Fischer Panda®

Power wherever you are™

Marine Generator Manual

Panda 4500 PMS FCB 230 V - 50 Hz

Panda 4200 PMS FCB 120 V - 60 Hz

Super silent technology

Fischer Panda GmbH

Current revision status

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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!

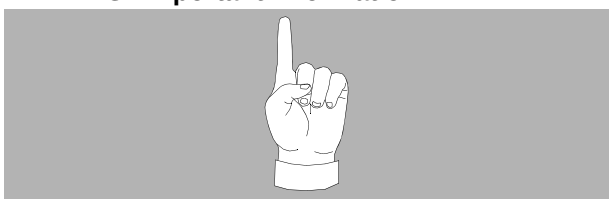
These symbols are used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury of lethal danger during certain maintenance work or operations. Read these instructions carefully.

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

An external signal may trigger an automatic start-up.

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: Hearing damage

WARNING: Magnetic field

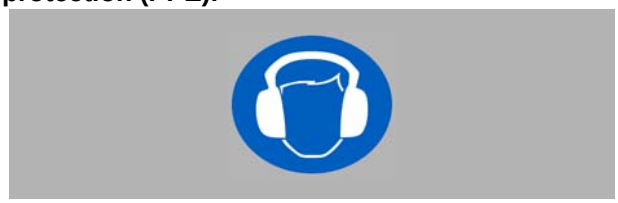
WARNING: Overpressure

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 98/37/EC

Manufacturer declaration in accordance with the Machinery Directive 98/37/EC

The generator was designed in such a way that all assemblies correspond with the **CE guidelines**. If Machinery Directive 98/37/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 98/37/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“ a/or 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.

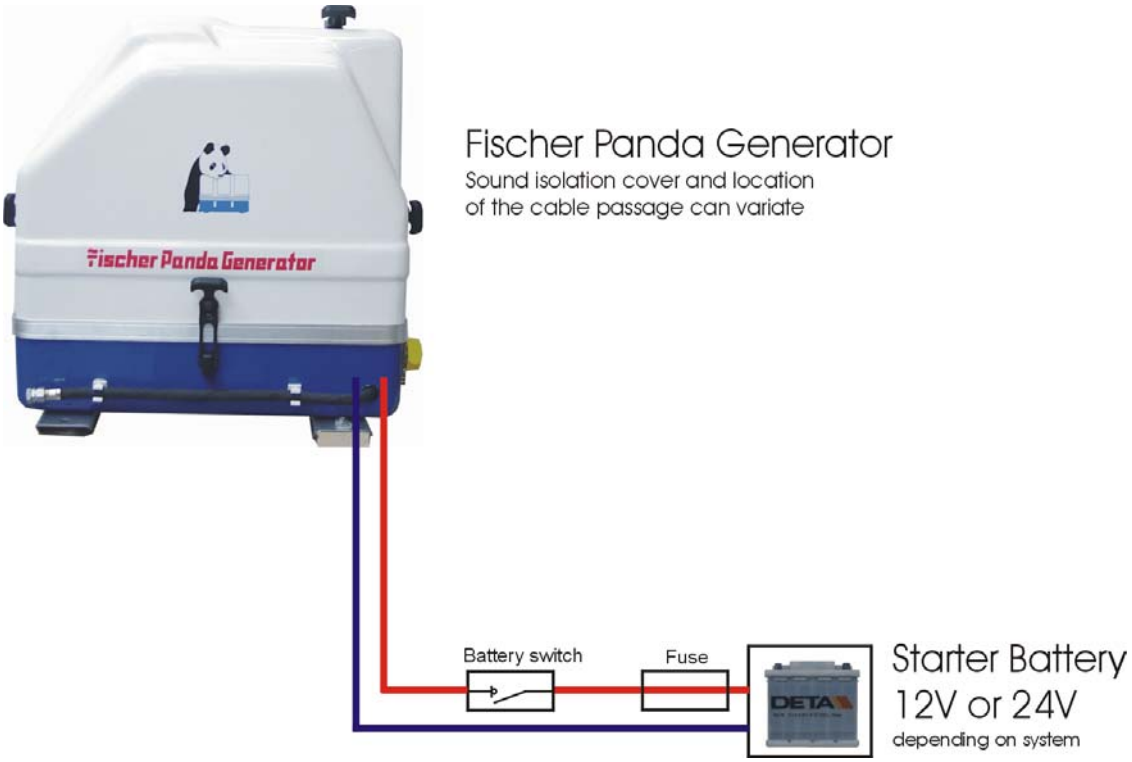
Install the battery cables in such a way that the insulation cannot be removed by chafing or other mechanical stresses.

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.

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

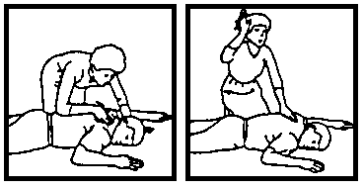
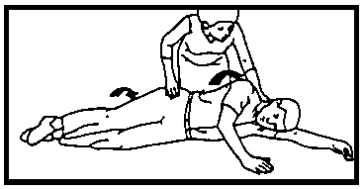
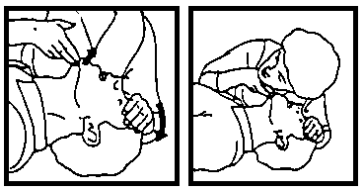
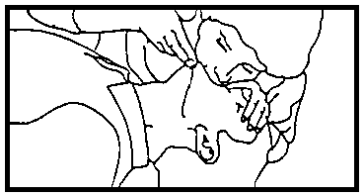
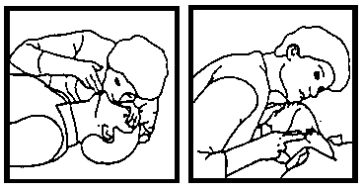


	First Aid in case of accidents by electrical shocks 5 Safety steps to follow if someone is the victim of electrical shock	
1	Do not touch the injured person while the generator is running.	
2	Switch off the generator immediately.	
3	If you cannot switch off the generator, pull, push, or lift the person 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.	

2.7 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.

3. Basics

3.1 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.

3.1.1 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.

3.1.1.1 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.

3.1.2 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.

3.1.2.1 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.

3.2 Panda Transport Box

3.2.1 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

3.2.2 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

3.3 Transport and Loading/Unloading

3.3.1 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.

3.3.2 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. 3.3-1: Lifting yoke (example)

3.4 Scope of delivery

The Fischer Panda PMS generator system contains following components:

3.4.1 Asynchronous Generatoren:

Fischer Panda Generator

representative picture

Fig. 3.4-1: Fischer Panda Generator

Remote control panel

representative picture

Fig. 3.4-2: Remote control panel

AC Control Box

Fig. 3.4-3: 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. 3.4.1-4: Fischer Panda Manual

The Fischer Panda Manual contains following components:

- Clear foil bag with general informations ect.

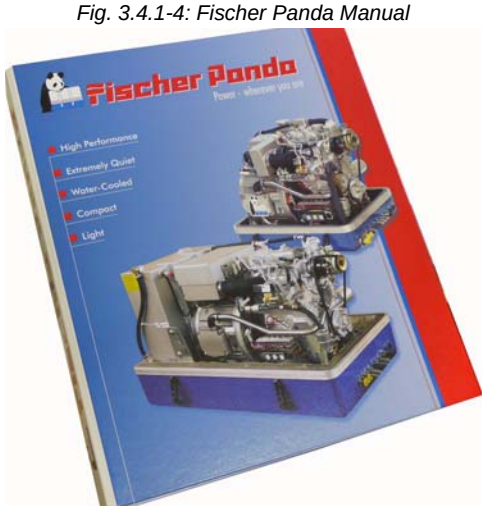
- Generator manual with added remote control panel manual

- 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.

3.5 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. 3.5-1: Sound insulation capsule, side part

Closure locked

Fig. 3.5.0-2: Closure locked

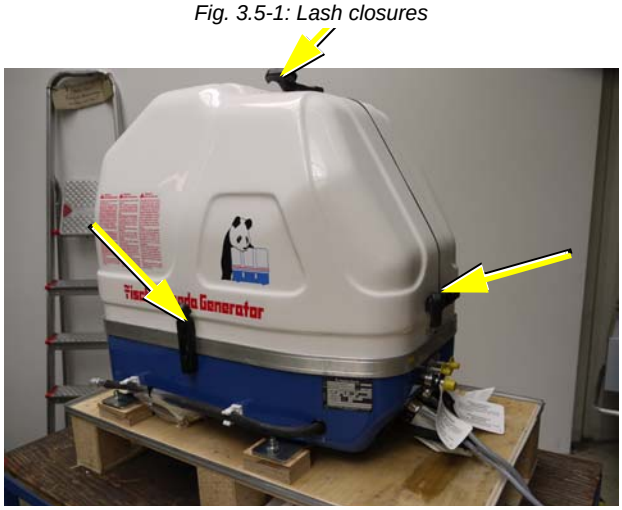
Closure open

Fig. 3.5-3: Closure open

3.5.1 Opening the GFK sound insulation capsule

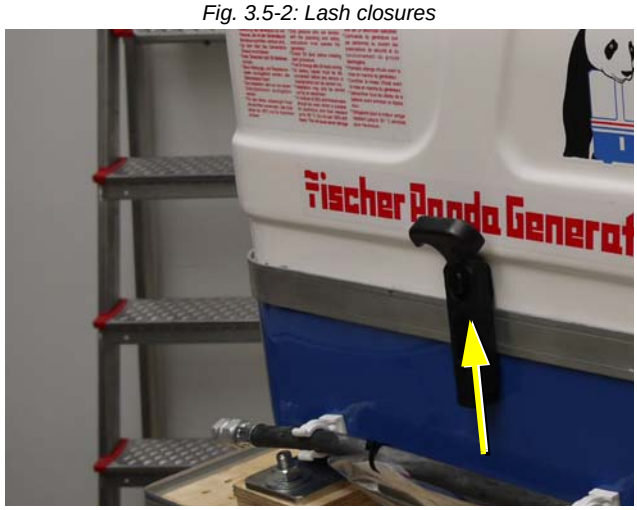
GFK sound insulation capsule with lash closures

Fig. 3.5-1: 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. 3.5-2: Lash closures



3.6 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).

3.6.1 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:

3.6.2 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

3.6.3 Arrangements at a medium-term standstill / winter storage

Medium-term stand still (3 to 6 months)

3.6.3.1 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!**

3.6.3.2 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 oilpressure 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.

3.6.4 Arrangements at a long-term standstill / shutdown

Standstill (more than 6 months)

3.6.4.1 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!**

3.6.4.2 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:

3.7

4. The Panda Generator

4.1 Type plate at the Generator

Fig. 4.1-1: Type plate at the generator - Picture shows 4000s SC

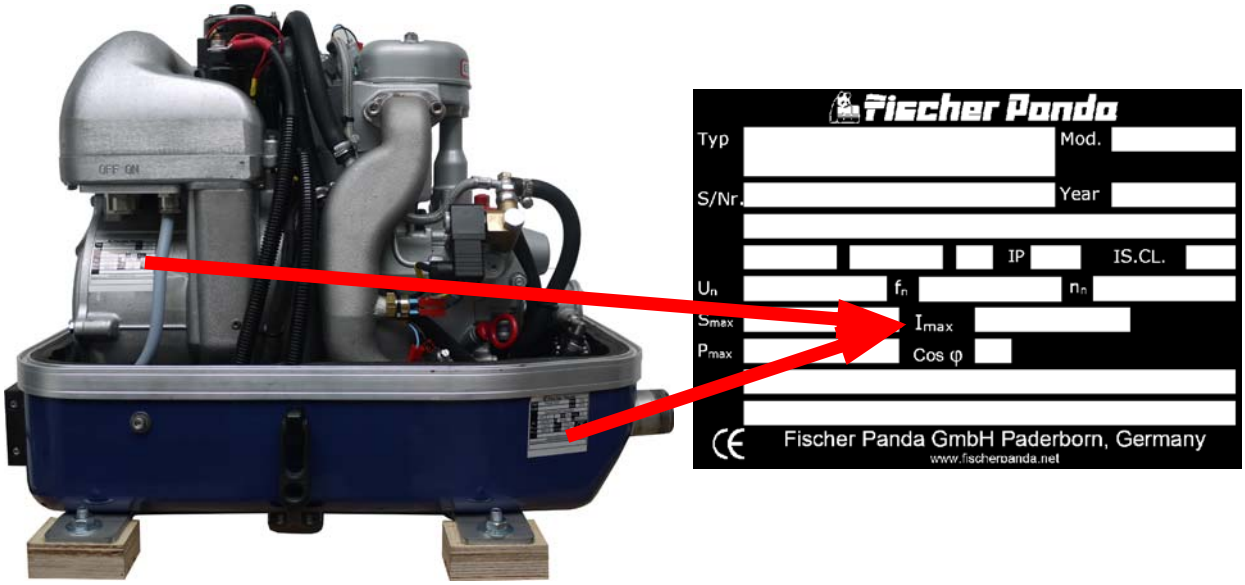
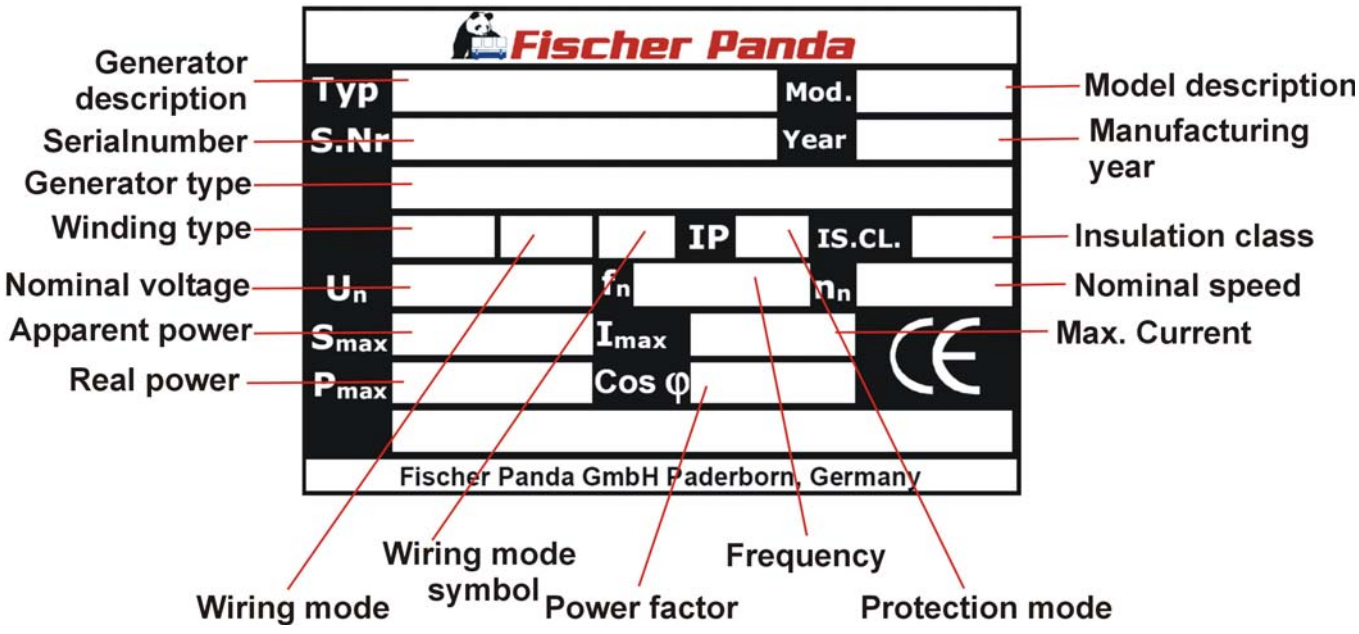


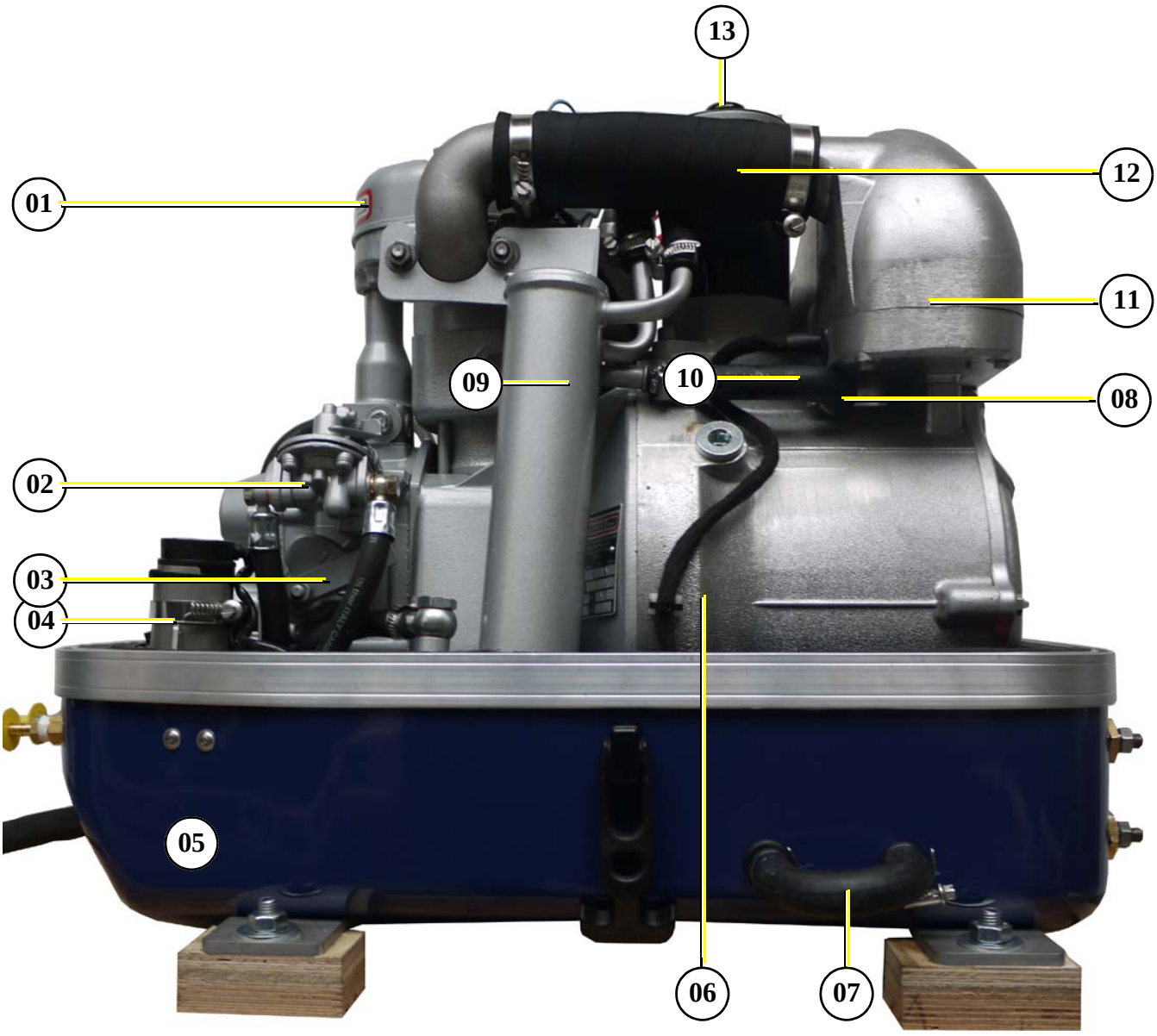
Fig. 4.1-2: Discription type plate



4.2 Description of the Generator 42000/4500 PMS

4.2.1 Right Side View 4200/4500 PMS

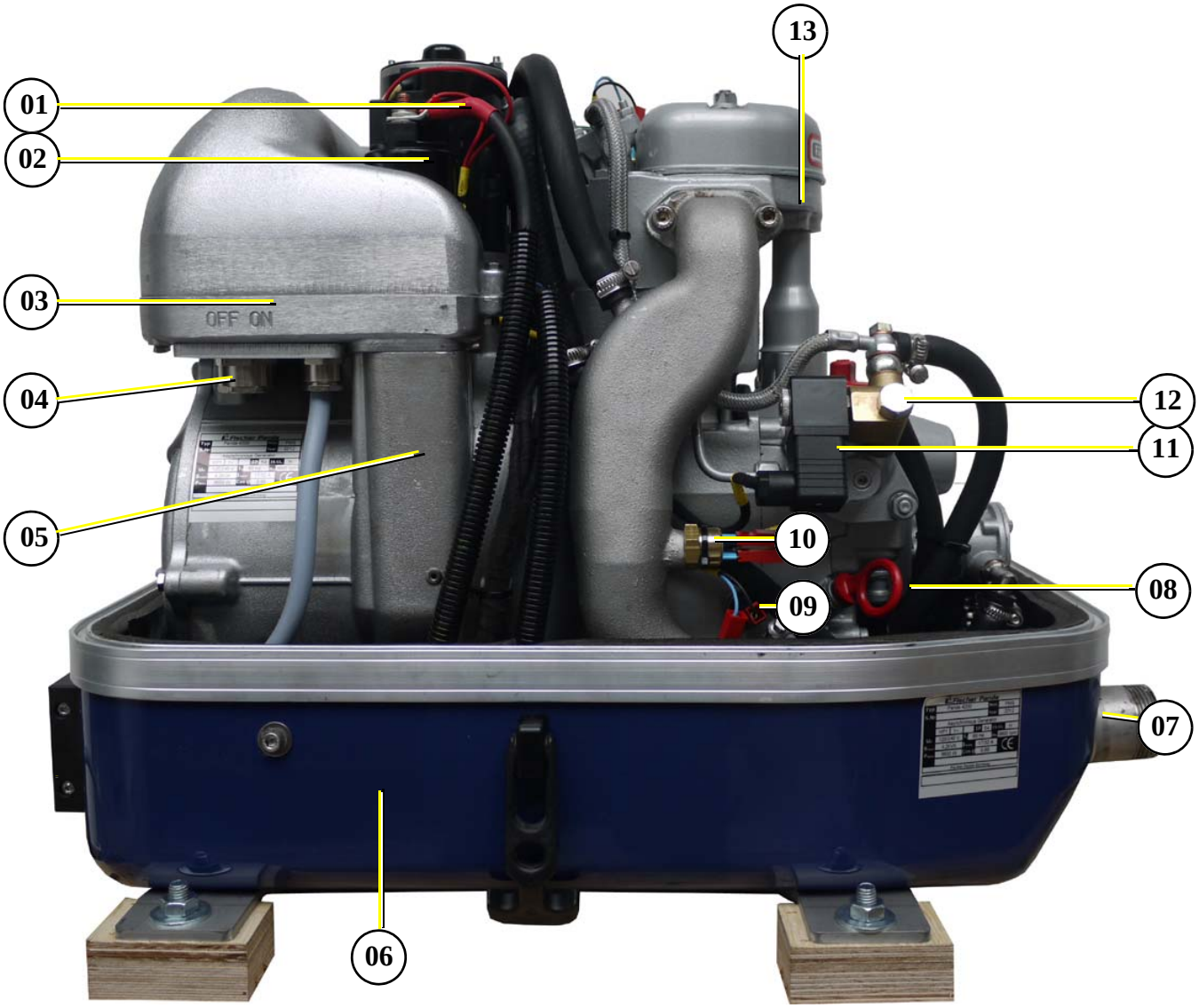
Fig. 4.2.1-1: Right side view



01) Cylinder head
02) Mechanical fuel pump
03) Speed adjust lever
04) Raw water pump
05) Sound cover base part
06) Generator housing with coil
07) Connection point external ventilation valve
08) Cooling water out at winding
09) Heat exchanger
10) Cooling water bypass from winding out to engine out
11) Generator power terminal box and airfilter housing
12) Air suction hose
13) Starter motor

4.2.2 Left Side View 4200/4500 PMS

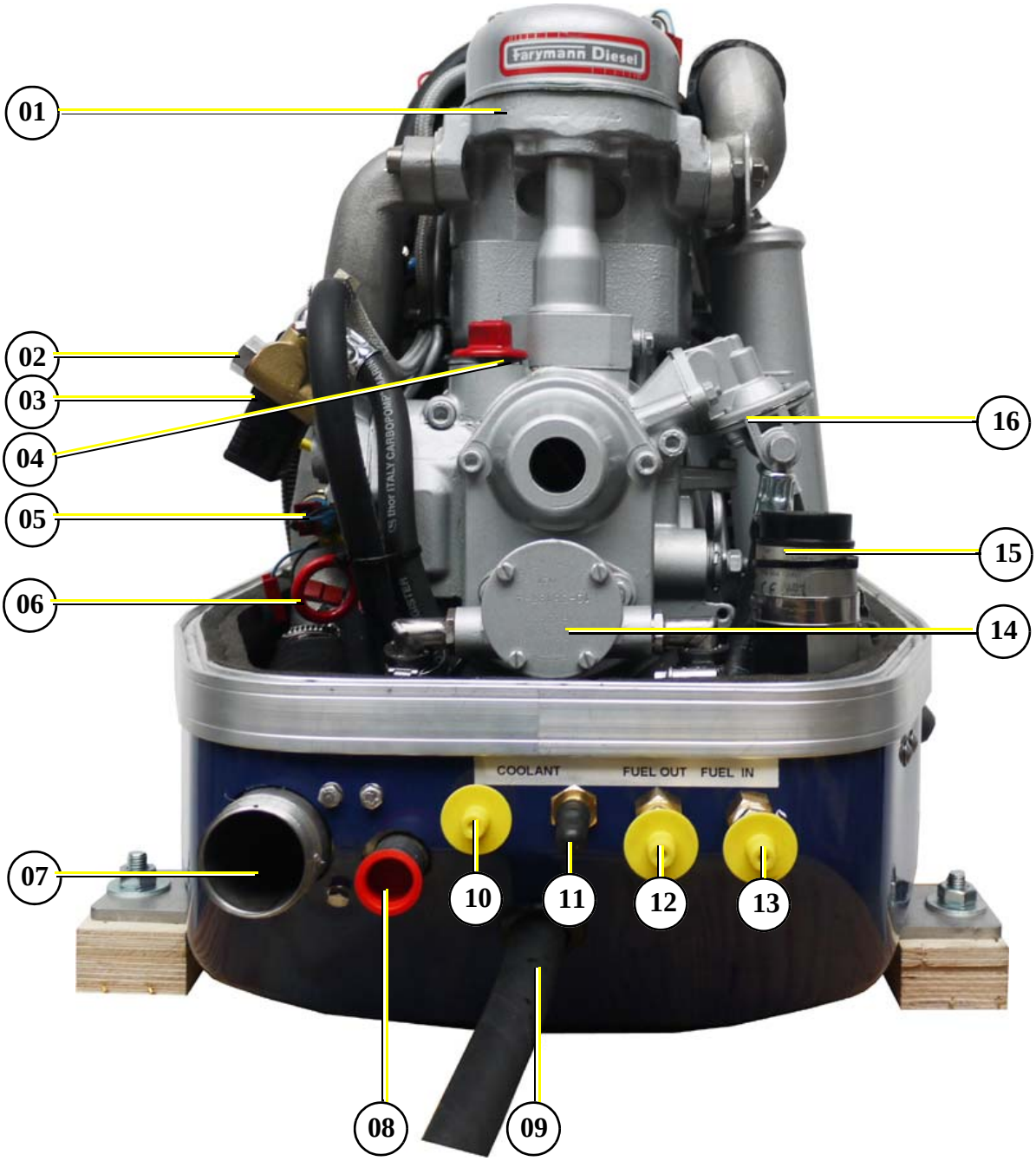
Fig. 4.2.2-1: Left side view



01) Starter motor
02) Solenoid switch for starter motor
03) Generator power terminal box and airfilter housing
04) Passage for load cable
05) Air suction pipe
06) Sound cover base part
07) Raw water in
08) Oil dipstick
09) Oil pressure switch
10) Thermo switch exhaust elbow
11) Fuel solenoid valve
12) Vent screw at fuel solenoid\
13) Cylinder head

4.2.3 Front View 4200/4500 PMS

Fig. 4.2.3-1: Front view



01) Cylinder head
02) Ventilation screw solenoid valve
03) Fuel solenoid valve
04) Oil filler neck
05) Water cooled exhaust elbow
06) Engine oil dipstick
07) Exhaust out
08) Cooling water in
09) Oil drain hose
10) Connection to external expansion tank (vent line)
11) Connection from external expansion tank (fill line)
12) Connection fuel OUT
13) Connection fuel IN
14) Raw water pump
15) Fresh water pump
16) Fuel pump

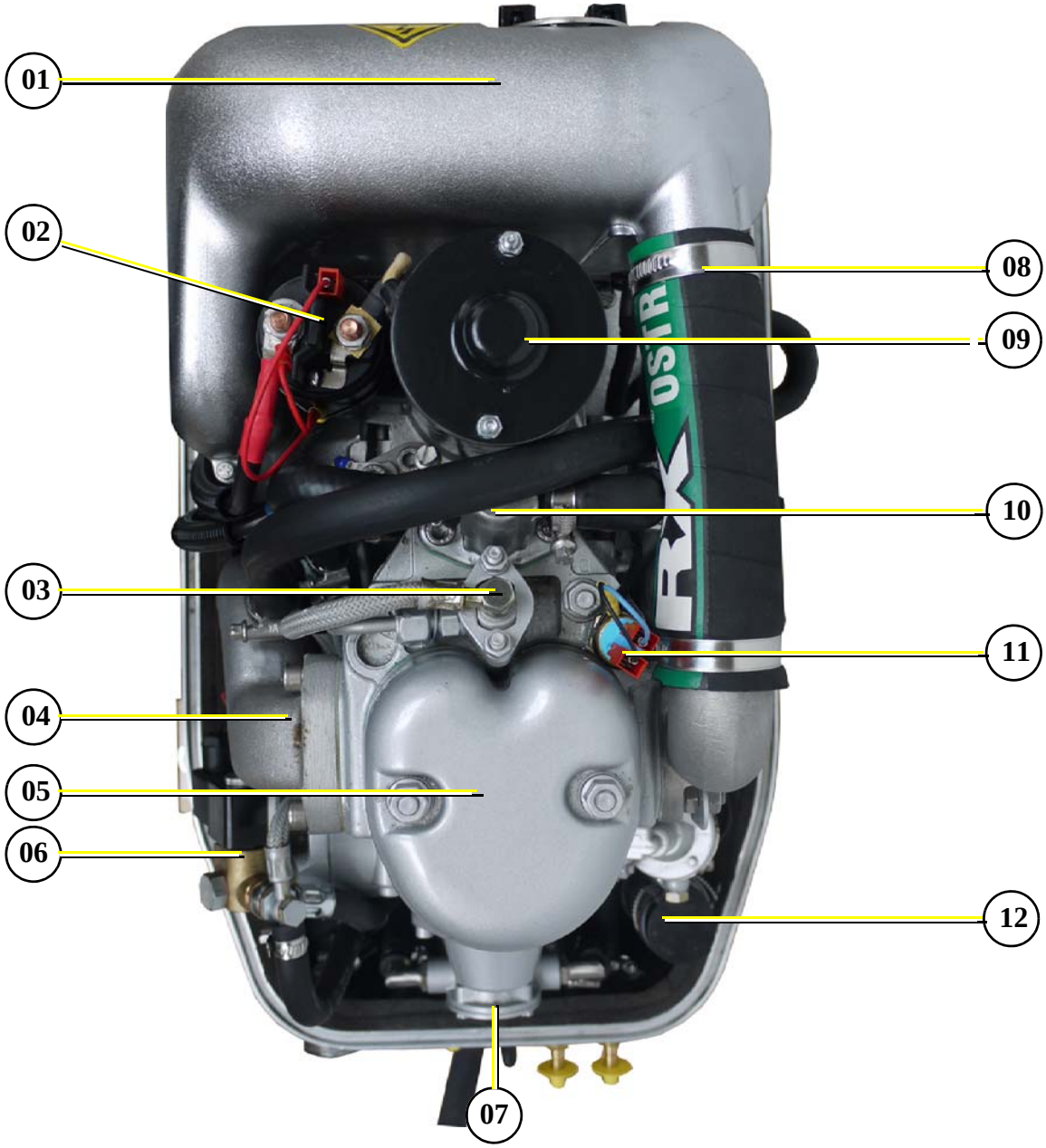
4.2.4 Back View 4200/4500 PMS

Fig. 4.2.4-1: Back view

01) Starter motor
02) Generator power terminal box and airfilter housing
03) Front plate
04) Ball bearing
06) Connection point Starter battery (-)
07) Connection cable to remote control panel
08) Connection cable to AC control box
09) Snap in holder air filter

4.2.5 View from above 42000/4500 PMS

Fig. 4.2.5-1: View from above



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

4.3 Details of Functional Units

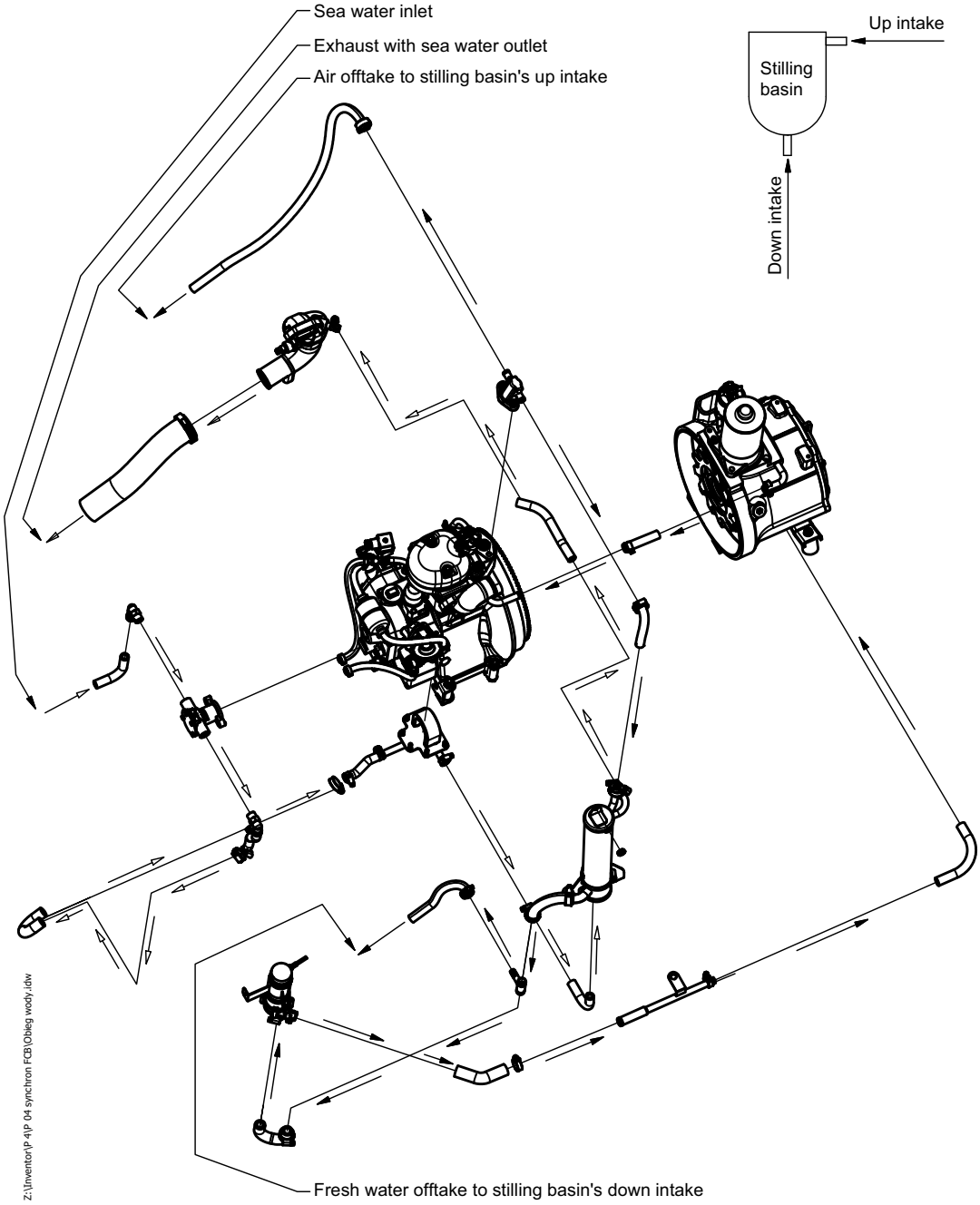
4.3.1 Remote Control Panel - see Remote Control Panel Datasheet

Remote Control Panel

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

4.3.2 Components of Cooling System (Raw water + Fresh water)

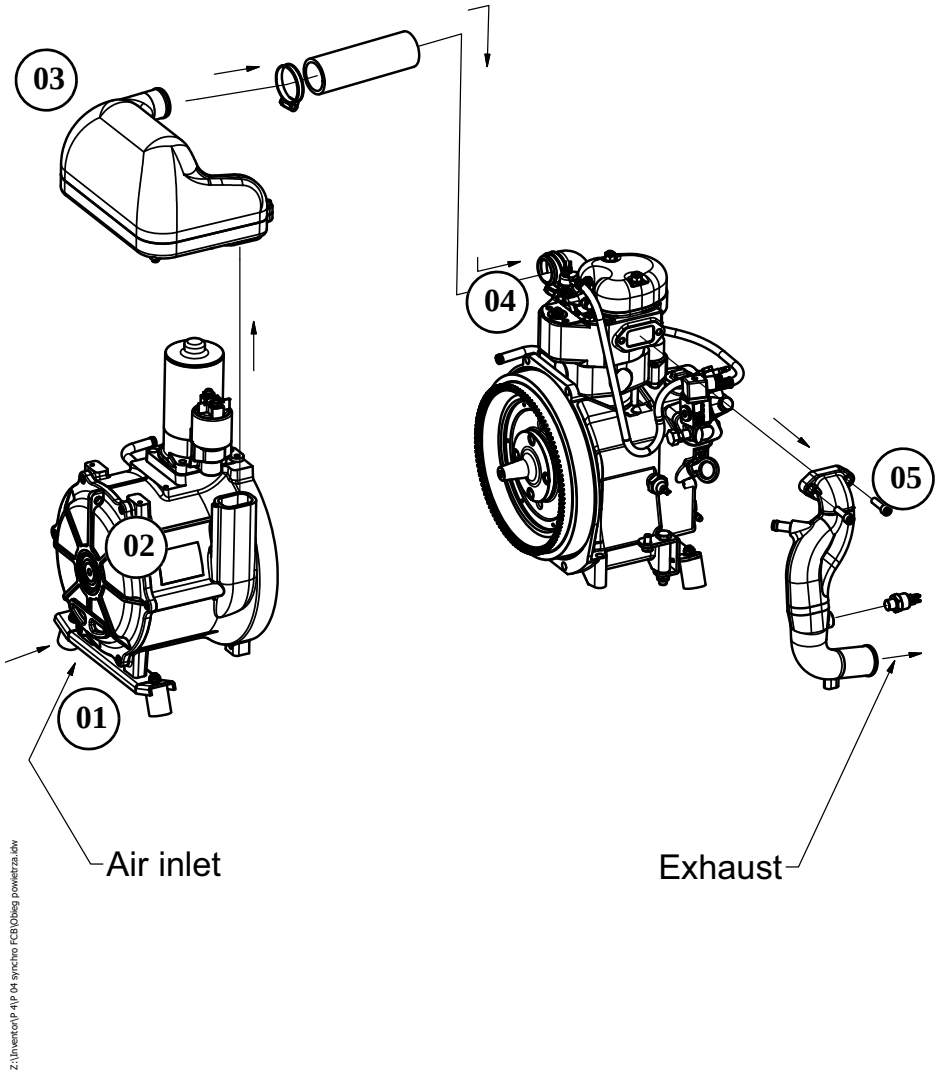
Fig. 4.3.2-1: Two circle system



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

4.3.3 Components of conbustion air

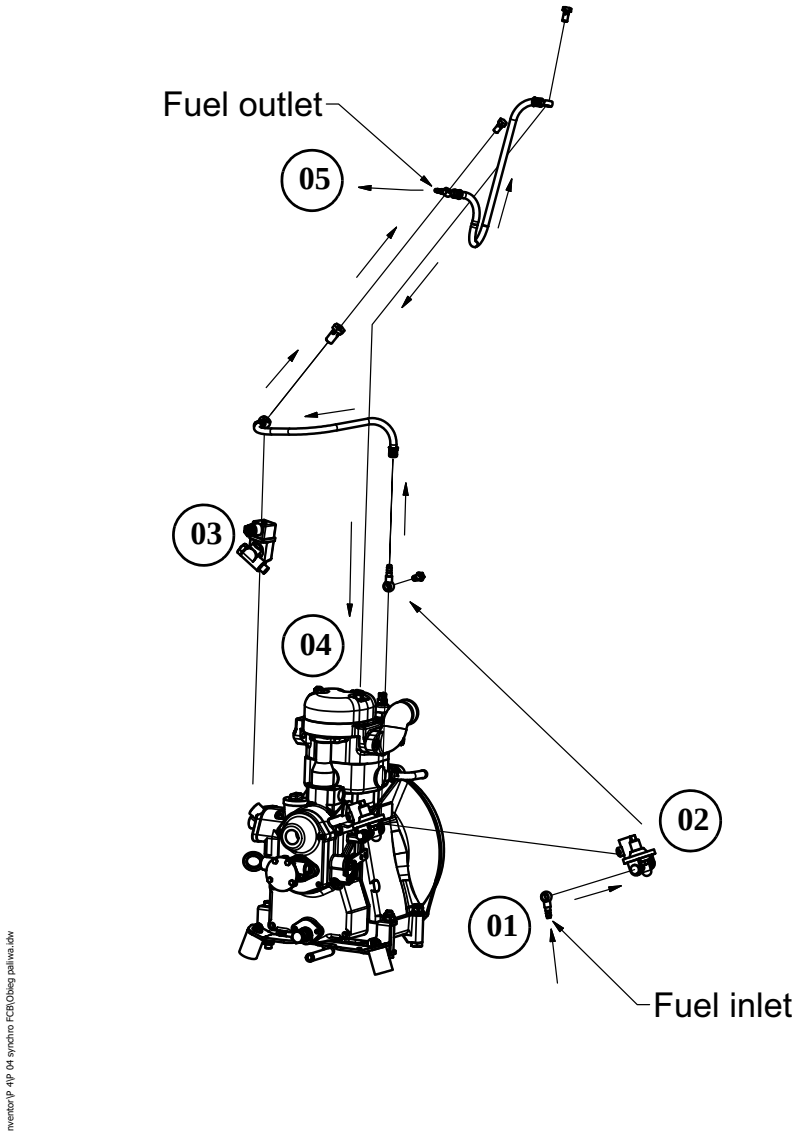
Fig. 4.3.3-1: Combustion Air circle



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

4.3.4 Components of the Fuel System 4000s SC + 4000s FC

Fig. 4.3.4-1: Fuel circle



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

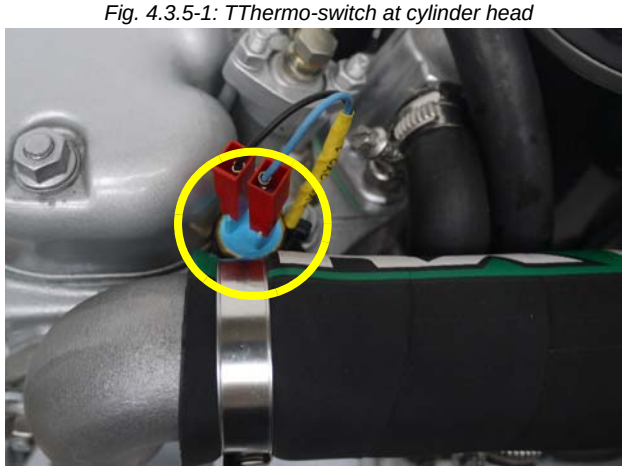
4.3.5 CSensors and Switches for Operation Surveillance

Thermo-switch at cylinder head

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

Sample picture 4000s FC

Fig. 4.3.5-1: TThermo-switch at cylinder head

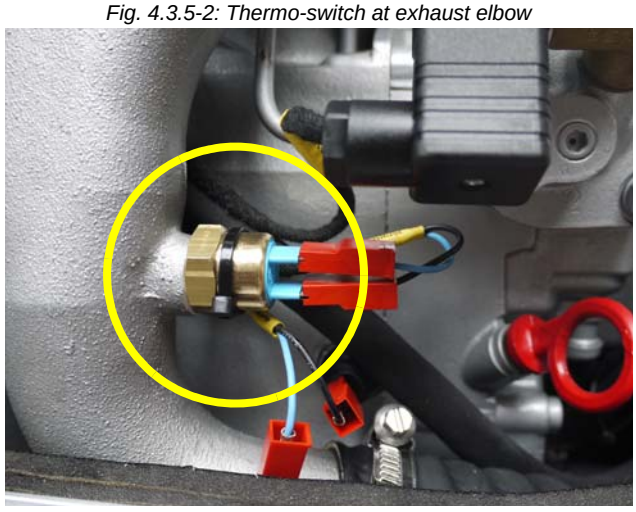


Thermo-switch at water-cooled exhaust elbow

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

Sample picture 4000s FC

Fig. 4.3.5-2: Thermo-switch at exhaust elbow



Thermo-switch in the generator coil

1. Generator coil

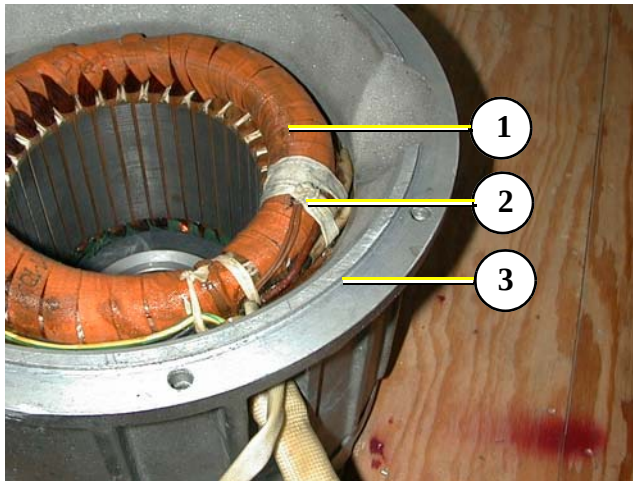
2. Thermo-switch

3. Housing

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

Sample picture

Fig. 4.3.5-3: Thermo-switch coil

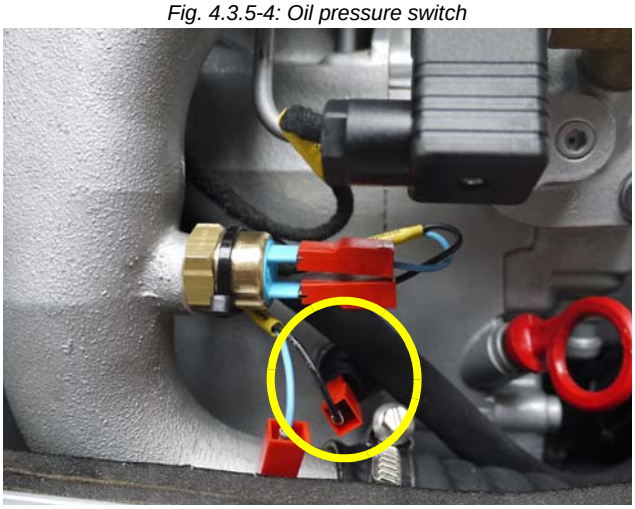


Oil pressure switch

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

Sample picture 4000s FC

Fig. 4.3.5-4: Oil pressure switch



4.3.6 Components of Oil Circuit 4000s SC + 4000s FC

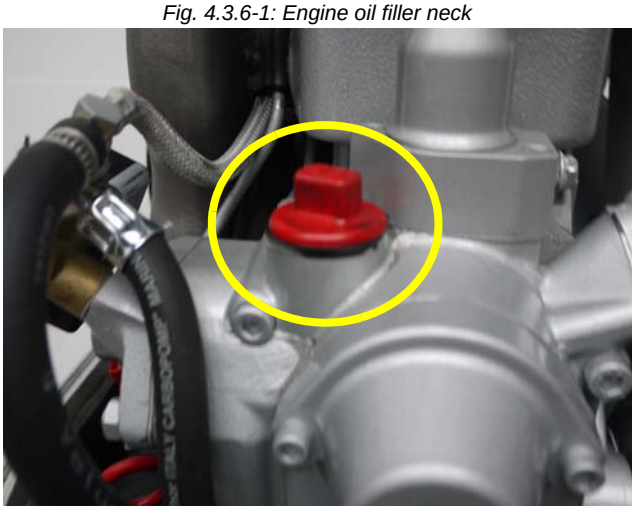
Oil filler neck with cap

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

Consider also the references to the engine oil specification.

Sample picture 4000s FC

Fig. 4.3.6-1: Engine oil filler neck

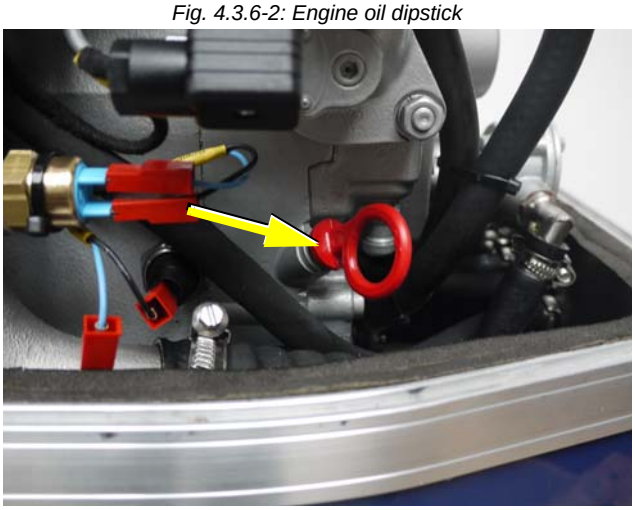


Oil dipstick

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

Sample picture 4000s FC

Fig. 4.3.6-2: Engine oil dipstick

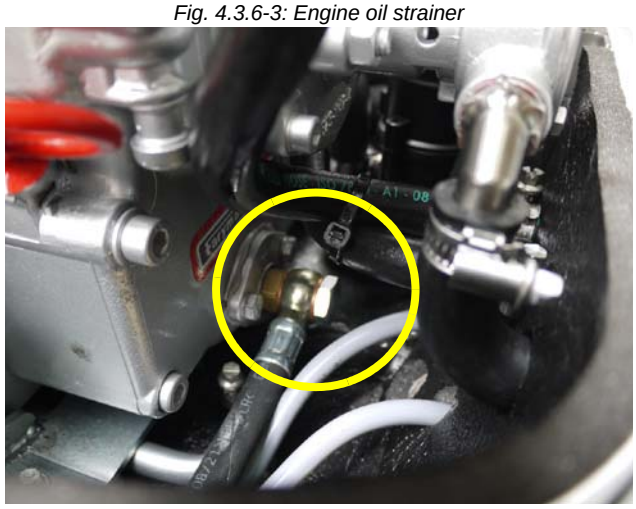


Engine oil strainer

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

Sample picture 4000s FC

Fig. 4.3.6-3: Engine oil strainer



Oil drain hose

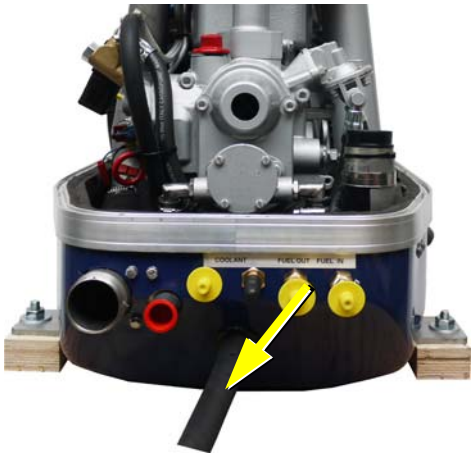
The Panda generator is so equipped that the engine oil can be drained by a drain hose. The generator should always be installed in such a way, that a collecting basin can be placed deep enough.

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

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

Sample picture 4000s FC

Fig. 4.3.6-4: Engine oil drain hose



4.4 Operation manual

4.4.1 Preliminary remarks

Advices regarding Starter Battery

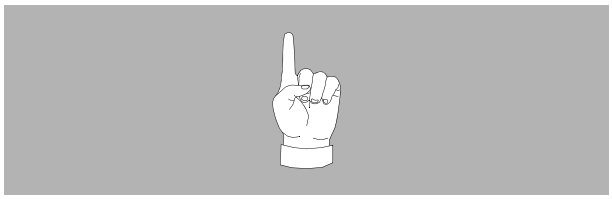
Fischer Panda recommends to use a normal starter battery. If the generator is required for extreme winter conditions, the starter battery capacity should be doubled. It is recommended to regularly charge the starter battery by a suitable battery-charging device (i.e. at least every two months). A correctly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

4.4.2 Daily routine checks before starting

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

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

Notice!:OIL PRESSURE CONTROL!



You should change the oil independently from the ambient temperature - see section 8.5, “Engine oil,” on page 135. Engine oil volume see section 8.2, “Technical Data,” on page 130.

2. State of cooling water.

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

3. Open sea cock for cooling water intake.

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

4. Check raw water filter.

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

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

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

6. Check all electrical lead terminal contacts are firm.

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

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

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

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

   The generator should only be started when all load have been switched off. The excitation of the generator will be suppressed, if the generator is switched off with load connected, left for a while, or switched on with extra load, thus reducing the residual magnetism necessary for excitation of the generator to a minimum. In certain circumstances, this can lead to the generator being re-excited 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).

4.4.3 Starting Generator- see remote control panel datasheet

In the event of starting problems, close the sea water inlet cock. Panda marine generators only.

Should there be any reason to turn the engine (over) or start the engine i.e. to bleed the fuel system, the sea water inlet cock must be closed! During the starting process, the cooling water pump is driven with the motor. The cooling water is discharged to the exhaust outlet and, since the motor has not run, the exhaust pressure is not high enough to expel the sea water which has been brought to the exhaust outlet. To avoid filling the exhaust outlet with water and causing further problems, close the inlet sea water valve.

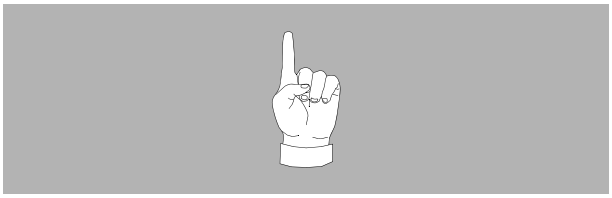
Once the engine is running, be sure to open the inlet valve!

Attention!:

4.4.4 Stopping Generator - see remote control panel datasheet

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

Notice!:



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5. Installation Instructions

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.

5.1 Personal requirements

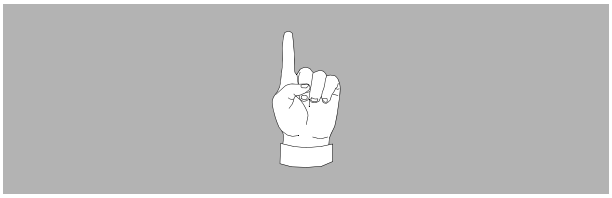
The described installation must be done by a technical trained person or a Fischer Panda service point.

5.1.1 Hazard notes for the installation

see “Safety first!” on Page 8.

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

Warning!: Risk of injury

injuries.

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.

5.2 Place of installation

5.2.1 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.

5.2.2 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 12mm/½“)

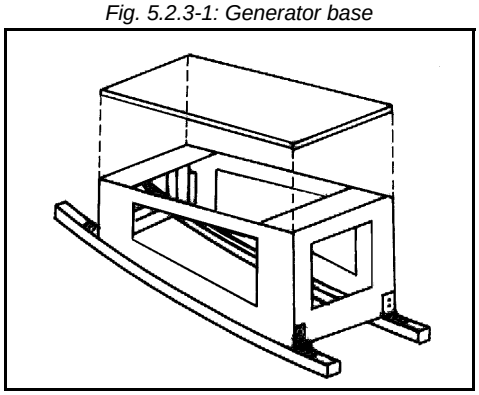
The generator sucks its air from the surrounding engine room. Therefore it must be ensured that sufficient ventilation openings are present, so that the generator cannot overheat.

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.

5.2.3 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. 5.2.3-1: Generator base



5.3 Generator Connections - Scheme

See chapter „The Panda Generator for the original position of the connections

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

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

Before working (installation) on the System read the section Cooling System Installation - Raw water

See chapter 3 for the original position of the connections

ATTENTION! 7

5.4 Installation of the cooling system - raw water

5.4.1 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:

5.4.2 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

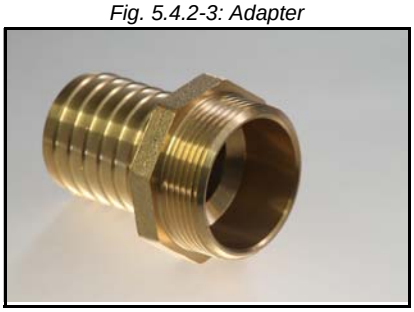
Fig. 5.4.2-1: Thru hull fitting with strainer

Sea cock

Fig. 5.4.2-2: Sea cock

Adapter

Fig. 5.4.2-3: Adapter

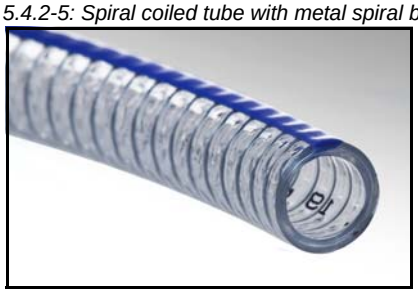


Raw water filter

Fig. 5.4.2-4: Raw water filter

Spiral coiled tube with metal spiral bead

Fig. 5.4.2-5: Spiral coiled tube with metal spiral bead



Ventilation valve

Fig. 5.4.2-6: Ventilation valve

Hose clamps

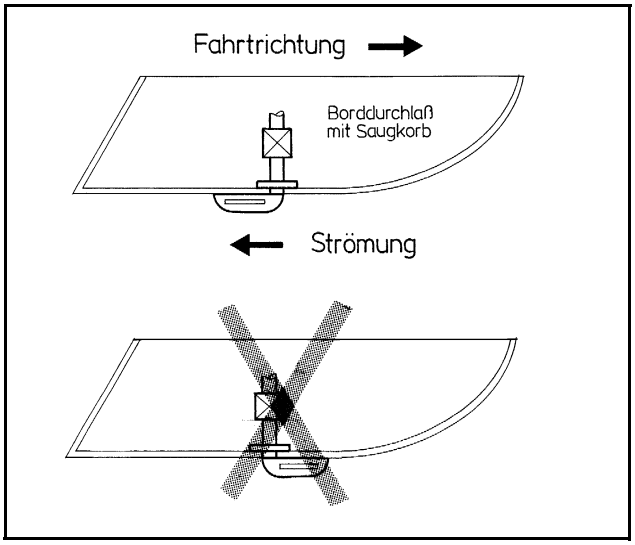
Fig. 5.4.2-7: Hose clamps

5.4.3 Installation of the through hull fitting in Yachts - Schema

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. 5.4.3-1: Position of the thru hull fitting



5.4.4 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 8.10, “Diameter of conduits,” on page 212

5.4.5 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

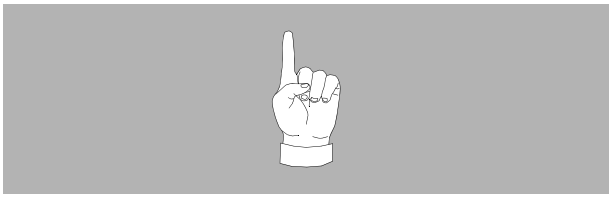
If the generator is installed above the waterline, it is possible that the impeller will wear out faster, because after starting, the pump runs dry for some seconds. The raw water hose should form a loop as near as possible to the raw water inlet of the generator (see picture below). This ensures the 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.

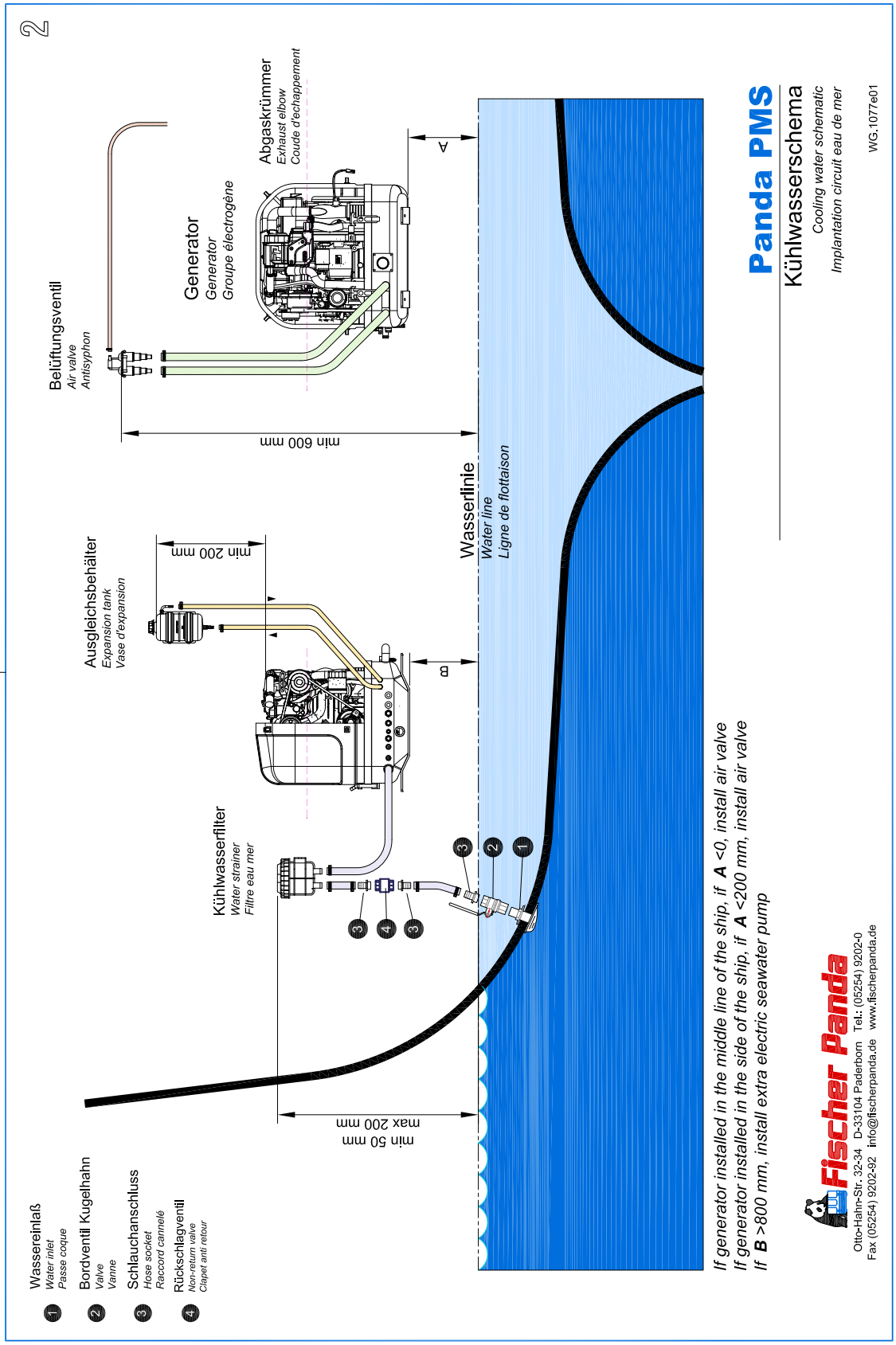
Replacement impeller and also a spare pump should always be on board. The old pump can be sent back to Fischer Panda for cost-effective repair.

NOTE:



5.4.6 Raw water installation schema

Fig. 5.4.6-1: Raw water installation schema



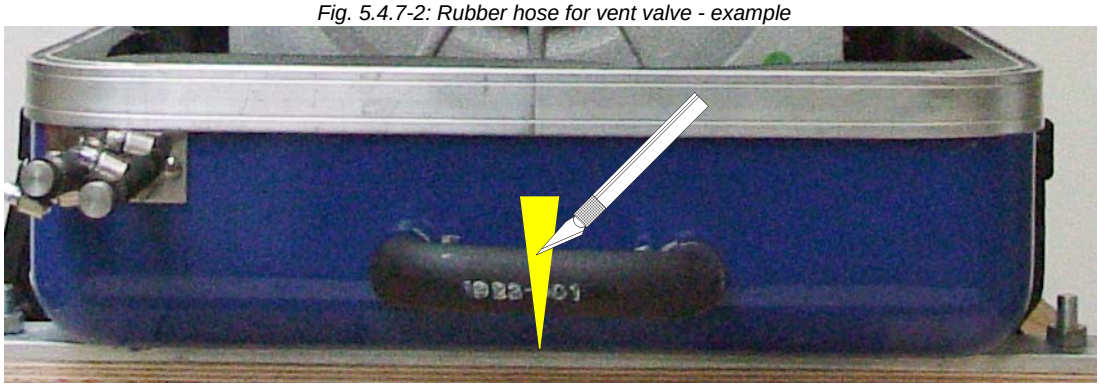
5.4.7 Generator installation below waterline

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. 5.4.7-1: Vent valve

Fig. 5.4.7-2: Rubber hose for vent valve - example



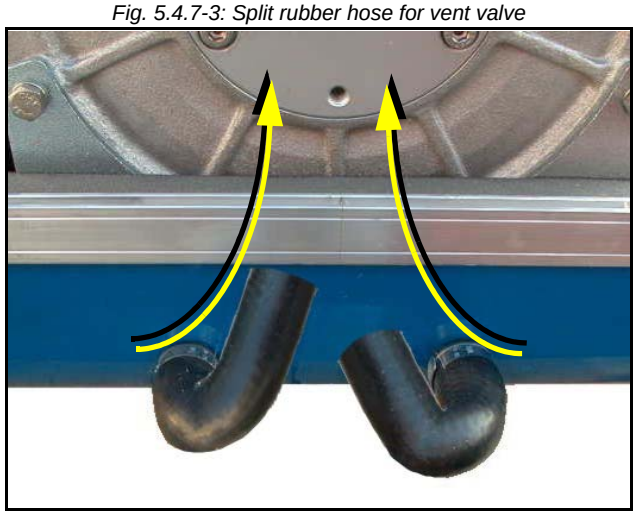
The rubber hose for the external vent valve will be cut...

...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. 5.4.7-3: Split rubber hose for vent valve



5.5 Installation of the cooling system - fresh water

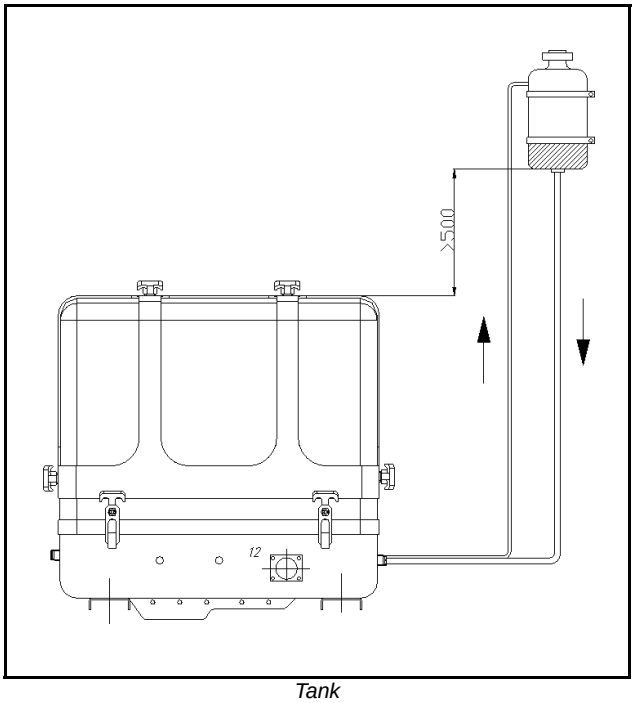
5.5.1 Position of the external cooling water expansion tank

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. 5.5.1-1: Position of the External Cooling Water Expansion Tank

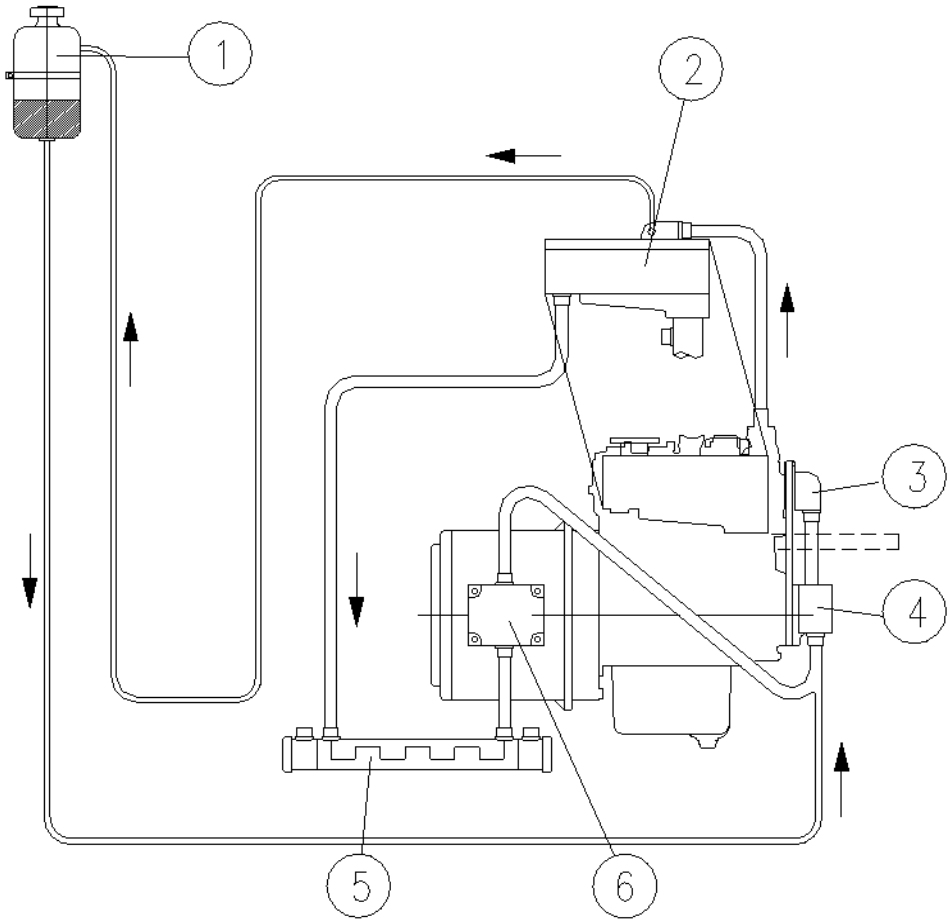


The external cooling water expansion tank may be filled only up to the lower edge of the lower tension tape (see note „max“) in the maximum filling level in cold condition.

ATTENTION!

5.5.2 Scheme for Freshwater Circuit at Two Circuit Cooling System

Fig. 5.5.2-1: Scheme for Freshwater Circuit at Two Circuit Cooling System



1. Expansion Tank
2. Exhaust Manifold
3. Thermostat Housing
4. Freshwater pump
5. Heat Exchanger
6. Cooling Water Connection Block

5.6 Installation of the water cooled exhaust system

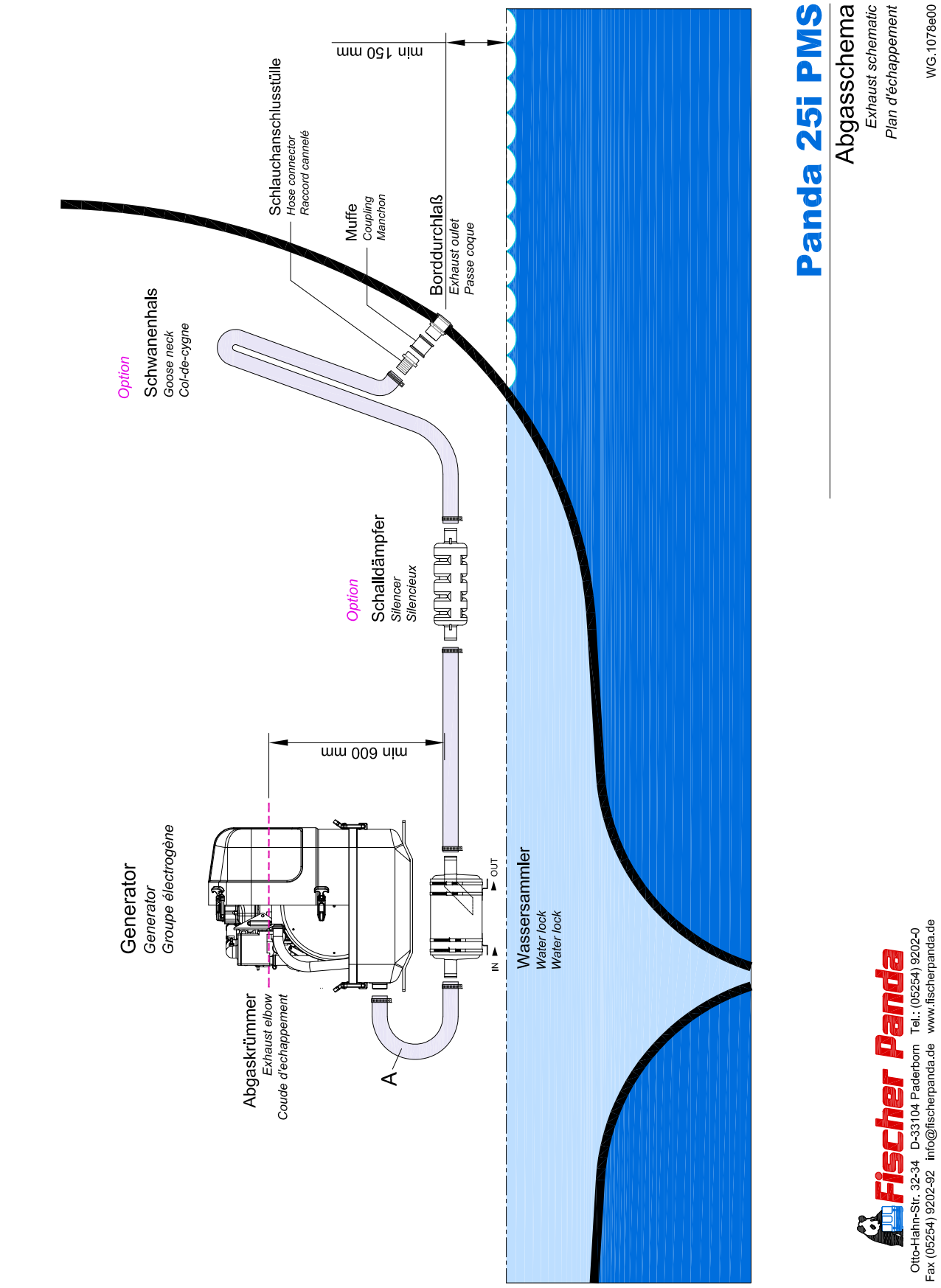
5.6.1 Installation of the standard exhaust system

The generator exhaust system must remain completely independent and separate from the exhaust system of any other unit(s) on board. The 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 8.10, “Diameter of conduits,” on page 212

Fig. 5.6.1-1: Installation Scheme Standard Exhaust System



5.7 Installation of the waterlock

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.

5.7.1 Possible cause for water in the exhaust hose

5.7.1.1 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.

5.7.1.2 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 part:

5.7.2 Installation area of the waterlock

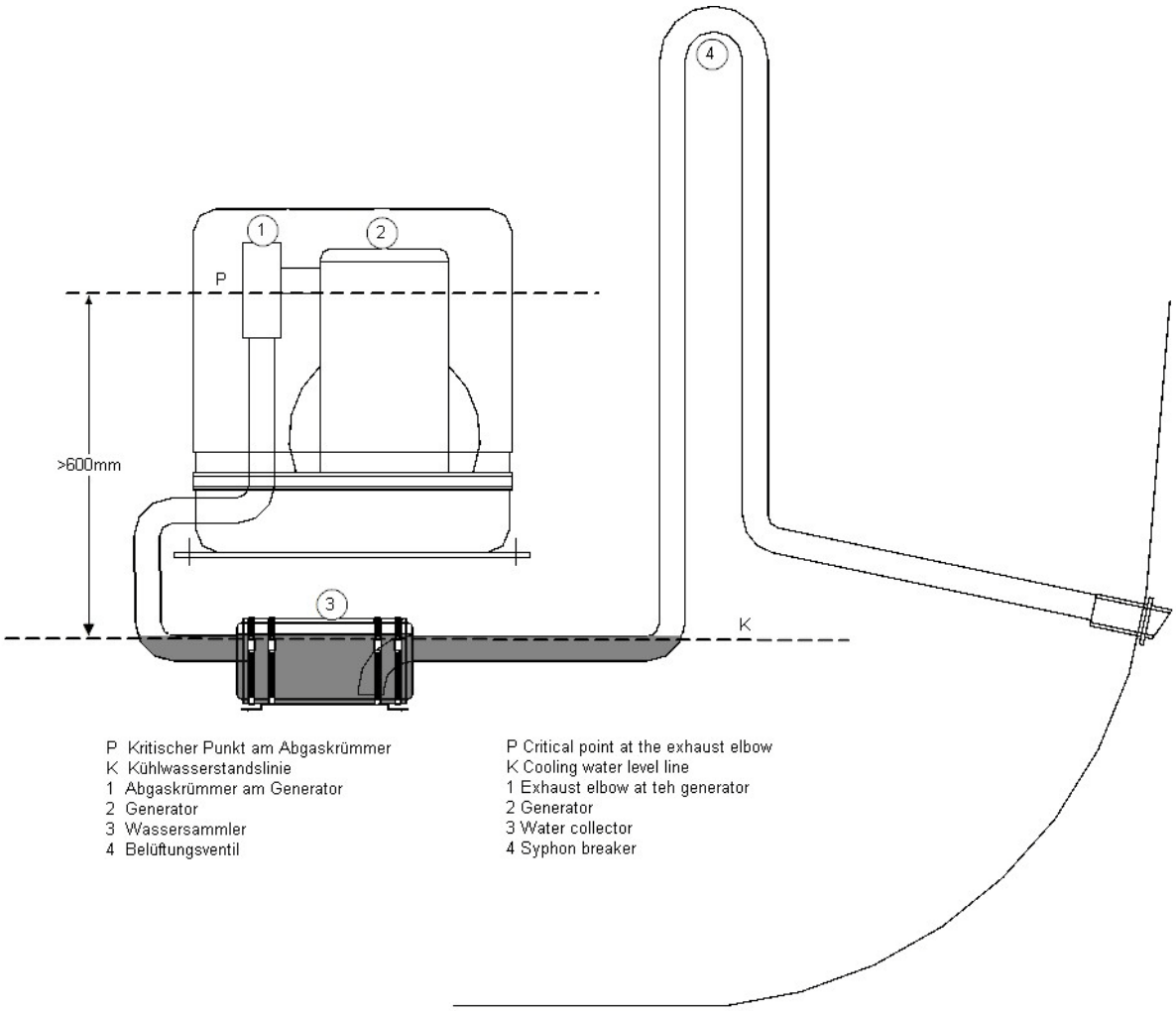
Concerning a water-cooled exhaust system, it must be regarded that - under no circumstances - cooling water from the exhaust hose can get into the exhaust elbow area at the engine. If this happens, the cooling water can get into the combustion chamber via an open discharge valve. This would lead to irreparable 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 pictures below show 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. 5.7.2-1: Installation area of the waterlock



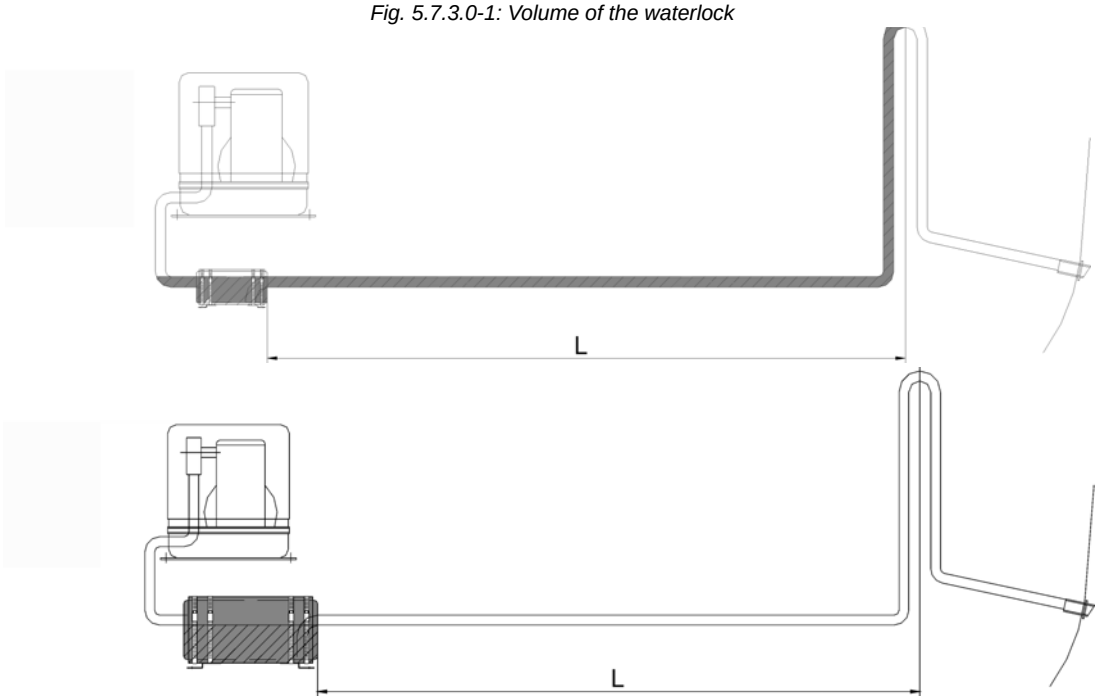
5.7.3 The volume of the waterlock

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.

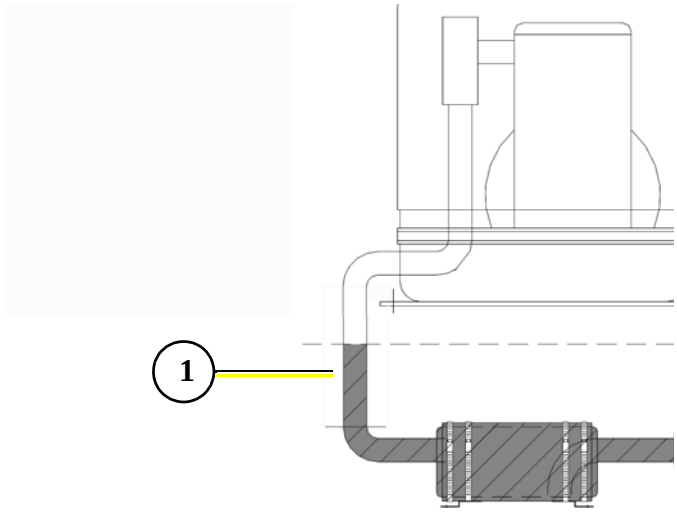
The waterlock must necessarily be measured so large, that it can take the entire amount of cooling water and, and the same time, does not exceed the prescribed vertical height of 600 mm up to the critical point at the exhaust elbow.

Fig. 5.7.3.0-1: Volume of the waterlock



If there are any doubts, a verifiction 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. 5.7.3.0-2: Testing the cooling water level



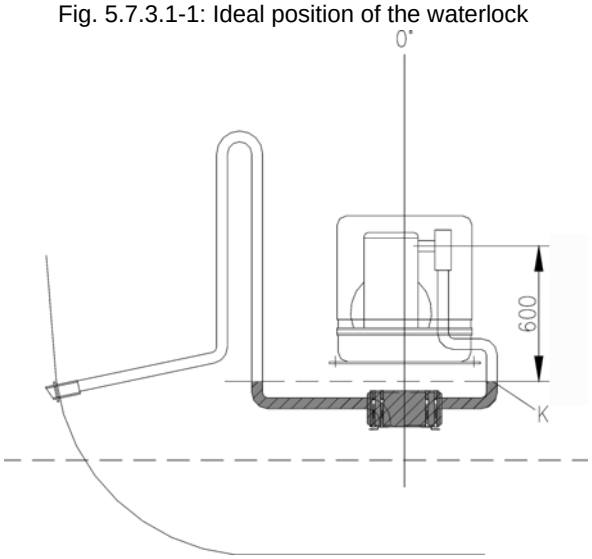
5.7.3.1 Ideal position of the waterlock

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:

In this picture, 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.

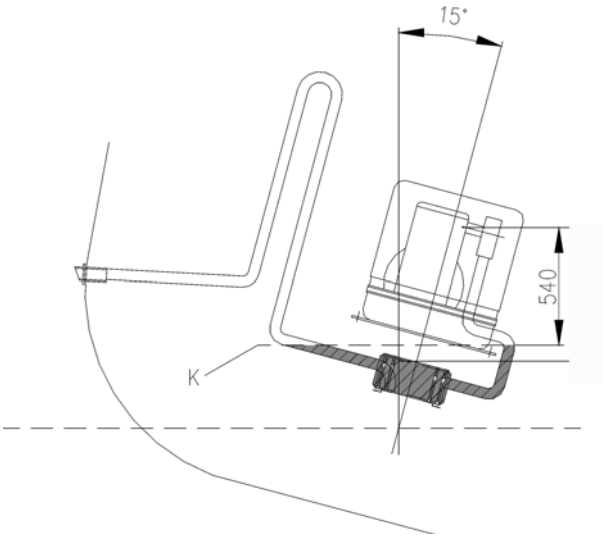
Fig. 5.7.3.1-1: Ideal position of the waterlock



Tilted position 15 degrees

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

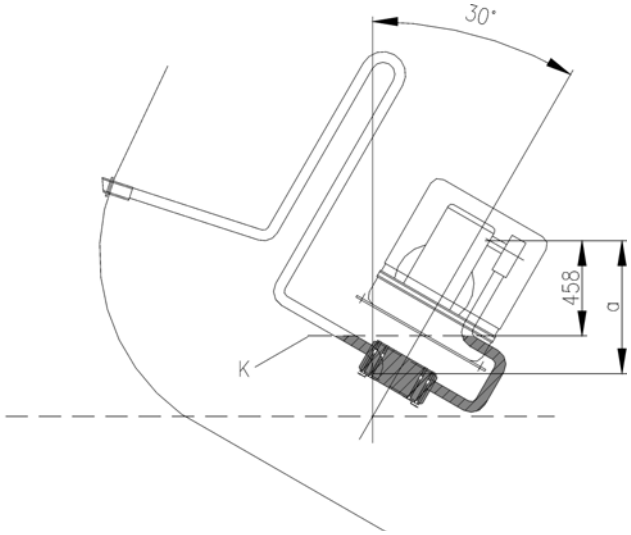
Fig. 5.7.3.1-2: Tilted position 15 degrees



Tilted position 30 degrees

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.

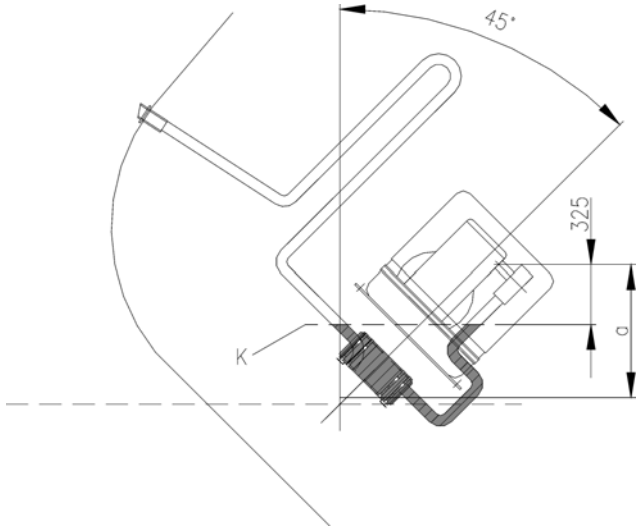
Fig. 5.7.3.1-3: Tilted position 30 degrees



Tilted position 45 degrees

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

Fig. 5.7.3.1-4: Tilted position 45 degrees



Even when the collector 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 motion („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:

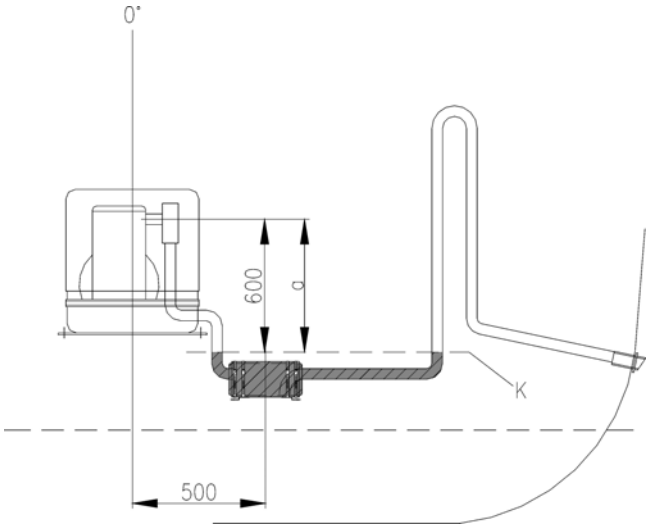
The preset minimum height of 600 mm must be regarded unconditionally and is only valid, if the waterlock is mounted in its ideal position in center underneath the generator. A higher position is highly recommended if it has to be reckoned with tilted positions of 45 degrees.

5.7.3.2 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:

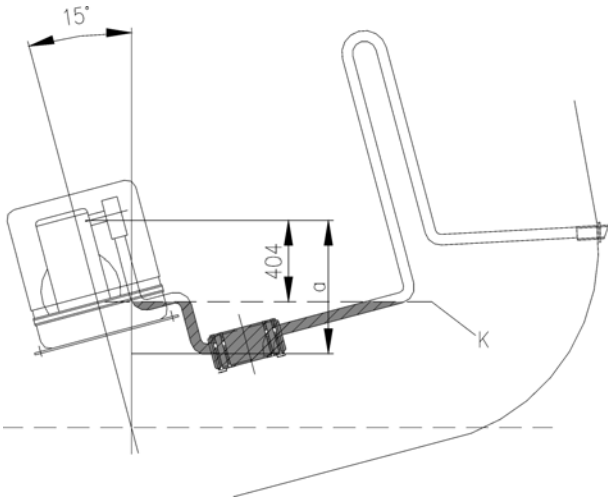
Fig. 5.7.3.2-1: waterlock, 500 mm next to the center line



Tilted position 15 degrees

Fig. 5.7.3.2-2: Tilted position, 15 degrees

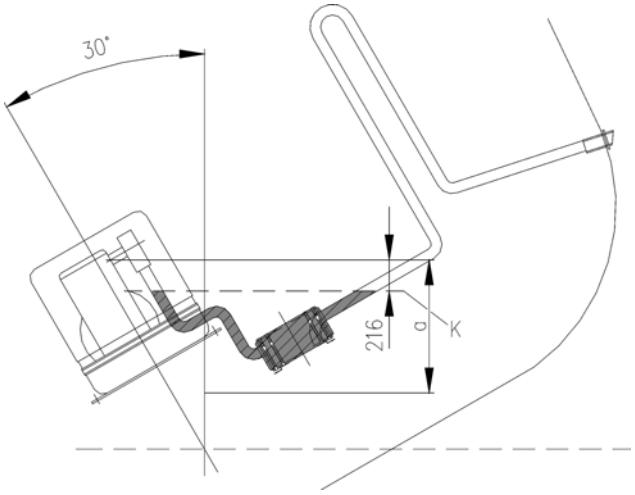
The distance is only 404 mm instead of the original 600 mm. So this is very close to the critical point.



Tilted position 30 degrees

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.

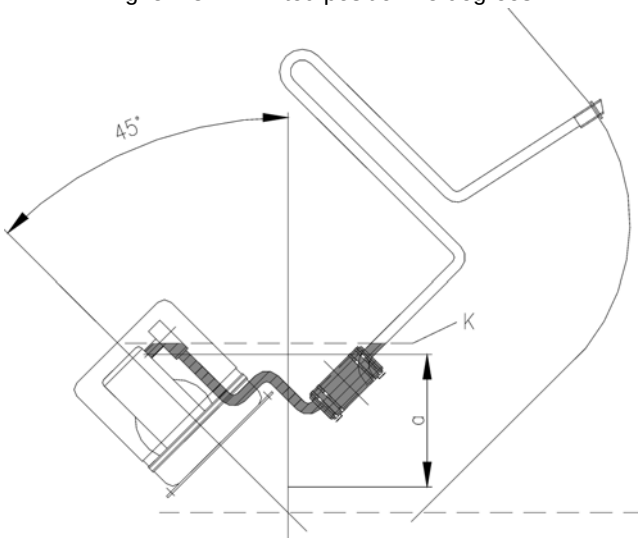
Fig. 5.7.3.2-3: Tilted position 30 degrees



Tilted position 45 degrees

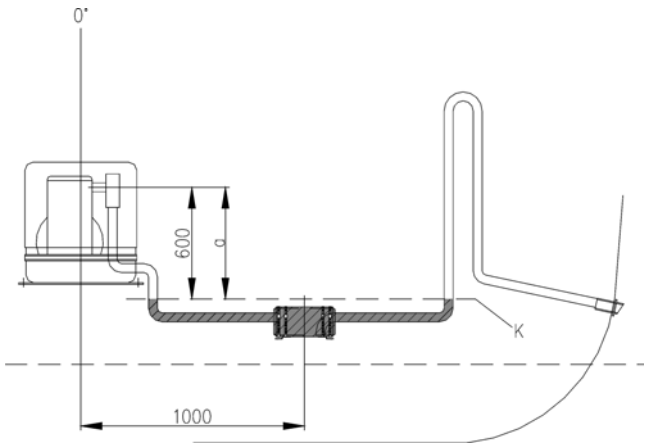
The water level is now at the same height as the critical point at the exhaust elbow. If the ship is sailed in a tilted position of 45 degrees with an installation like this, the ingress of cooling water into the combustion chamber is inevitable. Irreparable damages are preprogrammed.

Fig. 5.7.3.2-4: Tilted position 45 degrees



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

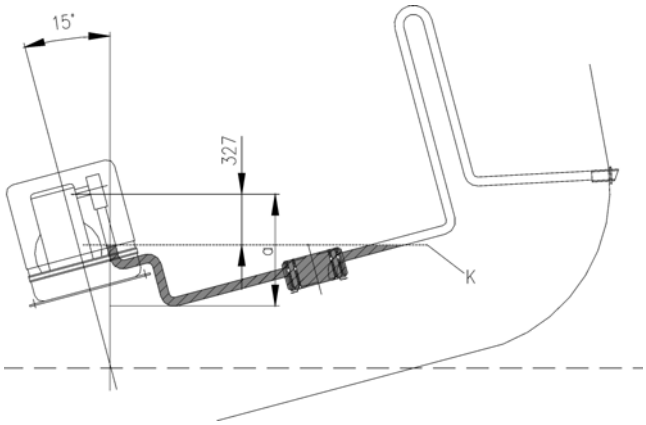
Fig. 5.7-5: waterlock, 1000 mm next to center line



Tilted position 15 degrees

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

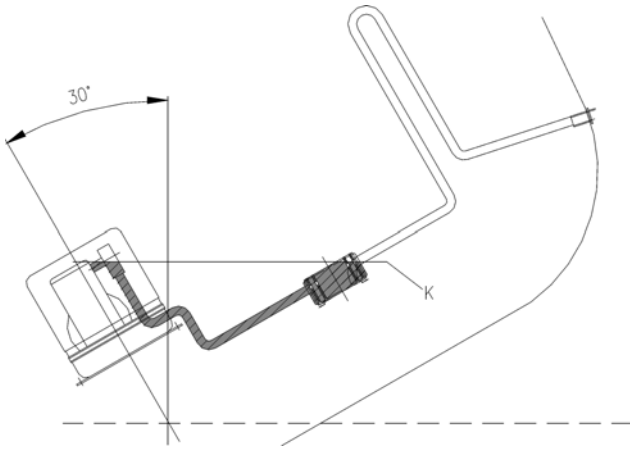
Fig. 5.7.3.2-6: Tilted position 15 degrees



Tilted position 30 degrees

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 preprogrammed.

Fig. 5.7.3.2-7: Tilted position 30 degrees



Summary:

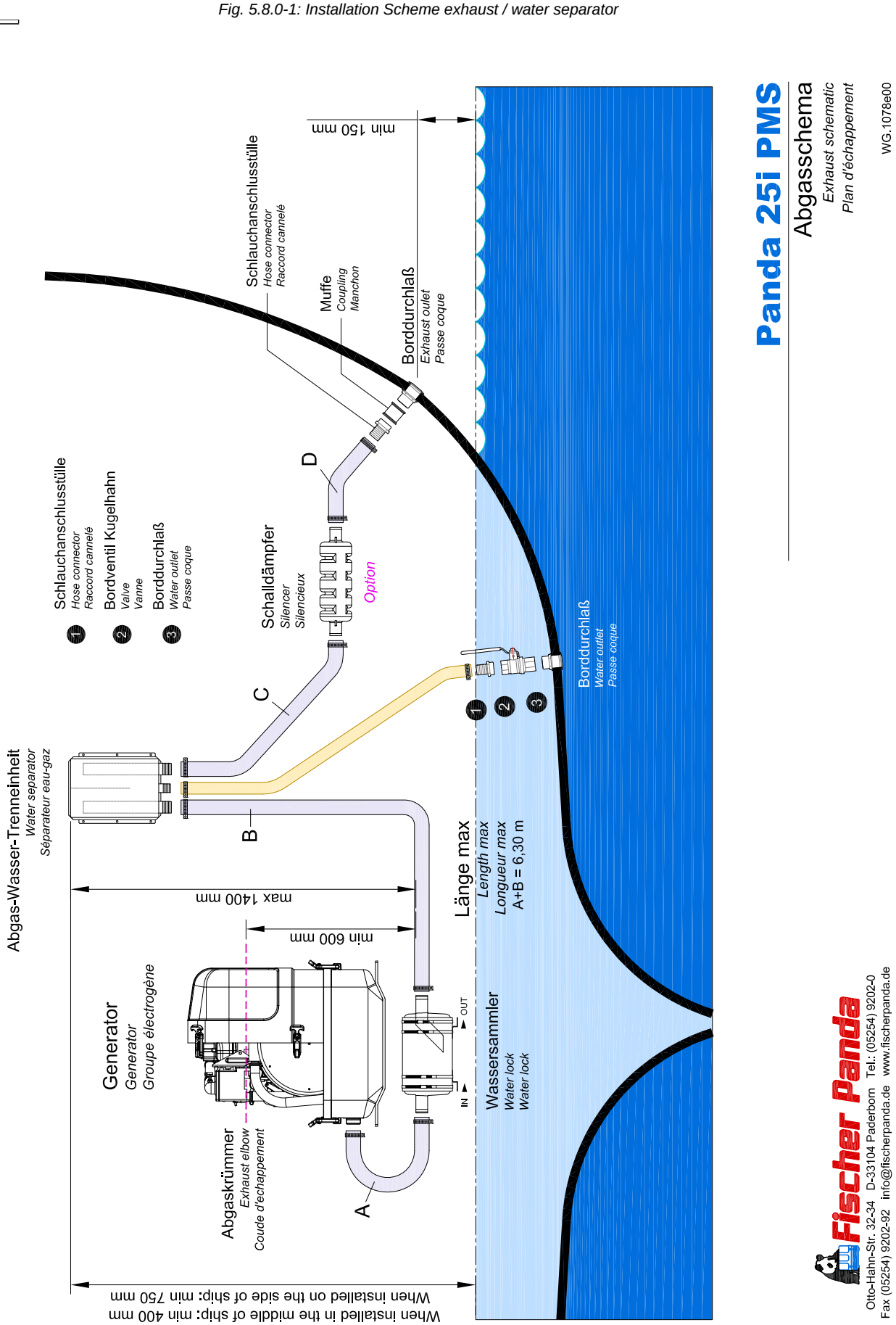
Concerning sailing yachts it must be regarded, that the waterlock is mounted in center underneath the generator, at least in reference to the ships' center line. Thus the waterlock is prevented from „leaking“ very strongly when the ship is tilted.

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.

5.8 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. 5.8.0-1: Installation Scheme exhaust / water separator



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Fax (05254) 9202-92 info@fischerpanda.de www.fischerpanda.de

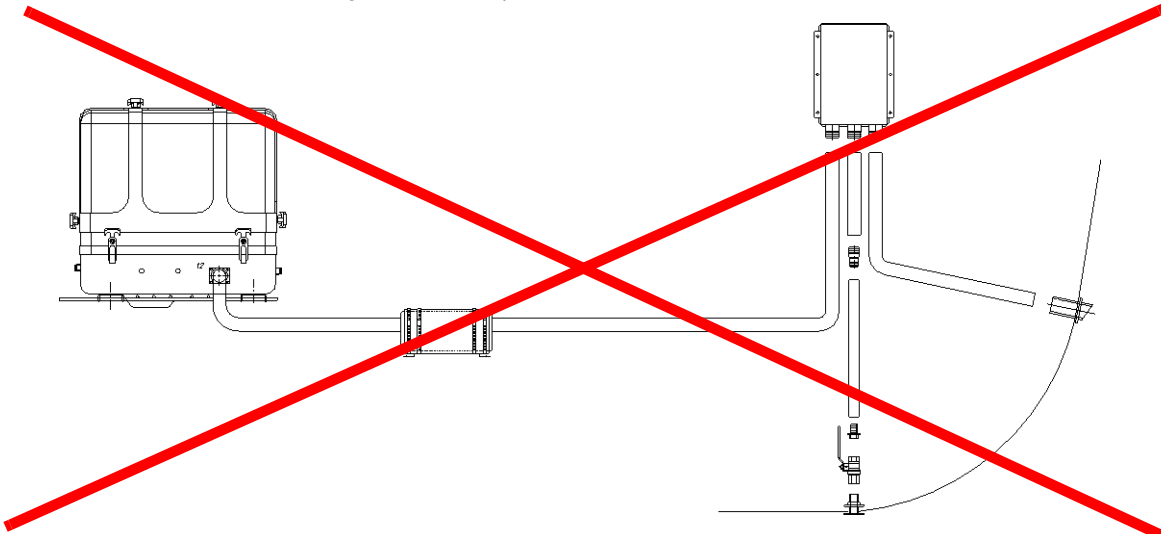
5.8.1 Installation exhaust water separator

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 10m (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. 5.8.1-1: 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

5.9 Fuel system installation

5.9.1 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. 5.9.1-1: Fuel hose

No return valve

representative picture

Fig. 5.9.1-2: No return valve

Pre filter with water separator

representative picture

Fig. 5.9.1-3: Pre filter with water separator

Pre filter with water separator

Alternative Article

representative picture

Fig. 5.9.1-4: Pre filter with water separator

Quick connector for fuel lines

representative picture

Fig. 5.9.1-5: Quick connector for fuel lines

Hose clamps

representative picture

Fig. 5.9.1-6: Hose clamps

5.9.2 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)

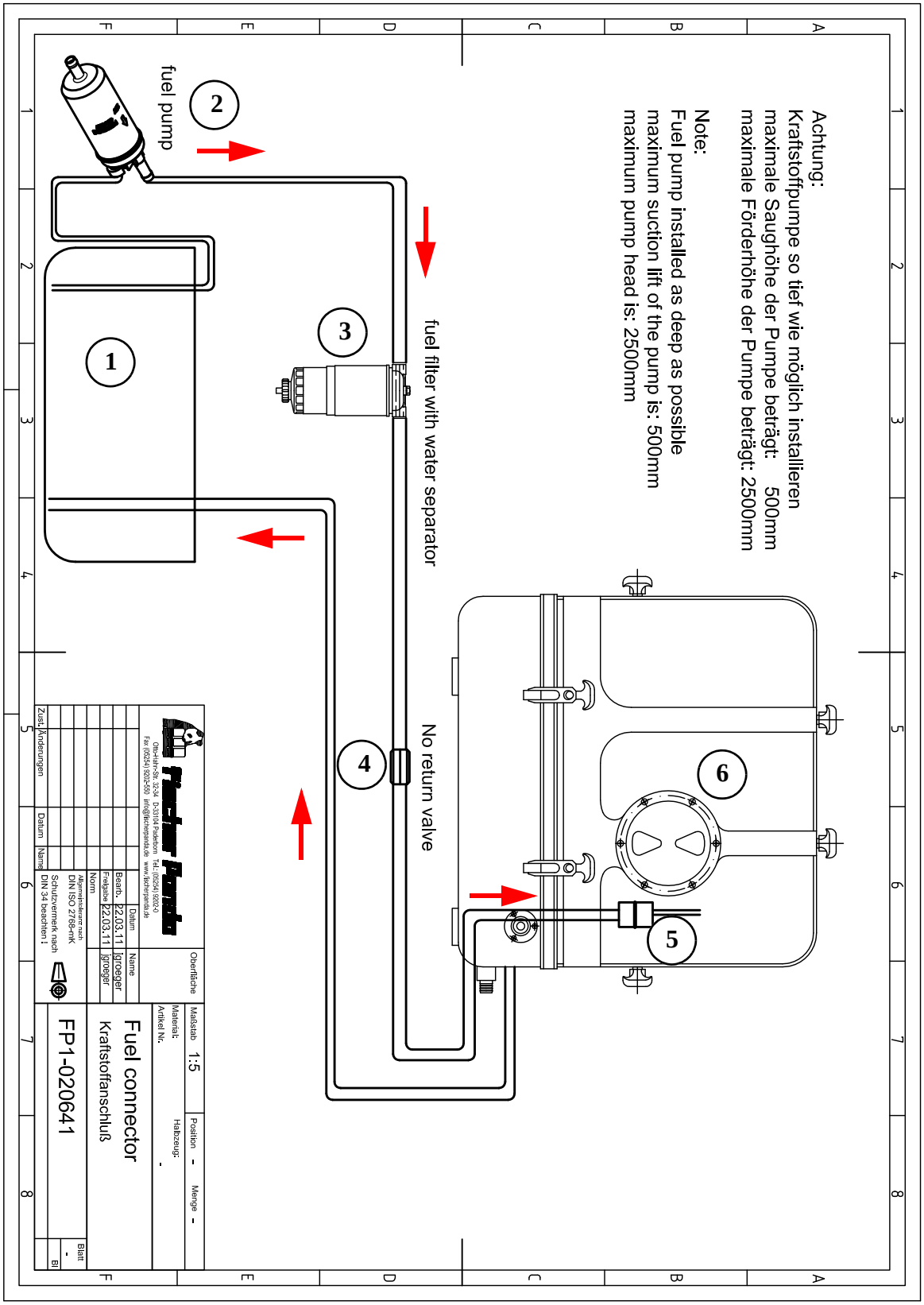
The external Fuel pump should be installed near the tank

Electrical fuel pump

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.

Fig. 5.9.2-1: electrical fuel pump

Fig. 5.9.2-2: Fuel system - schema



1. Fuel tank
2. external fuel pump
3. external fuel prefilter with water separator
4. Non return valve
5. Fuel fine filter
6. 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. 5.9.2-3: externer Feinfilter

5.9.3 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

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.

ATTENTION!

5.9.4 Position of the pre-filter with water separator

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

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

Fig. 5.9.4-1: Pre-filter with water separator

5.10 Generator DC system installation

The Panda generators from 6.500 NE 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.

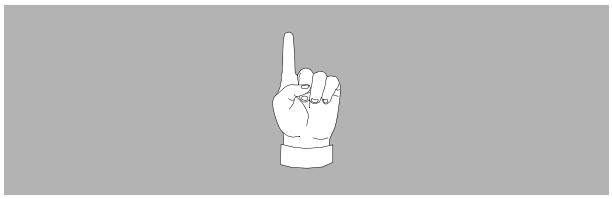
5.10.1 Connection of the starter battery block

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

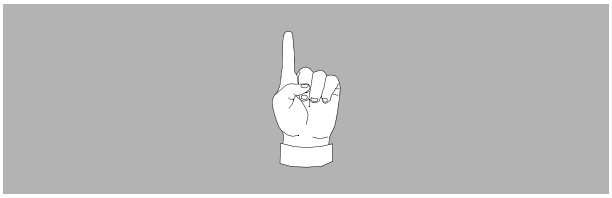
f.e. 12 V starter battery for a 12 V start system

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.

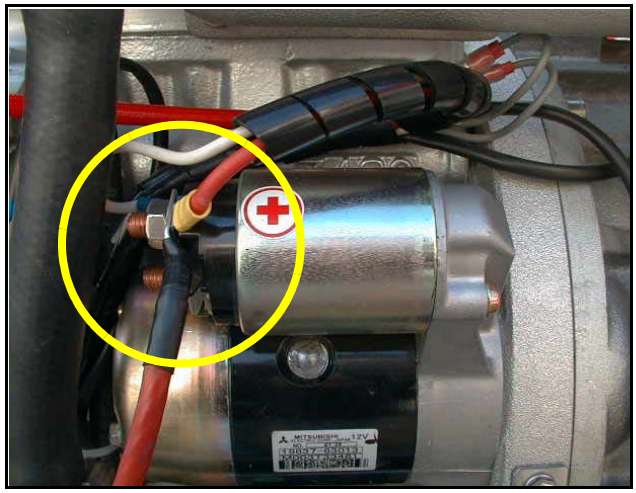
Make a test run after the installation and check the laying of the batteries during the test run and afterwards. If necessary, correct the laying.

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. 5.10.1-1: Positive Battery Cable

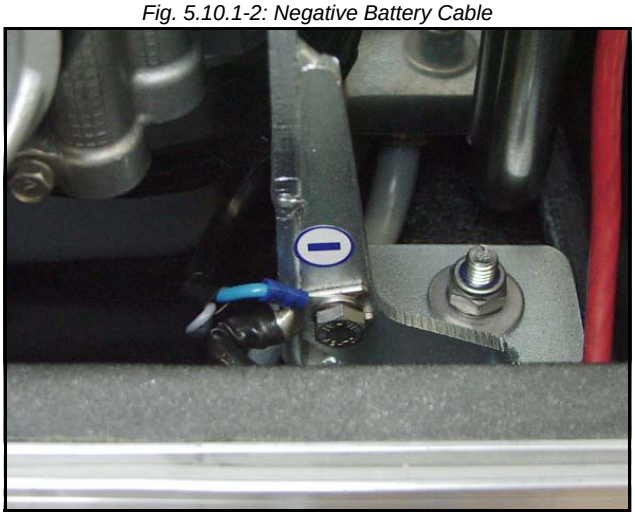


Negative battery cable

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 120 V installation!

Fig. 5.10.1-2: Negative Battery Cable



DC-Relay

The Panda generators 8000 to 30 are equipped with various DC-relays, which can be found under the terminal strip. The various relays have the following tasks (also see the DC circuit diagram)

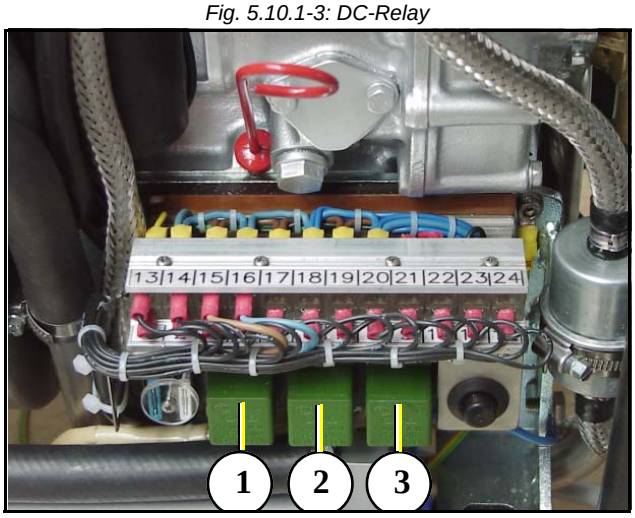
1. Starter motor relay

2. Pre-glow relay (glow plugs)

3. Fuel pump relay

Sample Picture - See wiring diagram

Fig. 5.10.1-3: DC-Relay



DC Starter Motor

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

1. Solenoid switch for starter motor

2. Starter motor

Fig. 5.10.1-4: DC Starter Motor

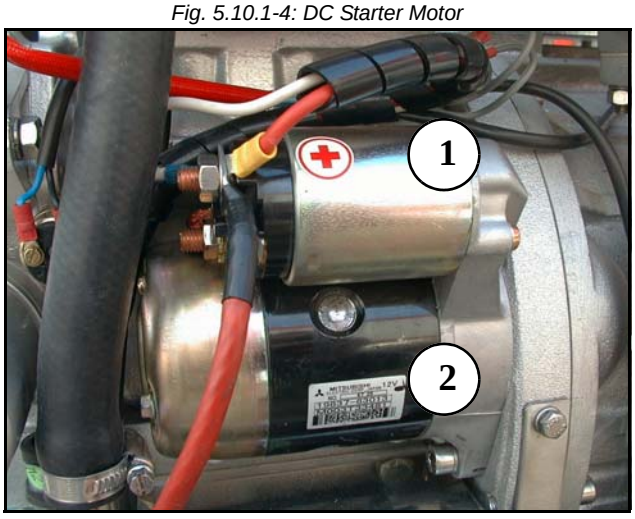
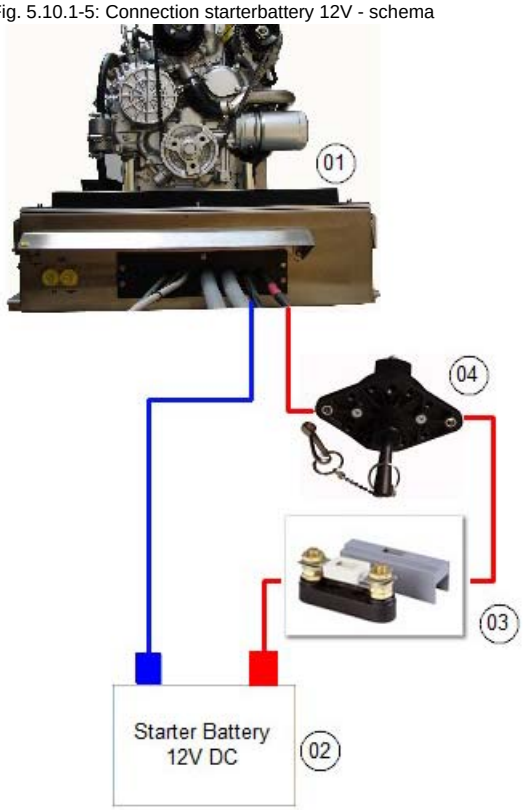
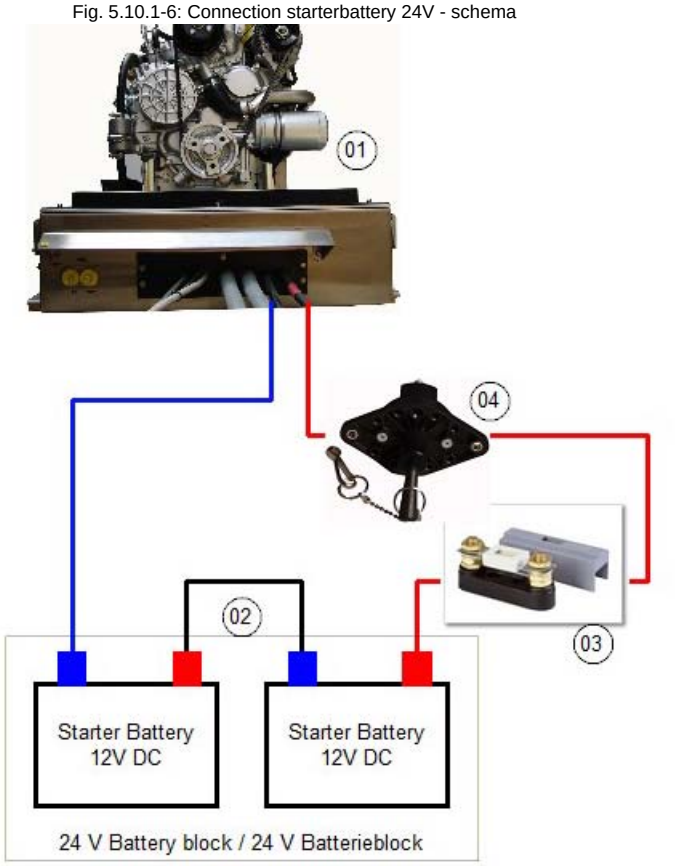


Fig. 5.10.1-5: Connection starterbattery 12V - schema



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

Fig. 5.10.1-6: Connection starterbattery 24V - schema



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

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

The starter batteries have to be connected in this order:

1. (+) cable of first battery

Fig. 5.10.2-1: Installation starter battery

2. (-) cable of second battery

Fig. 5.10.2-2: Installation starter battery

3. (+) cable of second battery

Fig. 5.10.2-3: Installation starter battery

4. (-) cable of first battery

Disconnect the batteries in in reverse procedure.

Fig. 5.10.2-4: Installation starter batterie

5.10.3 Connection of the remote control panel - see separate control panel manual

5.11 Generator AC System Installation

Before the electrical system is installed, READ the SAFETY INSTRUCTIONS of this manual FIRST!

Be sure that all electrical installations (including all safety systems) comply with all required regulations of the regional authorities. This includes lightening conductor, personal protection switch etc.

Warning!: Electrical Voltage

5.12 AC-Control box with VCS and starting current limitation

An AC-Control box is necessary for the operation of Panda generators. According to the generator capacity the AC Control box is variable dimensioned and equipped. It is supplied with a lockable cap.

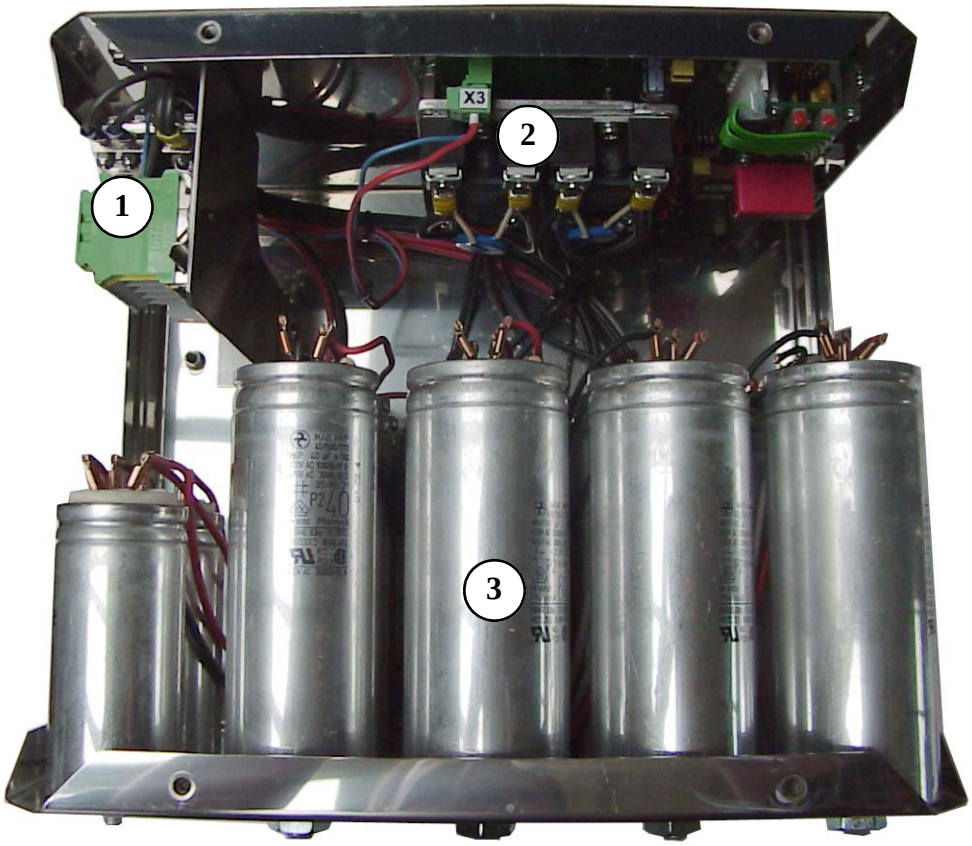
This cap must necessarily be locked when the generator is running, as at all models during operation, 400 V is present in the AC control box.

For the excitation of the generator all necessary capacitors, as well as the electrical control for the voltage/speed control VCS and the starting current limitation (not available at all models) are stored in the AC Control box. The AC Control box must be connected to the generator with the electrical lines (230V and 400V).

Only qualified personnel may carry out working at the AC Control box.

Danger to life - 400V AC

Fig. 5.12-1: AC-Control box - example

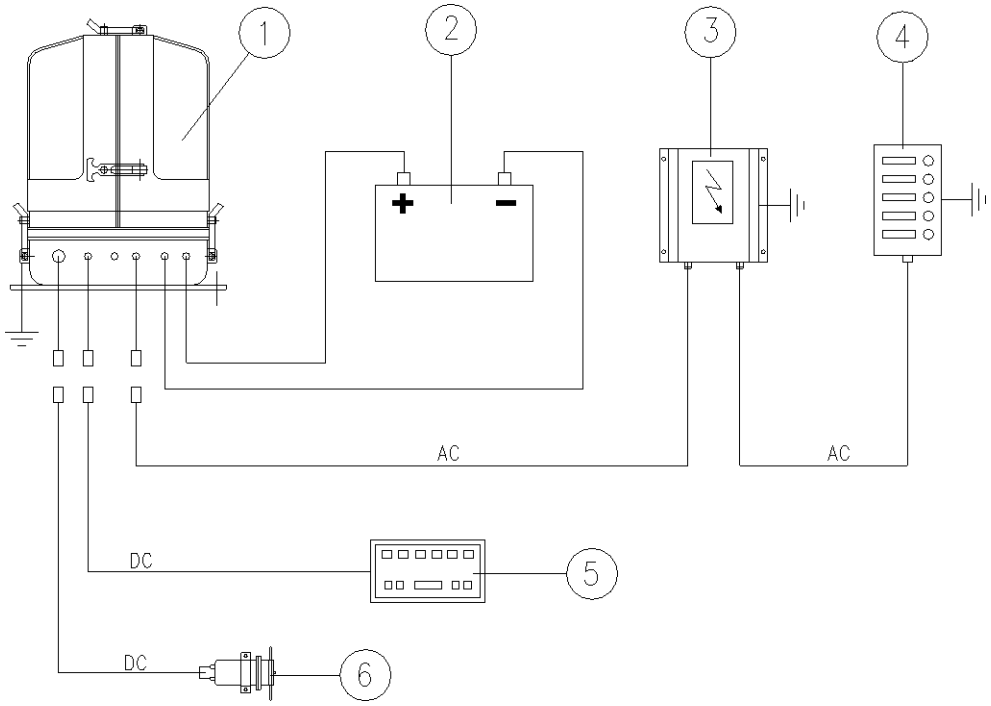


1. Terminal block for excitation
2. VCS board (not at ND models)
3. Capacitors

5.12.1 Installation with looped-in AC-Control box

All electrical safety installations have to be made on board (RCD etc.).

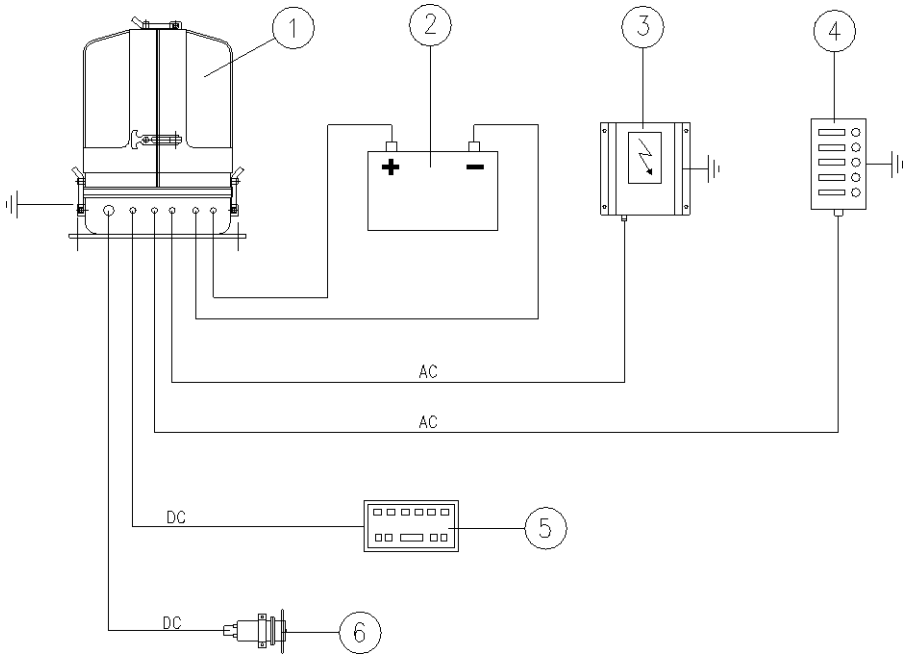
Fig. 5.12.1-1: Installation with looped-in AC Control box



1. Generator
2. Battery
3. AC-Control box
4. Distribution panel
5. Remote control panel
6. Diesel pump

5.12.2 Installation AC-Box / Distribution panel connected separately

Fig. 5.12.2-1: Installation AC-Box / Distribution panel connected separately



1. Generator
2. Battery
3. AC-Control box
4. Distribution panel
5. Remote control panel
6. Diesel pump

5.12.3 Electronic voltage control VCS (not existent at ND models)

All Panda generators from Panda 6000 upwards are fitted with the electronic voltage control "VCS" as standard.

The VCS controls the generator voltageand motor speed. An actuator on the injection pump can increase the engine speed compared to the idle speed.

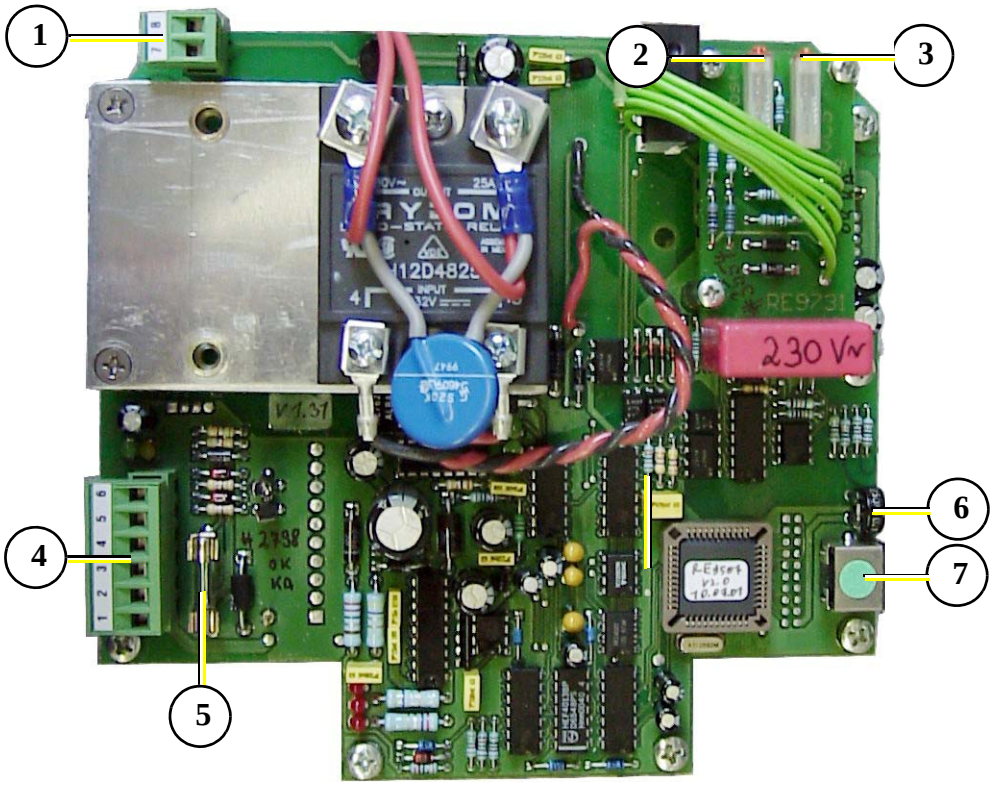
If the generator runs without load, the frequency should be approx. 48,5 - 49 Hz (50 Hz System) or 58,5 - 59 Hz (60 Hz System). The frequency (equates to the speed) can be increased by up to 8%. This ensures that the engine speed is increased when there is an extra load. The maximum speed is achieved when 80% load is reached.

The speed gauge is governed and limited by an adjusting screw, above and below. Adjustment of this screw may not occur without the expressive approval of the manufacturer.

All signals pass through the circuit board in the AC-Control box. The signal impulse for the actuator 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 by adjusting the minimum setting on the speed gauge to 5 % of the nominal load (for example 240V at a 230V system), in order to ensure that the generator output voltage at 70 % nominal load does not drop (for example 215V at a 230V system).

Fig. 5.12.3-1: VCS - example



1. Connection measuring voltage
2. Adjusting booster voltage (do not adjust!)
3. Adjustment VCS-voltage
4. Connection VCS inlet
5. Electrical fuse (1.6 A, slow to blow)
6. Potentiometer for booster time
7. Connection for PC

5.12.4 Alternative control: Mini-VCS

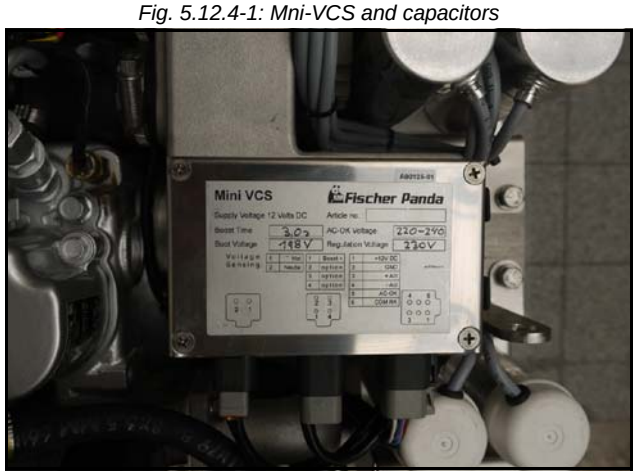
An alternative for generators without AC-Control box is the Mini-VCS.

The Mini-VCS and the capacitors may be mounted at the generator.

Mini VCS at the generator

Sample picture

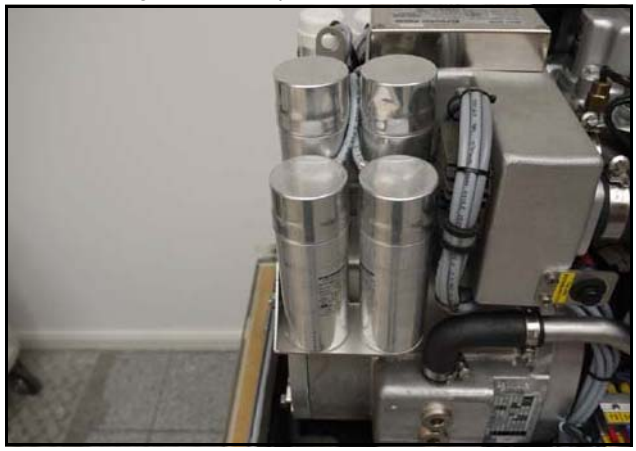
Fig. 5.12.4-1: Mni-VCS and capacitors



Capacitors for the excitation

Sample picture

Fig. 5.12.4-2: Capacitors for the excitation



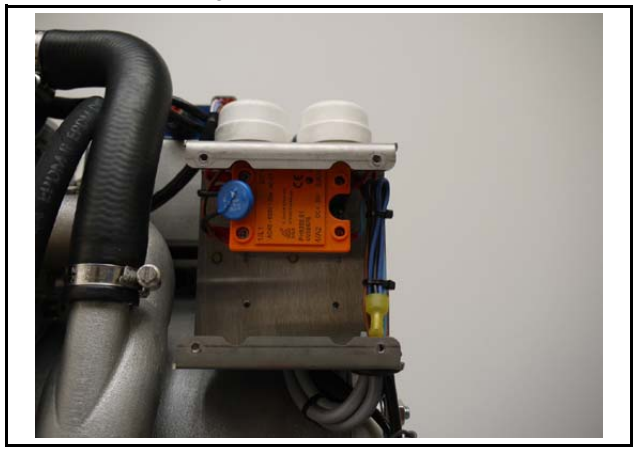
Boost relais

Additionally, the automatic start booster is located on the circuit control board. The starting current is increased by connecting a second group of capacitors, if the voltage drops below a pre-set voltage.

The starting current can be increased by 300% for a short period by combining both components voltage/speed control and ASB start booster.

Sample picture

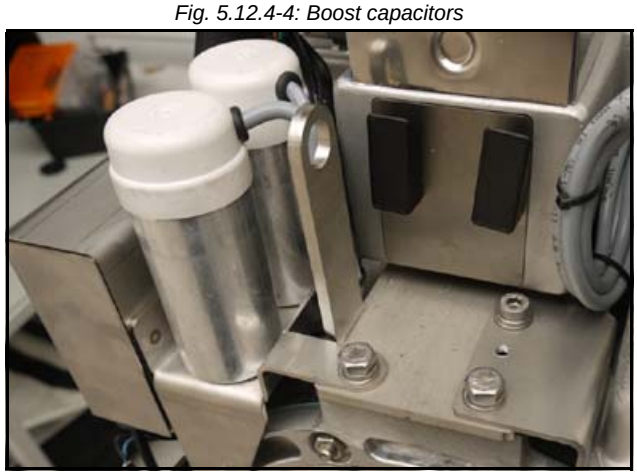
Fig. 5.12.4-3: Boost relais



Boost capacitors

Sample picture

Fig. 5.12.4-4: Boost capacitors



5.12.5 Connection to the AC on-board power supply

5.12.5.1 Protective conductor

The generator is equipped with a PEN protective conductor system as standard (this means that the neutral conductor is also used as protective conductor).

If a separate protective conductor is necessary (i. e. according to national safety regulations), the bridge circuit at the generator and the AC-Control box between null and generator housing has to be removed. Afterwards a separate protective conductor has to be installed and connected to all the system's attached metallic housings.

It is recommended to provide a voltage indication (voltmeter) and also a power indication, if applicable, in the installation system. The voltmeter (and power indication, if applicable) has to be installed behind the selector switch so that the voltage for every possible voltage source may be indicated. A separate voltmeter for the generator itself, is therefore not required.

5.12.5.2 Electrical fuse

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 fuse. This fuse should be sized so 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 30 kW 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 fuse see *Tabelle 9.6-1, "Nennströme," auf Seite 219*

5.12.5.3 Required cable crosssections

The following recommended electrical cable dimensions (cross sections) are the minimum required sizes for a safe installation. *(see "Cable cross section" on page 208.)*

5.12.5.4 Disconnector - power source selector (three way cam switch)

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 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 sepa-

rate.

As disconnector a cam switch should be used. This switch should have three positions: "Shore power" - "OFF" - "Generator". If an (DC-AC) inverter is used, a fourth position will be required.

0 Off

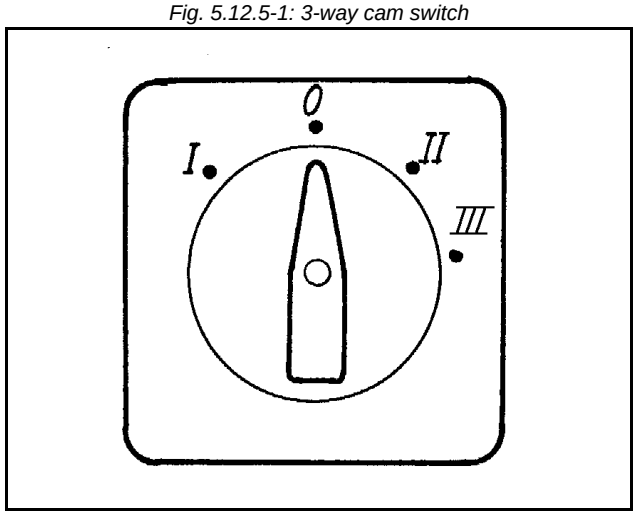
I Generator

II Shore power connection

III Inverter

Example

Fig. 5.12.5-1: 3-way cam switch



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

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

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

It is necessary that the 3-phase AC and the single-AC have to be installed separately from each other.

5.13 Special recommendations

5.13.1 Water sensor

Especially at older generators it may occur that by a leak in the hose system raw water gets from the sea water pump inito the generator. If a proper break is the cause, this may lead to considerable damages at the generator. To prevent this, Fischer Panda offers a water sensor in his accessories program, which may be installed in the generator. This sensor identifies the flooding and switches the generator off. The sensor should be installed as close as possible to the capsule floor.

The cables for the sensor are pre-installed from model 2000.

5.14 Instructions on prevention 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 hull of a neighbour ship), always assume that the different components proceed different electrical voltage, which affect the entire system and the components. DC voltage causes an electric current, if in the environment of these parts electrically leading liquids (electrolyte) are available. This is called „galvanic process“. The electrical charge of the negatively charged fields (anode) is led to the positively charged field (cathode). The negatively charged part (anode) „is sacrificed“ thereby, i. e. that the electrical particles at the surface of the material caus decomposition with this chemical process. Since aluminium is an electrically negatively charged metal, aluminium will play the role of the anode compared with most remaining metals. This applies in particular to copper, brass, and also steel and stainless steel etc. These metals are positively charged.

5.14.1 Instructions and measures on prevention of galvanic corrosion

Several measures must be considered when making the installation so that galvanic corrosion can be avoided as much as possible:

- Separation of the water column (between raw water and generator) after shutdown. This can either be a stop vlave turned by hand (Attention! The valve must be closed after each operation) or by the installation of an automatic ventilation valve. In this case the valve opens and closes automatically.
- Connecting all components (hull outlet, generator, heat exchanger etc.) to a common potential. For this all elements of the installation are connected by a cable (earthed).
- Strict separation of the generator from the 12 V on-board power supply, that means potential free installation of the 12 V system (generator installation und general on-board power supply).

Please find more details in the information sheet „galvanic corrosion (electrolysis)“ which you can order at Fischer Panda free of charge.

5.15 Checking and filling of the oil circuit

Check oil and fill the oil circuit as described in the service chapter.

5.15.1 First filling and ventilation of the internal cooling water circuit

The expansion tank is supplied with a pressure relief valve in the cap with 500 m bar. It is possible when operating the generator hot cooling water can leak here if there is an overpressure. When working always wear protective clothing and ensure an adaquate installation location.

Attention!: Risk of scalding.

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

ATTENTION: Maximum fill level = „max.“- marking

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

Sample picture

Fig. 5.15.1-1: Expansion tank

2. Open the venting screw at the pipe socket of the internal cooling water pump until bubble-free coolant escapes. Close the vent screw.

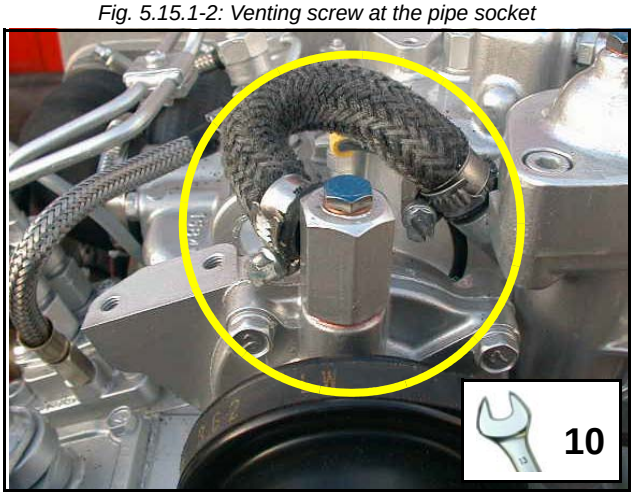
(not existent at all models)

Check the water level in the expansion tank during the venting. Fill up if necessary.

Never open the vent screw while the generator is running because water may be sucked into the cooling water circuit.

Sample picture

Fig. 5.15.1-2: Venting screw at the pipe socket

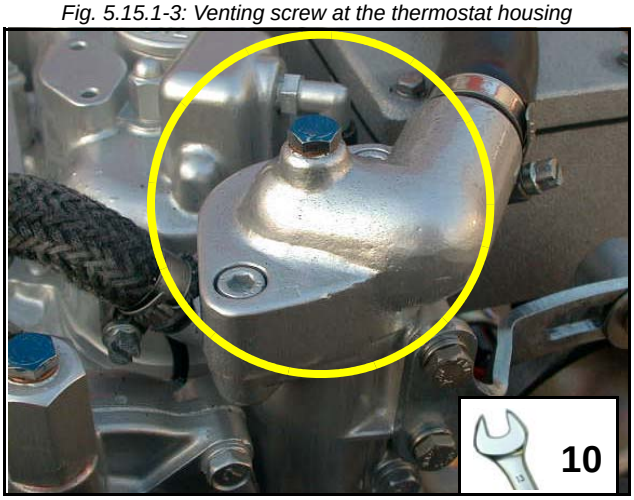


3. Open venting screw at the thermostat housing. Close the vent screw when air free water comes out.

Check the water level in the expansion tank during the venting. Fill up if necessary.

Sample picture

Fig. 5.15.1-3: Venting screw at the thermostat housing



4. Start the generator

After filling the generator must be started. During this first phase of start-up, the generator may not be loaded.

Switch off the generator after approx. 10 seconds of operation!

5. Repeat the steps 1-4 till no more air comes out of the venting screw at the thermostat housing.

Close the venting screws.

Fill up the expansion tank up to max. marking.

Close the expansion tank.

6. Re-ventilating process 10 operating hours after the first start-up (and if necessary).

Also after the first initial operation a small amount of air may reside in the cooling circuit. To ensure an imaculate und actual operation of the cooling system the ventilating process must be repeated casual in the next few days (weeks, if necessary). Small amount of air will still exit out of the ventilating openings, especially if the generator stood still for a long time.

During the ventilating process repeated checks must be made to check the cooling water is indeed circulating. If there are air bubbles in the internal cooling water pump, it is possible that the cooling water is not circulating. The generator will heat up very quickly and switch off, because of overheating.

ATTENTION: Check circulation

5.15.1.1 Anti-freeze in the cooling water circuit

In the interest of safety, the concentation of the coolant should be checked on a regular basis. Be sure that the coolant/antifreeze mixture is good for at least -15°C (5 ° F) which is recommended by the manufacturer. If your genset experiences lower temperatures, for example during storage or transportation, then the entire cooling system should be drained. The coolant also serves as corrosion protection of the engine.

5.15.2 Temperature check for controlling the cooling water circuit

Check with an IR-thermometer if a temperature difference exists between cooling water in-flow and cooling water return flow.

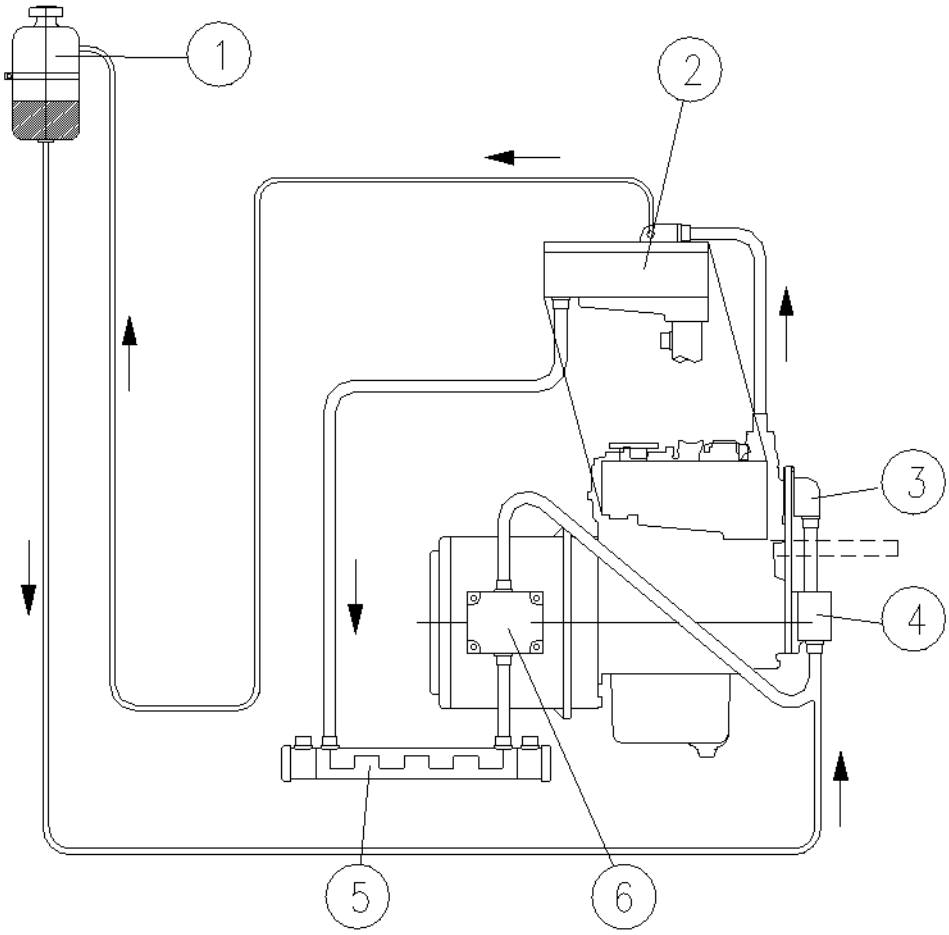
The cooling water in-flow line can be measured directly at the internal cooling water pump.

The cooling water return pipe can be measured either at the outlet of the water-cooled exhaust elbow or at the side where this pipe enters the heat exchanger.

The temperature difference between in-flow and return should be approx 10-18° C at nominal rating.

5.15.3 Fresh water circuit at a two circuit cooling system - schema

Fig. 5.15.3-1: Fresh water circuit at a two circuit cooling system - Schema



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

Some generators are equipped with an additional cooling water cap.

This only serves for the first filling at the factory.

This cap may not be opened when the generator is installed (hot cooling water may escape). Risk of scalding!

Sample picture

Fig. 5.15.3-2: Cooling water cap

5.16 Isolation test

After installation, before bringing into service and handover of the generator to the customer, an isolation test has to be accomplished as follows:

ATTENTION!

1. Switch off all electrical load.
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 exceed 50 mV (millivolt).
4. Once the safety systems have been installed, they must be checked. If a leakage current relay (RCD) has been installed, it also has to be tested in order to ensure that all contacts are connected properly. The individual phases have to be checked against each other, and between phase and ground. An additional 4th phase (L1') also needs to be checked at generators with DVS winding.
5. If the generator is protected by a ground connection, it has to be ensured that ALL electrical devices must also be connected to this „common“ ground (usually ground contacts are attached to the device's metallic housing).

The electrical system installation must also comply with the hook-up requirements of the shore current grid. Generally a leakage current relay (RCD) is sufficient for safe electrical operation; howewver, this must be confirmed by the electrical safety standard in the region where the system is attached to a main land power grid. The release current of the relay (RCD) has to meet the installation circumstances.

5.17 Initial Operation

After successful installation an initial operation has to be performed.

For this purpose the initial operation record has to be completely filled out by the installing expert. The filled record has to be handed out to the owner.

The owner has to be instructed regarding handling, servicing and risks of the generator. This applies to the service steps and risks mentioned in the manual as well as further risks which may arise from the specific installation and the connected components.

The original initial operation record has to be sent to Fischer Panda to receive the complete guarantee. Please make a copy for your own documentation.

Note:

6. Maintenance Instructions

6.1 Personal requirements

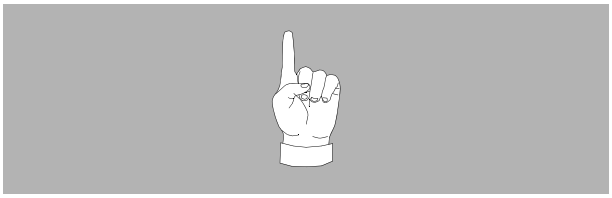
All maintenance, if not special marked, can be done by the trained persons.

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

6.2 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 manufacturer.

Warning!:

6.3 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.

6.4 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% (200h max.). Make sure that the dynamic operation hours are not reset accidently between the service interval.

Note:

6.5 General maintenance instructions

6.5.1 Checks before starting

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

6.5.2 Hose elements and rubber formed component in the sound cover

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

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

6.6 For maintenance intervalls see „General information for PMS-Generators“The raw water circuit

6.6.1 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. 6.6.1-1: Raw water filter

6.7 Causes with frequent impeller waste

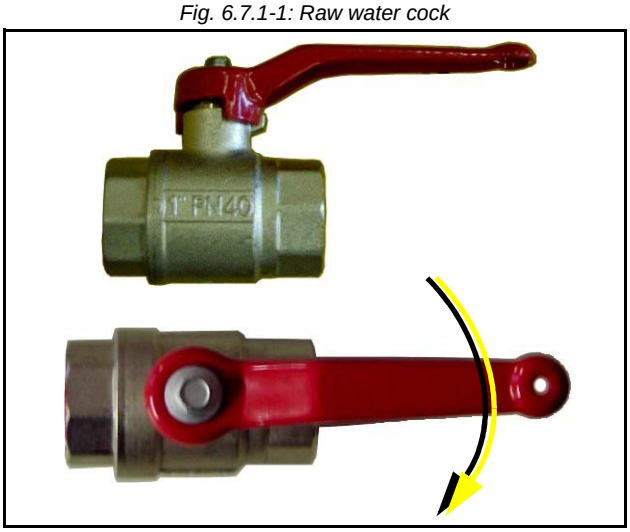
The impeller of the cooling water pump must be regarded as wearing part. The life span of the impeller can be extremely different and exclusively depends on the operating conditions. The cooling water pumps of the PANDA generators are laid out in such a way that the number of revolutions of the pump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

6.7.1 Replacement of the impeller

Close the raw water stop cock.

Representative picture

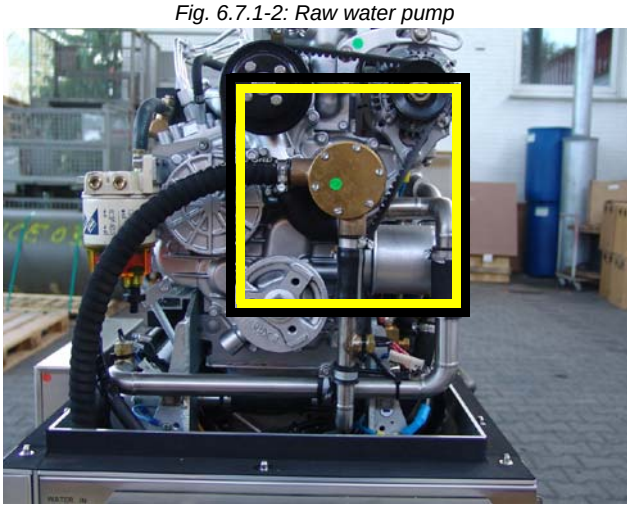
Fig. 6.7.1-1: Raw water cock



Raw water pump on the front side of the genset.

Representative picture

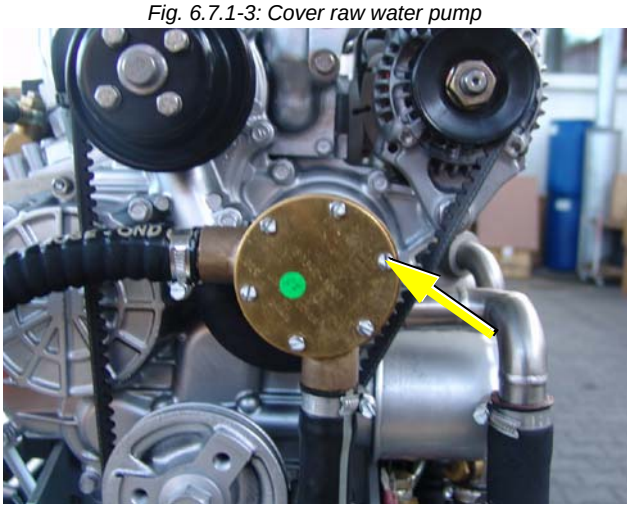
Fig. 6.7.1-2: Raw water pump



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

Representative picture

Fig. 6.7.1-3: Cover raw water pump

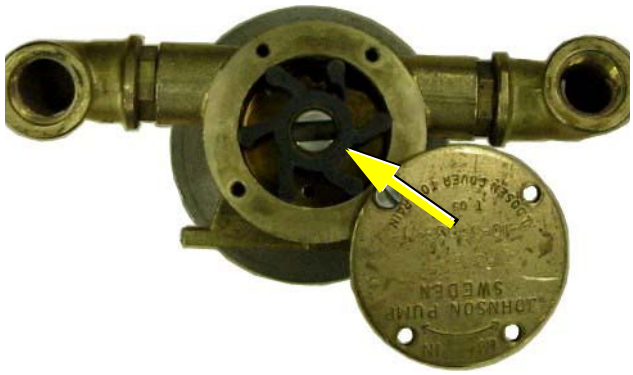


Pull to the impeller with a multigrip pliers of the wave.

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

Representative picture

Fig. 6.7.1-4: Impeller pump



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

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

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

Representative picture

Fig. 6.7.1-5: Impeller

Fastening the cover and use a new seal.

Representative picture

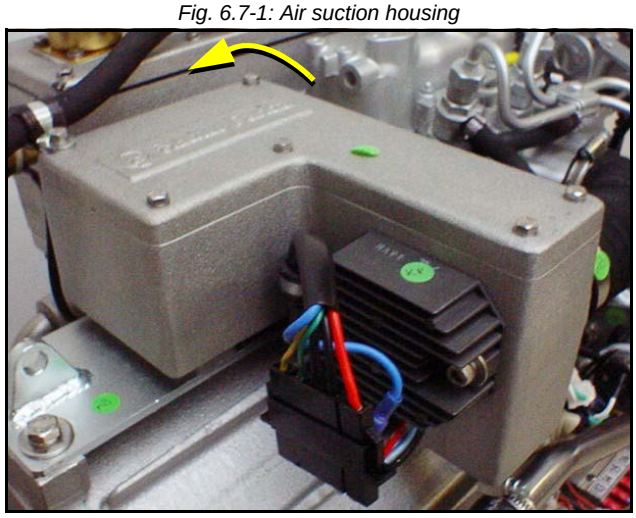
Fig. 6.7.1-6: Gasket

6.7.2 Replace the air filter mat

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

   Use spanner size 8mm.

Fig. 6.7-1: Air suction housing



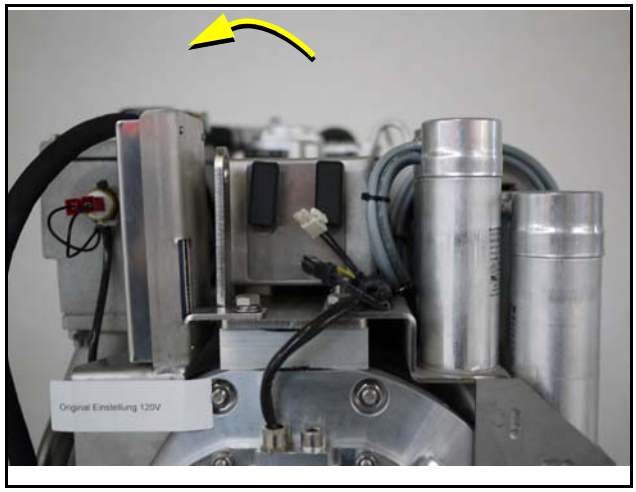
2. Change the air filter mat
3. Close the suction air housing

Fig. 6.7-2: Opened air suction housing

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

1. Air filter housing with pull out holder

Fig. 6.7.3-1: Air suction housing with pull out holder

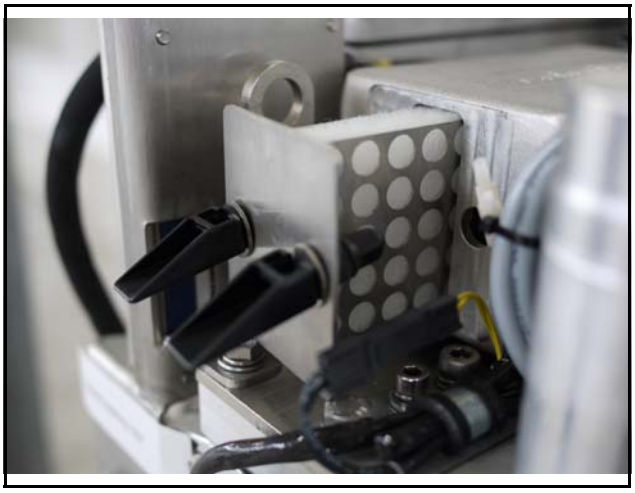


2. Tip the two fasteners 90°

Fig. 6.7.3-2: Air suction housing with pull out holder

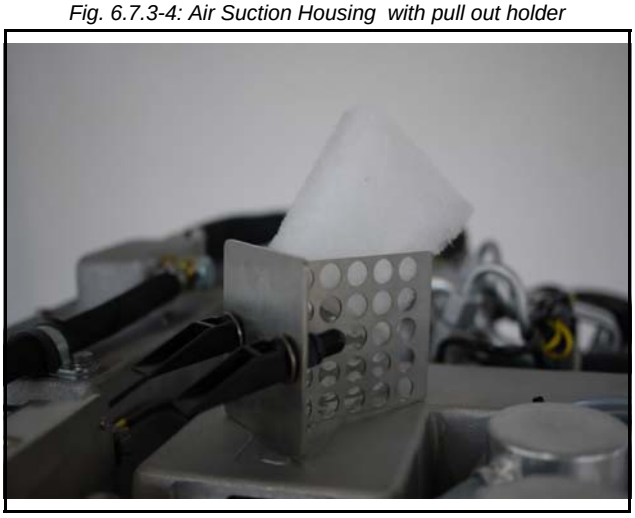
3. Pull the filter mat holder out

Fig. 6.7.3-3: Air suction housing with pull out holder



4. Replace the air filter mat
5. Assembly in reversed order

Fig. 6.7.3-4: Air Suction Housing with pull out holder

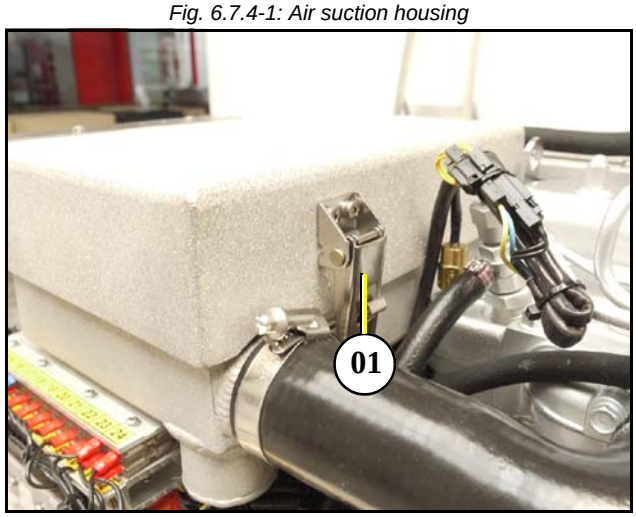


6.7.4 Alternative replacement of the air filter at housing with snap fasteners

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

   01. Closure

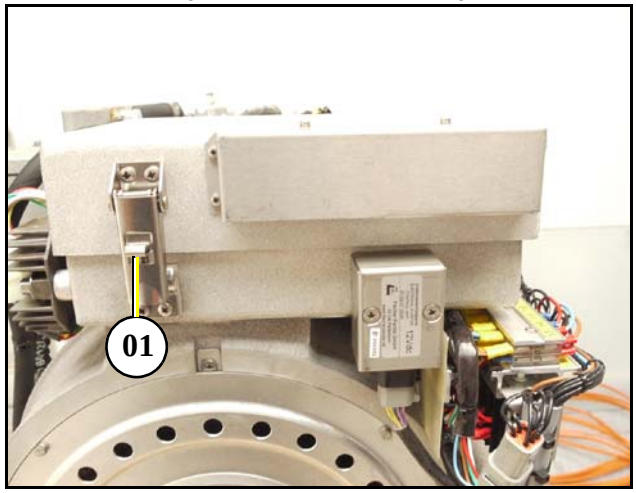
Fig. 6.7.4-1: Air suction housing



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

   01. Closure

Fig. 6.7.4-2: Air suction housing

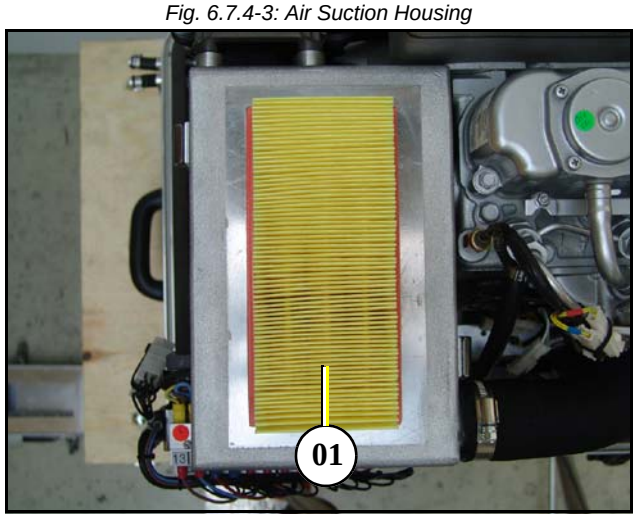


3. Open the air housing by pulling the cover.
4. Lift out the air filter element of the cover of the air filter housing.

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

Sample picture

Fig. 6.7.4-3: Air Suction Housing



6.8 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.

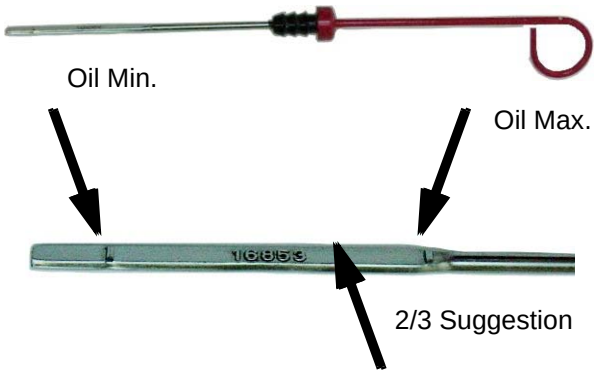
Oil dipstick

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. 6.8-1: Oil dipstick - Sample



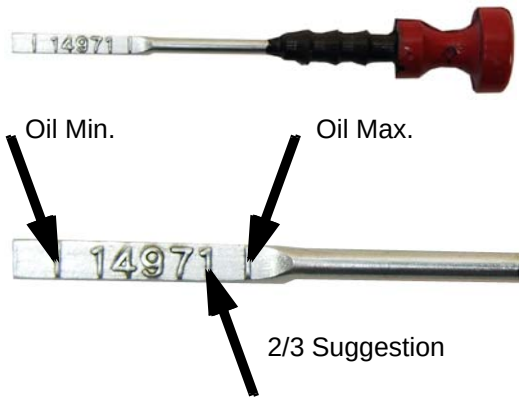
Oil dipstick EA 300 Engine

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. 6.8-2: 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.

6.8.1 Refilling Oil

You require:

Engine oil

1. Check oil-level as described under „Checking oil-level“ on page 1.
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 „Checking oil-level“ on page 1.

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

6.8.2 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.

6.9 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. 6.9-1: 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 17mm.

Fig. 6.9-2: Oil drain hose

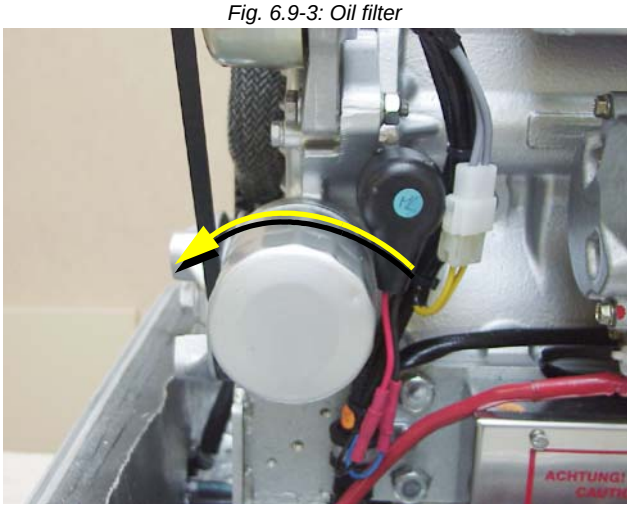
4. Discharge used oil.

   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. 6.9-3: Oil filter



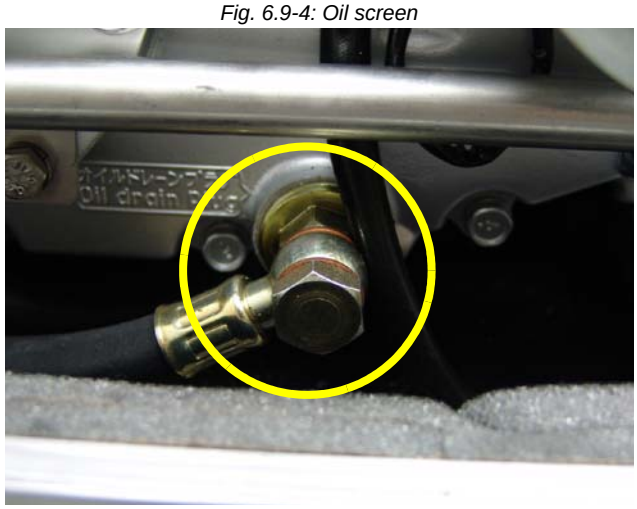
Oil screen with generators with EA300 engines

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

Use spanner size 17mm.

Sample picture

Fig. 6.9-4: 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. 6.9-5: Oil screen sealing ring

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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 „Checking oil-level“ on page 1.

   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.

6.9.1 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).

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

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

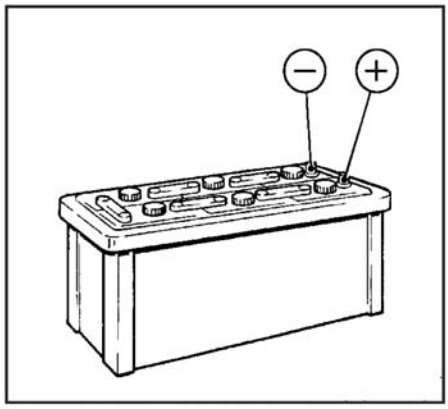
If from the battery manufacturer not otherwise mentioned.

6.10.1 Battery

6.10.1.1 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. 6.10.1.1-1: Battery

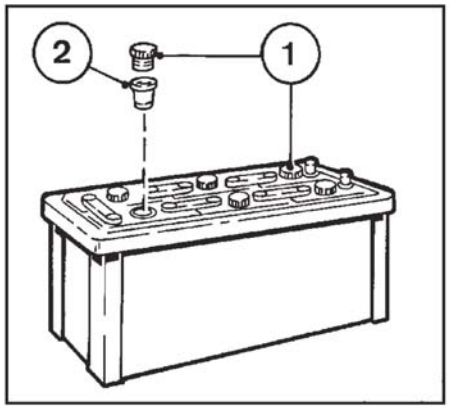


6.10.1.2 Check electrolyte level

- 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.

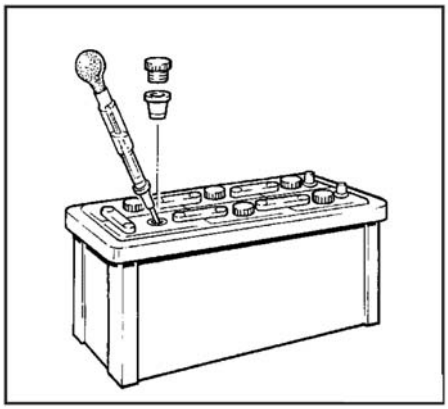
Fig. 6.10.1.2-1: Battery



6.10.1.3 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. 6.10.1.3-1: 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

6.11 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):

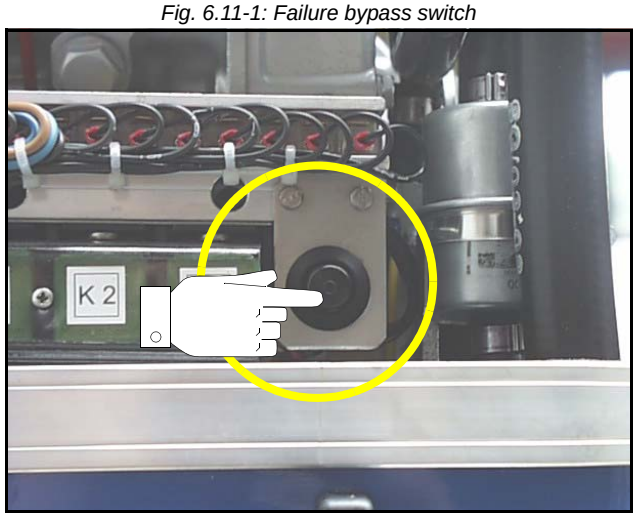
Generators with iControl system do not need a Failure bypass switch. At these generators the fuel pump can be activated by an option of the control panel. See Control panel manual.

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).

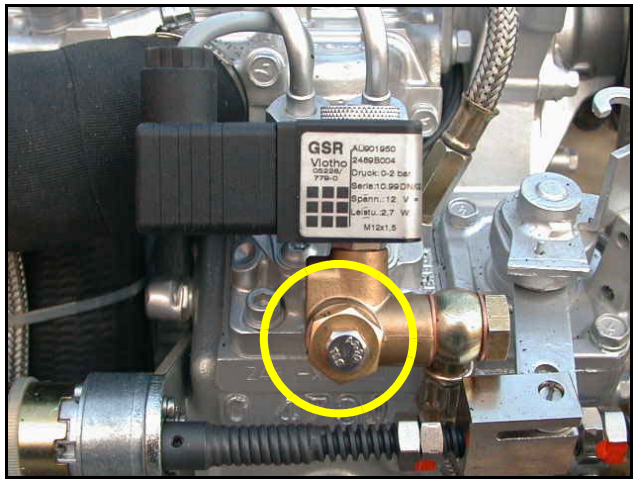
Fig. 6.11-1: Failure bypass switch



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.

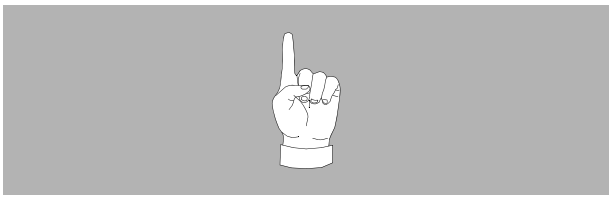
   Use spanner size 10mm.

Fig. 6.11-2: 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!:

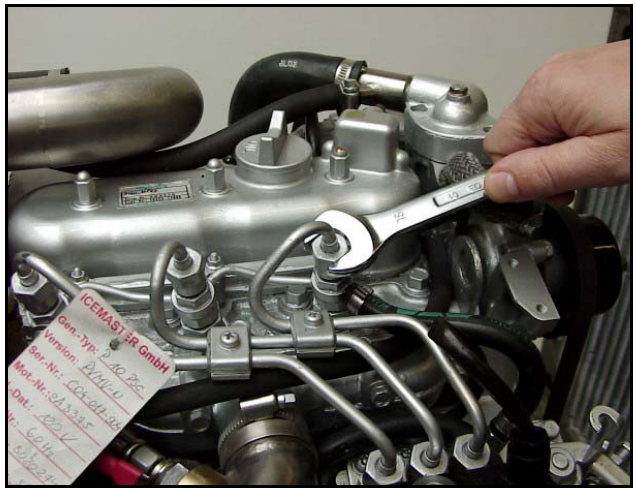


4. Pressing the starter button can now start the machine. The machine should start after a short period.
5. If this does not occur, then a connecting nut fitted to the injection line must be loosened and starting procedure repeated. Retighten the washers after successfully starting. The injection line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

   Use spanner size 17mm.

6. Switch main switch „OFF“

Fig. 6.11-3: Injection nozzles



6.11.1 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. 6.11.1-1: Fuel Filter

6.11.1.1 Optional fuel filter with sight glass

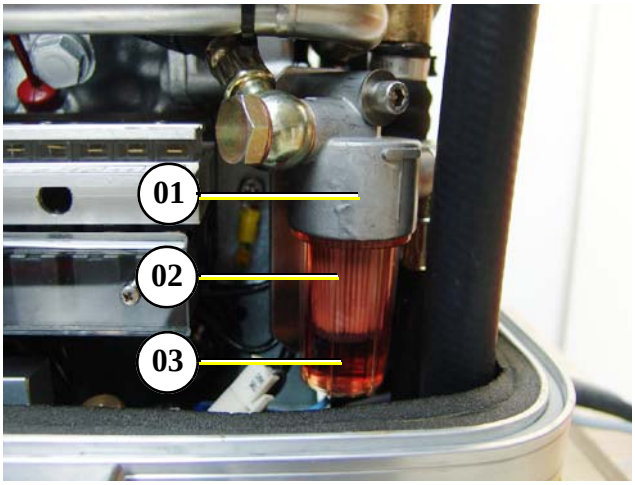
The filter change depends on the fuels' degree of pollution, but should be executed every 300 operating hours at the latest.

01. Fuel filter housing

02. Fuel filter element

03. Sight glass

Fig. 6.11.1.1-1: Fuel filter

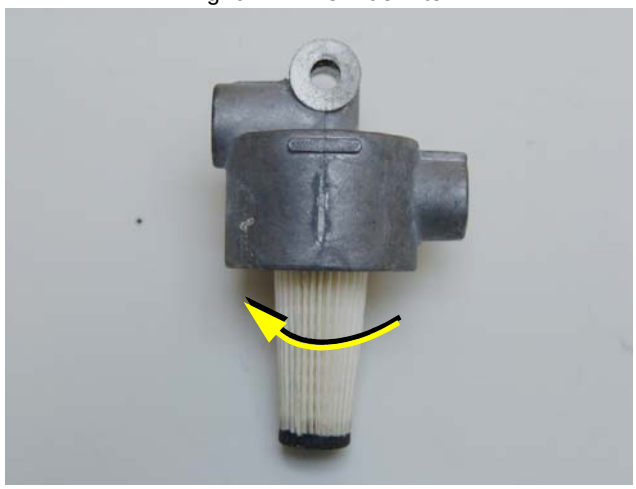


Unscrew the housing from its mount (left hand rotation).

Fig. 6.11.1.1-2: Fuel filter

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

Fig. 6.11.1.1-3: Fuel filter



Screw the new filter element into the mount.

Fig. 6.11.1.1-4: Fuel filter

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).

6.11.2 Check and discharge the capacitors

NEVER check the capacitors whilst the generator motor is running! Charged capacitors can be lethal. Do not contact the capacitors with bare fingers or non-insulated metallic objects! In order to test the capacitors, the terminal lead wires have to be disconnected using pliers or a screwdriver with insulated handle(s). Once the wires have been removed, the capacitors must be discharged by bridging the capacitor terminals with a discharge reactor.

Attention!:

The capacitors can be checked using a multimeter with capacitor measuring.

The capacitors fitted inside the cabinet are discharged over the soldered resistor at every capacitor. The discharge over the discharge reactor (see special tools) is security because the capacitor voltage is lethal.

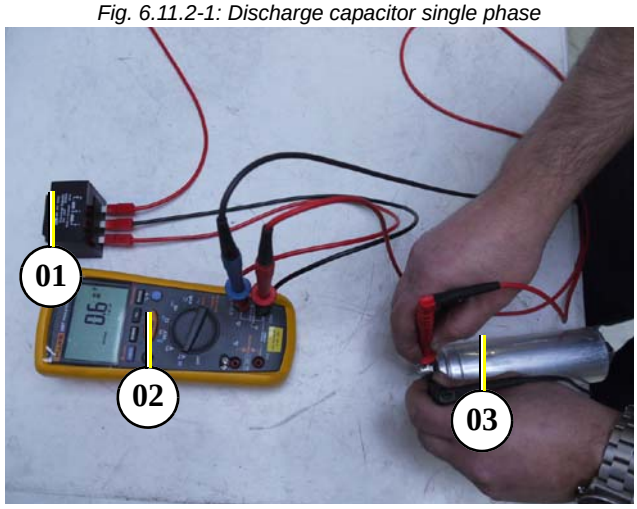
Discharge the capacitor - single phase

01. Discharge reactor (5-10kOhm)

02. Multimeter

03. Capacitor

Fig. 6.11.2-1: Discharge capacitor single phase



Discharge the capacitor - three phase

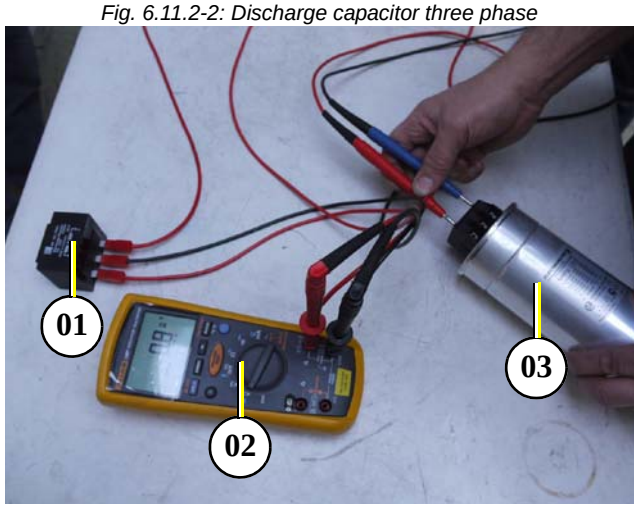
01. Discharge reactor (5-10kOhm)

02. Multimeter

03. Capacitor

At three phase capacitors the discharge must be made between every phase (L1-L2; L2-L3; L1-L3)

Fig. 6.11.2-2: Discharge capacitor three phase



Checking

Switch the multimeter to capacitor measuring and connect the meter end probes to the capacitor terminals. Measure capacity of the capacitor.

Fig. 6.11.2-3: Capacitor checking

Check all capacitors in the electrical cabinet

Test each capacitor by touching the multimeter (set on capacitor measuring) probes on the capacitor terminals: measure the capacity of the capacitors.

The capacitors should not be removed from the electrical cabinet before the check is made.

Checking the electrical connections to the Capacitor

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.

7. Generator Failure

7.1 Personal requirements

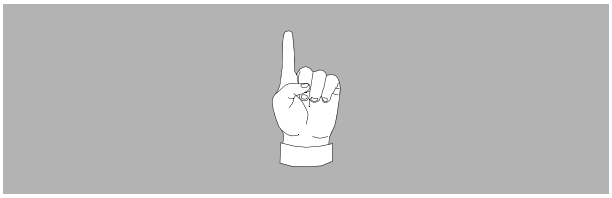
The work described here, unless otherwise indicated, are performed by the operator.

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.

7.2 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

7.3 Overloading the Generator

Please ensure that the genset is not overloaded. This is especially the case with multi-power aggregates. Overloading occurs when the electrical load (demand) induces a load torque in the generator which is higher than what the diesel drive motor can provide. Overloading causes the engine to run rough, burn oil, create excessive exhaust (environmentally unfriendly) and even to stall.

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 gensets life expectancy, the nominal electrical demand on the system should not be more than 70% of the rated genset power.

Bear this in mind when switching on electrical devices. This ensures a longer life expectancy.

Continuous performance is the uninterrupted running of the generator for many hours. 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.

7.3.1 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.

7.3.2 Overloading the Generator with Electric Motors

Please note that electric motors require six to ten times more power than their rated capacity to start.

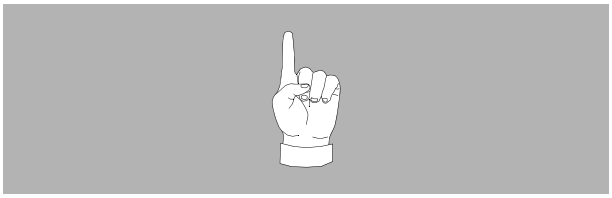
If the supplied generator power is lower than what the electric motor requires, the generator voltage will collapse. For applications where a high current draw is required to start an electrical device (such as an electric motor), the motor manufacturer should be consulted for possible solutions (for example: stronger capacitors, gradual power-up switches, or a specially designed starting unit for electric motors).

System efficiency can be improved by up to 50% and motor current draw (to start) reduced by as much as 100% if it is properly designed. If the inductive load (i.e. E-Motor) is more than 20% of the generator nominal power, a compensation is necessary. See also the information brochure „Special information for operation of Panda generators with inductive load“.

7.3.3 Generator Voltage Fluctuations and Monitoring

Before working (installation) on the System read the section Safety Instructions in this Manual.

Notice!:



During periods of high electric loading, the voltage may drop to 190V/50Hz (or 95V/60Hz) or even lower. Such voltage drops can potentially cause damage to certain electrical devices such as electric motors, compressors and electronic equipment. In order to ensure that sufficient voltage is available and to avoid the risk of damage to sensitive electrical devices, the supply voltage should be monitored with the voltmeter, which is mounted at the operation unit.

The voltmeter must be respectively checked if additional load is switched on. As long as the voltage remains below the critical level the sensitive devices must be switched off during this period.

Over voltage can be caused by the generator under certain circumstances. This occurs, especially if the speed of the motor changes (increases in speed). Adjustment to the normal motor speed (rpm) should only be done with the use of a rev counter and/or a voltmeter.

A voltage regulated circuit breaker is installed in the electrical system in order to avoid damage, if sensitive or valuable equipment is used. (voltage control with circuit breaker).

7.3.4 Automatic Voltage Monitoring and Auto-Shut Down

If air conditioning units (compressors) or other such valuable equipment are installed on-board, an automatic voltage monitoring unit should be installed to protect this equipment from possible sharp voltage drops. The voltage monitoring system shuts down the entire system (and therefore all users) through 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). The monitoring system also switches the grid back on once the required voltage level is again reached. This ensures no damage is caused to the load and fittings through under voltage. Such a voltage relay can be obtained from wholesale dealers or as a complete unit from PANDA dealers.

The circuit is always automatically cut off if the generator is stopped.

7.4 Adjusting Instructions for the Spindle of the actuator (not ND models)

There are two independent regulation devices for the speed range of the generator. Limited upward and downward:

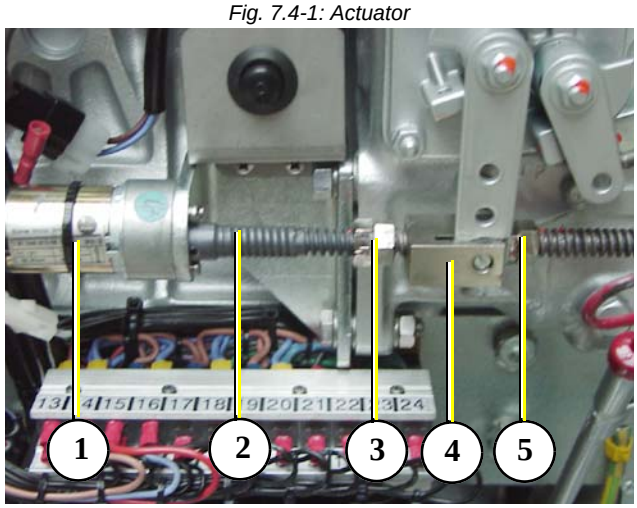
With the regulation nuts at the spindle of the actuator left and right of the spindle nut.

With an adjusting screw directly at the base of the speed regulator lever. (only up)

After all work at the components of the speed regulation is done the adjustment of the limitation must be checked.

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. 7.4-1: Actuator



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

7.4.1 Adjustment of the maximum upper speed

1. Disconnect the plug at the electrical supply line of the actuator.
2. Unclamp the countering nut at the limitation screw with a wrench SW 10.
3. Connect an electrical voltage instrument (voltmeter) with a display range until 300V AC to AC outlet in the electrical cabinet.
4. Be sure that no electrical load is adjusted.
5. Start the generator.
6. Increase the speed of the generator by turning the spindle of the actuator manually until the voltmeter reach a value of 270V.
7. Turn the limit stop screw tight against the limit stop point at the speed regulator lever.
8. Protect the limit stop screw with the countering nut.
9. Check again if the voltage of the generator is limited to max. 270V without load.

The adjustment of the upper limitation of the rev serves an additional safety. The value of the max. voltage lies above the normal operating border.

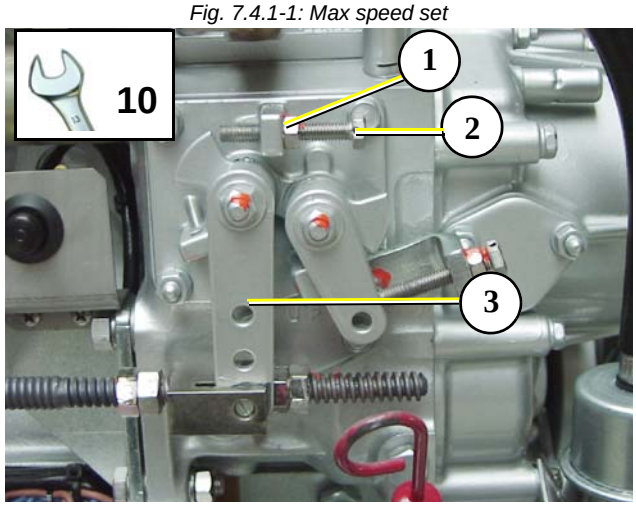
1. Countering nut

2. Adjusting screw for upper limitation

3. Speed regulator lever

This adjustment should not be changed, otherwise the warranty expires

Fig. 7.4.1-1: Max speed set



7.4.2 Adjustment of the normal speed limitation

Adjusting the lower limitation:

1. Disconnect the plug at the electrical supply line of the actuator.
2. Unclamp the countering nuts with two wrench SW 14.
3. Connect an electrical voltage instrument (voltmeter) with a display range until 300V AC to AC outlet in the electrical cabinet.
4. Be sure that no electrical load is adjusted.
5. Start the generator.
6. Decrease the rev of the generator by turning the spindle of the actuator manually until the voltmeter reach a value of 220V.
7. Both nuts must be screwed tight.
8. Check again if the lower voltage of the generator is limited to min. 220V without load.

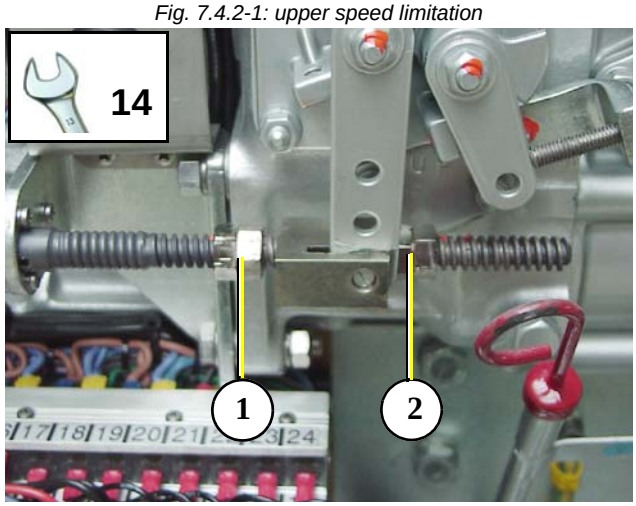
Adjusting the upper limitation:

1. Proceed like before and tighten the countering nuts at a voltage of max. 270V without load.
2. Check again if the upper voltage of the generator is limited to this value.

1. Adjusting nut for upper speed limitation

2. Adjusting nut for lower speed limitation

Fig. 7.4.2-1: upper speed limitation



If the adjustment is finished the plug of the actuator must be re-connect for operation.

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

7.4.3 Lubrication of the spiral thread spindle (not ND models)

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.

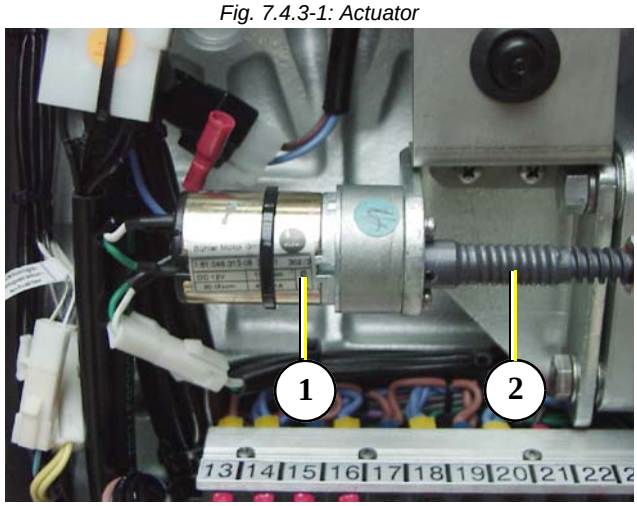
It is possible that the spindle could clamp if the spindle is not enough lubricated. Then the generator can be switched off by over- or under voltage.

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

1. Speed actuator

2. Spiral thread spindle

Fig. 7.4.3-1: Actuator



7.4.4 Effects of a overload to the actuator (not ND models)

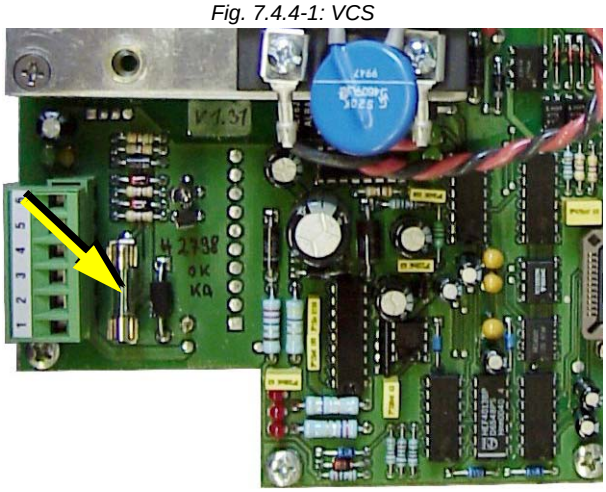
If the generator is overloaded the voltage falls on account of a not adequate motor power under the nominal value. The actuator stays at the upper keystroke and tries to rev up the diesel engine. An internal regulation limits the current to the actuator, nevertheless a longer overload can damage the winding of the actuator. (short of the winding). The motor gets not strictly inoperative but it can happen that the cranking torque of the actuator is getting weak. This has the consequence that the rev spindle can not be turned to all positions faultless. Therefore the voltage of the generator is regulated not good or sometimes not at all.

If you notice that the spindle of the actuator doesn't run faultless, first check if the aggregate was overloaded for a short time and if thereby the winding of the actuator was damaged. Then the actuator has to be changed.

Check the electrical fuse (miniature slow-to-blow fuse 1,6A) on the control printed circuit board if the actuator will not turn at all.

Change this fuse (1,6A slow to blow)

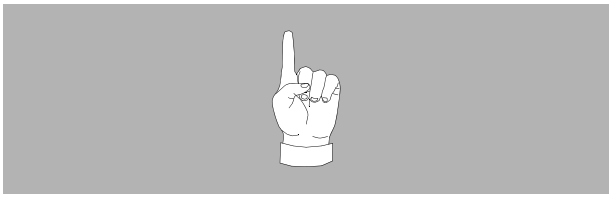
Fig. 7.4.4-1: VCS



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

The Mini VCS has no fuse to change

.Notice!:



7.4.4.1 Possible disturbances in the area of the rev regulation „VCS“

Failure	Cause
The spindle of the actuator jams	not regularly lubricated. surface is mechanical damaged. actuator is defect. defect of the VCS control (short of winding). signal 230V AC missing. limiting nut jams the spindle.
Fuse on the printed circuit board of the VCS control is melted.	constant overload of the generator.

7.4.4.2 Steps to check the voltage control by a disturbance:

1. Switch off all electrical consumers.
2. Disconnect the plug of the actuator.
3. Turn the actuator manually to check if the adjusting nut is jammed to the limit stop points.
4. Turn the actuator manually to check if the adjusting nut on the spindle runs faultless.

If there is no result by these steps the actuator is working mechanically correct. After this the electrical components must be checked:

1. Connect the plug of the actuator.
2. Start the generator.
3. Turn the actuator by hand and check if the spindle turns back by the motor.
4. If the motor react on the turn by manual strongly (the motor can normally hold with the fingers) the drive will be working faultless. If there are nevertheless faults in the voltage control there is a fault in the control VCS.

7.4.4.3 If the actuator is not moving the following points are necessary:

1. The motor turns not strongly rather weak:

   The actuator has shorts in the winding and must be changed. (pay attention that the generator is not overloaded anymore.)

2. The actuator does not move but the spindle can be turned manually. Disconnect the plug of the actuator. Connect provisional an external voltage source 12V-DC to the motor.

   The actuator don't turns with the external voltage source. The actuator is defect and have to be changed.

   The control must be inspected by the following steps if the actuator turns and works faultless with the external voltage source:

1. Check the fuse on the VCS printed circuit board.
2. Check if the sense voltage is wired to the VCS printed circuit board.
3. Check if the VCS supply voltage is wired to the VCS.
4. Check if the VCS outlet signal for the actuator is wired.

Change the VCS printed circuit board if the points above carries no clearance.

7.4.4.4 The mechanical voltage limitation must be checked regularly. The following steps have to be done:

1. Disconnect the plug of the actuator.
2. Switch off all consumers.
3. Connect an electrical voltmeter.
4. Start the generator.
5. Turn the actuator manually to the lower limit stop point.
6. The voltage must be 220V.
7. Turn the actuator manually to the upper limit stop point. The max. voltage is 270V.
8. A new adjustment is necessary in case of deviants.

7.5 Low Generator-Output Voltage

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

7.6 Testing generator stator windings

7.6.1 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 voltage between the phase(s) and N. If the measured values are under the substantially values in Table 9.4-5, "Voltage values stator coil," on Page 200, 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.)

7.6.2 Measuring the coil resistance

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

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

If strong deviations in the individual coils are measured, must assumed that there is a coil short-circuit in a coil. This leads to the fact that the generator does not excite itself any longer.

The actual values between the coils and ground are not to be determined exactly. It depends primarily on the fact that the values of all three measurements are close to the same. Deviations among themselves refer to a coil short-circuit. In this case the generator must be wound again by a specialist.

7.6.3 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 “Testing generator stator windings” on Page 122.).

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

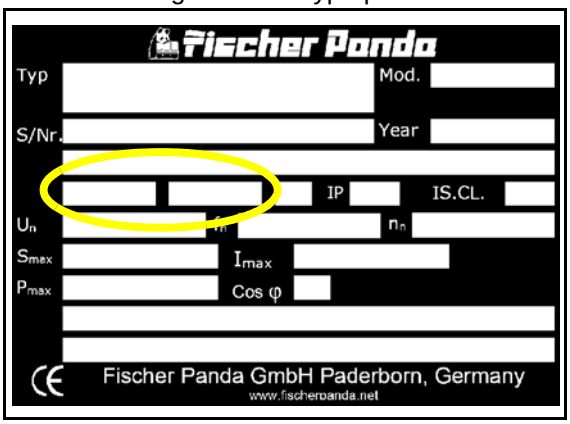
HP3 - 50Hz: L1, L2, L3

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. 7.6.3-1: Type 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 data can be requested.

7.6.4 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.

7.7 Starting Problems

7.7.1 Fuel Solenoid Valve (optional)

All engines are equipped with an electric inlet fuel solenoid valve (12V) which switches off the motor.

The fuel solenoid valve is located in front of the injection pump. It opens automatically, if the „START“-button is pressed on the remote control panel. The solenoid valve is CLOSED when the generator main power is switched „OFF“. For this reason, it requires a few seconds before the motor comes to a full halt

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.

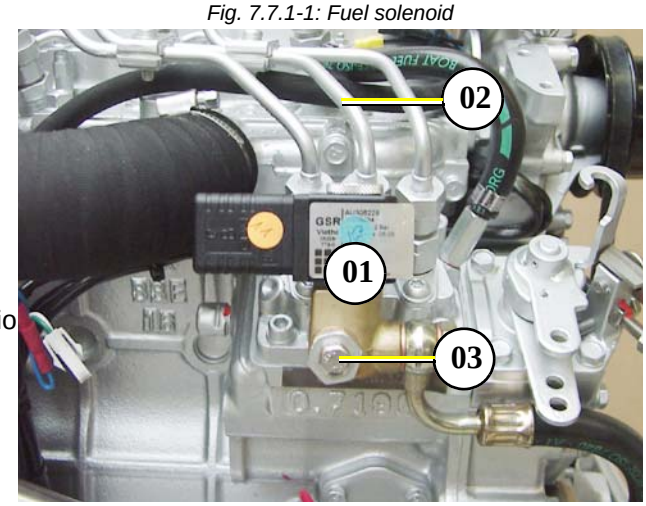
A check of the fuel solenoid valve by removing the plug from the fuel solenoid valve for a short period whilst in operation (first remove the small retention screw) and replace it immediately. The motor should „react immediately“ by revving high.If the motor does not react sharply to the reconnection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

01. Fuel solenoid valve

02. Fuel injector line

03. Ventilation screw

Fig. 7.7.1-1: Fuel solenoid



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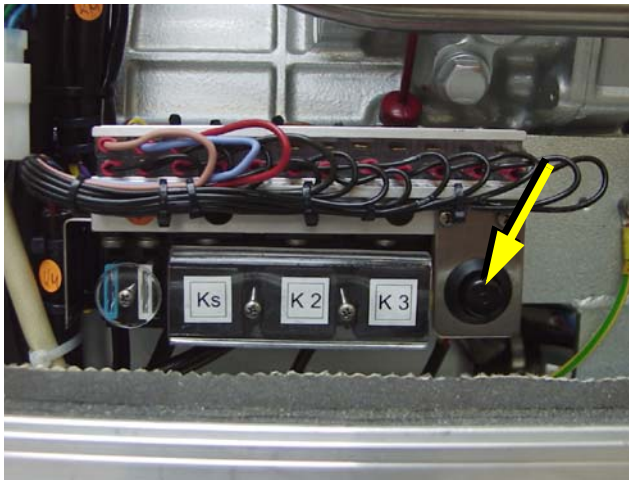
7.7.2 Failure Bypass Switch

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. 7.7.2-1: Failure bypass switch



This period can be reduced by pushing the button on the front of the generator. The generator can be started by means of the remote control as long as the button is depressed. The switch/button bypasses any faults allowing the generator to run.

Before depressing the button, a manual check of the oil dip stick 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.

BEWARE:

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-failure bypass 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 it 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.

7.7.3 Stop solenoid

There are two different variations:

A. Energized to stop

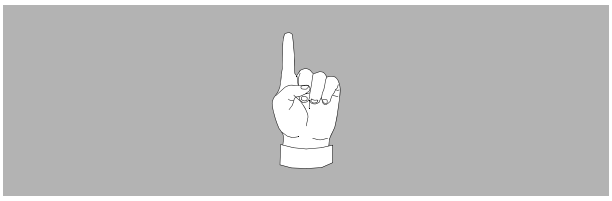
By pressing the „OFF“-button on the remote control panel the stop solenoid is supplied with voltage and operate, through this the injection nozzles resets to zero position and the generator stops.

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.

.Notice!:



Stop solenoid (optional)

Fig. 7.7.3-1: Stop solenoid

8. Tables

8.1 Troubleshooting

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

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

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

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

DIESEL MOTOR FAILS TO START	
Cause	**Solution**
Starter battery switched "OFF".	Check position of battery switch and switch "ON" (if installed).
Starter battery voltage insufficient (battery too weak).	Inspect battery terminals and cables for a good electrical connection (Inspect against corrosion, tattered wires, etc.).
Starting current disrupted.	During the normal starting process, the battery voltage drops to 11V with a fully charged battery. If the voltage does not drop during starting, the electrical connection is faulty. If the battery voltage drops lower than 11V, then the battery has been discharged.

STARTER IS TURNING MOTOR, BUT FAILS TO START	
Cause	**Solution**
Fuel inlet solenoid valve not opening.	Check wire connections and circuitry to solenoid valve. (ref. DC wiring diagram: Relay K2, Fuse)
Fuel pump not working.	Check fuel-filter and pump: clean if necessary.
Lack of fuel.	Check fuel supply.
Glow-plugs not working correctly.	Check glow plugs and heating time.
Too much air in fuel lines.	Test fuel system for leakage. Bleed air from fuel system (refer to section 6.11, “Ventilating the fuel system,” on page 110).
Fuel-filter blocked.	Replace fuel filter.

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

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

MOTOR SPEED DROPS	
Cause	**Solution**
Lack of fuel	Check fuel supply system: - fuel filter, renew if necessary - check fuel pump - check fuel lines (bleed if necessary)
Lack of intake air.	Check air intake paths. Check and clean air filter (and intake muffler if installed).
Generator overloaded by too many load.	Reduce the electrical load (switch off load).

MOTOR SPEED DROPS	
Generator overloaded by over-energizing.	Check that the proper capacitor type is installed and that they are connected correctly.
Defective generator (windings, bearings, or other).	Generator must be sent to manufacturer for repair of damaged bearings or winding.
Damaged engine.	Repair of bearing damage, etc., by Farymann-Service.

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

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

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

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

8.2 Technical Data

Fig. 8.2-1: Technical Data

	Panda 4000s	Panda 4200 FCB	4500FCB		
Type	Farymann 18W430	Farymann 18W430	Farymann 18W430		
Governor	mechanic	mechanic	mechanic		
Automatic startbooster	yes	yes	yes		
Cylinder	1	1	1		
Bore	82 mm	82 mm	82 mm		
Stroke	55 mm	55 mm	55 mm		
Stroke volume	290 cm^3	290 cm^3	290 cm^3		
Max. power (DIN 6271-NB) at 3000rpm	5,7 kW	5,7 kW	5,7 kW		
Rated speed 50 Hz	3600 rpm	3600 rpm	3600 rpm		
Idle running speed ²	3690 rpm	3690 rpm	3690 rpm		
Valve clearance (engine cold)	0,2 mm	0,2 mm	0,2 mm		
Cylinder head nut torque	30-33 Nm	30-33 Nm	30-33 Nm		
Compression ratio	20:1	20:1	20:1		
Lubrication oil capacity	1,25 l	1,25 l	1,25 l		
Fuel consumption ³	ca. 0,42- 1,12 l	ca. 0,42- 1,12 l	ca. 0,42- 1,12 l		
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF		
Cooling water requirement for seawater circuit (Marine generators only)	10-12 l/min	10-12 l/min	16-28l/min		
Permissible max. permanent tilt of engine	a) 25° across the longitudinal axis b) 20° in the longitudinal direction				
Recommend starter battery size	12V 28Ah equiva-lent	12V 28Ah equiva-lent	12V 36Ah equiva-lent		
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm^2	25mm^2	25mm^2		
Max. exhaust backpressure	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar²	9,3 kPa 93 Millibar		

² progressive speed by VCS
³ 0,35l/kW electrical power, the randomized values between 30% and 80% of the rated speed

Fig. 8.2-2: Technical Data

	Panda 6000 ND	Panda 8000 NE	Panda 9000 ND	Panda 1000NE	Panda 12000 NE
Type	Z482	Z482	D722	Z602	D722
Governor	MIni VCS	VCS	mechanic	VCS	VCS
Automatic startbooster	no	yes	no	yes	yes
Cylinder	2	2	3	2	3
Bore	67mm	67mm	67mm	72 mm	67mm
Stroke	68mm	68mm	68mm	73,6 mm	68mm
Stroke volume	479cm^3	479cm^3	719cm^3	599cm^3	719cm^3
Max. power (DIN 6271-NB) at 3000rpm	9,32kW	9,32kW	14,0kW	11,6kW	14,0kW
Rated speed 50 Hz	3000rpm	3000rpm	3000rpm	3000rpm	3000rpm
Idle running speed ²	3120rpm	2900rpm	3120rpm	3100rpm	2900rpm
Valve clearance (engine cold)	0,2mm	0,2mm	0,2mm	0,2mm	0,2mm
Cylinder head nut torque	42Nm	42Nm	42Nm	42Nm	42Nm
Compression ratio	23:1	23:1	23:1	24:1	23:1

	Panda 6000 ND	Panda 8000 NE	Panda 9000 ND	Panda 1000NE	Panda 12000 NE
Lubrication oil capacity	2,8l	2,8l	3,8l	2,8l	3,8l
Fuel consumption [3]	ca. 0,5-1,4l	ca. 0,7-1,8l	ca. 0,8-2,1l	ca. 1,0-2,66l	ca. 1,1-2,8l
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF	API CF	API CF
Cooling water requirement for seawater circuit (Marine generators only)	16-28l/min	16-28l/min	16-28l/min	16-28l/min	16-28l/min
Permissible max. permanent tilt of engine	a) 25° across the longitudinal axis b) 20° in the longitudinal direction				
Recommend starter battery size	12V 28Ah equiva-lent	12V 28Ah equiva-lent	12V 36Ah equiva-lent	12V 36Ah equiva-lent	12V 36Ah equiva-lent
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm²	25mm²	25mm²	25mm²	25mm²
Max. exhaust backpressure	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar²	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar

[2] progressive speed by VCS
[3] 0,35l/kW electrical power, the randomized values between 30% and 80% of the rated speed

Fig. 8.2-3: Technical Data

	Panda 14000 NE	Panda 15000NE	Panda 18 NE	Panda 24 NE	Panda 30 NE
Type	D782	D902	D1105	V1505	V1505 TD
Governor	VCS	VCS	VCS	VCS	VCS
Automatic startbooster	yes	yes	yes	no	no
Cylinder	3	3	3	4	4TD
Bore	67mm	72mm	78mm	78mm	78mm
Stroke	73,6mm	73,6mm	78,4mm	78,4mm	78,4mm
Stroke volume	782cm³	898cm³	1123cm³	1498cm³	1498cm³
Max. power (DIN 6271-NB) at 3000rpm	13,5kW	17,5kW	18,7kW	23,3kW	31,3kW
Rated speed 50 Hz	3000UpM	3000UpM	3000rpm	3000rpm	3000rpm
Idle running speed [2]	2900UpM	2900UpM	2900rpm	2900rpm	2900rpm
Valve clearance (engine cold)	0,2mm	0,2mm	0,2mm	0,2mm	0,2mm
Cylinder head nut torque	68Nm	42mm	68Nm	68Nm	68Nm
Compression ratio	23:1	24:1	22:1	22:1	23:1
Lubrication oil capacity	3,8l	3,7l	5,1l	6,0l	6,7l
Fuel consumption [3]	ca. 1,3-3,4l	ca. 1,3-3,6l	ca. 1,7-4,5l	ca. 2,2-5,9	ca. 2,7-7,2l
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF	API CF	API CF
Cooling water requirement for seawater circuit (Marine generators only)	16-28l/min	6-28l/min	28-40l/min	28-40l/min	40-50l/min
Permissible max. permanent tilt of engine	a) 25° crosswise to the longitudinal axis b) 20° in longitudinal direction				
Recommend starter battery size	12V 36Ah equiva-lent	12V 52Ah equiva-lent	12V 65Ah equiva-lent	12V 70Ah equiva-lent	12V 70Ah equiva-lent
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm²	25mm²	25mm²	25mm²	25mm²
Max. exhaust backpressure	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar²	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar

[2] progressive speed by VCS
[3] 0,35l/kW electrical power, the randomized values between 30% and 80% of the rated speed

Fig. 8.2-4: Technical data

	Panda 30 IC PMS	Panda 45LN	Panda 47 LN	Panda 60 PVM-NE MB	Panda 75 MB PVM-NE
Type	Kubota V 1505 TB	LDW 2204 MT	LDW 2204T	Mercedes Benz OM602	Mercedes OM603A
Governor	VCS	VCS	VCS	mechanical + VCS	mechanical + VCS
Automatic startbooster	yes	no	no	no	no
Cylinder	4	4	4	5	6
Bore	78mm	88 mm	88 mm	89 mm	89 mm
Stroke	78,4mm	90,4 mm	90,4 mm	92,4 mm	92,4 mm
Stroke volume	1498cm^3	2199 ccm	2199 ccm	2874 ccm	3500 ccm
Max. power (DIN 6271-NB) at 3000rpm	31,3kW	36 kW	36 kW	69 kW	
Rated speed 50 Hz	3000rpm	3000 rpm	3000 rpm	4000 rpm	3000 UpM
Idle running speed ²	2900rpm	3000 rpm	3000 rpm		2900 UpM[a]
Valve clearance (engine cold)	0,2mm	Hydro	Hydro		0,2 mm
Cylinder head nut torque	63,7 - 68,6Nm	68 Nm	68 Nm		25 Nm
Compression ratio	22,5:1-	22:16	22:16		22:1
Lubrication oil capacity	0,145 - 0,185mm	6,4l	6,4l	7,5 l	7,5l
Fuel consumption ³	ca. 2,7 - 7,1l	ca. 4,9-13,1l	ca. 3,78-10,1l	approx. 6,3 - 16,8 l	approx. 6,7 - 17,9l
Oil consumption	max. 1% of fuel consumption			max. 0,5% of fuel consumption	
Oil specification	API CF	API CF	API CF-4	API CF	API CF
Cooling water requirement for seawater circuit (Marine generators only)	40-50l/min	40-50l/min	40-50l/min		
Permissible max. permanent tilt of engine	a) 25° crosswise to the longitudinal axis b) 20° in longitudinal direction				
Recommend starter battery size	12V 70Ah equiva-lent	12V 88 Ah equi-valent	12V 88 Ah equi-valent	12V 95 Ah equi-valent	12V 95 Ah equi-valent
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm²	50mm²	50mm“	70mm²	70mm²
Max. exhaust backpressure	10,7 kPa 107 Millibar	10 kPa 100 Millibar	10kPa 100 Millibar		

a. Progressive govenor by VCS

² progressive speed by VCS
³ 0,35l/kW electrical power, the randomized values between 30% and 80% of the rated speed

Fig. 8.2-5: Technical data

	Panda 7,5-4	Panda 9-4	Panda 12-4	Panda 17-4	
Type	Kubota D905	Kubota D1105	Kubota V1505	Kubota V2203	
Governor	mechanical + VCS	VCS	VCS	VCS	
Automatic startbooster	no	no	no	no	
Cylinder	3	3	4	4	
Bore	72 mm	78 mm	78mm	87	
Stroke	73,6 mm	78,4 mm	78,4mm	92,4	
Stroke volume	898 ccm	1123 ccm	1498cm^3	2197	
Max. power (DIN 6271-NB) at 3000rpm	17,5 kW	18,7 kW	23,3kW	20,1 KW	
Rated speed 50 Hz	1500 rpm	1500 rpm	1500 rpm	1500 rpm	
Idle running speed ²	1500 rpm	1500 rpm	1800 rpm	1500 rpm	
Valve clearance (engine cold)	0,145 - 0,185 mm	0,145 - 0,185 mm	0,2mm	0,2mm	
Cylinder head nut torque	63,7 - 68,6 Nm	63,7 - 68,6 Nm	68Nm	68Nm	

	Panda 7,5-4	Panda 9-4	Panda 12-4	Panda 17-4	
Compression ratio	23:1	23:1	22:1	22:1	
Lubrication oil capacity	5,1 l	5,1 l	6,0l	9,5	
Fuel consumption [3]	0,7 - 1,8 l	0,84 - 2,24 l	ca. 1,20-3,36 l	ca. 1,8-4,9 l	
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF	API CF	
Cooling water requirement for seawater circuit (Marine generators only)	6-28l/min	28-40l/min	28-40l/min	28-40l/min	
Permissible max. permanent tilt of engine	a) 25° crosswise to the longitudinal axis b) 20° in longitudinal direction				
Recommend starter battery size	12V 65Ah äquiva-lent	12V 65Ah äquiva-lent	12V 70Ah äquiva-lent	12V 120Ah äqui-valent	
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm²	25mm²	25mm²	70mm²	
Max. exhaust backpressure	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	

Fig. 8.2-6: Technical Data

	Panda 22-4	Panda 30/4	Panda 40/4	Panda 50/4	Panda 70/4
Type	Kubota V2403	V3600	V3600	V3800 DI-T	BF4M 1013EC
Governor	VCS	VCS	VCS	Mechanical + GAC	VCS
Automatic startbooster	no	no	no	no	no
Cylinder	4	4	4	4	4
Bore	87 mm	98 mm	98 mm	100 mm	108
Stroke	102,4 mm	120 mm	120 mm	120 mm	130
Stroke volume	2434 ccm	3620 ccm	3620 ccm	3769 ccm	4764
Max. power (DIN 6271-NB) at 3000rpm	31,1 kW	45,8 kW	58,8 kW	62,0 kW	85,0 kW
Rated speed 50 Hz	1500 rpm	1500 rpm	1500 rpm	1500 rpm	1500 rpm
Idle running speed [2]	1800 rpm	1800 rpm	2800 rpm	1800 rpm	1800 rpm
Valve clearance (engine cold)	0,18 - 0,22 mm	0,2 mm	0,2 mm	0,2 mm	Inlet $0,3^{+0,1}$ / Outlet $0,5^{+0,1}$
Cylinder head nut torque	93,1 - 98 Nm	68 Nm	68 Nm	68 Nm	
Compression ratio		22,6:1	22,6:1	19,0:1	17,6:1
Lubrication oil capacity	9,5 l	13,2 l	13,2 l	13,2 l	14,0 l
Fuel consumption [3]	approx. 1,95 - 5,2	ca. 3,15-8,4 l	ca. 3,78-10,1 l	4,2-11,2 l	6,5-17,3 l
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF	API CF	API CF
Cooling water requirement for seawater circuit (Marine generators only)	40-50l/min	40-50l/min	40-50l/min	40-50l/min	
Permissible max. permanent tilt of engine	a) 25° crosswise to the longitudinal axis b) 20° in longitudinal direction				
Recommend starter battery size	12V 136Ah equi-valent	12V 136Ah equi-valent	12V 136Ah equi-valent	12V 136Ah equi-valent	
Recommend cable cross size starter battery cable *Length 4 meter max.*	70mm²	70mm²	70mm²	70mm²	
Max. exhaust backpressure	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	10,7 kPa 107 Millibar	

[2] *progressive speed by VCS*

[3] *0,35l/kW electrical power, the randomized values between 30% and 80% of the rated speed*

Fig. 8.2-7: Technical Data igenerators

	Panda 5000i	Panda 8000i	Panda 1000i	Panda 15000i	Panda 25i
Type	EA300	Z482	Z602	D902	Kubota V1505
Governor	iControl2	iControl2	iControl2	iControl2	iControl2
Automatic startbooster	no	no	no	no	no
Cylinder	1	2	2	3	4
Bore	75mm	67mm	72 mm	72mm	78mm
Stroke	70mm	68mm	73,6 mm	73,6mm	78,4mm
Stroke volume	309cm^3	479cm³	599cm³	898cm³	1498cm^3
Max. power (DIN 6271-NB) at 3000rpm	5,1kW	9,32kW	11,6kW	17,5kW	23,3kW
Rated speed 50 Hz	3000rpm	3000rpm	3000rpm	3000UpM	1500 rpm
Idle running speed ²	2900rpm	2900rpm	3100rpm	2900UpM	1800 rpm
Valve clearance (engine cold)	0,16 - 0,20mm	0,2mm	0,2mm	0,2mm	0,2mm
Cylinder head nut torque	58,8 - 63,7Nm	42Nm	42Nm	42mm	68Nm
Compression ratio	1,3l	23:1	24:1	24:1	22:1
Lubrication oil capacity	ca. 0,42 - 1,12 l	2,8l	2,8l	3,7l	6,0l
Fuel consumption ³		ca. 0,7-1,8l	ca. 1,0-2,66l	ca. 1,3-3,6l	ca. 1,20-3,36 l
Oil consumption	max. 1% of fuel consumption				
Oil specification	API CF	API CF	API CF	API CF	API CF
Cooling water requirement for seawater circuit (Marine generators only)		16-28l/min	16-28l/min	6-28l/min	28-40l/min
Permissible max. permanent tilt of engine	a) 25° crosswise to the longitudinal axis b) 20° in longitudinal direction				
Recommend starter battery size	12V 28Ah äquiva-lent	12V 28Ah equiva-lent	12V 36Ah equiva-lent	12V 52Ah equiva-lent	12V 70Ah äquiva-lent
Recommend cable cross size starter battery cable *Length 4 meter max.*	25mm²	25mm²	25mm²	25mm²	25mm²
Max. exhaust backpressure	EA300	9,3 kPa 93 Millibar²	9,3 kPa 93 Millibar	9,3 kPa 93 Millibar²	10,7 kPa 107 Millibar

8.3 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

8.3.1 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

8.4 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.

8.5 Engine oil

8.5.1 Engine oil classification

8.5.1.1 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.

8.5.1.2 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 CCEngine oil for small demands

API CDEngine oil for suction- and turbo diesel engine

API CFReplace the specification API CD since 1994

API CGEngine oil for highest demands, turbo-tested

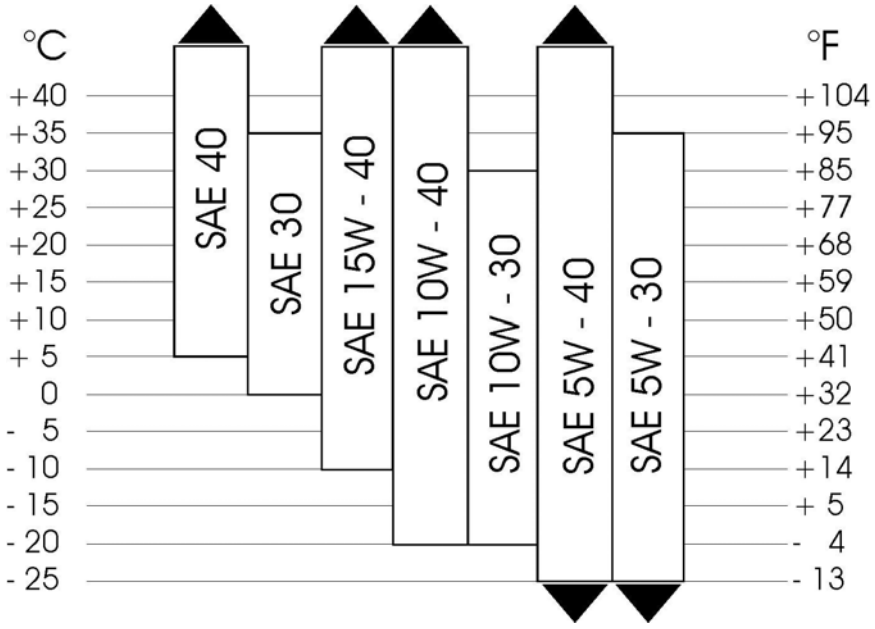
See technical data for the specificated engine oil

Notice!:

Fig. 8.5.1.2-1: 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. 8.5.1-2: Temp. range of the SAE classes



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9. Remote Control Panel P4 Control

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

	Dokument	Hardware	Software
Aktuell:	R02	V1.00	----------
Ersetzt:	R01	V1.00	----------

9.1 Remote control panel

Remote control panelP4 Control

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

Fig. 9.1-1: Remote control panel

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9.1.1 Cleaning and Replacing parts at the generator

Disconnect the battery when working on the generator

The battery must always be disconnected (first negative then positive pole), when work on the generator or the electrical system of the generator are made, so that the generator can not be started accidentally.

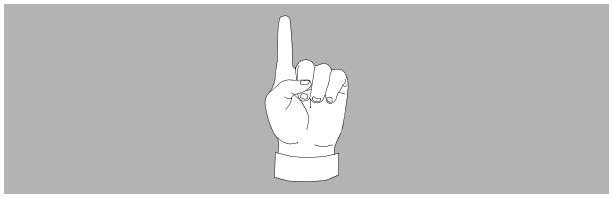
This is especially true for systems with an automatic start function. The automatic start function is to be deactivated before the work.

Sea valve must be closed. (only PMS version)

Attention!:

Note also the safety of the other components of your system.

Note!:



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

Warning!: Hot surface/material

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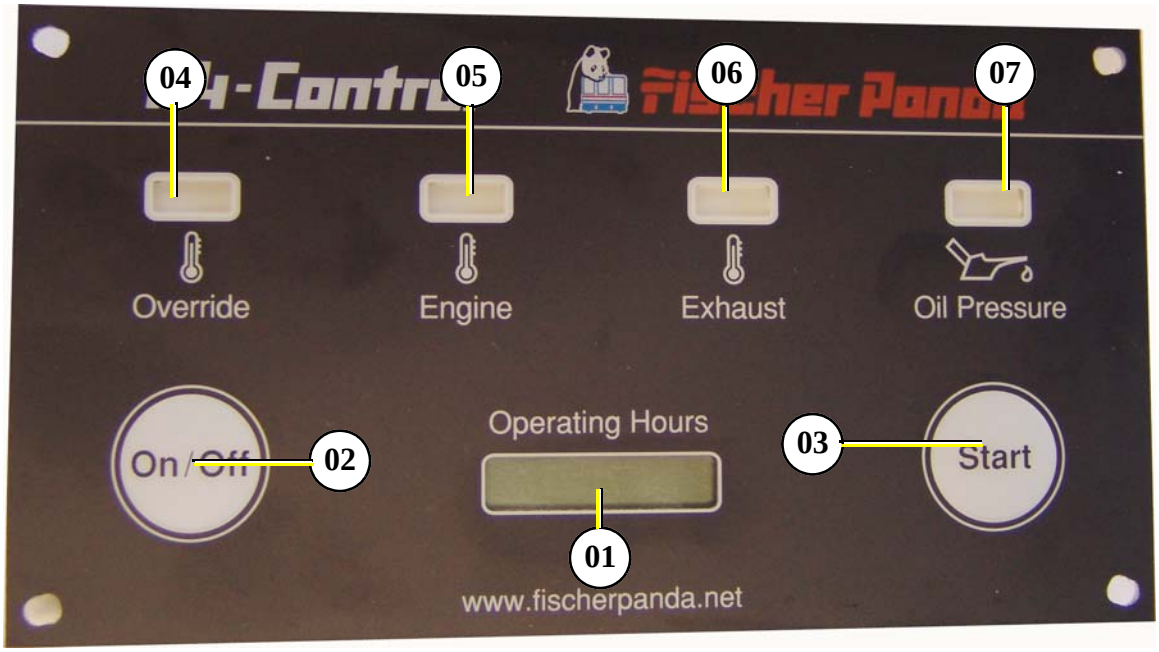
9.2 Front side

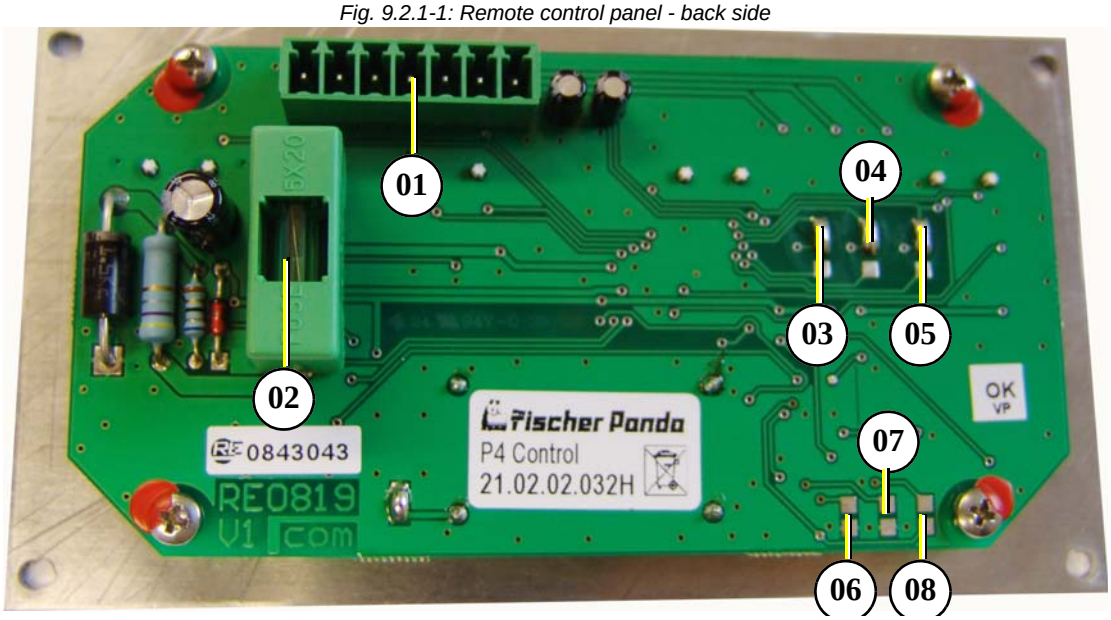
Fig. 9.2-1: Remote Control Panel - Front Side



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

9.2.1 Back Side

Fig. 9.2.1-1: Remote control panel - back side



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

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9.3 Operation Manual

9.3.1 Preliminary Remarks

Advices concerning the starter battery

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

9.3.2 Override Function

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

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

The control light „Override“ is turned on:

- if the panel ist on and the generator is stopped (funktion control)
- during the „Start“ button is pressed (Override activ)
- during the setted time after the „Start buton is released“ (Override activ)

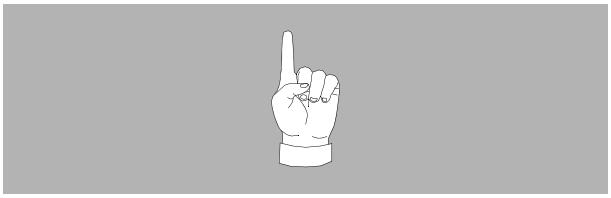
Not in use at the Panda 4000s serie.

9.3.3 Daily routine checks before starting

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

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

*Notice!:***OIL PRESSURE CONTROL!**



2. State of Cooling Water.

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

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

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

4. Check Raw water Filter. (only Marine)

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

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

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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.(only Marine)

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

9. Check the Automatic Controls Functions and Oil Pressure.

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

9.3.4 Starting the Generator

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

In the event of starting problems, close the sea water inlet cock. Panda marine generators only.

Should there be any reason to turn the engine (over) or start the engine i.e. to bleed the fuel system, the sea water inlet cock must be closed! During the starting process, the cooling water pump is driven with the motor. The cooling water is discharged to the exhaust outlet and, since the motor has not run, the exhaust pressure is not high enough to expel the sea water which has been brought to the exhaust outlet. To avoid filling the exhaust outlet with water and causing further problems, close the inlet sea water valve.

Once the engine is running, be sure to open the inlet valve!

Attention!:

9.3.5 Stopping Generator

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

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

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

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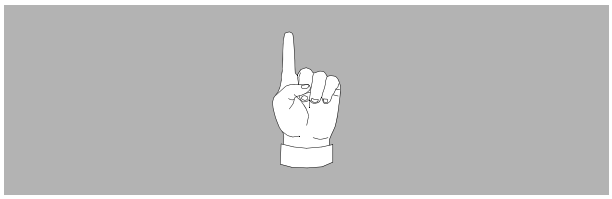
Never switch off the battery until the generator has stopped.

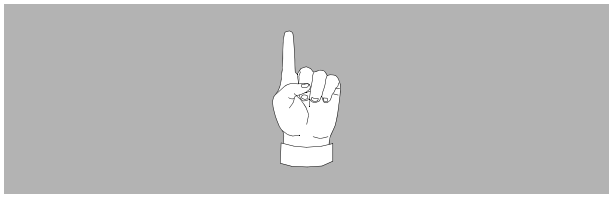
5. If necessary, close sea cock.

Notice!:



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

:*Notice!:*



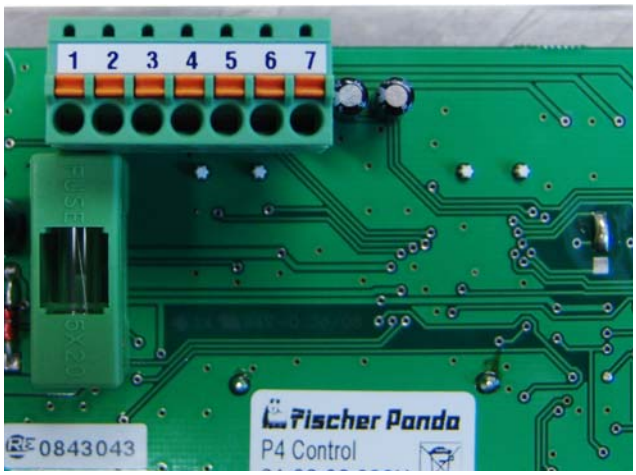
9.4 Installation of the Panel

9.4.1 Connection of the remote control panel

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

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

Fig. 9.4.1-1: Remote control panel - back side



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

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4	T-EXH	i	Error „exhaust temp.“. Temperature switch exhaust elbow in. Can be setted up by jumper as NC or NO Gives 22mA (12V +) on the switch. Status is displayed by green/red LED.
5	Oil-Press	i	Error „oil pressure“. Oil pressure switch in. Can be setted up by jumper as NC or NO Gives 22mA (12V +) on the switch. Status is displayed by green/red LED.
6	Start	o	Start relay out . Is activ while the „Start“ button is pressed. The supply voltage is switched on the relay. (see remarks 1-3)
7	Fuel-Pump	o	Fuel pump relay out. Is activ, if no error (temp. or oil press. at 3, 4, 5) is accured. Is activ during the „Override“. The supply voltage is switched on the relay. (see remarks 1-3)

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

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

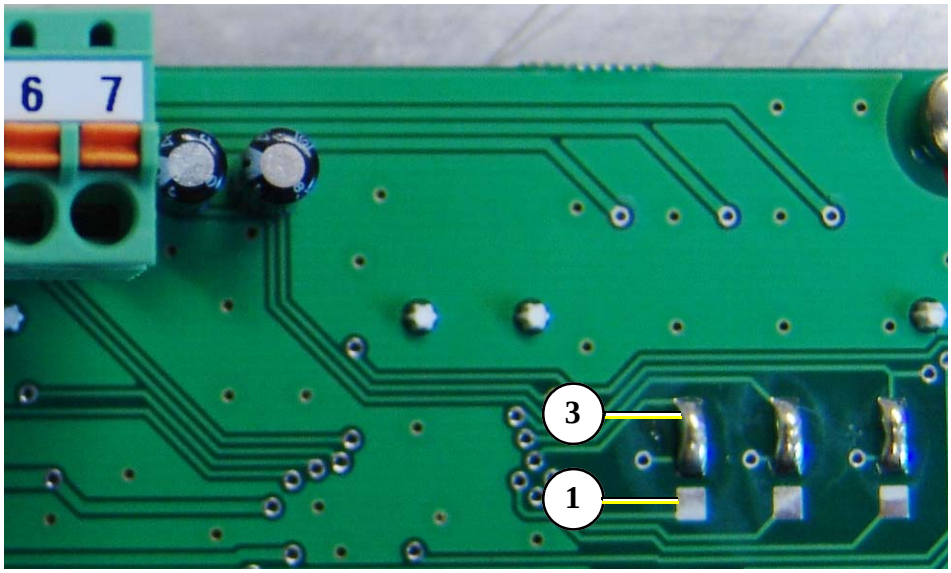
3) The out is protected by an freewheeling diode.

9.5 Jumperconfiguration

9.5.1 Jumper configuration for the input

9.5.2 Jumper J101-J103

Fig. 9.5.2-1: Jumper J101 - J103



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

Jumper	Status	Desc.
J101	1-2	Temp. switch engine head is NC

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

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9.5.3 Jumper for configuraton odf the „Override“ time

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

1 is atandard for „override“ activated

2 is standard for „Override“deactivated“

9 is standard for „Test mode“

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

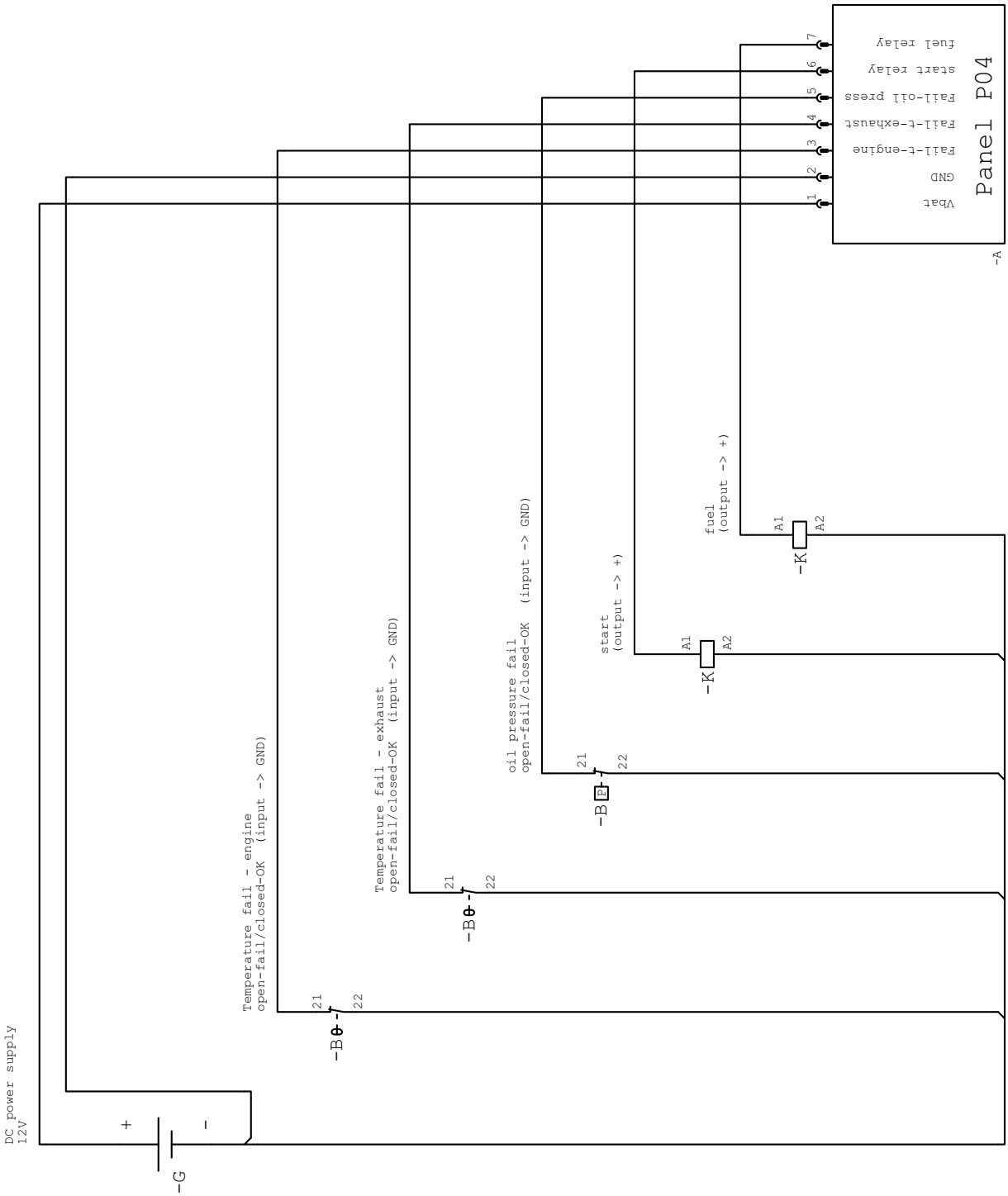
9.6 Maximum ratings

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

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

Operation Voltage Ub is the voltage at terminator X1.1

Parameter	Desc.	min.	max.	
Betriebsspannung	without time limit. full function	10,5	15	V
	without time limit, full function (except H-Meter, LED light lower)	6		V
	maximal 60min, Ta = 65°C, full function		17	V
	maximal 60s, Ta = 65°C, full function		18	V
	maximal 100ms, Ta = 65°C, full funktion		22	V
	maximal 100ms, full funktion, except H-Meter, some LED out of ordert	4,5		V
ambient temperature for operation		0	+85	°C
capacity of the outputs	without time limit		0,25	A
	without time limit (1 output only)		0,4	A
External voltage on the outputs	Outputs with freewheeling diode for short out negative external voltage	-0,3	Ub	V
External Voltage on the inputs	without time limit. Voltage which are out of the rating will be short out by the Z- diode.	-0,3	Ub	V
Internal F1	Microfuse 5 x 20mm glass fuse slow to blow		0,5	A


Panel P04
Vbat
GND
Fail-t-engine
Fail-t-exhaust
Fail-oil press
start relay
fuel relay
-A
1
2
3
4
5
6
7
DC power supply
12V
+
-
-G
Temperature fail - engine
open-fail/closed-OK (input -> GND)
-B
21
22
Temperature fail - exhaust
open-fail/closed-OK (input -> GND)
oil pressure fail
open-fail/closed-OK (input -> GND)
start
(output -> +)
fuel
(output -> +)
-K
A1
A2