Manual Marine Generator

Panda 12 mini PMS Digital

120V - 60Hz / 10,5kW

Super silent technology

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Dear Customer,

Thank you for purchasing a Fischer Panda Generator and choosing Fischer Panda as your partner for mobile power on board. With your generator, you now have the means to produce your own power – wherever you are - and experience even greater independence. Not only do you have a Fischer Panda generator on board, you also have worldwide support from the Fischer Panda Team. Please take the time to read this and find how we can support you further.

Installation Approval and Warranty

Every generator has a worldwide warranty. You can apply for this warranty through your dealer when the installation is approved. If you have purchased an extended warranty, please ensure that it is kept in a safe place and that the dealer has your current address. Consult your dealer about warranty options especially if you have purchased a used generator. He will be able to advise about authorised Fischer Panda Services worldwide.

Service and Support

To ensure that your generator operates reliably, regular maintenance checks and tasks as specified in this manual must be carried out. Fischer Panda can supply Service Kits which are ideal for regular servicing tasks. We only supply the highest quality components which are guaranteed to be the RIGHT parts for your generator. Service “Plus” Kits are also available and ideal for longer trips where more than one service interval may be required.

If you require assistance – please contact your Fischer Panda Dealer. Please do not attempt to undertake any repair work yourself, as this may affect your generator warranty. Your dealer will also be able to assist in finding your nearest Fischer Panda service station. Your nearest service station can also be found in our Global Service Network which can be downloaded from our homepage.

Product Registration

Please take the time to register your Fischer Panda Generator on our website at

http://www.fischerpanda.de/mypanda

By registering, you will ensure that you will be kept up to date on any technical upgrades or specific information on the operation or servicing of your generator. We can even let you know about new Fischer Panda products – especially helpful if you are planning to upgrade or expand your installation at a later date.

Fischer Panda Quality - Tried and Tested

DIN-certified according DIN ISO 9001

Thank you for purchasing a Fischer Panda Generator.

Your Fischer Panda Team

1. General Instructions and Regulations

1.1 Safety first!

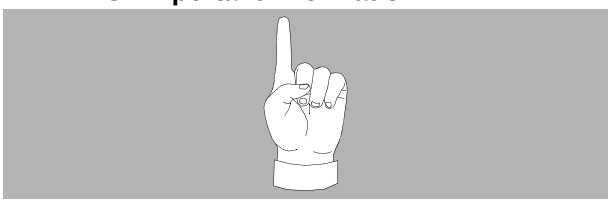
These symbols are used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury of lethal danger during certain maintenance work or operations. Read these instructions carefully.

Can cause acute or chronic health impairments or death even in very small quantities if inhaled, swallowed, or absorbed through the skin.

WARNING: Hazardous materials

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: Important information!



Warning of materials that may ignite in the presence of an ignition source (cigarettes, hot surfaces, sparks, etc.).

WARNING: Fire hazard

In the environment described / during the work specified, smoking is prohibited.

PROHIBITED: No smoking

Fire and naked light are ignition sources that must be avoided.

PROHIBITED: No fire or naked light

The equipment shall not be activated or started up while work is in progress.

PROHIBITED: Do not activate/start up

Touching of the corresponding parts and systems is prohibited.

PROHIBITED: Do not touch

Danger for life! Working at a running generator can result in severe personal injury.

The generator can be equipped with a automatic start device. This means, an external signal may trigger an automatic start-up. To avoid an unexpected starting of the generator, the starter battery must be disconnected before working at the generator.

DANGER: Automatic start-up

This danger symbol refers to the danger of electric shock and draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in severe personal injury or loss of life due to electric shock.

WARNING: Hazardous electric voltage

General warning of a hazard area

WARNING: General warning

Can cause acute or chronic health impairments or death even in very small quantities if inhaled or ingested.

WARNING: Danger due to inhalation and/or ingestion

Warning of live parts that may cause electric shock upon contact. Especially dangerous for persons with heart problems or pacemakers.

WARNING: Risk of electric shock upon contact

Danger of injury due to being pulled into equipment. Bruising and torn off body parts possible. Risk of being pulled in when touching with body part, loose-fitting clothing, scarf, tie, etc.

WARNING: Danger due to rotating parts

Warning of substances that may cause an explosion under certain conditions, e.g. presence of heat or ignition sources.

WARNING: Explosion hazard

Warning of hot surfaces and liquids. Burn/scalding hazard.

WARNING: Hot surface

Warning of substances that cause chemical burns upon contact. These substances can act as contaminants if introduced into the body.

WARNING: Danger due to corrosive substances, potential contamination of person

When the system is opened, the pressure can be relieved abruptly and expel hot gases and fluids. Risk of injury due to parts flying about, burn hazard due to liquids and gases.

WARNING: System may be pressurised!

Warning of hearing damages.

WARNING: Hearing damage

Warning of magnetic field.

WARNING: Magnetic field

Warning of overpressure.

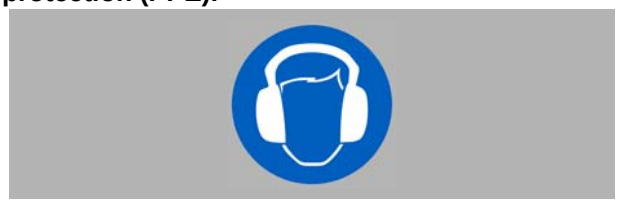
WARNING: Overpressure

Wearing the applicable snugly fitting protective clothing provides protection from hazards and can prevent damage to your health.

MANDATORY INSTRUCTION: Wear snugly fitting protective clothing (PPE).

Wearing hearing protection provides protection from acute and gradual hearing loss.

MANDATORY INSTRUCTION: Wear hearing protection (PPE).



Wearing safety goggles protects the eyes from damage. Optical spectacles are not a replacement for the corresponding safety goggles.

MANDATORY INSTRUCTION: Wear safety goggles (PPE).

Wearing protective gloves provides the hands from hazards like friction, graze, punctures or deep cuts and protects them from contact with hot surfaces.

MANDATORY INSTRUCTION: Wear protective gloves (PPE).

Compliance with the instructions in the manual can avert danger and prevent accidents. This will protect you and the generator.

MANDATORY INSTRUCTION: Observe the instructions in the manual.

Environmental protection saves our living environment. For you and for your children.

MANDATORY INSTRUCTION: Comply with environmental protection requirements.

1.2 Tools

These symbols are used throughout this manual to show which tool must be used for maintenance or installation.

	Spanners W.A.F X = width across flats of X mm
	Hook wrench for oil filter
	Screw driver, for slotted head screws and for Phillips head screws
	Multimeter, multimeter with capacitor measuring unit
	Socket wrench set
	Hexagon socket wrench set

	Clamp-on ammeter (DC for synchronous generators; AC for asynchronous generators)
	Torque wrench

1.3 Manufacturer declaration in accordance with the Machinery Directive 2006/42/EC

Manufacturer declaration in accordance with the Machinery Directive 2006/42/EC

The generator was designed in such a way that all assemblies correspond with the CE guidelines. If Machinery Directive 2006/42/EC 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 complies with the Machinery Directive 2006/42/EC. This includes the exhaust system, cooling system and electrical installations.

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

1.4 Customer registration and guarantee

Use the advantages of registering your product:

- you will receive a Guarantee Certificate after approval of your installation data
- you will receive extended product information that may be relevant to safety.
- You will receive free upgrades as necessary.

Additional advantages:

Based on your complete data record, Fischer Panda technicians can provide you with fast assistance, since 90 % of the disturbances result from defects in the periphery.

Problems due to installation errors can be recognized in advance.

1.4.1 Technical support

Technical Support via the Internet: info@fischerpanda.de

1.4.2 Caution, important information for start-up!

1. The commissioning log shall be filled in immediately after initial operation and shall be confirmed by signature.
2. The commissioning log must be received by Fischer Panda GmbH at Paderborn within 4 weeks of initial operation.
3. After receiving the commissioning log, Fischer Panda will make out the official guarantee certificate and send it to the customer.
4. If warranty claims are made, the document with the guarantee certification must be submitted.

If the above requirements are not or only partly fulfilled, the warranty claim shall become void.

1.5 Safety Instructions - Safety First!

1.5.1 Safe operation

Careful handling of the equipment is the best insurance against an accident. Read the manual diligently, and make sure you understand it before starting up the equipment. All operators, regardless of their experience level, shall read this manual and additional pertinent manuals before commissioning the equipment or installing an attachment. The owner shall be responsible for ensuring that all operators receive this information and are instructed on safe handling practices.

1.5.2 Observe safety instructions!

Read and understand this manual and the safety instructions on the generator before trying to start up and operate the generator. Learn the operating practices and ensure work safety. Familiarise yourself with the equipment and its limits. Keep the generator in good condition.

1.5.3 Personal protective clothing (PPE)

For maintenance and repair work on the equipment, ***do not*** wear loose, torn, or ill-fitting clothing that may catch on protruding parts or come into contact with pulleys, cooling disks, or other rotating parts, which can cause severe injury.

Wear appropriate safety and protective clothing during work.

Do not operate the generator while under the influence of alcohol, medications, or drugs.

Do not wear head phones or ear buds while operating, servicing, or repairing the equipment.

1.5.4 Cleanliness ensures safety

Keep the generator and its environment clean.

Before cleaning the generator, shut down the equipment and secure it against accidental start-up. Keep the generator free from dirt, grease, and waste. Store flammable liquids in suitable containers only and ensure adequate distance to the generator. Check the lines regularly for leakage and eliminate leaks immediately as applicable.

1.5.5 Safe handling of fuels and lubricants

Keep fuels and lubricants away from naked fire.

Before filling up the tank and/or applying lubricant, always shut down the generator and secure it against accidental start-up.

Do not smoke and avoid naked flame and sparking near fuels and the generator. Fuel is highly flammable and may explode under certain conditions.

Refuel in well-ventilated open spaces only. If fuel/lubricant was spilled, eliminate fluids immediately.

Do not mix diesel fuel with petrol or alcohol. Such a mixture can cause fire and will damage the generator.

Use only approved fuel containers and tank systems. Old bottles and canisters are not adequate.

1.5.6 Exhaust fumes and fire protection

Engine fumes can be hazardous to your health if they accumulate. Ensure that the generator exhaust fumes are vented appropriately (leak-proof system), and that an adequate fresh air supply is available for the generator and the operator (forced ventilation).

Check the system regularly for leakage and eliminate leaks as applicable.

Exhaust gases and parts containing such fumes are very hot; they may cause burns under certain circumstances. Always keep flammable parts away from the generator and the exhaust system.

To prevent fire, ensure that electrical connections are not short-circuited. Check regularly that all lines and cables are in good condition and that there is no chafing. Bare wires, open chafing spots, frayed insulation, and loose cable connections can cause dangerous electric shocks, short-circuit, and fire.

The generator shall be integrated in the existing fire safety system by the operating company.

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.

Exhaust gases from diesel motors and some components are carcinogenic and can cause deformities and other genetic defects.

1.5.7 Safety precautions against burns and battery explosions

The generator and its cooling agents and lubricants as well as the fuel can get hot while the generator is operated. Use caution around hot components such as parts containing exhaust fumes, radiator, hoses, and engine block during operation and after the generator was shut down.

The cooling system may be pressurised. Open the cooling system only after letting the engine and the coolant cool down. Wear appropriate protective clothing (e.g. safety goggles, gloves).

Prior to operation, ensure that the cooling system is sealed and that all hose clamps are tightened.

The battery represents an explosion hazard, this applies both to the starter battery and the battery bank of the AGT generators. While batteries are being charged, a hydrogen-oxygen mixture is generated, which is highly explosive (electrolytic gas).

Do not use or charge batteries if the fluid level is below the MINIMUM marking. The life span of the battery is significantly reduced, and the risk of explosion increases. Refill to a fluid level between maximum and minimum level without delay.

Especially during charging, keep sparks and naked fire away from the batteries. Ensure that the battery terminals are tightly connected and not corroded to avoid sparking. Use an appropriate terminal grease.

Check the charge level with an adequate voltmeter or acid siphon. Contact of a metal object across the terminals will result in short-circuiting, battery damage, and high explosion risk.

Do not charge frozen batteries. Heat the batteries to +16 °C (61 °F) prior to charging.

1.5.8 Protect your hands and body from rotating parts!

Always keep the capsule closed while operating the generator.

To check the V-belt tension, always shut down the generator.

Keep your hands and body away from rotating parts such as V-belt, fans, pulleys, and flywheel. Contact can cause severe injury.

Do not run the engine without the safety devices in place. Prior to start-up, mount all safety devices securely and check for proper attachment and function.

1.5.9 Anti-freeze and disposal of fluids

Anti-freeze contains toxic substances. To prevent injury, wear rubber gloves and wash off any anti-freeze immediately in case of skin contact. Do not mix different anti-freeze agents. The mixture may cause a chemical reaction generating harmful substances. Use only anti-freeze that was approved by Fischer Panda.

Protect the environment. Collect drained fluids (lubricants, anti-freeze, fuel), and dispose of them properly. Observe the local regulations for the respective country. Ensure that no fluids (not even very small quantities) can drain into the soil, sewers, or bodies of water.

1.5.10 Implementation of safety inspections and maintenance

Disconnect the battery from the engine before performing service work. Affix a sign to the control panel - both the main and the corresponding slave panel - with the instruction “DO NOT START UP - MAINTENANCE IN PROGRESS“ to prevent unintentional start-up.

To prevent sparking due to accidental short-circuiting, always remove the earthing cable (-) first and reconnect it last. Do not start work until the generator and all fluids and exhaust system parts have cooled down.

Use only suitable tooling and appliances and familiarise yourself with their functions to prevent secondary damage and/or injury.

Always keep a fire extinguisher and a first aid box handy while performing maintenance work.

1.6 Warning and instruction signs

Keep warning and instruction signs clean and legible.

Clean the signs with water and soap and dry them with a soft cloth.

Immediately replace damaged or missing warning and instruction signs. This also applies to the installation of spare parts.

1.6.1 Special instructions and hazards of generators

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

The generator must not be operated with the cover removed.

If the generator is being installed without a sound insulation capsule, it must be ensured 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 easily visible signs must show that the generator must only be switched on while the capsule is closed.

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

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 during installation. For safety reasons, only an electrician may carry out the installation of the electrical connections of the generator.

1.6.1.1 Protective conductor and potential equalisation:

Electric current below 48 V may be life-threatening. Fort this reason systems are grounded with a protective conductor. In connection with a RCD the current supply will be disconnected in case of a failure.

Appropriate safety precautions like the RCD and corresponding fuses have to be provided by the customer to guarantee a save operation of the generator.

1.6.1.2 Protective conductor for Panda AC generators:

The generator is earthed“ as a standard (centre and ground are interconnected in the generator terminal box by a shunt). This is a basic first-level safety measure, which offers protection as long as no other measures are installed. Above all, it is designed for delivery and a possible test run.

This „neutralisation“ (Protective Earthing Neutral - PEN) is only effective if all parts of the electrical system are jointly „earthed“ to a common potential. The shunt can be removed if this is necessary for technical reasons and another protective system has been set up instead.

While the generator is being operated, the full voltage is applied to the AC control box, as well. Therefore, it is essential to ensure that the control box is closed and secured against touch while the generator is running.

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 up unintentionally.

1.6.1.3 Switch off all loads while working on the generator

All loads must be disconnected prior to working on the generator to avoid damage to the devices. In addition, the semiconductor relays in the AC control box must be disconnected in order to avoid the booster capacitors being activated during set-up. The negative terminal of the battery must be disconnected.

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 store electrical energy. High voltages may remain across the capacitor contacts even after they have been disconnected from the mains. As a safety precaution, do not touch the contacts. If the capacitors must be replaced or inspected, the contacts shall be short-circuited by connecting an electrical conductor to discharge potentially remaining potential differences.

If the generator is switched off normally, the working capacitors are automatically discharged via the winding of the generator. The booster capacitors are discharged by means of internal discharge resistors.

For safety reasons, all capacitors must be discharged through short-circuiting before work is carried out on the AC control box.

1.6.1.4 Potential equalisation for Panda AGT DC generators

For further information specific to your generator, see the chapter installation.

1.6.1.5 Safety instructions concerning cables

Cable types

It is recommended to use cables that are in compliance with the standard UL 1426 (BC-5W2) with type 3 (ABYC section E-11).

Cable cross-section

The cable shall be selected taking into account the amperage, cable type, 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 to install a self-draining cable conduit classified as V-2 or higher in compliance with UL 94 in the area of the cable guide inside the capsule. It must be ensured that the cable guide is not routed along hot surfaces such as the exhaust manifold or the engine oil drain screw but instead is installed free from any influence due to friction and crushing.

1.6.2 Recommended starter battery sizes

Use only batteries approved by the manufacturer as starter batteries.

Use the battery capacity recommended by the engine manufacturer.

ATTENTION!

Prior to installation, verify that the voltage of the starter battery complies with the start-up system voltage.

e.g. 12 V starter battery for 12 V start-up system

e.g. 24 V starter battery for 24 V start-up system (e. g. 2x 12 V in series)

1.6.3 Important instructions for batteries - starter and/or traction batteries

ATTENTION!!! Start-up:

Installation of battery connection lines.

Observe the instructions installation guidelines of the battery manufacturer.

Observe the regulations “ABYC regulation E11 AC and DC electrical systems on boats“, as EN ISO 10133:2000 “Small craft -- Electrical systems -- Extra-low-voltage DC installations“, as applicable!

The battery compartment and the corresponding installation shall be dimensioned adequately.

The batteries can be separated mechanically or with an adequate power relay.

Observe the applicable instructions concerning fire and explosion protection of the battery manufacturer.

Install a fuse of appropriate size in the positive connection of the starter battery. Install as close to the battery as possible but with a max. distance of 300 mm (12 in) from the battery.

The cable from the battery to the fuse shall be protected with a conduit/protective sleeve against fraying.

Use self-extinguishing and fire-protected cables for installation that are designed for max. temperatures of 90 °C, 195 °F.

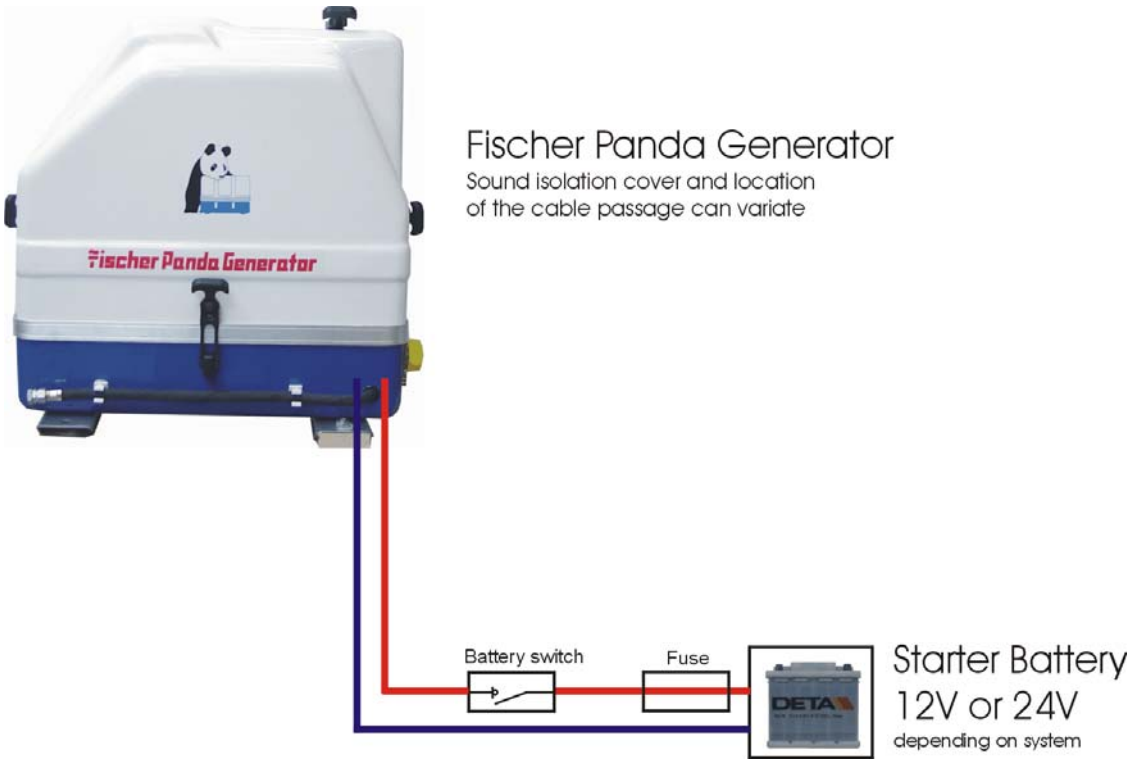
Install the battery cables in such a way that the insulation cannot be removed by chafing or other mechanical stresses.

The battery terminals must be protected against accidental short-circuiting.

Inside the Fischer Panda generator capsule, the positive battery cable must be routed so that it is protected from heat and vibrations by means of an adequate conduit/protective sleeve. It must be installed so that it does not come into contact with rotating parts or such that heat up during operation such as pulley, exhaust manifold, exhaust pipe, and motor itself. Do not overtighten the cable, as it may be damaged otherwise.

After completing the installation, perform a test run of the generator and check the battery cable installation during and after the test run. Implement corrections as necessary.

Fig. 1.6-1: Sample diagram for starter battery installation



1.6.4 General safety instructions for handling batteries

These instructions shall apply in addition to the instructions of the battery manufacturer:

- While you are working on the batteries, a second person should be within earshot to help you if necessary.
- Keep water and soap ready in case battery acid is burning your skin.
- Wear eye protection and protective clothing. Do not touch your eyes while handling batteries.

- If you have acid splashes on the skin or clothing, wash them out with lots of water and soap.
- If acid sprays into your eyes, immediately flush them with clean water until no more burning is felt. Immediately seek medical assistance.
- Do not smoke near the batteries. Avoid naked fire. The area around batteries is a potentially explosive atmosphere.
- Ensure that no tools are dropped on the battery terminals; cover them as necessary.
- Do not wear jewellery or watches on your arms during installation that might short-circuit the battery. Otherwise, there is a risk of skin burns.
- Protect all battery contacts against accidental contact.

- For battery banks: Use only deep cycle batteries. Starter batteries are not suitable. Lead-acid gel batteries are recommended. They are maintenance-free, cycle stable, and do not release gases.
- Never charge a frozen battery.
- Avoid battery short-circuits.

- Ensure proper ventilation of the battery to vent gases that may be released.
- Battery connection terminals must be checked for proper seating before operation.
- Battery connection cables shall be installed with utmost care and shall be checked for excessive heating under load. Check the battery near vibrating components regularly for chafing and insulation defects.

ATTENTION! For battery charger generators (Fischer Panda AGT-DC)!

Prior to installation, verify that the voltage of the battery bank complies with the output voltage of the generator.

1. In case of Emergency First Aid / Im Notfall - Erste Hilfe

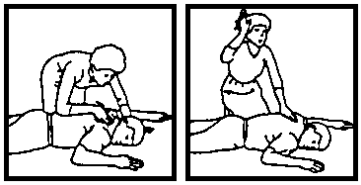
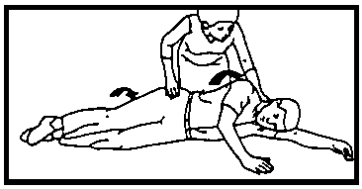
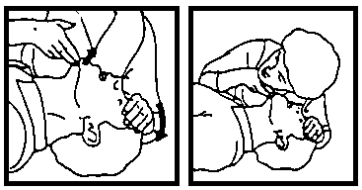
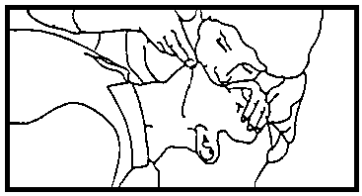
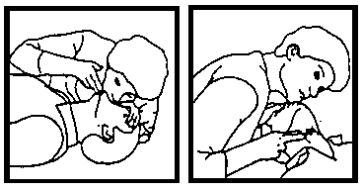


	First Aid in case of accidents by electrical shocks 5 Safety steps to follow if someone is the victim of electrical shock	
1	Do not touch the injured person while the generator is running.	
2	Switch off the generator immediately.	
3	If you cannot switch off the generator, pull, push, or lift the person to safety using a wooden pole, rope or some nonconducting material.	
4	Call an emergency doctor as soon as possible.	
5	Immediately start necessary first aid procedures.	

1.7 WHEN AN ADULT STOPS BREATHING

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.

Warning:

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 towards 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.

2. Basics

2.1 Intended use of the machine

The Fischer Panda generator is made to produce electrical energy out of diesel fuel.

The diesel fuel is converted to mechanical energy by the diesel engine. This mechanical energy drives the generator. In the genset, the mechanical energy is converted to electrical energy. This process is controlled by (sometimes external) components, the remote control panel and the voltage control system (VCS).

For the process is a sufficient amount of fuel and combustion air necessary. Arising exhaust and heat must be lead away.

If the electrical power should be applied to a local net, The regulation and installation instructions of the Net owner and the regional authorities must be respected. This includes lightening conductor, personal protection switch etc.

Misapplication of the Product can damage and destroy the product and the electrical net inclusive all load which is attached to the net, and contain hazards like short circuit. It is not allowed to modify the product in any case. Never open the sound cover during operation. The safety and hazard notes of the manual must be respected.

2.1.1 Purpose of the manual and description of the definitions trained person/operator/ user

This manual is work instruction and operation instruction for the owner and user of Fischer Panda generators.

The manual is the base and the guideline for the correct installation and maintenance of Fischer Panda Generators.

The manual does not substitute the technical evaluation and should be used as an example guide only.

The installation must be undertaken and proved by a suitable qualified/trained person and may in accordance with the law as required by the country and special situation.

2.1.1.1 Trained persons

Trained persons for the mechanical components are motor mechanics or persons with similar education and training.

Trained persons for the electrical components are electricians or persons with similar education and training.

After the Installation, the trained person must instruct the owner for operation and maintenance of the generator. This must include the hazards of the generator use.

2.1.2 Operator

The operator is the for the operation of the generator responsible person.

After the installation, the operator must be instructed for the operation ad maintenance of the generator. This must include the hazards during operation of the generator and a instruction for the maintenance.

The operator must read and follow the manual and must respect the hazard notes and safety instructions.

2.1.2.1 User

Users are persons, established by the operator, to operate the generator.

The operator must assure that the user read and understand the manual and that all hazard notes and safety instructions are respected. The user must be instructed by the operator regarding his activity at the generator.

2.2 Panda Transport Box

2.2.1 Bolted Fischer Panda Transport Box

1. Remove the bolts for cover / sidewalls
2. Remove the cover
3. Remove the loose accessories
4. Remove the bolts for sidewalls / floor pallet
5. Remove the sidewalls
6. Open the generator attachment

2.2.2 Fischer Panda Transport Box with metal tab closure

1. Bend up the metal tab closures on the transport box lid.
2. Remove the cover
3. Remove the loose
4. Bend open the metal tab closures on the transport box bottom.
5. Remove the sidewalls
6. Open the generator attachment

2.3 Transport and Loading/Unloading

2.3.1 Transporting the generator

- The generator must always be upright for transport.
- For transport, the Fischer Panda Transport Box shall be used for the generator. The generator shall be securely attached to the bottom of the box.
- For loading/unloading, an adequate industrial truck shall be used.
- Depending on the transport distance (e.g. air cargo), the generator fluids (coolant, engine oil, fuel) may have to be drained. The corresponding instructions and warnings must be fitted to the transport packaging.

2.3.2 Loading/unloading of the generator

For loading/unloading the generator, appropriate ring eye bolts shall be installed in the holes in the support rails. The load bearing capacity of each ring eye bolt must at least equal the generator weight.

An adequate lifting yoke shall be used for transport/ loading

Fig. 2.3-1: Lifting yoke (example)

2.4 Scope of delivery

The Fischer Panda PMS generator system contains following components:

2.4.1 Asynchronous Generator:

Fischer Panda Generator

representative picture

Fig. 2.4-1: Fischer Panda Generator

Remote control panel

representative picture

Fig. 2.4-2: Remote control panel

AC Control Box

Fig. 2.4-3: AC Control Box

The AC Control Box contains the capacitors and the control circuit board (VCS) for the generator.

At ND generators and generators with mini VCS the capacitors and the VCS may mounted at the generator. The AC Control Box is not required for this generators.

representative picture

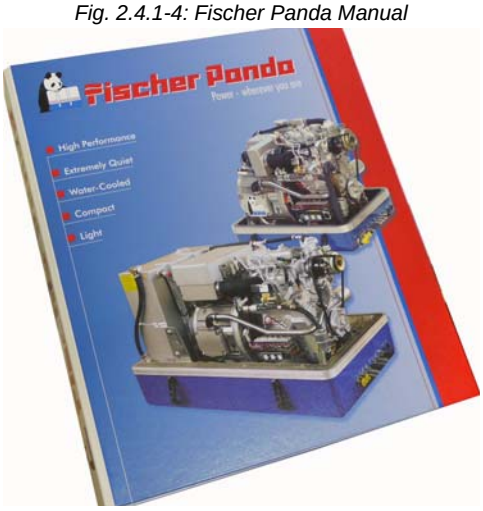
Fischer Panda Manual

Fig. 2.4.1-4: Fischer Panda Manual

The Fischer Panda Manual contains following components:

- Clear foil bag with general informations ect.
- Generator manual with added remote control panel manual
- Spare part catalogue „Installation & Service Guide“
- Engine manual from the engine manufacturer.
- Wiring diagram for the generator

representative picture



Optionales components f.e.:

- Fuel pump
- Installation kit
- Water lock
- ect.

2.4.2 Opening the MPL sound insulation capsule

To open the sound insulation capsule, the closures must be rotated roughly 180° counter-clockwise. Use a flat head screwdriver. Pull the sidewalls out by gripping into the slots.

Fig. 2.4-1: Sound insulation capsule, side part

Closure locked

Fig. 2.4.2-2: Closure locked

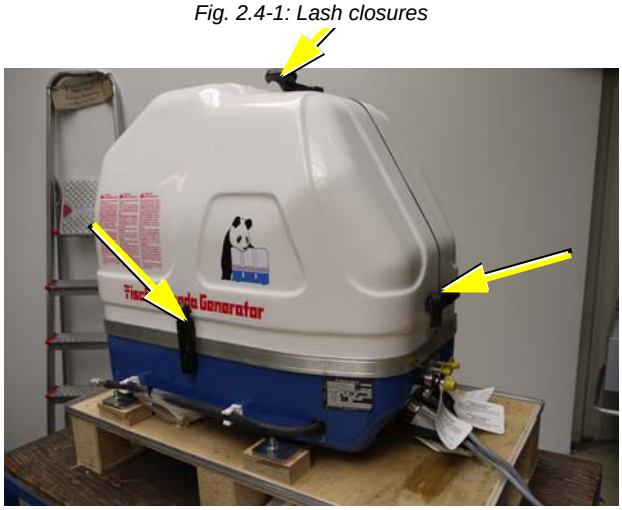
Closure open

Fig. 2.4-3: Closure open

2.4.3 Opening the GFK sound insulation capsule

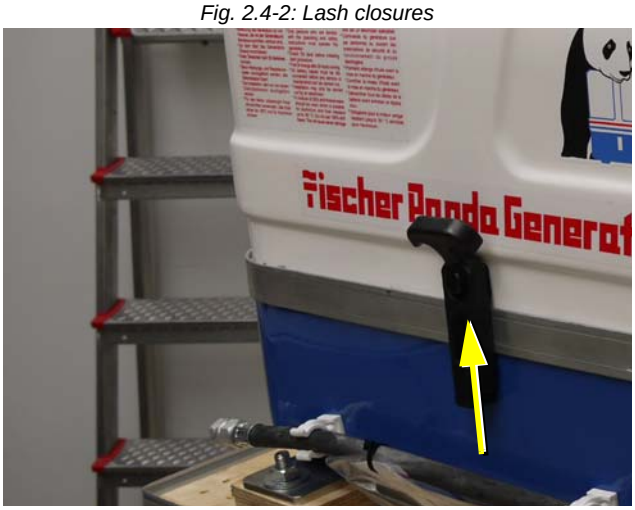
GFK sound insulation capsule with lash closures

Fig. 2.4-1: Lash closures



To open the lash closures pull the handle in arrow direction and lift the lash of the closure pin. After lifting of the lashes, the sound isolation cover upper pars can be removed.

Fig. 2.4-2: Lash closures



2.5 Special maintenance notes and arrangements at long periods of stand still time or shutdown

Stand still is divided into the following groups:

- Short-term standstill (1 to 3 months).
- Medium-term standstill / winter storage (3 to 6 months).
- Long-term standstill (storage) / shutdown (more than 6 months).

2.5.1 Reference note for the starter battery at a long-term standstill

Starter batteries

Self-discharge of batteries is a physical and chemical process and cannot even be avoid by disconnecting the battery.

Notice:

- Disconnect the battery from the generator at a long-term standstill.
- Charge the battery on a regular basis. Follow the notes of the battery manufacturer.

Before charging the battery, check the acid level according to the type of battery and refill each cell with distilled water up to the marking if necessary.

Today's starter batteries are normally maintenance-free.

Deep discharge may damage the battery and may be useless afterwards.

Keep the battery clean and dry. Continuously clean the battery terminals (+ and -) and clamps and lubricate with an acid-free and acid-resistant grease. Make sure there is a good contact of the clamp connections when assembling. If voltage is approx. below 1,95 Volt, the cell should not decline the open-circuit voltage of the battery. This equates approx. 2,1V / cell open-circuit voltage when battery is fully charged.

For a 12 V battery applies 11,7 V lower open-circuit voltage (battery flat) - conservation charging 13,2 V.

For a 24 V battery applies 23,4 V lower open-circuit voltage (battery flat) - conservation charging 26,4 V.

These data relate to a battery temperature of 20-25°C. Consider the specifications of the battery manufacturer.

Fischer Panda recommendation:

- Install a battery main switch and turn it to the off-position. (Disrupt the battery circuit)
- Install a sufficient fuse in the positive battery line close to the battery
- Check contacts for corrosion on a regular basis.

Notice:

2.5.2 Arrangements at a short-term standstill

Short-term standstill (1 to 3 months)

- Measure the charge of battery via the open-circuit voltage
- At stand still >7 days - disconnect the battery (e.g. put battery main switch to 0)
- Within 2-3 months - let the engine run for at least 10 min
- Fill fuel tank to 100% (level to full).

2.5.3 Arrangements at a medium-term standstill / winter storage

Medium-term stand still (3 to 6 months)

2.5.3.1 Arrangements for conservation:

- Check the charge of battery and recharge approximately every 3 months if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection of the cooling water and refill if applicable.

  The anti-freeze protection should not be older than 2 years. The content of the anti-freeze protection should be between 40% and 60% to ensure corrosion protection in the cooling water circuit; Refill anti-freeze if necessary.

  If cooling water will be drained, for example after a conservation of the engine, no water should remain within the engine during the stand still. At the control unit a correspondent note „NO COOLING WATER“ has to be placed.
- Drain engine oil as required. Refill engine with conservation oil up to maximum at the oil dip stick.
- Drain diesel fuel from tank and refill with conservation mixture (90% diesel and 10% conservation oil - up to max).

Let engine run for 10 min.

- Remove v-belt as required and store packed at a dry place. Protect from UV radiation.

Cover alternator openings. **Attention!**

No cleaning fluids or preserving agents may enter the alternator. Danger to destroy the alternator.

- Clean engine according to the manufacturer.
- Inject engine parts and v-belt pulleys with a preserving agent.
- Clean air filter housing and inject with a preserving agent.
- Close suction hole and exhaust opening (e.g. with tape or end caps).
- Drain sea water circuit.
- Close sea cock.
- Clean sea water filter.
- Remove impeller and store.

Carry out a deconservation before recommissioning. **Attention!**

2.5.3.2 Arrangements for deconservation after a medium-term standstill (3 to 6 months).

- Check charge of battery and recharge if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection of the cooling water and refill if applicable.
- Drain engine oil. Renew oil filter and oil according to specification.
- Remove preservation agent of the engine with petroleum.
- Degrease the v-belt pulleys and install v-belt correctly. Check v-belt tension!
- Disconnect turbocharger oil pressure line if existent and refill clean motor oil in pipe.
- Keep engine shut-off lever in 0-position and turn engine several times by hand.
- Clean air filter housing with petroleum, check air filter and renew if necessary.
- Remove covers of the exhaust opening and the suction holes.
- Connect battery. Close battery main switch.
- Install impeller.
- Open sea cock.
- Check sea water filter.
- Keep shut-off lever at generator in 0-position and activate starter for approx. 10 sec. Make a break for 10 sec. and repeat procedure twice.
- Visual inspection of the generator according to initial operation and start generator.

2.5.4 Arrangements at a long-term standstill / shutdown

Standstill (more than 6 months)

2.5.4.1 Arrangements for conservation:

- Check the charge of battery and recharge approximately every 3 months if necessary. Consider the specifications of the battery manufacturer.

- Check anti-freeze protection of the cooling water and refill if applicable.

  The anti-freeze protection should not be older than 2 years. The content of the anti-freeze protection should be between 40% and 60% to ensure corrosion protection in the cooling water circuit; Refill anti-freeze if necessary.

  If cooling water will be drained, for example after a conservation of the engine, no water should remain within the engine during the stand still. At the control unit a correspondent note „NO COOLING WATER“ has to be placed.
- Drain engine oil as required. Refill engine with conservation oil up to maximum at the oil dip stick.
- Drain diesel fuel from tank and refill with conservation mixture (90% diesel and 10% conservation oil - up to max).

Let engine run for 10 min.

- Remove v-belt as required and store packed at a dry place. Protect from UV radiation
- Disconnect battery.Sprinkle terminals with acid-free grease.

Cover alternator openings. **Attention!**

No cleaning fluids or preservative agents may enter the alternator. Danger to destroy the alternator.

- Clean engine according to the manufacturer.
- Inject engine parts and v-belt pulleys with a preserving agent.
- Clean air filter housing and inject with a preserving agent.
- Sprinkle exhaust turbo charger (if existent) with conservation agent at intake and exhaust and close lines again. Sprinkle preserving agent to the intake and exhaust lines than attach again.
- Remove valve cover and sprinkle the inside of the cover, shafts, springs, rocker lever etc. with preserving agent.
- Remove injectors and sprinkle the cylinder area with preserving agent. Keep the shut-off lever on the 0-position and turn the engine by hand for several times. Screw in the injectors with new gaskets. Consider the torsional moments.
- Sprinkle slightly the radiator cap and tank lid and respectively the radiator cap at the expansion tank and reinstall.
- Close intake and exhaust openings (for example with tape or end caps).
- Drain sea water circuit.
- Close sea cock.
- Clean sea water filter.
- Dismount impeller and store.

Carry out a de-conservation before recommissioning. **Attention!**

2.5.4.2 Arrangements after a long-term standstill (shutdown) / recommissioning (more than 6 months):

- Check the charge of battery and recharge if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection and level of the cooling water and refill if applicable.
- Drain engine oil. Renew oil filter and oil according specification.
- Remove preservation agent of the engine with petroleum.
- Degrease the v-belt pulleys and install v-belt correctly. Check v-belt tension!
- Disconnect turbocharger oil pressure line if existent and refill clean motor oil in pipe.
- Keep engine shut-off lever in 0-position and turn engine several times by hand.
- Clean air filter housing with petroleum, check air filter and renew if necessary.

- Remove covers of the exhaust opening and the suction holes.
- Connect battery. Close battery main switch.
- Install impeller.
- Open sea cock.
- Check sea water filter.
- Keep shut-off lever at generator in 0-position and activate starter for approx. 10 sec. Make a break for 10 sec. and repeat procedure twice.
- Visual inspection of the generator according to initial operation and start generator.

Fischer Panda recommendation:

After a long-term standstill a complete 150 h inspection according to inspection schedule should be carried out.

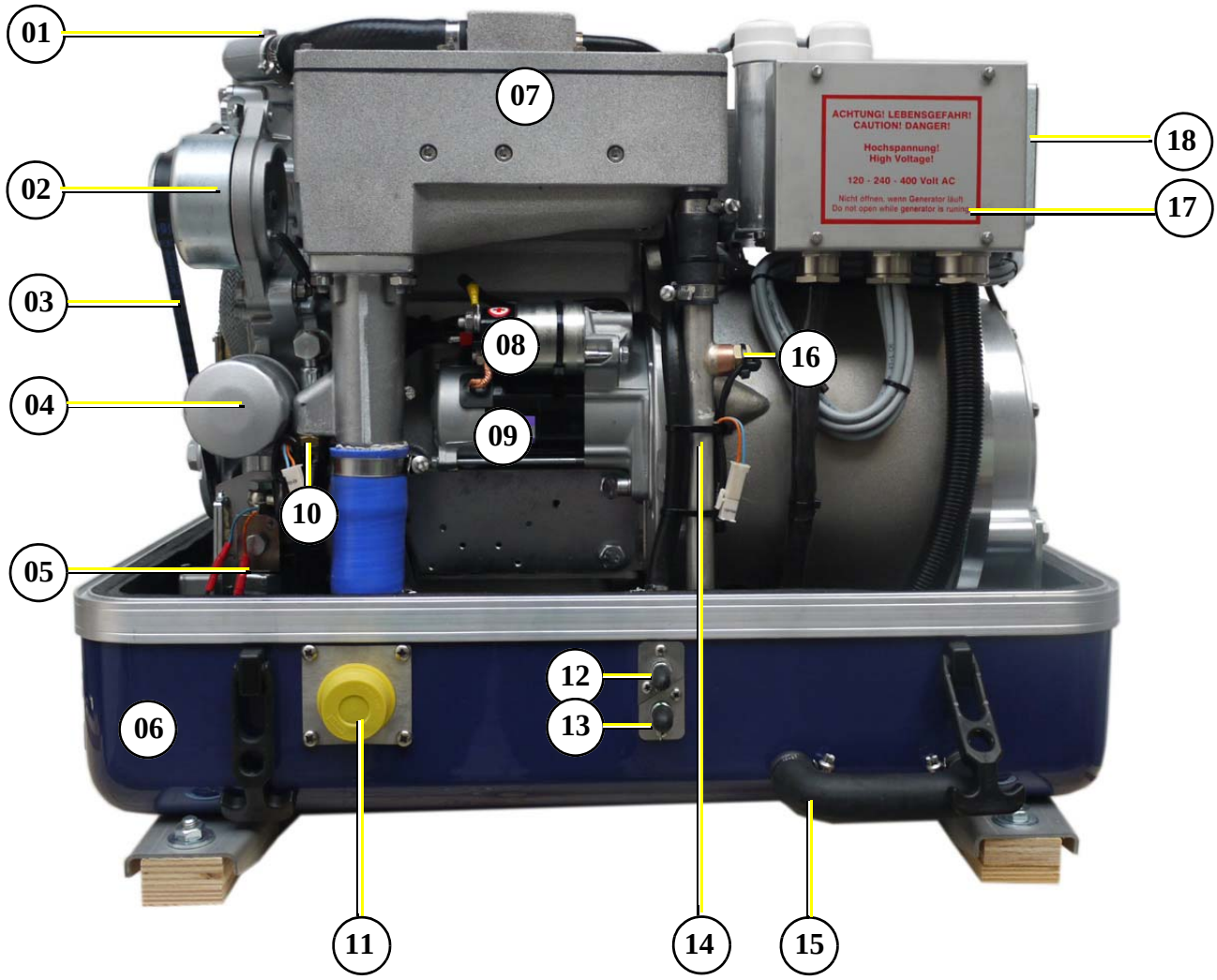
Notice:

3. The Panda Generator

3.1 Description of the Generator

3.1.1 Right Side View

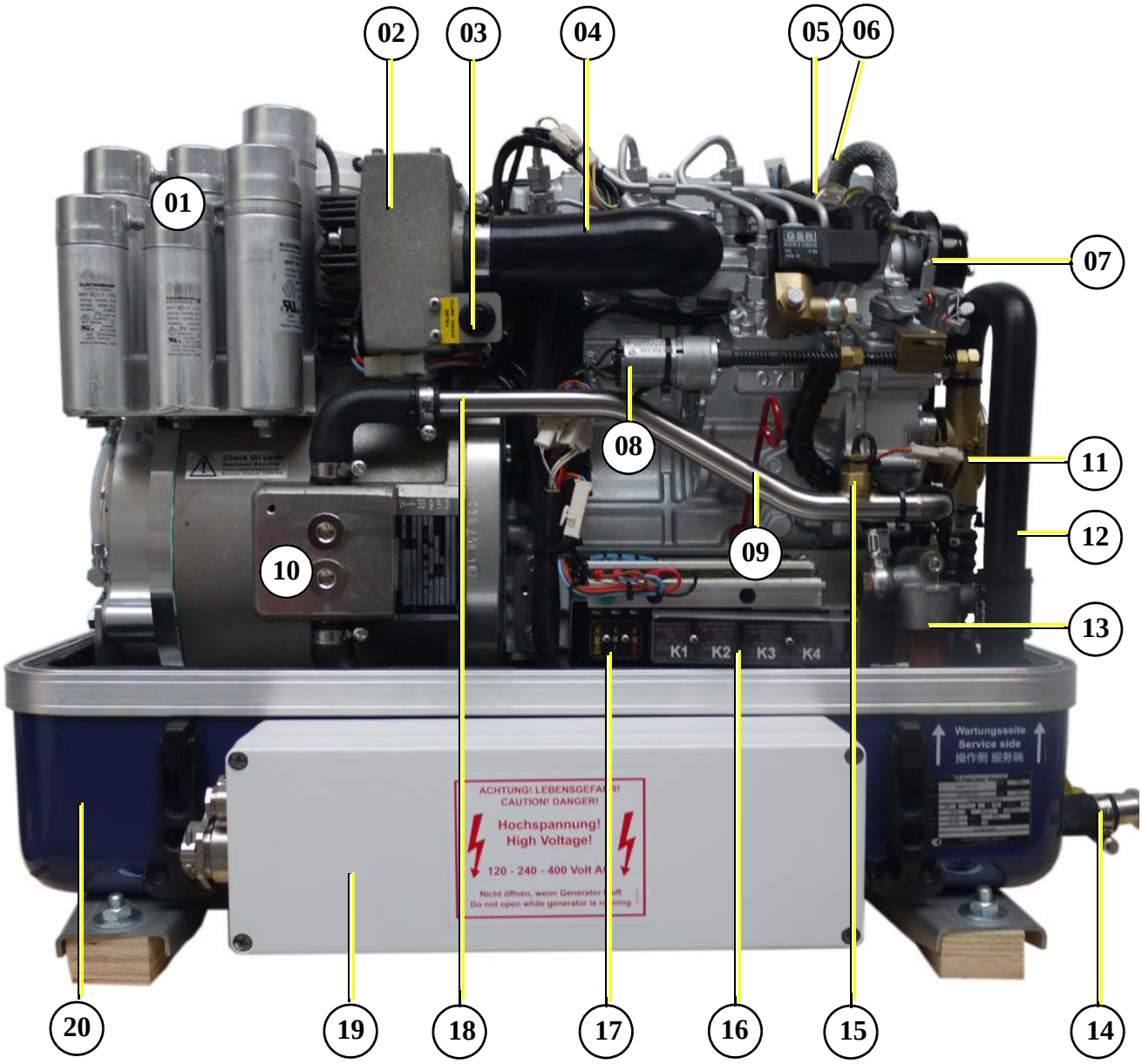
Fig. 3.1.1-1: Right Side View



01. Thermostat housing
02. 24V DC-alternator
03. V-belt for DC-alternator and cooling water pump
04. Engine oil filter
05. Oil pressure switch
06. Sound cover - base part
07. Water-cooled exhaust elbow
08. Starter motor
09. Solenoid switch for starter motor
10. Thermo-sensor exhaust
11. Exhaust output
12. Intake to external cooling water expansion tank
13. Backflow from external cooling water expansion tank
14. Freshwater return pipe
15. Connection external ventilation valve
16. Exhaust connection
17. Generator terminal boxl
18. Solid state relais for bosster capacitors

3.1.2 Left Side View

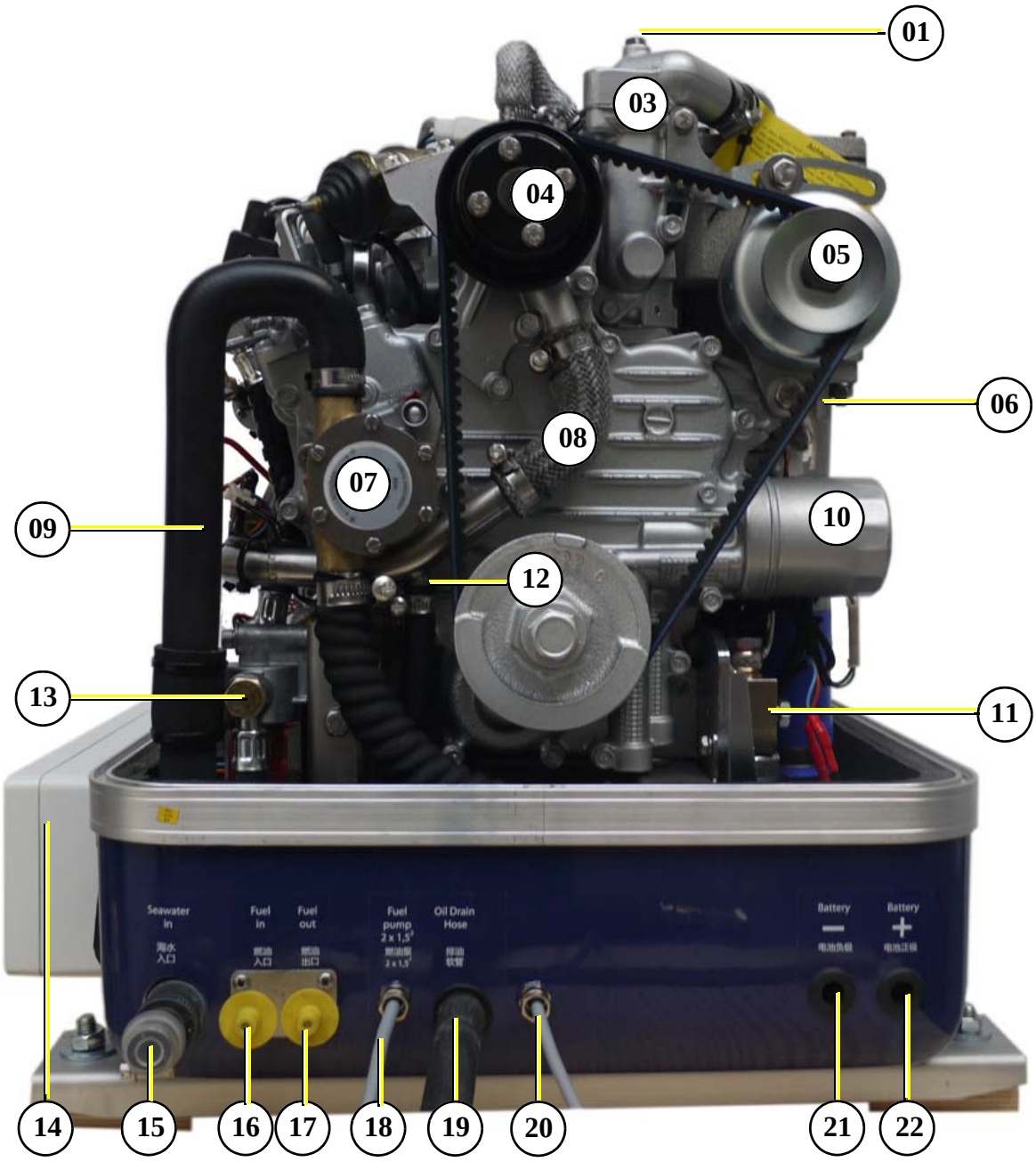
Fig. 3.1.2-1: Left Side View



01. Excitation capacitors (2x40µF + 4x50µF)
02. Air suction housing with air filter
03. Failure bypass switch
04. Air suction hose to induction elbow
05. Stop solenoid
06. Ventilation screw thermostat housing
07. Pulley for internal cooling water pump
08. Actuator for speed control
09. Oil dipstick
10. Cooling water connection block
11. Raw water pump
12. Raw water intake hose
13. Fuel filter
14. Raw water inlet
15. Thermo-sensor freshwater in
16. Power relays
17. Electical fuses
18. Cooling water pipe, connection block - cooling waterpump
19. Control box
20. Sound cover - base part

3.1.3 Front View

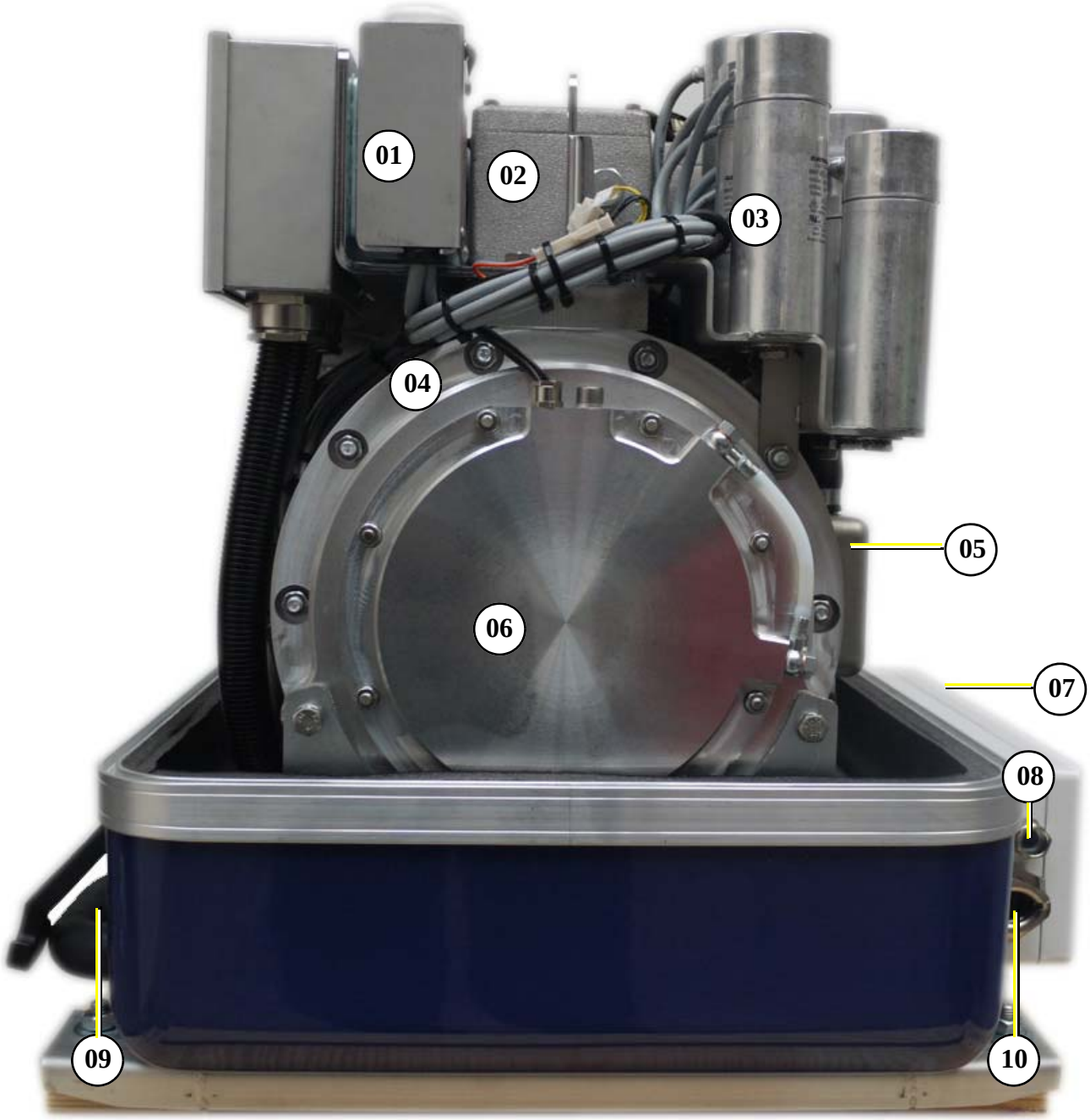
Fig. 3.1.3-1: Front View



01. Ventilation screw thermostat housing
03. Thermostat housing with thermostat set
04. Pulley for internal cooling water pump
05. 24V DC-alternator
06. V-belt for DC-alternator and internal cooling water pump
07. Raw water pump
08. Freshwater intake pipe
09. Hose for raw water intake
10. Engine oil filter
11. Oil pressure switch
12. Injection hose, freshwater from external expansion tank
13. Fuel filter
14. Control box
15. Raw water inlet
16. Fuel intake connection
17. Fuel backflow connection
18. Cable fuel pump
19. Oil drain hose
20. Cable for fuel level sensor
21. Passage for cable starter battery minus (-)
22. Passage for cable starter battery plus (+)

3.1.4 Back View

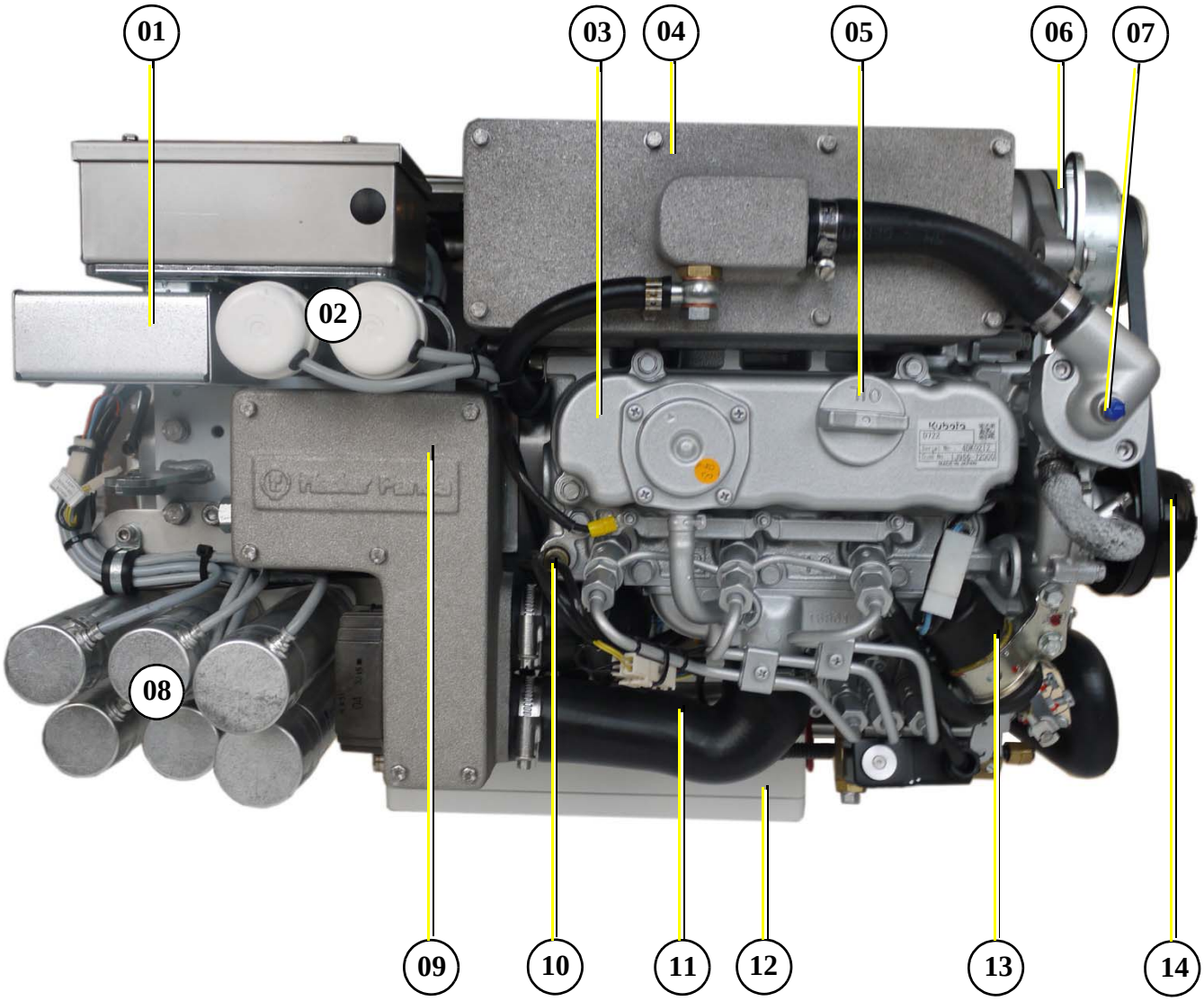
Fig. 3.1.4-1: Back View



01. Solid state relays for booster capacitors
02. Air suction housing with air filter
03. Excitation capacitors
04. Generator front cover
05. Cooling water connection block
06. Cover for oil-cooled bearing
07. Control box
08. Passage for cable control panel
09. Connection external ventilation valve
10. Passage for cable load

3.1.5 View from Above

Fig. 3.1.5-1: View from Above



01. Solid state relays for booster capacitors
02. Booster capacitors
03. Valve cover
04. Water cooled exhasut elbow
05. Oil filler neck
06. DC-Alternator
07. Ventilation screw at thermostat housing
08. Excitation capacitors
09. Air suction housing with air filter
10. Cylinder head thermo-switch
11. Air suction hose to induction elbow
12. Control box
13. Stop solenoid
14. Pulley for internal cooling water pump

3.2 Details of functional units

3.2.1 Remote control panel

The remote control panel is equipped with some new monitoring functions, which increases the operational safety of the generator. A failure message is shown over contacts which are normaly closed. If a connection is intermitted triggers this a failure message.

Fig. 3.2.1-1: Remote control panel

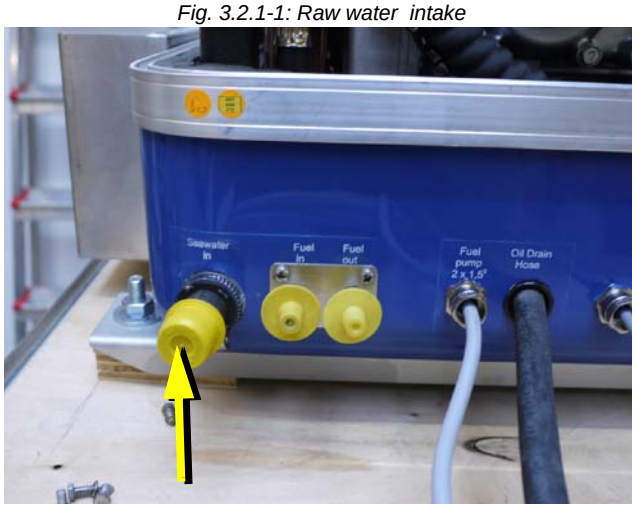
01. Digital display
02. S1 Button „ON/OFF“ „Stand by“
03. S2 Button „Alarm mute / Program level“
04. S3 Button „Screen shift“
05. S4 Button „rpm Shift n1/n2“
06. S5 Button „Generator run/stop / Select Save“

3.2.1.1 Components of Cooling System (Raw water)

Raw water intake

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

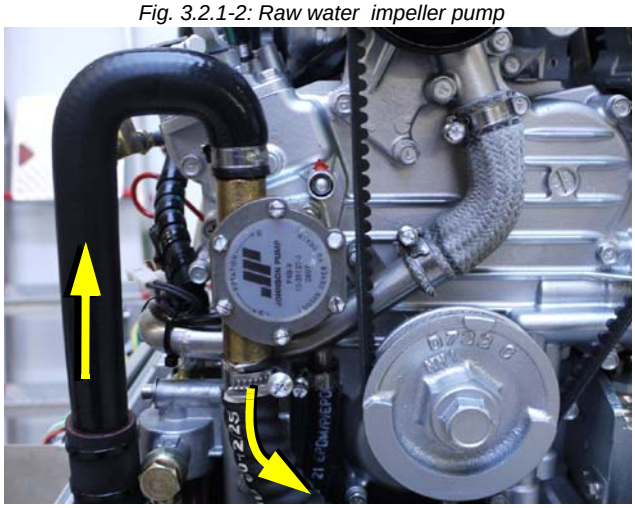
Fig. 3.2.1-1: Raw water intake



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.

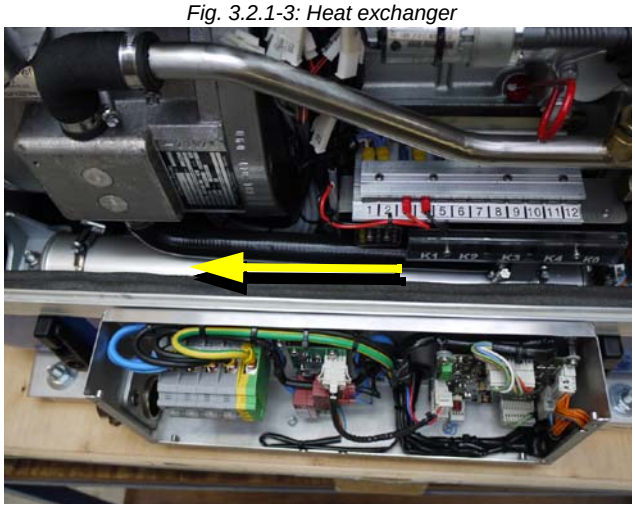
Fig. 3.2.1-2: Raw water impeller pump



Heat exchanger

Separates the raw water system from the freshwater system.

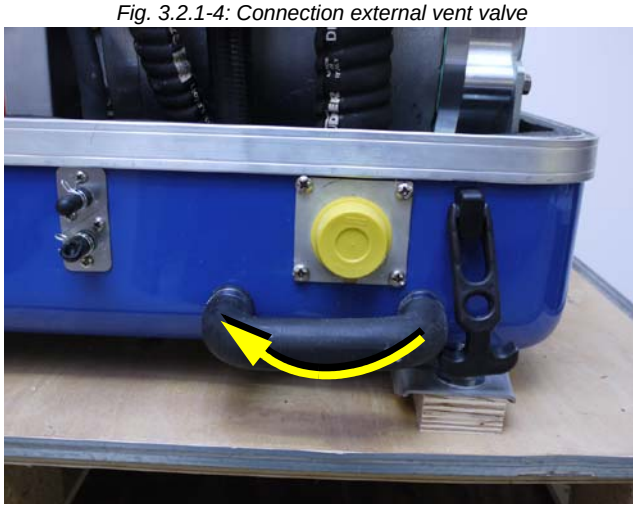
Fig. 3.2.1-3: Heat exchanger



Ventilation valve

A siphon must be installed if the generator sinks below the water line because of the rocking of the boat, even if it is only for a short period of time. A hosepipe on the generator casing has been produced for this. Both connecting pieces are bridged by a formed piece of hose.

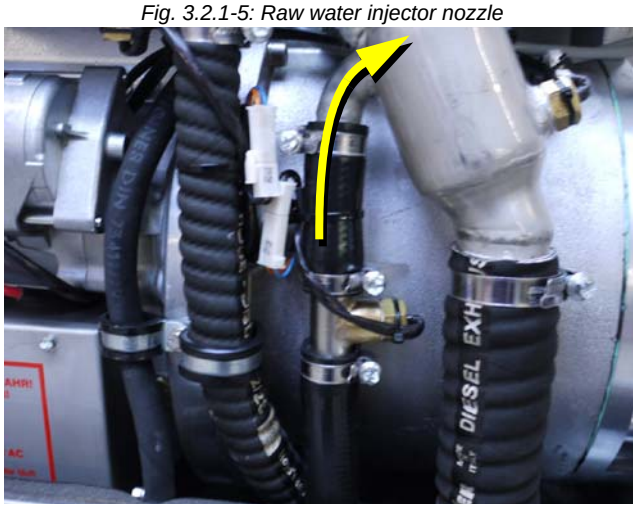
Fig. 3.2.1-4: Connection external vent valve



Raw water injector nozzle

The injection point for the marine generator water-cooled exhaust system is situated at the exhaust connection pieces The exhaust connections must be regularly checked for signs of corrosion.

Fig. 3.2.1-5: Raw water injector nozzle

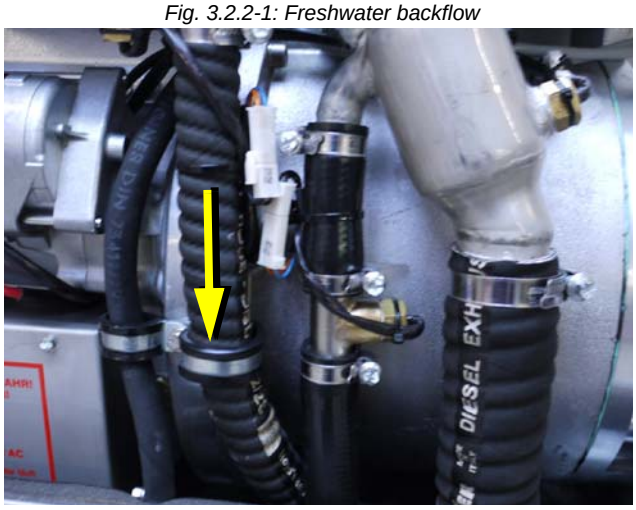


3.2.2 Components of Cooling System (Freshwater)

Freshwater backflow

The cooling water is fed to the heat exchanger from the water-cooled manifold by means of the pipe shown in the diagram.

Fig. 3.2.2-1: Freshwater backflow



Ventilation pipe

The ventilation pipe at the water-cooled exhaust manifold leads to the external expansion tank. This pipe only serves as a ventilation pipe, if both pipes are to be connected to the external expansion tank (ventilation pipe and intake pipe).

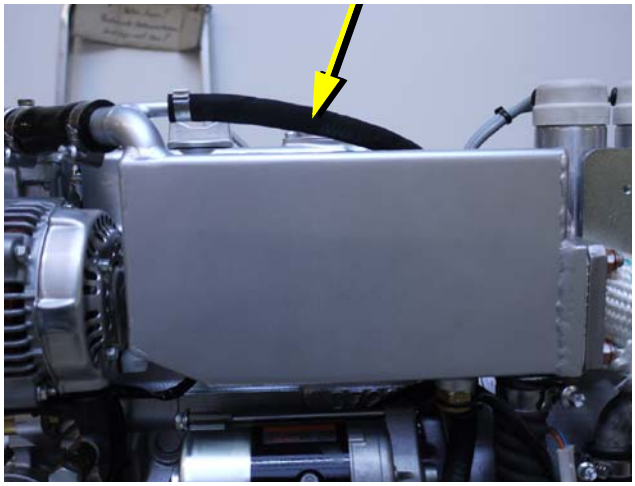


Fig. 3.2.2-3: External expansion tank

Hose connection pieces for the external expansion tank

The external expansion tank is connected by two hose connections. The connecting pieces shown here serves as constant ventilation for the water-cooling system.

In case the external expansion tank is connected with two hoses, the system will ventilate itself. In this case, additional ventilation is only necessary when the generator is initially filled, or if the cooling water is not circulating.

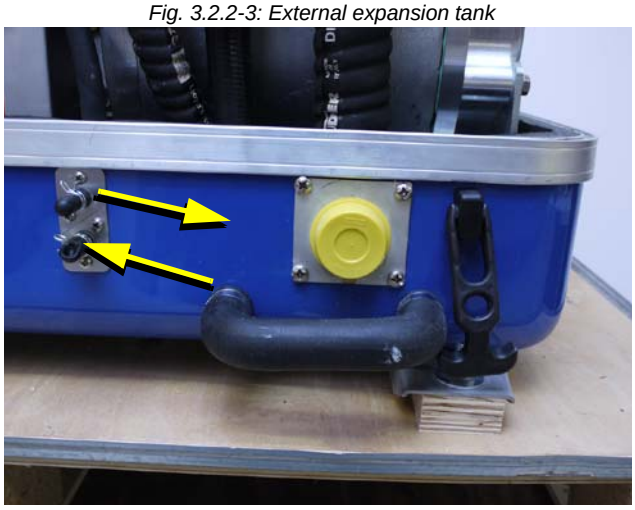
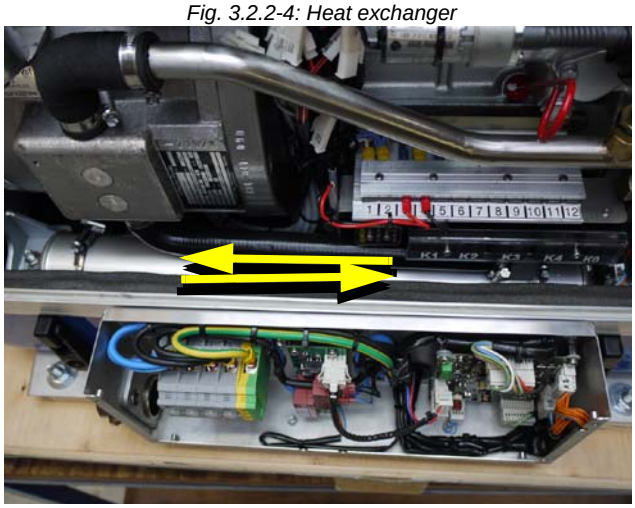


Fig. 3.2.2-4: Heat exchanger

Heat exchanger

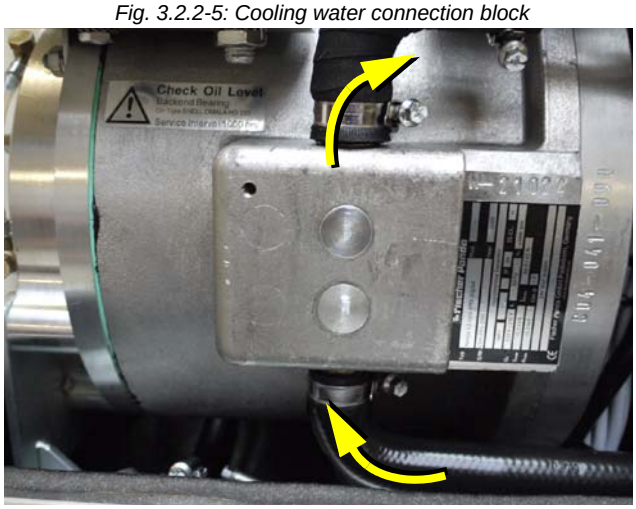
Separates the raw water system from the freshwater system.



Cooling water connection block

The cooling water is fed to the generator and drained via the cooling water connection block. The cooling water connection block consists of an aluminium alloy, which can behave like a sacrificial anode.

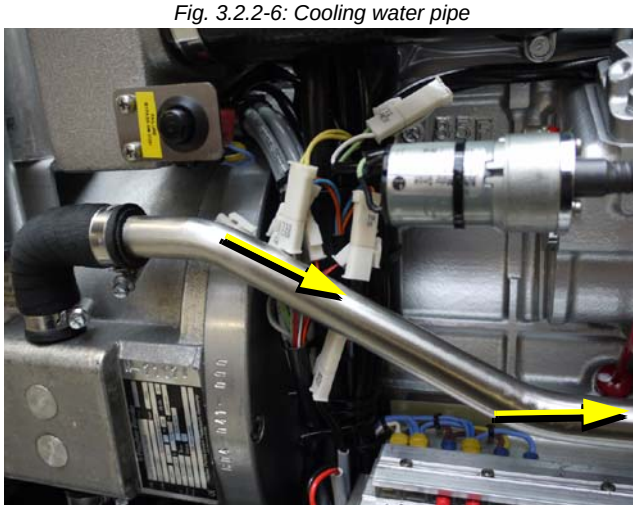
Fig. 3.2.2-5: Cooling water connection block



Cooling water pipe

From the cooling water connection block the fresh water is lead to the water pump

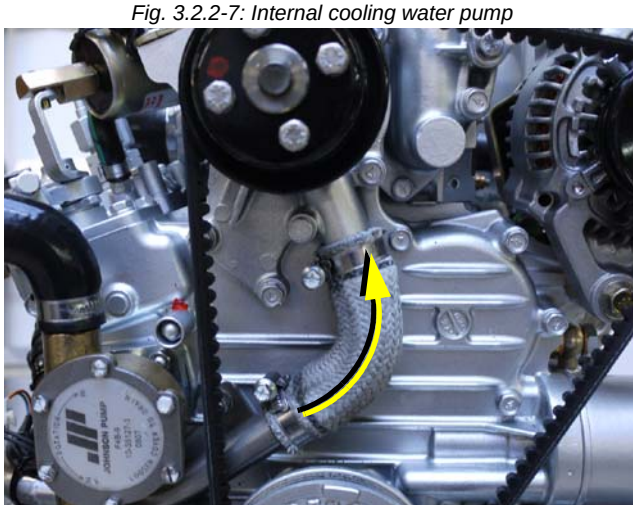
Fig. 3.2.2-6: Cooling water pipe



Internal cooling water pump

The diesel motor cooling water pump (see arrow) aids the circulation of the internal freshwater system.

Fig. 3.2.2-7: Internal cooling water pump



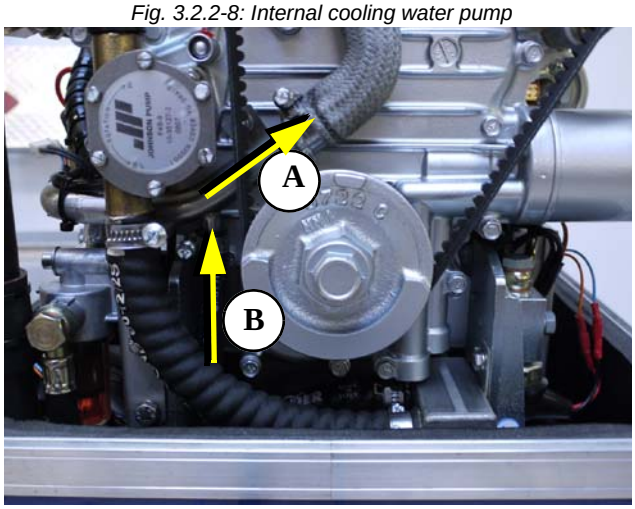
Cooling water intake

A.) To the thermostat housing

B.) From the external expansion tank

The intake pipe from the external cooling water expansion tank is connected to the point shown with „B“.

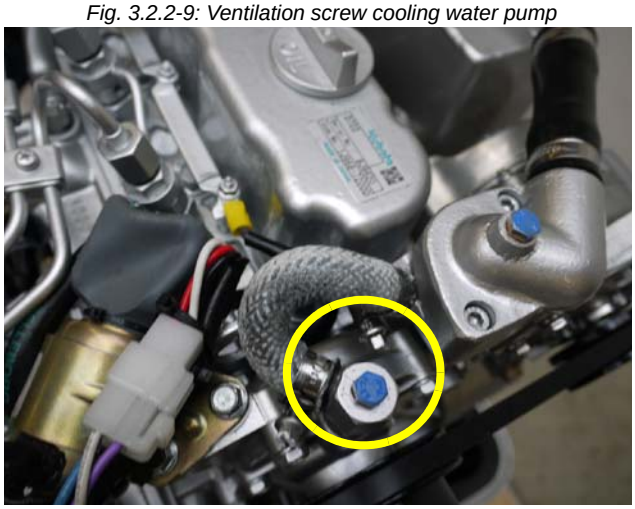
Fig. 3.2.2-8: Internal cooling water pump



Ventilation screw cooling water pump

The ventilation screw above the cooling water pump casing may not be opened, whilst the generator is running. If this occurs by mistake, air will be drawn through the opening. Extensive ventilation of the whole system is then necessary.

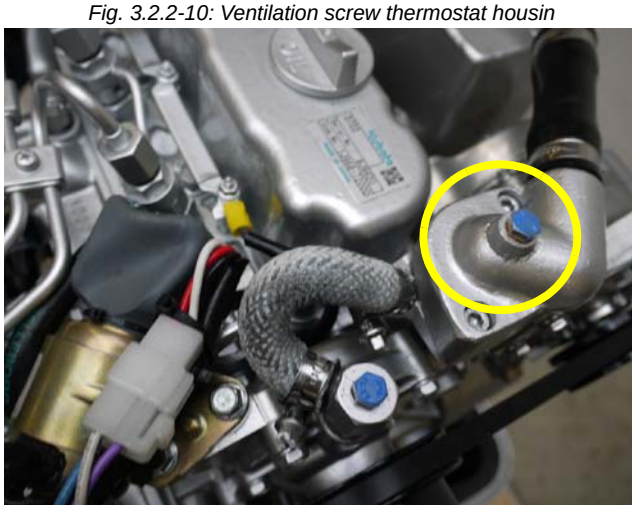
Fig. 3.2.2-9: Ventilation screw cooling water pump



Ventilation screw thermostat housing

The ventilation screw on the thermostat housing should occasionally be opened for control purposes. Standing machinery should principally carry out ventilating.

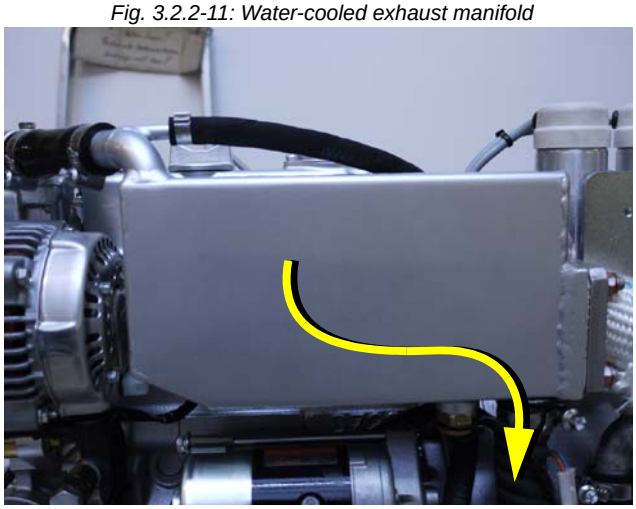
Fig. 3.2.2-10: Ventilation screw thermostat housin



Water-cooled exhaust manifold

The manifold is cooled by means of the internal cooling system (freshwater). The cooling water filler necks on the casing of the manifold may not be opened. These cooling water necks are only required to fill the motor with cooling water in cases of repair. The normal cooling water controls may only be carried out at the external expansion tank.

Fig. 3.2.2-11: Water-cooled exhaust manifold

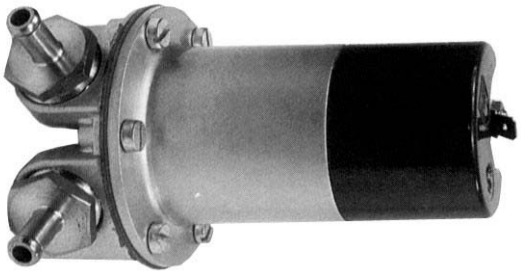


3.2.3 Components of the fuel system

External fuel pump

The Panda generator is always supplied with an external, electrical (12 V of DC) fuel pump. The fuel pump must be always installed in the proximity of the tank. The electrical connections with the lead planned for it are before-installed at the generator. Since the suction height and the supply pressure are limited, it can be sometimes possible that for reinforcement a second pump must be installed.

Fig. 3.2.3-1: External fuel pump

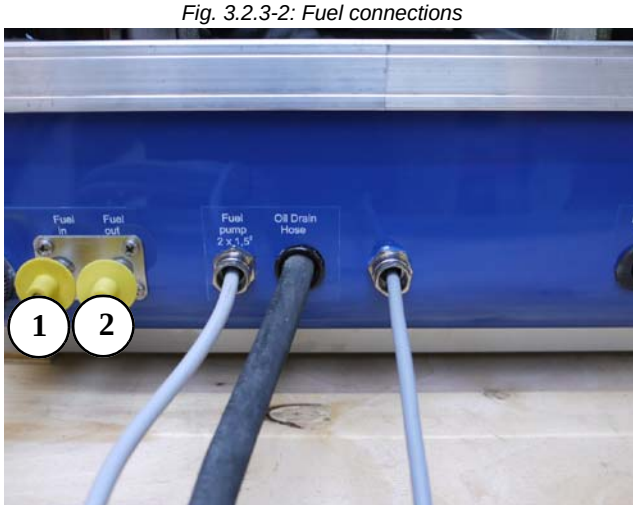


Connecting pieces for the fuel pipe

1. Fuel intake

2. Fuel backflow

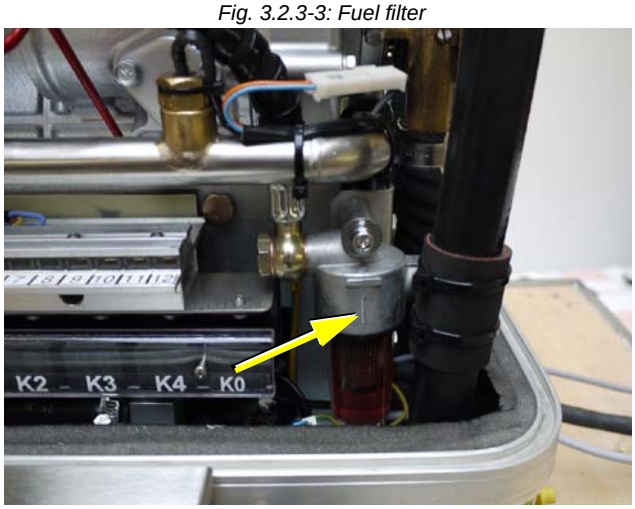
Fig. 3.2.3-2: Fuel connections



Fuel filter

A consequential filtering of fuel is especially important for all marine systems. A fine filter, which is firmly attached to the inside of the sound insulation capsule for the marine version, is supplied on delivery, and loose for other makes. In all cases a further pre-filter with water separator must be installed. See directions for fuel filter installation.

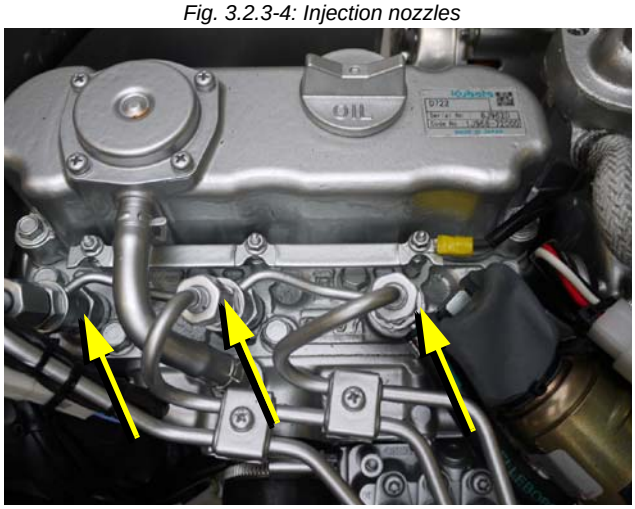
Fig. 3.2.3-3: Fuel filter



Injection nozzles

If the engine does not start after the ventilation, the fuel injection lines must be de-aerated individually.

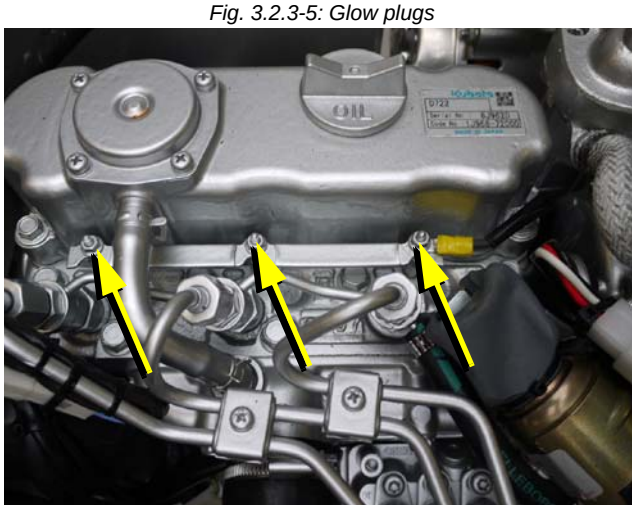
Fig. 3.2.3-4: Injection nozzles



Glow plugs

The glow plugs serve the pre-chamber for the heating with cold start. The heat-treat fixture must be operated, if the temperature of the generator is under 16°C. This is practically with each start the case. The heat-treat fixture may be held down also during start and favoured the starting procedure.

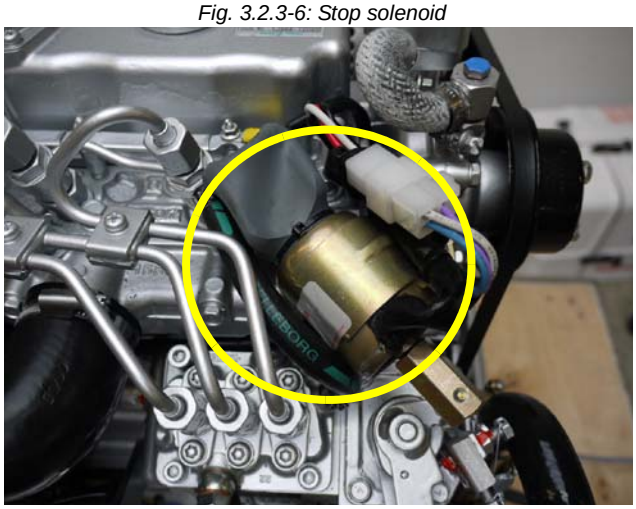
Fig. 3.2.3-5: Glow plugs



Stop solenoid for engine stop

Some model are equipped with an stop solenoid. The generator is stopped by the co-operation of the stop solenoid immediately after switching off. The adjustment of the stop solenoid must always be chekked, in order to be sure that the stop lever can move also during the operation freely and is not under pre-stressing.

Fig. 3.2.3-6: Stop solenoid



3.2.4 Components of combustion air

Air suction openings at the sound cover

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

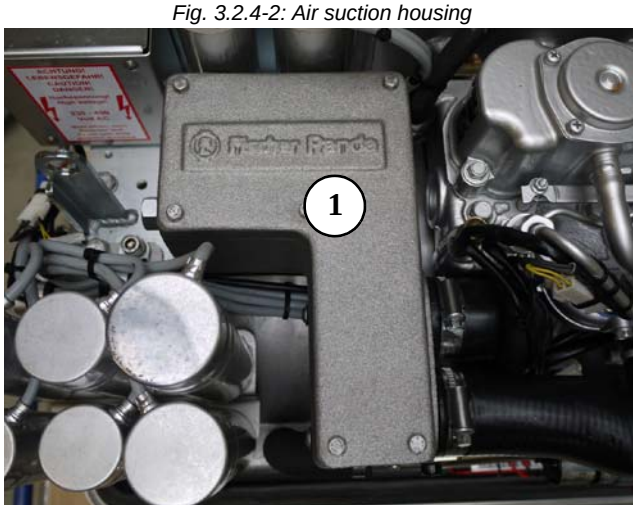
It must be consistently paid attention that the generator is installed in such a way that from down no water can arrive into the proximity of these air openings. (minimum distance 150 mm)

Fig. 3.2.4-1: Combustion air intake

Air suction housing

If the cover (pos. 1) is removed, the inside of the air suction housing becomes visible. In these air suction housings is a filter element. At the marine version the filter is normally not changed. It should be chekked once in a while.

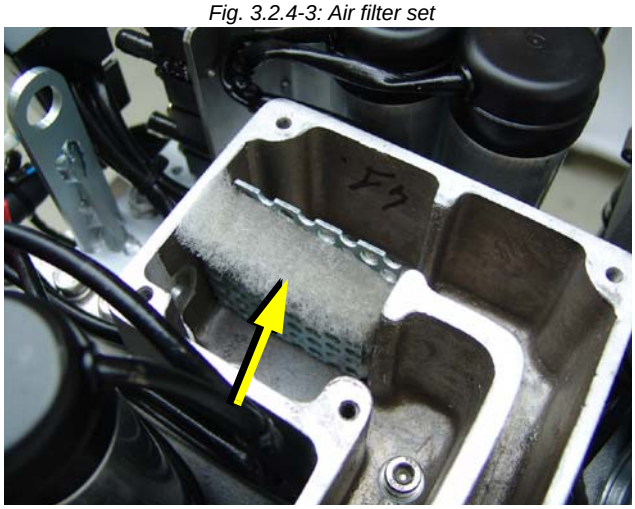
Fig. 3.2.4-2: Air suction housing



Air suction housing with air filter set

The figure shows the air filter element in the air suction housing. However the return pipe of the crank case exhaust flows also into the air suction housing, it can be faced with older generators and/or with engines on high running time that oel vapors affect the air filter. Therefore an check is advisable once in a while.

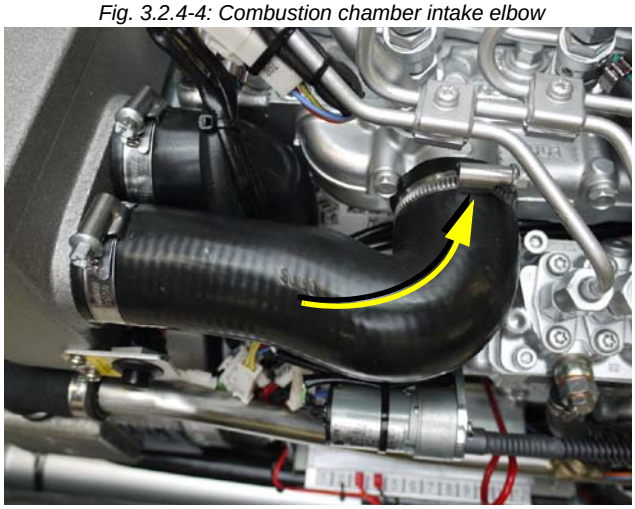
Fig. 3.2.4-3: Air filter set



Combustion chamber intake elbow

The figure shows the induction elbow at the combustion engine. At the front of this induction elbow you can see the hose connection between air suction housings and induction elbow. The air filter must be checked, if this hose pulls together at operation.

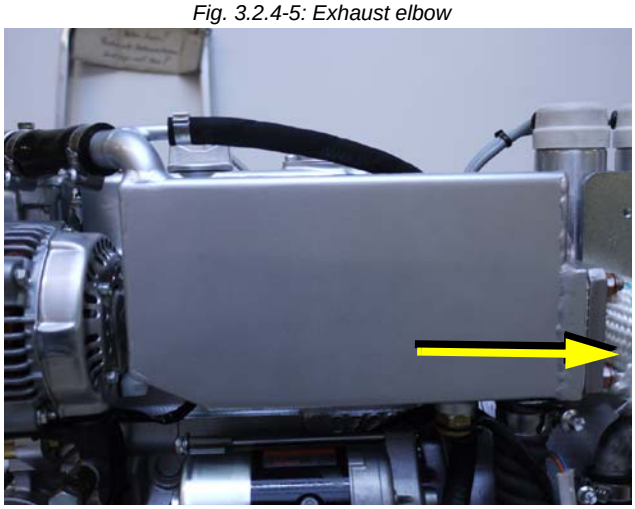
Fig. 3.2.4-4: Combustion chamber intake elbow



Exhaust elbow

On the back of the engine is the water-cooled exhaust elbow. On the top side the pipe union for the internal raw water circuit is to be seen and the filler neck for the cooling water. This cooling water filler neck is used only at first filling. Control of the cooling water and if necessary refill takes place at the external cooling water expansion tank.

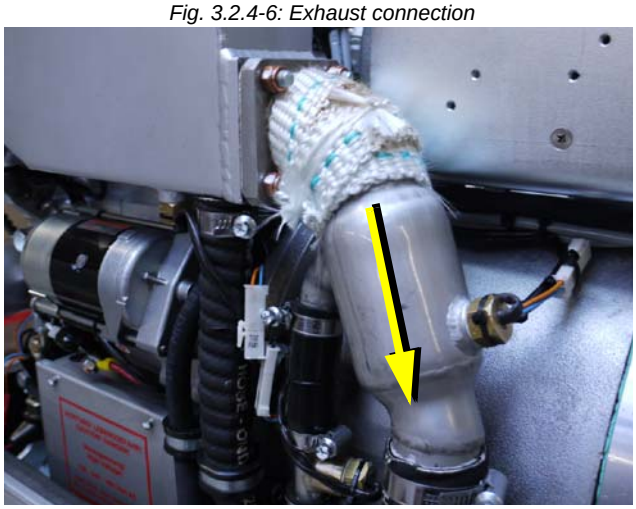
Fig. 3.2.4-5: Exhaust elbow



Exhaust connection at the exhaust elbow

Raw water from the external cooling circle is fed here.

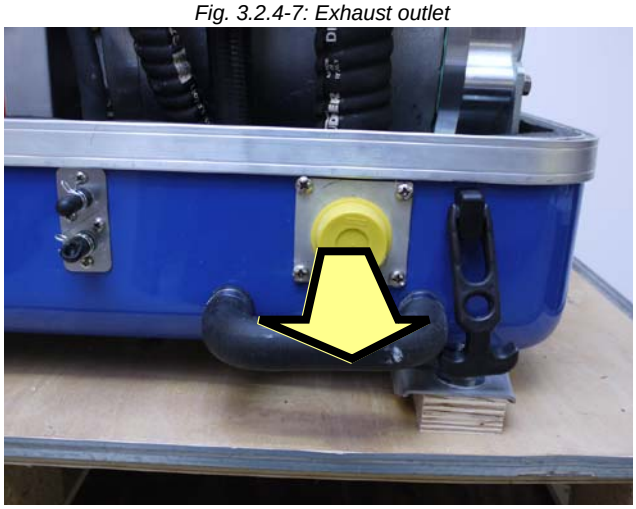
Fig. 3.2.4-6: Exhaust connection



Exhaust outlet

Connect the exhaust pipe with the water lock.

Fig. 3.2.4-7: Exhaust outlet



3.2.5 Components of the electrical system

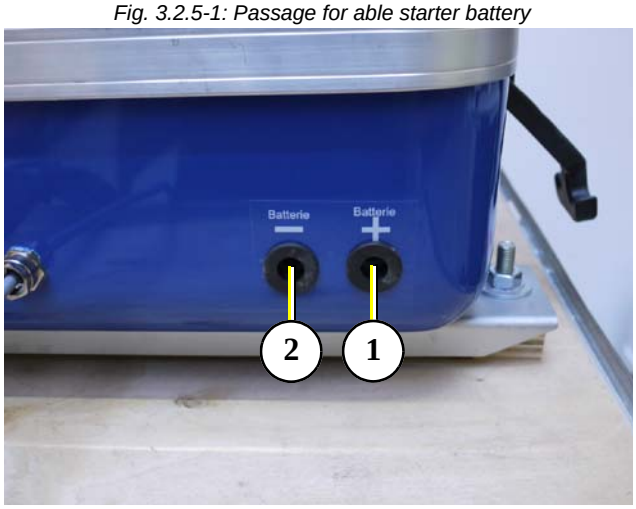
Passage for cable starter battery

1. Passage for cable starter battery (plus)

2. Passage for cable starter battery (minus)

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

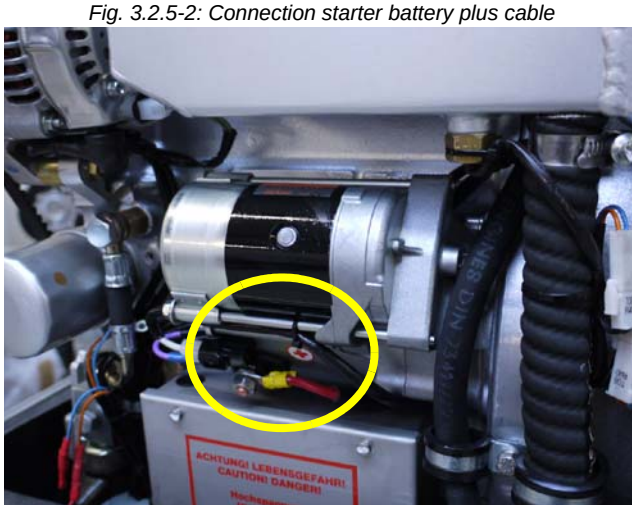
Fig. 3.2.5-1: Passage for able starter battery



Connection starter battery plus cable

The plus cable of the starter battery must be connected at the solenoid of the stater motor.

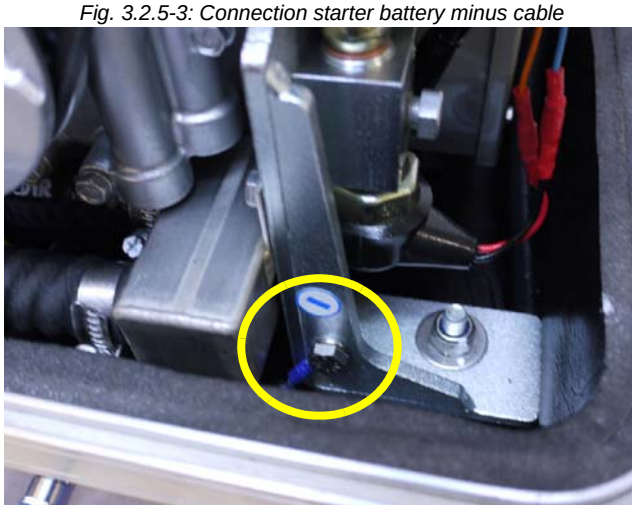
Fig. 3.2.5-2: Connection starter battery plus cable



Connection starter battery minus cable

The minus cable of the starter battery must be connected at the right engine bracket when you look fron the front side.

Fig. 3.2.5-3: Connection starter battery minus cable

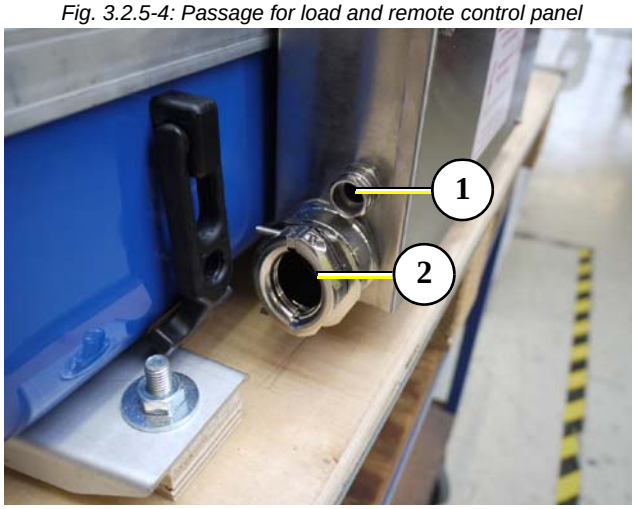


Passage for load and remote control panel

1. Remote control panel

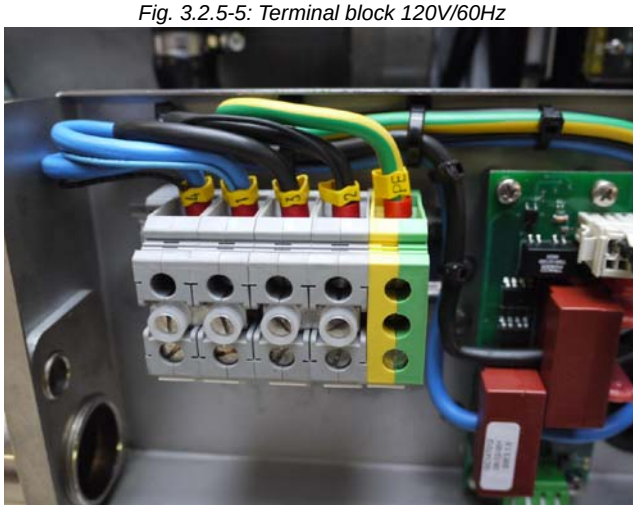
2. Load

Fig. 3.2.5-4: Passage for load and remote control panel



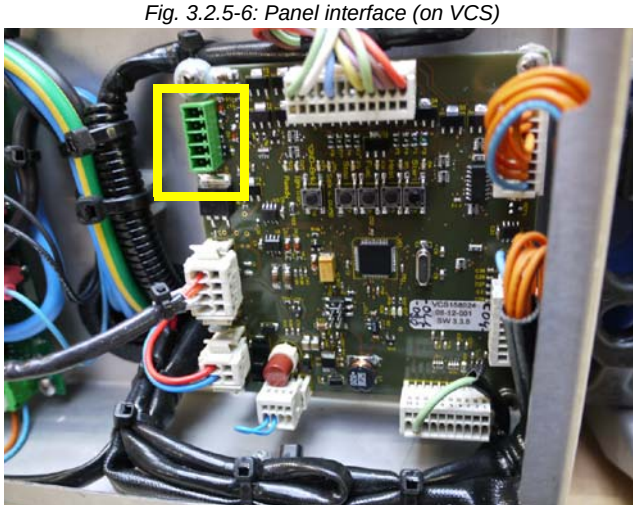
Terminal block for load 120V/60Hz

Fig. 3.2.5-5: Terminal block 120V/60Hz



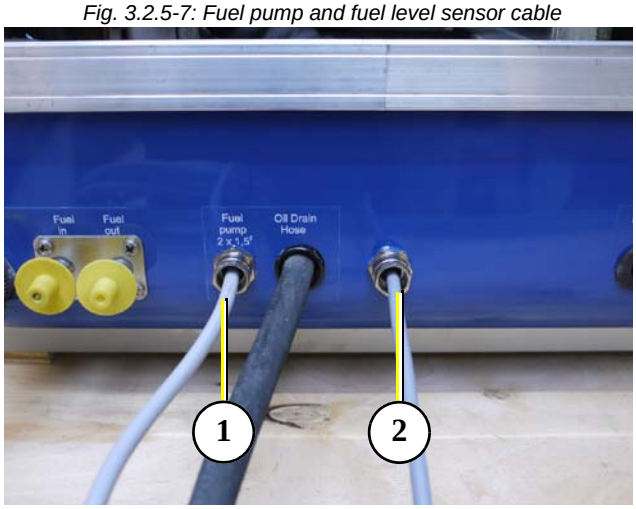
Panel interface (on VCS)

Fig. 3.2.5-6: Panel interface (on VCS)



Connection external fuel pump and fuel level sensor

Fig. 3.2.5-7: Fuel pump and fuel level sensor cable



At the front of the sound cover is the withdrawal for the cable for the fuel pump and the fuel level sensor.

1. Cable for fuel pump

2. Cable for fuel level sensor

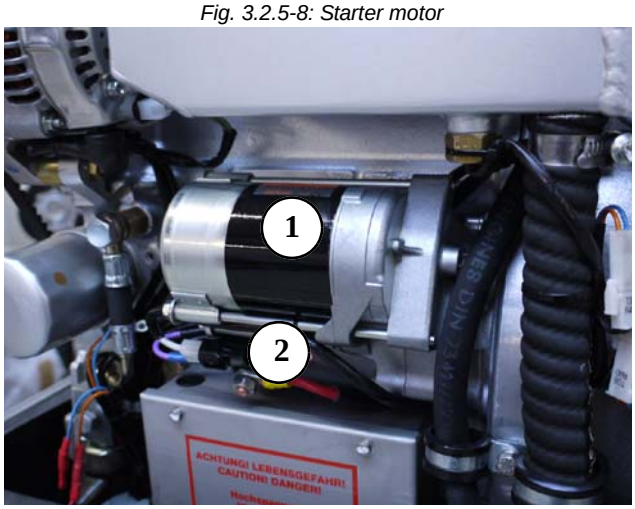
Starter motor

1. Starter motor and

2. Solenoid switch

The Diesel engine is electrically started. On the back of the engine is accordingly the electrical starter with the solenoid switch.

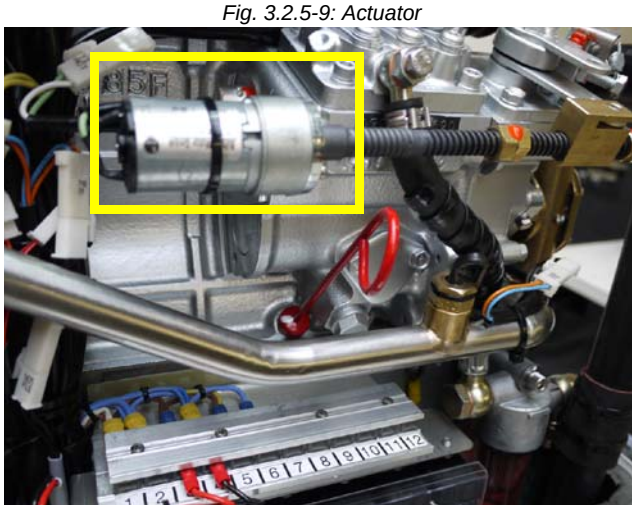
Fig. 3.2.5-8: Starter motor



Actuator for speed regulation

The generator voltage is determined by progressive speed control through "VCS" in conjunction with the speed actuator. Speed increases with increasing load.

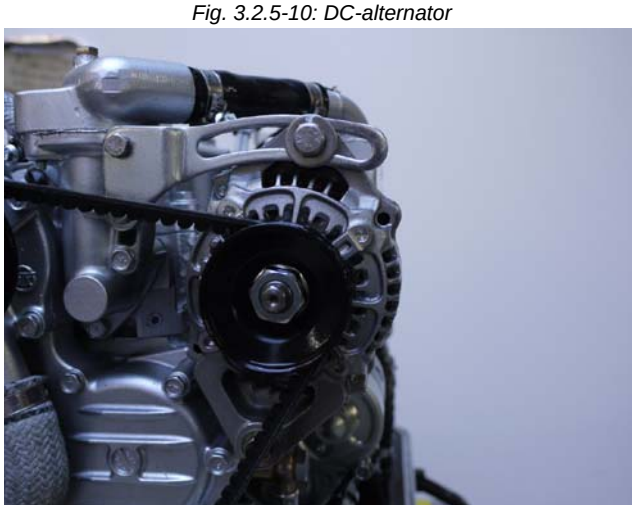
Fig. 3.2.5-9: Actuator



DC-alternator

All Panda generators from Panda 6.000 are provided with its own charge system. This DC-alternator is powered over a v-belt together with the internal cooling water pump.

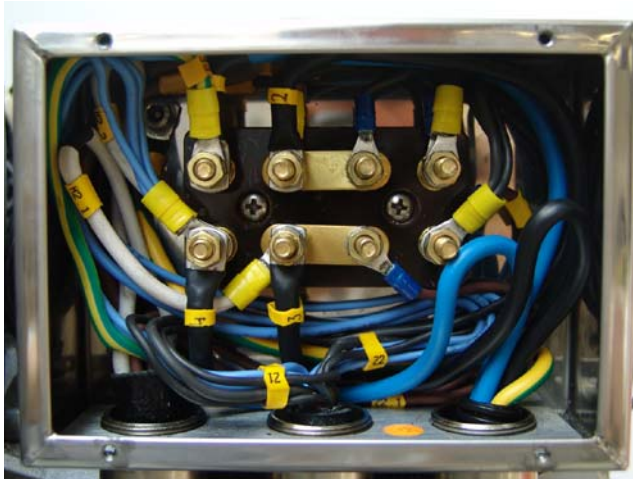
Fig. 3.2.5-10: DC-alternator



Generator power terminal box 120V/60Hz

At the back of the generator is the generator power terminal box. In this box the electrical connection points of the AC generator are connected. 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. 3.2.5-11: Generator power terminal box 120V/60Hz



Relays

K0 power relay for ground isolate relay

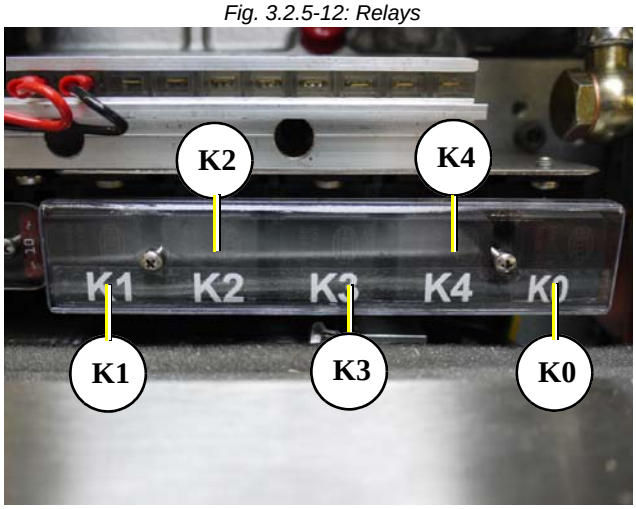
K1 power relay for starter motor

K2 power relay for glow plugs

K3 power relay for fuel pump

K4 power relay for stop solenoid

Fig. 3.2.5-12: Relays



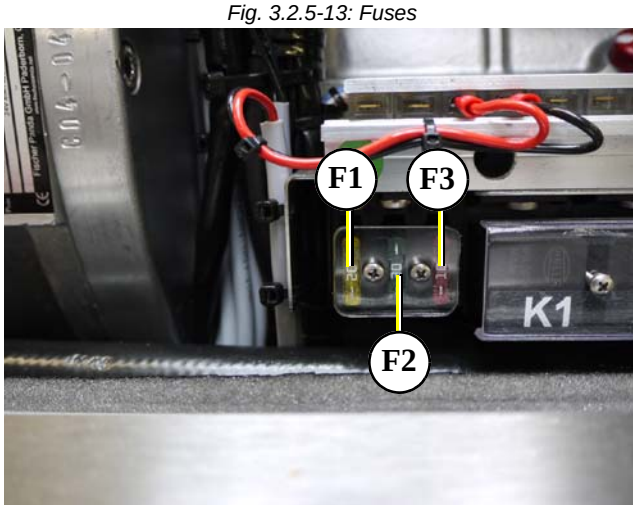
Fuses

F1 fuse 20A for relay K0

F2 fuse 30A for relay K2

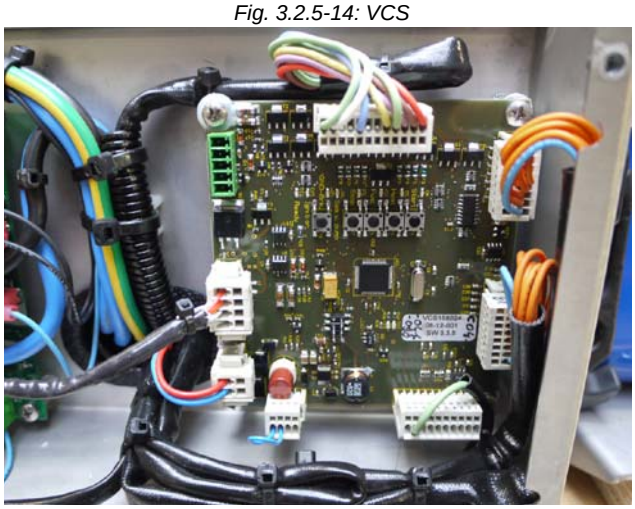
F3 fuse 10A for 12V DC system

Fig. 3.2.5-13: Fuses



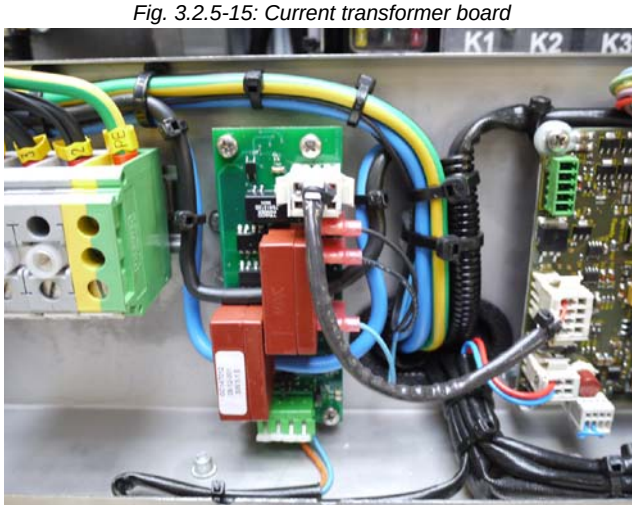
VCS printed circuit board

Fig. 3.2.5-14: VCS



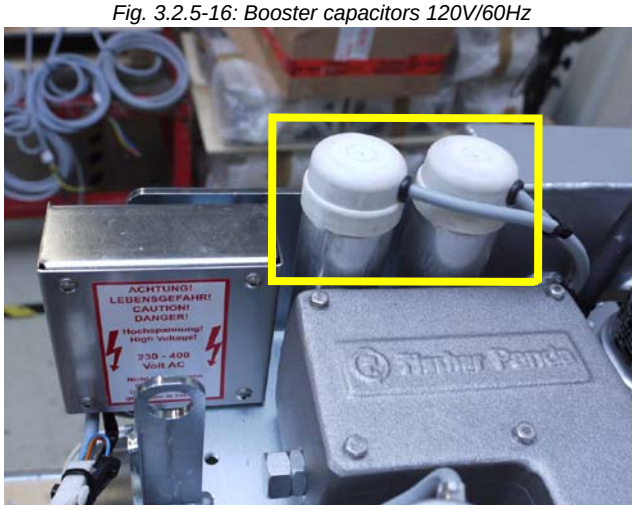
Current transformer board

Fig. 3.2.5-15: Current transformer board



Booster capacitors 120/60Hz

Fig. 3.2.5-16: Booster capacitors 120V/60Hz



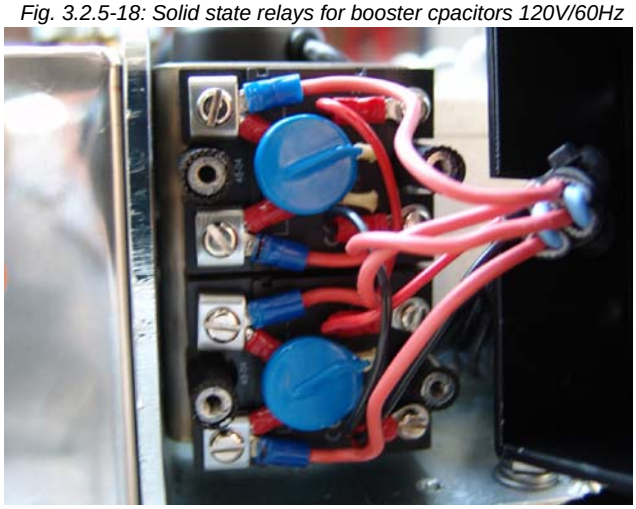
Excitation capacitors 120V/60Hz

Fig. 3.2.5-17: Excitation capacitors 120V/60Hz

Solid state relays for booster capacitors 120V/60Hz

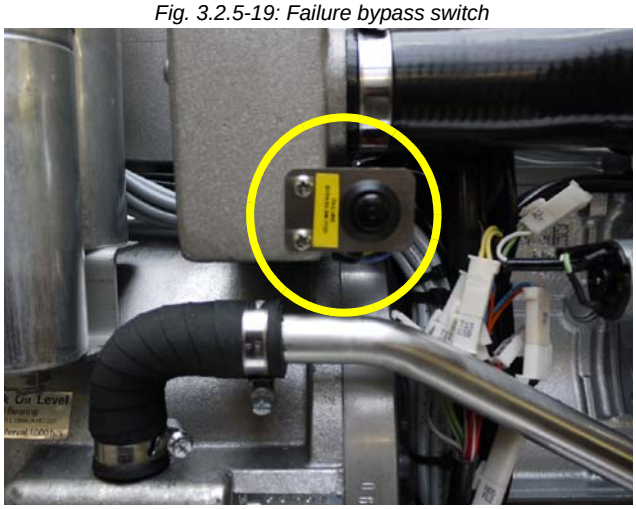
2xSolid state relays for booster cpacitors.

Fig. 3.2.5-18: Solid state relays for booster cpacitors 120V/60Hz



Failure bypass switch

Fig. 3.2.5-19: Failure bypass switch



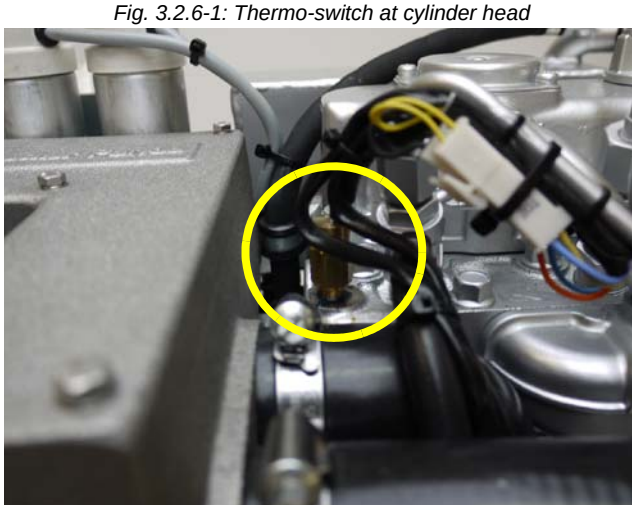
3.2.6 Sensors and switches for operating surveillance

Thermo-switch at cylinder head

The thermo-switch at the cylinder head serves the monitoring of the generator temperature. All thermo-switches for the generators from Panda 6.000 upward are two-pole and layout as "openers".

110°C and 130°C

Fig. 3.2.6-1: Thermo-switch at cylinder head



Thermo-switch in the generator coil

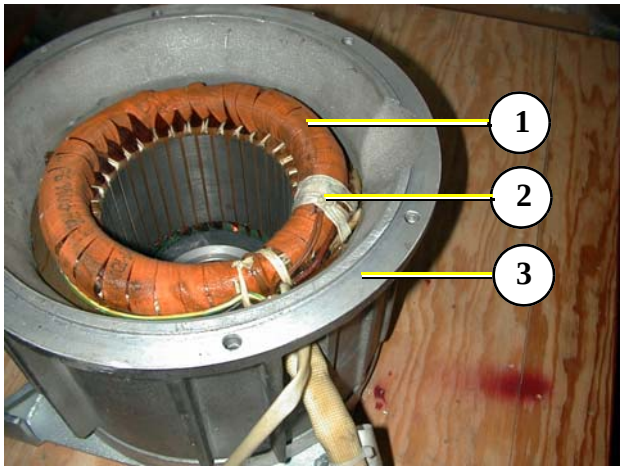
1. Generator coil

2. Thermo-switch 4x165/175°C

3. Housing

For the protection of the generator coil there are two thermo-switches inside the coil, which are for inserted parallel and safety's sake independently from each other.

Fig. 3.2.6-2: Coil thermo-switch

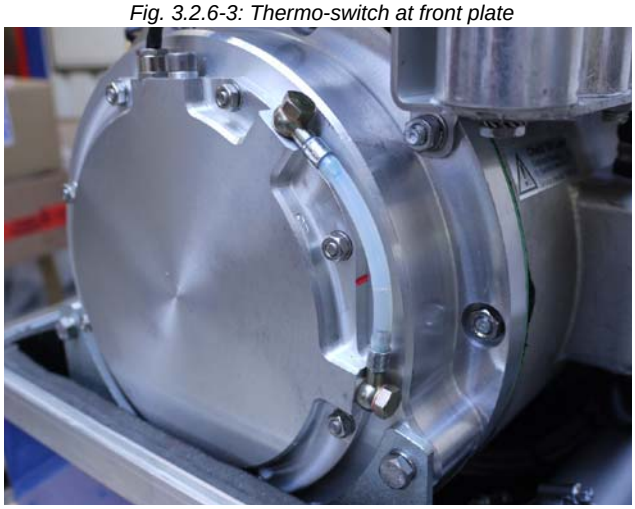


Thermo-switch at the front plate

The generator bearing is equipped with an thermoswitch, which switches the engine off if the temperature becomes to high.

130°C

Fig. 3.2.6-3: Thermo-switch at front plate

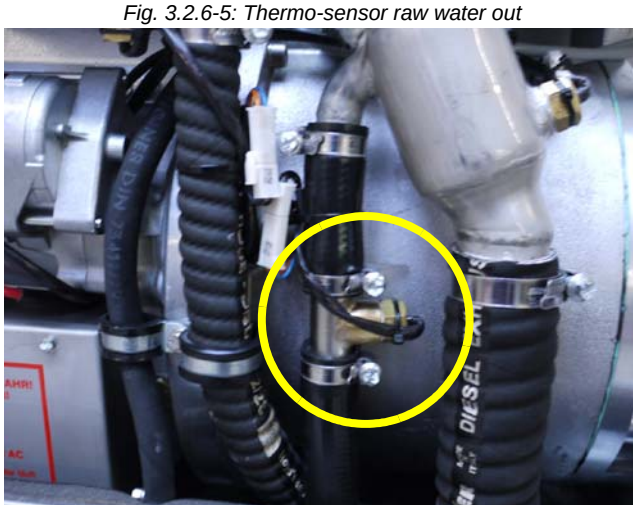


Thermo-sensor raw water in

Fig. 3.2.6-4: Thermo-sensor raw water in

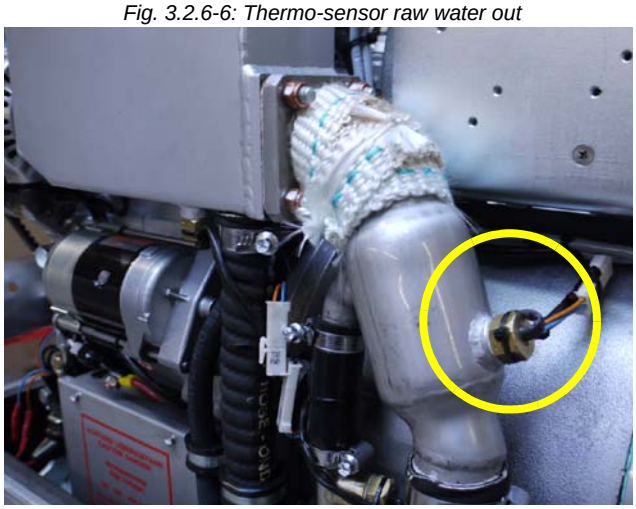
Thermo-sensor raw water out

Fig. 3.2.6-5: Thermo-sensor raw water out



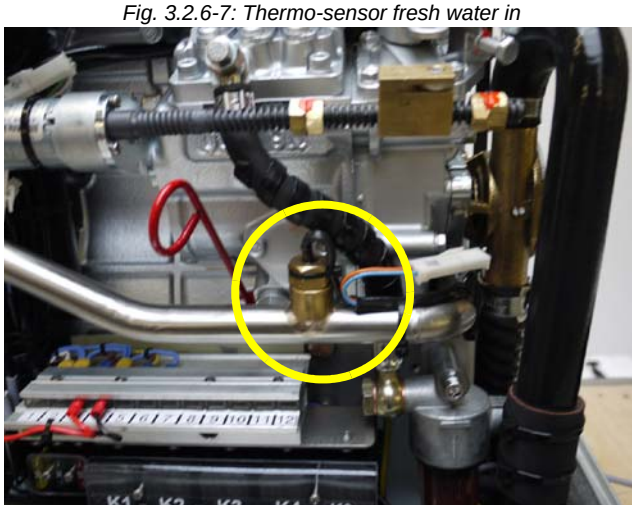
Thermo-sensor exhaust

Fig. 3.2.6-6: Thermo-sensor raw water out



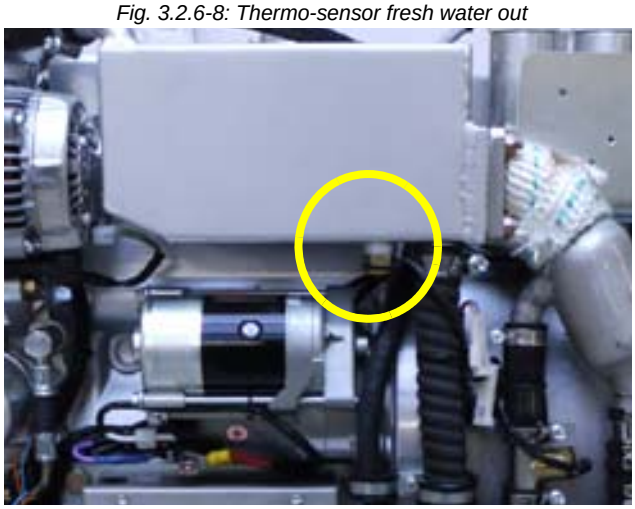
Thermo-sensor fresh water in

Fig. 3.2.6-7: Thermo-sensor fresh water in



Thermo-sensor fresh water out

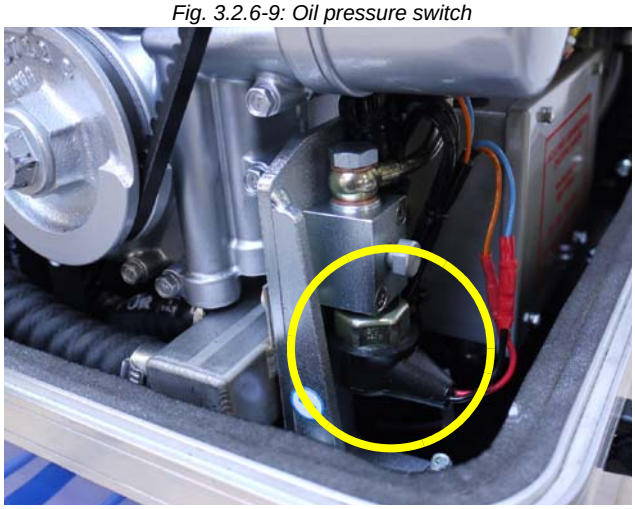
Fig. 3.2.6-8: Thermo-sensor fresh water out



Oil pressure switch

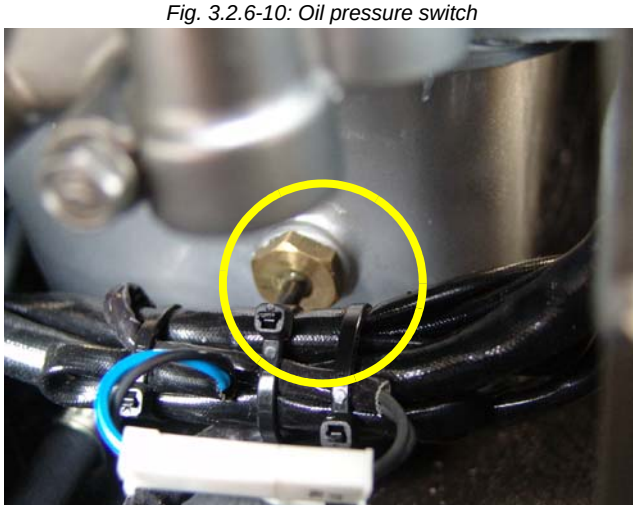
In order to be able to monitor the lubricating oil system, an oil pressure switch is built into the system. The oil pressure switch is on the back of the engine (below the oil filter).

Fig. 3.2.6-9: Oil pressure switch



Thermo-sensor oil temp

Fig. 3.2.6-10: Oil pressure switch



3.2.7 Components of the oil circuit

Oil filler neck with cap

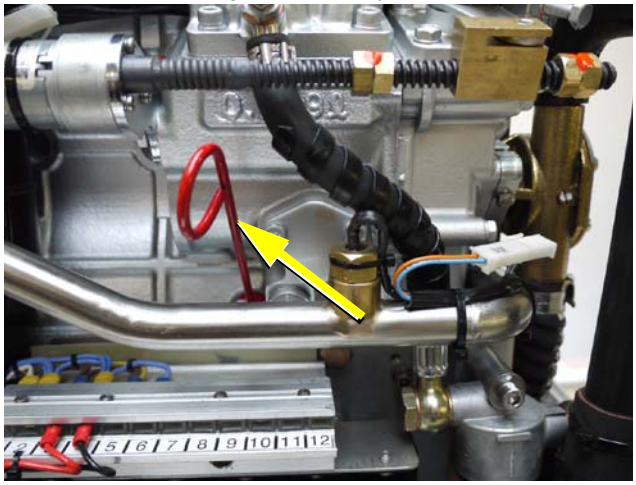
Fig. 3.2.7-1: Oil filler neck with cap

Normally the filler neck for the engine oil is on the top side of the valve cover. At numerous generator types a second filler neck is attached additionally at the operating side. Please pay attention that the filler necks are always well locked after filling in engine oil.

Consider also the references to the engine oil specification.

Oil dipstick

Fig. 3.2.7-2: Oil dipstick

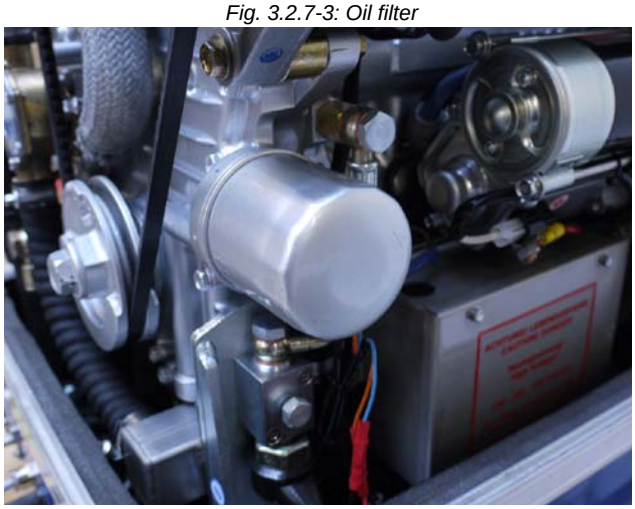


At the dipstick the permissible level is indicated by the markings "maximum" and "minimum". The engine oil should be never filled up beyond the maximum conditions.

Oil filter

The oil filter should be exchanged with an oil change.

Fig. 3.2.7-3: Oil filter

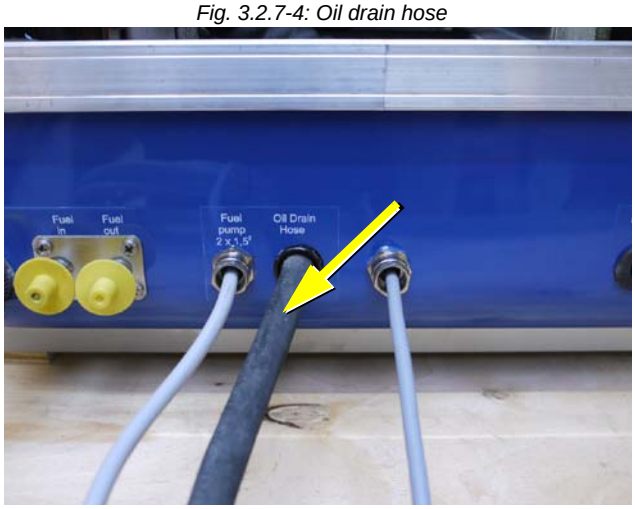


Oil drain hose

The Panda generator is equipped that the engine oil can be drained over an drain hose. The generator should be always installed therefore that a collecting basin can be set up deeply enough. If this is not possible, an electrical oil drain pump must be installed.

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

Fig. 3.2.7-4: Oil drain hose



3.3 Operation instructions

3.3.1 Preliminary remark

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.

Tips regarding Starter Battery

3.3.2 Daily routine checks before starting

1. Oil Level Control (ideal level: MAX).

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.

ATTENTION! OIL PRESSURE CONTROL!

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 maximum level, if the level drops below the mark between maximum und minimum levels.

The oil level of the oil cooled bearing must be checked before every start - see flow glas at the generator front cover.
Service interval 1000hrs.

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.

   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.

   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.

   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.

   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).

3.3.3 Starting Generator

1. If necessary, open the fuel valve.
2. If necessary, close the main battery switch.
3. Check if all the load have been switched off.

   The load is switched off, before the generator is switched off. The generator is not to be started with load connected. If necessary, the main switch or fuse should be switched off or the load should be individually switched off.

4. Press Standby „ON/OFF“ button (Position 2 on control panel).

   Control light for "Stand by" button must light up.

5. Press Generator "RUN/STOP" button (Position 06 on control panel).

   After the automatic pre-glow phase the engine starts.

   Control light for „Generator“ button must light up.

   If the genset does not immediately start, then the fuel intake should be checked to ensure it is flowing freely. (For temperatures below - 8°C check whether there is winter fuel)

6. Check circuit-voltmeter and frequency is within the tolerance rage
7. Switch on load.

3.3.4 Stopping the 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 load 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 Generator „RUN/STOP“ button and switch off the generator.
4. Press Standby „ON/OFF“ button to switch off the panel.
5. Activate additonal switches (Battery switch, fuel stop valve etc.).

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

6. If necessary, close sea cock.

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4. Installation Instruction

All connections (hoses, wires etc.) and installation instructions are designed and suited for “standard” installation situations.

In situations where Fischer Panda has no detailed information concerning certain installation requirements (such as vehicle specifications, maximum vehicle speed - and all other conditions concerning special operating situations) the installation instructions should be used as an example guide only. The installation must be undertaken and proved by a suitable qualified/trained person and should be in accordance with the law as required by the country and special situation.

Damages caused by faulty or incorrect installation are not covered by the warranty.

Attention!: Adapt system correctly.

4.1 Personal requirements

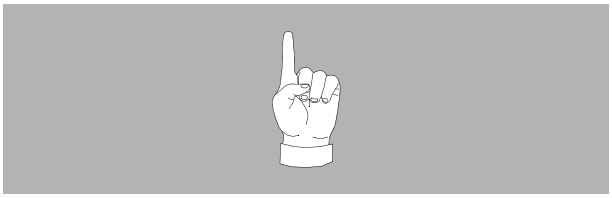
The described installation must be done by a technical trained person or a Fischer Panda service point.

4.1.1 Hazard notes for the installation

see “Safety first!” on Page 10.

Follow the general safety instruction at the front of this manual.

Notice:



DANGER TO LIFE! - Incorrect handling may lead to health damage and to death.

Always disconnect the battery bank (first negative terminal than positive terminal) before you work at the generator or the electric system of the generator so that the generator may not be started unintentionally.

.Warning!: Automatic start

Improper installation can result in severe personal injuries or material damage. Therefore:

- Always undertake installation work when the generator is switched off.
- Ensure there is sufficient installation clearance before start working.
- Ensure tidiness and cleanliness at the workplace. Loose components and tools lying around or on top of each other are sources of accidents.
- Only perform installation work using commercially available tools and special tools. Incorrect or damaged tools can result injuries.

Warning!: Risk of injury

Oil and fuel vapours can ignite at contact with ignition sources. Therefore:

- No open flames during work on the generator.
- Do not smoke.
- Remove oil and fuel residues from the generator and floor.

Warning!: Danger of fire

Contact with engine oil, antifreeze and fuel can result in damage to health. Therefore:

- Avoid skin contact with engine oil, fuel and antifreeze.
- Remove oil and fuel splashes and antifreeze from the skin immediately.
- Do not inhale oil and fuel vapours.

Danger!: Danger of poisoning

DANGER TO LIFE! - Improper handling can result in severe personal injury and death.

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.

ATTENTION!: Danger to Life - High voltage

Generator, oil and antifreeze can be hot during/after operation. Risk of severe burns!

During operation an over pressure in the cooling system may be established.

Warning!: Hot surface/material

Batteries contain corrosive acids and bases.

Improper handling can lead to heating of the batteries and bursts. Corrosive acids and bases may leak. Under bad conditions it may lead to an explosion.

Consider the instructions of the battery manufacturer.

Warning: Danger of chemical burns

During installation/maintenance personal protective equipment is required to minimize the health hazards:

- Protective clothing
- Safety boots
- Protective gloves
- Ear defender
- Safety glasses

Instruction!: Personal protective equipment necessary

Disconnect all load during the work at the generator to avoid damages at the load.

Attention!: Disconnect all load.

4.2 Place of installation

4.2.1 Preliminary remark

- There must be sufficient fresh air supply for the combustion air.
- It has to be ensured that the cooling air supply from underneath or sidewise is sufficient.
- During operation the sea cock has to be opened.
- The generator may only be opened by a technical trained person.
- The generator may only be operated by a trained person.

4.2.2 Preparing the base - placement

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 placed in the proximity of light walls or floors, which can have resonance vibrations because of airborne sounds. If this should be unavoidable, then it is recommended that this surface is lined with 1 mm lead foil, which will change the mass and the vibration behaviour.

You should avoid fixing the generator on a slippery surface with little mass (i.e. plywood). This acts as an amplifier of airborne sounds in the most unreasonable case. An improvement can be achieved by reinforcing these surfaces with 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 conditions.

As the generator sucks in its combustion air via several drill holes in the capsule base, the capsule base must be installed with sufficient space to the basement so that the air supply is guaranteed (at least 12 mm/½“)

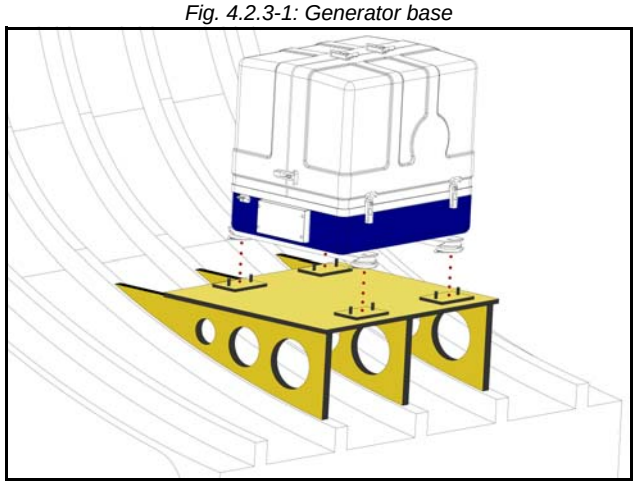
The generator sucks its air from the surrounding engine room. Therefore it must be ensured that sufficient ventilation openings are present, so that the generator cannot overheat.

High temperature of the intake air declines the power of the generator and increases the coolant temperature. Air temperatures of more than 40 °C reduce the power by 2 % per temperature rise of 5 °C. In order to keep these effects as small as possible, the temperature in the engine room should not be higher than 15 °C in relation to the outside temperature.

4.2.3 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 aggregate is „free“ downwards, the combustion air can be sucked in unhindered. In addition the vibrations are void which would arise with a closed capsule base.

Fig. 4.2.3-1: Generator base



4.3 Generator Connections

Sample for the connection at the Fischer Panda generator. See the description of the generator for the original location.

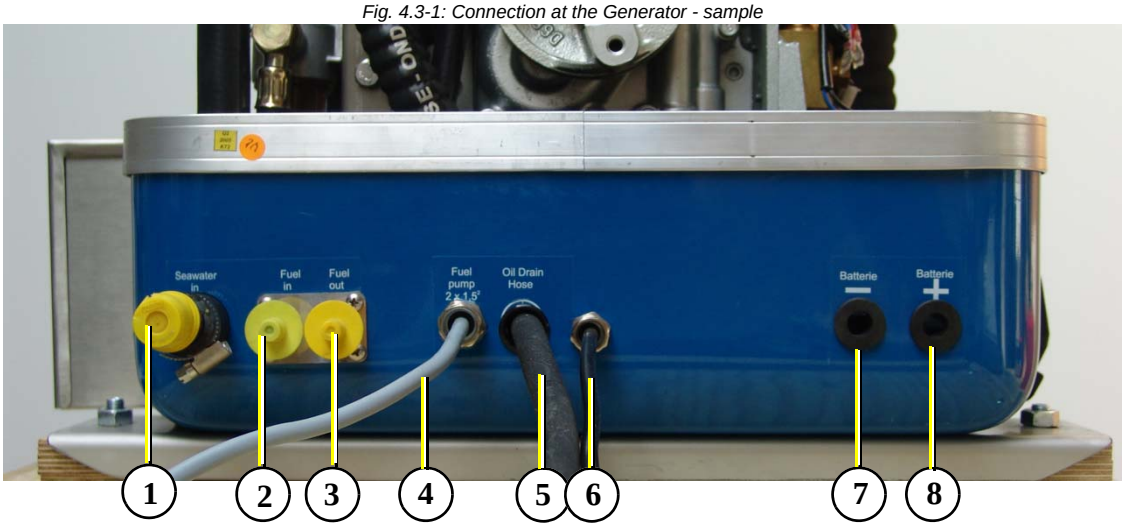
All electrical wires are connected within the capsule tightly to the motor and the generator. This is also the case for fuel lines and cooling water lines.

The electrical connections MUST be carried out according to the respective valid regulations. This also concerns used cable materials. The cable supplied is 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.

Before working (installation) on the System read the section „Safety Instructions“ in this manual.

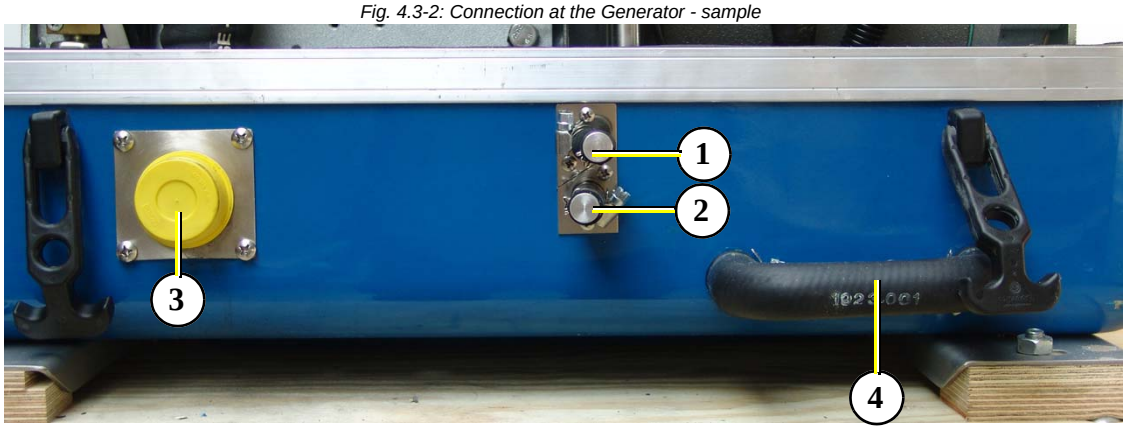
ATTENTION!

Fig. 4.3-1: Connection at the Generator - sample



1. Raw water inlet
2. Fuel supply (in)
3. Fuel return line (out)
4. Cable for external fuel pump
5. Motor oil drain hose
6. Cable for main power
7. Generator Starter-battery negative (-)
8. Generator Starter-battery positive (+)

Fig. 4.3-2: Connection at the Generator - sample



1. Backflow from external expansion tank
2. Intake to external expansion tank
3. Exhaust output
4. Connection external ventilation valve

4.4 Installation of the cooling system - raw water

4.4.1 General information

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

4.4.2 Fischer Panda installation kit - raw water

The following additional components will be required for the specified installation. You can purchase them as an installation kit or separately at Fischer Panda.

Note:

Through hull fitting with strainer

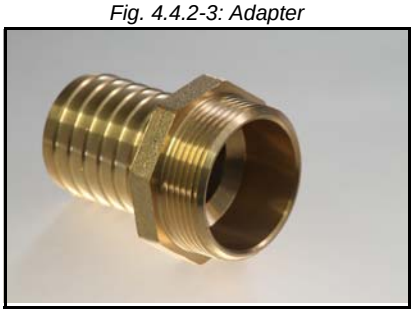
Fig. 4.4.2-1: Thru hull fitting with strainer

Sea cock

Fig. 4.4.2-2: Sea cock

Adapter

Fig. 4.4.2-3: Adapter

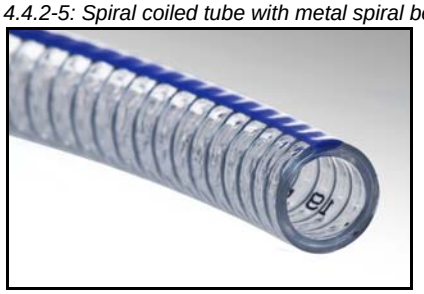


Raw water filter

Fig. 4.4.2-4: Raw water filter

Spiral coiled tube with metal spiral bead

Fig. 4.4.2-5: Spiral coiled tube with metal spiral bead



Ventilation valve

Fig. 4.4.2-6: Ventilation valve

Hose clamps

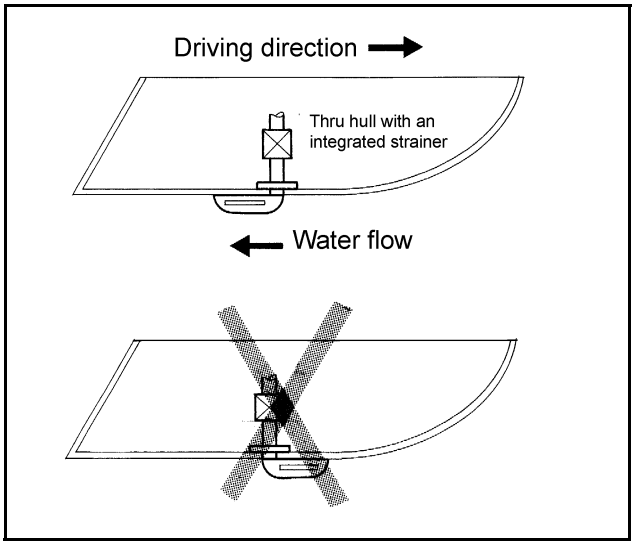
Fig. 4.4.2-7: Hose clamps

4.4.3 Installation of the through hull fitting in Yachts - scheme

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

For Panda generators, the through hull 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. 4.4.3-1: Position of the through hull fitting



4.4.4 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 must have an inner diameter of at least 1" (25 mm).

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

The intake suction line should be kept as short as possible. Install the raw 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 see section 11.10, “Diameter of conduits,” on page 165

4.4.5 Generator installation above waterline

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

If the generator is installed above the waterline, it is possible that the impeller will wear out faster, because after starting, the pump runs dry for some seconds. The raw water hose should form a loop as near as possible to the raw water inlet of the generator (see picture below). This ensures the pump only sucks in air for a short time. The impeller pump will be lubricated by raw water and the impeller life span will be increased.With the installation of a non return valve in the raw water inlet line, which is under the waterline, this problem can be restricted.

When starting the generator you should always consider when raw water runs out of the exhaust system. If this takes longer than 5 seconds you should replace the impeller pump because it sucks in air for too long before it delivers raw water. The impeller has lost its effect and cannot suck in raw water anymore. This results to an overheating of the motor. If the impeller is not exchanged early enough the impeller blades may break into pieces and plugging the cooling water cycle. It is very important to exchange the impeller after a couple of months.

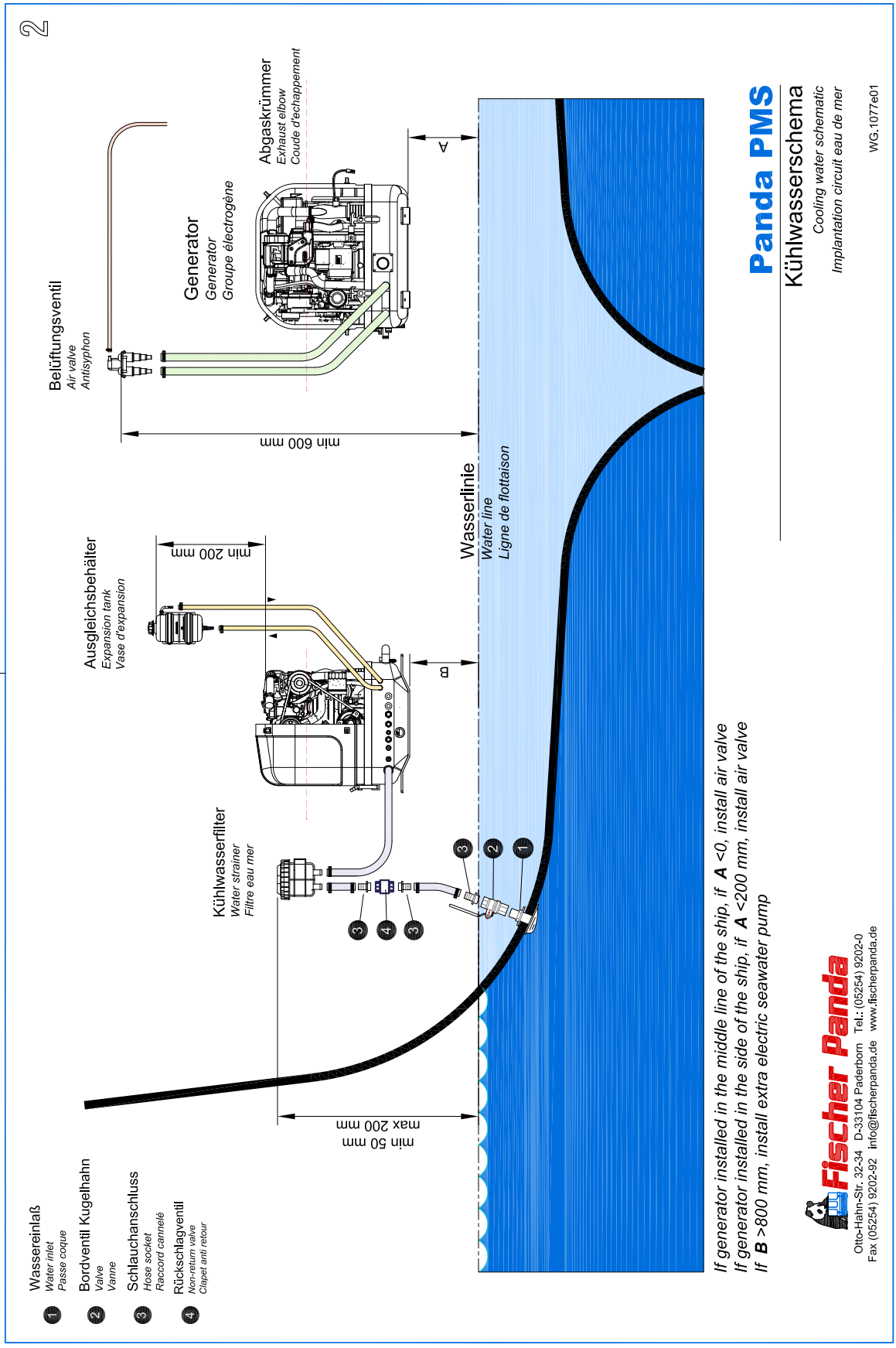
Never change the impeller for many years, without exchanging the old pump. If the sealing ring is defective within the pump, raw water runs into the sound cover of the genset. A repair is then very expensive.

NOTE:

Replacement impeller and also a spare pump should always be on board. The old pump can be sent back to Fischer Panda for cost-effective repair.

4.4.6 Raw water installation scheme

Fig. 4.4.6-1: Raw water installation schema



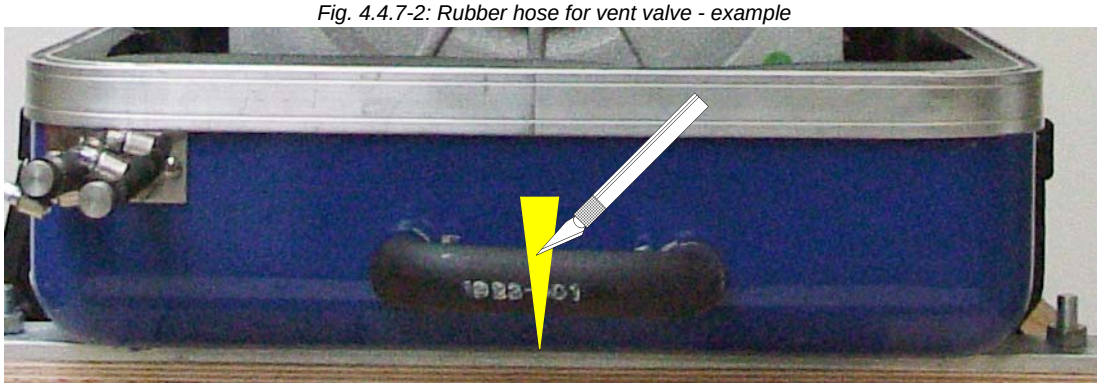
4.4.7 Generator installation below waterline

If the generator cannot be attached at least 600 mm above the waterline, a vent valve must be installed at the raw water line.

Possible heeling must be taken into consideration if installed at the "mid-ship line"! The water hose for the external vent valve is located at the back of the sound insulated capsule. This hose is split in the middle and extended respectively at each end by an additional hose and a connecting nipple. Both hose ends must be led outside of the sound cover, if possible 600 mm over the waterline in the mid-ship line. The valve is connected at the highest place to the two hose ends. If the valve jams the cool water line cannot be de-aerated after stopping the generator, the water column is not discontinued and water can penetrate into the combustion chamber of the engine. This will lead to damage the engine in a short term!

Fig. 4.4.7-1: Vent valve

Fig. 4.4.7-2: Rubber hose for vent valve - example



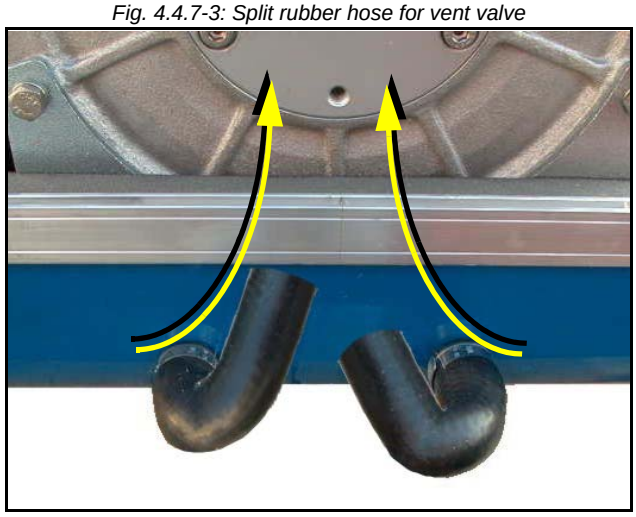
The rubber hose for the external vent valve will be cut...

...and bend upwards.

Both hose ends will be extended respectively with a hose and connected with a vent valve 600 mm over the waterline.

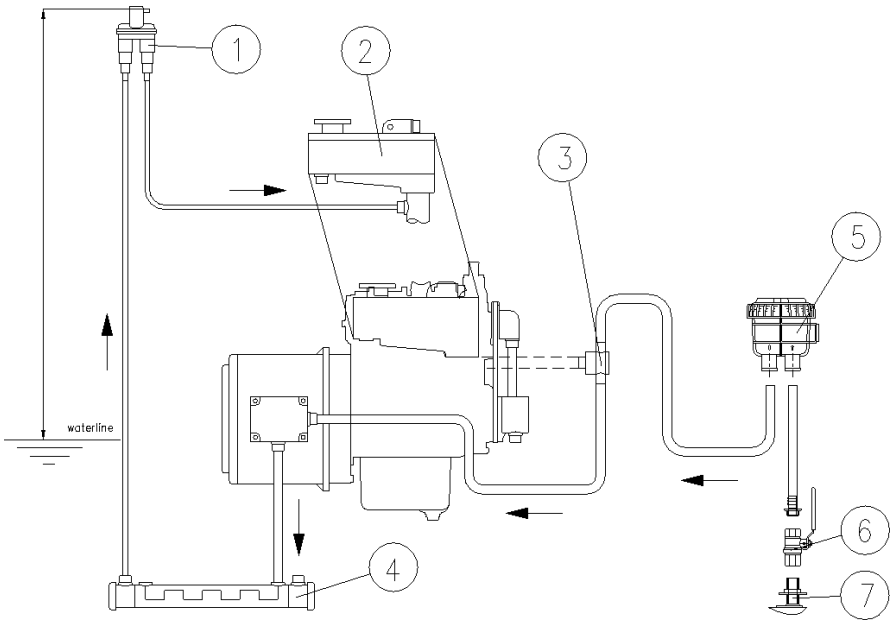
Example

Fig. 4.4.7-3: Split rubber hose for vent valve



4.4.8 Generator Housing cooled by raw water

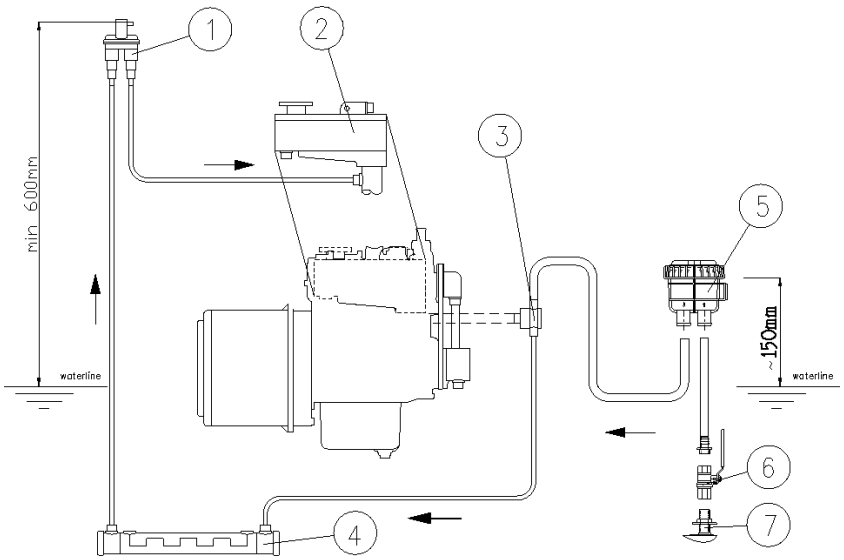
Fig. 4.4.8-1: Installation scheme for direct cooling



1. Vent valve
2. Coolant connection block
3. Raw water pump
4. Exhaust manifold
5. Raw water filter ø 1"
6. Water cock ø1“
7. Through hull

4.4.9 Indirect cooling of the genset housing (by the heat exchanger)

Fig. 4.4.9-1: Installation scheme indirect cooling of the genset housing



1. Vent valve
2. Exhaust manifold
3. Raw water pump (Raw water impeller pump)
4. Heat exchanger
5. Raw water filter
6. Water cock
7. Hull inlet

4.5 Installation of the cooling system - fresh water

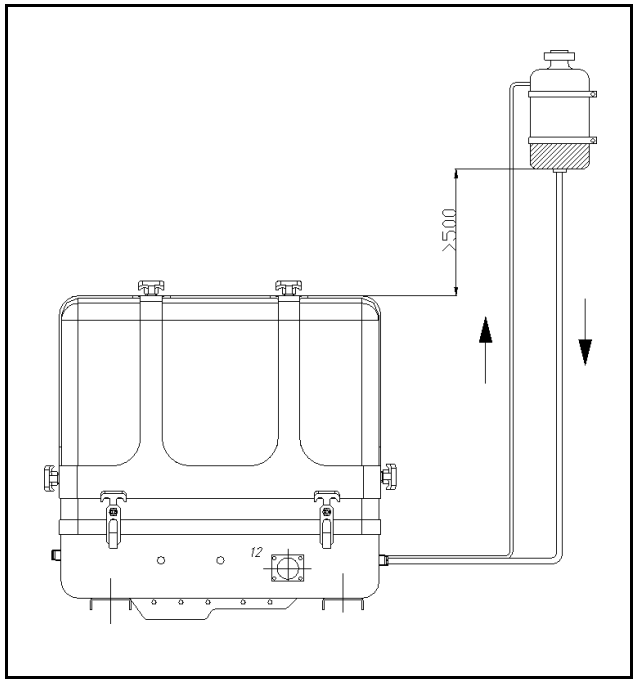
4.5.1 Position of the external cooling water expansion tank

Position of the external cooling water expansion tank

The Panda generator is normally supplied with an additional, external cooling water expansion tank. This tank must be installed in such a way that its lower edge is at least 500 mm more highly arranged than the upper edge of the sound cover.

If this 500 mm should be fallen below, i.e. the cooling water expansion tank is lower installed, very large problems can occur with filling and ventilating. Extend and displace the hose lines to the outside or possibly even up to the deck.

Fig. 4.5.1-1: Position of the External Cooling Water Expansion Tank

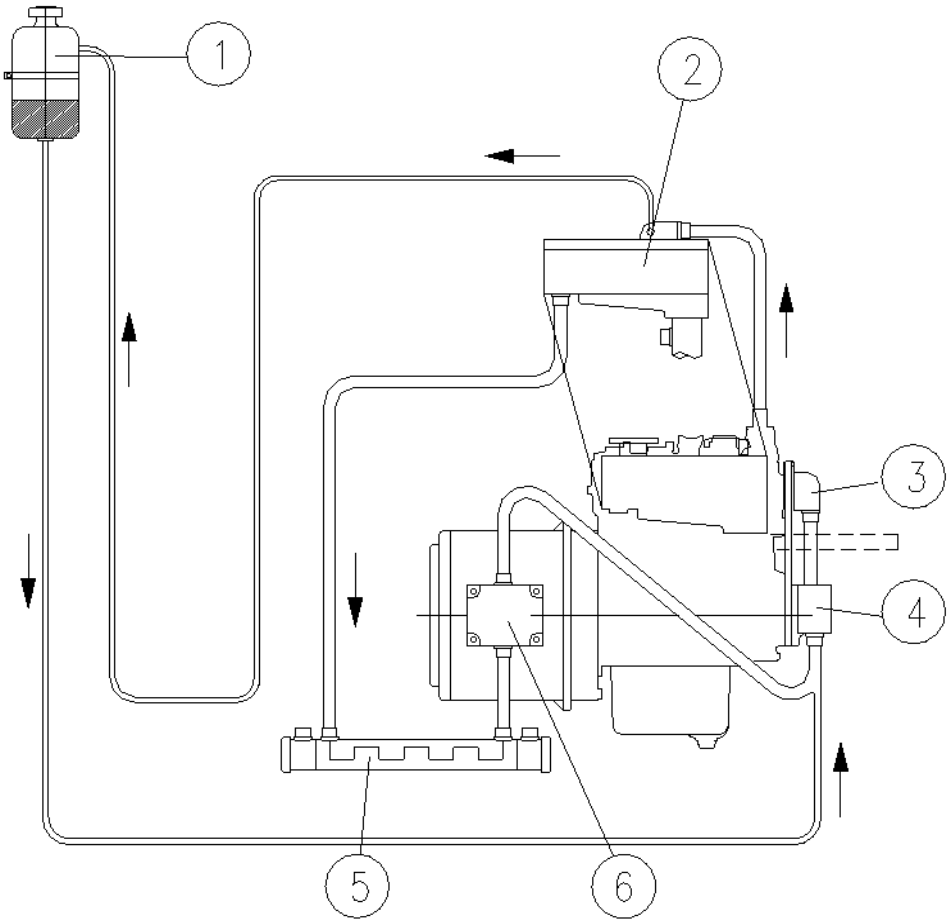


The external cooling water expansion tank may be filled only up to the lower edge of the lower tension tape (see note „max“) in the maximum filling level in cold condition.

ATTENTION!

4.5.2 Scheme for freshwater circuit at two circuit cooling system

Fig. 4.5.2-1: Scheme for freshwater circuit at two circuit cooling system



1. Expansion tank
2. Exhaust manifold
3. Thermostat housing
4. Fresh water pump
5. Heat exchanger
6. Cooling water connection block

4.5.3 De-aerating at the first filling of the internal cooling water circuit

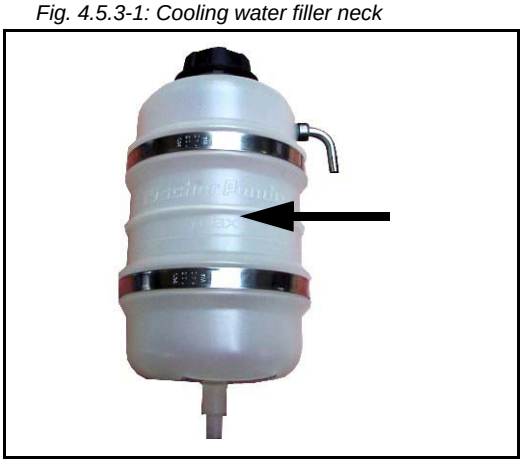
1. For the preparation of filling the following steps are to be undertaken:

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

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

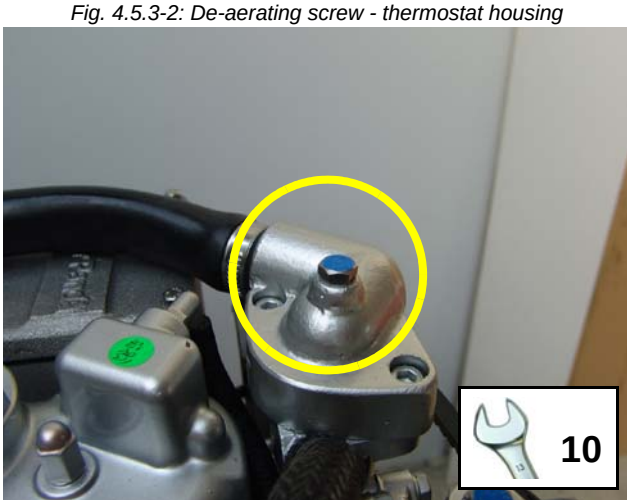
The cover of the external expansion tank temporary must be opened (all other closures are now closed!).

Fig. 4.5.3-1: Cooling water filler neck



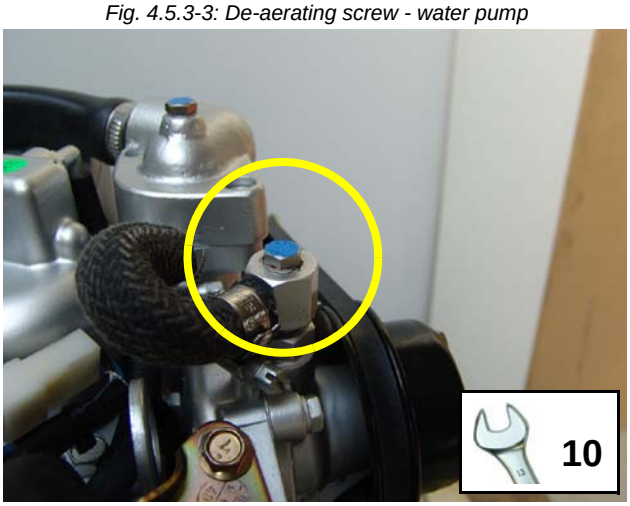
b. De-aerating screw on the thermostat housing,

Fig. 4.5.3-2: De-aerating screw - thermostat housing



c. De-aerating screw on the pipe socket of the internal cooling water pump.

Fig. 4.5.3-3: De-aerating screw - water pump



d. Filling the cooling water circle

e. close the de-aerating screws and refill the expansion tank

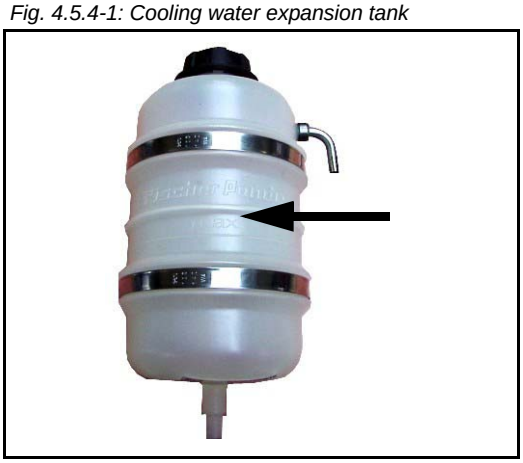
In the interest of safety, the freezing point of the closed circuit coolant should be **checked on a regular basis**. Be sure that the coolant/antifreeze mixture is good for at least -15°C (5°F) and if it is possible that your genset experiences lower temperatures, for example during storage or transportation, then the entire cooling system should be drained and purged. To purge the cooling system, compressed air at about 0.5 bar (7.5 psi) is sufficient.

Notice: Anti-freeze

4.5.4 Filling and de-aerating of the internal cooling water circuit

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

Fig. 4.5.4-1: Cooling water expansion tank



The cover of the external expansion tank temporary must be opened (all other closures are now closed!).

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

d. Start the generator

After filling the generator this must be started. During this first phase of start-up, the generator may not be loaded. Switch the generator off after max. 2 minutes of operation!

3. First de-aerating

The cooling water circuit of the generator must be de-aerated now by multiple repeating of the de-aerating procedure. During the entire procedure the external cooling water expansion tank remains opened (i.e. the cap must be removed).

After the first stopping of the the generator wait about one minute until the air in the cooling water can be drop off and raise to the highest point (ventilation point).

Now open all three ventilation points one after another as long as cooling water exit. Then the closure screw must be closed immediately. (Turn on only lightly to treat the thread.)

Pay attention that the external cooling water expansion tank is filled with enough cooling water during the de-aerating. (If necessary refill over and over.)

One de-aerating step will be last as a rule max. 2 minutes and following steps contained:

1. The generator runs approx. 1 minute.
2. Stop the generator.
3. Hold on one minute for drop of air.
4. The collected air is led out over the two de-aeration points.

The ahead described de-aerating process must be repeated as long as after the stopping and drop off air none air exit out of the de-aerating ports, only cooling water.

4. Again de-aerating process in the few days after the first startup

Also after the first implementing a small amount of air can be reside in the cooling circuit. To ensure an imaculate und actual operating of the cooling system the de-aerating process must be repeated casual in the next few days (if necessary weaks). Small amount of air will be still exit out of the de-aerating openings especially if the generator stood still for a long time.

During the de-aerating process it must be checked again and again if the cooling water is indeed circulating. If air bubbles established in the internal cooling water pump, it could be, that the cooling water circuit is not circulate. Then the generator would be warming very fast and switched off by overheating.

ATTENTION!

4.5.5 Pressure test for control of cooling water circuit

Check with the hand if a temperature difference exists whether between cooling water in-flow and cooling water return.

Feel the cooling water in-flow line at the internal cooling water pump.

Feel the cooling water return pipe either at the outlet of the water-cooled exhaust elbow union or at the side, where this pipe entry at the heat exchanger.

The temperature difference between in-flow and return is approx 10 degrees.

4.6 Installation of the water cooled exhaust system

4.6.1 Fischer Panda installation kit - Exhaust System

The following additional components will be required for the specified installation. You can purchase them as an installation kit or separately at Fischer Panda.

Note:

Waterlock

Fig. 4.6.1-1: Waterlock

Exhaust-Water-Seperator

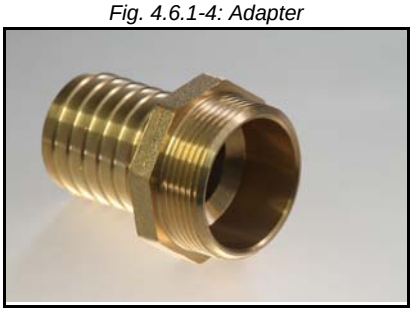
Fig. 4.6.1-2: Exhaust Water seperator

Through hull fitting without strainer

Fig. 4.6.1-3: Through hull fitting without strainer

Adapter

Fig. 4.6.1-4: Adapter



Sleeve adapter

Fig. 4.6.1-5: sleeve adapter

Exhaust hose black with wireinlay

Fig. 4.6.1-6: Exhaust hose black with wireinlay

Seacock

Fig. 4.6.1-7: Seacock

Hoseclamps

Fig. 4.6.1-8: Hoseclamp

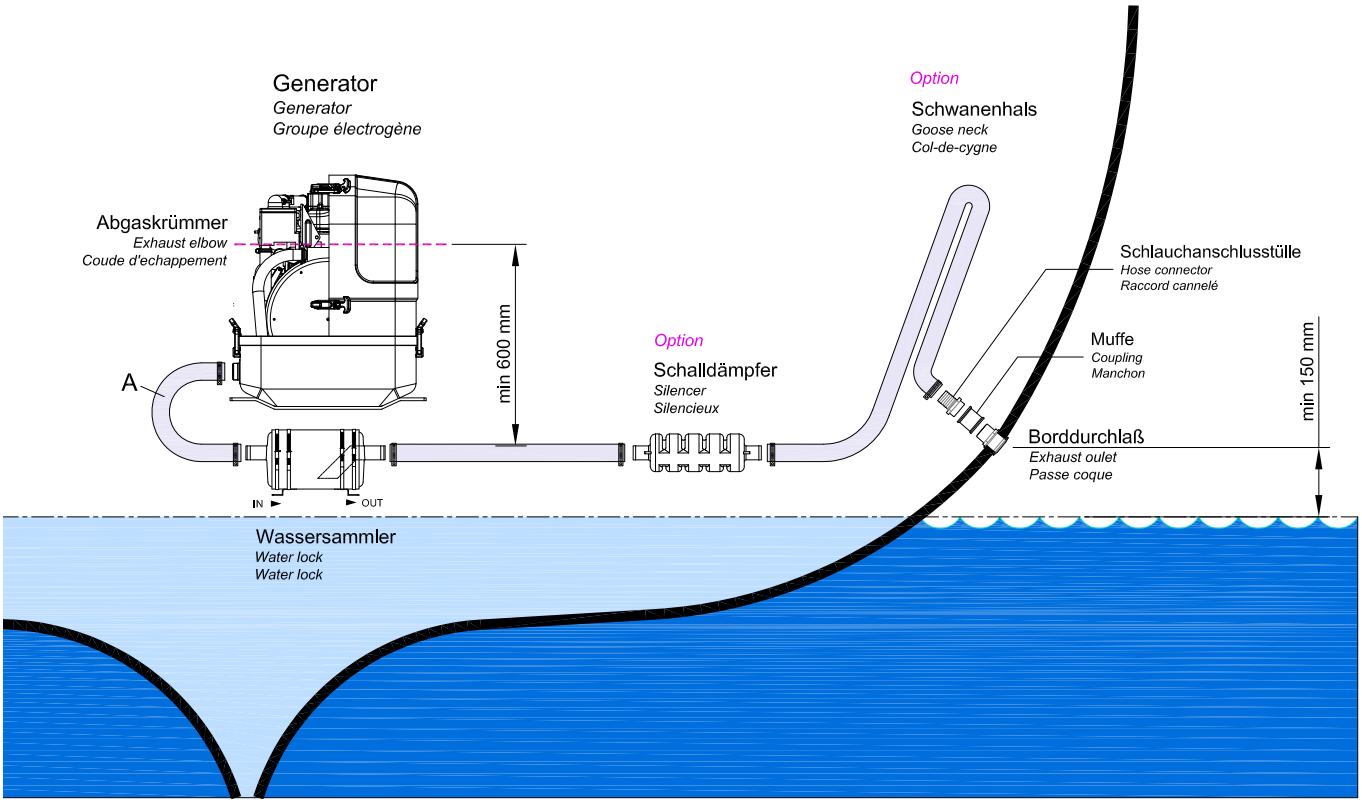
4.6.2 Installation of the standard exhaust system

The generator exhaust system must remain completely independent and separate from the exhaust system of any other unit(s) on board. The 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. In order that the back pressure inside the exhaust is not to high, the total length of the exhaust system should not exceed 6,3 m.

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

Exhaust diameter see section 11.10, “Diameter of conduits,” on page 165.

Fig. 4.6.2-1: Installation Scheme Standard Exhaust System



4.7 .Installation of the waterlock

Pay attention to the right flow direction throught the waterlock.

Note!:

Unfortunately, it can occasionally occur that, because of an disadvantageous mounting position of the waterlock, sea water gets into the diesel engines' combustion chamber. This disables the diesel engine by irreversible damages. Quite frequently, this leads to discussions during which the parties involved in the yachts' construction or the installation of the generator have to explain themselves.

One point in this situation can be clarified definitely:

If sea water gets into the inner section of the engine, this is not possible due to constructional defects of the generator or to malfunctions on the engine itself. It can only reach the combustion chamber via the exhaust hose and thus get into the engine.

Thereby, the position of the generator and the waterlock, as well as the arrangement of the cooling water and exhaust hoses play the decisive role.

If the waterlock is arranged in an unfavourable position, the cooling water flowing back in the exhaust hose can rise so high, that it reaches the exhaust stack. Since at least one discharge valve is always open when the engine is shut off, the sea water has free access to the combustion chamber. By capillary action, this sea water then flows past the cocks and even reaches the engine oil in that way. (In fact, a surprisingly high oil level is a first indication of an upcoming catastrophe).

If an usual high oil level can be detected and/or the oil is of a greyish colour, the engine must not be used anymore. This is a certain sign for cooling water that got into the oil pan. If the engine is started under these conditions, the water and the oil are mixed into an emulsion. The oil will quickly become so viscous that one will have to call it a paste. In this phase the fine oil hoses are blocked and a few moments later the machine gets destroyed because of insufficient lubrication. Before this happens, an immediate oil change should be made. Since the water can only reach the engine via the combustion chamber, it can be assumed that the compression rings will start to corrode. These effects have to be discussed with an engine expert. It will

certainly be reasonable to immediately inject plenty penetrating oil through the intake stack and to slowly turn the engine with the starter motor.

The cooling water can reach the exhaust area via the exhaust hose as well as via the cooling water feed.

4.7.1 Possible cause for water in the exhaust hose

4.7.1.1 Possible cause: exhaust hose

If the cause is the exhaust hose itself, the following points are to be checked at the hose:

a) Position of the waterlock is too high. The water reaches the exhaust hose.

b) Position of the waterlock is too far away from the middle of the generator. The water reaches the exhaust hose in tilted position.

c) The waterlock is too small relating to the length of the exhaust hose.

4.7.1.2 Possible cause: cooling water hose

If the generator is not clearly installed 600 mm over the water line, the cooling water feed must be equipped with a „venting valve“ which is at least led out 600 mm over the water line. (This position must also be assured in every tilted position. Therefore, the venting valve should be located in the ships’ center line, so that it cannot move in tilted position).

a) Position of the venting valve is too low. The water flows into the exhaust area when the ship is tilted.

b) Position of the venting valve is too far from the ships’ center line. The water reaches the exhaust area when the ship is tilted.

c) The venting valve does not work, because it jams or it is clotted. (The venting valve’s function needs to be checked regularly.)

As it consistently happens that functioning risks are not realised during the laying of the exhaust hose, the following explanations refer explicitly to the exhaust hose. Here, the location, the size and the position of the „waterlock“ play a very decisive role:

4.7.2 Installation area of the waterlock

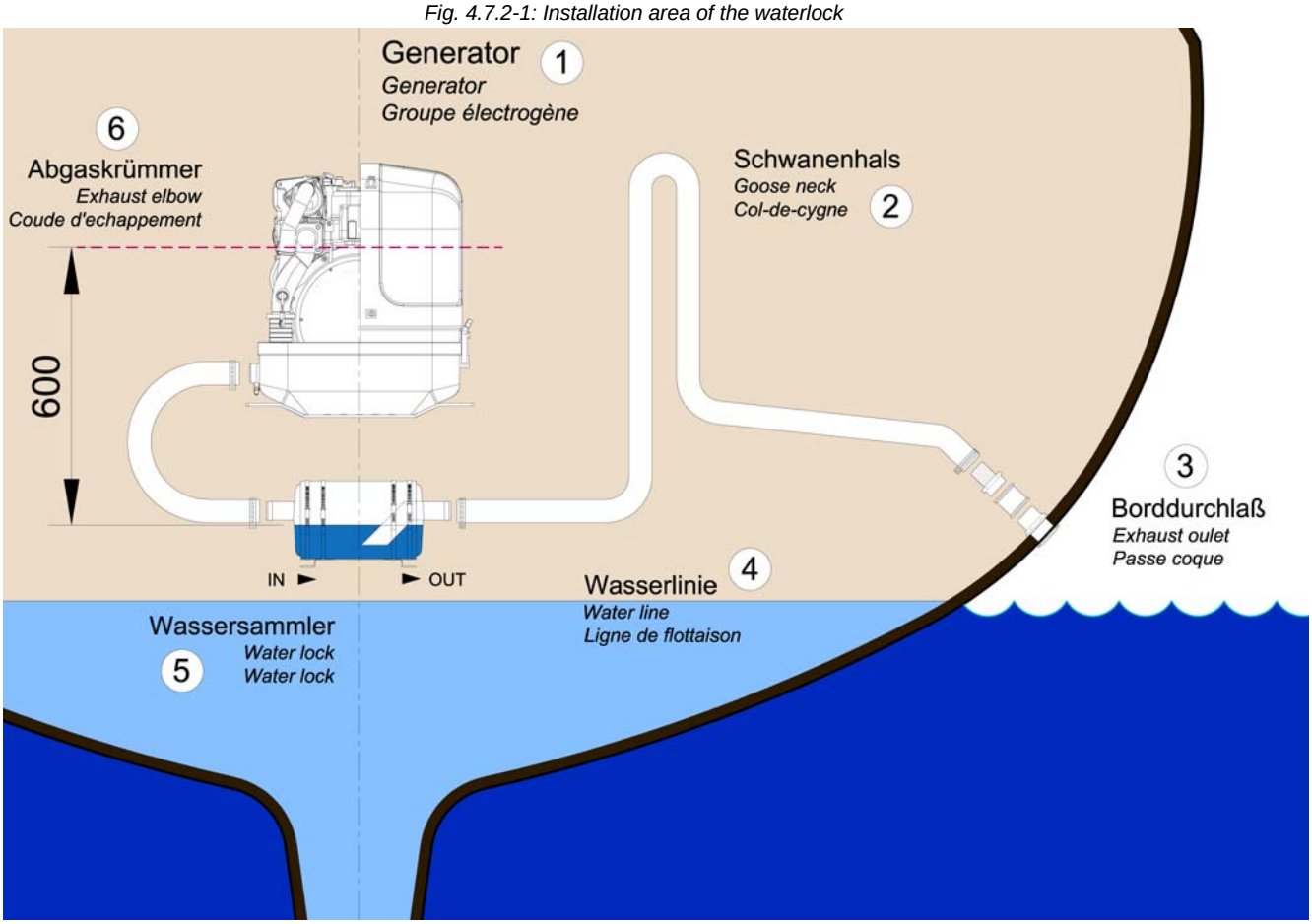
Concerning a water-cooled exhaust system, it must be regarded that - under no circumstances - cooling water from the exhaust hose can get into the exhaust elbow area at the engine. If this happens, the cooling water can get into the combustion chamber via an open discharge valve. This would lead to irreparable damage at the engine.

In addition to that, one has to reckon with possible tilted positions of sailing yachts, which makes the position of the waterlock even more important. In general one could say that:

The deeper the waterlock is located underneath the generator, the better the protection from entering water into the combustion chamber.

The picture below shows that the distance between the critical point at the exhaust elbow and the maximum permissible water level in the exhaust hose is stated with 600 mm. This distance should be understood as a minimum distance.

Fig. 4.7.2-1: Installation area of the waterlock

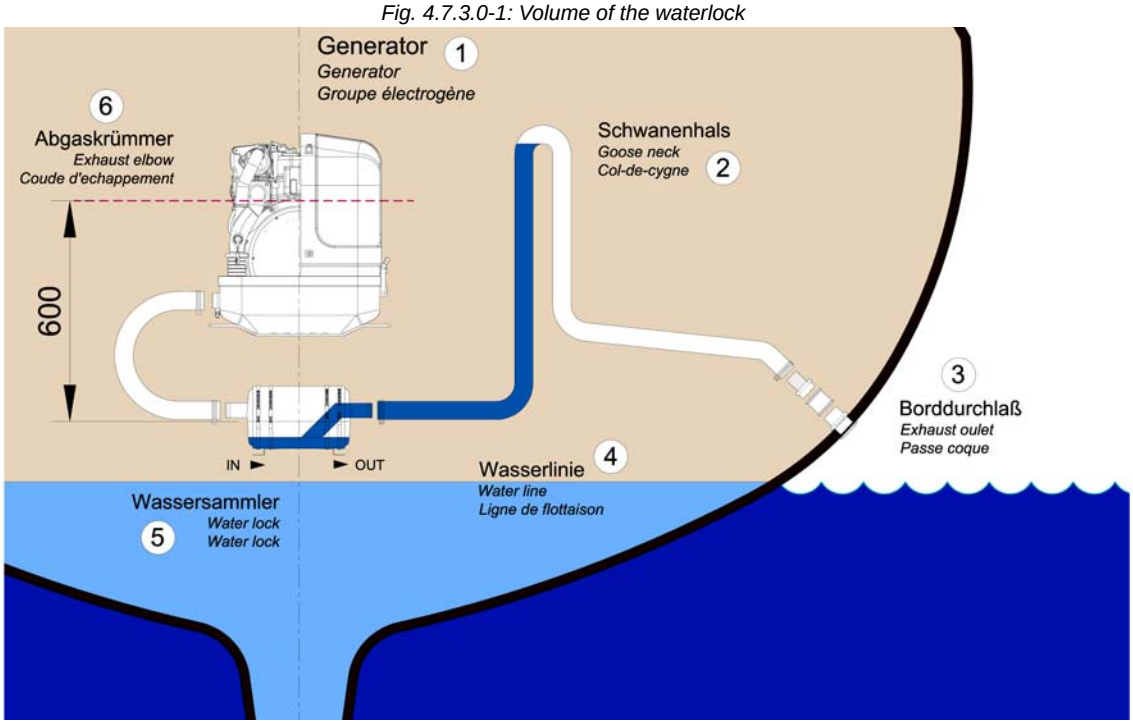


4.7.3 The volume of the waterlock

The waterlock must be measured so large, that it can take the entire amount of water flowing back from the exhaust hose. The amount of water depends on the hoses' length (L) and its cross section. While the diesel engine is running, cooling water is continuously injected into the exhaust system and is carted outside with the emissions by the exhaust gas pressure. When the engine is turned off, the number of revolutions sinks quite fast. By doing so, the point is reached where the exhaust gas pressure does not suffice anymore to cart the cooling water out. All cooling water remaining in the hose at that point flows back into the waterlock. At the same time, the diesel engine itself continues to cart cooling water through the cooling water pump, as long as it keeps on rotating.

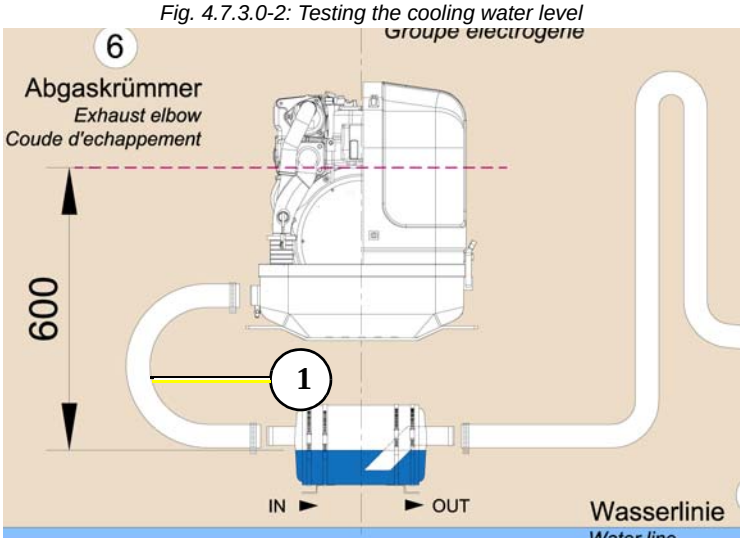
The waterlock must necessarily be measured large enough that it can take the entire amount of cooling water and, at the same time, does not exceed the prescribed vertical height of 600 mm up to the critical point at the exhaust elbow.

Fig. 4.7.3.0-1: Volume of the waterlock



If there are any doubts, a verification can easily be made by temporarily using a clear-sighted hose (1) as exhaust hose. In that way, the cooling water level can be checked very easily.

Fig. 4.7.3.0-2: Testing the cooling water level

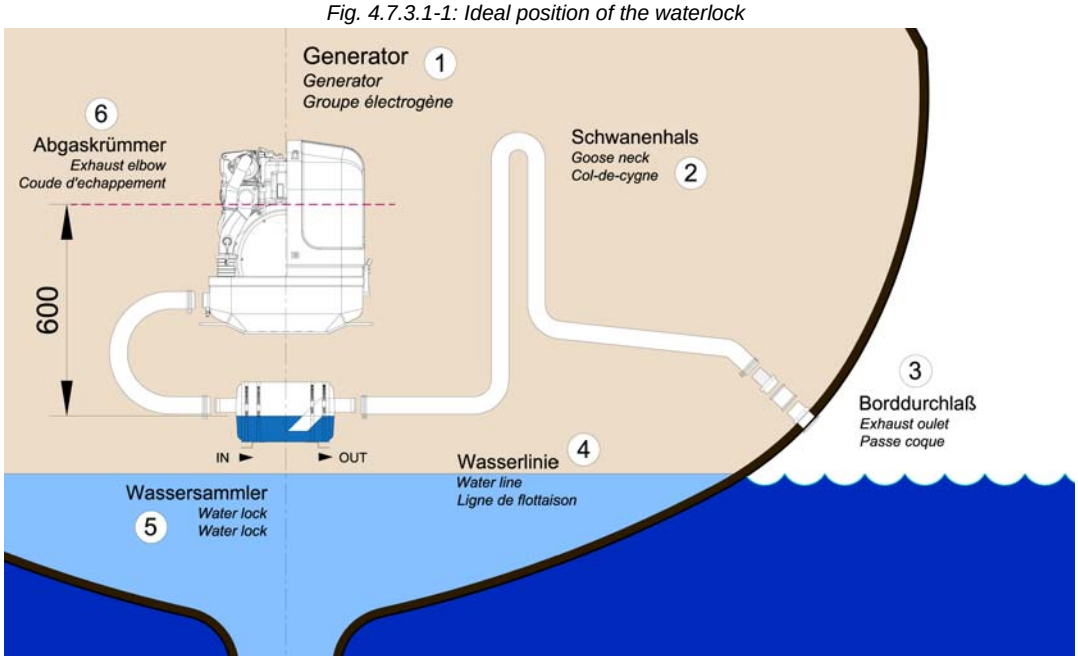


4.7.3.1 Ideal position of the waterlock

Important Note!

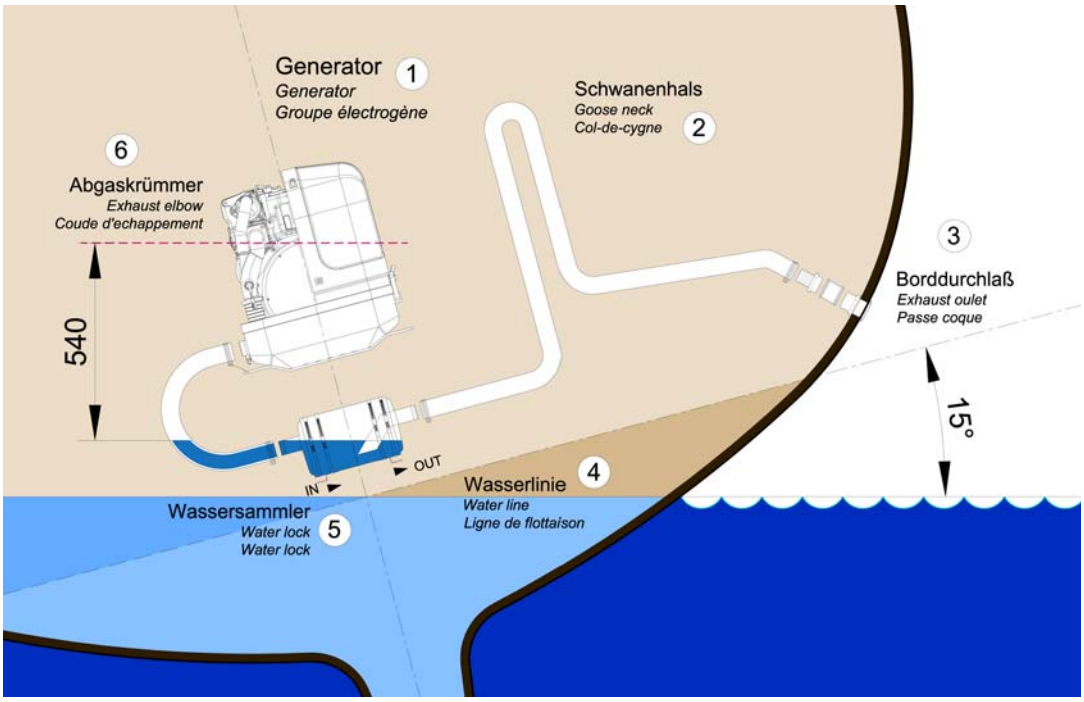
The ideal position of the waterlock would be in center underneath the generator. Only in this position it is assured that the water level cannot change drastically in tilted position by the waterlock moving out of the center line. See the following pictures:

Fig. 4.7.3.1-1: Ideal position of the waterlock



In Fig. 4.7.3.1-1, the waterlock is mounted in center underneath the generator. When the ship tilts, the position of the waterlock related to the critical point at the exhaust hose, changes only slightly.

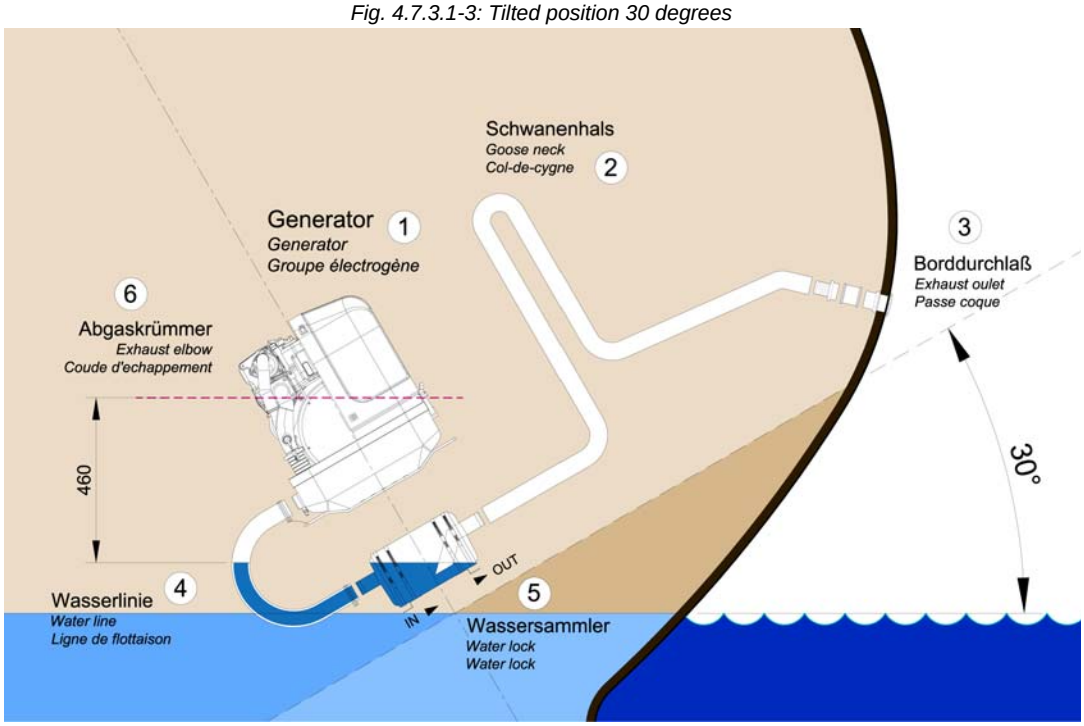
Fig. 4.7.3.1-2: Tilted position 15 degrees



Tilted position 15 degrees - Fig. 4.7.3.1-2

The distance from the exhaust elbow to the hydrostatic head has derated to 540 mm.

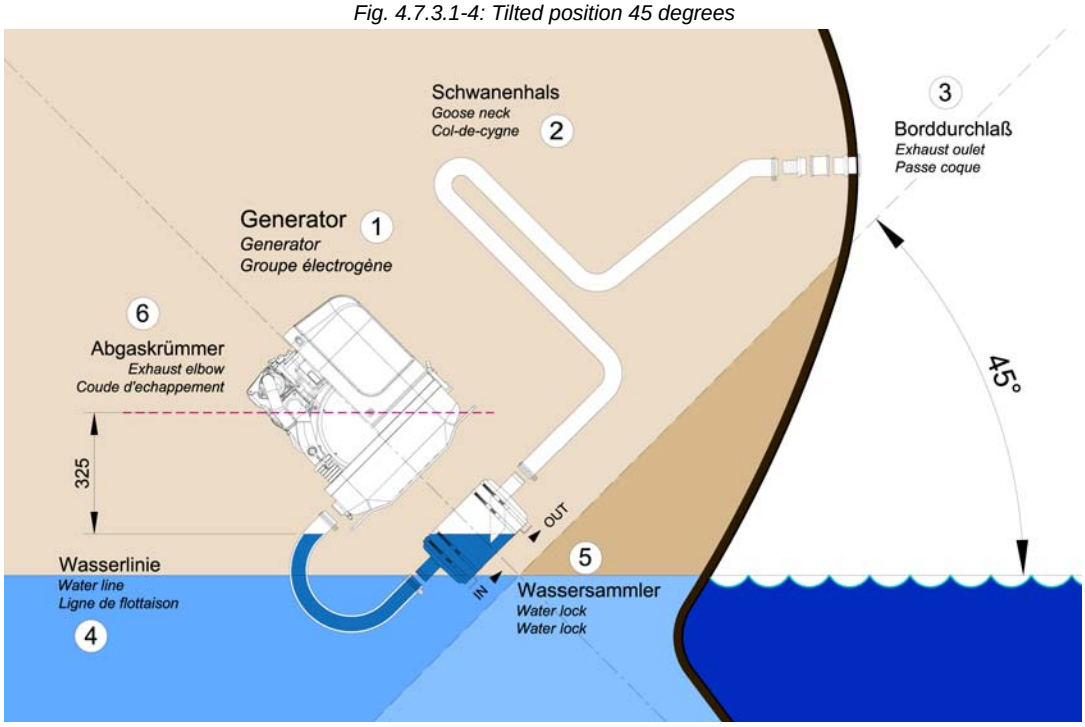
Fig. 4.7.3.1-3: Tilted position 30 degrees



Tilted position 30 degrees - Fig. 4.7.3.1-3

The distance of the water level, even in ideal position, changes that only 458 mm distance remain. So the critical distance is under-run already.

Fig. 4.7.3.1-4: Tilted position 45 degrees



Tilted position 45 degrees - Fig. 4.7.3.1-4

In this case the water level rise so high, that the distance constitutes only 325 mm.

Even when the water lock is mounted in the ideal spot, at an extremely tilted position of 45 degrees there is still the risk that water can get straight into the discharge stack area through strong rocking motions („sloshing“). This shows that the distance of 600 mm represents a minimum size at which, even when installed ideally, the water can slosh into the exhaust elbow when the ship is very tilted or rocks very hard.

Summary:

The preset minimum height of 600 mm must be regarded unconditionally and is only valid if the waterlock is mounted in its ideal position in center underneath the generator. A higher position is highly recommended if it has to be reckoned with tilted positions of 45 degrees.

4.7.3.2 Example of the installation of the waterlock off-center and possible effects:

The following pictures are primarily relevant for an installation of the generator with the waterlock on sailing yachts. A change in the mounting position caused by tilted position does not have to be reckoned concerning motor yachts. Here it is only necessary to regard that the volume of the waterlock is measured so large that it can take the entire amount of water flowing back, and at the same time, maintains the minimum distance of 600 mm.

A) Installation of the waterlock 500 mm next to the generator's center line:

Fig. 4.7.3.2-1: waterlock, 500 mm next to the center line

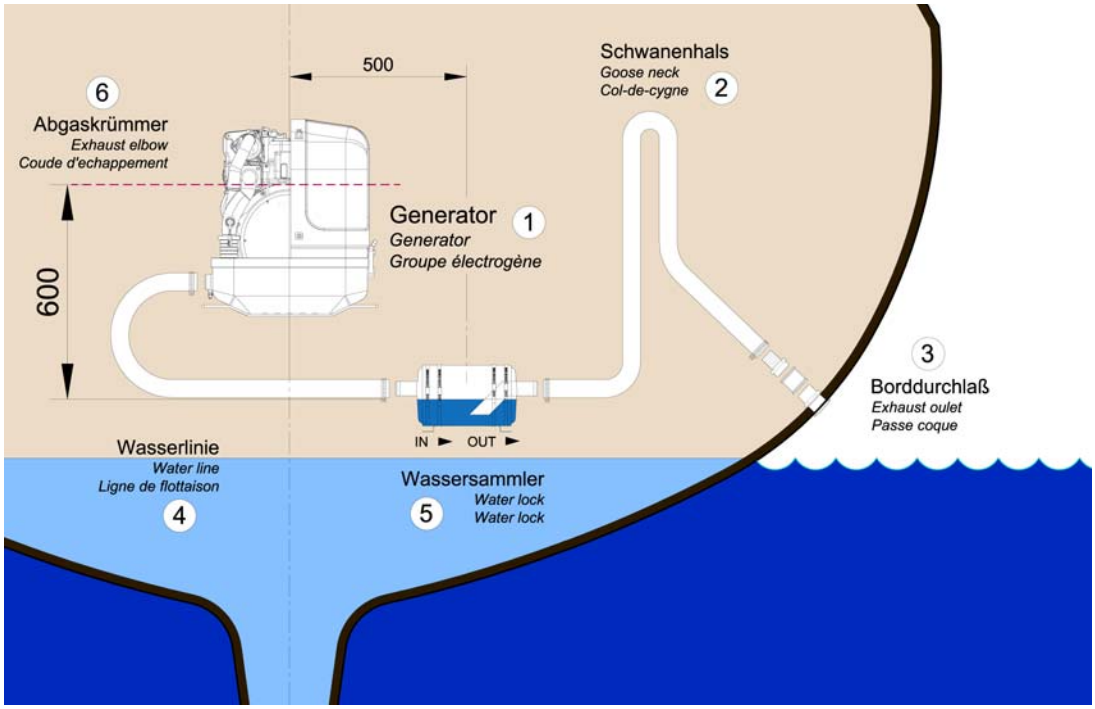
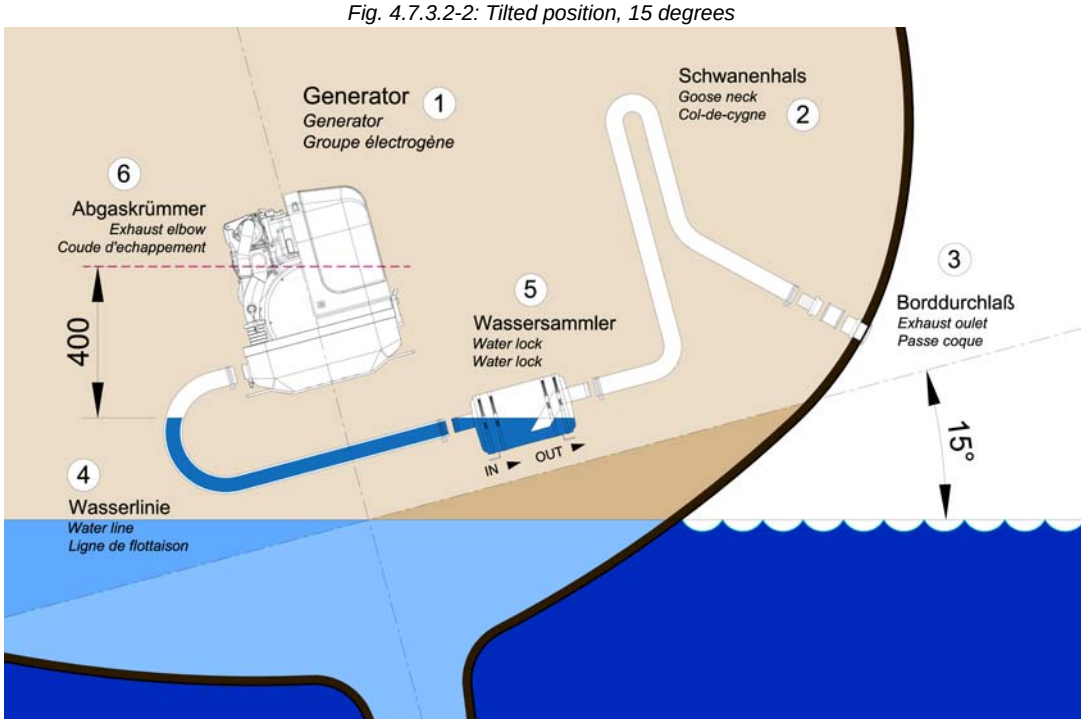


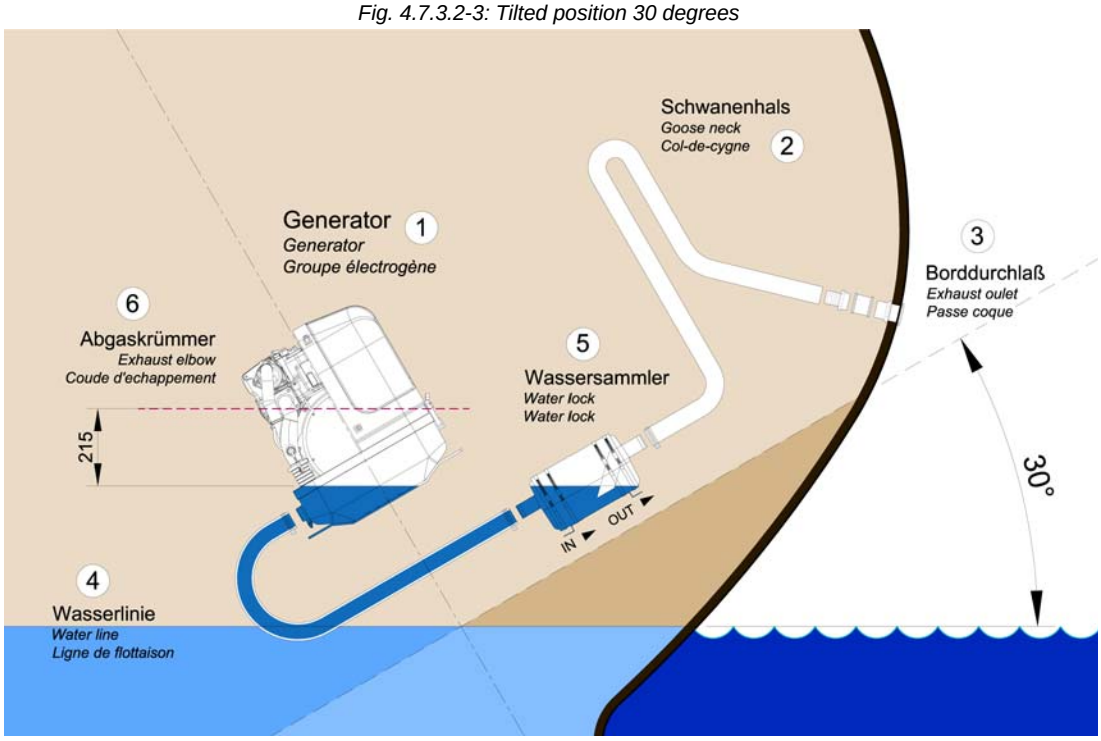
Fig. 4.7.3.2-2: Tilted position, 15 degrees



Tilted position 15 degrees - Fig. 4.7.3.2-2

The distance is only 404 mm instead of the original 600 mm. So this is very close to the critical point.

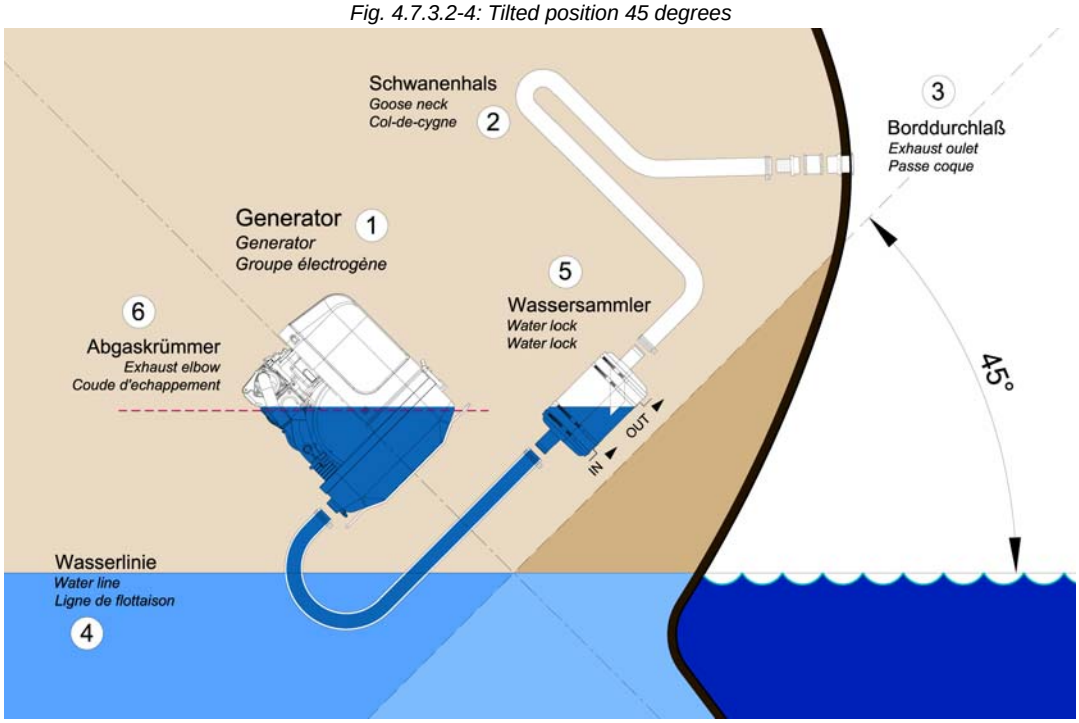
Fig. 4.7.3.2-3: Tilted position 30 degrees



Tilted position 30 degrees - Fig. 4.7.3.2-3

The distance between the hydrostatic head and the critical point at the exhaust elbow is only 216 mm. This means that in a tilted position of 30 degrees you already face the highest risk of sea water sloshing into the combustion chamber.

Fig. 4.7.3.2-4: Tilted position 45 degrees



Tilted position 45 degrees - Fig. 4.7.3.2-4

The water level is now at the same height as the critical point at the exhaust elbow. If the ship is sailed in a tilted position of 45 degrees with an installation like this, the ingress of cooling water into the combustion chamber is inevitable. Irreparable damages are pre-programmed.

B) Installation distance between waterlock and the generator's center line 1000 mm

Fig. 4.7.3.2-5: waterlock, 1000 mm next to center line

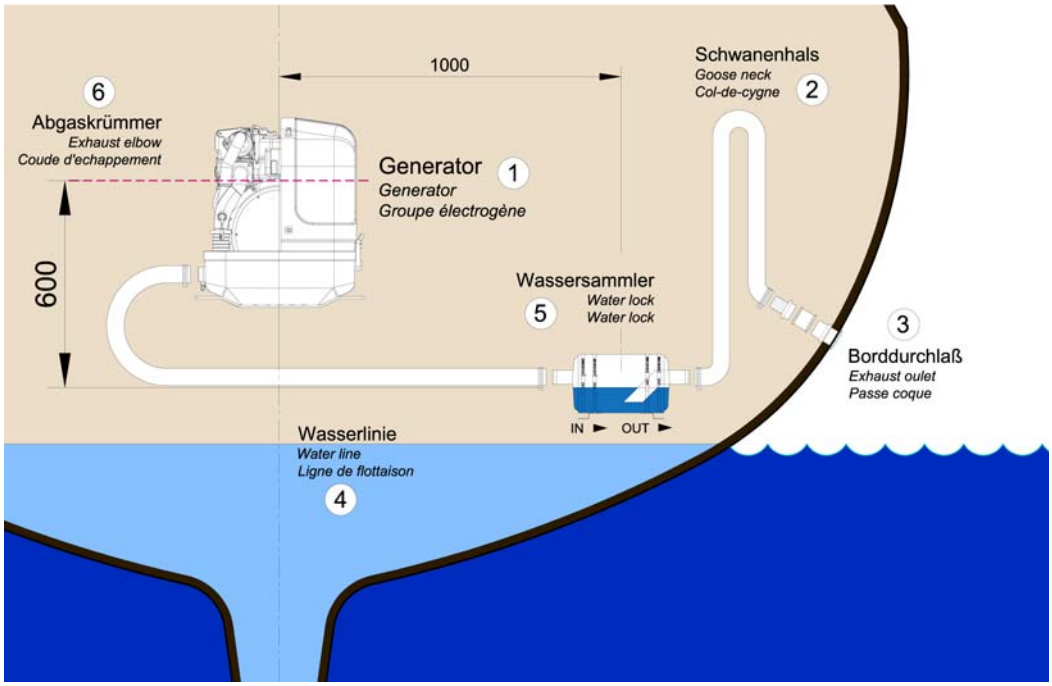
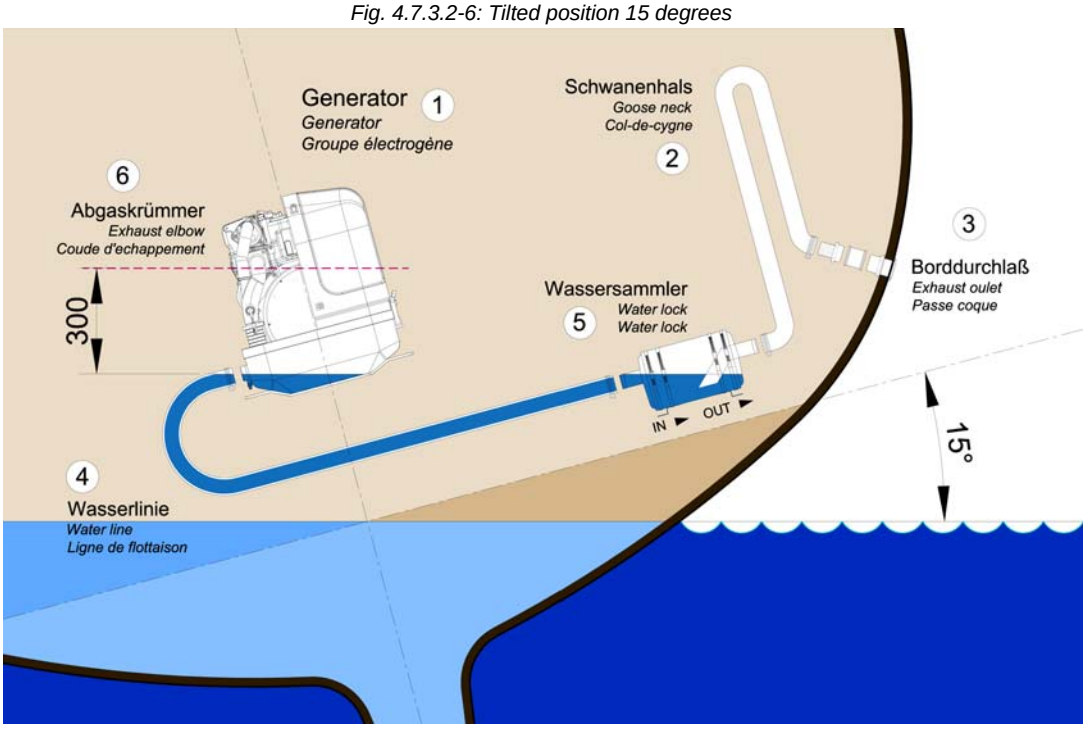


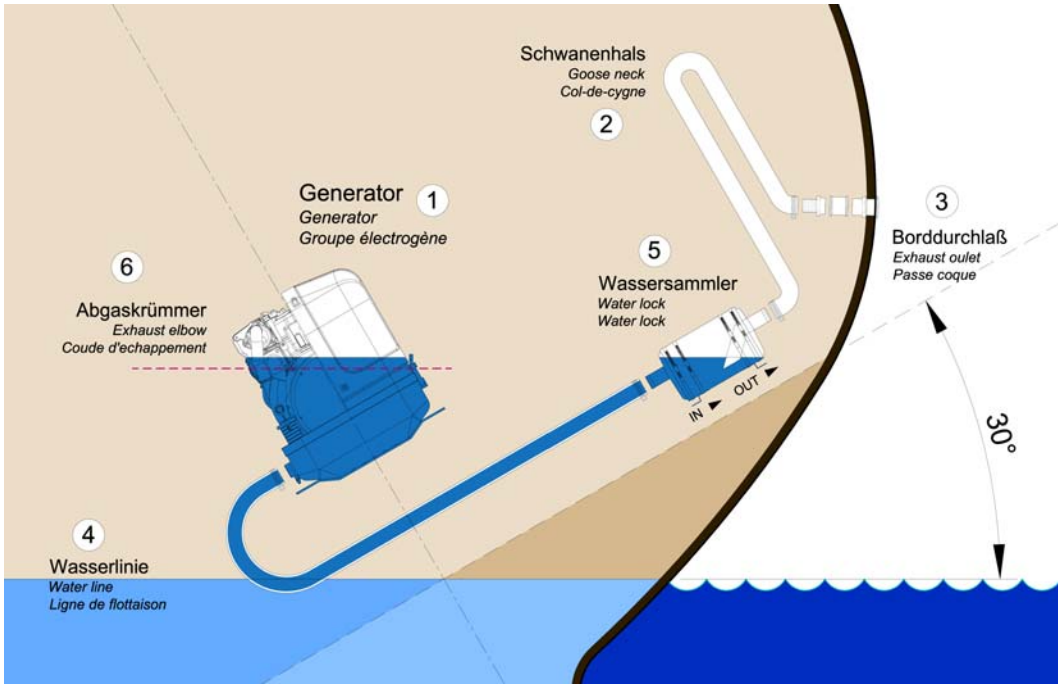
Fig. 4.7.3.2-6: Tilted position 15 degrees



Tilted position 15 degrees - Fig. 4.7.3.2-6

The distance is, contrary to the original 600 mm, only 327 mm. This is very close to the critical point already.

Fig. 4.7.3.2-7: Tilted position 30 degrees



Tilted position 30 degrees - Fig. 4.7.3.2-7

The water level and the critical point at the exhaust elbow are at the same level now. If the ship is sailed in a tilted position of 30 degrees with an installation like that, the infiltration of cooling water into the combustion chamber is inevitable. Irreparable damages are pre-programmed.

Summary:

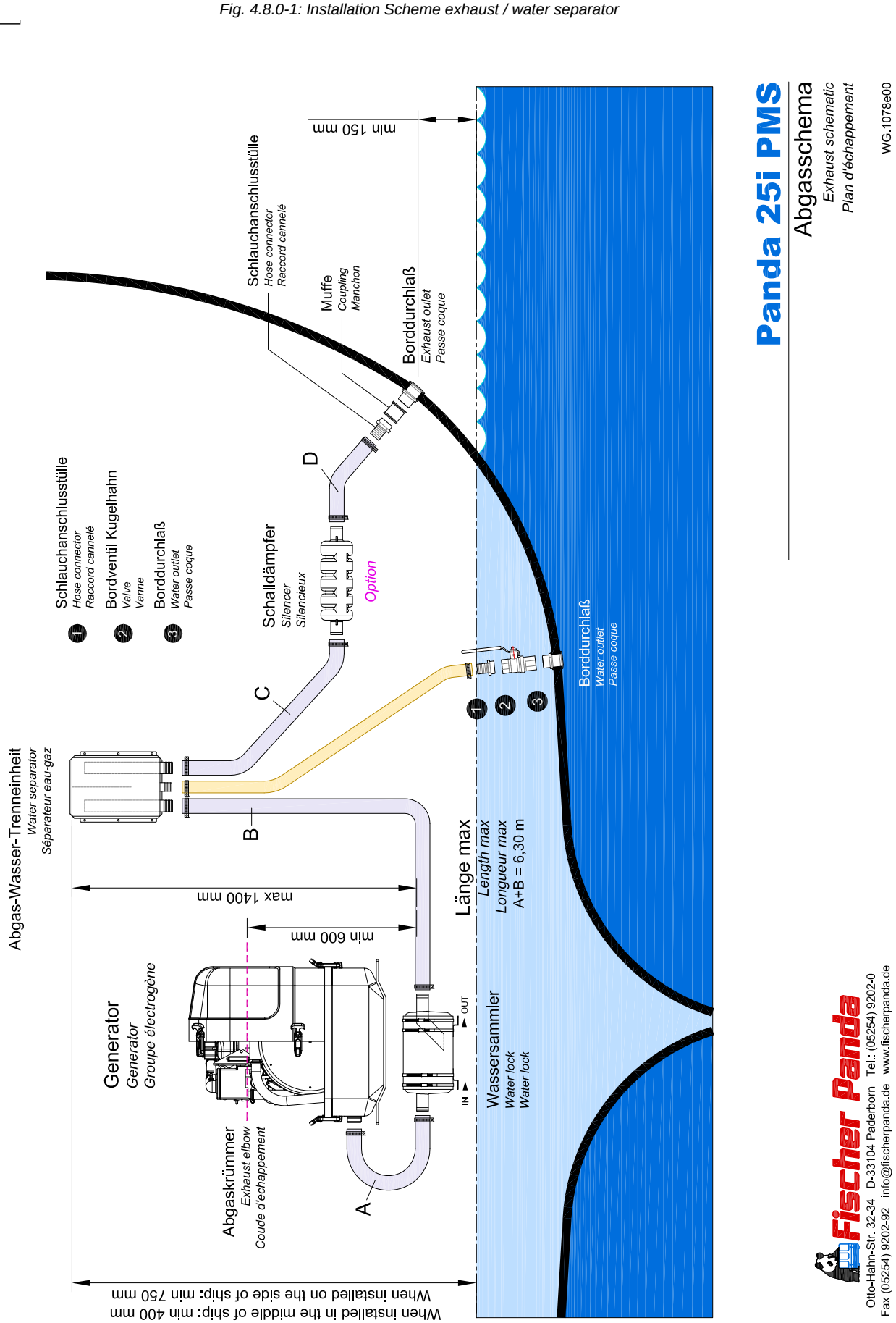
Concerning sailing yachts it must be regarded, that the waterlock is mounted in center underneath the generator, at least in reference to the ships' center line. Thus the waterlock is prevented from „leaking" very strongly when the ship is tilted.

The „leaking" of the waterlock leads to a rise of the water level which then gets too close to the exhaust elbow's critical point.

4.8 Exhaust / water separator

In order to reduce the noise level of the generator unit to a minimum, an optional exhaust outlet muffler can be mounted next to the through-hull fitting. Additionally there is a component at Fischer Panda, which acts as both an „exhaust goose neck", and water separator. With this „exhaust/water separator" the cooling water is derived over a separate pipe. The exhaust noises emanating from the exterior of the yacht are strongly decreased. Particularly the „water splash".

Fig. 4.8.0-1: Installation Scheme exhaust / water separator



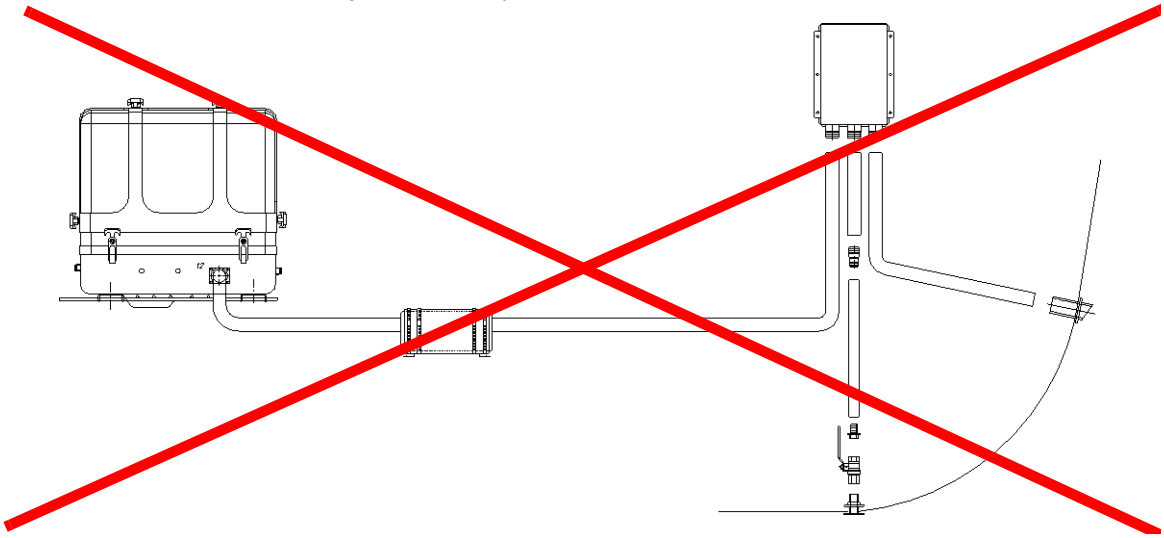
4.8.1 Installation exhaust water separator

If the exhaust water separator was sufficiently highly installed, a goose neck is no longer necessary. The exhaust/ water separator fulfils the same function. If the „Super silent“ 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.

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

The generator will not disturb your boat neighbours, if the „Super silent exhaust system has been correctly installed. The exhaust noise should be almost inaudible.

Fig. 4.8.1-1: Example for an unfavourable Installation



Example of an unfavourable installation:

- Water lock not far enough below the lowest level of the generator
- Distance water lock to exhaust/water separator too large

4.9 Fuel system installation

4.9.1 Fischer Panda installation kit - Fuel system

The following additional components will be required for the specified installation. You can purchase them as an installation kit or separately at Fischer Panda.

Note:

Fuel hose

representative picture

Fig. 4.9.1-1: Fuel hose

No return valve

representative picture

Fig. 4.9.1-2: No return valve

Pre filter with water separator

representative picture

Fig. 4.9.1-3: Pre filter with water separator

Pre filter with water separator

Alternative Article

representative picture

Fig. 4.9.1-4: Pre filter with water separator

Quick connector for fuel lines

representative picture

Fig. 4.9.1-5: Quick connector for fuel lines

Hose clamps

representative picture

Fig. 4.9.1-6: Hose clamps

4.9.1.1 The following items need to be installed:

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

The external Fuel pump should be installed near the tank

Electrical fuel pump (force pump)

With the Fischer Panda generator is usually supplied an external, electrical fuel pump (DC). The fuel pump must be installed close at the fuel tank. The electrical connections is prepared at the generator.

Some generators (f.e. with Deutz diesel engine) has an engine driven internal fuel pump. At these generators the electrical fuel pump is optional,.

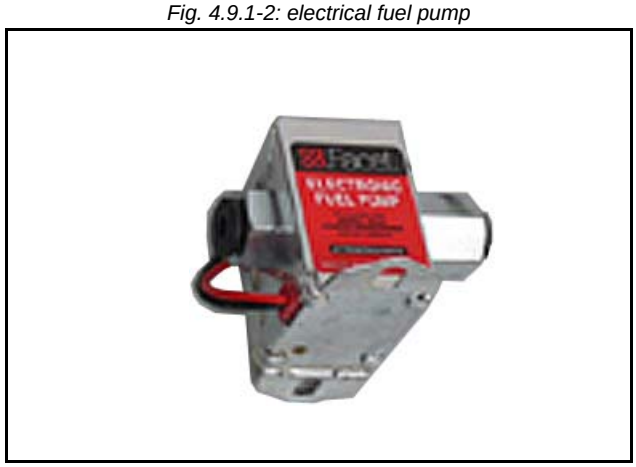
Fig. 4.9.1-1: electrical fuel pump

Electrical fuel pump (liftpump)

With the Fischer Panda generator is usually supplied an external, electrical fuel pump (DC). The fuel pump must be installed close at the generator. The electrical connections is prepared at the generator.

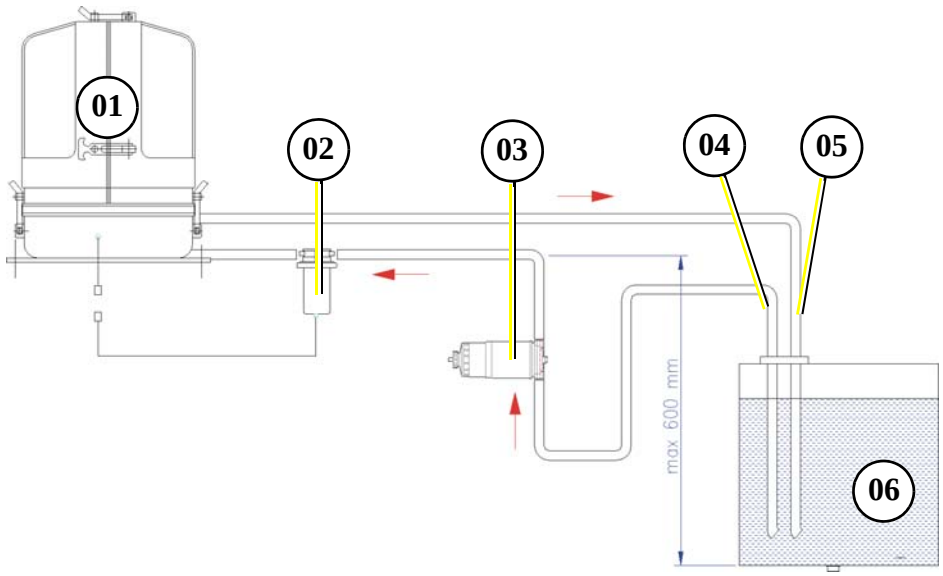
Some generators (f.e. with Deutz diesel engine) has an engine driven internal fuel pump. At these generators the electrical fuel pump is optional,.

Fig. 4.9.1-2: electrical fuel pump



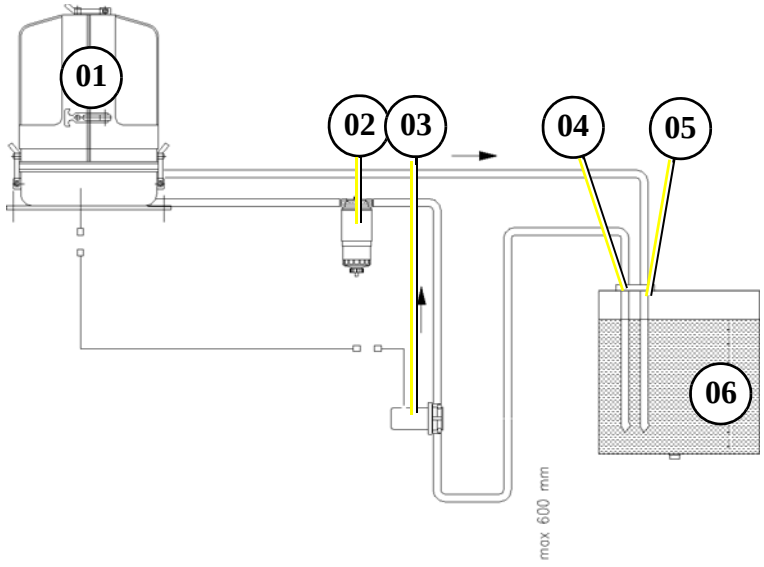
4.10 Installation Schema

Installationsschema mit Saugpumpe (z.B. Racor) / Installation scheme with lift pump (f.e. Facett)



01. Generator / Generator / Génératrice
02. Elektrische Kraftstoffpumpe (DC) / Electric fuel pump (DC) / Pompe électrique carburant (DC)
03. Kraftstoffilter mit Wasserabscheider / Fuel filter with water separator / Filtre de carburant avec séparateur d´eau *)
04. Kraftstoff-Vorlauf / Fuel forward / Amenée du carburant *)
05. Kraftstoff-Rücklauf / Fuel return / Retour du carburant *)
06. Kraftstofftank / Fuel tank / Réservoir de carburant
*) not supplied with standard generator.

Installationsschema mit Druckpumpe (z.B. Pieburg) / Installation scheme with force pump (f.e. Pierburg)



01. Generator / Generator / Génératrice
02. Kraftstoffilter mit Wasserabscheider / Fuel filter with water separator / Filtre de carburant avec séparateur d´eau *)
03. Elektrische Kraftstoffpumpe (DC) / Electric fuel pump (DC) / Pompe électrique carburant (DC)
04. Kraftstoff-Vorlauf / Fuel forward / Amenée du carburant *)
05. Kraftstoff-Rücklauf / Fuel return / Retour du carburant *)
06. Kraftstofftank / Fuel tank / Réservoir de carburant
*) not included with standard generator

External fine filter

At generators with Kubota EA 300 or Farymann engines, the fine filter is delivered with the generator. This fine filter should be installed in the fuel feed line next to the generator.

representative picture

Fig. 4.10.0-1: externer Feinfilter

4.10.1 Connection of the fuel lines at the tank

General fuel feed and return line must be connected to the tank at separate connection points.Lead the return fuel pipe connected to the day tank to the floor

Note:

Connection of the return pipe to the tank

The return pipe connected to the tank must be dropped to the same depth as the suction pipe, if the generator 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 is 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 placed in the tank. The instructions „Bleeding Air from the Fuel System“ must be read after initial operation or after it has stood still for a long period, in order to preserve the starter battery.

Non-return valve for the fuel return pipe

ATTENTION!

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

4.10.2 Position of the pre-filter with water separator

Inside the generator capsule itself, there is the fuel filter installed (exception: Panda 4500). Additional fuel filters (with water separator) 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.

Additionally to the standard fine filter a pre-filter with water separator must be installed outside of the sound insulation capsule in the fuel system line (not included in the delivery).

representative picture

Fig. 4.10.2-1: Pre-filter with water separator

4.11 Bleeding air from 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 air-bled after some time automatically. It is nevertheless essential to bleed the system as follows prior to the first operation (as all hoses are empty):

Switch „Stand by“- switch on control panel "ON".

Push „Fuel pump“- switch S3 (located on the relay board) and hold tight. The electric fuel pump has to be running audibly. By moving the switch you can hear the solenoid valve of the generator starting and stopping (when the sound cover is taken off). After the fuel pump has been running 3 to 4 minutes because the switch has been pushed down the bleeding screw of the solenoid valve has to be unscrewed. When opening the screw carry on pushing the switch. To avoid fuel getting in the sound cover a piece of cloth or absorbent paper should be put under the connection. As soon as fuel is running out without bubbles the air bleeding screw can be screwed in again. Only now stop pushing the „Fuel pump“-switch S3.

Now the unit can be started by pushing the "Run/Stop"-button. The unit should start after a short while. Should the unit not start one of the pipe union nuts of a injection hose has to be unscrewed and one has to try again to start the unit. After the unit has started the pipe union nut has to be tightened again.

„Stand by“-switch "OFF".

If there is no fuel soslonoid, please lose the fuel line at one injection nozzle and lift up a bit, instead of open the de-aerating screw of the solonoid.

Fuel solenoid valve

Fig. 4.11.0-1: Fuel solenoid valve

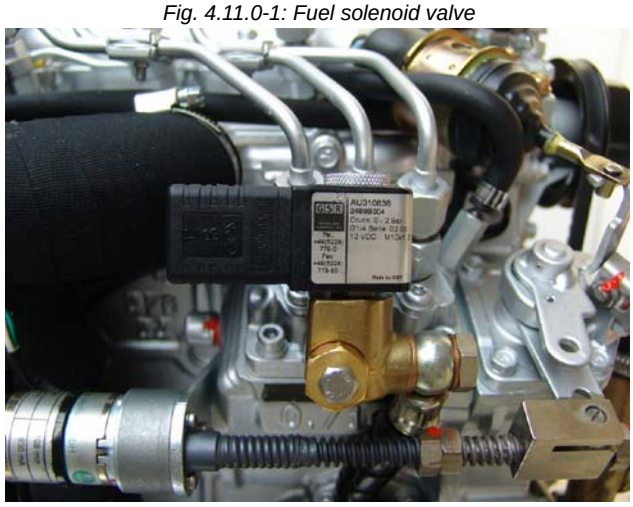


Fig. 4.11.0-2:

4.12 Generator DC system installation

The Panda generators from 6000 upwards have their own dynamo to charge a DC starter battery.

It is recommended to install an additional starter battery for the generator.

The generator is then independent from the remaining battery set. This enables you to start the genset at any time with its own starter battery even if the other batteries are discharged. A further advantage of a separate starter battery is that it isolates the generator's electric system from the rest of the boat's DC system, i.e. minus pole (-) is not connected electrically to Earth/Ground.

The generator is then Earth/Ground free.

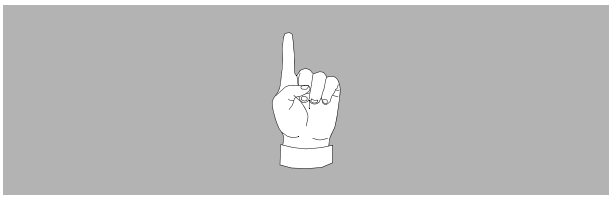
4.12.1 Connection of the starter battery block

IAn own separate starter battery must be installed for the generator.

The positive cable (+) of the battery is attached directly at the solenoid switch of the starter motor (position 1). The negative cable (-) of the battery is attached underneath the starter motor at the engine mount (position 2).

Panda Generators Panda 6000 and higher normally provided with an alternator/dynamo to charge the starter battery. At generators without alternator/dynamo it is needed to charge the starter battery with an external battery charger.

NOTE:



Make sure that the voltage of the starter battery fits to the start system voltage

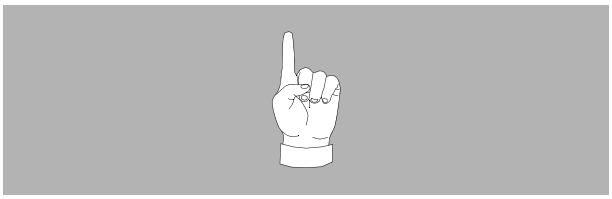
f.e. 12 V starter battery for a 12 V start system

f.e. 24 V starter battery for a 24 V start system (2x12 V batteries in a row)

ATTENTION!

To avoid large voltage drops the battery should be installed as near as possible to the generator. The positive terminal of the battery is attached at the red cable, the negative pole at the blue cable.

NOTE:



It must be guaranteed that first the cables are attached at the generator and then at the battery.

ATTENTION!: Consider correct connection sequence

Battery connection

Wrong connection of the battery bank can cause a short-circuit and fire.

ATTENTION!: Right connection of the battery.

Install an appropriate fuse and a battery circuit breaker in the plus pole cable of the battery, but with a distance to the battery of up to 300 mm (12 inch) at maximum.

The cable from the battery to the safety device must be secured with protective pipe/sleeve against chafing through.

For the connection use self-extinguishing and fire-protected cables, which are appropriate for temperatures up to 90 °C, 195 °F.

The batteries must be installed in such a way that they do not chafe through or other mechanical load can be stripped.

The battery poles must be secured against unintentional short-circuit.

The positive battery cable within the generator must be shifted in such a way that it is protected against heat and vibrations by appropriate sleeve/protective pipe. It must be shifted in such a way that it does not affect rotary parts or parts, that become hot in operation, e.g. wheel, exhaust elbow union, tail pipe and the engine. Do not lay the cable too tautly, since otherwise it could be damaged.

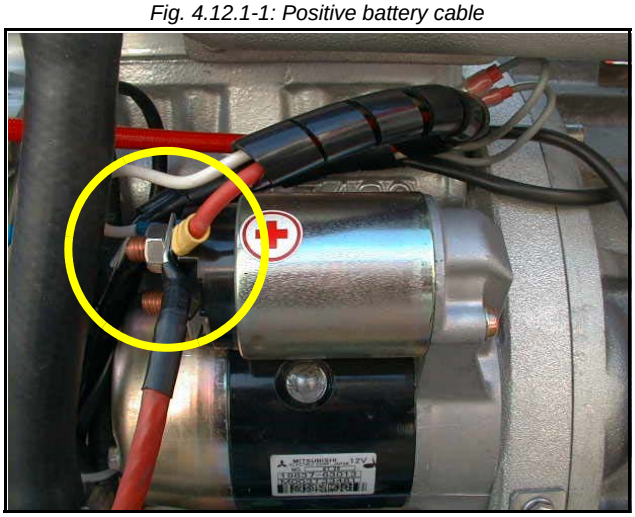
Make a test run after the installation and check the laying of the batteries during the test run and afterwards. If necessary, correct the laying.

Examine regularly the cable laying and the electrical connections.

Positive battery cable

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

Fig. 4.12.1-1: Positive battery cable

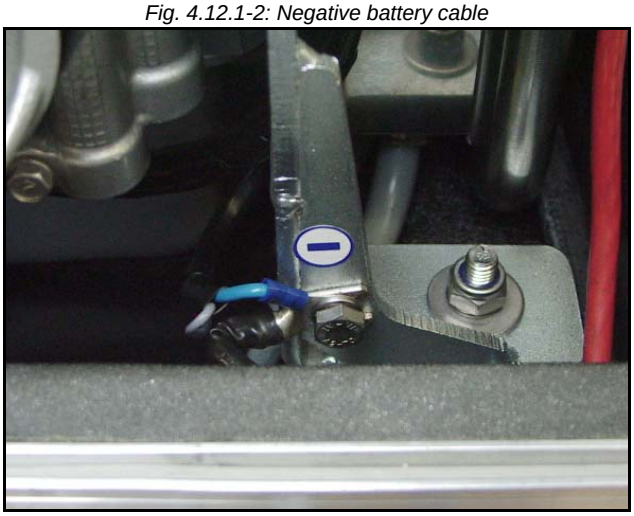


Negative battery cable

The negative (-) battery cable is connected to the engine foot.

Note! The battery negative pole may not be connected with the boat ground or with the protective grounding of the 12 V installation!

Fig. 4.12.1-2: Negative battery cable



DC starter motor

All Panda generators are equipped with an independent DC starter motor.

1. Solenoid switch for starter motor

2. Starter motor

Fig. 4.12.1-3: DC starter motor

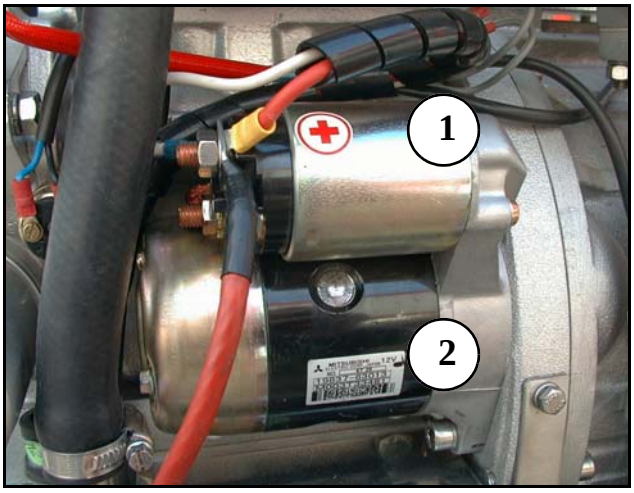
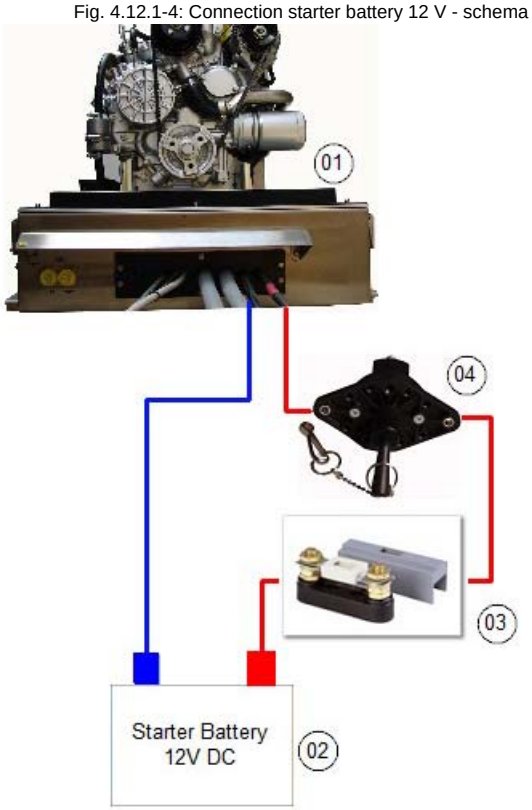
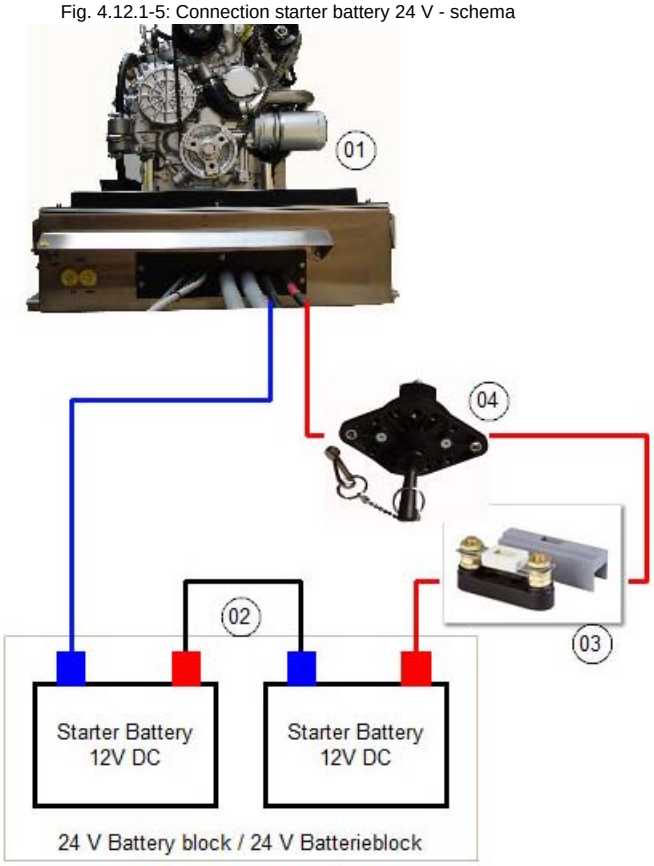


Fig. 4.12.1-4: Connection starter battery 12 V - schema



1. Generator
2. Battery block
3. Fuse
4. Battery main switch

Fig. 4.12.1-5: Connection starter battery 24 V - schema



1. Generator
2. Battery block
3. Fuse
4. Battery main switch

4.12.2 How to connect two 12 V batteries to a 24 V battery bank

The starter batteries have to be connected in this order:

1. (+) cable of first battery

Fig. 4.12.2-1: Installation starter battery

2. (-) cable of second battery

Fig. 4.12.2-2: Installation starter battery

3. (+) cable of second battery

Fig. 4.12.2-3: Installation starter battery

4. (-) cable of first battery
5. Disconnect the batteries in reverse procedure.

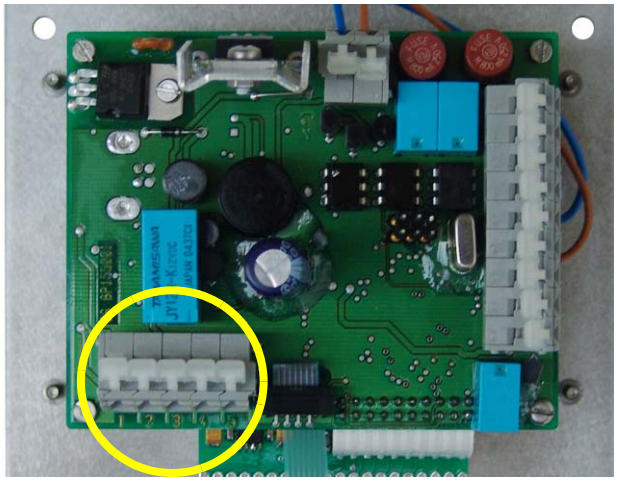
Fig. 4.12.2-4: Installation starter battery

4.12.3 Installation of the remote control panel

The control cables are securely connected to the genset. On the back of the control panel is a terminal block for the remote control cable.

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

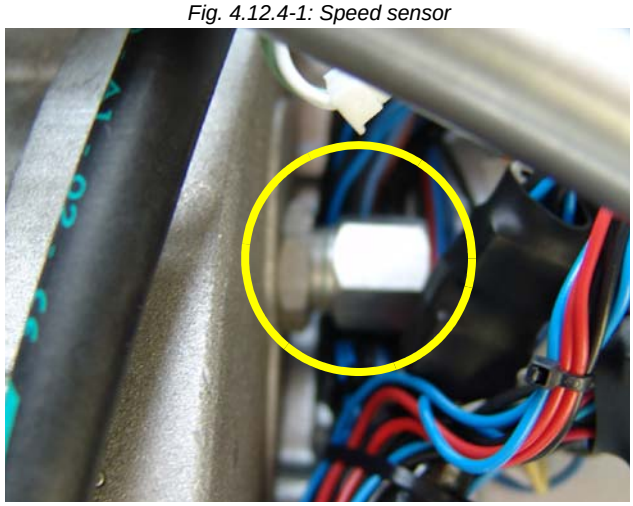
Fig. 4.12.3-1: Remote control panel - back side



4.12.4 The speed sensor

Speed sensor

Fig. 4.12.4-1: Speed sensor



Installation of the speed sensor

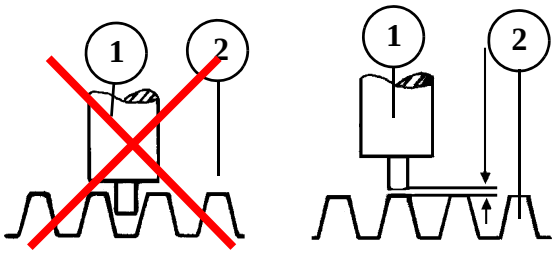
The speed sensor tip must have between 0.3 to 0.8mm of clearance (air gap) from the gear tooth tips. In order to achieve this clearance: the speed sensor tip should be aligned with the tip of a gear tooth and screwed in until it touches the tip of the tooth. (**ATTENTION! Ensure that when inserting the sensor, that the sensor tip is not screwed into the root of the gear tooth)**. The screw is subsequently turned anticlockwise by half a turn (0.3 to 0.8mm) and held by a counter nut.

ATTENTION! For Panda 8000 and Panda 9000 the speed sensor has to be mounted in axial direction.

1. Speed sensor on threaded seat

2. Engine Flywheel (with gear teeth)

Fig. 4.12.4-2: Speed sensor



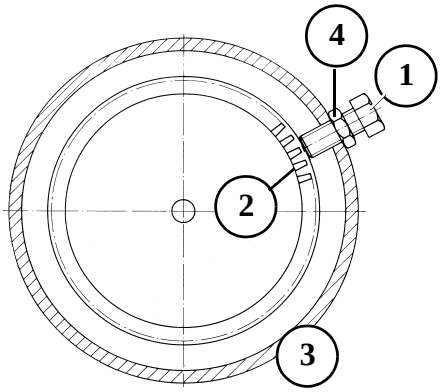
1. Speed sensor on threaded seat

2. Engine Flywheel (with gear teeth)

3. Generator housing

4. Retention/tightening nut

Fig. 4.12.4-3: Speed sensor



4.12.5 Electronic starter control unit

If there is an automatic starting requirement and if the remote control panel is switched off, then this automatic starting requirement is ignored. Automatic starting is only possible if after switching on of the remote control panel the automatic starting requirement takes place.

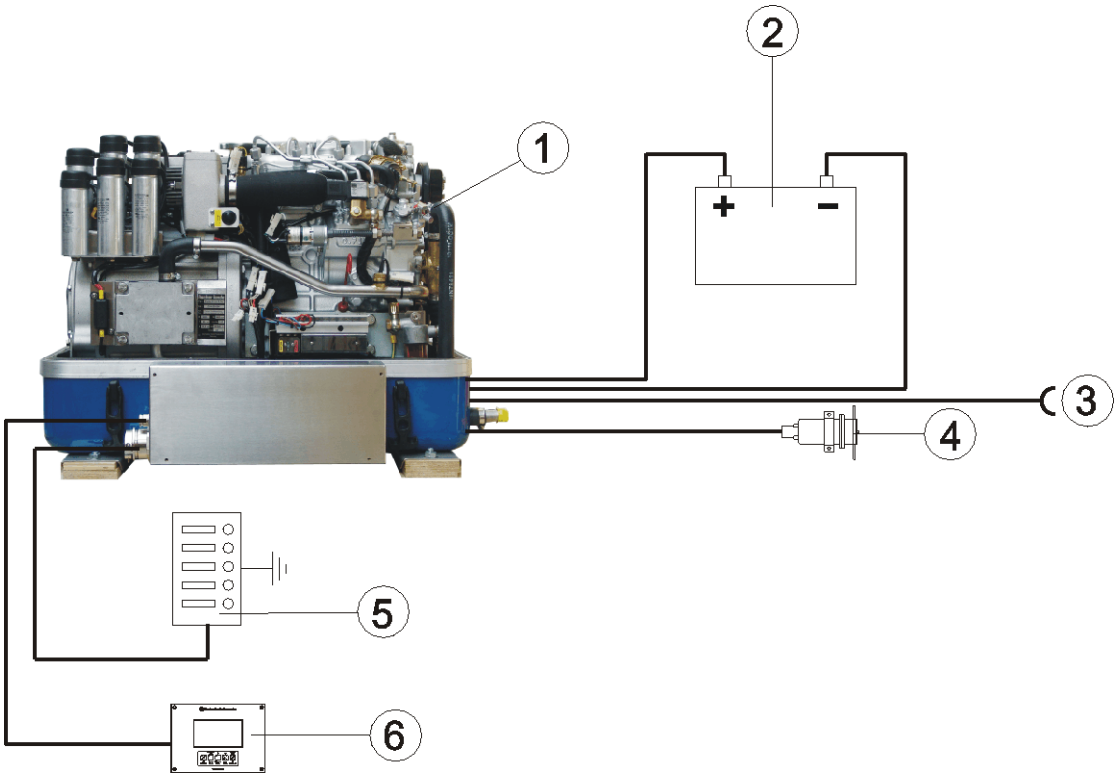
4.13 Generator AC System-Installation

Before the electrical system is installed, READ the "Safety Instructions - Safety First!" on page 17 in 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.

ATTENTION!

4.13.1 Installation AC-Box

Fig. 4.13-1: Installation scheme

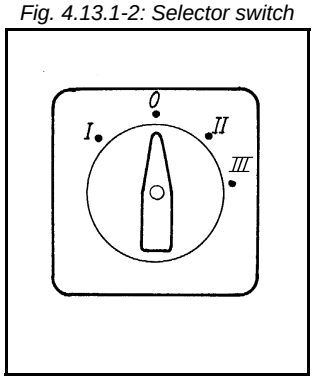


1. Generator
2. Starter battery
3. Fuel level sensor
4. Fuel pump
5. Distribution panel
6. Remote control panel

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 consumers 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.

Fig. 4.13.1-2: Selector switch



0. OFF

I. Generator

II. Shore power connection

III. Inverter

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. The generator should have its own AC **input electrical fuses**. The fuses should be sized such that the rated current of the generator on each of the individual phases is not exceeded by more than 25%.

Data for gensets with power output greater than 30kW on request!

The fuses must be of the slow type. A 3-way motor protection switch must be installed to protect the electrical motor.

Required cable cross-sections

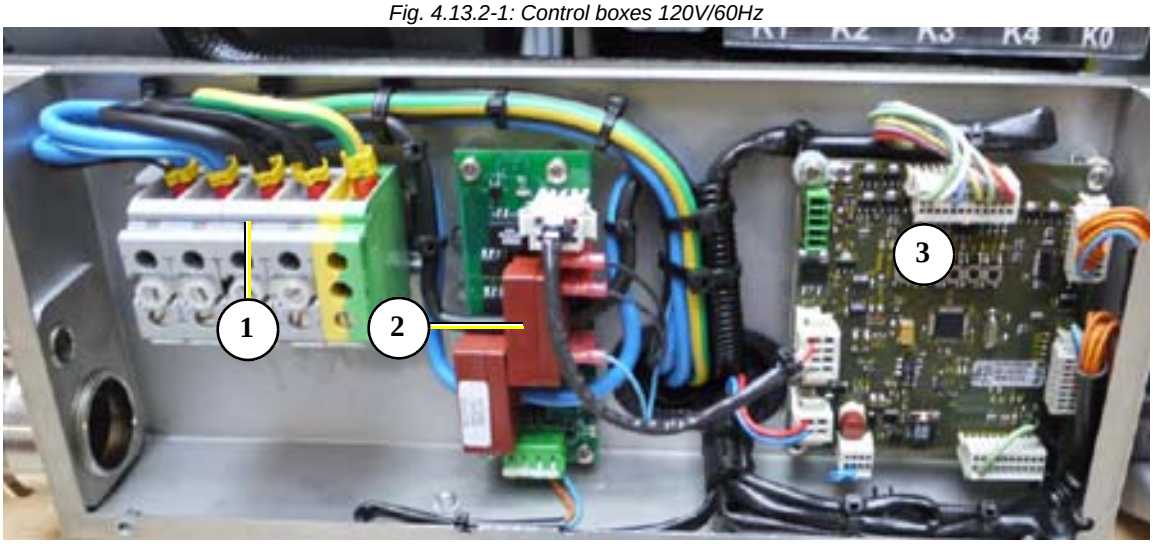
The following recommended electrical cable dimensions (cross sections) are the minimum required sizes for a safe installation. *(see Table 7.1.0-2, “Wiring for vehicles.,” on page 167)*

4.13.2 Control box

Before working on the System read the section “Safety Instructions - Safety First!” on page 17 in this Manual.

ATTENTION!

Fig. 4.13.2-1: Control boxes 120V/60Hz



1. Terminal block 120V/60Hz
2. Current transformer board
3. VCS board

4.13.3 VCS-voltage control

All Panda generators from Panda 8000 upwards are fitted with the electronic voltage control "VCS" as standard.

The VCS controls the generator voltage and motor speed. A servo motor on the injection pump can increase the engine speed by up to 8%.

If the generator is run without load, the voltage should be 240V with a frequency of approx 57,8 to 58,6Hz (48,5 - 49Hz for 230V 50Hz models). The frequency (equates to the speed) can be increased by up to 8%. This ensures that the engine speed is increased when there is an extra load. The maximum speed is achieved when 80% load is reached.

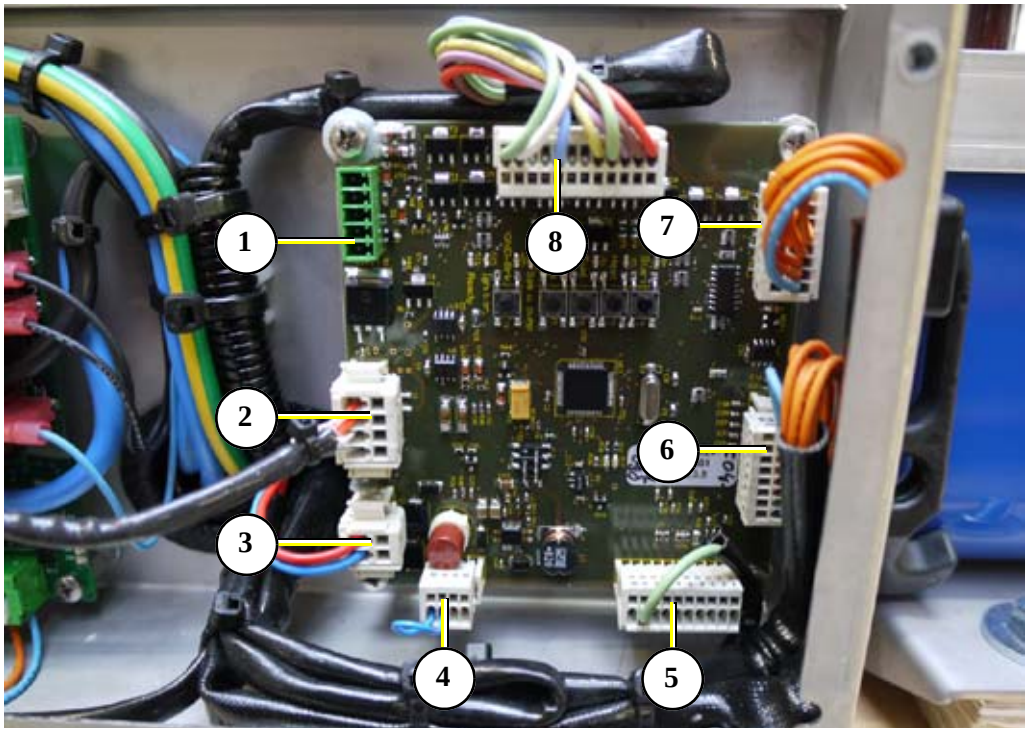
All signals pass through the circuit board in the Control box. The signal impulse for the servo motor is passed to the electric motor by means of the 5 core wire.

The generator maintains its full capability if the VCS has a defect.

In this case the base current must be raised to at least 240V by adjusting the minimum setting on the speed gauge, in order to ensure that the generator output voltage at 70% nominal load does not drop below 215V.

For detailed information section 7.6.2, “Scheme VCS board,” on page 171.

Fig. 4.13.3-1: VCS board



1. Terminal for control panel J6
2. Connector for CT board J7
3. Connector for Power supply J5
4. Connector for Digital/binary input J10
5. Connector for Analogue/binary input J4
6. Connector for Analogue/binary input J3
7. Connector for Analogue input J2
8. Connector for Binary output J9

4.13.4 Current transformer board

For detailed information section 7.6.4, “Scheme current transformer board,” on page 173.

4.14 Insulation test

Once the electrical system installation is complete, a ground insulation test must be performed as follows:

ATTENTION:

1.) Switch off all on-board electrical devices.

2.) Start the generator..

3.) Measure the AC-voltage with a voltmeter (adjust to Volt/AC) between:

a) generator housing and AC-Control box

b) generator housing and ground.

The measured voltage must not exeed 50mV (millivolts).

4.) Once the safety systems have been installed, they must be checked. If a leakage current relay has been installed, it also has to be tested. In order to ensure that the leakage voltage relay functions properly, the individual generated phases from the generator must be checked between each other, between phase and ground, (the single phase or 4th phase also needs to be checked in this fashion).

5.) If the generator is protected by a ground connection, then **ALL** electrical devices, must also be connected to this "common" ground (usu. ground contacts are attached to the devices' metallic housings).

The electrical system installation must also comply to the hook-up requirements of the shore current grid. Generally a leakage current relay is sufficient for safe electrical operation, however, this must be confirmed by the electrical safety standard in the region where the system is attached to a main land power grid. The relay has to be meet the required safety standard regulations.

In addition to a proper circuit diagrams, terminal points, connections, electrical devices, etc. should also be labelled with stickers or signs

There is always the possibility that circuits have been rerouted/changed or individual components have not been not been correctly laid out on the circuit diagrams.

The installation electrician should therefore check and label all electrical connections to ensure that they correspond to the main circuit diagram. The inspection and correct labelling is especially critical for terminals L1/ L2/L3/L1'/N (for the 230V-50Hz model) and for terminals L1/L2/L3/N &1/2/3/4 for the 60Hz (120V) models. The electrician is **therefore obliged, before** installation to check whether the generator is earth-free. As long as this test has not been carried out all other components for electrical installation must be removed. Once the system has been installed and inspected, this test should also be performed with all electrical devices (i.e. voltage check between common and metallic housings) while the generator is running.

4.15 Voltage controller

With a engine-operated generator set count always on the fact that through disturbances at the controlling of the diesel engine the control of the number of revolutions monitoring is lost. In this case the diesel engine could wind up without limitation and produce a voltage, which becomes substantially larger than the electrical load can process. This can destroy very expensive items of equipment. It must be take for granted that for the protection of the electrical load a voltage controller with isolating relays is used for a solid installation. The appropriate accessory components are available at Icemaster.

If it is about a duo combination generator, the voltage control for both output parts (single phase AC and three-phase AC) should be planned.

At different PANDA generators a voltage control is integrated. This voltage control affects only the diesel engine. If the rated voltage exceed approx. 15%, this voltage control is activated, as the diesel engine is turned off. This is only possible with the delay of some seconds, load could be damaged in the meantime. The only safe method for the protection of the electrical devices is the installation of an external voltage controller with separation contactor.

We recommend this measure with all reproduction and point out also that the generator manufacturer is not responsible for damage, which are caused by overvoltage at external devices.

Protect your valuable devices by an external voltage controller!

Position of the external voltage controller

Reasonable the external voltage controller is mounted in such a way it works not only for the generator but for all AC voltage supplies in the electrical system, also for shore power and inverter. In these cases usually a selector switch is intended, which can be determined, which voltage supply is switched to the electrical system. The voltage conteroller must be installed at the exit of the selector switch, thus in the electrical system.

4.15.1 Adjustment of the rated voltage

The voltage controller must be ordered for the appropriate rated voltage (12, 24, 32, 48, 42 V DC). Other voltage on request.

Changing between these voltages is not possible.

4.15.2 Functional decription of the voltage controller

The voltage controller has 3 different adjustment possibilities:

upper switching point, lower switching point and time lag of the generator.

In factory setting the voltage controller is in the following attitude:

a) upper switching point (disconnection) 13.6V

b) lower switching point (insertion) 11.52V

A) upper switching point (disconnection)

B) lower switching point (insertion)

C) td = time lag of the generators after achievement of the upper switching point

1.measuring voltage plus (+)

2.measuring voltage minus (-)

3.Charging voltage

4.Battetry lower voltage

5.not allocated

6.not allocated

7.output positive (+)

8 output negative (-)

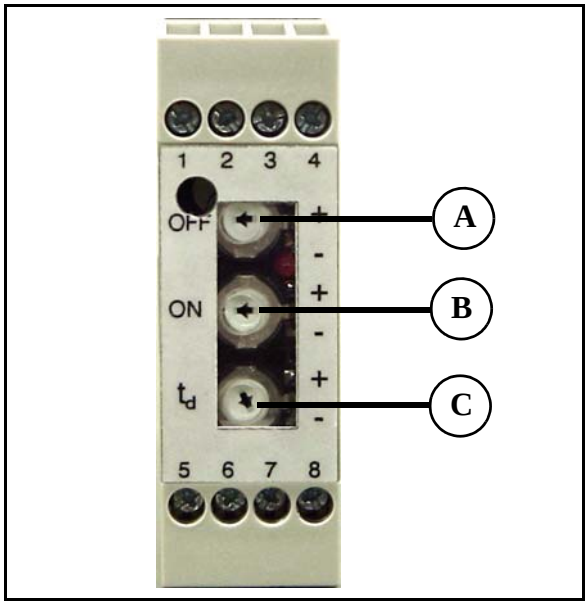


Fig. 4.15.2-1: Voltage controller

4.15.3 Time lag of the switching points

For the upper as well as for the lower switching point a time delay is adjusted. That is, the voltage must have overstep or fall short of the switching point on the time lag.

Following values are adjusted:

a) upper switching point (13,6V), lag: min. 20 seconds

b) lower switching point (11,52V), lag: 40 seconds

Additional notes to the recommendation "External, electrical voltage controller"

At Diesel engines count always on the fact that a diesel engine "revs up" due to special circumstances uncontrolled. This is the case if by damage to the system engine oil arrives into the sucking in way. This is possible at many engines by the crank case exhaust. A crank damage could cause for example that by overpressure too much oil is pressed into the crank case, so that this oil arrives into the sucking in way. The engine cannot switch off itself any longer. Usually then a damage to the engine is the result. It would be fatal, even if this damage to the engine were the cause of the destruction of all switched on electrical load, because uncontrolled revving up of the Diesel engine

leads also to an extreme increase of the voltage. Only by an external voltage controller with separation contactor can be prevented such damage.

4.16 Instructions on preventation of galvanic corrosion

Galvanic corrosion

If several machines are connected by a common electrical potential (e.g. mass) and the system is also still in contact with other metal parts (e.g. the trunk of a neighbour ship), always assume that the different construction units proceed different electrical voltage, which affect on the entire system and the construction units. DC voltage causes an electric current, if in the environment of these parts electrically leading liquids (electrolyte) are available. Also calls "galvanic process". The electrical charge of the negatively charged ranges (anode) is led to the positively charged range (cathode). The negatively charged part (anode) "is sacrificed" thereby, i.e. that the electrical particles at the surface of the material cause decomposition with this chemical process. Since aluminum is an electrically negatively charged metal, aluminum will play the role of the anode compared with most remaining metals. This applies in particular opposite copper, brass, and steel, high-grade steel etc.. These metals are positively charged.

Several measures must be considered when making the installation, so that bimetallic corossion can be avoided as much as possible:

- Electrical isolation of the water pump. Synthetic washers and synthetic distant plates are attached beneath the water pump, so that the potential difference between the generator and raw water is interrupted.
- Separation of the water columns (between raw water and generator) after switching off. This can either be a stop valve turned by hand. (BEWARE! The valve must be closed after each operation). Or by the installation of an automatic ventilation valve. In this case the valve opens and shuts automatically.
- Connecting all components (hull outlet, generator, heat exchanger etc.) to a common potential. For this all elements are connected by means of a cable (earthed).
- Strict separation of the generator from 12V ship mains, that means earth free installation of the 12V system (generator installation and general ship mains).

Please take more details from the information pack "Bimetalic Corrosion (Electrolysis)", which You can order from Fischer Panda gratis.

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5. Maintenance Instructions

5.1 Personal requirements

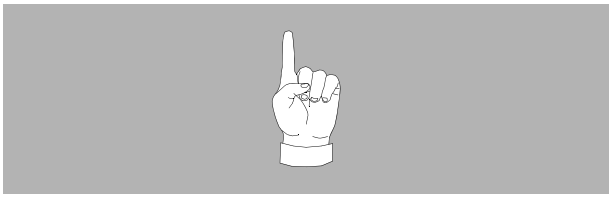
All maintenance, if not special marked, can be done by the trained persons.

Further maintenance must be done by technical personal or Fischer Panda service points.

5.2 Hazard notes for the maintenance

Follow the general safety instruction at the front of this manual.

Notice!:



Danger for life! - The generator can be equipped with a automatic start device. This means the generator can be started by an external signal. To avoid an unexpected starting of the generator, the starter battery must be disconnected before start working at the generator.

Warning!: Automatic start

Working at a running generator can result in severe personal injury. Therefore before starting work at the generator:

Make sure that the generator is stopped and the starter battery is disconnected to guarantee that the generator cannot be inadvertently started.

Do not run the generator with removed sound isolation cover

Warning!: Risk of injury

Improper installation/maintenance can result in severe personal injuries or material damage.

- Always undertake installation/maintenance work when the generator is switched off.
- Ensure there is sufficient installation clearance before start working.
- Ensure tidiness and cleanliness at the workplace. Loose components and tools lying around or on top of each other are sources of accidents.
- Only perform installation work using commercially available tools and special tools. incorrect or damaged tools can result injuries.

Warning!: Risk of injury

Oil and fuel vapours can ignite on contact with ignition sources. Therefore:

- No open flames during work on the generator.
- Do not smoke.
- Remove oil and fuel residues from the generator and floor.

Warning!: Danger of fire

Contact with engine oil, antifreeze and fuel can result in damage to health. Therefor:

- Avoid skin contact with engine oil, fuel and antifreeze.
- Remove oil and fuel splashes and antifreeze from the skin immediately.
- Do not inhale oil and fuel vapours.

Danger!: Danger of poisoning

Danger for Life. Improper handling, operation, installation and maintenance can result in severe personal injury and/or material damage.

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.

ATTENTION!: Danger to Life - High voltage

Generator, oil and antifreeze can be hot during/after operation. Risk of severe burns.

Warning!: Hot surface/material

During Installation/maintenance personal protective equipment is required to minimize the health hazards.

- Protective clothing
- safety boots
- protective gloves
- Ear defender
- safety glasses

Instruction!: Personal protective equipment necessary.

Disconnect all load during the work at the generator to avoid damages at the load.

Attention!: disconnect all load

Batteries contains acid or alkalis.

Improper handling can result in battery explosion and leakage. Acid or alkalis can run out. An explosion of the battery is possible.

See the operation and safety instruction from your battery

Warning!:

manufacturer.

Batteries contain corrosive acids and lyes.
Improper handling can cause the batteries to heat up and burst. Corrosive acid/lye may leak. Under unfavorable conditions, the battery may explode.

Observe the instructions from your battery manufacturer.

5.3 Environmental protection

Danger to the environment due to mishandling!

Significant environmental damage can occur, particularly for incorrect disposal, if environmentally hazardous operating materials are mishandled. Therefore:

- Always observe the instructions mentioned below.
- Take immediate action if environmentally hazardous materials reach the environment. Inform the responsible local authorities about the damage in the case of doubt.

The disposal must be performed by a specialist disposal company.

Environmental protection.

5.4 Maintenance Requirements

Control 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

Once a week

- Lubrication of actuator-trapezoid thread spindle

5.5 Maintenance interval

For the maintenance interval, please see the „General information for PMS generators“ which are attached to this manual.

At generator with dynamic operation hours (f.e. Generators with iControl2 system) the maintenance interval can may be extended.

With the dynamic operation hours the service interval can be raised up to 30 % (200 h max.). Make sure that the dynamic operation hours are not reset accidently between the service interval.

Note:

5.5.1 Check of hoses and rubber parts in the sound insulated capsule

Check all hoses and hose connections for good condition. The rubber hoses are very sensitive to environmental influences. They wear quickly in an environment of dry air, oil and fuel vapours, and high temperatures. The hoses

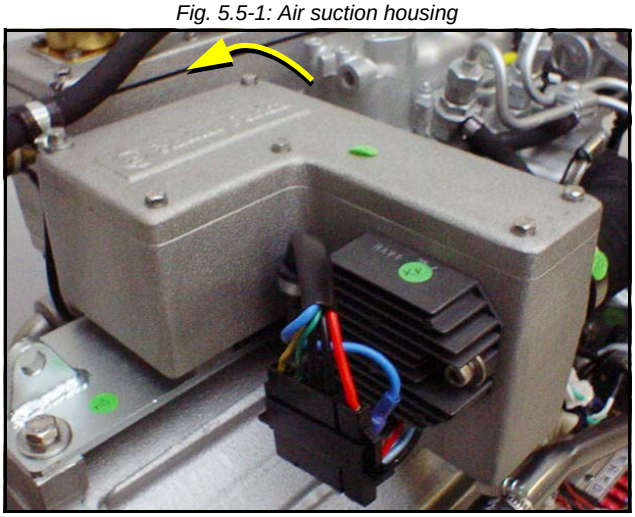
must be checked regularly for elasticity. There are operating situations, when hoses must be renewed once a year.

5.5.2 Replace the air filter mat

1. Open the air suction housing by loosen the six screws on the housing cover.

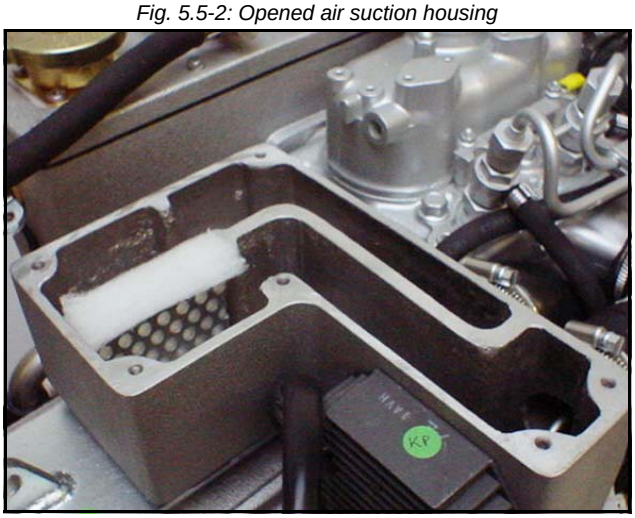
   Use spanner size 8 mm.

Fig. 5.5-1: Air suction housing



2. Change the air filter mat.
3. Close the suction air housing.

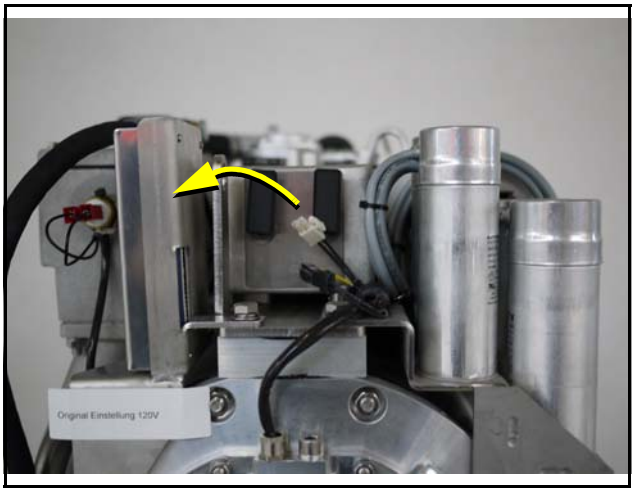
Fig. 5.5-2: Opened air suction housing



5.5.3 Alternative replacement of the air filter mat with pull out holder

1. Air filter housing with pull out holder.

Fig. 5.5.3-1: Air suction housing with pull out holder

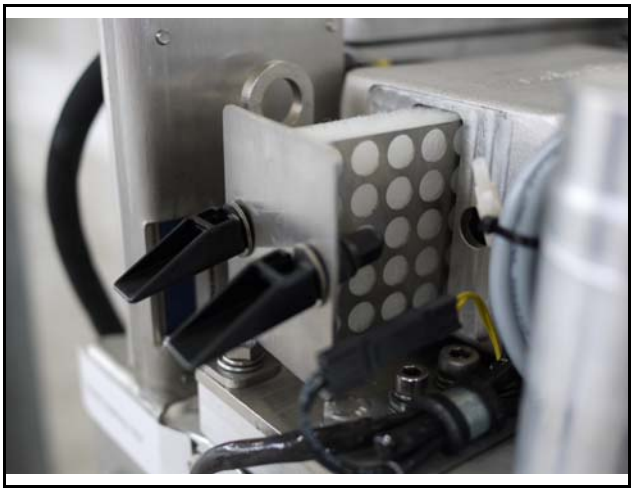


2. Tip the two fasteners 90°.

Fig. 5.5.3-2: Air suction housing with pull out holder

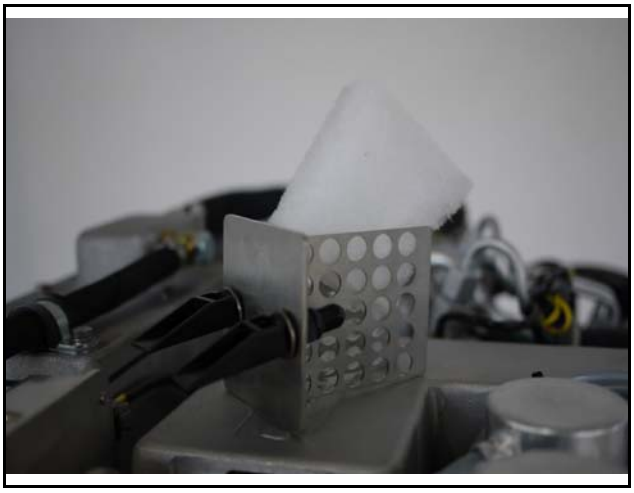
3. Pull the filter mat holder out.

Fig. 5.5.3-3: Air suction housing with pull out holder



4. Replace the air filter mat.
5. Re-assembly in reversed order.

Fig. 5.5.3-4: Air suction housing with pull out holder

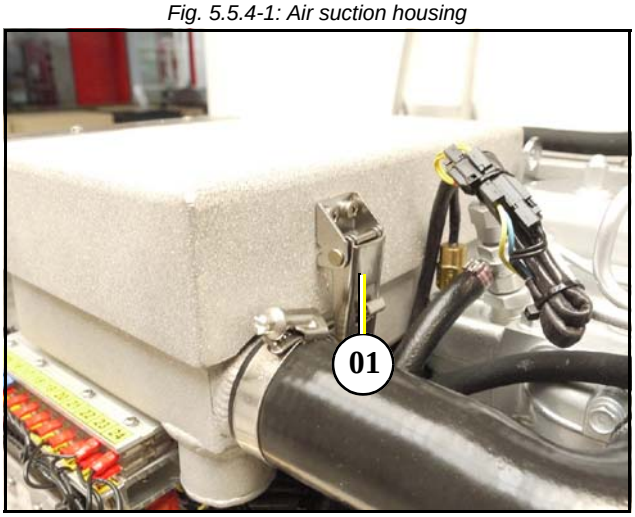


5.5.4 Alternative replacement of the air filter at housing with snap fasteners

1. Open the combustion air housing by loosening the closure on the right side of the housing.

   01. Closure

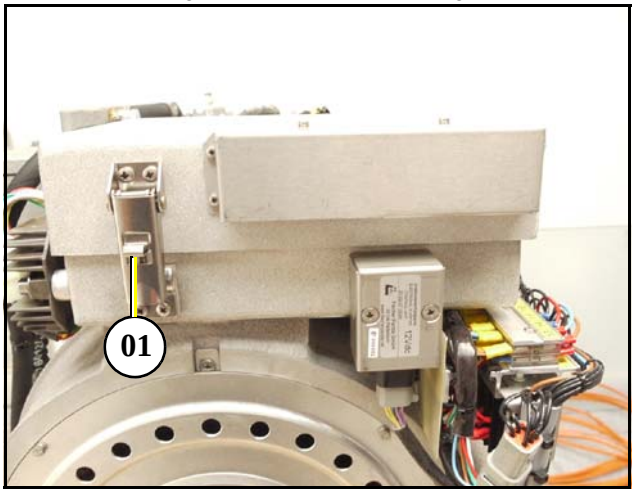
Fig. 5.5.4-1: Air suction housing



2. Open the combustion air housing by loosening the closure on the left side of the housing.

   01. Closure

Fig. 5.5.4-2: Air suction housing

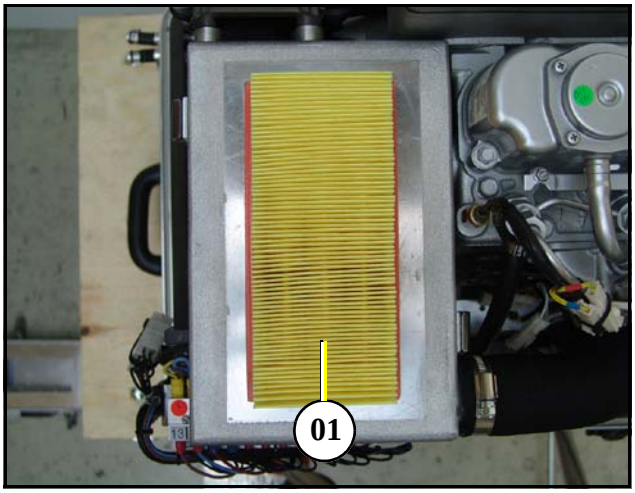


3. Open the air housing by pulling the cover.
4. Lift out the air filter element of the cover of the air filter housing.

   01. Air filter
5. Replace cover in reverse procedure.

Sample picture

Fig. 5.5.4-3: Air suction housing



5.6 Ventilating the fuel system

Normally, the fuel system is designed to ventilate 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 ventilate the system as follows prior to the first operation (as all hoses are empty):

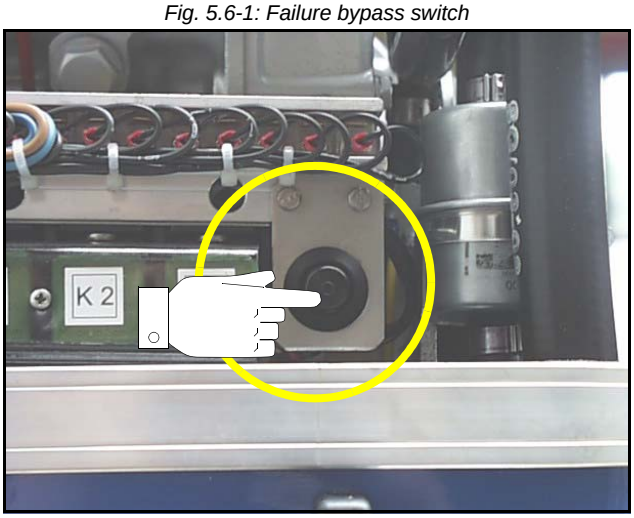
Generators with iControl system do not need a Failure bypass switch. At these generators the fuel pump can be activated by an option of the control panel. See Control panel manual.

Attention:

1. Main power switch „OFF“

2. Press failure bypass switch and keep firmly pressed. The electrical fuel pump must be audible. Switching on and off the solenoid valve at the generator will be audible by pressing the failure bypass switch (if capsule removed).

Fig. 5.6-1: Failure bypass switch



Note!

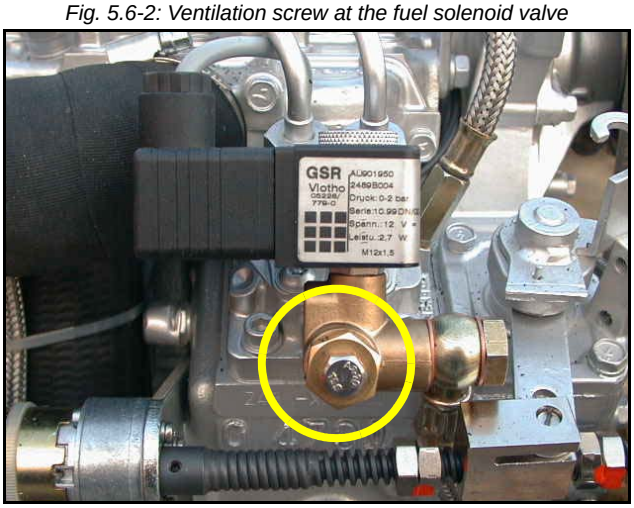
Generators with iControl system has no failure bypass switch. The Fuel pump can be activated at the iControl panel.

Please see iControl manual for details.

3. Pressing the failure bypass switch for approx 3 - 4 minutes will loosen the ventilation screw located at the fuel solenoid valve. The button must continue to be pressed, whilst opening the screw. A large cloth or Kleenex tissue must be laid beneath the connection to prevent escaping fuel running into the capsule. If the fuel runs out without air bubbles, then the ventilation screw can be closed. Only then may the button be released.

   Use spanner size 10 mm.

Fig. 5.6-2: Ventilation screw at the fuel solenoid valve



Not all generator models has a fuel solenoid valve. At generators without fuel solenoid valve, a single ventilation screw is installed.

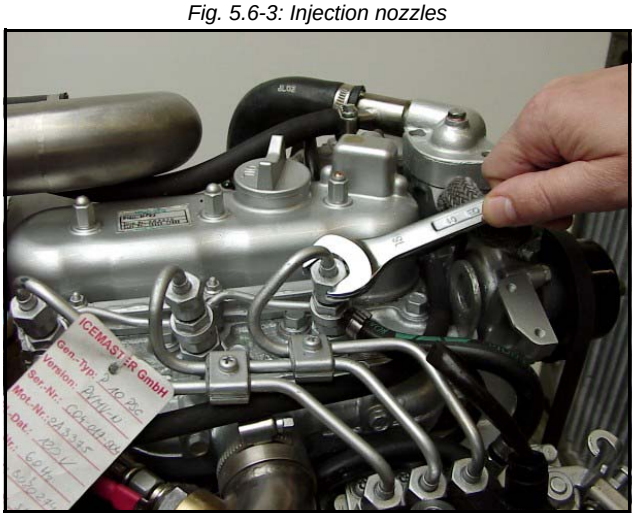
Note!:

4. Pressing the starter button can now start the machine. The machine should start after a short period.
5. If this does not occur, then a connecting nut fitted to the injection line must be loosened and starting procedure repeated. Retighten the washers after successfully starting. The injection line must be raised by several millimetres.

   Use spanner size 17 mm.

6. Switch main switch „OFF“.

Fig. 5.6-3: Injection nozzles



5.6.1 Replacement 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. 5.6.1-1: Fuel Filter

5.6.1.1 Optional fuel filter with sight glass

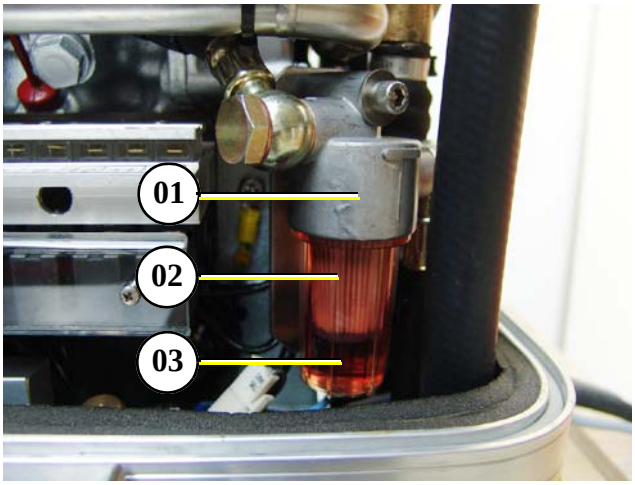
The filter change depends on the fuels' degree of pollution, but should be executed every 300 operating hours at the latest.

01. Fuel filter housing

02. Fuel filter element

03. Sight glass

Fig. 5.6.1.1-1: Fuel filter

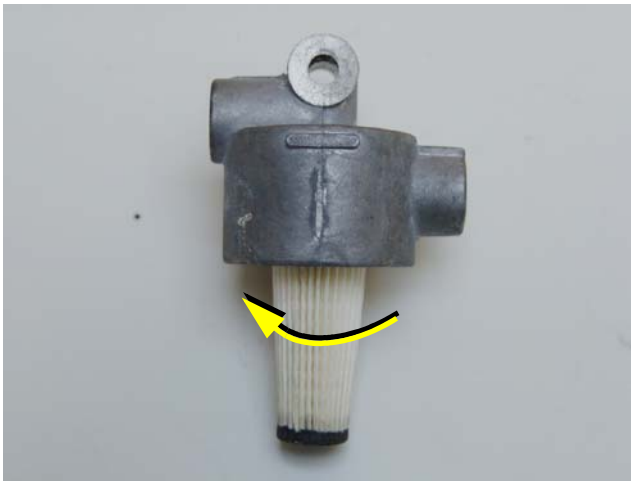


1. Unscrew the housing from its mount (left hand rotation).

Fig. 5.6.1.1-2: Fuel filter

2. Unscrew the filter element from the mount (left hand rotation).

Fig. 5.6.1.1-3: Fuel filter



3. Screw the new filter element into the mount.
4. Lubricate the sight glasses o-ring with a heat resistant grease (Specification: Antiseize) and screw the sight glass back into its mount (right hand rotation).

Fig. 5.6.1.1-4: Fuel filter

5.7 Checking oil-level

You require:

paper towels / cloth for the oil dipstick

The generator must be placed at level.

- with vehicular generators: Place the vehicle on a levelled surface.

- with PSC generators: Place the generator on a levelled surface.
- with marine generators: Measure the oil-level when the ship is not lop-sided.

Run the generator for about 10 minutes to ensure that the engine is warm. Wait for 3 minutes, so the oil can flow back into the oil pan.

Generator and coolant can be hot during and after operating.

Wear personal protective equipment. (Gloves, protective goggles, protective clothing and safety shoes)

Caution: Burn hazard!

- Assure generator against accidental start.
- Open the generator casing.
- Pull the oil dipstick out of the check rail.
- Clean oil dipstick.
- Put the oil dipstick back into the check rail and wait for 10 seconds.
- Pull the oil dipstick out of the check rail and read off the oil-level at the lower end of the stick.

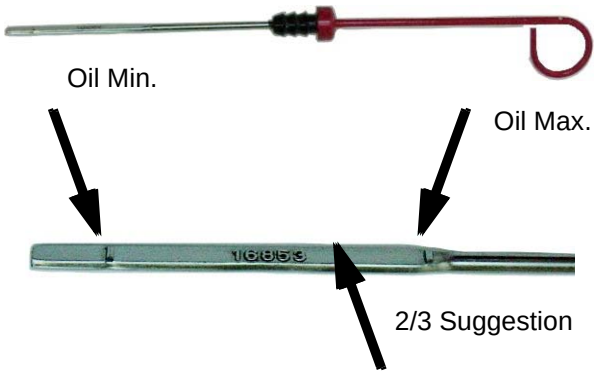
Oil dipstick

The oil-level is to be checked by means of the oil dipstick.
The prescribed filling level must not cross the „Max“-mark.

We recommend an oil-level of 2/3.

Sample picture

Fig. 5.7-1: Oil dipstick - Sample



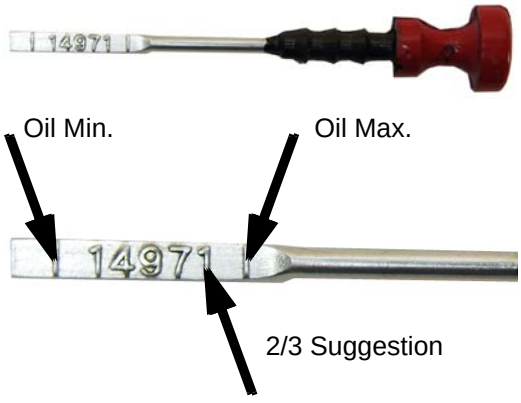
Oil dipstick EA 300 Engine

The oil-level is to be checked by means of the oil dipstick.
The prescribed filling level must not cross the „Max“-mark.

We recommend an oil-level of 2/3.

Sample picture

Fig. 5.7-2: Oil dipstick



Oil should be refilled, if the oil-level is under 1/3 between the minimum and the maximum mark.

Fischer Panda recommends an oil-level of 2/3 between the minimum and the maximum mark.

If the oil-level is under the MIN-mark, check how many operating hours went by since the last oil change, by means of your service manual or an existing oil change tag. - with operating hours between 50 and 150 hours it is only

necessary to refill oil. See „Refilling oil“ on page 2.

- with 150 operating hours or more the oil should be changed (See your generators' service table)
- if the oil-level is under the minimum mark by less than 50h, there might be a technical problem! In that case, we recommend going to a shop or a Fischer Panda service point.
- if the oil is cloudy or even „creamy“, coolant might have mixed with the oil. See a garage or a Fischer Panda service point immediately.

5.7.1 Refilling Oil

You require:

Engine oil

1. Check oil-level as described under section 5.7, “Checking oil-level,” on Page 125.
2. Oil dipstick is pulled out of the check rail.
3. Open the oil filler cap.
4. Fill in oil (approx. 1/2 litre) and wait for about 2 min. so this it can flow into the oil pan.
5. Wipe off the oil dipstick and put it into the check rail.
6. Pull the oil dipstick out of the check rail and check the oil-level. See section 5.7, “Checking oil-level,” on Page 125.

If oil-level is still too low (under 2/3): repeat steps 4-6.

5.7.2 After the oil level check and refilling the oil

- Put the oil dipstick back into the check rail.
- Close the oil filling cap.
- Remove potential oil stains and splashes from the generator and surroundings.
- Close the generator casing.
- Remove lock against accidental generator start.

5.8 Replacement of engine oil and engine oil filter

You require:

- Engine oil. See attachment.

- New oil filter (not with generators with EA300 engines)

- Sealing for oil drain screw

- Personal protective gear

- Container to collect used oil (heat resistant and of sufficient size)

- Open-ended wrench for oil drain screw

- Paper towels and cloth

- Oil filter wrench

- Oil resistant mat, so prevent used oil from getting into underground water

The generator must be placed at level.

- with vehicular generators: Place the vehicle on a levelled surface.
- with PSC generators: Place the generator on a levelled surface.
- with marine generators: Change the oil when the ship is not lop-sided.

Run the generator for about 10 minutes to ensure that the engine is warm.

Wait for 3 minutes, so the oil can flow back into the oil pan.

Generator and coolant can be hot during and after operating.

Wear personal protective equipment. (Gloves, protective goggles, protective clothing and safety shoes)

Caution: Burn hazard!

1. Prepare generator.
   - Assure generator against accidental start.
   - Open the generator casing.
   - with generators that have an external oil drain hose: Release the oil drain hose from the mounting.
   - with generators that have an internal oil drain hose: Open the lead-through for the oil drain hose (left turn of the sealing). Pull out the sealing with the oil drain hose.

   Place an oil resistant mat under the oil drain hose area and prepare the container.

2. Loosen oil filling cap.

   Unscrew the oil filling cap. This is necessary, because otherwise a vacuum will form and the oil can not completely drain off.
   Sample picture

Fig. 5.8-1: Oil filling cap

3. Open oil drain screw.

   Unscrew the oil drain screw by means of the open-ended wrench from the oil drain hose (rotating direction left). Use a second open-ended wrench to lock. Make sure to do this over the container.
   Use spanner size 17 mm.

Fig. 5.8-2: Oil drain hose

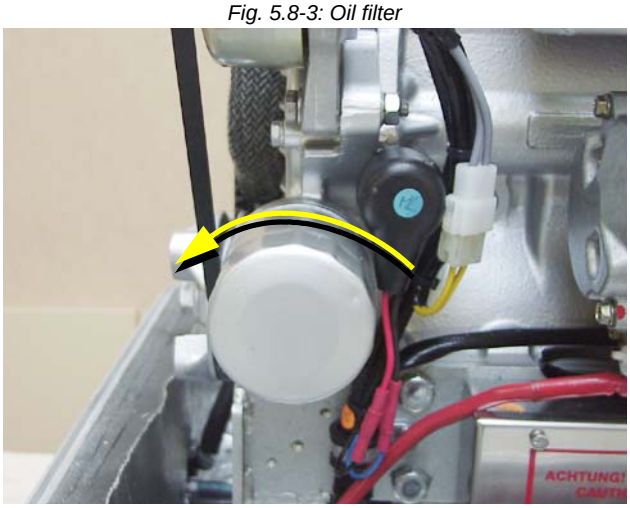
4. Discharge used oil.

   Let the entire amount of oil drain out of the engine. This can take several minutes.

5. Remove used oil filter / clean oil screen

   Release the oil filter by turning the filter wrench counterclockwise. The filter might be full of oil. Make sure to not spill anything and avoid skin contact.
   Sample picture

Fig. 5.8-3: Oil filter



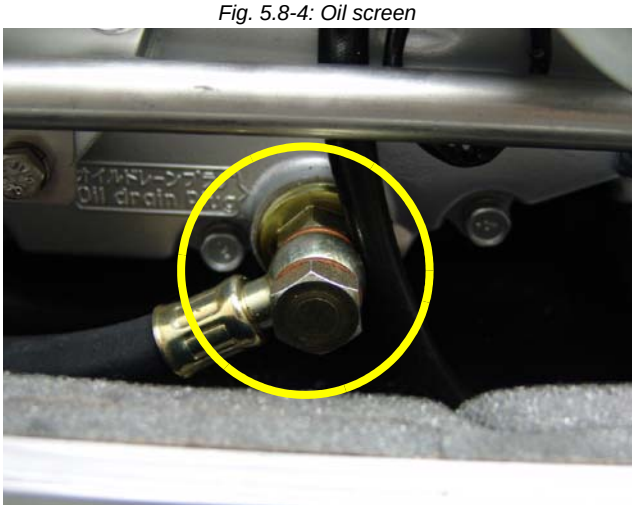
Oil screen with generators with EA300 engines

The oil screen should be cleaned every 500 operating hours: to do so follow the instructions in the engine manual.

Use spanner size 17 mm.

Sample picture

Fig. 5.8-4: Oil screen



6. Preparing a new filter

   Clean the engines' filter holder brush a thin oil layer on the sealing of the new filter.

Fig. 5.8-5: Oil screen sealing ring

7. Mounting the new filter

   Carefully screw in the new filter by hand. It must not be tightened too much. Screw in the oil drain screw again and tighten is with the wrench. Use a new sealing for the oil drain screw.

8. Fill in oil. (oil fill capacity: see attachment)

   Fill the engine oil into the engine via feed hopper. Check oil-level after every 2 litres with the oil dipstick.

9. Check proper filling level. See section 5.7, "Checking oil-level," on Page 125.

   When the proper filling level is reached, screw in the oil cap again. Run the engine for 10 minutes and then turn it off. Check the oil-level once more after several minutes with the oil dipstick. If it is too low, refill some oil.

10. Clean up

    Wipe off all oil splashes from the generator and make sure that the drain screw has no leak.

5.8.1 After the oil change

- Put the oil dipstick back into the check rail.
- Close the oil filling cap.
- Remove potential oil stains and splashes from the generator and surroundings.
- Close the generator casing.
- Remove lock against accidental generator start.
- Duly dispose of used oil and filter.

  Used oil is very toxic and must not be disposed with domestic waste. It is prohibited to dispose used oil with waste water! Make sure that used oil is disposed properly (e.g.: where oil is bought or at collection stations).

5.9 Verifying the starter battery and (if necessary) the battery bank

Check the condition of the battery. Proceed here as prescribed by the battery manufacturer.

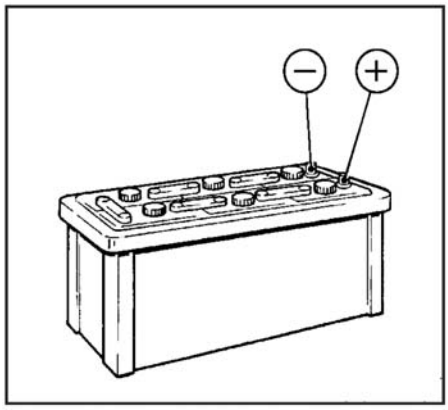
If from the battery manufacturer not otherwise mentioned.

5.9.1 Battery

5.9.1.1 Check battery and cable connections

- Keep battery clean and dry.
- Remove dirty clamps.
- Clean terminal posts (+ and -) and clamps of the battery, and grease with acid-free and acid-resistant grease.
- When reassembling, ensure that clamps make good contact. Tighten clamp bolts hand-tight.

Fig. 5.9.1.1-1: Battery

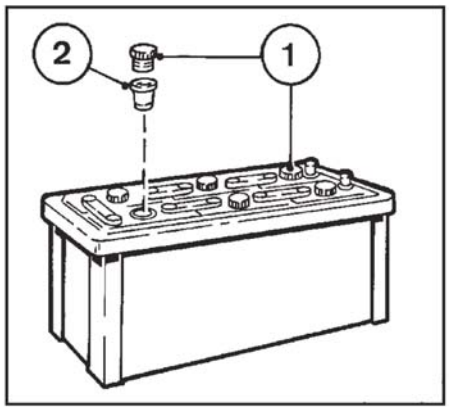


5.9.1.2 Check electrolyte level

- Remove sealing caps 1.
- If testers 2 are present:
- Electrolyte level should reach the base of these.
- Without testers:

  The electrolyte level should be 10-15 mm above the top of the plates.
- If necessary, top up with distilled water.
- Screw sealing caps back in.

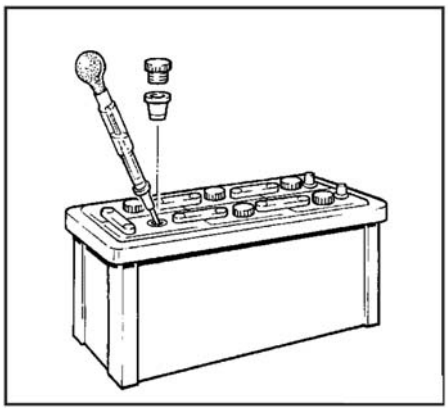
Fig. 5.9.1.2-1: Battery



5.9.1.3 Check electrolyte density

- Measure the electrolyte density of individual cells with a commercial hydrometer. The hydrometer reading (see table on following page) indicates the battery's state of charge. During measurement, the temperature of the electrolyte should preferably be 20 °C.

Fig. 5.9.1.3-1: Battery



Electrolyte density		
in [kg/ l]		Charge status
Normal	Tropical	
1.28	1.23	well charged
1.20	1.12	semi-charged, re-charge
1.12	1.08	discharged, immediately charge

The gases emitted by the battery are explosive! Keep sparks and naked flames away from the battery!

Do not allow battery acid to come into contact with skin or clothing!

Wear protective goggles!

Do not rest tools on the battery!

Attention

5.10 Replacing the Actuator

The described procedure is representative for Fischer Panda generators. The original location of the item must be taken from the generator description of this manual. All replacements and repairs should be done by a trained person.

NOTE:Representative procedure

Ensure that the generator cannot be started up accidentally. Remove battery main switch.

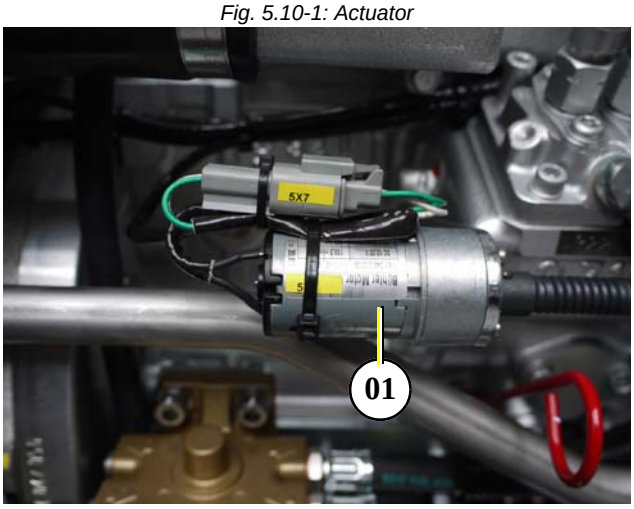
ATTENTION!

For part numbers, refer to the spare parts catalogue.

1. Open the capsule.
   01. Actuator

Representative picture

Fig. 5.10-1: Actuator

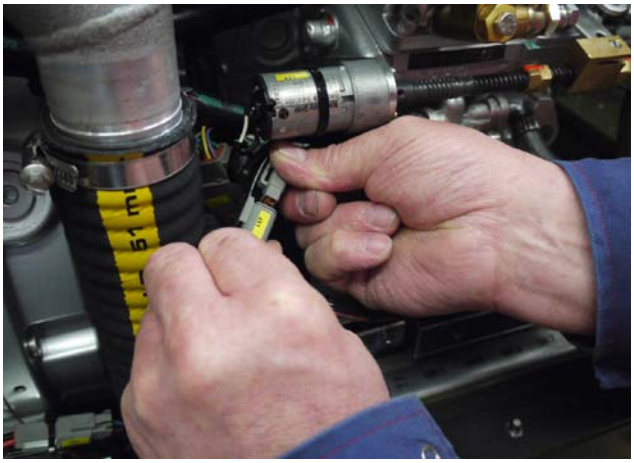


Figures similar!

2. Disconnect electric supply line from the actuator.

Representative picture

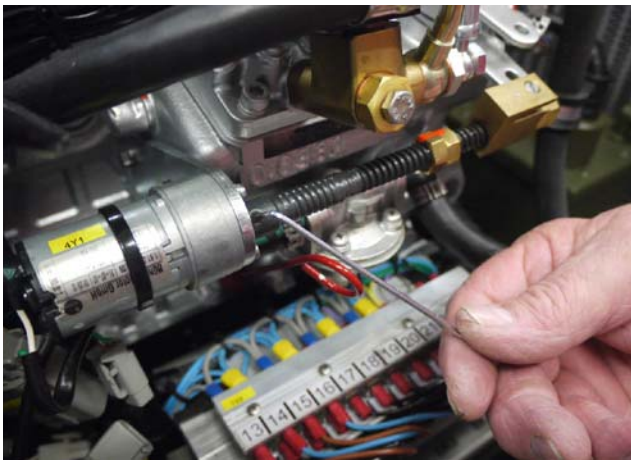
Fig. 5.10-2: Actuator



3. Unscrew the grub screw using a size 2 mm socket wrench.

Representative picture

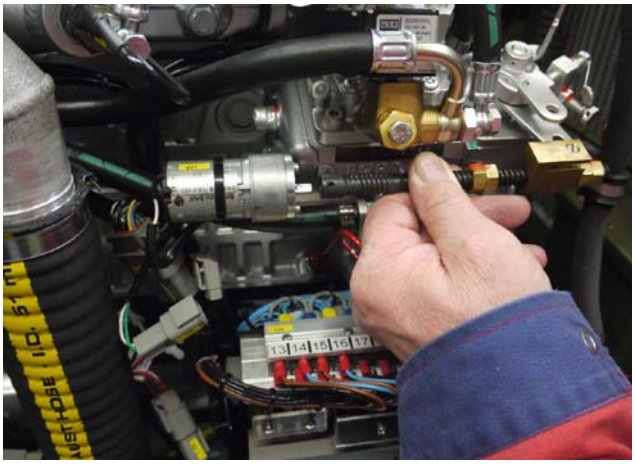
Fig. 5.10-3: Actuator



4. Slide spindle to the right.

Representative picture

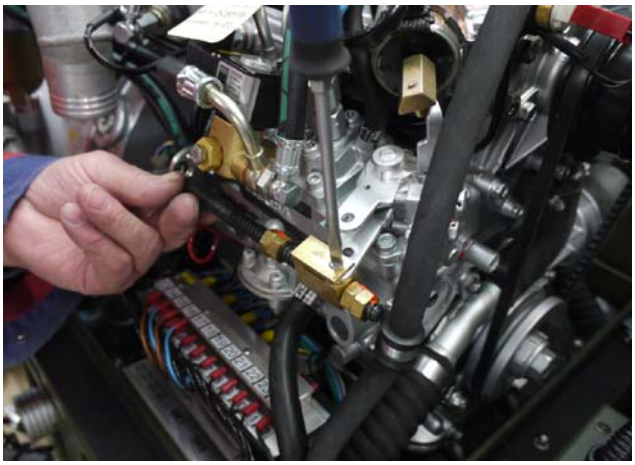
Fig. 5.10-4: Actuator



5. Remove screw with a size 0 or 1 screwdriver.

Representative picture

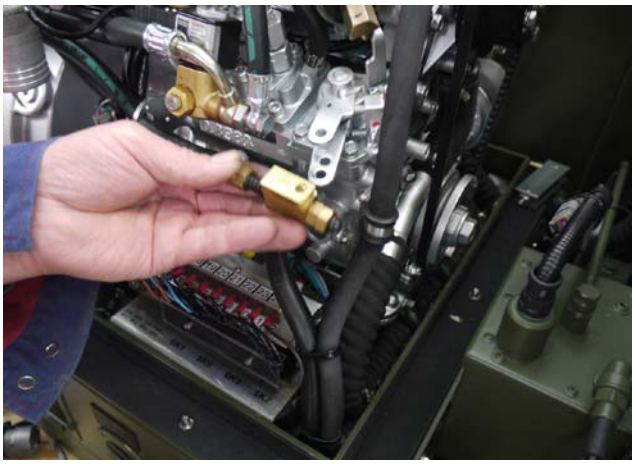
Fig. 5.10-5: Actuator



6. Remove the spindle.

Representative picture

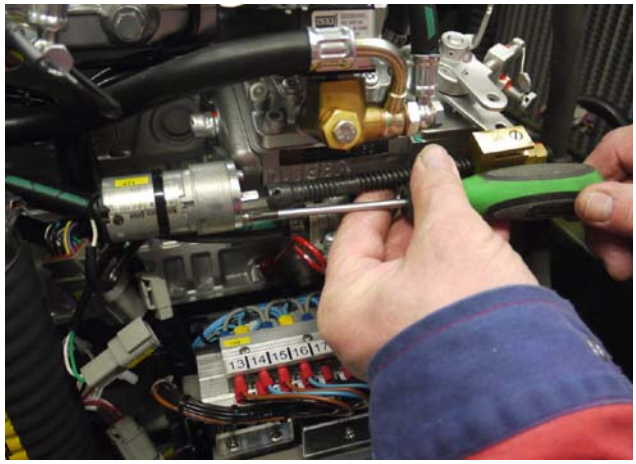
Fig. 5.10-6: Actuator



7. Unscrew three screws on the actuator with a size 0 or 1 phillips screwdriver.

Representative picture

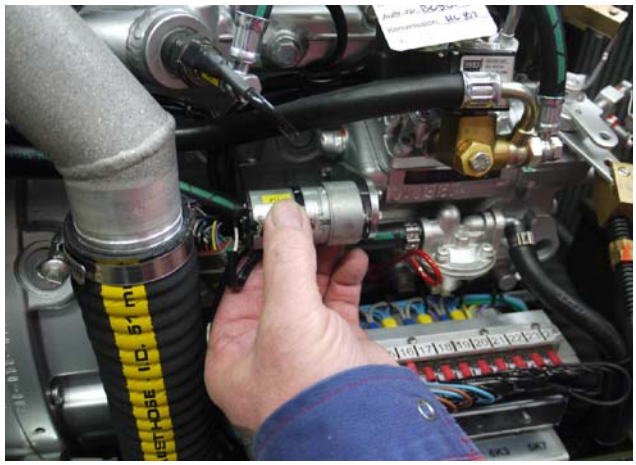
Fig. 5.10-7: Actuator



8. Remove the actuator.
9. To reinstall, reverse the order of steps.
10. Pull out electric starter.
11. To reinstall, reverse the order of steps.

Representative picture

Fig. 5.10-8: Actuator



5.11 Lubrication of the spiral thread spindle

The spiral thread spindle must be lubricated carefully and regularly. Please only use a temperature independence lubricant (up to 100°C) witch is also equipped with „emergency run qualities“.

Spread also lubricant to the end of the nuts.

It is possible that the spindle could clamp if the spindle is not enough lubricated. Then the generator can be switched off by over- or undervoltage.

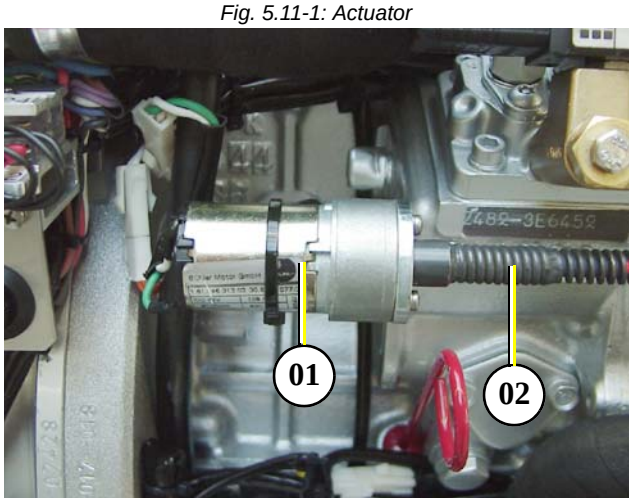
All screws at the actuator and the spindle must be ensured „solvable“ with a screw safety grease.

01. Rev actuator

02. Spiral thread spindle

Representative picture

Fig. 5.11-1: Actuator



5.11.1 Draining the coolant

In principle only describes here, how the cooling water of the raw water cycle can be drained. The mixture of the fresh water circuit should not be drained in principle. See measures for the preparation of the winter storage.

The simplest and cleanest method consists of the fact to bring the external vent 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.

5.12 Replacing the V-belt at Kubota 02/05 series

The described procedure is representative for Fischer Panda generators. The original location of the item must be taken from the generator description of this manual. All replacements and repairs should be done by a trained person.

NOTE:Reprehensive procedure

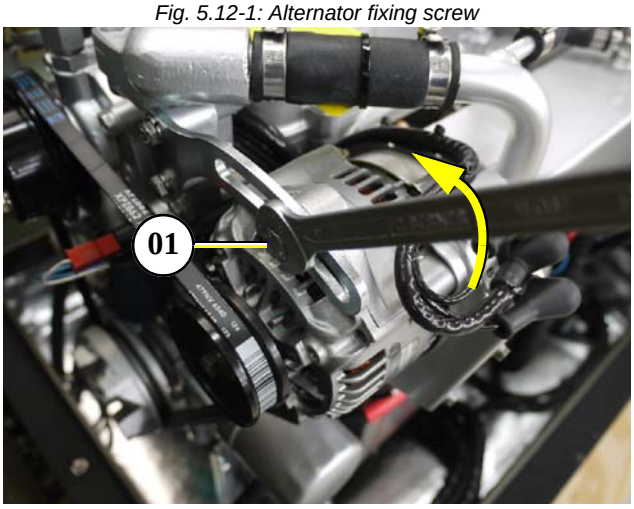
Due to the relatively high ambient temperature inside the closed sound insulation capsule (approx. 85 °C), the useful life of the V-belt is reduced. It is possible that the plasticisers in the rubber compounds may partially lose their effectiveness even after a short operating time because the air in the sound insulated capsule can be both relatively warm and dry.

The V-belt must therefore be checked at very short time intervals. It may be necessary to replace the V-belt after several weeks because of unfavourable conditions. A replacement interval of 250 operating hours must never be exceeded. The V-belt should be inspected after 50 operating hours. The V-belt must be considered a wearing part.

1. Loosen the fixing screw above the alternator.
   Wrench with width across flats of 12 mm.

   01. Fixing screw

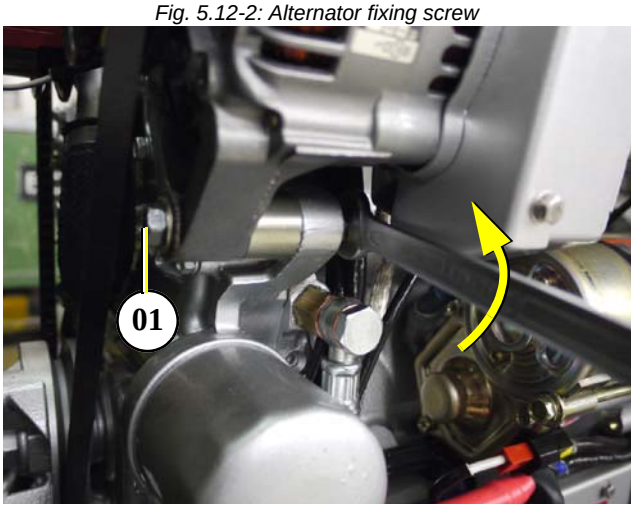
Fig. 5.12-1: Alternator fixing screw



2. Loosen the fixing screw below the alternator.
   Wrench with width across flats of 12 mm.

   01. Fixing screw

Fig. 5.12-2: Alternator fixing screw



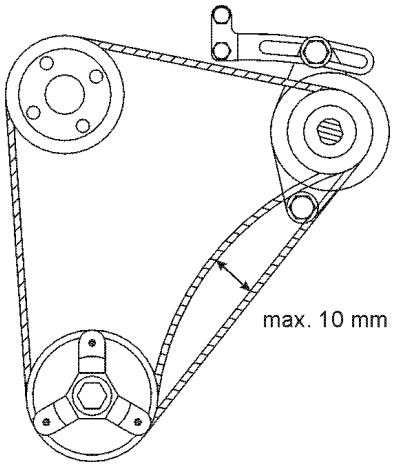
3. Push alternator towards the thermostat housing.
4. Replace the V-belt (Quad Power XPZ 862).

Fig. 5.12-3: Replacing the V-belt

5. The V-belt is tensioned by pulling back the alternator. The V-belt should yield approx. 1 cm when pushed in with a thumb.

Re-tighten the screws above and below the alternator.

Fig. 5.12-4: Replacing the V-belt



5.13 The raw water circuit

5.13.1 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 exchanged.

Fig. 5.13.1-1: Raw water filter

5.14 Causes with frequent impeller waste

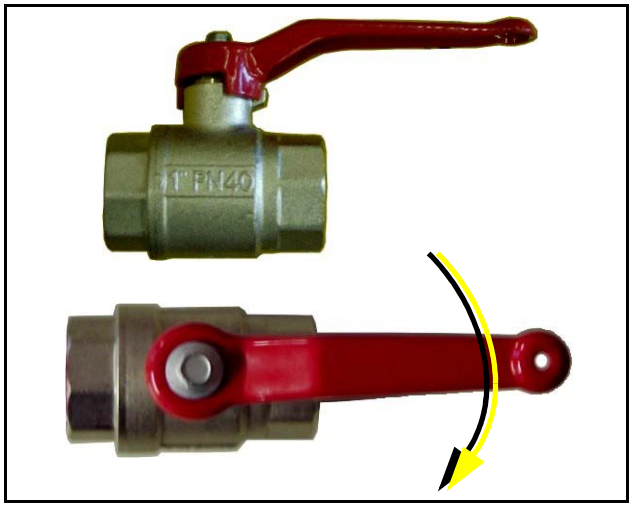
The impeller of the cooling water pump must be regarded as wearing part. The life span of the impeller can be extremely different and exclusively depends on the operating conditions. The cooling water pumps of the PANDA generators are laid out in such a way that the number of revolutions of the pump lies low compared with other gensets. This is for the life span of the pump a positive effect. Unfavourable 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 water bodies. 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 unfavourable 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")

5.14.1 Replacement of the impeller

Close the raw water stop cock.

Representative picture

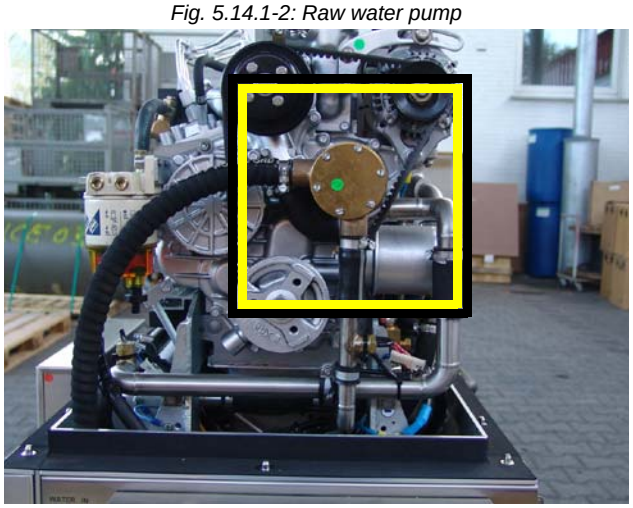
Fig. 5.14.1-1: Raw water cock



Raw water pump on the front side of the genset.

Representative picture

Fig. 5.14.1-2: Raw water pump



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

Representative picture

Fig. 5.14.1-3: Cover raw water pump

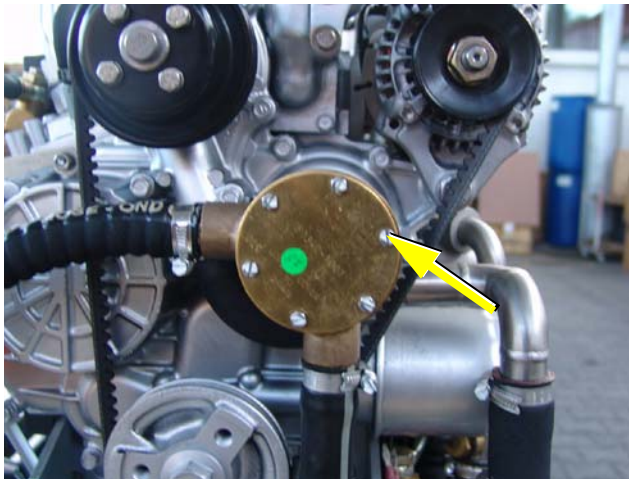
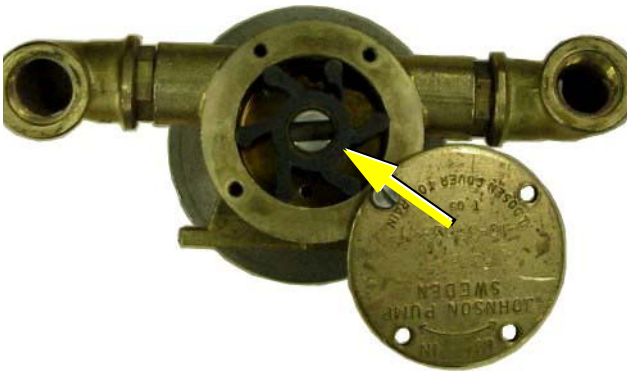


Fig. 5.14.1-4: Impeller pump

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



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

Representative picture

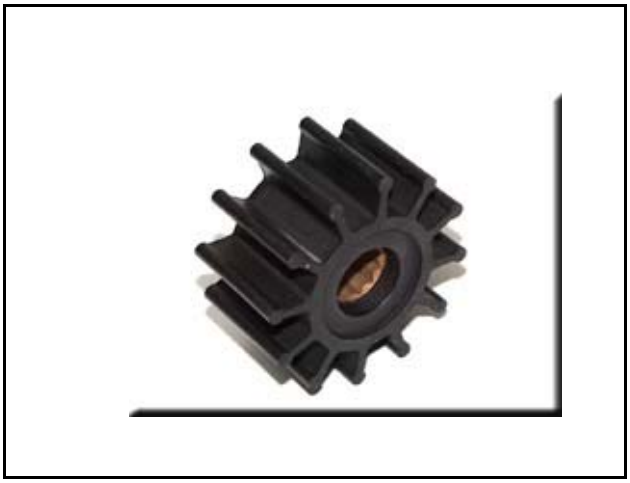
Check to the impeller for damage and replace it if necessary.

Fig. 5.14.1-5: Impeller

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.

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

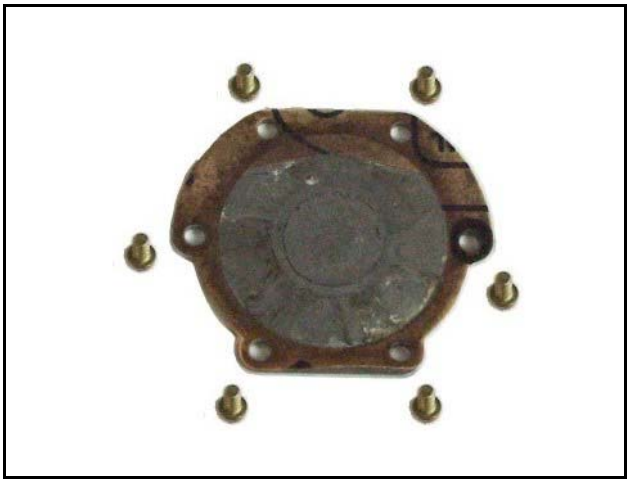
Representative picture



Fastening the cover and use a new seal.

Fig. 5.14.1-6: Gasket

Representative picture



5.15 Special maintenance notes and arrangements at long periods of stand still time or shutdown

Stand still is divided into the following groups:

- Short-term standstill (1 to 3 months).
- Medium-term standstill / winter storage (3 to 6 months).

- Long-term standstill (storage) / shutdown (more than 6 months).

5.15.1 Reference note for the starter battery at a long-term standstill

Starter batteries

Self-discharge of batteries is a physical and chemical process and cannot even be avoid by disconnecting the battery.

Notice:

- Disconnect the battery from the generator at a long-term standstill.
- Charge the battery on a regular basis. Follow the notes of the battery manufacturer.

Before charging the battery, check the acid level according to the type of battery and refill each cell with distilled water up to the marking if necessary.

Today's starter batteries are normally maintenance-free.

Deep discharge may damage the battery and may be useless afterwards.

Keep the battery clean and dry. Continuously clean the battery terminals (+ and -) and clamps and lubricate with an acid-free and acid-resistant grease. Make sure there is a good contact of the clamp connections when assembling. If voltage is approx. below 1,95 Volt, the cell should not decline the open-circuit voltage of the battery. This equates approx. 2,1V / cell open-circuit voltage when battery is fully charged.

For a 12 V battery applies 11,7 V lower open-circuit voltage (battery flat) - conservation charging 13,2 V.

For a 24 V battery applies 23,4 V lower open-circuit voltage (battery flat) - conservation charging 26,4 V.

These data relate to a battery temperature of 20-25°C. Consider the specifications of the battery manufacturer.

Fischer Panda recommendation:

- Install a battery main switch and turn it to the off-position. (Disrupt the battery circuit)
- Install a sufficient fuse in the positive battery line close to the battery
- Check contacts for corrosion on a regular basis.

Notice:

5.15.2 Arrangements at a short-term standstill

Short-term standstill (1 to 3 months)

- Measure the charge of battery via the open-circuit voltage
- At stand still >7 days - disconnect the battery (e.g. put battery main switch to 0)
- Within 2-3 months - let the engine run for at least 10 min
- Fill fuel tank to 100% (level to full).

5.15.3 Arrangements at a medium-term standstill / winter storage

Medium-term stand still (3 to 6 months)

5.15.3.1 Arrangements for conservation:

- Check the charge of battery and recharge approximately every 3 months if necessary. Consider the specifications of the battery manufacturer.

- Check anti-freeze protection of the cooling water and refill if applicable.

  The anti-freeze protection should not be older than 2 years. The content of the anti-freeze protection should be between 40% and 60% to ensure corrosion protection in the cooling water circuit; Refill anti-freeze if necessary.

  If cooling water will be drained, for example after a conservation of the engine, no water should remain within the engine during the stand still. At the control unit a correspondent note „NO COOLING WATER“ has to be placed.
- Drain engine oil as required. Refill engine with conservation oil up to maximum at the oil dip stick.
- Drain diesel fuel from tank and refill with conservation mixture (90% diesel and 10% conservation oil - up to max).

Let engine run for 10 min.

- Remove v-belt as required and store packed at a dry place. Protect from UV radiation.

Cover alternator openings. **Attention!**

No cleaning fluids or preserving agents may enter the alternator. Danger to destroy the alternator.

- Clean engine according to the manufacturer.
- Inject engine parts and v-belt pulleys with a preserving agent.
- Clean air filter housing and inject with a preserving agent.
- Close suction hole and exhaust opening (e.g. with tape or end caps).
- Drain sea water circuit.
- Close sea cock.
- Clean sea water filter.
- Remove impeller and store.

Carry out a deconservation before recommissioning. **Attention!**

5.15.3.2 Arrangements for deconservation after a medium-term standstill (3 to 6 months).

- Check charge of battery and recharge if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection of the cooling water and refill if applicable.
- Drain engine oil. Renew oil filter and oil according to specification.
- Remove preservation agent of the engine with petroleum.
- Degrease the v-belt pulleys and install v-belt correctly. Check v-belt tension!
- Disconnect turbocharger oil pressure line if existent and refill clean motor oil in pipe.
- Keep engine shut-off lever in 0-position and turn engine several times by hand.
- Clean air filter housing with petroleum, check air filter and renew if necessary.
- Remove covers of the exhaust opening and the suction holes.
- Connect battery. Close battery main switch.
- Install impeller.
- Open sea cock.
- Check sea water filter.
- Keep shut-off lever at generator in 0-position and activate starter for approx. 10 sec. Make a break for 10 sec. and repeat procedure twice.

- Visual inspection of the generator according to initial operation and start generator.

5.15.4 Arrangements at a long-term standstill / shutdown

Standstill (more than 6 months)

5.15.4.1 Arrangements for conservation:

- Check the charge of battery and recharge approximately every 3 months if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection of the cooling water and refill if applicable.

  The anti-freeze protection should not be older than 2 years. The content of the anti-freeze protection should be between 40% and 60% to ensure corrosion protection in the cooling water circuit; Refill anti-freeze if necessary.

  If cooling water will be drained, for example after a conservation of the engine, no water should remain within the engine during the stand still. At the control unit a correspondent note „NO COOLING WATER“ has to be placed.
- Drain engine oil as required. Refill engine with conservation oil up to maximum at the oil dip stick.
- Drain diesel fuel from tank and refill with conservation mixture (90% diesel and 10% conservation oil - up to max).

Let engine run for 10 min.

- Remove v-belt as required and store packed at a dry place. Protect from UV radiation
- Disconnect battery.Sprinkle terminals with acid-free grease.

Cover alternator openings. **Attention!**

No cleaning fluids or preservative agents may enter the alternator. Danger to destroy the alternator.

- Clean engine according to the manufacturer.
- Inject engine parts and v-belt pulleys with a preserving agent.
- Clean air filter housing and inject with a preserving agent.
- Sprinkle exhaust turbo charger (if existent) with conservation agent at intake and exhaust and close lines again. Sprinkle preserving agent to the intake and exhaust lines than attach again.
- Remove valve cover and sprinkle the inside of the cover, shafts, springs, rocker lever etc. with preserving agent.
- Remove injectors and sprinkle the cylinder area with preserving agent. Keep the shut-off lever on the 0-position and turn the engine by hand for several times. Screw in the injectors with new gaskets. Consider the torsional moments.
- Sprinkle slightly the radiator cap and tank lid and respectively the radiator cap at the expansion tank and reinstall.
- Close intake and exhaust openings (for example with tape or end caps).
- Drain sea water circuit.
- Close sea cock.
- Clean sea water filter.
- Dismount impeller and store.

Carry out a de-conservation before recommissioning. **Attention!**

5.15.4.2 Arrangements after a long-term standstill (shutdown) / recommissioning (more than 6 months):

- Check the charge of battery and recharge if necessary. Consider the specifications of the battery manufacturer.
- Check anti-freeze protection and level of the cooling water and refill if applicable.
- Drain engine oil. Renew oil filter and oil according specification.
- Remove preservation agent of the engine with petroleum.
- Degrease the v-belt pulleys and install v-belt correctly. Check v-belt tension!
- Disconnect turbocharger oil pressure line if existent and refill clean motor oil in pipe.
- Keep engine shut-off lever in 0-position and turn engine several times by hand.
- Clean air filter housing with petroleum, check air filter and renew if necessary.
- Remove covers of the exhaust opening and the suction holes.
- Connect battery. Close battery main switch.
- Install impeller.
- Open sea cock.
- Check sea water filter.
- Keep shut-off lever at generator in 0-position and activate starter for approx. 10 sec. Make a break for 10 sec. and repeat procedure twice.
- Visual inspection of the generator according to initial operation and start generator.

Fischer Panda recommendation:

After a long-term standstill a complete 150 h inspection according to inspection schedule should be carried out.

Notice:

5.16 Replacing the Water Pump at Kubota 02 series

The described procedure is representative for Fischer Panda generators. The original location of the item must be taken from the generator description of this manual. All replacements and repairs should be done by a trained person.

NOTE:Representative procedure

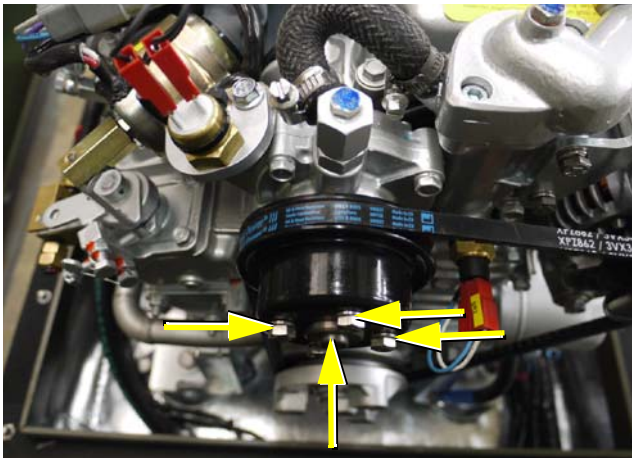
Hot surface! Burn hazard!

ATTENTION!

1. Drain cooling water from entire system.
2. Remove V-belts, see „Replacement of the V-Belt in this manual“
3. Remove all 4 screws on the pulley. W.A.F: 10 mm

4. Remove pulley.
5. For reinstallation, clean the pulley.
6. Remove the water pump fixing screws (2) and remove the water pump (1) from the transmission housing. Wrench with width across flats of 10 mm.

Fig. 5.16-1: Pulley

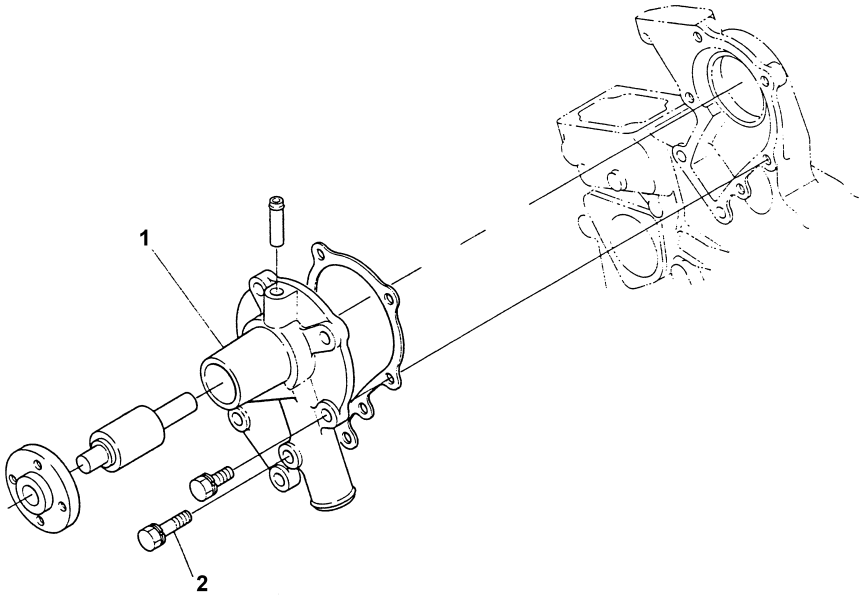


For reinstallation:

- Apply liquid sealant (Three Bond 1215 or equivalent) to both sides of the new water pump gasket.
- To reinstall, reverse the order of steps.

7. Refill cooling water.
8. De-aerate the cooling water system.
9. Perform test run.

Fig. 5.16-2: Water pump



1. Water pump
2. Hex screw

5.17 Replacing the valve cover gasket at Kubota 02 series

The described procedure is representative for Fischer Panda generators. The original location of the item must be taken from the generator description of this manual. All replacements and repairs should be done by a trained person.

NOTE:Representative procedure

1. Remove de-aerating hose. Use Cobra pliers to open the Cobra clamp.

2. Clean during reinstallation.
3. Remove the cap nuts of the valve cover (3). Wrench with W.A.F. of 10 mm.

4. Remove the valve cover (1).
5. Replace the valve cover gasket (2) with new gasket.
6. Insert the valve cover (1) taking care not to damage the O-ring.
7. Tighten the cylinder head screws (3) after filling with engine oil. Torque: 3.9 to 5.9 Nm.

Fig. 5.17-1: De-aerating hose

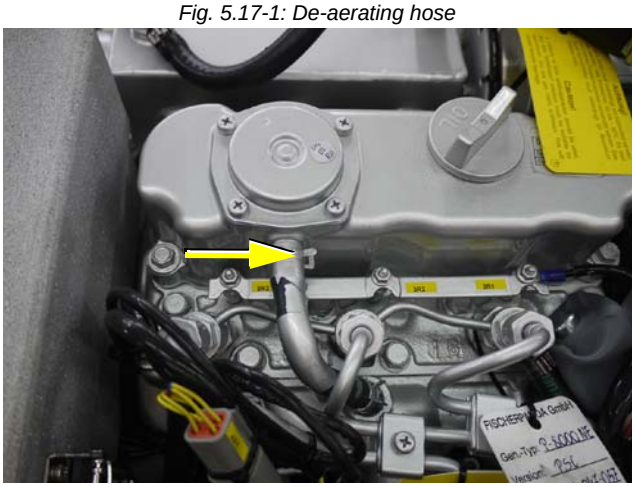
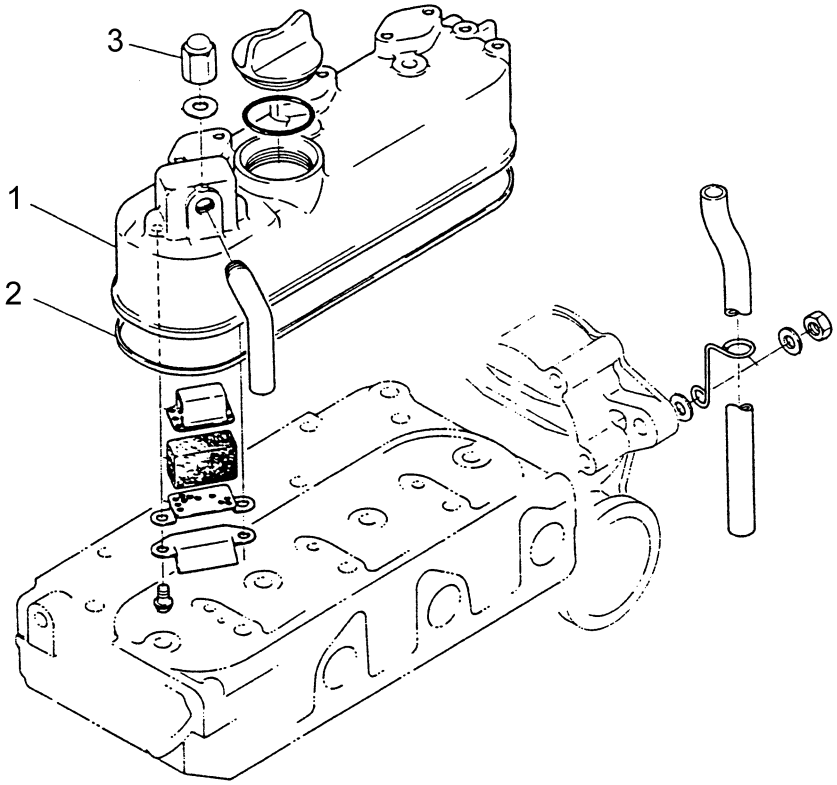


Fig. 5.17-2: Valve cover



1. Valve cover
2. Valve cover gasket
3. Hex nut

5.18 Adjusting the valve clearance at Kubota 02 series

The described procedure is representative for Fischer Panda generators. The original location of the item must be taken from the generator description of this manual. All replacements and repairs should be done by a trained person.

NOTE:Representative procedure

Tools:

- Wrench for valve cover: W.A.F. of 10 mm
- Spanner for counter nut: W.A.F. of 11 mm
- Flat screwdriver for adjusting screw
- Feeler gauge

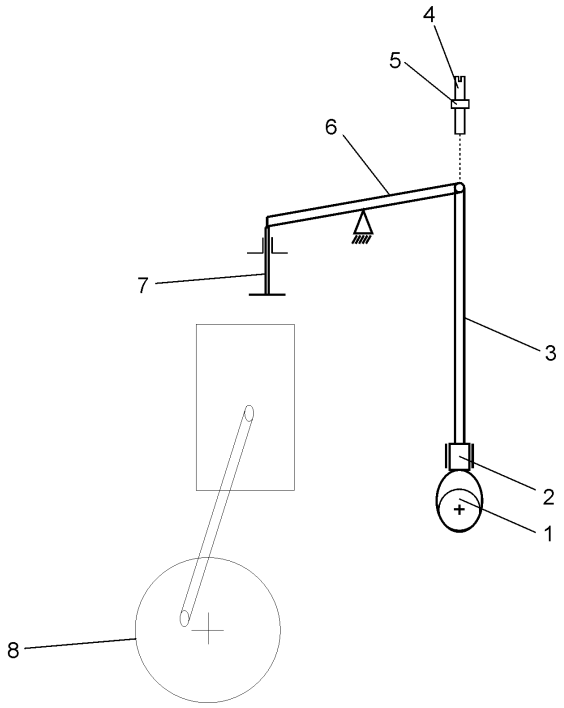
1. Unscrew valve cover.
2. Rotate crankshaft until the valve to be adjusted is fully open. If necessary, rotate back and forth to determine the dead centre. See Fig. 5.18-1, “Valve open,” on page 150.
3. Rotate crankshaft 360°. The valve is then closed, as the cam shaft was rotated 180°. See Fig. 5.18-2, “Valve closed,” on page 150.
4. Check the valve clearance with a feeler gauge! If the engine is cold, the valve clearance must be between 0.145mm and 0.185mm. The feeler gauge must slide between rocker arm and valve stem with light suction. Adjust the valve clearance as necessary using the screw on the rocker arm. Loosen the counter nut first. After adjusting, the counter nut must be retightened. Check the valve clearance again.
5. Perform the same procedure with the other valves.
6. Refit the valve cover and firmly tighten the screws.

Mark the valves that were already checked!

NOTE:

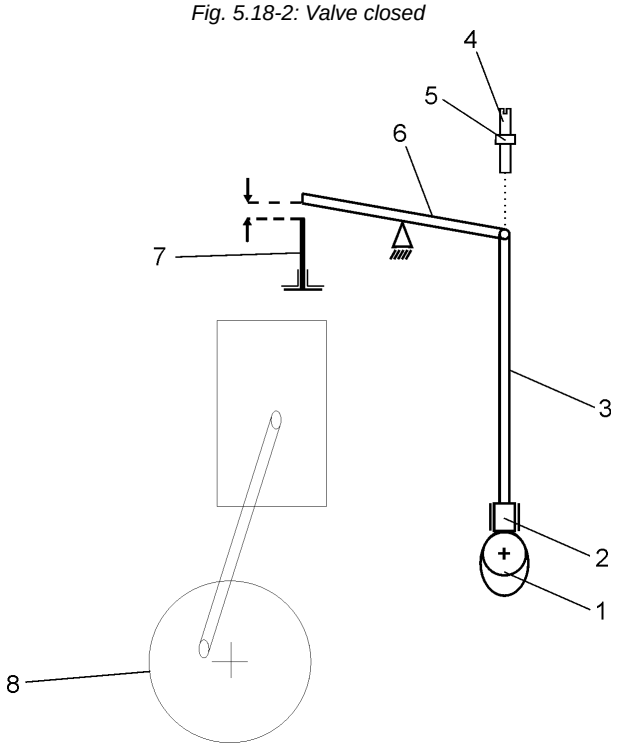
1. Cam shaft
2. Cam follower
3. Push rod
4. Adjusting screw
5. Counter nut
6. Rocker arm
7. Valve
8. Crankshaft

Fig. 5.18-1: Valve open



1. Cam shaft
2. Cam follower
3. Push rod
4. Adjusting screw
5. Counter nut
6. Rocker arm
7. Valve
8. Crankshaft

Fig. 5.18-2: Valve closed



Clearance of intake and discharge valve (cold)	Factory specification	0.145 to 0.185 mm 0.00571 to 0.00728 inch

6. Generator Failure

6.1 Personal requirements

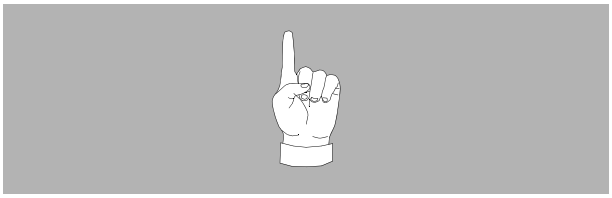
The work described here, unless otherwise indicated, are performed by the operator.

More repair work may be performed only by specially trained personnel or by authorized repair shops (Fischer Panda service points). This is especially for working on the valve timing, fuel injection system and the engine repair.

6.2 Hazard notes for the troubleshooting

Follow the general safety instruction at the front of this manual.

Notice!:



Danger for life! - The generator can be equipped with an automatic start device. This means the generator can be started by an external signal. To avoid an unexpected starting of the generator, the starter battery must be disconnected before start working at the generator.

Warning!: Automatic start

Working at a running generator can result in severe personal injury. Therefore before starting work at the generator:

Make sure that the generator is stopped and the starter battery is disconnected to guarantee that the generator cannot be inadvertently started.

Do not run the generator with removed sound isolation cover.

Warning!: Risk of injury

Improper installation/maintenance can result in severe personal injuries or material damage.

- Always undertake installation/maintenance work when the generator is switched off.
- Ensure there is sufficient installation clearance before start working.
- Ensure tidiness and cleanliness at the workplace. Loose components and tools lying around or on top of each other are sources of accidents.
- Only perform installation work using commercially available tools and special tools. incorrect or damaged tools can result injuries.

Warning!: Risk of injury

Oil and fuel vapours can ignite on contact with ignition sources. Therefore:

- No open flames during work on the generator.
- Do not smoke.
- Remove oil and fuel residues from the generator and floor.

Warning!: Danger of fire

Contact with engine oil, antifreeze and fuel can result in damage to health. Therefor:

- Avoid skin contact with engine oil, fuel and antifreeze.
- Remove oil and fuel splashes and antifreeze from the skin immediately.
- Do not inhale oil and fuel vapours.

Danger!: Danger of poisoning

Danger for Life. Improper handling, operation, installation and maintenance can result in severe personal injury and/or material damage.

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.

ATTENTION!: Danger to Life - High voltage

Generator, oil and antifreeze can be hot during/after operation. Risk of severe burns.

Warning!: Hot surface/material

During Installation/maintenance personal protective equipment is required to minimize the health hazards.

- Protective clothing
- safety boots
- protective gloves
- Ear defender
- safety glasses

Instruction!: Personal protective equipment necessary.

Disconnect all load during the work at the generator to avoid damages at the load.

Attention!: Disconnect all load

6.3 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

6.4 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.

Effects of Short Circuiting and Overloading on the Generator

The generator **cannot** be damaged by short circuiting or overloading. Short circuiting and overloading suppress the magnetic excitation of the generator, thus, no current is generated and the voltage will collapse. This condition is immediately offset once the short-circuit has been eliminated and/or the electrical overload removed.

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").

6.4.1 Monitoring the Generator Voltage

see “Safety first!” on Page 10.

ATTENTION! -

The voltage range of the power stations normally lies between 200 and 240V (100 - 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 190V (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 load is 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 load is 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).

6.4.2 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.

6.5 Adjusting Instructions for the Spindle of the actuator

Two independent devices limit engine speed range. They are:

Regulating nuts on the spindle of the actuator left and right of the spindle nut.

An adjusting screw at the base of the rev regulator lever. (only upper revs limit)

1. Actuator

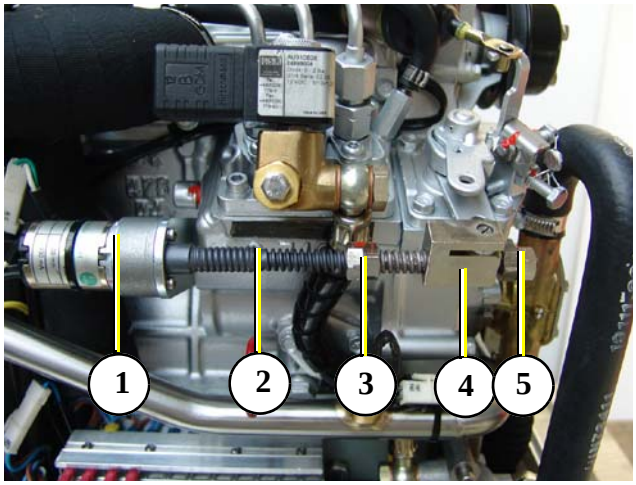
2. Spiral thread spindle

3. Regulating nuts for max. speed

4. Spindle nut with speed regulator level

5. Regulating nuts for min. speed

Fig. 6.5-1: Actuator

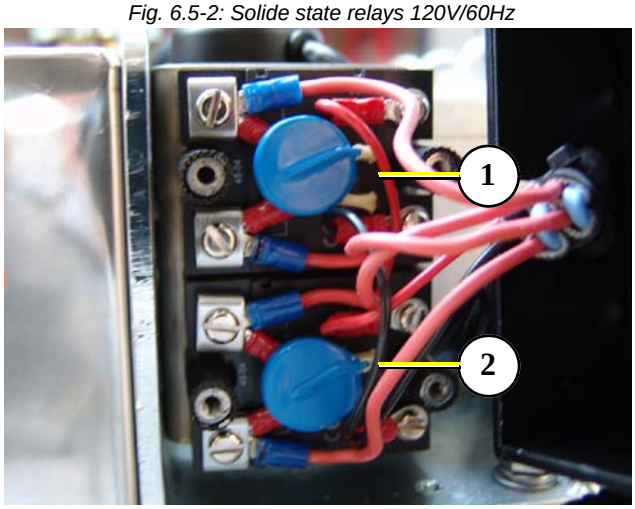


During any work on the generator all load must be switched off to avoid damage to the equipment. Also the solid state relay, located in the electrical cabinet should be disconnected to avoid an accidental discharge of the booster capacitors.

1. Solid state relay for booster capacitors

2. Solid state relay for booster capacitors

Fig. 6.5-2: Solide state relays 120V/60Hz



6.5.1 Adjustment of the maximum engine speed:

1. Disconnect the electrical supply line to the actuator.

1. Plug for actuator

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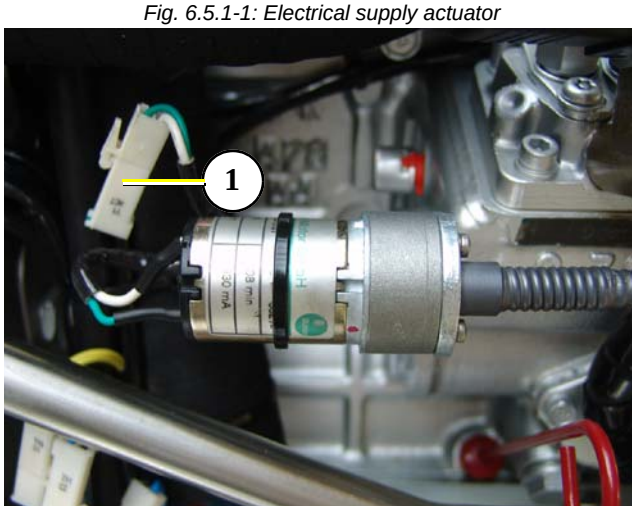
Fig. 6.5.1-1: Electrical supply actuator



2. Loosen the max speed lock nut with two spanners size 14mm.

1. Spanner size 14mm

2. Spanner size 14mm

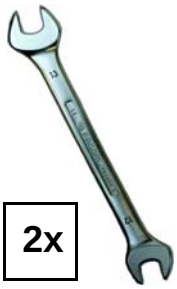
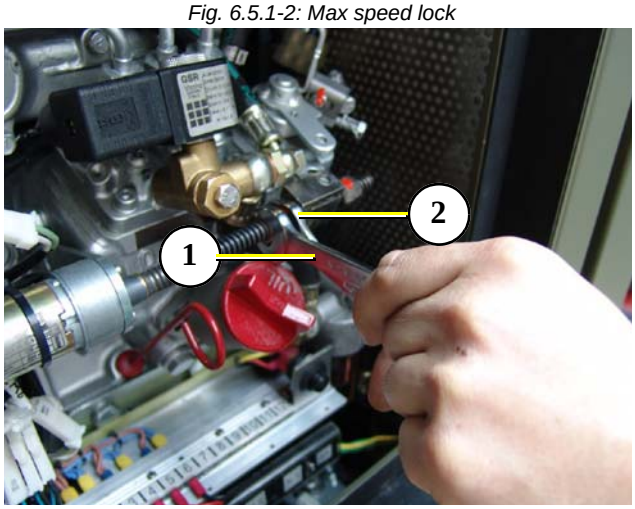
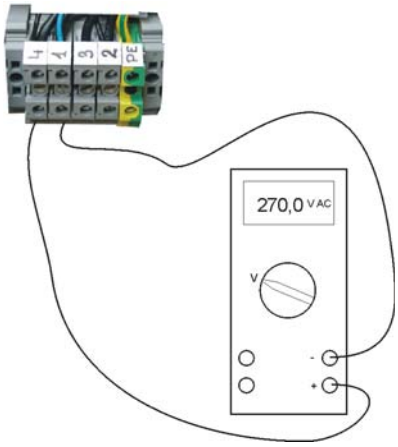


Fig. 6.5.1-2: Max speed lock



3. Connect a voltmeter (TRMS) with a display range 300V AC to the AC outlet between 4 and 1 to the load socket.

Fig. 6.5.1-3: Connect voltmeter - 120V/60Hz



4. Ensure no electrical load is connected.
5. Start the generator.

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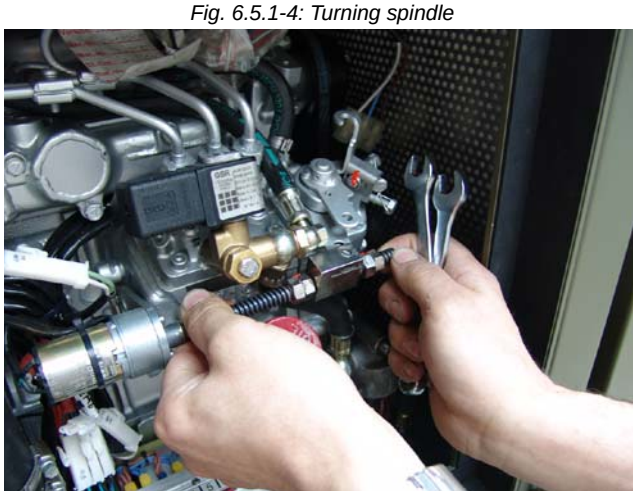
Fig. 6.5.1-4: Turning spindle



6. Increase the speed of the generator by turning the spiral spindle manually until the voltmeter shows a value of 260V.

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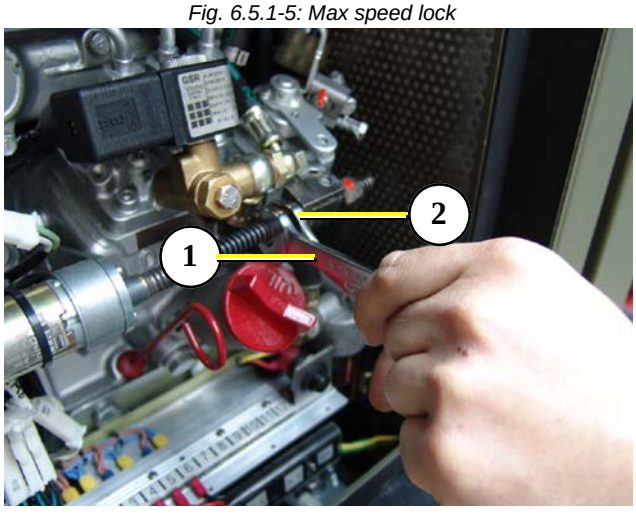
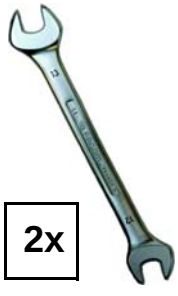
Fig. 6.5.1-5: Max speed lock



7. Turn the limit nut tight to keep the speed setting.
8. Secure the limit nut with the lock nut.

1. Spanner size 14mm

2. Spanner size 14mm



9. Check the voltage of the generator is limited to max. 260V (without load).
10. Re-adjust if necessary by repeating the procedure.

6.5.2 Adjustment of minimum engine speed

1. Repeat the loosening procedure detailed above on the minimum speed locking and adjusting nuts.
2. Be sure that no electrical load is connected.
3. Start the generator.
4. Decrease the rev of the generator by turning the spindle of the actuator manually until the voltmeter shows a value of 200V.
5. Tighten both nuts as before.
6. Check the lower voltage of the generator is limited to min. 200V without load.
7. Re-adjust if necessary.

6.5.3 Lubrication of the spiral thread spindle

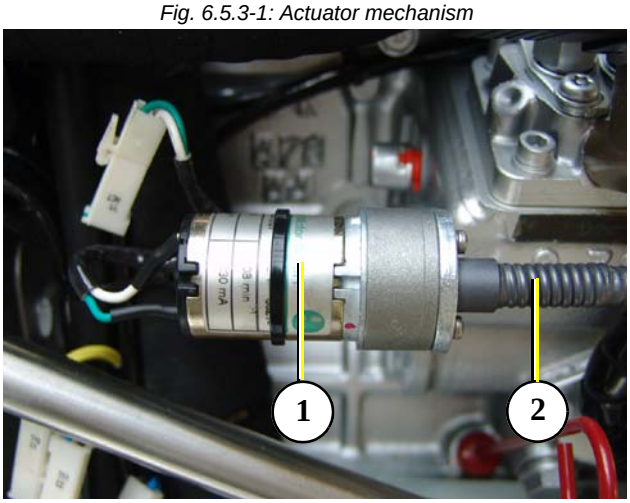
The spiral thread spindle must be lubricated carefully and regularly. Use only a temperature resistant safety grease (up to 100°C) ". Ensure lubricant is applied right up to the nuts and especially between the nuts and the spindle nut (See Fig. 6.5.3-1, “Actuator mechanism,” on Page 157)

It is possible that the spindle could seize if it is not regularly lubricated. Should this be the case, the generator may switch off automatically due to over or under voltage.

1. Speed actuator

2. Spiral thread spindle

Fig. 6.5.3-1: Actuator mechanism



6.5.4 Overload damage to the actuator mechanism

If a generator overload occurs, the voltage falls and the actuator will move to the upper limit trying to increase engine revolutions. If this situation goes on for a long time it can result in damage to the actuator windings. The actuator may not become inoperative, but its action may become weak and not perform in all spindle positions as well as it should. So the voltage of the generator may be regulated poorly or possibly not at all.

If it is noticed that the spindle of the actuator is operating slowly or erratically the actuator may need to be replaced. To check the actuator, follow the procedure below.

6.5.4.1 If the actuator does not move:

1. The actuator does not move but the spindle can be turned manually. Disconnect the power to the actuator and connect an external 12V-DCsource to the actuator.

   a. If the actuator still does not operate it is defective and must be replaced

   b. If the actuator works properly with the external voltage source:

- Check the fuse on the VCS printed circuit board.
- Check if the alternator voltage sensor (X3) is properly connected to the VCS circuit board.
- Check filters.
- Check if the VCS DC supply voltage is properly connected (clamp 3(+) and clamp 4(-) of X1) .
- Check if the VCS output to the actuator is properly connected (clamp 1(+) and clamp 2(-) of X1).

If no fault is found, the VCS circuit board must be replaced.

6.5.4.2 Voltage control check procedure:

1. Switch off load.
2. Disconnect the power to the actuator.
3. Turn the actuator spindle manually to check if an adjusting nut is jammed.
4. Turn the actuator spindle manually to check if the adjusting nuts allow smooth spindle operation.
5. If no fault is found from these checks there is nothing mechanically wrong. Proceed to check electrical functions:
6. Reconnect the power to the actuator.
7. Start the generator.
8. Turn the actuator spindle by hand and check if the spindle is returned by the actuator motor.
9. If the motor reacts strongly (the motor can normally be halted with the fingers) the drive is working properly.
10. If the motor is weak or hesitant there are short circuits in the actuator windings and the actuator must be replaced.

6.5.4.3 Check the limits of the generator voltage

The mechanical voltage limitation should be checked regularly as follows:

1. Plug for actuator

a. Disconnect the electrical supply line to the actuator.

b. Switch off any load.

c. Connect an electrical voltmeter.

d. Start the generator.

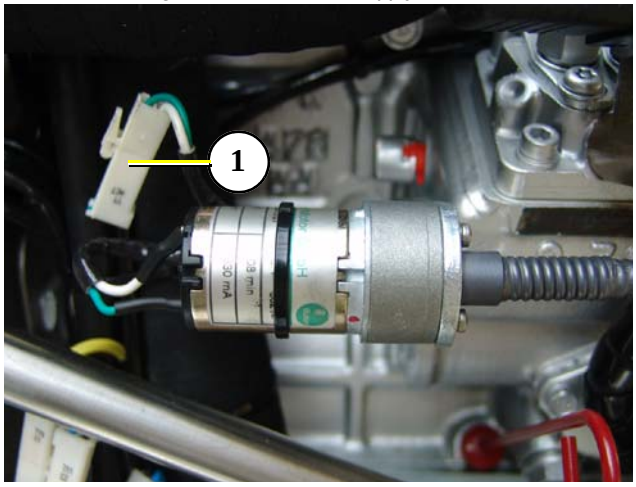
e. Turn the actuator manually to the lower limit stop point.

f. The voltage must be 200V between L1 and N.

g. Turn the actuator manually to the upper limit stop point. The max. voltage is 260V.

h. A new adjustment is necessary in case of variation from these figures.

Fig. 6.5.4-1: Electrical supply actuator



6.5.5 VCS By-Pass Facility

If there is a problem in the VCS which cannot be cured (e.g. awaiting parts), the generator can be run safely and normally with the VCS generator output monitor disconnected. The engine speed can then (if necessary) be adjusted as already described to produce the required voltage and the generator will run normally.

6.5.6 Low Generator Output Voltage

Before working (installation) on the System read the section “Safety first!” on Page 10. in this Manual.

ATTENTION!

Panda generators are designed such that even high electrical variations will not cause serious damage to the generator.

If the generator does not produce any voltage while the engine is running, the suspected cause lies outside the generator capsule.

- electrical load not switched off prior to start
- short circuit somewhere in electrical system
- electrical overload

6.6 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 load is switched off, the generator runs without load, you can assume one or more condensers are defective.

6.6.1 Discharge the capacitors

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 first!” on Page 10.

ATTENTION!

1) Switch off generator

2) Disconnect starter battery

3) Open the sound cover

4) Remove the caps of the capacitors

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

Fig. 6.6.1-1: Discharge capacitors

6.6.2 Checking the capacitors

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. 6.6.2-1: Checking capacitors

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.

6.6.3 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 7.1.0-1, “Voltage values stator coil,” on Page 167, a coil damage is to be accepted.

During the measurement in the 60Hz version both partial coils must be interconnected, i.e. a connection must be provided between line 1 and line 3. (see wiring diagram)

(notes: the voltage results from the remainder magnetism of the rotor, which induced a voltage in the coil.)

6.6.4 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 Fig. 6.6.1-1, “Discharge capacitors,” on Page 160).

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.

The contacts which can be measured depend on the type of the generator (see identification plate):

HP1 - 50Hz: L, Z

HP1 - 60Hz: L, Z

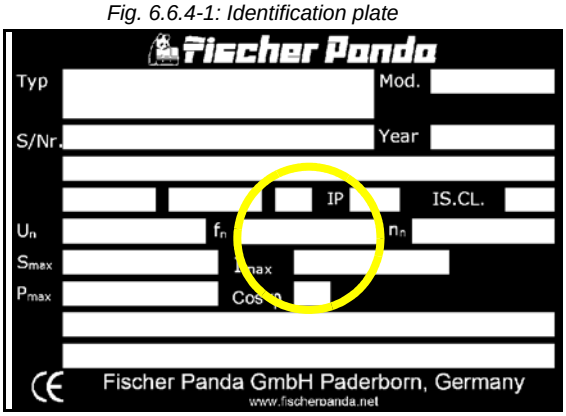
HP3 - 50Hz:: L1, L2, L3

HP3 - 60Hz:: L1, L2, L3, 1, 2, 3 , 4

DVS - 50Hz : L1, L2, L3, L1’

DVS - 60Hz : L1, L2, L3, L1’, 1, 2, 3, 4

Fig. 6.6.4-1: Identification plate



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.

6.6.5 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 section 7.2, “Technical data” on page 168.

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

6.7 Generator provides no Voltage

6.8 Starting Problems

6.8.1 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.

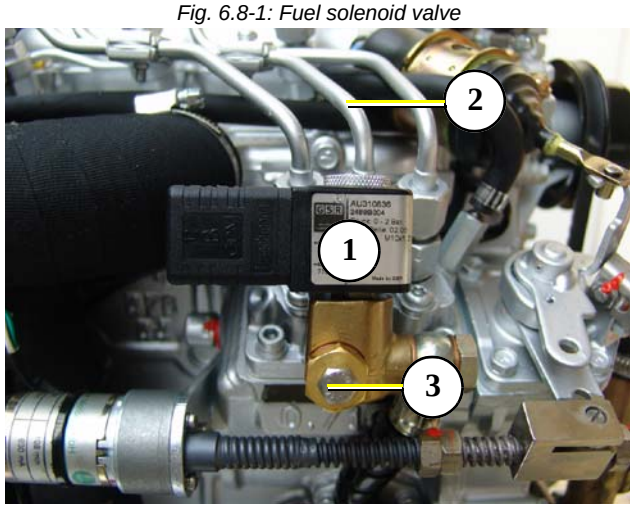
A check of the fuel solenoid valve by removing the plug from the fuel solenoid valve for a short period whilst in operation (first remove the small retention screw) and replace it immediately. The motor should "react immediately" by revving high. If the motor does not react sharply to the reconnection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

1. Fuel solenoid valve

2. Injection nozzle

3. De-aerating screw

Fig. 6.8-1: Fuel solenoid valve



6.8.2 Stop solenoid

There are two different variations:

A. Energized to stop

By pressing the „OFF“-button on the remote control panel the stop solenoid is supplied with voltage and operate, through this the injection nozzles resets to zero position and the generator stops.

B. Energized to run

This version is equipped with two solenoids an actuating and a stop solenoid. After being fed with current, the

actuating solenoid attracts the adjusting lever of the fuel injection pump, through which the fuel can flow. The actuating solenoid is switched off once the final position has been reached, which is maintained by the stop solenoid for as long as the generator is running

When starting the "START"-button may not be pressed longer than 5 sec., because the stop solenoid pulls too much current over the starter. Otherwise the stop solenoid must be disconnected.

.ATTENTIONT

Stop solenoid

Fig. 6.8.2-1: Stop solenoid

6.8.2.1 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.

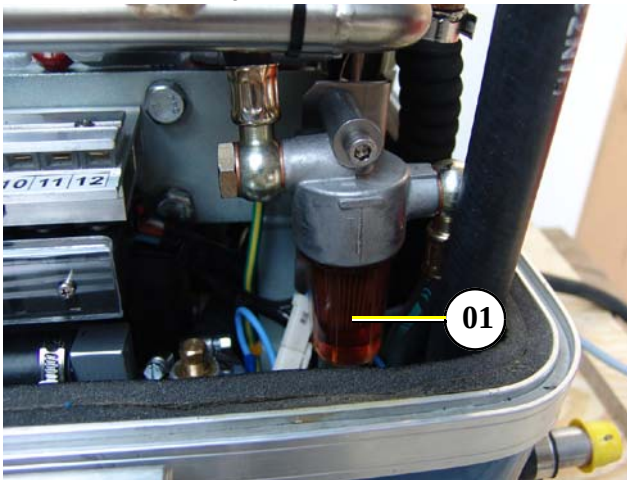
6.8.3 Dirty fuel filter

If the fuel filter is dirty change the filter element.

For replacing the filter element see section 5.6.1, “Replacement of the fuel filter” on page 124.

01. Fuel filter element

Fig. 6.8.3-1: Fuel filter

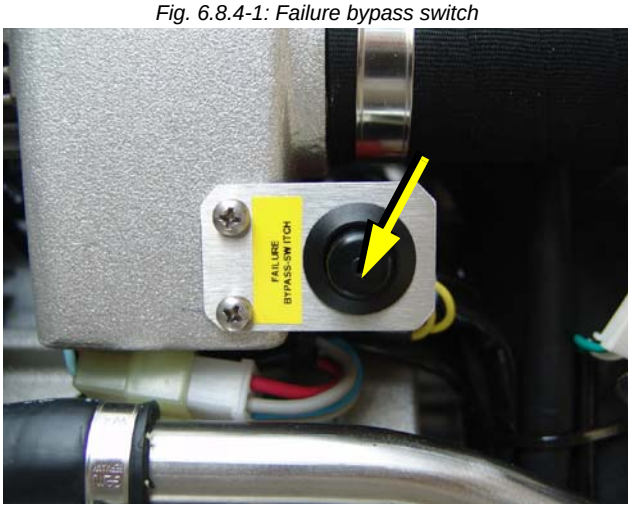


6.8.4 Failure Bypass Switch

The start-failure bypass switch enables an immediate restart facility of the generator, should it cut out, even if this was caused by over-heating. There is normally a requirement to wait until the motor has cooled down to the correct temperature. This can last for several hours in certain circumstances, since the generator is enclosed in a sound-insulated casing, which prevents heat loss.

Failure bypass switch

Fig. 6.8.4-1: Failure bypass switch



To prevent such a shut down period the generator can be started in the normal way while pressing the Failure bypass button is depressed. This by-passes any faults thus allowing the generator to run.

Before pressing the bypass button and starting the generator, a manual check of the engine oil level must be carried out as it is possible that the oil pressure switch caused the generator to cut out. Once it has been ascertained that the reason for the engine cutting out is over- heating and not lack of oil, the generator can be started and run for several minutes without load, so that the engine is returned to normal operating temperature.

CAUTION:

If temperature is the reason for the generator cutting out when it is running under load, then an immediate investigation should be made to determine the cause. It could be a fault with the internal cooling system, the fan, the radiator air-intake or dirty radiator.

Repeated use of the failure bypass switch should be avoided, if the generator repeatedly cuts out during operation without determining the cause of the engine cut-outs.

The generator should always be run without load for several minutes before being switched off, so that temperature stabilisation occurs. Residual heat can cause the generator to overheat, even after it has been switched off.

Should the overheating alarm be activated after the generator has been switched off, then this can also be bypassed using the switch.

6.8.5 Troubleshooting Table

For Troubleshooting see section 7.1, “Troubleshooting” on page 165.

7. Tables

7.1 Troubleshooting

GENERATOR OUTPUT VOLTAGE TOO LOW For 50Hz versions: less than 200V 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 240V-50Hz / 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.
Measurering voltage on the VCS circuit board is missing.	Check VCS System, check cable connections.

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 (120V-60Hz), it is usually because the motor draws too much current during starting process.	Check the motor's current draw required for starting (switch to 380V if possible). This could be remedied by providing stronger capacitors or installing an optional "Easy Start Booster Set". 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)
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 "Bleeding Air from Fuel System").
Fuel-filter blocked.	Replace fuel filter.

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 Kubota-Service. (refer to Kubota motor-manual)
Cooling water in combustion chamber.	1. Turn generator "OFF" at control panel. 2. Remove the glow plug (see Kubota-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 RUNS IRREGULARLY	
Cause	**Solution**
Faulty centrifugal injector governor.	Have the centrifugal governor inspected by a Kubota-Service technician.
Too much air in fuel lines.	Bleed air from fuel system.

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 Kubota-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 "Inlet 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 Kubota-Service if necessary.

SOOTY, BLACK EXHAUST	
Cause	**Solution**
Generator is overloaded.	Check electrical load and switch off unnecessary load.

SOOTY, BLACK EXHAUST	
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 Kubota-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 Kubota.

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 Kubota-Service, or Panda representative.

Fig. 7.1.0-1: Voltage values stator coil

Terminal	Panda 12mini
4 - 2 (60Hz)	~ 3-5 Volt

Generator type	Ø Cooling water conduit		Ø Exhaust conduit [mm]	Ø Fuel conduit	
	Frehwater [mm]	Raw water [mm]		Supply [mm]	Return [mm]
Panda PMS 12mini	20	20	40	8	8

Panda 12mini - 120 V / 60 Hz	43 A

Fig. 7.1.0-2: Wiring for vehicles.

Wiring for vehicles. Single phase, not tin plated, PVC-insulated.		
Nominal conductor cross-section [mm²]	Allowed continuous current (guidance level) [a]	
	at +30°C [A]	at +50°C [A]
1	19	13,5
1,5	24	17,0
2,5	32	22,7
4	42	29,8
6	54	38,3
10	73	51,8
16	98	69,6
25	129	91,6
35	158	112
50	198	140
70	245	174
95	292	207
120	344	244

a. According to DIN VDE 0298, part 4.

The cable cross-section must be arranged at three phase generators, if load of the generator is asymmetric!

IMPORTANT FOR THREEPHASE GENERATORS!

7.2 Technical data

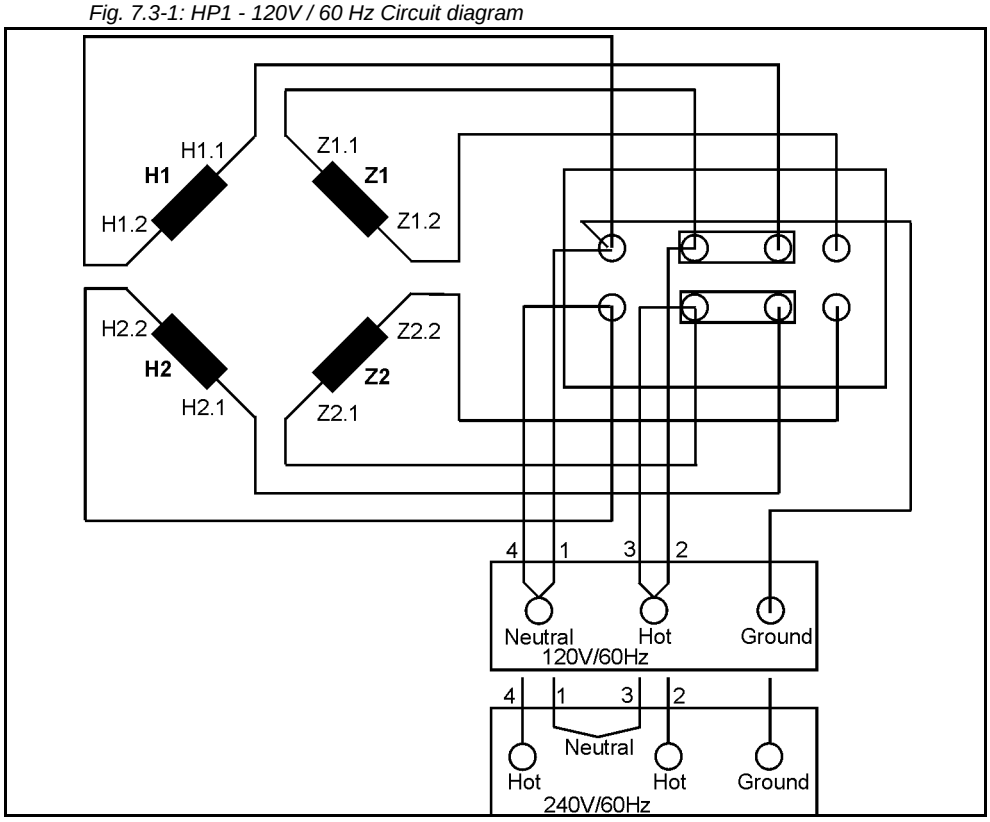
Fig. 7.2-1: Technical Data

	Panda 12mini PMS Digital 120V/60Hz
Type	Kubota D 722
Govenor	VCS
Automatic Startbooster	yes
No. cylinder	3
Bore	67mm
Stroke	68mm
Stroke volume	719cm^3
max. power (SAEJ1349) at 3600rpm	12,15kW
Rated speed	3600rpm
Idle running speed [a]	3510rpm
Lubrication oil capacity	3,8l
Fuel consumption [b]	ca. 1,1 - 2,94l
Oil consumption	max. 1% of fuel consumption
Cooling water requirement for raw water circuit	16-28l/min
Da	240mm
Di	135mm
Lfe	120mm
Ohmic resistance	H1/H2: 0,2 Ohm; Z1/Z2: 0,5 Ohm
Inductive resistance	H1/H2: 0,5 mH; Z1/Z2: 3,5 mH
Capacitors	Booster: 2x40µF; Excitation: 4x50µF

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

7.3 Types of coil

Fig. 7.3-1: HP1 - 120V / 60 Hz Circuit diagram



7.4 Engine oil

7.4.1 Engine oil classification

7.4.1.1 Operating range:

The operating range of an engine oil is determined by SAE class. „SAE“ is for the union of American auto engineers (Society of Automotives Engineers).

The SAE class of an engine oil only informs over the viscosity of the oil (larger number = more viscous, smaller number = more highly liquidly) e.g. to 0W, 10W, 15W, 20, 30, 40. The first number shows the liquid of the oil with cold weather, the second number refers to the fluidity with heat. Complete yearly oils have usually SAE classes of SAE 10W-40, SAE 15W-40 etc.

7.4.1.2 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.

API C for diesel engine

Examples for diesel engine oil:

API CC Engine oil for small demands

API CD Engine oil for suction- and turbo diesel engine

API CF Replace the specification API CD since 1994

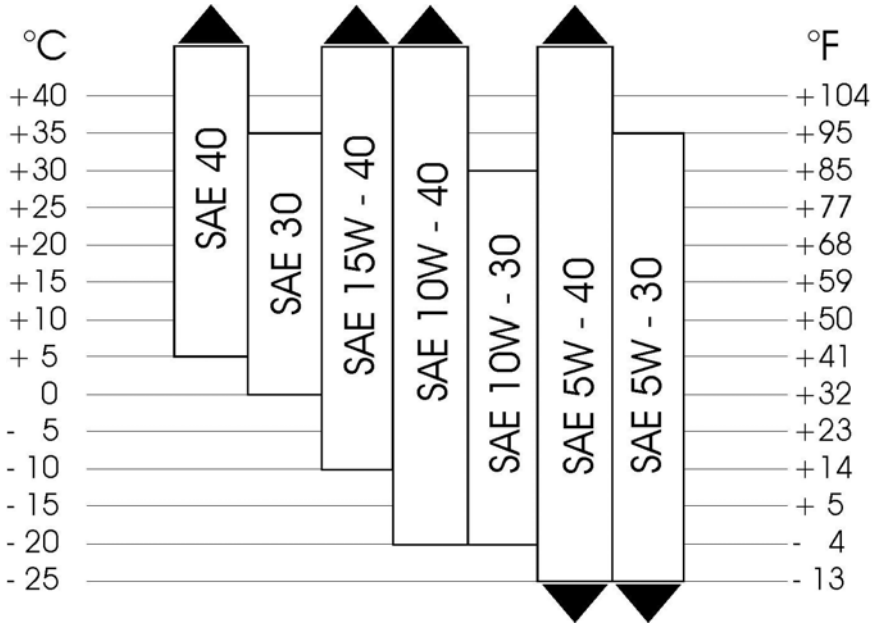
API CG Engine oil for highest demands, turbo-tested

See technical data for the specificated engine oil **Notice!:**

Fig. 7.4.1.2-1: Engine oil type.

Engine oil type	
over 25 °C	SAE30 or SAE10W-30; SAE10W-40
0 °C to 25 °C	SAE20 or SAE10W-30; SAE10W-40
below 0 °C	SAE10W or SAE10W-30; SAE10W-40

Fig. 7.4.1-2: Temp. range of the SAE classes



7.5 Fuel

Use a clean No. 2 Diesel fuel oil (SAE J313 JUN87) according to ASTM D975 and EN 590.

Do not use alternative fuel, because its quality is unknown or it may be inferior in quality. Kerosene, which is very low in cetane rating, adversely effects the engine.

7.6 Coolant specifications

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

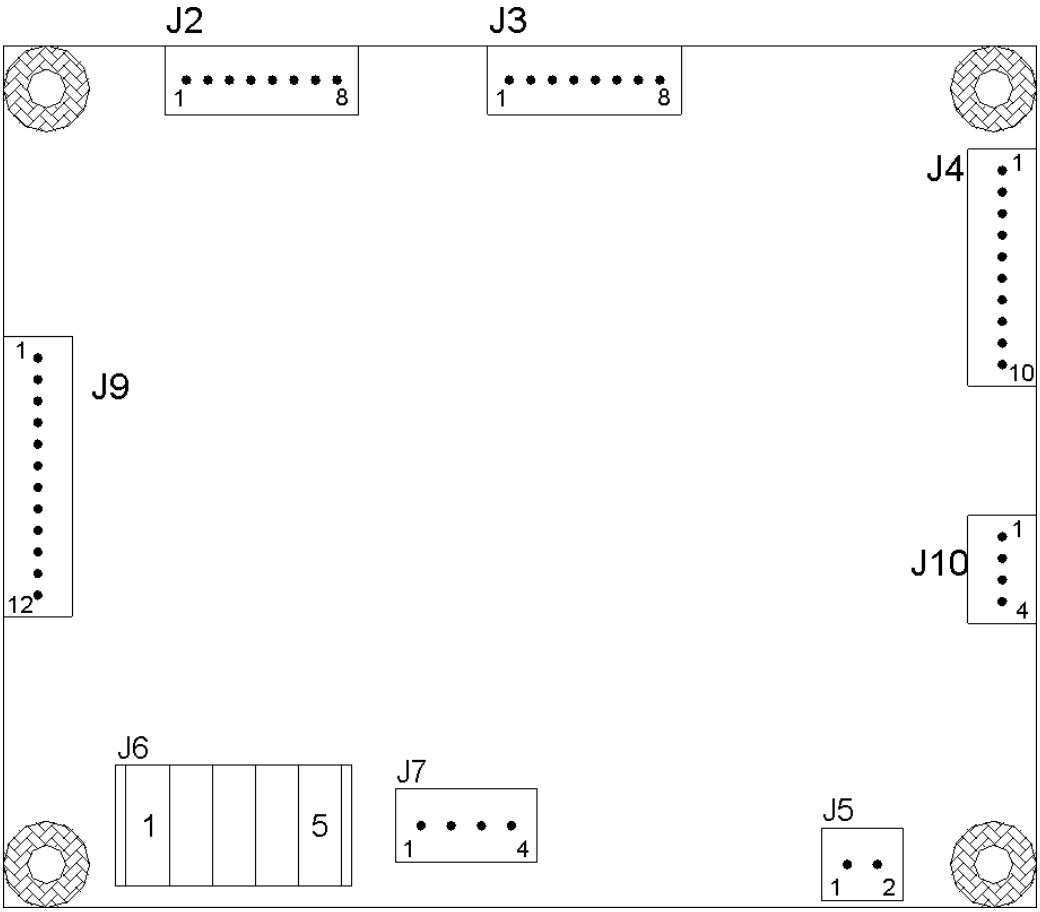
Chemical and physical properties		
Reserve alkalinity of 10ml	ASTM D 1121	13 – 15 ml HCl 01 mol/l
Density, 20°C	DIN 51 757 procedure 4	1,121 – 1,123 g/cm^3
Water content	DIN 51 777 part 1	max. 3,5 %
pH-value undiluted		7,1 – 7,3

7.6.1 Coolant mixture ratio

Water/antifreeze	Temperature
70:30	-20°C
65:35	-25°C
60:40	-30°C
55:45	-35°C
50:50	-40°C

7.6.2 Scheme VCS board

Fig. 7.6.2-1: Scheme VCS board



7.6.3 Legend VCS board

Fig. 7.6.3-1: J2, Analogue input

J2, Analogue input	
1	Temperature raw water input

J2, Analogue input	
2	Temperature fresh water input
3	Temperature cylinder head
4	Tank sensor
5	Temperature coil 1
6	Temperature coil 2
7	Temperature bearing
8	Reference (Ground)

Fig. 7.6.3-2: J3, Analogue / binary input

J3, Analogue / binary input	
1	Oil pressure analogue
2	Oil pressure switch
3	Temperature engine oil
4	Temperature raw water outlet
5	Temperature fresh water outlet
6	Temperature exhaust manifold
7	Temperature diode heat sink
8	Reference (Ground)

Fig. 7.6.3-3: J4, Analogue / binary input

J4, Analogue / binary input	
1	Supply output battery voltage / 2,5A
2	Supply output 5V / 1A
3	Binary input air intake
4	Analogue input raw water pressure
5	Binary input engine oil level
6	Binary input bearing oil level
7	Binary input coolant level
8	Binary input water leakage
9	Binary input alternator signal
10	Reference (Ground)

Fig. 7.6.3-4: J5, Power supply

J5, Power supply	
1	+9...18 or +18...36V DC
2	Reference (Ground)

Fig. 7.6.3-5: J6, Panel connector

J6, Panel connector	
1	Supply battery voltage / 1A
2	Reference (Ground)
3	Trigger signal „VCS on“
4	Serial IO „Data+“
5	Serial IO „Data-“

Fig. 7.6.3-6: J7, CT board connector

J7, CT board connector	
1	Supply battery voltage / 1A
2	Reference (Ground)
3	Serial IO „Data+“
4	Serial IO „Data-“

Fig. 7.6.3-7: J9, Binary output

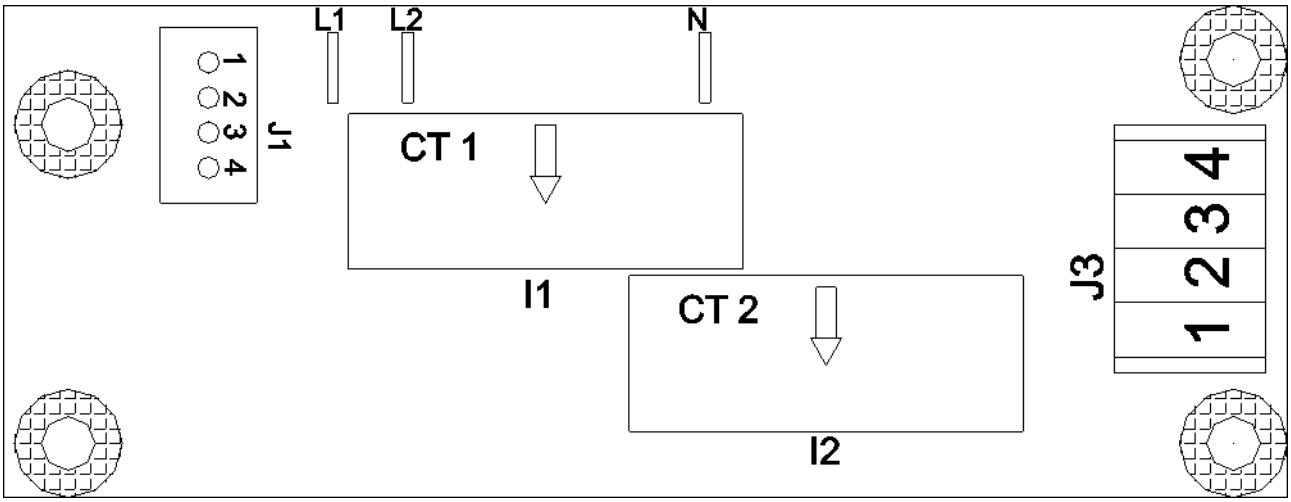
J9, Binary output	
1	Supply output battery voltage / 1A
2	Supply output battery voltage / 1A
3	Output „Motor start“
4	Output „Glow plugs“
5	Output „Fuel pump“
6	Output „Motor stop“
7	Output „Raw water pump“
8	Output „Ground separation relay“
9	Output „Ignition“
10	Output „Ready“
11	Output „Actuator +“
12	Output „Actuator -“

Fig. 7.6.3-8: J10, Digital / binary input

J10, Digital / binary input	
1	Supply output battery voltage / 0,5A
2	Sensing input local remote start
3	Sensing input engine speed
4	Reference (Ground)

7.6.4 Scheme current transformer board

Fig. 7.6-1: Scheme current transformer board



7.6.5 Legend measuring board

Fig. 7.6.5-1: J1, Connector to measuring/compensation board

J1, Connector to measuring/compensation board	
1	Supply voltage output
2	Ground
3	Serial bus data +
4	Serial bus data -

Fig. 7.6.5-2: J3, Booster control output

J3, Booster control output	
1	Booster on, +15V / max 10mA
2	Booster reference
3	Booster on, +15V / max 10mA
4	Booster reference

8. Remote control panel

The remote control panel is equipped with some monitoring functions, which increases the operational safety of the generator. A failure message is shown over contacts which are normaly closed. If a connection is intermitted triggers this a failure message.

There are two different displays:

1) The „Engine view“, which shows you the engine relevant datas like temperatures.

2) The „Generator view“, which shows you the generator relevant datas like voltages.

To Start the Engine:

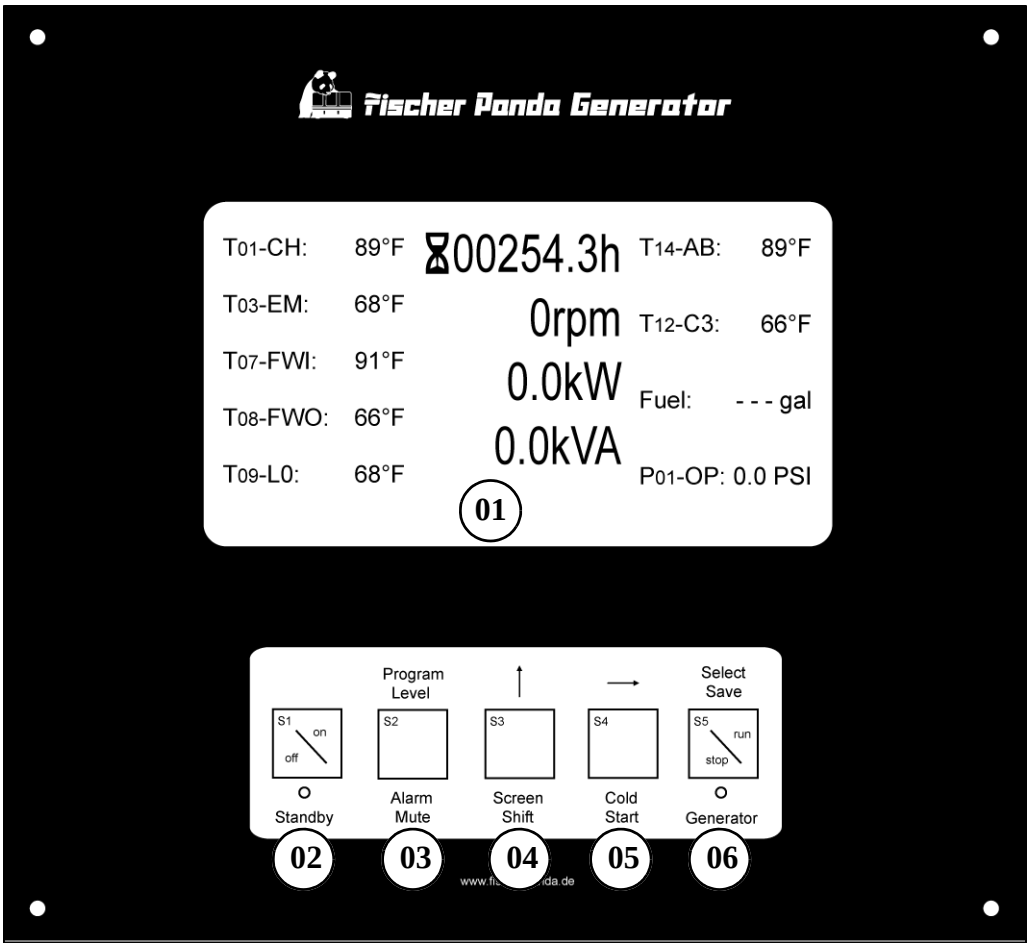
1.) Press the „Standby“-Switch (02) - the LED below the button has to come up.

You should see a display that looks like the one beneath.

2.) Press the „run/stop“ button (06) (after the automatic pre-glow phase the engines starts)

The LED below the button blinks during the start procedure, when the engine has started the LED flashes constant.
First the generator runs in idle-speed for the predefined period.
Than the engine runs up to the normal rotation speed.

Fig. 8.0-1: Digital Panda Remote Control Panel



01. Digital display
02. S1 Button „ON/OFF“ „Stand by“
03. S2 Button alarm mute / program level
04. S3 Button display shift
05. S4 Button rpm shift / cold start
06. S5 Button run/stop / select save

Panel „Engine view“ in Stand by mode

T01-CH: Cylinder head

T02-EM: Exhaust manifold

T07-FWI: Freshwater - in

T08-FWO: Freshwater - out

T09-LO: Lubricating oil

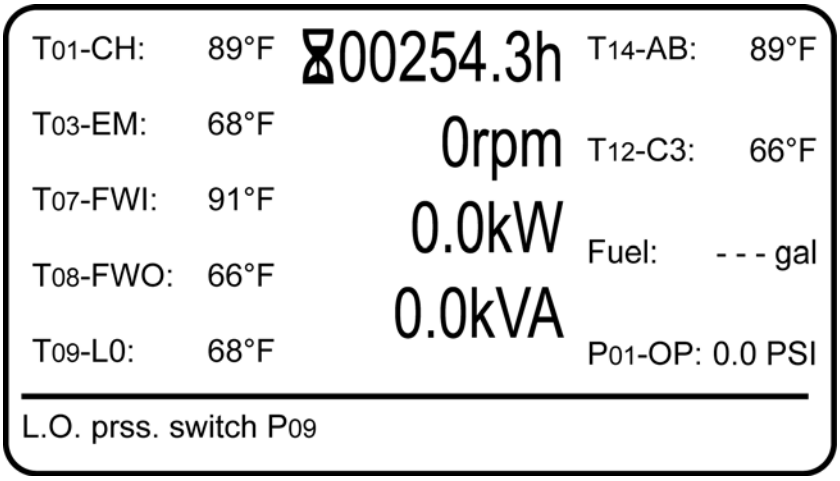
T14-AB: Alternator bearing

T12-C3: Temperatur at coil 3

(display changes - only the coil with the the highest temperature)

P01-OP: Oil-pressure

„- - -“ means that the sensor isn’t connected or a cable is broken.



Panel „Generator view“ in Stand by mode

01: rounds per minute

02. elapsed hours

03: apparent power

04: frequency 0Hz

05: status line(s)

06: effective power with bar line

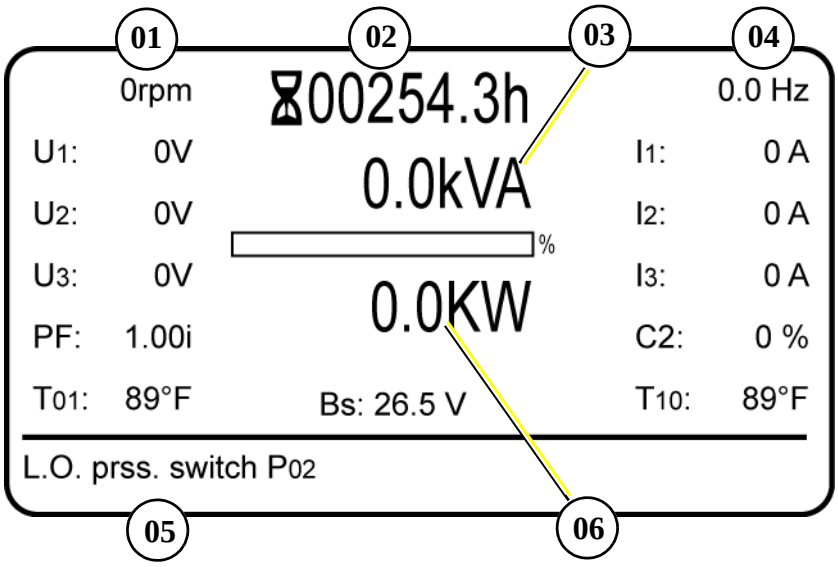
PF: active power factor

Bs: battery voltage

C2: compensation level

Un: phase voltage

In: phase current



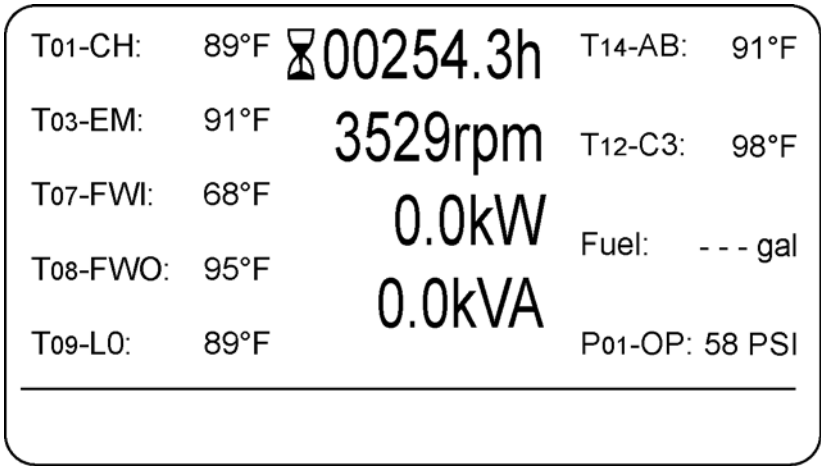
Panel „Engine view“ when unit is running without load

After pressing start and after the automatic pre-glow phase, the generator runs in idle-speed.

The engine runs up to the normal rotation speed of about 3529rpm.

The temperatures at the different test points begin to change.

Oil pressure shows 58 PSI.

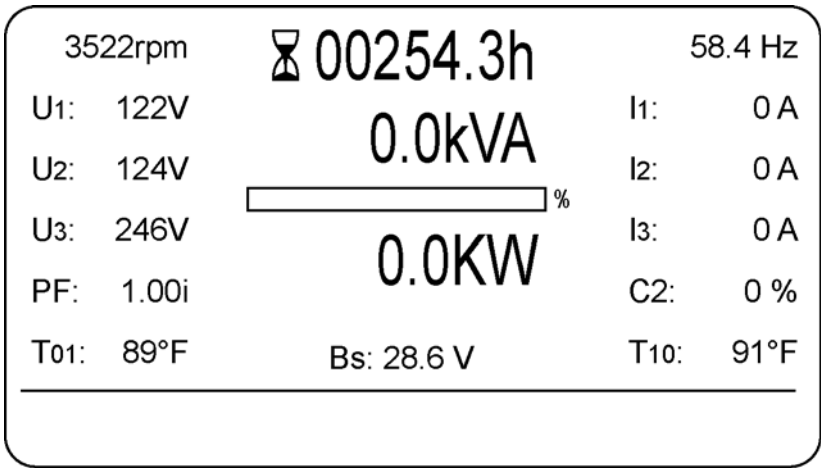


Panel „Generator view“ when unit is running without load

The rotation speed keeps constant at approx. 3500rpm

Now you can see the voltages at the seperat phases.

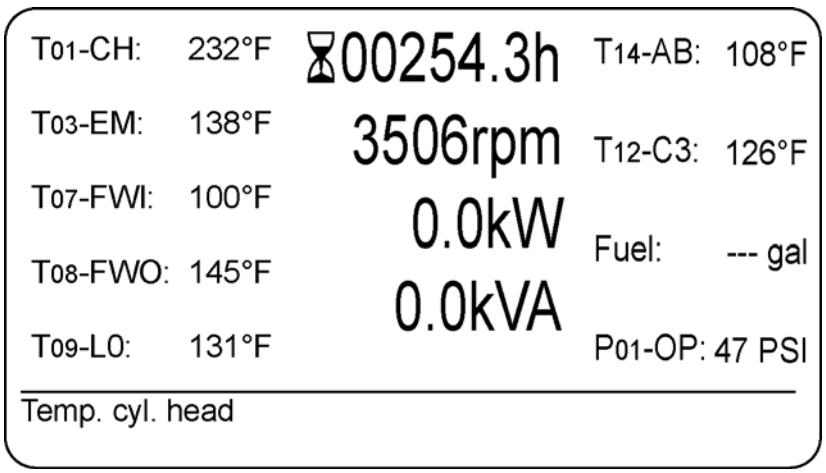
Values for kVA and kW are 0, because the generator runs without load.



Panel „Engine view“ in case of warning

T01-CH, the cylinder head - temperature has reached 232°F. The other temperatures are inside the permissible range.

A warning „Temp. cyl head“ occurs at the lower left side of the panel.

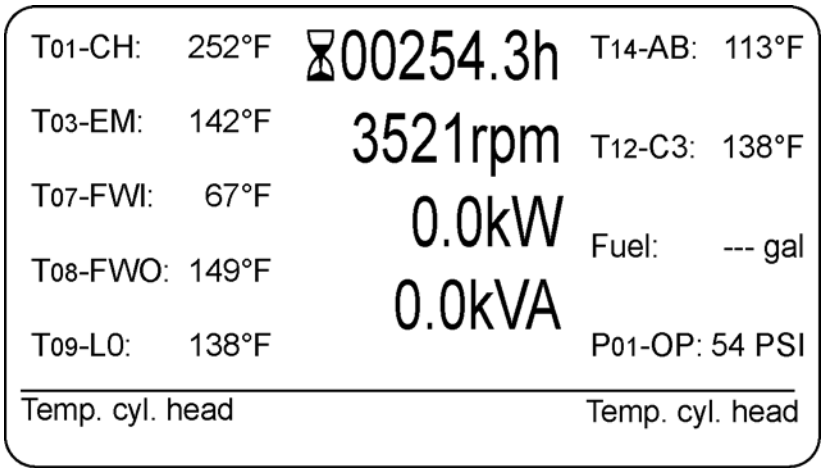


Panel „Engine view“ in case of error

T01-CH, the cylinder head - temperature has reached 252°F. The other temperatures are inside the permissible range.

A warning „Temp. cyl head“ occurs at the lower left side of the panel.

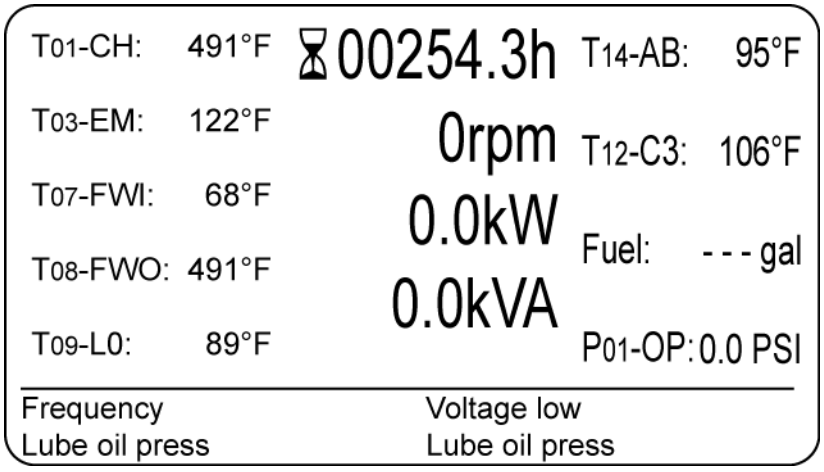
Additionaly, a failure comes at the lower right side.



Panel „Engine view“ after error-caused shutdown

The engine shuts down and the two status lines show different warnings and failures.

Naturally, there aren't 491°F at the T01 or T08. This value says that the temperature is too high and the engine has shut down.



Program mode for panel parallel switching

ATTENTION: It is not allowed to program two panels at the same time. Pragram first one panel and then the second.

To get into the „Program mode“ press the buttons „Program Level (S2)“ and „Display shift (S3)“ at the same time.

In this mode you must adust the panel for parallel switching.

To change the settings use button S3 and to scroll use button S2.

The „Display“ must be switched to „US standard“.

The first panel get the „Adress 0“.

The second panel get the „Adress 1“

To store this settings press the button „Select Save“.

Display:	US standard (metric)
Adress:	0 (1-7)
Nominal power:	0200 x0.1kW

An failure override button enables an immediate restart facility of the generator, should it cut out, even if this was caused by over-heating. There is normally a requirement to wait until the motor has cooled down to the correct temperature. This can last for several hours in certain circumstances, since the generator is enclosed in a sound-insulated casing, which prevents heat loss.

This period can be reduced by pushing the „Alarm Mute“ button. By pressing the button all faults are overrided for 10 seconds. When the button is pressed again during the 10 seconds, 10 seconds will be added to the remaining time. The generator can be started. The button bypasses any faults allowing the generator to run.

Before depressing the button, a manual check of the oil dipstick must be carried out to determine whether the generator has sufficient oil, as it is possible that the oil pressure switch causes the generator to cut out. If it has been ascertained that the reason for the motor cutting out is overheating and not lack of oil, the generator can be run for several minutes without load, so that the motor is cooled by the circulating coolant.

ATTENTION:

If the temperature is the reason for the generator cutting out when it is running under load, then an immediate check must be made to determine the cause. It could be a fault with the cooling system, one of the fans, the air-intake or a fault with the external cooling system.

Continual use of the starter-override switch should be avoided, while the generator cuts out during operation. The generator must always run without load for several minutes before being switched off, so that a temperature compensation occurs. Heat accumulation can cause the generator to overheat, even after ist has been switched off.

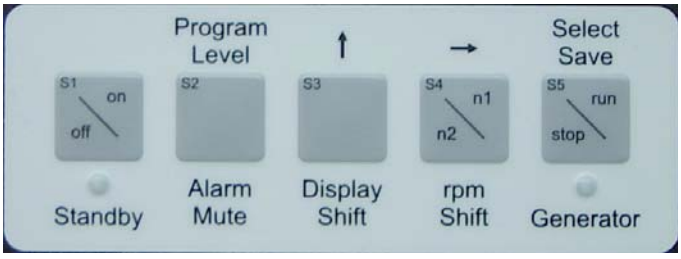
Should the overheating alarm be set off, caused by heat accumulation, after the generator has been switched off, then this can also be bypassed using the switch.

Push:

„Alarm Mute“ to acknowledge

again „Alarm Mute“ to deactivate all sensors and

„Motor Start“ to restart the engine



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