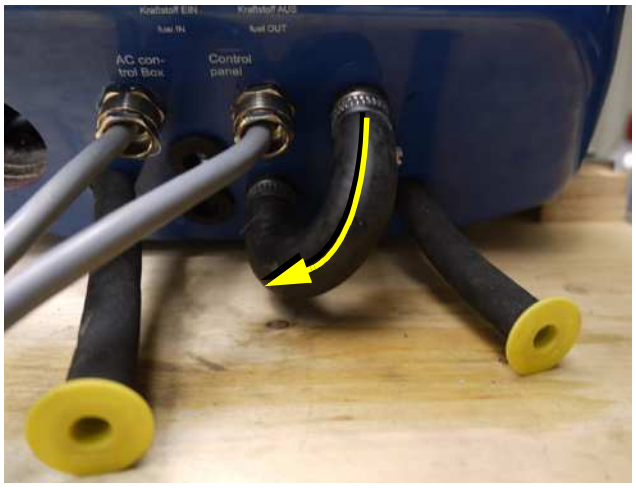


Fig. A.4.3-3: Connection external ventilation valve

Heat exchanger

The internal fresh water cooling circle is separated by the heat exchanger from the raw water cooling circle. It is reached that the raw water circle does not come with the construction units of the generator into contact. The raw water commes from the oil cooler and is led at the discharge of the heat exchanger directly into the exhaust elbow.

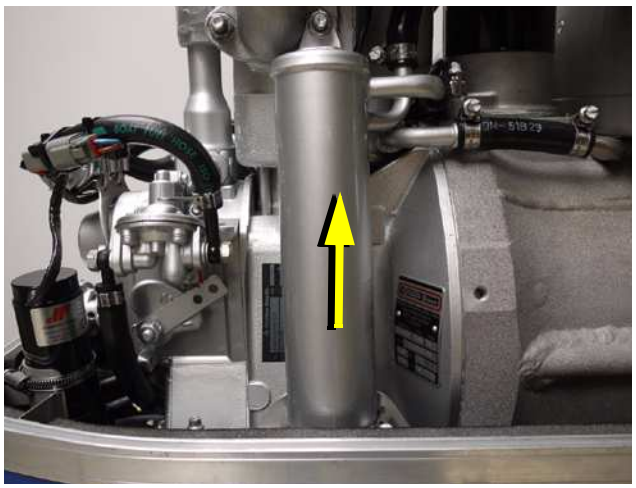


Fig. A.4.3-4: Heat exchanger

Injection port raw water

The point of introduction (point of injecting) for the raw water cooled exhaust system of the marine generator is at the exhaust elbow. The exhaust elbow must be checked regularly carefully for traces by corrosion.

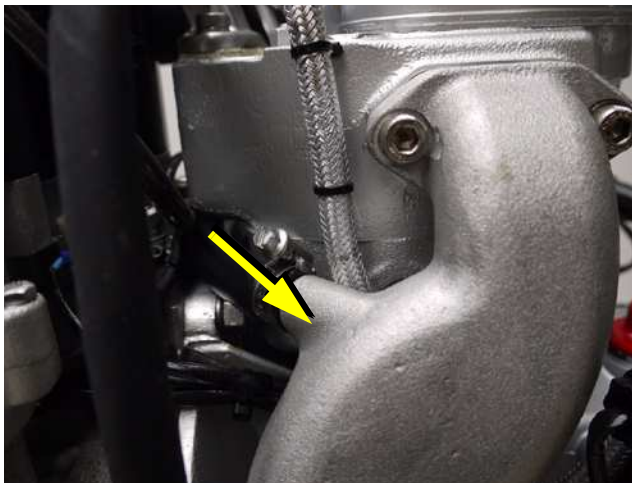


Fig. A.4.3-5: Injection raw water

Raw water output

The raw water discharges together with the exhaust.

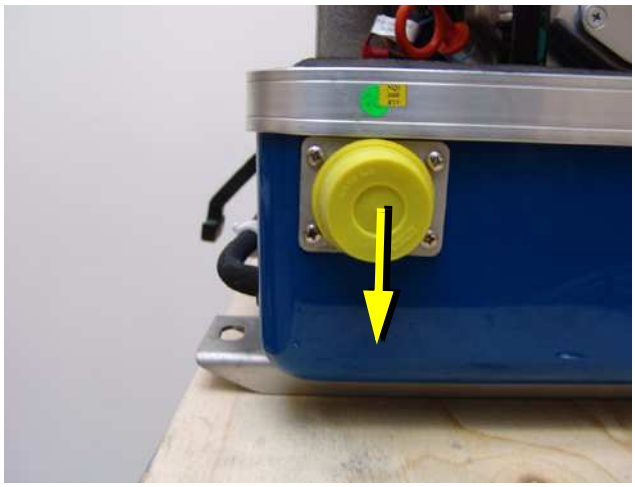


Fig. A.4.3-6: Raw water output

A.4.3.2Components of Cooling System (Fresh water)4000s FCB

Connection external expansion tank

The external expansion tank is connected by two hose connections.

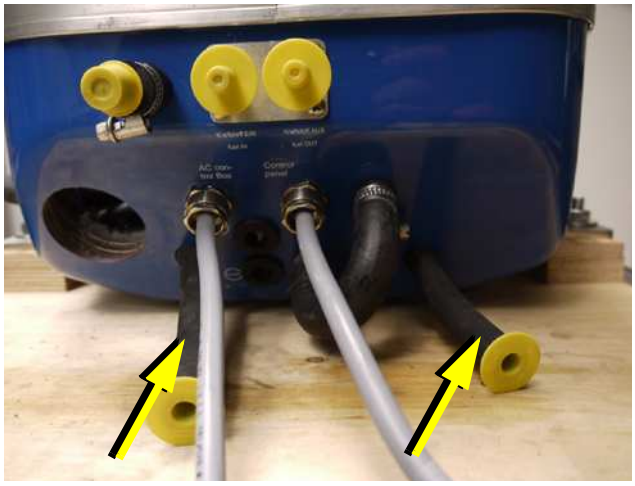


Fig. A.4.3-1: Connection external expansion tank

Cooling water pump

The cooling water pump pumps the fresh water from the heat exchanger to the generator housing.

Fig. A.4.3-2: Cooling water pump

Generator housing

The water in is at the bottem of the Generator housing. The water out is at the top of the generator.

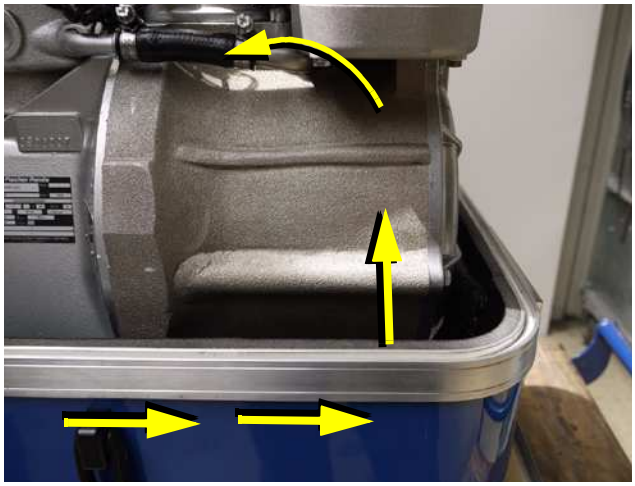


Fig. A.4.3-3: Generator housing

Engine in

Fig. A.4.3-4: Engine in

Engine out (water connection block)

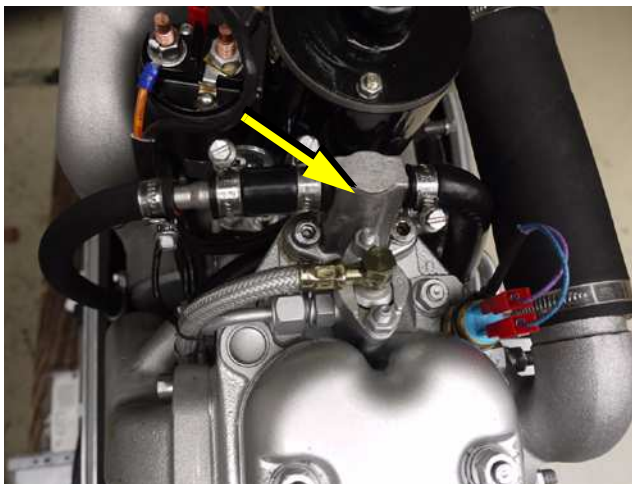


Fig. A.4.3-5: Engine out

Heat exchanger

The heat exchanger separates the internal fresh water cooling circle from the raw water cooling circle, so that the generator components do not have contact with the raw water circulation system. The raw water is fed directly to the exhaust connection piece at the heat exchanger outlet.

The fresh water flows to the cooling water pump.

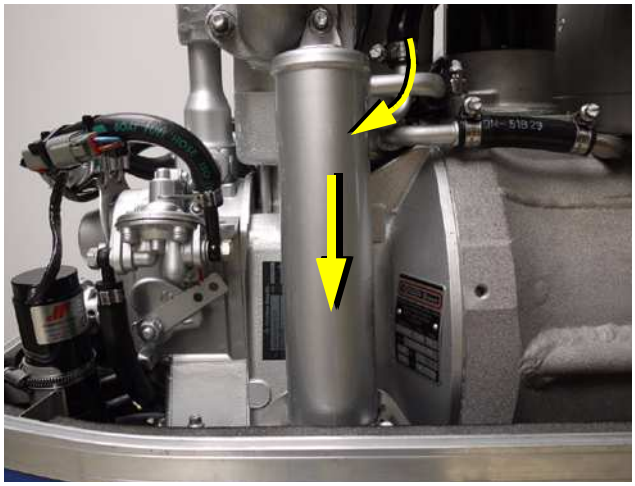


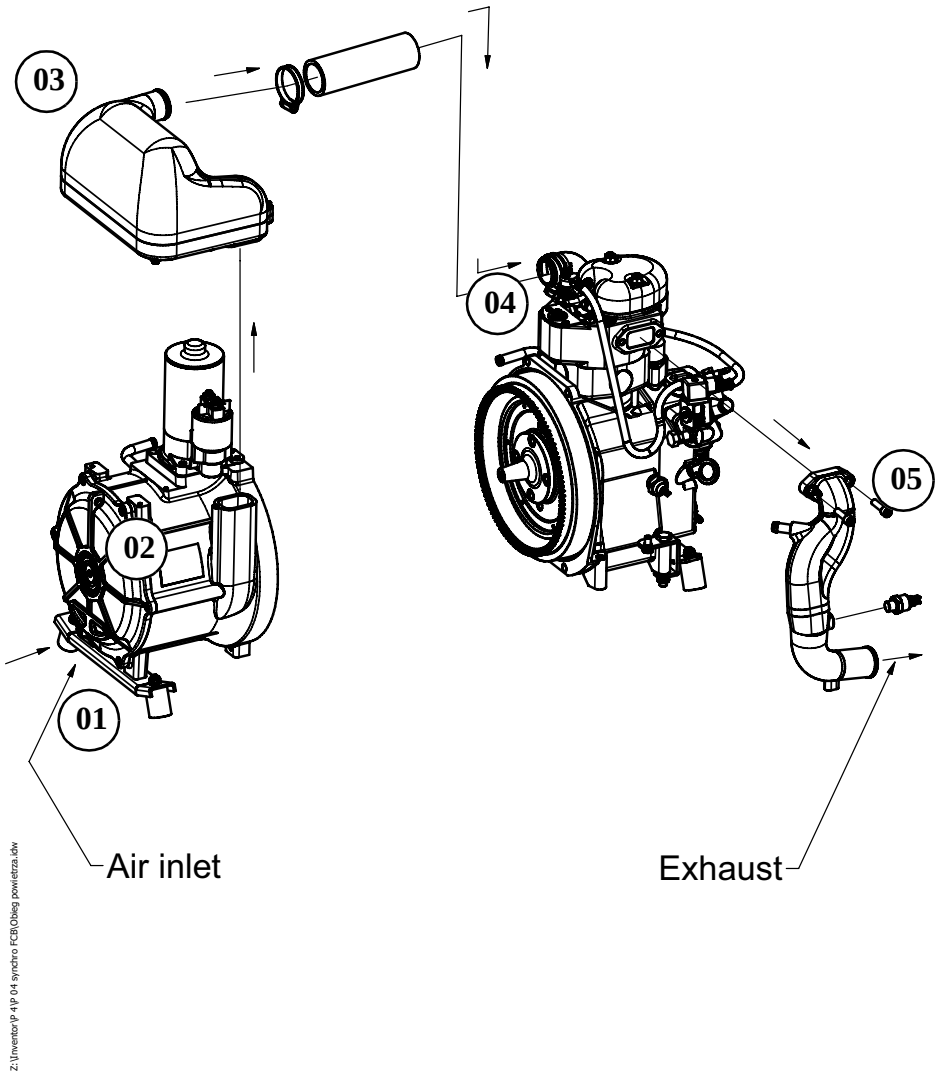
Fig. A.4.3-6: Heat exchanger

Cooling water pump

The cooling water pump pumps the fresh water from the heat exchanger to the generator housing.

Fig. A.4.3-7: Cooling water pump

A.4.4 Components of conbustion air 4000s SCB + 4000s FCB



01) Air inlet
02) Generator housing with coil
03) Generator power terminal box and airfilter housing
04) Air in at engine
05) Water cooled exhaust elbow

Combustion air intake

The sound insulated capsule for the marine generator is normally provided at the side surface with drillings, through which the combustion air can influx.

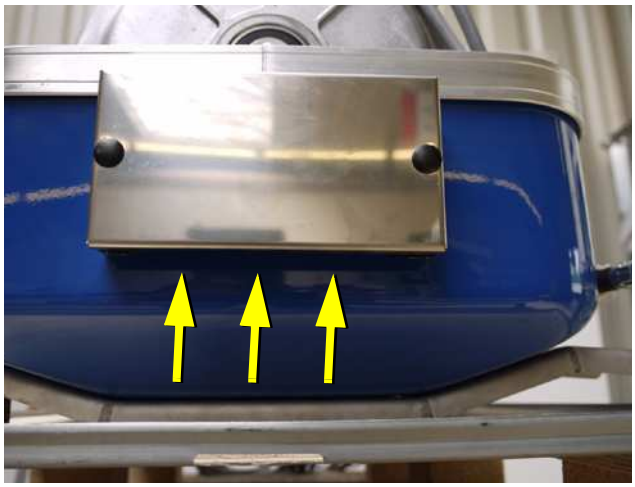


Fig. A.4.4-1: Combustion air intake

Cooling of the generator housing

The cumbustian air is pre-warmed in the generator housing. This supports the cooling of the winding.

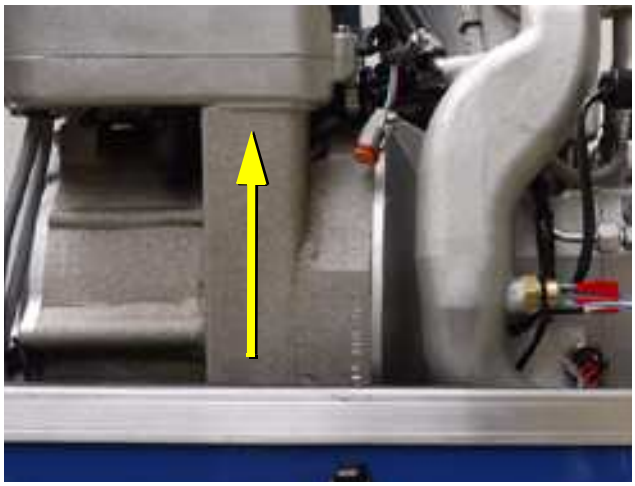


Fig. A.4.4-2: Combustion air intake

Air suction housing

If the capsule is removed, the inside of the air suction housing becomes visible. In these air suction housing is a filter element. In the marine version, the filter is normally not changed. It should be checked once in a while.

Fig. A.4.4-3: Air suction housing

Exhaust elbow

At the back of the engine is the water-cooled exhaust elbow.

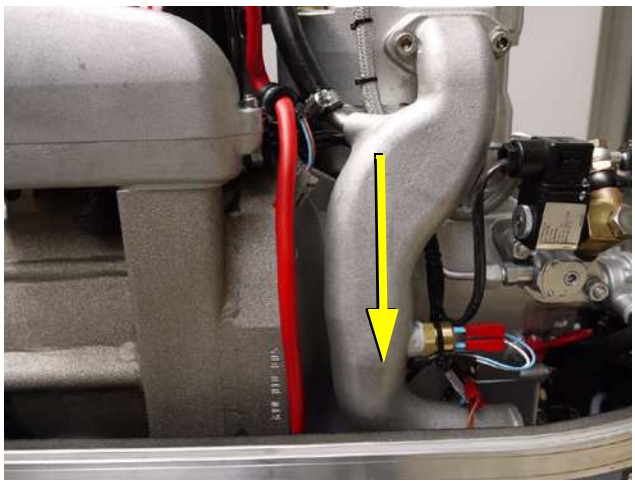


Fig. A.4.4-4: Exhaust elbow

Exhaust outlet

Connect the exhaust pipe with the water lock.

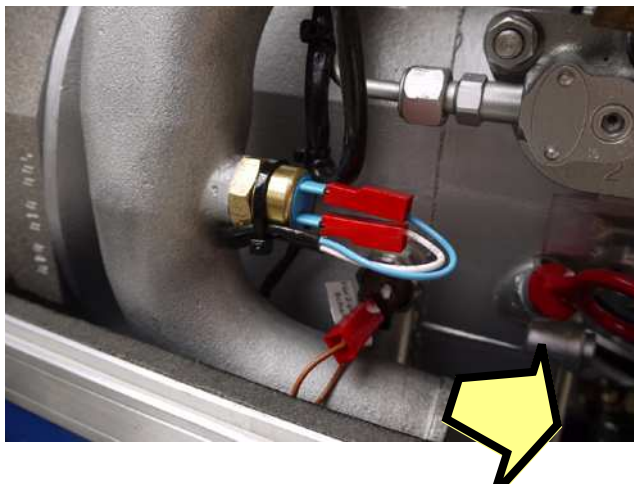
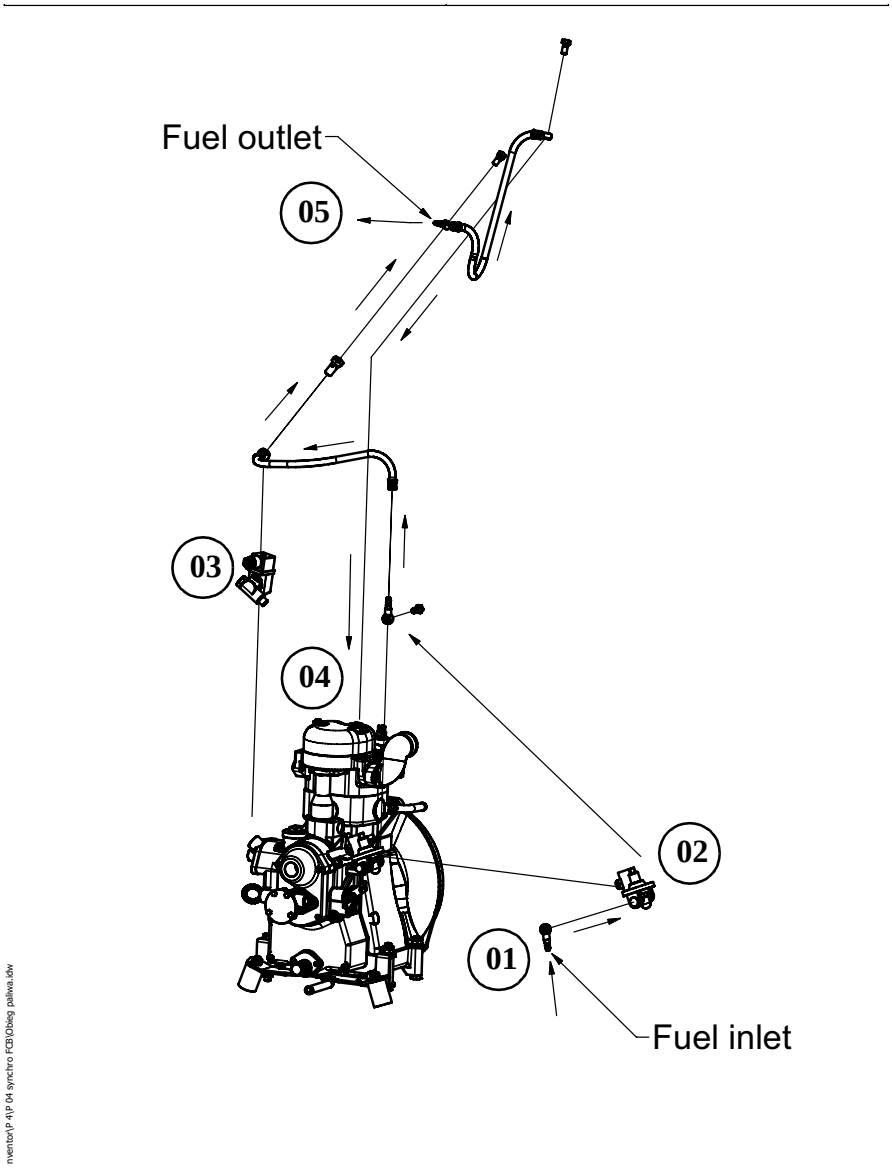


Fig. A.4.4-5: Exhaust output

A.4.5 Components of the Fuel System 4000s SCB + 4000s FCB



01) Fuel in
02) Fuel pump
03) Fuel stop solonoid
04) Injection nozzle at engine
05) Fuel out (Fuel return line)

Connecting pieces for the fuel pipes

1. Fuel IN

2. Fuel OUT

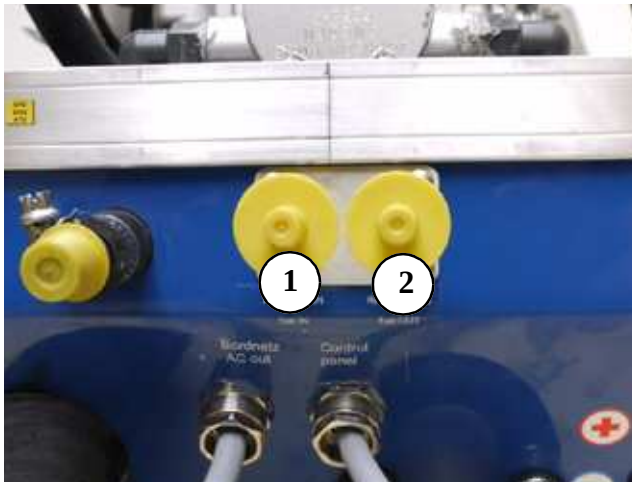


Fig. A.4.5-1: Fuel connections

Fuel pump

Fig. A.4.5-2: External fuel pump

Fuel solenoid valve

The fuel solenoid valve opens automatically if „START“ is pressed on the remote control panel. The solenoid closes, when the generator is switched to „OFF“ position. It takes a few seconds before the generator stops.

If the generator does not start or does not run smoothly (i.e. stutters), or does not attain full speed, then the cause is foremostly the solenoid.

Fig. A.4.5-3: Fuel solenoid valve

Injection nozzle at engine

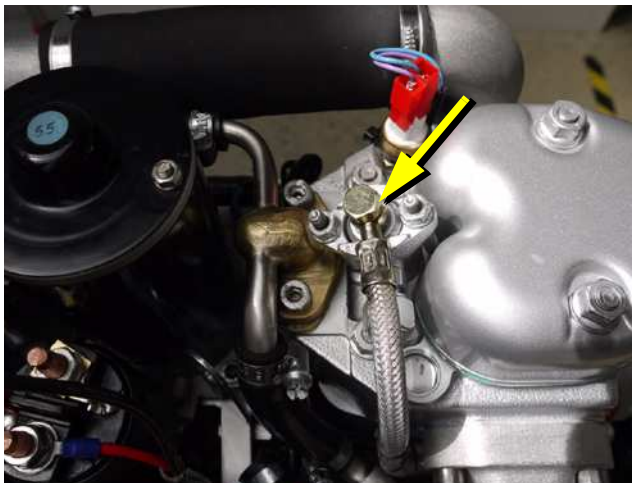


Fig. A.4.5-4: Injection nozzle at engine

A.4.6 Components of Electrical System 4000s SCB + 4000s FCB

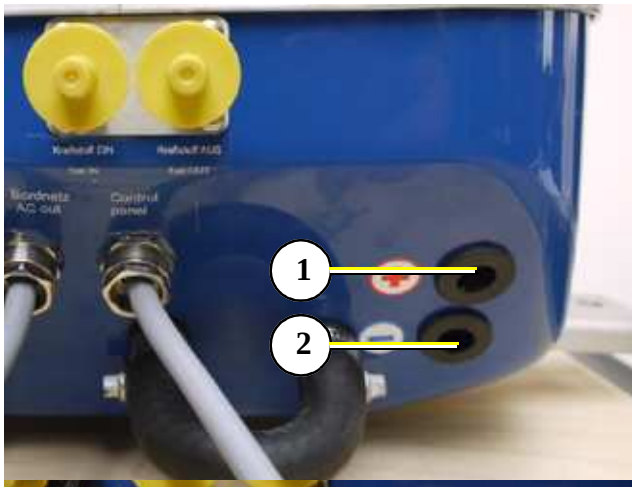
Connection starter battery

1. Passage for starter battery cable (plus)

2. Passage for starter battery cable (minus)

During the connection to the starter battery it must always be ensured that the contact is perfectly guaranteed.

4000s SCB --->



4000s FCB -->

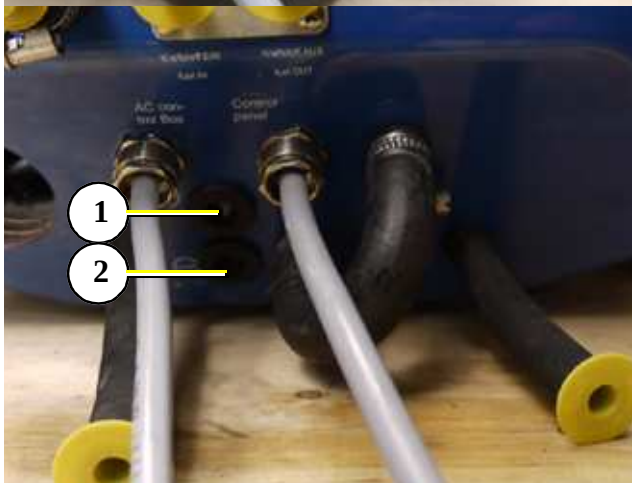


Fig. A.4.6-1: Connections for starter battery

Electrical connections for control and load

At the front of the generator are also all remaining cables for the electrical connections depending upon type.

1. Remote control panel

2. AC out

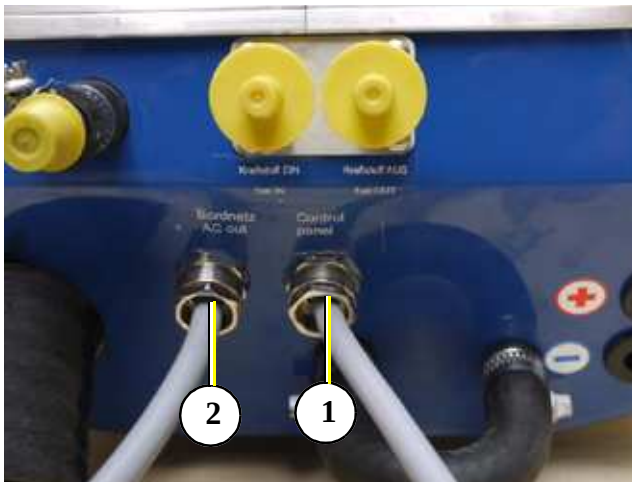


Fig. A.4.6-2: Load

Fuel Pump connection point

An optional electrical fuel pump can be connected at the left side of the generator.

1. Plug Type „Deutsch“ for external electrical fuel pump

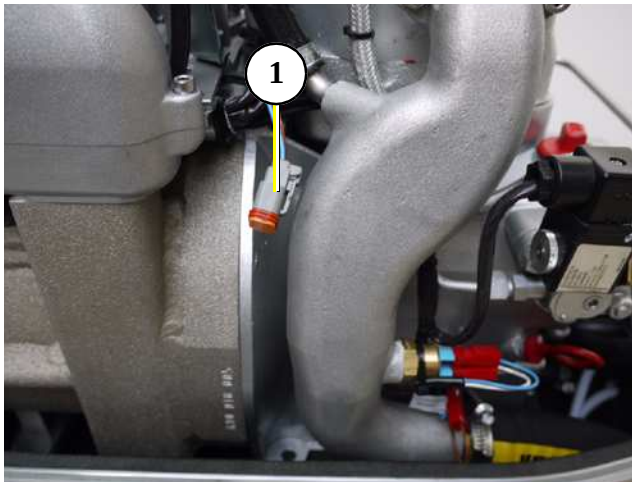


Fig. A.4.6-3: Electrical connections

Starter motor

1. Starter motor and

2. Solenoid switch

The Diesel engine is started electrically.

The electrical starter with the solenoid switch is located at the back of the engine.

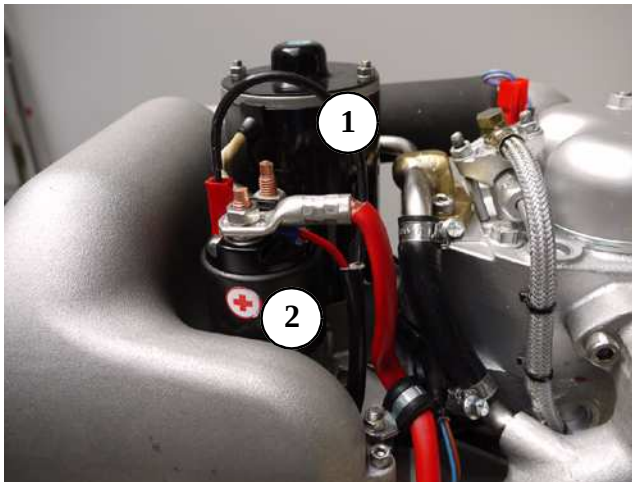


Fig. A.4.6-4: Starter motor

Generator power terminal box

Above the winding housing is the generator power terminal box. In this box, the electrical connection points for the AC generator are blocked.

Here is also the bridge for the protective grounding of the generator. The cover may only be removed, if it is guaranteed that the generator cannot be inadvertently started.

Fig. A.4.6-5: Generator power terminal box

Terminal block for remote control cable with fuses and power relays inside of the generator power terminal box

01. Fuse DC 25A

02. Plug for remote control panel

03. Generator power terminal block

04. Circuit breaker AC 15A

05.Relais for Starter and Fuel stop solonoid

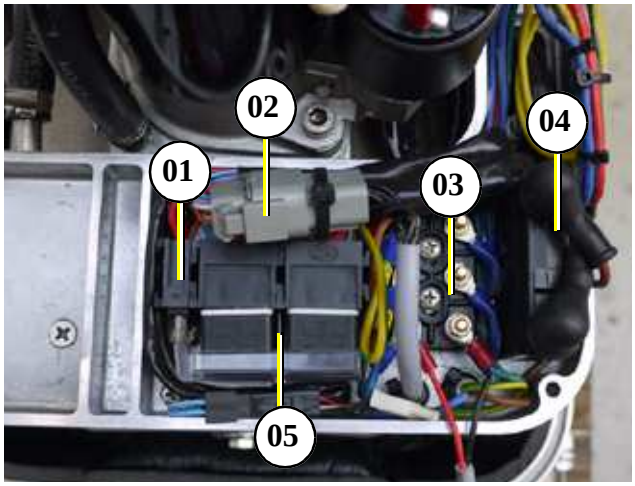


Fig. A.4.6-6: Terminal block

Circiut breaker for load

The circuit breaker for the load can be controlled from the outside of the power terminal box

01. Circuit breaker AC 15A

Fig. A.4.6-7: Terminal block

Capacitor

01. The capacitor can be located in the power terminal box cover

Fig. A.4.6-8: Terminal block

A.4.7 Sensors and Switches for Operation Surveillance

Thermo-switch at cylinder head

The thermo-switch at the cylinder head serves to monitor the generator temperature.

Fig. A.4.7-1: Thermo-switch at cylinder head

Thermo-switch at water-cooled exhaust elbow

This thermo switch is located at the water-cooled exhaust elbow union and serves to monitor the temperature of the fresh water cooling system. It takes a measurement at the hottest spot, since the combustion gases are guided from the cylinder head for the exhaust elbow.

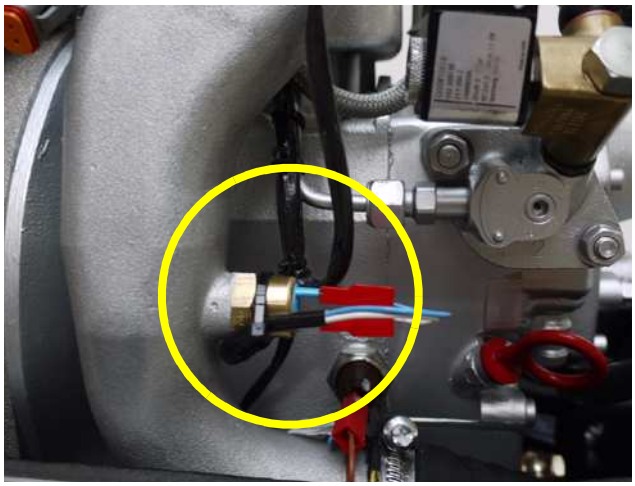


Fig. A.4.7-2: Thermo-switch at exhaust elbow

Thermo-switch in the generator coil

1. Generator coil
2. Thermo-switch
3. Housing

Two thermo switches are located inside the winding to protect the generator coil, which for safety reasonsare installed independently in parallel.

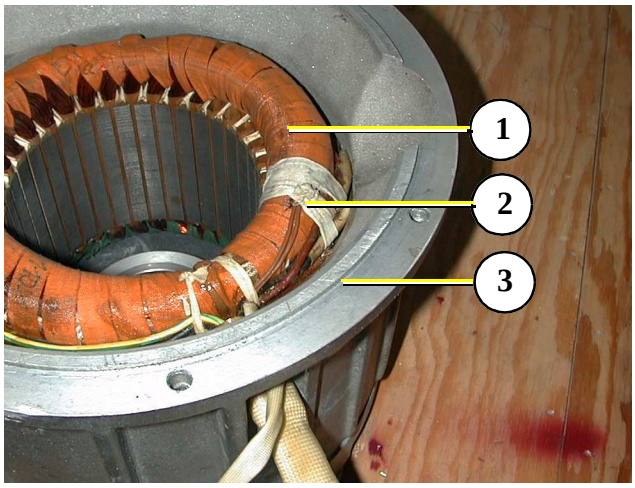


Fig. A.4.7-3: Thermo-switch coil

Oil pressure switch

In order to be able to monitor the lubricating oil system, an oil pressure switch is built into the system.

Fig. A.4.7-4: Oil pressure switch

A.4.8 Components of Oil Circuit 4000s SCB + 4000s FCB

Oil filler neck with cap

Normally the filler neck for the engine oil is on the top side of the valve cover. A second filler neck is additionally attached at the operating side for numerous generator types. Please ensure that the filler necks are always well secured after filling with engine oil.

Consider also the references to the engine oil specification.

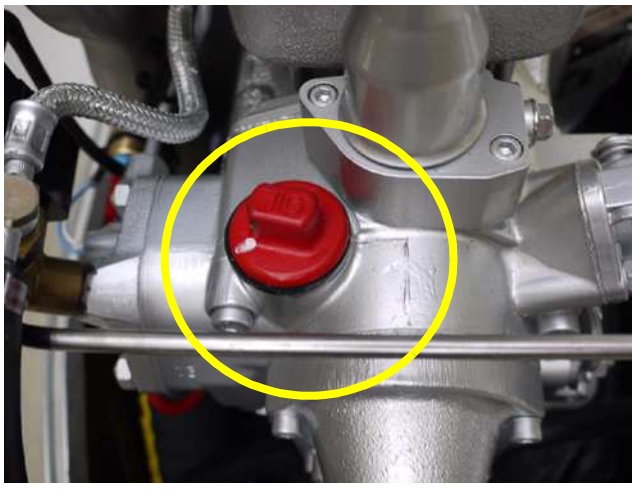


Fig. A.4.8-1: Engine oil filler neck

Oil dipstick

At the dipstick the permissible level is indicated by the markings "maximum" and "minimum". The engine oil should be never filled beyond the maximum.

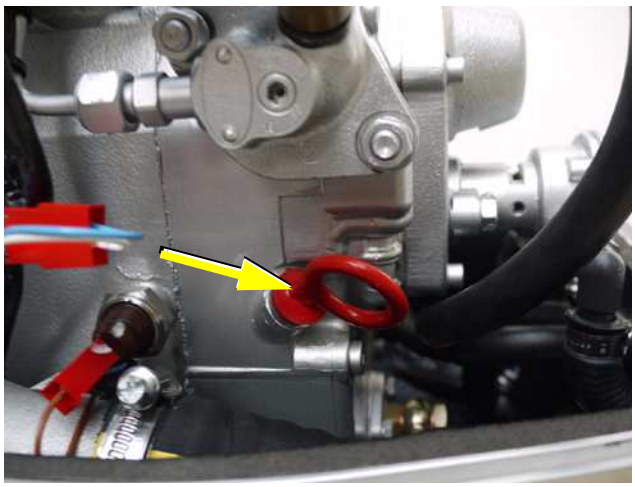


Fig. A.4.8-2: Engine oil dipstick

Engine oil strainer

The oil strainer is normally maintenance-free; pre-supposed, the oil change intervals are kept.

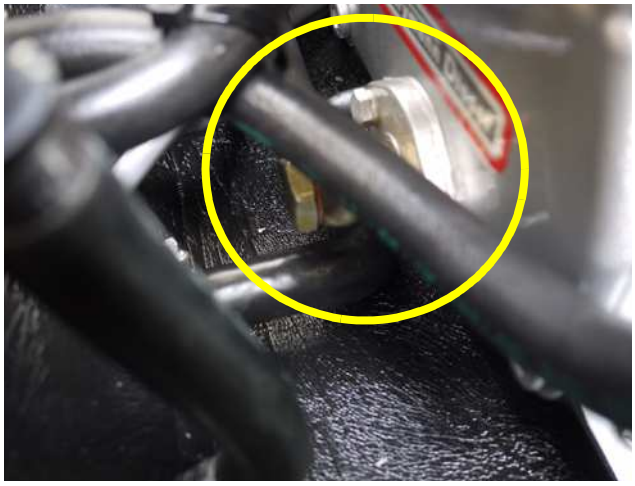


Fig. A.4.8-3: Engine oil strainer

Oil drain hose

The Panda generator is so equipped that the engine oil can be drained by a drain hose. The generator should always be installed in such a way, that a collecting basin can be placed deep enough.

f this is not possible, an electrical oil drain pump must be installed.

Note: Lubricating oil should be drained in the warm condition!

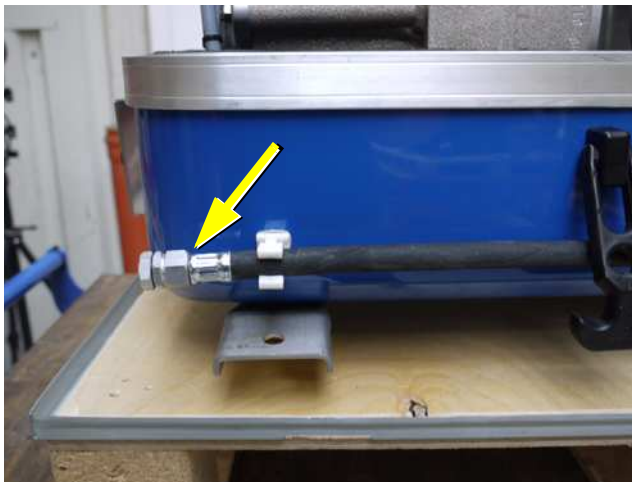


Fig. A.4.8-4: Engine oil drain hose

A.5 Operation manual

A.5.1 Preliminary remarks

Advices regarding Starter Battery

Fischer Panda recommends to use a normal starter battery. If the generator is required for extreme winter conditions, the starter battery capacity should be doubled. It is recommended to regularly charge the starter battery by a suitable battery-charging device (i.e. at least every two months). A correctly charged starter battery is necessary for low temperatures.

A.5.2 Daily routine checks before starting

1. Oil level control (ideal level: 2/3 of maximum level).

AtTENTION! OIL PRESSURE CONTROL!
True, the diesel motor automatically switches off when there is a lack of oil, but it is very damaging for the motor, if the oil level drops to the lowest limit. Air can be sucked in suddenly when the boat rocks in heavy seas, if the oil level is at a minimum. This affects the grease in the bearings. It is therefore necessary to check the oil level daily before initially running the generator. The oil level must be topped up to the 2/3 maximum level, if the level drops below the mark between maximum und minimum levels.

You should change the oil independently from the ambient temperature - see section E.3, “Engine oil,” on Page 105. Engine oil volume see section E.2, “Technical Data Engine,” on Page 103.

2. State of cooling water.

The external compensation tank should be filled up to a maximum during cold state. It is very important that large expansion area remains above the cooling water level.

3. Open sea cock for cooling water intake.

For safety reasons, the sea cock must be closed after the generator has been switched off. It should be re-opened before starting the generator.

4. Check raw water filter.

The raw water filter must be regularly checked and cleaned. The impeller fatigue increases, if residual affects the raw water intake.

5. Check all hose connections and hose clamps are leakage.

Leaks at hose connections must be immediately repaired, especially the raw water impeller pump. It is certainly possible that the raw water impeller pump will produce leaks, depending upon the situation. (This can be caused by sand particles in the raw water etc.) In this case, immediately exchange the pump, because the dripping water will be sprayed by the belt pulley into the sound insulated capsule and can quickly cause corrosion.

6. Check all electrical lead terminal contacts are firm.

This is especially the case with the temperature switch contacts, which automatically switch off the generator in case of faults. There is only safe if these systems are regularl checked, and these systems will protect the generator, when there is a fault.

7. Check the motor and generator mounting screws are tight.

A.5.2 Daily routine checks before starting

The mounting screws must be checked regularly to ensure the generator is safe. A visual check of these screws must be made, when the oil level is checked.

8. Switch the land electricity/Generator switch to zero before starting or switching off all load.

The generator should only be started when all load have been switched off. The excitation of the generator will be suppressed, if the generator is switched off with load connected, left for a while, or switched on with extra load, thus reducing the residual magnetism necessary for excitation of the generator to a minimum. In certain circumstances, this can lead to the generator being re-excitated by means of a DC source. If the generator does not excitate itself when starting, then excitation by means of DC must be carried out again.

9. Check the automatic controls functions and oil pressure.

Removing a cable end from the monitoring switch carries out this control test. The generator should then automatically switch off. Please adhere to the inspection timetable (see Checklist in the appendix).

A.5.3 Starting Generator - see remote control panel datasheet

A.5.4 Stopping Generator - see remote control panel datasheet

ATTENTION

NOTE: If the generator switches itself off for temperature reasons during operation with load, examine immediately what the cause was. A possible cause could be an error at the cooling system or any error in the range of the outside of the cooling system.

B. Installation Instructions

B.1 Placement

B.1.1 Placement and Basemount

Since Panda generators have extremely compact dimensions they can be installed in tight locations, attempts are sometimes made to install them in almost inaccessible places. Please consider that even almost maintenance-free machinery must still remain accessible at least at the front (drive belt, water pump) and the service-side (actuator, dipstick). Please also note that in spite of the automatic oil-pressure sensor it is still essential that the oil level has to be checked regularly.

The generator should not be installed in the proximity of light walls, which can get into resonant vibrations by airborne sound. If this is not possible, these surfaces should line with 1 mm lead foil, so the mass and the swinging behavior are changed.

Avoid to install the generator on a smooth surface with small mass (e.g. plywood plate). This affects in the unfavorable case like an amplifier the airborne sound waves. An improvement can be archieved by reinforcing these surfaces by ribs. In addition, the breakthroughs, which interrupt these surfaces, should be sawed off. The lining of the surrounding walls with a heavy layer (i.e. lead) and foam additionally improve the condition.

There must be sufficient free space between the fundament and the capsule base, since the motor takes in combustion air through several holes in the capsule base, to ensure an intake of air (at least 12 mm (½“)).

The generator takes in air from the surrounding machine room. It must therefore be ensured that sufficient ventilation openings are available, so that the generator cannot overheat.

If the inducted air has a high temperature, the generator performance deteriorates and raises the cooling water temperature. Air temperatures of more than 40 °C reduce the performance by 2 % for each 5 °C temperature increase. The temperatur e in the machine room should not be more than 15 °C higher than the outside temperature.

B.1.2 Advice for optimal sound insulation

The convenient base consists of a stable framework, on which the generator is fastened by means of shock mounts. Since the generator is "free" downward, the combustion air can be sucked in unhindered. In addition are void the vibrations, which would arise with a closed soil.

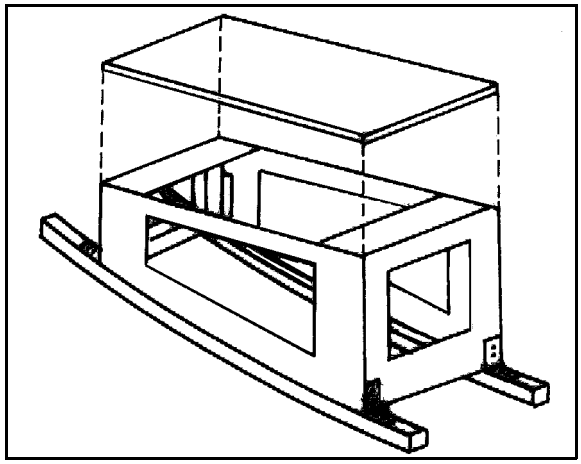


Fig. B.1.2-1: Convenirnt base

B.2 Generator Connections - Scheme

All electrical wires are connected tightly to the motor and the generator. This is also the case for fuel lines and cooling water lines.

The electrial connections must be carried out according to the respective valid regulations. This also concerns used cable materials. The cables supplied are meant for laying „protected“ (i.e. in pipe) at a temperature up to a max. of 70 °C (160 °F). The on-board circuit must also be fitted with all essential fuses.

ATTENTION! Before working (installation) on the System read the section “Safety instructions - Safety first!” on page 11 in this Manual.

Panda 4000s SCB PMS front side

01. Passage for exhaust connection
02. Cooling water (Raw water) in
03. Fuel in and out
04. Passage for battery cable
05. Cable for load
06. Cable for remote control panel
07. Hose for cooling water circle ventilation valve connection

Fig. B.2-1: Connections SCB

Panda 4000s FCB PMS front side

01. Passage for exhaust connection
02. Cooling water (Raw water) in
03. Fuel in and out
04. Passage for battery cable
05. Cable for load
06. Cable for remote control panel
07. Hose for cooling water circle ventilation valve connection

Fig. B.2-2: Connections SCB

Exhaust connection

01. Connect your exhaust hose direct to the water cooled exhaust elbow.

Use both clamps delivered with the generator.

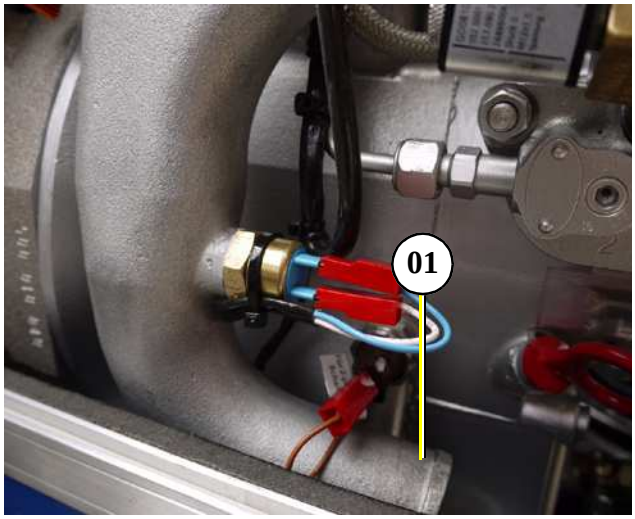


Fig. B.2-3: Connections

B.3 Cooling System Installation - Raw water

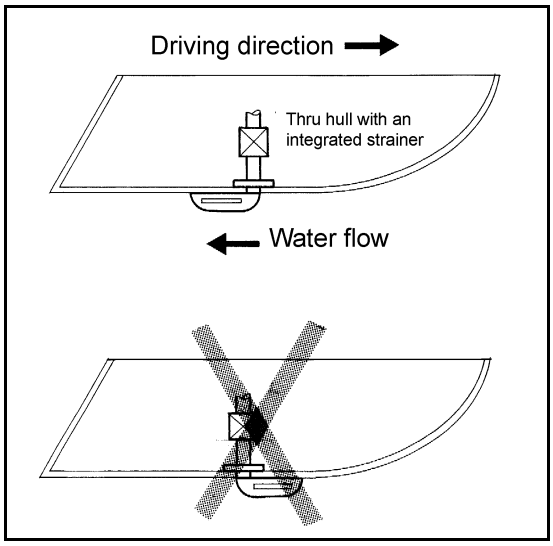
B.3.1 General References

The genset should have its own sea water (coolant water) inlet and should not be connected to any other engine systems. Ensure that the following installation instructions are complied with:

Avoid galvanic corrosion

For the avoidance of galvanic corrosion refer to the chapter "Service instruction for marine gensets (corrosion protection)“.

B.3.2 Installation of the thru-vessel fitting in Yachts



It is good practice for yachts to use a hull inlet fitting with an integrated strainer. The thru-vessel fitting (raw water intake) is often mounted against the sailing direction to induce more water intake for cooling.

For Panda generators, the thru-vessel inlet should NOT point in the sailing direction! When sailing at higher speeds more water will be forced into the inlet than the pump can handle and your generator will flood!

Fig. B.3.2-1: Thru-vessel fitting

B.3.3 Quality of the raw water sucking in line

In order to keep the suction resistance in the line at a minimum, the raw water intake system (i.e. sea cock, thru-hull fitting, inlet filter, etc.) must have an inner diameter of at least 1" (25mm).

This applies also to installation components such as thru-hull fitting, sea cock, sea water filter etc.

The intake suction line should be kept as short as possible. Install the sea water inlet in close proximity to the genset.

After start-up the cooling water quantity must be measured (e.g. by catching at the exhaust). The flow rate, as well as the necessary cross section of the cooling water pipe is taken from Table E.2.1, “Technical Data Generator 4000s SCB + FCB,” on page 104.

B.3.4 Installation above waterline

The Panda is equipped with a direct drive water intake pump mounted directly on the motor. Since the intake pump is an impeller pump there are wearing parts which are likely to require replacement after some time. Ensure that the genset is installed such that the intake pump can be easily accessed. If this is not possible, an external intake pump could be installed in an easily accessed location.

If the generator is installed above the waterline it is possible that the impeller wearout will be stronger. After the start the pump runs dry some seconds.

The raw water hose should describe a loop as near as possible to the raw water inlet of the generator (see picture below). With it the pump only sucks in air for a short time. The impeller will be lubricated by the raw water and its life time will rise.

By the installation of a check valve in the sea water inlet line, which is under the waterline, this problem can be limited a little .

It is very important to change the impeller every few month. When starting the generator you should pay attention and listen when raw water comes out from the exhaust. If this lasts longer than 5 seconds the impeller has to be changed, because he sucks to much air before raw water reaches the impeller and the impeller wears out strongly. In this case the impeller looses its function, which leads to an overheating of the engine.

If the impeller isn't exchanged early enough, the impeller wings can break into pieces and clog the cooling circuit. Therefore it is very important to change the impeller every few month.

NOTE:

Never change the impeller for many years, without exchanging the old pump. If the sealing ring is defective within the pump, raw water runs into the sound cover of the genset. A repair is then very expensive.

Replacement impeller and also a spare pump should always be on board. The old pump can be sent back to Fischer Panda, where it is then economically overhauled completely.

1. Raw water filter
2. Water cock
3. Hull inlet

Make certain that the raw water filter lies above the water level, otherwise with cleaning water can penetrate by the hull inlet.

An external pre-pump can relieve the impeller.

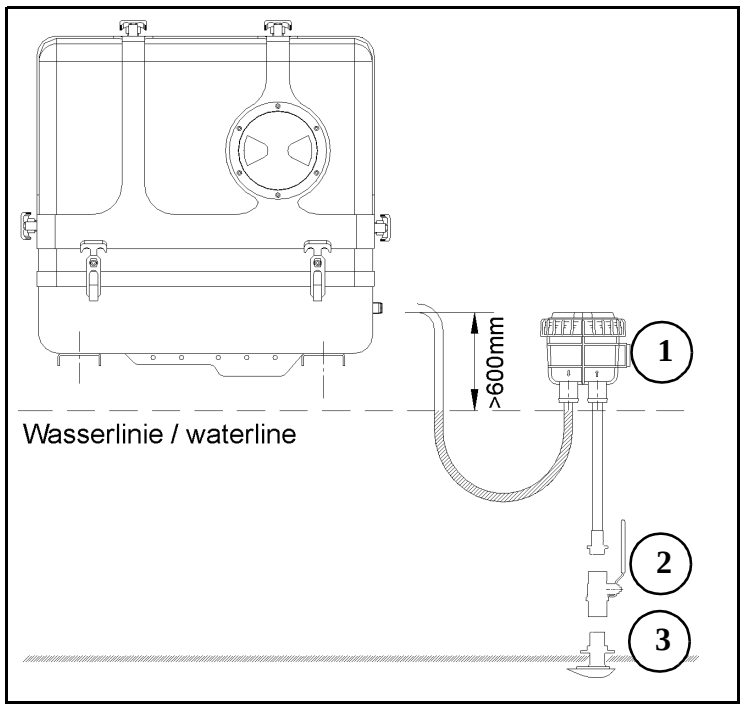
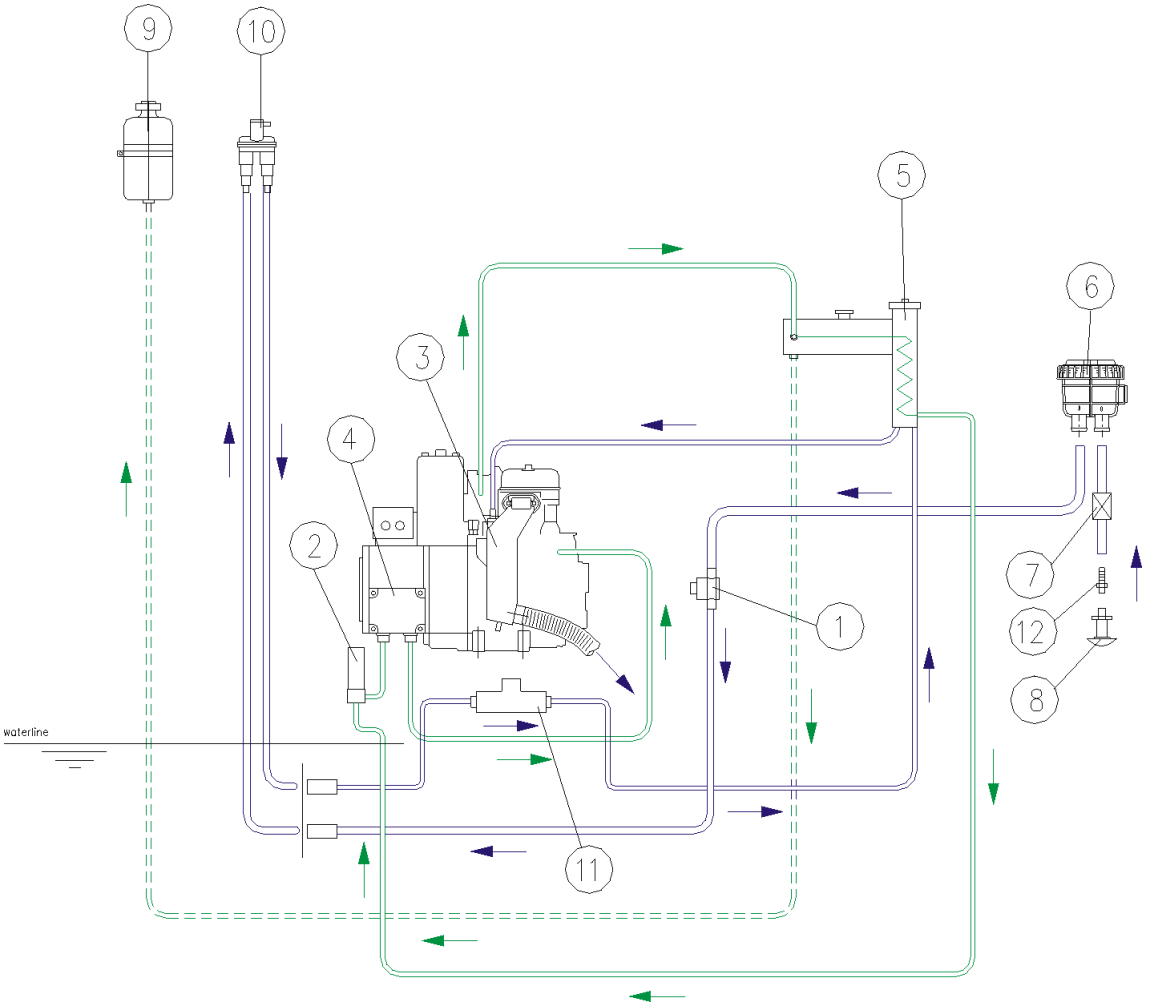


Fig. B.3.4-1: Raw water filter



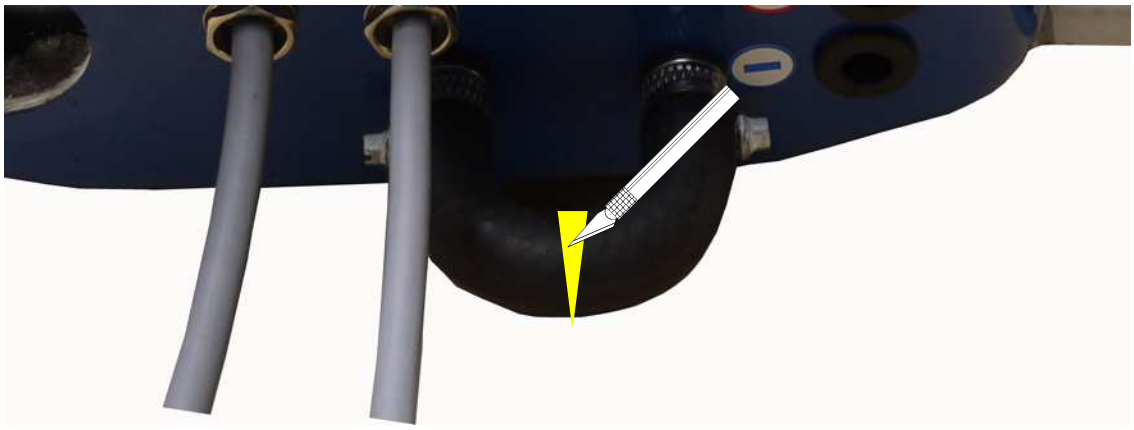
1. Raw water impeller pump
2. Freshwater pump
3. Water-cooled exhaust elbow
4. Cooling water connection block
5. Heat exchanger
6. Raw water filter
7. Water cock
8. Raw water inlet
9. Expansion tank
10. Vent valve
11. Oil cooler
12. Reducer

Fig. B.3.4-2: Installation example over the waterline FCB version

B.3.5 Installation below waterline

If the generator can not be attached at least 600mm over the waterline, a vent valve must be installed into the raw water line. Possible heeling must be taken into consideration if installed at the „mid-ship line“! This hose is split in the middle and extended respectively at each end by an additional hose and a connecting pipe. Both hose ends must be led out outside of the sound cover to one point, if possible 600mm over the waterline in the mid-ship line. The valve is connected at the highest place to the two hose ends.

If the valve is jammed, then the cooling water line cannot be ventilated after the generator has been stopped, the water column is not interrupted and water can enter the combustion compartment of the motor. This can quickly cause damage to the motor!



Cut the hose for the external vent valve...

Fig. B.3.5-1: Connection external ventilation valve

....and bent it upwards.

Both hose ends must be led out outside of the sound cover to one point, if possible 600mm over the waterline in the midship line. The valve is connected at the highest place with the two hose ends.

sample picture

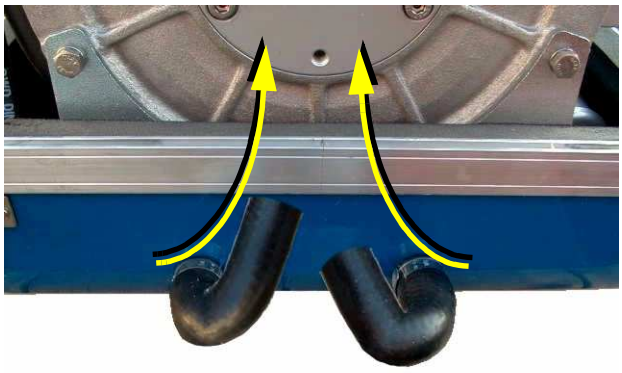


Fig. B.3.5-2: Connection external ventilation valve

NOTE: The ventilation valve must be installed directly behind the water pump.

If the water pump ceases, the valve spring ensures that air can enter and therefore, a syphon effect is avoided.

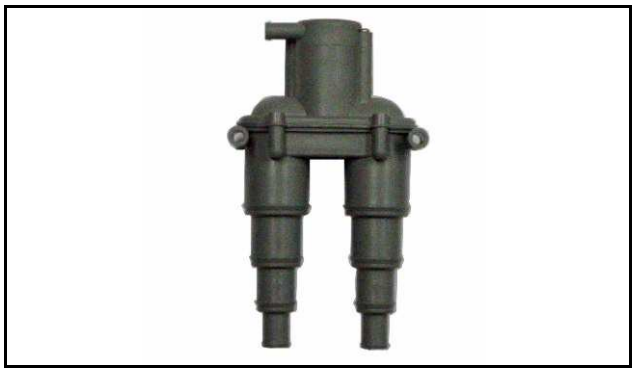
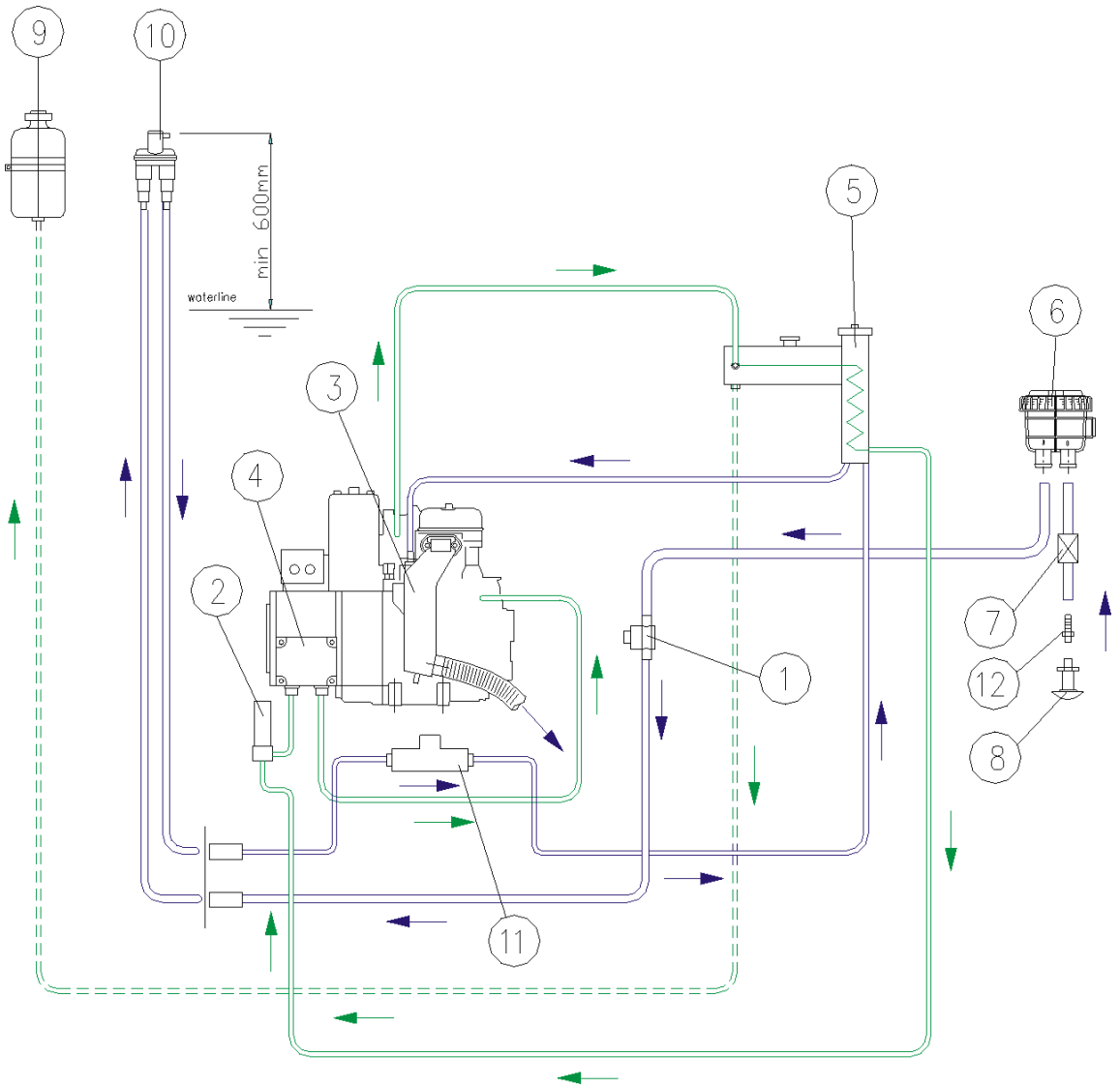


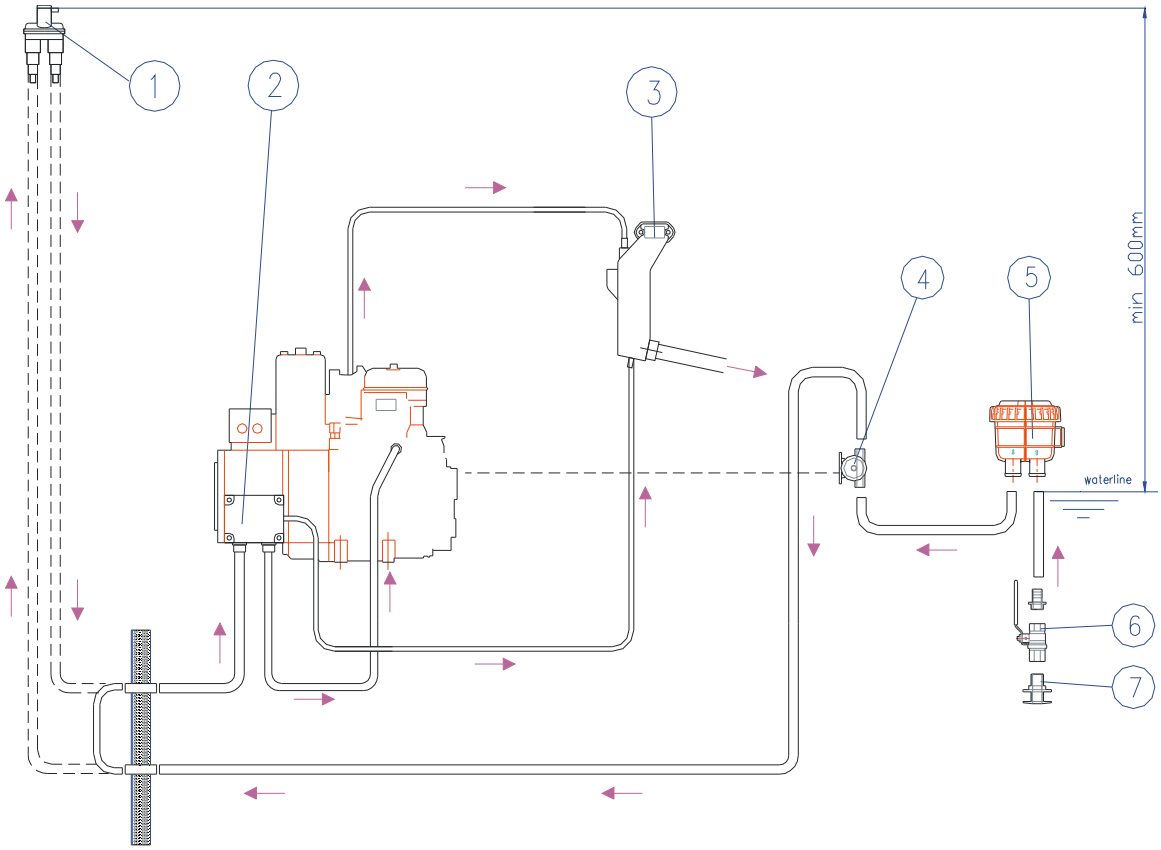
Fig. B.3.5-3: Ventilation valve



1. Raw water impeller pump
2. Freshwater pump
3. Water-cooled exhaust elbow
4. Cooling water connection block
5. Heat exchanger
6. Raw water filter
7. Water cock
8. Raw water inlet
9. Expansion tank
10. Vent valve
11. Oil cooler
12. Reducer

Fig. B.3.5-4: Installation example under the waterline FCB

B.3.6 Raw water single circuit cooling system



1. Vent valve
2. Coolant connection bock
3. Exhaust elbow
4. Raw water pump
5. Raw water filter
6. Sea cock
7. Hull inlet

Fig. B.3.6-1: Installation example under the waterline SCB

B.3.7 Ventilating at the first filling of the Fresh water cooling circuit - FCB only

The Fresh water circle of the Panda 4000s FCB PMS is self venting while the electrical coolant pump is running. Make shure, that the generator is aligned horizontally to all sides.

1. Fill up the external cooling water expansion tank with coolant.

ATTENTION: maximum fill level = „max.“- mark.

The cover of the external expansion tank temporarily must be opend.

Make shure that during the filling procedure everytime enough coolant (min 1/3) is in the expension tank.

Fig. B.3.7-1: Expansion ttank

2. When the coolant level in the expansion tank do not drop any more, disconnect the oil pressure switch.

While disconnecting the oil pressure switch, the remote control panel get a „Oil pressure OK“ and the electrical colling water pump can be turned on and off by switching the panel on and off.

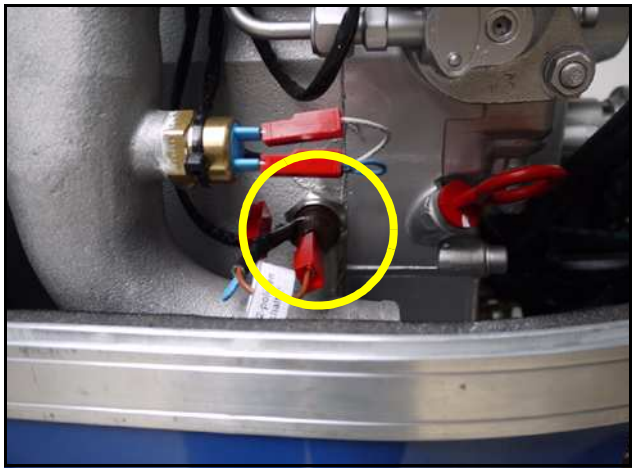


Fig. B.3.7-2: Oil pressure switch

3. Turn the remote control panel on and let the coolant pump run for at least 10 minutes.

4. Turn the remote control panel off, reconnect the oil pressure switch and fill up the coolant level at the expension tank to max. Close the expansion tank.

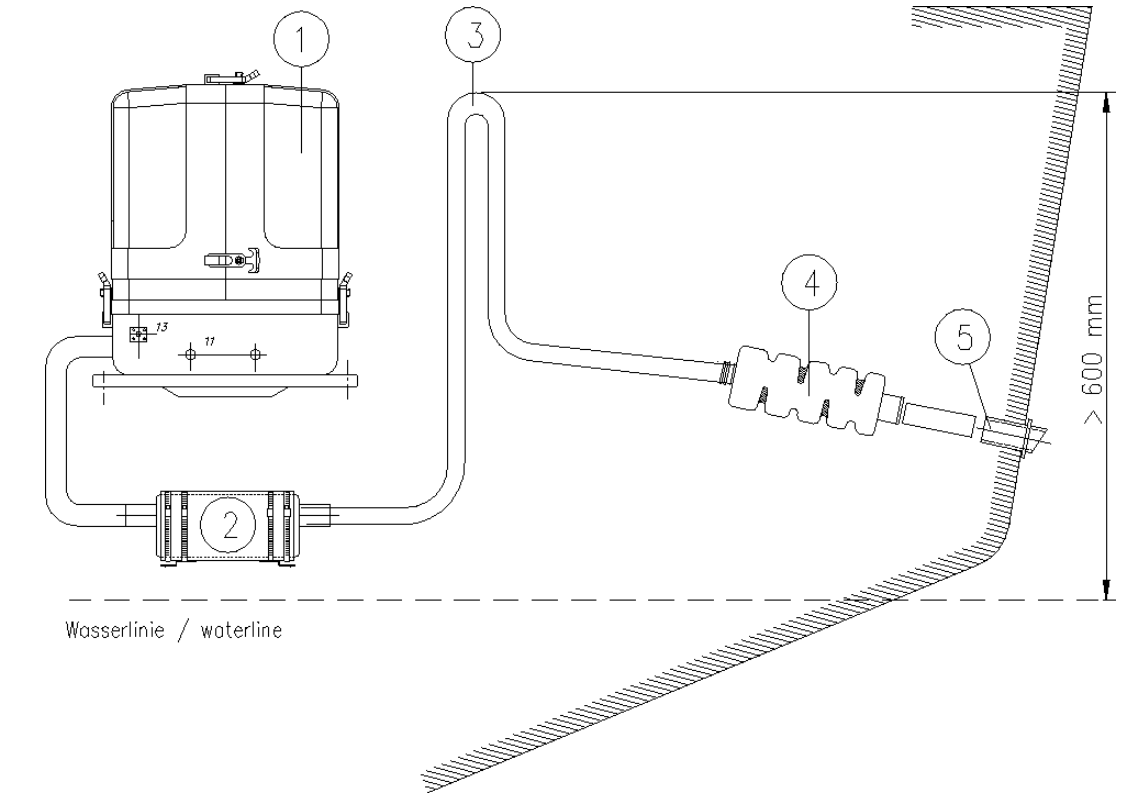
B.4 Watercooled Exhaust System

By injecting the outlet seawater into the exhaust manifold, the exhaust gases are cooled and the noise emissions from the exhaust system are reduced.

B.4.1 Installation of the standard exhaust system

The generator exhaust system must remain completely independent and separate from the exhaust system of any other unit(s) on board. The exhaust hose has an inner diameter of 30mm. The water lock must be installed at the lowest point of the exhaust system. An optional noise insulated water lock can also be installed. The exhaust hose descends from the capsule to the water lock. Then the hose rises via the "goose neck" to the silencer (see drawing). The goose neck must be vertical and sit preferably along the ship's keel centre line. The exhaust system must be installed so that the back pressure inside the exhaust does not exceed 0.4 bar (6 psi) and total length does not exceed 6m (20 ft.).

Exhaust diameter see *Table E.2.1, "Technical Data Generator 4000s SCB + FCB," on page 104.*



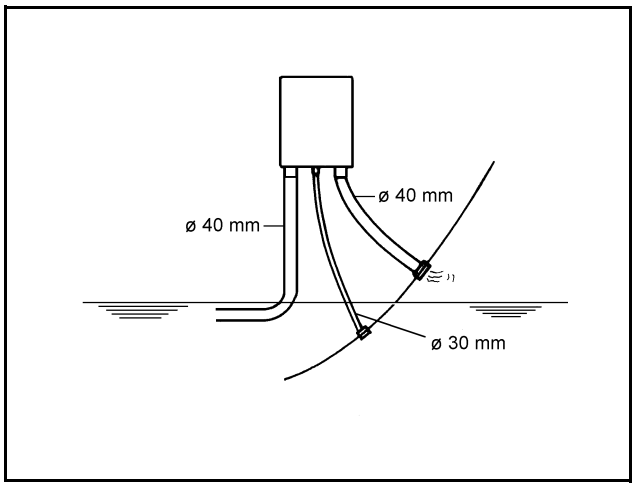
1. Generator
2. Water lock
3. Goose neck
4. Silencer
5. Hull outlet

Fig. B.4.1-1: Insatalltion example - standard exhaust szstem

B.4.2 Exhaust / water separator

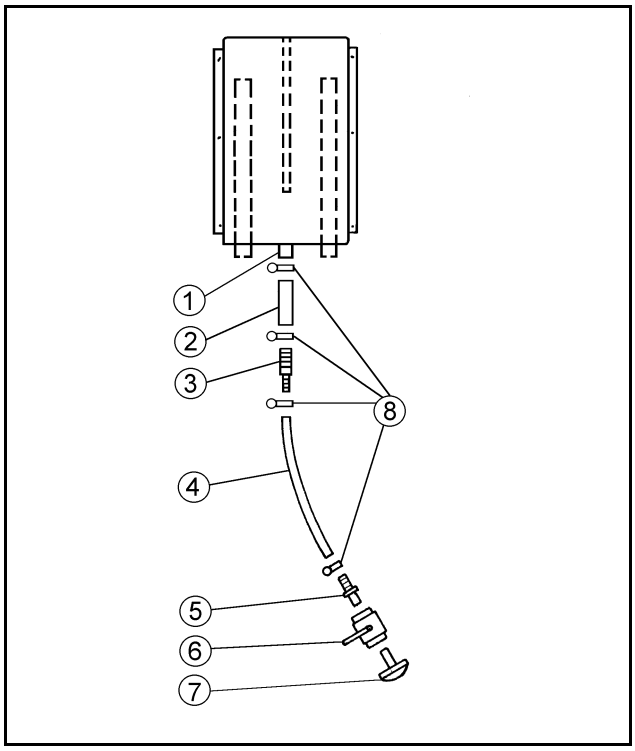
The exhaust/water separator

In order to reduce the noise level of the generator unit to a minimum, an optional exhaust outlet muffler mounted next to the thru-hull fitting can be installed. Additionally there is component at Fischer Panda, which exercise both functions of a "exhaust goose neck", and the water separation. With this "exhaust/water separator" the cooling water is derived over a separate pipe. Thereby the exhaust noises at the exterior of the yacht are strongly decreased. Particularly the "water plash" allocate.



The water flow on the exhaust/water separator unit has an inner diameter (ID) of 30mm. If the path from the water separator to the sea water outlet is very short, the hose can be further reduced to 1" (25mm) ID.

Fig. B.4.2-1: Exhaust/water seaparator

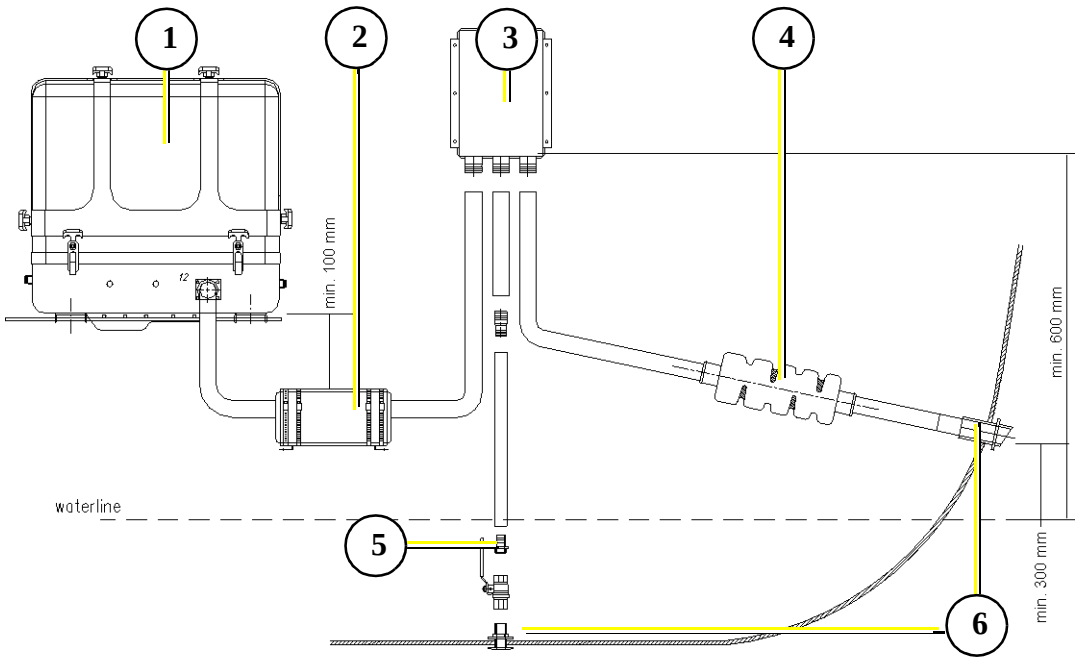


1. Raw water outlet ø 30mm
2. Hose connector ø 30mm
3. Reducer 30/20mm (if required)
4. Hose
5. Hose connector
6. Sea cock
7. Hull outlet
8. Hose clips

Fig. B.4.2-2: Exhaust/water seaparator

B.4.3 Installation exhaust/water separator

If the exhaust/water separator was sufficiently highly installed, a goose neck is no longer necessary. The exhaust/water separator fulfills the same function. If the "Supersilent" exhaust system were installed correctly, the generator will not disturb your boat neighbour. The exhaust noise should be nearly inaudible. The best result is reached, if the hose line, which derive the cooling water, is relocate on a short way "falling" directly to the outlet and this outlet is under the waterline.



1. Generator
2. Silencer / Water lock
3. Exhast/Water-separator
4. Silencer
5. Sea cock
6. Hull outlet

Fig. B.4.3-1: Installation example - exhaust/water separator

If the thru-hull exhaust outlet has to be mounted far from the generator, an exhaust-water separator must definitely be installed. The sea water from the separator must then run along the shortest possible path is the thru-hull outlet. For such long exhaust routes, the exhaust hose diameter should also be increased from NW40mm to NW50mm in order to reduce the back-pressure. The exhaust may have a length of over 10m (32 ft.) if the exhaust hose diameter is increased to 50mm. An additional outlet exhaust muffler close to the hull outlet will help further to reduce noise emissions.

An unfavorable installation:

- water lock not deeply enough under the hights level of the generator
- distance water lock to exhaust/water separator too largely

B.5 Fuel System Installation

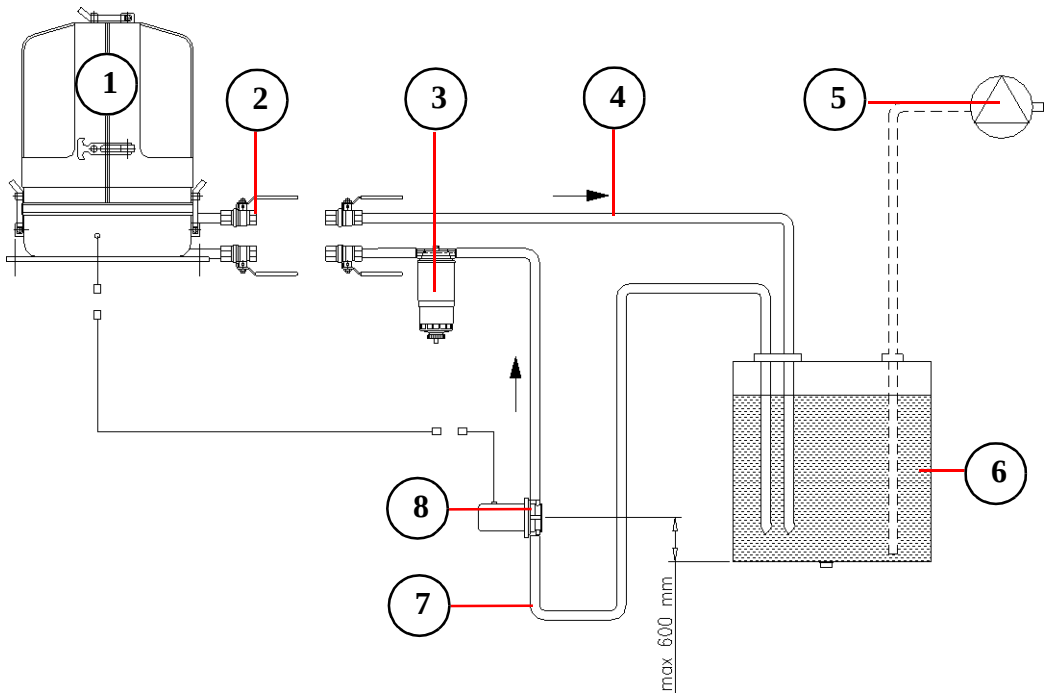
B.5.1 General References

Fuel filters (with water seperator) must be mounted outside the capsule in easily accessible places in the fuel lines between the tank intake fuel pump and the diesel motor's fuel pump.

Generally forward and return fuel flow pipes must be mounted to the diesel tanks. Do not connect the generator fuel supply lines with any other fuel lines of other diesel systems.

The following items need to be installed:

- Pre-filter with water separator (not part of the delivery)
- Fine particle fuel filter
- Return fuel line to fuel tank (unpressurized)



1. Generator
2. Fuel stop cock
3. Fuel filter
4. Fuel return
5. Condensation water suction pump
6. Fuel tank
7. Fuel supply
8. Electrical fuel pump (12V-DC) (optional)

Fig. B.5.1-1: Installation example - fuel

B.5.2 Connection of the fuel lines at the tank

Lead the return fuel pipe connected to the day tank to the floor

The return pipe connected to the tank must be dropped to the same depth as the suction pipe, the generfator is mounted higher than the tank, in order to prevent fuel running back into the tank after the motor has been switched off, which can lead to enormous problems if the generator switched off for a long period.

Non-return Valve in the Suction Pipe

A non-return valve must be fitted to the suction pipe, which prevents the fuel flowing back after the generator has been switched off, if it is not possible to use the return flow pipe as a submerge pipe be placing it in the tank. The instructions Table C.3, “Ventilating the fuel system,” on page 82 must be read after initial operation or after it has stood still for a long period.

ATTENTION! Non-return valve for the fuel return pipe

If the fuel tank should be installed over the level of the generator (e.g. daily tank), then non-return valve must be installed into the fuel return pipe to guaranteed that through the return pipe no fuel is led into the injection pump.

B.5.3 Position of the pre-filter with water separator

Additionally to the standard fine filter a prefilter with water separator must be installed outside of the sound cover in the fuel system line. (is not included in delivery.)

Fig. B.5.3-1: Fuel filter with water separator

B.6 Generator 12V DC System-Installation

The Panda 4000s needs a battery with a capacity of at least 44Ah for the start. The generator can be attached to the existing starting battery of the main engine or be supplied with its own battery.

The Panda 4000s is not equipped with its own 12V battery loading installation. Thus that the starting battery is charged during the generator operation, at the exit of the generator a battery charger is ensured is normally attached. This battery charger should be selected in such a way that the rated output approx. 10% of battery capacity correspond. (120Ah starting battery requires a battery charger with approx. 10 - 12A charging current).

In the Panda accessories program special battery chargers are available, which are designed to load in connection with the generator particularly effectively. This is however necessary only if the electrical system is to be loaded hereby. For loading the generator and/or starting battery a simple, low-priced battery charger is sufficient.

B.6.1 Connection of the 12V starter battery

The positive (+) battery cable is connected direcly to the solenoid switch of the starter.

Attention: Use the prepared protective tube for the battery (+) cable.

Fig. B.6.1-1: Connection starter battery plus cable

Connection of the battery (-)

Connect the battery (-) with the connection point at the engine foot

1. Battery (-) connection point

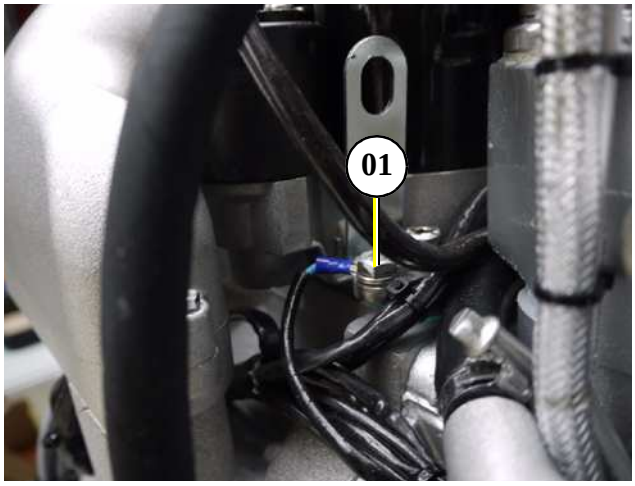


Fig. B.6.1-2: Connection starter battery minus cable

The Panda generator Panda 4000s SCB is equipped with two various DC-relays and one electrical fuse, which can be found at the terminal strip. The various relays and fuse have the following tasks (also see the DC circuit diagram):

1. Starter relay K1
2. Fuel pump start relay K3
3. Electrical fuse (15A)

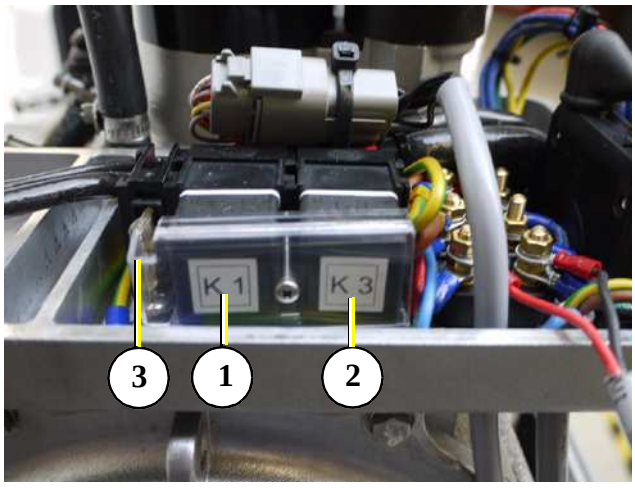


Fig. B.6.1-3: Relays and fuse

All Panda generators are equipped with an independent 12V-DC starter motor. The connecting lines cross-section from the battery to the DC system should measure 25mm².

1. Solenoid switch for starter motor

2. Starter motor

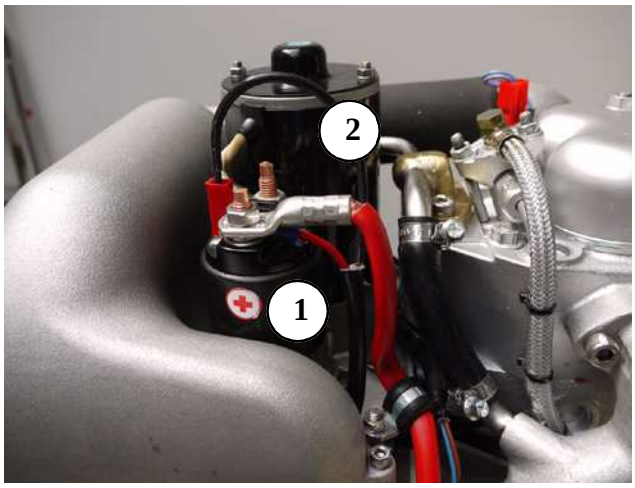


Fig. B.6.1-4: Starter motor

B.6.1.1Additional information for battery connection

ATTENTION !!! Commissioning:

Installation of battery lines.

! Consider ABYC regulation E11 AC and DC electrical systems on boats

and/or

EN ISO 10133:2000 small watercrafts, electrical systems, low voltage (DC) systems

Install a right sized fuse in the positive battery line as close as possible to the battery, but max 12 inch, 300mm from the battery. The length of the cable to the fuse, the cable must be protected by a sheath or conduit against damage of the insulation

Use only cable with self retardant and self extinguishing insulation suitable for high temperatures up to 195℉, 90℃

Install battery lines in a safe way the cable insulation will not be shaved or damaged.

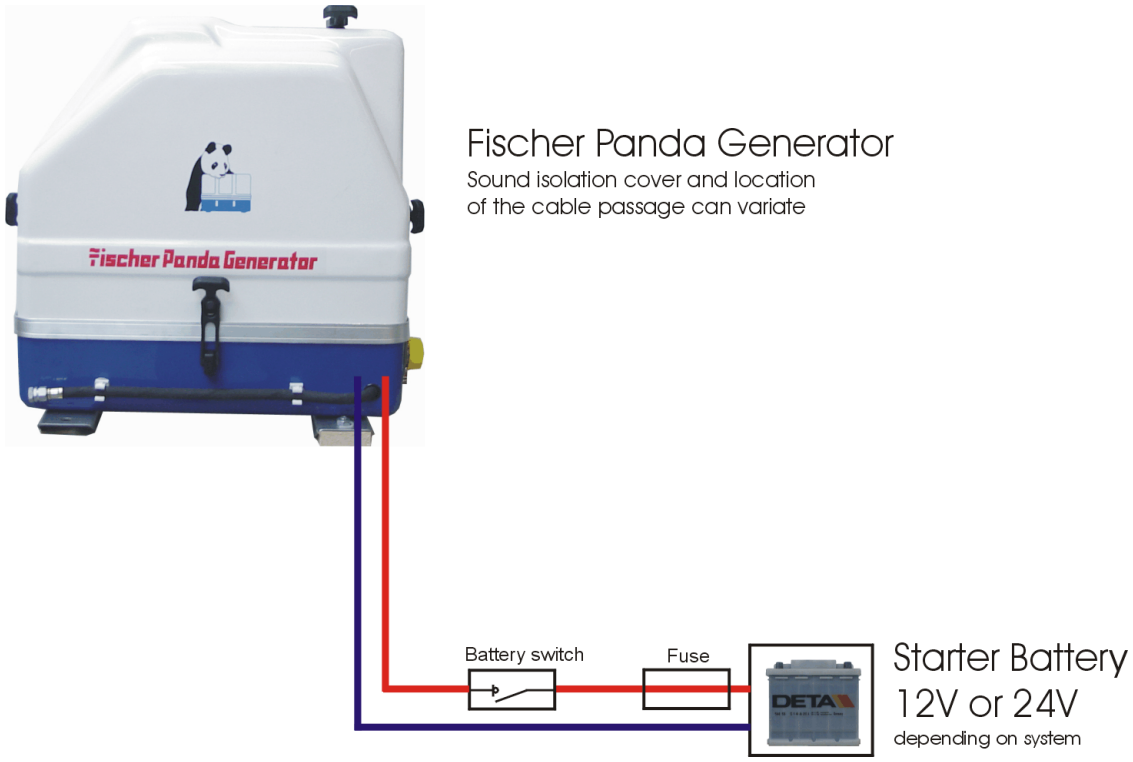
Battery poles must be protected against short circuits by error.

Inside the capsule of the Fischer Panda Generator the battery positive line must be protected against heat and vibration by a suitable conduit or sheath and must be routed that way it is not touching any area that will get hot under normal operation like entire engine itself, exhaust elbow and exhaust manifold or exhaust lines or the V-belt and pulleys. The cable shall not be to tight otherwise damage will happen

Run the generator carefully after installation and double check, if there is any possibility for damage of the battery cable. Correct if necessary .

Use multi-core stranded wire only, for the battery connection.

Sample diagram for starterbattery installation

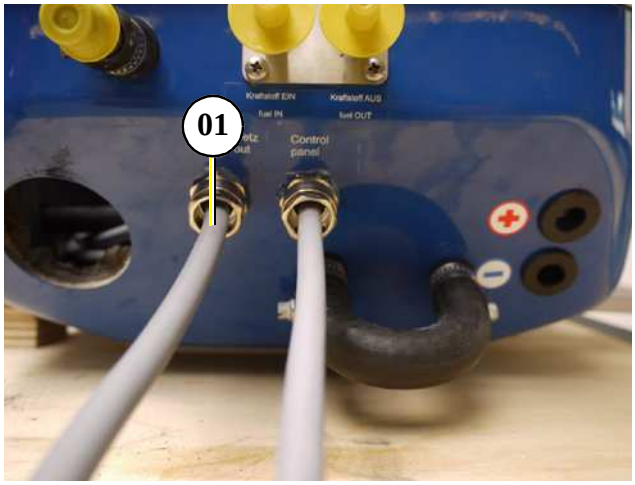


B.6.2 Connection of the load

Connection of the load

Connect the load at the prepared cable

01. Cable for load



B.6.3 Connection of the remote control panel - see remote control panel datasheet

As standard a 7 core connection-cable, 7m long, is included in the supply. Cores are numbered from 1 to 7. The control cables are securely connected to the genset. On the back of the control panel there are terminals numbered from 1 - 7. Connect the cores of the control-cable in respective order.

Please ensure that the remote control panel is installed in a protected, dry and easily accessible place.

01. Cable for remote control panel

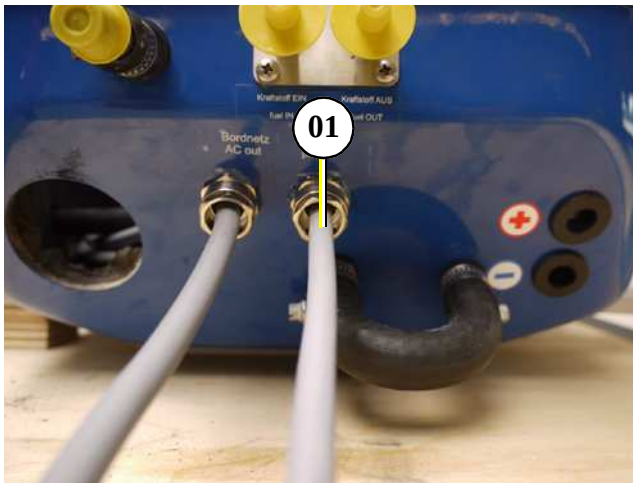
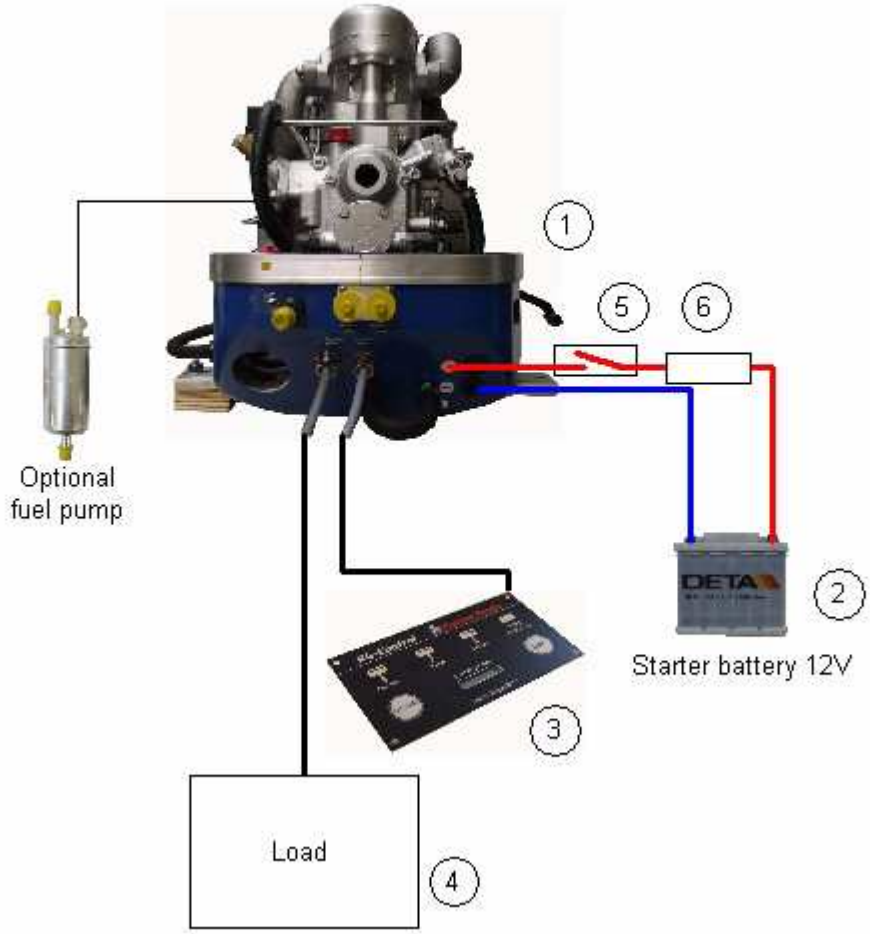


Fig. B.6.3-1: Remote control panel - back side

B.7 Generator AC System-Installation

ATTENTION! Before the electrical system is installed, READ the section “Safety instructions - Safety first!” on page 11 of this manual FIRST! Be sure that all electrical installations (including all safety systems) comply with all required regulations of the regional authorities. This includes lightnening conductor, personal protection switch etc.

B.7.1 Electrical connection scheme



1. Generator
2. Starter battery
3. Remote control panel
4. Load connection
5. Battery switch
6. Fuse

Fig. B.7.1-1: Installation example - with separat load output

All electrical safety installations have to be made on board.

A power source selector switch must be installed between the generator (or if applicable, AC-Control box) and the ship´s electrical supply system. This switch must used to ensure that all AC load can be switched off at once. This switch should also be installed to keep the generator and shore (grid) power systems separate.

A 3-way cam-type switch should be used. This switch basic positions: "Shore power" - "OFF" - "Generator". If an (DC-AC) inverter is used, a fourth position will be required.

0. OFF

I. Generator

II. Shore power connection

III. Inverter

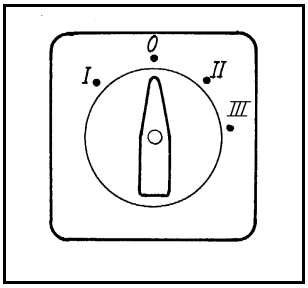


Fig. B.7.1-2: Power source selector switch

The cam-type switch must have **2 poles**, so that "MP" and "phase" can be switched off.

If a 3-phase current system is also installed with the option of supplying from either the generator or shore power, an **additional** switch must be installed to keep these systems separate.

An alternative to a manual rotating switch is an automatic power relay. When the generator is not running, the relay remains in the shore power position. As soon as the generator is running, the power relay switches automatically to the generator position.

If the system has both single and 3-phase AC, it is CRITICAL that the two systems remain SEPARATE!

Electrical fuses

It is absolutely essential that the electrical system installation is inspected by a qualified electrical technician.

Required cable cross-sections

The following recommended electrical cable dimensions (cross sections) are the minimum required sizes for a safe installation. *(see Table E.2.1, “Technical Data Generator 4000s SCB + FCB,” on page 104.*

C. Maintenance Instructions

C.1 General maintenance instructions

C.1.1 Checks before starting

• Oil level
• Cooling system leaks
• Visual check for any changes, leaks oil drain system, v-belt, cable connections, hose clips, air filter, fuel lines

C.1.2 Hose elements and rubber formed component in the sound cover

Check all hoses and hose connections for good condition. The rubber hoses are very sensitive to enviromental influences. They can season fast with dry air, in which environment of muted oil and fuel steams and increased temperature. The hoses must be checked regularly for elasticity. There are operating situations, at which the hoses must be renewed once in the year.

Additionally to usual tasks of maintenance (oil level check, oil filter control etc.) further maintenance activities are to be accomplished for marine gensets. It belongs control of the sacrificial anode (cooling water connection block) and the front seal cover at the generator.

For maintenance intervalls see „General information for PMS-Generators“

C.2 Oil circuit maintenance

The first oil change is to be accomplished after a period of operation from 35 to 50 hours. Afterwards
the oil is to be changed after 150 hours. For this the oil SAE30 for temperatures over 20℃ and SAE20 for temperatures between 5℃ and 20℃ is to be used. At temperatures under 5℃ oil of the viscosity SAE10W or 10W-30 is prescribed.

Type and amount of required oil see:

See “Engine oil” on page 105 and “Technical Data Engine” on page 103.

C.2.1 Engine oil change

Oil drain screw

For the oil change an oil drain hose is lead through the sound cover.

The oil can be discharged by opening the oil drain screw. For countering use a second wrench.

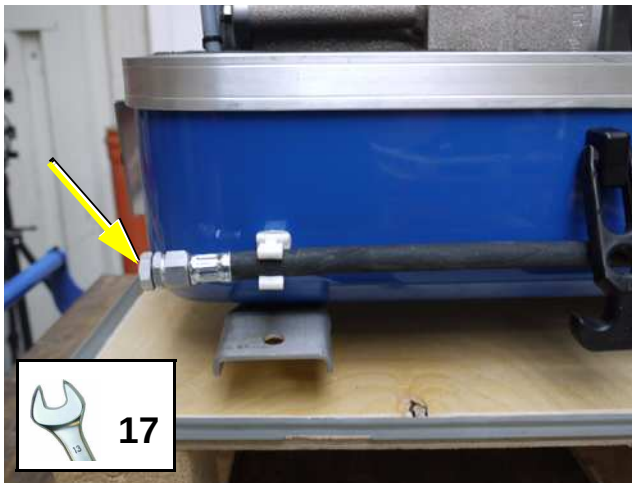


Fig. C.2.1-1: Oil drain screw

Oil drain pump

If discharging of the oil is not possible, we recommend the employment of a hand pump, which can be attached to the oil drain hose.

Afterwards the oil drain screw is closed again.

Oil strainer

The Farymann engine type 18W430 is not equipped with a replaceable oil filter. Instead the engine has an oil strainer (at the face down, see picture). The strainer is to be cleaned every 500 hours. For this the engine must be lifted with the front from the sound cover. The Panda 4000s possesses an oil drain hose at the oil strainer for discharging the engine oil with the oil change.

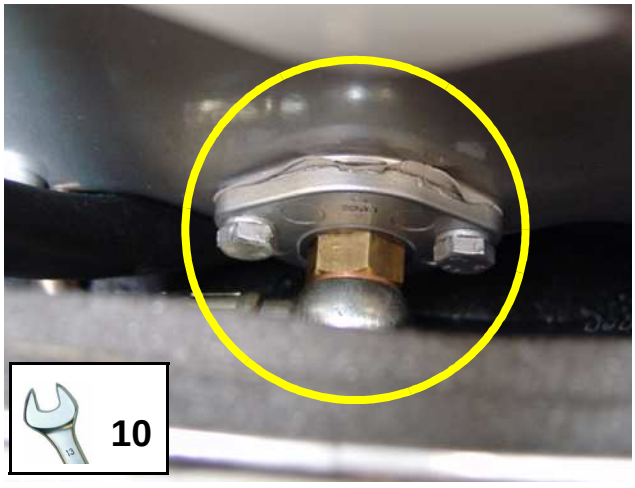


Fig. C.2.1-2: Oil strainer

Open the oil filler neck

After opening the cap of the oil filler neck the new oil is refilled.

Please wait instant, before measure the oil level, the oil must set off in the sump.

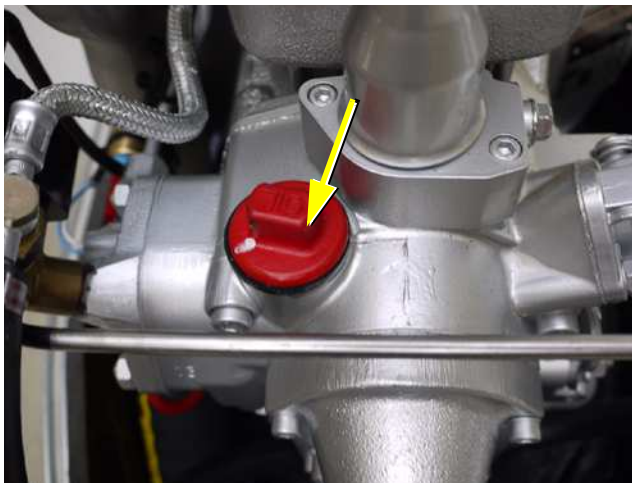


Fig. C.2.1-3: Oil fillerneck

Oil dipstick

With the help of the engine oil dipstick the oil level is to examined. The prescribed filling level may not exceed the „Max“ marking.

We recommend 2/3 oil level.

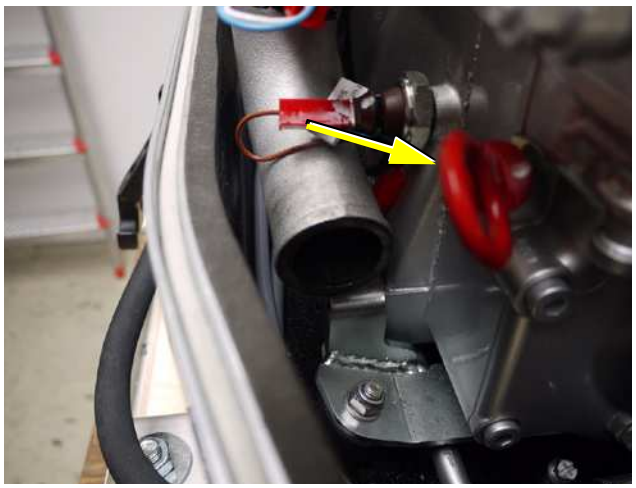


Fig. C.2.1-4: Oil dipstick

C.3 Ventilating the fuel system

Normally, the fuel system is designed to bleed out air itself i.e. as soon as the electric starter motor starts operation the fuel pump starts working and the fuel system will be de-aerated after some time automatically. It is nevertheless essential to bleed the system as follows prior to the first operation (as all hoses are empty):

Using the lever on the fuel pump, pump by hand until the counter pressure becomes noticeable. This builds up the primary pressure in the fuel system snd accelebrates the venting

01. Fuel pump

02. lever at fuel pump

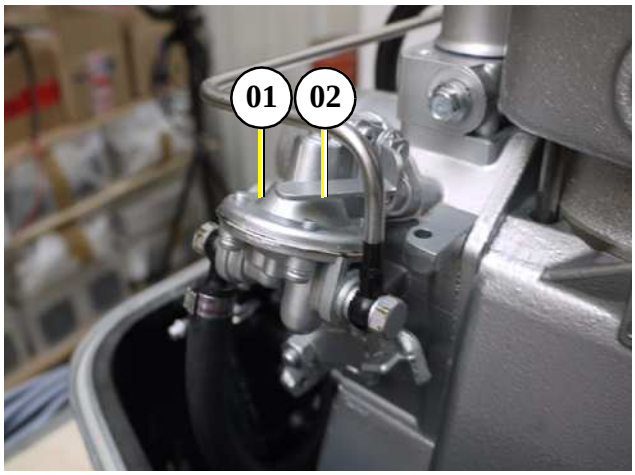


Fig. C.3.0-1: Terminal block

C.3.1 Checking the water separator in the fuel supply

The pre-filter with water separator has a cock at its lower surface, with this cock the downward sunk water can be discharged.

This is simply possible, water is heavier due to its density than the Diesel.

This pre-filter does not belong to the scope of supply.

Fig. C.3.1-1: Fuel filter with water separator

C.3.2 Exchange of the Fuel Filter

Fig. C.3.2-1: Fuel Filter

C.3.2 Exchange of the Fuel Filter

Exchanging the filter, depending upon fuel contamination, should take place after 300 operational hours at the very least. The inlet must be clamped, before exchanging the filter.

Remove the hoses from the used filter and fasten them to the new filter. The arrow on the filter housing indicates the direction of the fuel flow. A clogged filter causes a decreased power output of the generator.

Fig. C.3.2-1: Fuel Filter

C.4 Replace the air filter element

ATTENTION! Before the generator power terminal box with air filter is opened, READ the section “Safety instructions - Safety first!” on page 11 of this manual FIRST! Be sure that the generator is stopped and secured against accidently restart.

Open the air suction holder by loosen the two quick release fasteners.

Fig. C.4-1: Air suction housing

Pull the holder out to change the element.

Fig. C.4-2: Air filter element

If no change of the cooling water level can be determined, the generator is started for 5 minutes. Afterwards repeat the de-aeration two - three times.

It is meaningful to repeat the de-aeration procedure also after some days again to guarantee that in the system remained bubbles are removed.

C.4.1 Draining the coolant

In principle only describes here, how the cooling water of the raw water cycle can be drained. See measures for the preparation of the winter storage.

The simplest and cleanest method consists of the fact to bring the external ventilation valve below the generator level and hold over a collecting basin. Open the valve now, the water from the raw water circuit flows downward into the container.

Fig. C.4.1-1: Ventilation valve

C.5 The raw water circuit

C.5.1 Clean raw water filter

The raw water filter should be released regularly from arrears. In each case the water cock must be closed before. It is mostly sufficient to beat the filter punnet.

If water should seep through the cover of the raw water filter, this may be sealed in no case with adhesive or sealant. Rather must be searched for the cause for the leakage. In the simplest case the sealing ring between caps and filter holders must be replaced.

Fig. C.5.1-1: Raw water filter

C.5.2 Causes with frequent impeller waste

The impeller of the cooling water pump must be regarded as wearing part. The life span of the impeller can be extremely different and exclusively depends on the operating conditions. The cooling water pumps of the PANDA generators are laid out in such a way that the number of revolutions of the pump lies low compared with other gensets. This is for the life span of the pump a positive effect. Unfavorably affects the life span of the impeller, if the cooling water sucking in way is relatively long or the supply is handicapped, so that the cooling water sucking in range develops a negative pressure. This can reduce first of all the power of the cooling water pump extremely that the wings of the impeller are exposed to very strong loads. This can shorten the life span extremely. Further the operation of the impeller pump loaded in waters with a high portion of suspended matters. The use of the impeller pump is particularly critical in coral waterbodies. Cases are well-known, which a impeller pump had so strongly run after 100 hours already that the lip seal on the wave was ground in. In these cases sharp crystal parts of the coral sand assess in the rubber seal and affect like an abrasive the high-grade steel shank of the impeller pump. If the generator were mounted over the water level it is particularly unfavorable for the impeller pump. After the first start some seconds will pass by, until the impeller can suck in cooling water. This short unlubricated operation time damages the impeller. The increased wear can lead after short time to the loss. (see special notes: "Effects on the impeller pump, if the generator is mounted over the waterline")

C.5.3 Replace the impeller

Close the raw water stop cock.

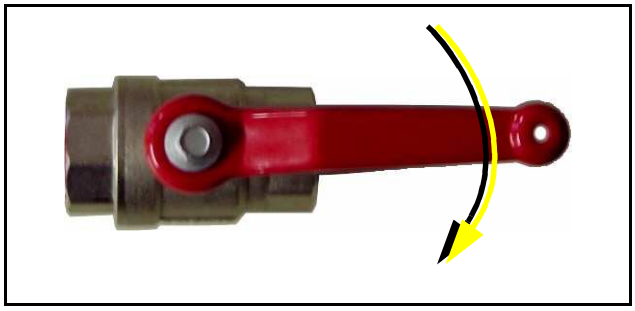


Fig. C.5.3-1: Raw water stop cock

Raw water pump on the front side of the genset.

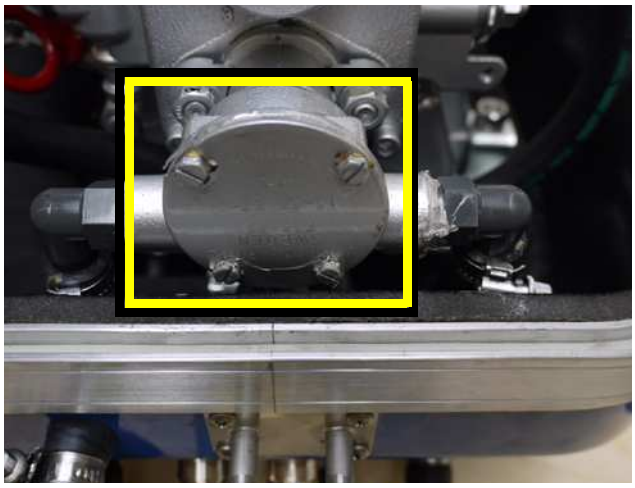


Fig. C.5.3-2: Raw water pump

Remove the cover of the raw water pump by loosen the 4 wing screws from the housing.

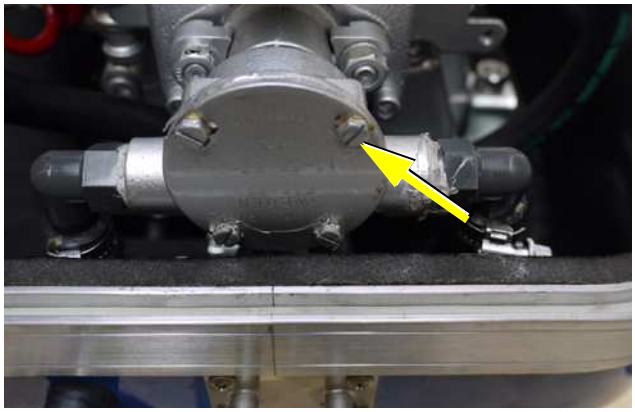
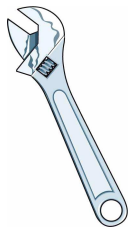


Fig. C.5.3-3: wing screw raw water pump



Mark the impeller, to make sure that these is used in the correct position at re-installation.

Pull to the impeller with a multigrip pliers of the wave.

Fig. C.5.3-4: Impeller

Check to the impeller for damage and replace it if necessary.

Before the reinsertion into the housing the impeller should have been lubricated with glycerin or with a non-mineral oil based lubricant e.g. silicone spray.

Attention - this is very important, because the impeller can dissolve otherwise very fast.

Fig. C.5.3-5: Impeller

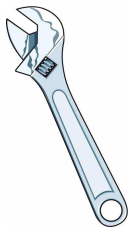
The impeller is attached to the pump wave if the old impeller is used, pay attention to the before attached marking).

Fastening the cover and use a new gasket.

Fig. C.5.3-6: Gasket

C.6 Conservation at longer operation interruption

C.6.1 Measures on preparation of the winter storage



1. Rinse raw water circuit with an anti-freeze solution, even if this contains a corrosion protection means. The raw water inlet must be removed at the water cock. Over a hose connector the anti-freeze protection mixture is to be sucked in from a container. The leaked cooling water with the exhaust is to be led back into the sucking in container. The circuit must be kept upright some minutes to guaranteed that the anti-freeze protection mixture reaches all ranges of the cooling system.
2. The concentration of the anti-freeze mixture in the internal cooling circuit must be checked with a suitable measuring instrument. The concentration must be furnished according to the lowest temperatures which can be expected.
3. Clean raw water filter and check seal.
4. Check water cock for practicability. And spray with a corrosion protection oil from the inside or lubricate with acidless grease.
5. Check all hoses and hose connectors for good condition. The rubber hoses are very sensitive to enviromental influences. They can age fast with dry air, in environment of light oil and fuel steams and increased temperature. The hoses must be checked regularly for elasticity. There are operating situations, which the hoses must be renewed once in the year.
6. Check the hose connectors at all raw water valves doubly and if possible protect them with double hose clamps.
7. Dismount the impeller of the cooling water pump and check for wear. The impeller may not remain in the pump. It must be greased with vaseline and be kept at a dark place. It can be reintragrated in the spring again into the pump, if it is in good condition. The impeller is a wearing part, it is recommended to renew it always in the spring, independently how many operating hours the genset ran.
8. Control of the vent valve at the raw water inlet. If the generator is installed below the waterline, always a vent valve is necessary. The vent valve must be checked also during the season regularly. In the winter storage the vent valve should always be disassembled, checked and greased. Hardens or got parts dirty are to be replaced.
9. Check water lock: If the generator were rinsed with an anti-freeze mixture, the antifreeze mixture can leave in the water lock. If the generator were rinsed with fresh water, the water in the water lock must be drained. Otherwise the danger exists that the collector is blown up and destroyed by ice.
10. Check the exhaust/water separator on leakage and if the hose connectors at the lower surface of the separation unit are in normal condition. (with extremely sulfureous fuels it is possible that also high-grade steel tube ends are attacked.)
11. Check all construction units at the generator inside the sound cover for leakages. If there are traces of humidity in the sound cover, the cover must be dried. Further the cause for the wetness must be surched and eliminated.
12. During the winter storage the upper section of the sound cover must be taken off, in order to avoid condensed moisture formation, if traces of humidity remain in the sound cover inside casing by leakages in the raw water circuit.
13. The generator housing and the housing of the engine should be sprayed with a corrosion protection oil before the winter storage. This procedure is recommended also in the season. This procedure can avoid that arising and humidity marks on the surface of the aluminum construction units be noticed too late.
14. Disconnect the starter battery (positive and negative pole).

C.6.1 Measures on preparation of the winter storage

15. Lubricate the spindle for the number of revolutions adjustment device with a special lubricant (Antiseize grease).
16. Check cooling water connection block at the generator housing on traces of corrosion and if necessary renew. (only such traces are to be considered, which refer to clear "blossoming" of the material. If the surface is only grey coated, this is only an indication for the fact that aluminum came into contact with condensed moisture.)
17. Use of a air dehumidifier. The best way to protect a yacht in the winter storage against damage by humidity is, to places a air dehumidifier inside the ship and locks all hatches. The devices have a hygrometer, which switches the device off, if the humidity is under the adjusted value. There is no better method, in order to protect pads, cable, electronics, wood, engines etc. optimally against any rotting by humidity.

C.6.2 Initiation at spring

- Before the first start turn the engine once with the hand, in order to eliminate necessary existing corrosion beginnings in the bushing. If necessarily carry out normal engine inspection.
- Change engine oil and engine oil filters.
- Reintegrate the impeller of the cooling water pump and check pump for leakage.
- Charge starter battery of the generator, connect cables and check battery voltage.
- Start generator and check the basic adjustments of the generator such as voltage, speed regulation etc..
- Check all switching off devices for function by operational procedures.

Fischer Panda does not take over adhesion for possible damages!

D. Generator Failure

D.1 Tools and measuring instruments

In order to be able to manage disturbances while driving, following tools and measuring instruments should belong to the equipment on board:

- Multimeter for voltage (AC), frequency and resistance
- Measuring instrument for inductance
- Measuring instrument for capacity
- Current absorbing clamps
- Thermometer (ideal is a infrared thermometer)
- Pressure device (pincer) für coolant circuit

D.2 Overloading the Generator

Please ensure that the genset is not overloaded. Overloading occurs when the electrical load (demand) induces a load torque in the generator which is higher than that which the diesel drive motor can provide. Overloading causes the engine to run rough, burn oil, creates excessive exhaust (environmentally unfriendly) and even to stall. Extra caution should be practised with multi-power units (single and 3-phase current generation) to avoid overloading the diesel drive engine.

The generator should only be loaded at the peak rated power for short periods only! A high peak current is required to start many electrical devices, especially electric motors and compressors (from a still stand state).

In order to prolong the genset´s life expectancy, the nominal electrical demand on the system should not be more than 70% of the rated genset peak load.

Keep PEAK LOADING demand in mind when switching on electrical devices (esp. fridge compressors, electric motors, battery chargers, kettles, etc.) which are fed by the generator. Careful "powering up" (gradual loading) of the electrical demand on the generator will help prolong the life of your genset! The genset can be run for several hours at partial load (i.e. 2/3 of rated power), however it is not advised that it is run for more than 2-3 hours at full load. The Panda is designed so as not to overheat even under extreme conditions. Note: The exhaust gas will become sooty during peak-load operation.

Overloading the Generator with Electric Motors

With the operation of electric motors it must be considered that these take up a multiple of their rated output as starting current (six to tenfold).

If the power of the generator for the engine is not sufficient, the voltage in the generator breaks down after switching on the engine. For special approach problems the manufacturer can give recommendations regarding the accomplishment of the situation (e.g. amplified capacitors, gradual start switch or extra developed starting unit for electric motors).

The system efficiency can be improved up to 50% and the starting current can be improved up to 100% by a professional adjustment of the engines. If the inductive load (electrical motors etc.) lies over 20% of the generator rated output a compensation is appropriate (see in addition also the writing: "Operation Instructions for Generators with Inductive Loads").

D.2.1 Monitoring the Generator Voltage

ATTENTION! - See “Safety instructions - Safety first!” on Page 11.

The voltage range of the power stations normally lies between 100V and 130V in the 60Hz version. In some countries even substantially larger tension deviations are being called "normally". The PANDA generators are aligned that they keep these default values during normal load.

With high load or overload it can occur that the voltage drops on 95V in the 60Hz version and partly still more deeply. That can become critical for certain devices (e.g. for electric motors, cooling compressors and possibly for electronic devices). It must be paid attention that the voltage for such loads are sufficient. This can be supervised by a voltmeter.

The voltmeter should be always installed behind the change over switch generator/land power, so that each voltage source is shown. No further voltmeter is provided for the generator itself.

If additional loads are switched on, the voltage must be controlled in each case at the voltmeter. Sensitive devices must be switched off so long, until the voltage exceed the critical parameter.

Under certain circumstances the generator provides overvoltage. This arises if the number of revolutions of the generator is increased. Changing the number of revolutions may be made only with a tachometer and/or a voltmeter.

If sensitive and/or valuable devices are used, which are to be protected against this risk, an automatic overvoltage protection must be mounted. (voltage control with disconnection).

D.2.2 Automatic Voltage Monitoring and Auto-Shut Down

If air conditioning units (compressors) or other such valuable equipment is installed on-board, it is recommend that an automatic voltage monitoring unit be installed to protect this equipment from possible sharp voltage drops. The voltage monitoring system shuts down the entire system (and therefore all users) by means of a circuit breaker relay as soon as the voltage falls below a set value (the monitor will also shut down the on-board grid automatically when the generator is stopped). Such a relay with contactor can be obtained from the installator or as a complete unit from your Panda dealer.

During any operation at the generator all load have to be switched off to avoid damages at the equipments. Also the solid state relay, which is installed in the AC-control box must be disconnected to avoid an accidentally activation of the booster capacitors.

Re-connect the connections if the electrical supply lines in the AC-control box were also be disconnected.

The generator can't be damaged by an overload because the winding is overload- and short-circuit safety. But damages are possible in the periphery. Especially connected loads are endangered because a lower voltage can damage them by order.

D.3 Low Generator-Output Voltage

If the produced alternating voltage is too low, switch the load off, in order to relieve the generator. Mostly the problem already solved. If the output voltage is still too low, even if all loads are switched off, the generator runs without load, you can assume one or more condensers are defective.

D.3.1 Discharge the capacitors

ATTENTION! Never work at the electrical cabinet, when the generator is running! Do not contact the capacitor. Before working on the system read the section "Safety instructions - Safety first!" on Page 11.

1) Switch off generator

2) Disconnect starter battery

3) Generator power terminal box

4) Remove the caps

The capacitor is discharged, by short circuit the two contacts. In addition use the cone end of an isolated screwdriver.

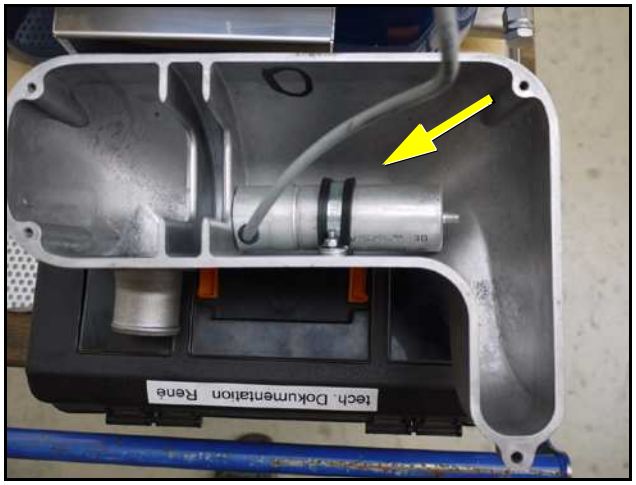


Fig. D.3.1-1: Capacitors

D.3.2 Checking the capacitor

If the capacitors are to be checked, it is to be made certain that the capacitors will be discharged before touching.

Already a visual check can give information on whether the capacitors are defective:

- Leaks dielectric?

- did the capacitor became longer?

The capacitors can be tested with a multimeter. Switch the measuring instrument to "pass" and connect both connections of the capacitor with the connections at the measuring instrument.

Touch with the test prods the two contacts of the capacitor. By the internal battery a charge transfer in the capacitor should take place now.

If changes the poles of the capacitor with the test prods, again a short "beep" should have to be heard. This short sound is only an indication for the fact that the capacitor is not defective.

Fig. D.3.2-1: Checking the capacitor

Should a steady sound or no sound have to be heard, the capacitor is defective and must be replaced.

In order to go surely that the capacitor has still its full capacity, use a capacity measuring instrument.

The capacitors, which not achieve the imprinted capacity value at this measurement, should be exchanged as fast as possible. If all capacitors are still functional, must be checked whether the connection to the strip is correct.

Checking the electrical connections to the capacitors

It must be ensured that the electrical connections to the capacitor are always tight fitting. Loose connections with transitional resistance can mean that the contact surfaces will become heated externally. This can lead to faster deterioration of the capacitors.

D.3.3 Checking the generator voltage

In order to test, whether the fixed winding produces enough voltage, proceed in such a way:

1. Guarantee that the connection to the electrical system is interrupted.
2. Remove all conductions in the power terminal box of the generator.
3. Starter battery must be connected with the generator.
4. Start the generator start.
5. Measure with a voltmeter the votage between the phase(s) and N. If the measured values are under the substantially values in Table E.2.1, “Technical Data Generator 4000s SCB + FCB,” on Page 104, a coil damage is to be accepted.

D.3.4 Measuring the coil resistance

For this a measuring instrument must be used that is suitable for low impedance values.

- Adjust the measuring instrument to resistance test. If hold the poles of the measuring instrument hold together, 0.00 ohms should be indicated. If the poles are isolated, the display should indicate an overflow. Please implement this test, in order to examine the equipment.
- Measure of the resistance within the individual windings.

Wenn hier starke Abweichungen in den einzelnen Wicklungsteilen gemessen werden, muß man davon ausgehen, daß es in einer Wicklung einen Wicklungsschluß gibt. Auch dies führt dazu, daß der Generator sich nicht mehr erregt.

Die tatsächlichen Werte zwischen den Wicklungsteilen und Masse sind jedoch nicht so genau zu bestimmen. Es kommt in erster Linie darauf an, daß die Werte aller drei Messungen möglichst gleich sind. Abweichungen untereinander weisen auf einen Wicklungsschluß hin. In diesem Fall muß der Generator von einem Fachmann neu gewickelt werden.

D.3.5 Checking the coil(s) to short-circuit

In order to check the coils for short-circuit, first all lines, which lead to the electrical system, must be interrupted. This happens on the power terminal box of the generator or, if available, in the electrical system junction box. Guarantee that no voltage lies at the lines, before they are interrupted (see “Discharge the capacitors” on Page 93).

Now remove the bridge between "N" and "PE", so that coils and housing are electrically separate from each other.

Check with a circuit indicator (multimeter) in the power terminal box if between the individual connection points of the coil and the housing (PE) a pass exists.

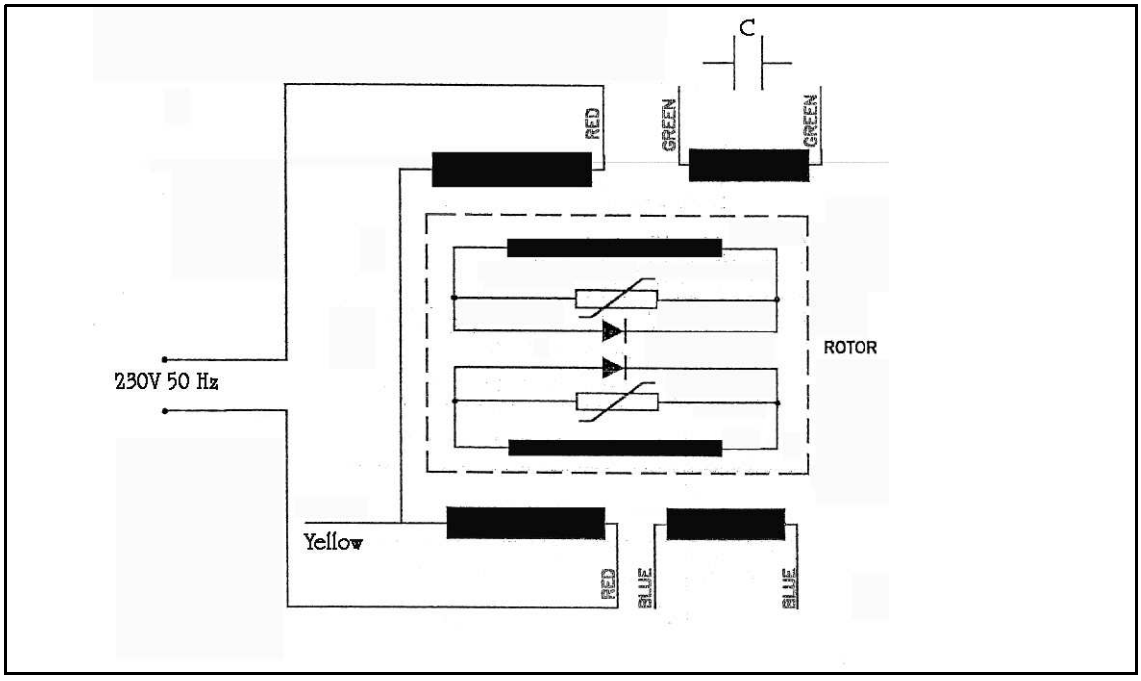


Fig. D.3.5-1: Coilplan

If a pass (beep) should be determined, the generator must be returned for examination in the plant, or it can also be wound again locally. For this coil datas can be requested.

D.3.6 Measuring the inductive resistance

Unfortunately the checking of the ohmic resistance permits still no reliable statement about the condition of the coil. If the ohmic resistance values arise inequalities between the coils, that is a safe indication for the fact that the coil is defective. To be exactly sure the inductive resistance of the coil have to be measured. For this a special measuring instrument is necessary, which measures the inductance of a coil.

Inductance is measured in the same way as the ohmic resistance, i.e. the coils are compared. The value is indicated in mH (milli Henry).

The arranging value for the inductive resistance can take from the Table E.2.1, “Technical Data Generator 4000s SCB + FCB,” on Page 104.

Note: These values depends strongly from the measuring method (kind of the measuring instrument)

D.4 Starting Problems

D.4.1 Fuel Solenoid Valve

The fuel solenoid valve is located in front of the injection pump. It opens automatically, if the „START“-button is pressed on remote control panel. If the generator is switched to "OFF", the solenoid valve closes. It takes some seconds, before the generator stops.

If the generator fails to start, runs rough, does not reach the proper RPM, or does not stop properly, the first item to suspect in most cases is the fuel solenoid valve and should be inspected first.

A check of the fuel solenoid valve by removing the plug from the fuel solenoid valve for a short period whilst in operation (first remove the small retention screw) and replace it immediately. The motor should "react immediately" by revving high. If the motor does not react sharply to the reconnection of the solenoid wire, it is a sign that the solenoid valve could be faulty.

1. Fuel solenoid valve
2. Ventilation screw

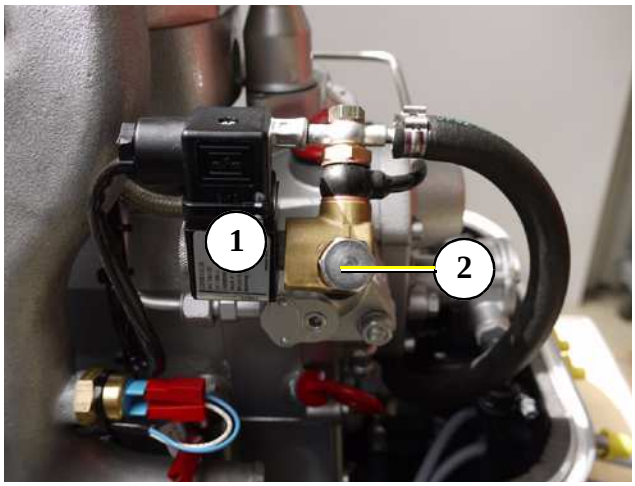


Fig. D.1: Fuel solenoid valve

Damage to starter motor

The starter is fitted with a free wheel or axial rotating spring cog, which prevents the starter being driven externally by means of the motor. The free wheel will be heavily worn, if the starter still operates, thereby causing damage to the springs, roller bearings or cog teeth. This could lead to complete destruction of the starter.

It is important that every person who operates the generator is informed of this situation. This is practically the only handling error that can be made on board that can lead to fatal consequences for both generator and operator.

D.4.2 Troubleshooting Table

For troubleshooting see “Troubleshooting” on Page 99.

E. Tables

E.1 Troubleshooting

GENERATOR OUTPUT VOLTAGE TOO LOW For 60Hz versions: less than 100V	
Cause	**Solution**
Generator is overloaded.	Reduce the electrical load. (Switch off load)
Motor is not reaching the rated rpm.	Refer to "motor faults" section.
Defective capacitor(s).	Check capacitors and replace if necessary.

GENERATOR VOLTAGE TOO HIGH (MORE THAN 135V-60Hz) If the generator is providing excessively high voltage, the following potential causes should be investigated:	
Cause	**Solution**
Over-energizing due to wrong capacitors.	Check capacitors type and replace if necessary.

GENERATOR VOLTAGE FLUCTUATES	
Cause	**Solution**
1. Disturbances on the electrical system/user side. 2. Motor disturbances.	1. Check if electrical load is fluctuating. 2. Refer to section: "Motor runs irregular".

GENERATOR NOT ABLE TO START ELECTRIC MOTOR	
Cause	**Solution**
If the generator is unable supply enough power to start an electric motor, it is usually because the motor draws too much current during starting process.	Check the motor's current draw required for starting Enquire at your nearest Panda dealer or directly at the manufacturer.

DIESEL MOTOR FAILS TO START	
Cause	**Solution**
Starter battery switched "OFF".	Check position of battery switch and switch "ON" (if installed).

Starter battery voltage insufficient (battery too weak).	Inspect battery terminals and cables for a good electrical connection (Inspect against corrosion, tattered wires, etc.).
Starting current disrupted.	During the normal starting process, the battery voltage drops to 11V with a fully charged battery. If the voltage does not drop during starting, the electrical connection is faulty. If the battery voltage drops lower than 11V, then the battery has been discharged.

STARTER IS TURNING MOTOR, BUT FAILS TO START	
Cause	**Solution**
Fuel inlet solenoid valve not opening.	Check wire connections and circuitry to solenoid valve. (ref. DC wiring diagram: Relay K2, Fuse)
Fuel pump not working.	Check fuel-filter and pump: clean if necessary.
Lack of fuel.	Check fuel supply.
Glow-plugs not working correctly.	Check glow plugs and heating time.
Too much air in fuel lines.	Test fuel system for leakage. Bleed air from fuel system (refer to section C.3, “Ventilating the fuel system,” on page 82).
Fuel-filter blocked.	Replace fuel filter.

MOTOR RUNS IRREGULARLY	
Cause	**Solution**
Faulty centrifugal injector governor.	Have the centrifugal governor inspected by a Fary-mann-Service technician.
Too much air in fuel lines.	Bleed air from fuel system.

MOTOR DOES ACHIEVE ENOUGH SPEED DURING STARTING PROCESS	
Cause	**Solution**
Starter battery voltage insufficient.	Check battery.
Damaged bearing(s) piston (seized).	Repairs need to be carried out by Farymann-Service. (refer to Farymann motor-manual)
Cooling water in combustion chamber.	1. Turn generator "OFF" at control panel. 2. Remove the glow plug (see Farymann-manual). 3. Rotate the motor by hand carefully. 4. Check if there is water in the oil and change both oil and filter if necessary. 5. Determine cause for excess water in the combustion chamber. The excess water can be caused by a defective air vent in the cooling water system, which should be checked and cleaned, or replaced if faulty.

MOTOR SPEED DROPS	
Cause	**Solution**
Lack of fuel	Check fuel supply system: - fuel filter, renew if necessary - check fuel pump - check fuel lines (bleed if necessary)
Lack of intake air.	Check air intake paths. Check and clean air filter (and intake muffler if installed).
Generator overloaded by too many load.	Reduce the electrical load (switch off load).
Generator overloaded by over-energizing.	Check that the proper capacitor type is installed and that they are connected correctly.
Defective generator (windings, bearings, or other).	Generator must be sent to manufacturer for repair of damaged bearings or winding.
Damaged engine.	Repair of bearing damage, etc., by Farymann-Service.

MOTOR RUNS IN OFF POSITION	
Cause	**Solution**
Fuel inlet solenoid valve or throttle shut solenoid is not switching off.	Check wire connections to solenoid. Check valve functions as in the "Fuel Solenoid Valve" or in the trottle shut off solenoid sections. Replace if necessary.

MOTOR STOPS BY ITSELF	
Cause	**Solution**
Lack of fuel.	Check fuel supply system.
Excess heat in cooling system (thermo switch tripped)- lack of cooling water. Is indicated on the remote control panel.	Check cooling water system flow: water pump, inlet water filter, extra heat exchanger coolant flow.
Lack of oil (oil pressure sensor tripped). Is indicated on the remote control panel.	Check oil-level and if necessary top up. Check motor's oil-pressure and have repaired by Farymann-Service if necessary.

SOOTY, BLACK EXHAUST	
Cause	**Solution**
Generator is overloaded.	Check electrical load and switch off unnecessary load.
Insufficient intake air.	Check intake air filter; clean if necessary.
Fuel injector faulty.	Replace injector.
Valve clearance incorrect.	Readjust valve clearance to correct value (refer to Farymann-manual).
Poor fuel quality.	Use better quality diesel (recommended: 2-D Diesel).
Poor combustion.	Incorrect AFR (air/fuel ratio) due to motor timing adjustment. Have motor serviced by Farymann.

GENERATOR MUST BE SHUT OFF IMMEDIATELY IF:	
Cause	**Solution**
- motor rpm suddenly rises or drops - unusual noise comes from genset - exhaust colour suddenly becomes dark - leakage in the cooling water system.	Refer to respective section of manual and if necessary, have repaired by Farymann-Service, or Panda representative.

E.2 Technical Data Engine

Type	**Farymann 18W430**
Govenor	mechanical
Cylinder	1
Bore	82 mm
Stroke	55 mm
Stroke volume	290 cm^3
max. power (DIN 6271 IFN-ISO)	5,7 kW
Nominal speed 60 Hz	3600 rpm
Idle running speed [a]	3690 rpm
Valve clearance (engine cold)	0,2 mm
Cylinder head nut torque	30-33 Nm
Compression ratio	20:1
Lubrication oil capacity	1,25 l
Fuel consumption [b]	approx. 0,42- 1,12 l
Oil consumption	max. 1% of the fuel comsumption
Cooling water requirement for raw water circuit	10-12 l/min
Permissible max. permanent tilt of engine	a) 25° acr oss the longitudinal axis b) 20° in the longitudinal direction

a. progressive govenor by VCS
b. 0,35l/kW electrical power, the randomized values between 30% and 80% of the rating power

E.2.1 Technical Data Generator 4000s SCB + FCB

Generator	**Panda 4000S SCB**
Nominal power	3.8 kW , 3000mtr nn., 50℃
Nominal voltage	230V / 50 Hz single phase
max. current	15 A
Frequency	50Hz
Cable cross-section	single-phase: 3x 2,5mm²
ohmic resistance coil	Exciting wiring = Green-Green Cable 2,3 Ohm Generator wiring = Red-Red Cable 1,2 Ohm Generator wiring = Red-Yellow Cable 0,6 Ohm
inductive resistance coil	Exciting wiring = Green-Green Cable 12,2 mH Generator wiring = Red-Red Cable 5,4 mH Generator wiring = Red-Yellow Cable 2,3 mH
Voltage stator coil	single-phase: L-N: 2-4V
Coolant hoses [Ø / mm]	Raw water: 12
Exhaust hose [Ø / mm]	40
Fuel hose [Ø / mm]	Supply / return: 8

E.3 Engine oil

Engine oil classification

Operating range:

The operating range of an engine oil is determined by SAE class. "SAE" is for the union of American engineers (Society of Automotives Engineers). The SAE class of an engine oil only informs over the viscosity of the oil (larger number = more viscous, lower number = more highly liquidly) e.g. to 0W, 10W, 15W, 20, 30, 40. The first number shows the liquid of cold weather, the second number refers to the fluidity with heat. Complete yearly oils have usually SAE 10W-40, SAE 15W-40 etc.

Quality of oil:

The quality of an engine oil is specified by the API standard ("American Petroleum Institutes"). The API designation is to be found on each engine oil bundle. The first letter is always a C.

API C for diesel engines

The second letter is for the quality of the oil. The more highly the letter in the alphabet, the better the quality.

Examples for diesel engine oil:

API CG Engine oil for highest demands, turbo-tested

Engine oil types	
above 25℃	SAE30 or SAE10W-30 SAE10W-40
0℃ to 25℃	SAE20 or SAE10W-30 SAE10W-40
below 0℃	SAE10W or SAE10W-30 SAE10W-40

E.4 Coolant

Use a mixture of water and antifreeze. The antifreeze needs to be suitable for aluminium. The antifreeze concentration must be regularly checked in the interests of safety.

Fischer Panda recommend to use the product: GLYSANTIN PROTECT PLUS/G 48.

Engine coolant automotive industry Product description		
Product name	GLYSANTIN ® PROTECT PLUS / G48	
Chemical nature	Monoethylenglycol with inhibitors	
Physical form	Liquid	
Chemical and physical properties		
Reserve alkalinity of 10ml	ASTM D 1121	13 – 15 ml HCl 01 mol/l
Density, 20℃	DIN 51 757 procedure 4	1,121 – 1,123 g/cm^3
Water content	DIN 51 777 part 1	max. 3,5 %
pH-value undiluted		7,1 – 7,3

Coolant mixture ratio	
Water/antifreeze	Temperature
70:30	-20℃
65:35	-25℃
60:40	-30℃
55:45	-35℃
50:50	-40℃

E.5 Capsule Measurements 4000s

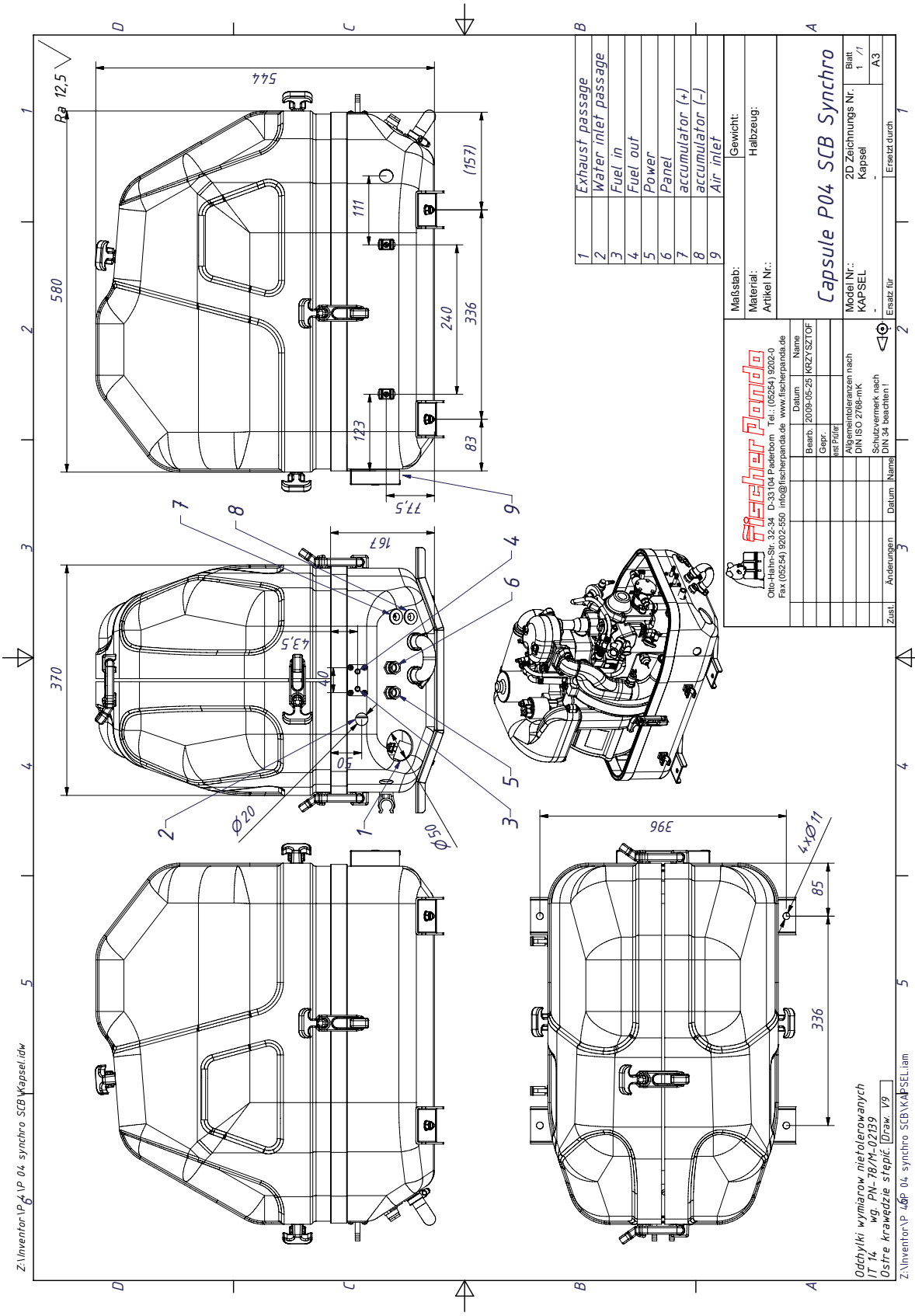


Fig. E.5-1: Capsule measurments

Fischer Panda Datasheet

A. Remote Control Panel P4 Control

Art Nr..	**21.02.02.032H**
Bez.	Remote Control Panel P4 Control

	Dokument	Hardware	Software
Aktuell:	R01	V1.00	----------
Ersetzt:		----------	----------

A.1 Remote control panel

Remote control panelP4 Control

The remote control panel is necessary to control the generator and to evaluate the motor/generator properties. The generators will automatically cutout, if it does not run as required. The generator may not be run without the remote control panel.

Fig. A.1-1: Remote control panel

Fischer Panda Datasheet

A.2 Cleaning and Replacing parts at the generator

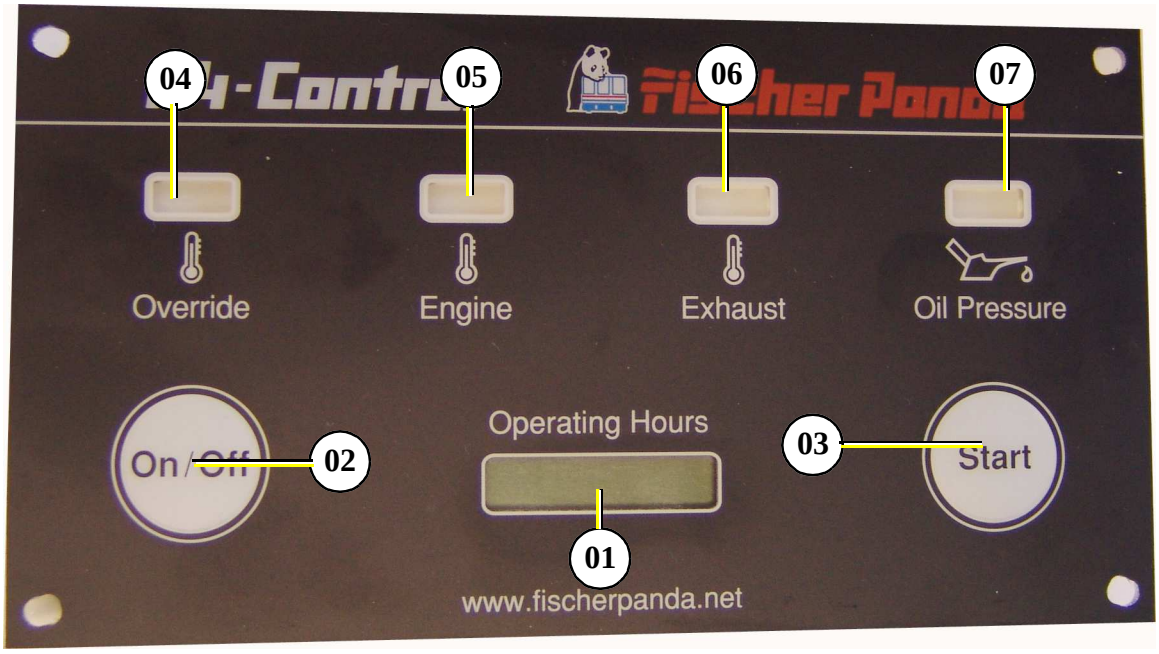
The battery must always be disconnected, if work on the generator or electrical system is to be carried out, so that the generator cannot be started unintentionally .

Note the safety instruction in the generator manual.

Seawater valve must be shut (Marine version)

Attention!!! Parts of the generator and the cooling water may be hot after operation. !!!DANGER!!!

A.3 Front side

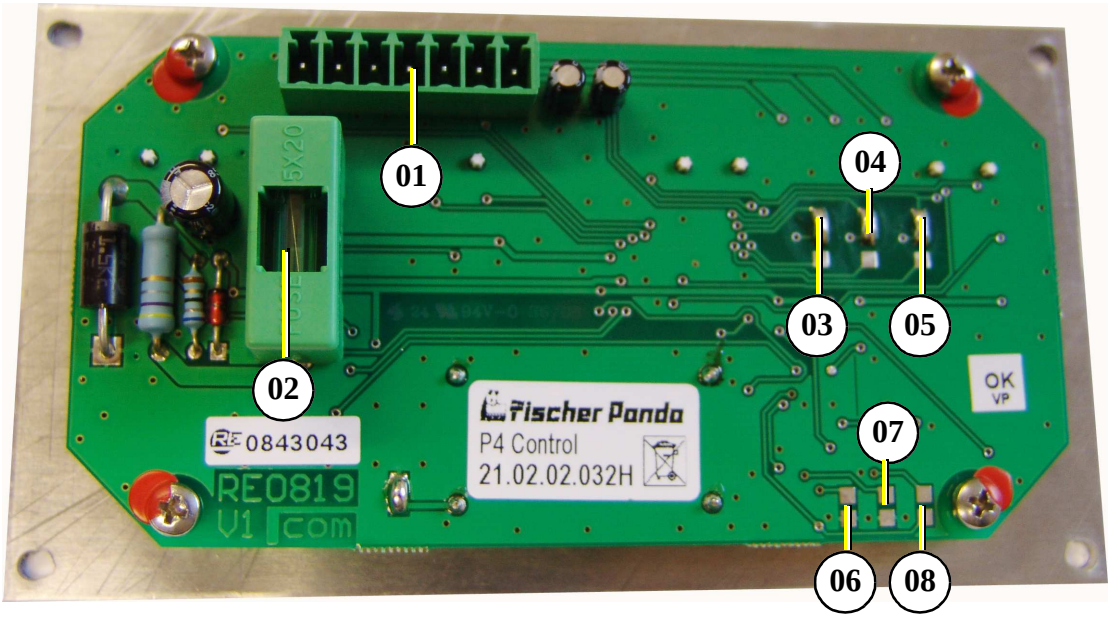


01) Diplay operating hours
02) Power „ON/OFF“-button
03) Generator „Start“-button
04) Control light „Override“
05) Warning light for engine temperature
06) Warning light for exhaust temperature
07) Warning light for oil pressure

Fig. A.3-1: Remote Control Panel - Front Side

Fischer Panda Datasheet

A.3.1 Back Side



01) Connector for generator cable
02) Fuse 0,5A
03) Jumper J103
04) Jumper J102
05) Jumper J101
06) Jumper J104
07) Jumper J105
08) Jumper J106

Fig. A.3.1-1: Remote control panel - back side

A.4 Operation Manual

A.4.1 Preliminary Remarks

Advices concerning the starter battery

Fischer Panda recommends normal starter battery use. If a genset is required for extreme winter conditions, then the starter battery capacity should be doubled. It is recommended that the starter battery be regularly charged by a suitable battery-charging device (i.e., at least every 2 months). A correctly charged starter battery is necessary for low temperatures.

Fischer Panda Datasheet

A.4.2 Override Function

Depending on the installation situation, a heat accumulation inside the generator sound insulated capsule may occur (especially after longer run time with high load). According to this sitiuation the engine overheat switch release after the generator has already stopped. The generator can not be starded until the engine has cooled down.

To prevent this, the P4 Control panel has an override mode. While the start button is pressed and several sekonds after it (can be modified with jumpers on the panel back side), the temperature error is ignored. The circulation of the cooling wtaer cool down the engine and the generator can be started normal.

The control light „Override“ is turned on:

- if the panel ist on and the generator is stopped (funktion control)

- during the „Start“ button is pressed (Override activ)

- during the setted time after the „Start buton is released“ (Override activ)

Not in use at the Panda 4000s serie.

A.4.3 Daily routine checks before starting

1. Oil Level Control (ideal level: 2/3).

AtTTENTION! OIL PRESSURE CONTROL!
True, the diesel motor automatically switches off when there is a lack of oil, but it is very damaging for the motor, if the oil level drops to the lowest limit. Air can be sucked in suddenly when the boat rocks in heavy seas, if the oil level is at a minimum. This affects the grease in the bearings. It is therefore necessary to check the oil level daily before initially running the generator. The oil level must be topped up to the 2/3 level, if the level drops below the min. mark

2. State of Cooling Water.

The external compensation tank should be filled up to a maximum of in a cold state. It is very important that large expansion area remains above the cooling water level.

3. Open Sea Cock for Cooling Water Intake. (only Marine)

For safety reasons, the seacock must be closed after the generator has been switched off. It should be re-opened before starting the generator.

4. Check Raw water Filter. (only Marine)

The raw water filter must be regularly checked and cleaned. The impeller fatigue increases, if residual affects the raw water intake.

5. Check all Hose Connections and Hose Clamps are Leakage.

Leaks at hose connections must be immediately repaired, especially the raw water impeller pump. It is certainly possible that the raw water impeller pump will produce leaks, depending upon the situation. (This can be caused by sand particles in the raw water etc.) In this case, immediately exchange the pump, because the dripping water will
be sprayed by the belt pulley into the sound insulated casing and can quickly cause corrosion.

6. Check all electrical Lead Terminal Contacts are Firm.

This is especially the case with the temperature switch contacts, which automatically switch off the generator in case of faults. There is only safety if these systems are regularly checked, and these systems will protect the generator, when there is a fault.

7. Check the Motor and Generator Mounting Screws are Tight.

Fischer Panda Datasheet

A.4.3 Daily routine checks before starting

The mounting screws must be checked regularly to ensure the generator is safe. A visual check of these screws must be made, when the oil level is checked.

8. Switch the Land Electricity/Generator Switch to Zero before Starting or Switch Off all the load.(only Marine)

The generator should only be started when all the load have been switched off. The excitation of the generator will be suppressed, if the generator is switched off with load connected, left for a while, or switched on with extra load, thus reducing the residual magnetism necessary for excitation of the generator to a minimum. In certain circumstances, this can lead to the generator being re-excitated by means of a DC source. If the generator does not excitate itself when starting, then excitation by means of DC must be carried out again.

9. Check the Automatic Controls Functions and Oil Pressure.

Removing a cable end from the monitoring switch carries out this control test. The generator should then automatically switch off. Please adhere to the inspection timetable (see Checklist in the appendix).

A.4.4 Starting the Generator

1. Open sea lock and close battery switch if necessary.
2. Push „ON/OFF“ button to switch panel on.
3. Push „Start/Stop“ button to start the generator.
4. Switch on load.

A.4.5 Stopping Generator

1. Switch off load.
2. If the load is higher than 70% of the nominal load, the generator temperatures should be stabilised by switching off the loag for at least 5 minutes.

At higher ambient temperatures (more than 25°C) the generator should always run for at least 5 minutes without load, before it is switched off, regardless of the load.

3. Press „OFF“ button and switch off the generator.
4. Activate additonal switches (Battery switch, fuel stop valve etc.).

NOTE: Never switch off the battery until the generator has stopped.

5. If necessary, close sea cock.

ATTENTION

NOTE: If the generator switches itself off with the operation with load for temperature reasons, must be examined immediately, which the cause is. That can be an error at the cooling system or any error in the range of the outside cooling system.

A.5 Installation of the Panel

A.5.1 Connection of the remote control panel

As standard a 7 core connection-cable, 7m long, is included in the supply. Cores are numbered from 1 to 7. The control cables are securely connected to the genset. On the back of the control panel there are terminals numbered from 1 - 7. Connect the cores of the control-cable in respective order.

Please ensure that the remote control panel is installed in a protected, dry and easily accessible place.

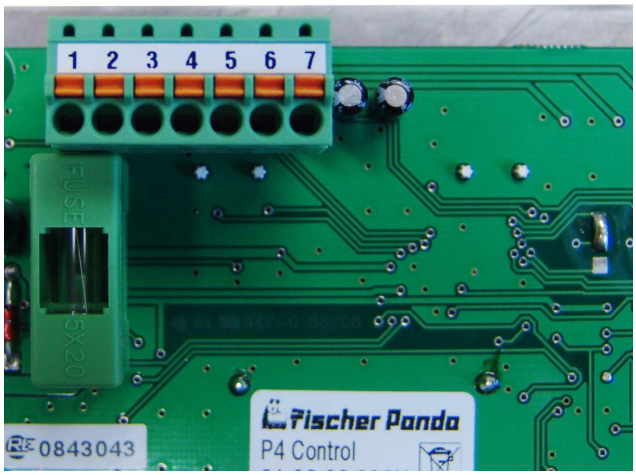


Fig. A.5.1-1: Remote control panel - back side

Ter..-Nro	Terminator.-name	i / o	Description
1	Vbat	i	Power supply 12V (+)
2	GND	i	Power supply 12V(-)
3	T-Cyl	i	Error „engine temp“. Temperature switch engine head in. Can be setted up by jumper as NC or NO Gives 22mA (12V +) on the switch. This error is ignored while the „Start“ button is pressed and several seconds after it is released (time set up by jumpers) The yellow „Override“ LED is on while the error is ignored. Status is displayed by green/red LED.
4	T-EXH	i	Error „exhaust temp.“. Temperature switch exhaust elbow in. Can be setted up by jumper as NC or NO Gives 22mA (12V +) on the switch. Status is displayed by green/red LED.
5	Oil-Press	i	Error „oil pressure“. Oil pressure switch in. Can be setted up by jumper as NC or NO Gives 22mA (12V +) on the switch. Status is displayed by green/red LED.
6	Start	o	Start relay out . Is activ while the „Start“ button is pressed. The supply voltage is switched on the relay. (see remarks 1-3)

Fischer Panda Datasheet

7	Fuel-Pump	o	Fuel pump relay out. Is activ, if no error (temp. or oil press. at 3, 4, 5) is accu-red. Is activ during the „Override“. The supply voltage is switched on the relay. (see remarks 1-3)

1) Max. current out continous operation: 0,25A short time 0,4A

2) Max. current out is limited by the panel fuse (minus 0,1A for the panel).

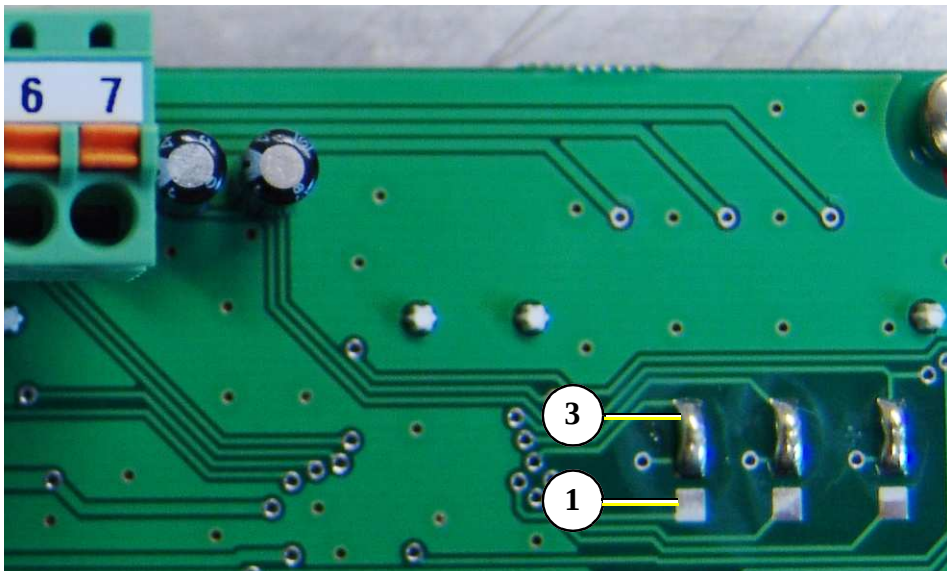
3) The out is protected by an freewheeling diode.

A.6 Jumperconfiguration

A.6.1 Jumper configuration for the input

A.6.2 Jumper J101 - J103

At the 3 pin jumpers J101-J103 the pin 3 is at the termination block side.



Jumper	Status	Desc.
J101	1-2	Temp. switch engine head is NC
	2-3	Temp. switch engine head is NO
J102	1-2	Temp switch exhaust elbow is NC
	2-3	Temp switch exhaust elbow is NO
J103	1-2	Oil pressure switch is NC
	2-3	Oil pressure switch is NO

A.6.3 Jumper for configuraton odf the „Override“ time

	J104	J105	J106	Test-Mode	Override time [s]
1	**open**	**open**	**open**	**no**	**40**
2	**closed**	**open**	**open**	no	20
3	**open**	**closed**	**open**	no	10
4	**closed**	**closed**	**open**	no	5
5	**open**	**open**	**closed**	**no**	**0,16**
6	**closed**	**open**	**closed**	no	0,08
7	**open**	**closed**	**closed**	no	0,04
8	**closed**	**closed**	**closed**	no	0,02
9	**open**	**open**	**- -**	**yes**	**2,5**
10	**closed**	**open**	- -	yes	1,25
11	**open**	**closed**	- -	yes	0,63
12	**closed**	**closed**	- -	yes	0,31

1 is atandard for „override“ activated

2 is standard for „Override“deactivated“

9 is standard for „Test mode“

The Test mode is activ as long as the button „on/off“ is pressed by turning on the panel.

A.7 Maximum ratings

Operation outside of the maximum ratings can causes damage at the panel and the generator

In not indicated otherwise the ambiant temperature is assumed. All oltage data are against GND (X1.2).

Operation Voltage Ub is the voltage at terminator X1.1

Parameter	Desc.	min.	max.	
Betriebsspannung	without time limit. full function	10,5	15	V
	without time limit, full function (except H-Meter, LED light lower)	6		V
	maximal 60min, Ta = 65℃, full function		17	V
	maximal 60s, Ta = 65℃, full function		18	V
	maximal 100ms, Ta = 65℃, full funktion		22	V

Fischer Panda Datasheet

	maximal 100ms, full funktion, except H-Meter, some LED out of ordert	4,5		V
ambient temperature for operation		0	+85	℃
capacity of the outputs	without time limit		0,25	A
	without time limit (1 output only)		0,4	A
External voltage on the outputs	Outputs with freewheeling diode for short out negative external voltage	-0,3	Ub	V
External Voltage on the inputs	without time limit. Voltage which are out of the rating will be short out by the Z- diode.	-0,3	Ub	V
Internal F1	Microfuse 5 x 20mm glass fuse slow to blow		0,5	A

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