Fischer Panda

Power - wherever you are

Marine Generator

AGT 8000 PMS

12-72V / 8kW

Fischer Panda GmbH

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Inhalt / Contens

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1. General References and Regulations

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

Fischer Panda

FISCHER GENERATORS have been manufactured since 1978 and are a well-known brand for first class diesel generators with especially effective sound-insulation. Fischer has been one of the leading manufacturers for marine generators in respect of quality and know-how during this period. FISCHER, as the worldwide manufacturer of modern marine diesel generators, developed the Sailor-Silent series for example and produced a GFK sound-insulated capsule as early as 1979 and the basis for new generator technology.

The companies Fischer and Icemaster amalgamated under the direction of Icemaster in 1988, in order to concentrate on the development of new products. Production was moved to Paderborn.The amalgamation of the two qualified companies led to the development of a complete new programme within a short space of time. The generators developed at that time set new technological standards worldwide.

The generators became more efficient and powerful than other generators in the same nominal performance range, because of the improved cooling. Panda generator demonstrated its superiority in several tests by renowned institutes and magazines during the past years. The patented VCS (voltage Control System) means it can meet all demands including motor speed. The start-booster (ASB) means Panda generators meet the highest demands in respect of voltage stability and starting values.

A water-cooled Fischer Panda generator, with the same drive motor, produces 15 % more effective output than the majority of conventional generators. This superiority in efficiency also ensures a fuel saving to the same extent.

The Fischer Panda generators are currently manufactured in the performance range from 2 to 200 kW in various versions. Fast running motors are preferred for performances up to approx. 30 kW (nominal speed 3000 resp. 3600 rpm). The heavier slow runners are preferred for the higher range. The fast running generators have proved themselves many times for many uses, that they meet the demands in quality of yachts and vehicles, and offer space and weight saving of 50 % compared to slow running generators.

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

The HTG-alternators ensure that a charging rate of 280 amps is achieved that was scarcely thought possible for this compact construction. This alternator replaces a separate shipboard generators (constant 230 volts AC with up to 3.500 W from the main machine)

1.1 Safety first symbols

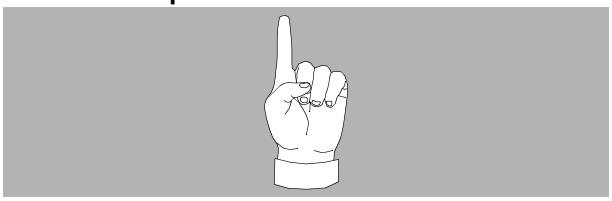
These symbols are used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use unit.

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

Warning!: Toxic elements

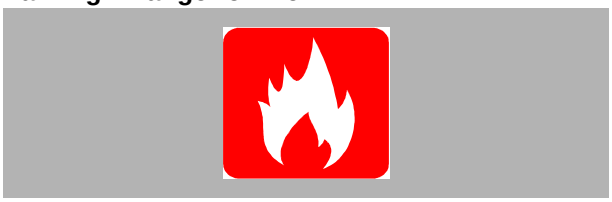
This warning symbol draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in damage or destruction of equipment

Attention!: Important Advice



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!: Danger of fire



Do not smoke in that area / do not smoke during the describes works

Prohibitation!: No Smoking

Fires and open light are ignition sources, which must be avoided.

Prohibitation: Fire and open flames prohibited

Do not turn on or start operation. People are working at the generator and/or electrical system

Prohibitation: Turn on / start operation prohibited

Berühren der entsprechenden Teile und Anlagen verboten

Proscription!: Do not touch

Generator can be started by an external signal

Warning!: Automatic start.

These symbols refer to electrical danger and points to special warnings, instructions and advices, which must be noticed. Otherwise an electrical shock with personal injury or death can be the consequence.

Warning!: High voltage / danger by electricity - Danger for life

General Warning

Warning!: Danger for life and/or equipment

Substances can be harmful or lead to death, if accumulated or swallowed

Warning!: Harmful if accumulate

Warning of live parts, which can cause electrical impacts during contact. Special danger for persons with heart problems and/or pace makers.

Warning!: Electric shock

Danger of injury by drawing into the machine. Injury by crushes and eventually the separation of extremities. Danger of drawing during contact with extremities, loose clothes, scarf, ties etc.

Warning!: Rotating parts

Warning of materials, which can lead to explosions under certain conditions - e.g. heat or ignition sources

Warning!: Risk of explosion

Surfaces and substances may be hot. Danger of burn / scalding

Warning!: Hot surface

Warning of materials, which cause corrosive damage during contact. These materials can work contaminating when entering into the body.

Warning!: Danger carrosive material - contermination of persons possible

When opening the system the pressure can suddenly escape and drag along liquids. Danger of injury by parts flying around, danger of burn by liquids and gases.

Warning!: System can be under pressure!

Warning!: Hearing damage

Warning!: Magnetic field

Warning!: High pressure

Protective clothing is close fitting, with low resistance to tearing, with narrow sleeves and without protruding parts. It mainly provides protection against being entangled by moving machine parts.

Instruction!: Wear personal protective equipment (PPE)

Wear ear defenders to protect the ears against hearing damage.

Instruction!: Wear personal protective equipment (PPE)

Wear safety glasses to protect the eyes against parts flying around or squirts of fluids. Optical eyeglasses are not replacement for appropriate eye protectors.

Instruction!: Wear personal protective equipment (PPE)

Wearing protective gloves protects the hands against friction, graze, punctures or deep cuts as well as contact with hot surfaces.

Instruction!: Wear personal protective equipment (PPE)

Read and consider the regulations, safety instructions and installation guidelines of manual, in order to avoid dangers and accidents. You protect yourself and the generator.

Instruction!: Read the manual instructions

Environmental protection is the protection of our habitat. For you and your children

Instruction!: Environmental protection

1.2 Tools

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

	Spanners SW X = required size X mm
	Hook wrench for oil filter
	Screw driver, for slotted head screws and for recessed head screws
	Multimeter, multimeter with capacitor measuring
	Socket wrench set
	Hexagon wrench keys

	Current clamp (DC for synchron generators; AC for asynchron generators)
	Torque wrench

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

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

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

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

1.4 Customer registration and guarantee

Use the advantages of the customer registration:

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

Far advantages:

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

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

1.4.1 Technical Support

Technical Support per Internet: info@fischerpanda.de

1.4.2 Attention, important directions regarding operation!

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

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

1.5 Safety instructions - Safety first!

1.5.1 Safe operation

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

1.5.2 Observe safety instructions

Read and understand carefully this manual and „Labels at the engine“ before attempting to start and operate the generator. Learn how to operate and work safely. Know how your equipment and its limitations. Always keep the generator in good condition.

1.5.3 Wear personal protective equipment (PPE)

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

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

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

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

1.5.4 Cleanness protect

Keep the engine and the surrounding clean.

Ensure that the generator is stopped before cleaning. Keep the generator clean and free of accumulated dirt, grease and trash to avoid fire. Store flammable liquids in proper containers and cabinets away from sparks and heat. Check for leak immidiately and repair if necessary.

1.5.5 Safe handling of fuel and lubricants - Keep away from fire

Keep away open fire from fuels and lubricants.

Always stop the generator before refueling and/or lubrivating and protect against unintentional starting.

Do not smoke or allow flames or sparks in your work area. Fuel is extremely flammable and explosive under certain conditions.

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

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

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

1.5.6 Exhaust gases and fire prevention

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

Check the Generator and all pipes and hoses regularly of leaks and repair immediately if necessary.

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

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

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

CALIFORNIA

Proposition 65 Warning

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

Exhaust gases of diesel engines and some components are carcinogen and can cause deformations and other gene effects.

1.5.7 Cautions against burns and battery explosion

To avoid burns, be cautious of hot components, e.g. muffler, muffler cover, radiator, hoses, engine body, coolants, engine oil, ect. during operation and after the engine has been shut down.

The Coolant system can be under pressure, Open the coolant system only, when the generator is colled down. Wear „Personal Protective Equipment„.

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

The battery (Starter battery and AGT battery bank) presents an explosive hazard. When the battery is being charged, hydrogen and oxigen gasses are extremly explosive.

Do not use or charge a battery if its fluid level is below the lower mark. Otherwise, the component parts may deteriorate earlier than expected, which may shorten the the service life or cause an explosion. Immediatly, add distilled water until the fluid level is between the lower and the upper marks.

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

Do not check the battery charge by placing a metal object across the terminals (danger of short circuit, battery damage and high danger of explosion). Use a Voltmeter or a hydrometer.

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

1.5.8 Keep hands away from rotating parts

Operate the generator with closed sound cover capsul only.

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

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

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

1.5.9 Anti-Freeze and disposal of fluids

Anti-freeze contains poison. Wear rubber gloves to avoid personal injury. In case of contact with skin, whash it off immideately. Do not mix different types of Anti-freeze. The mixture can produce chemical reactioncausing harmful substances. Use approved or genuine Fischer Panda Anti-freeze.

Protect the environment. When draining fluids from the generator, place a siutable container underneath the generator body. Consider the relevant enviromental protection regulations when disposing of oil, fuel, coolant, breakfluid, filters and batteries. Do not poor waste onto the ground, down a drain, or into any water source. Conducting safety checks and maintenance

1.5.10 Implementation of security and maintenance

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

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

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

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

1.6 Warning and caution labels

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

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

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

1.6.1 Safety instructions concerning operating the generator

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

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

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

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

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

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.

1.6.1.1 Protective grounding and potential equalisation

In the low voltage board for current supply of the consumers therefore a protective conductor is grounded and connected with electrically conductive objects. The connection with an outer conductor with these object then leads to the earth fault. This earth fault leads to the release of an over-current protection mechanism and thus to the disconnection of the voltage.

1.6.1.2 Ground wire

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

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

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

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

1.6.1.3 Switch off all load when working on the generator

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

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

A) The working capacitors

B) The (Booster) capacitors

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

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

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

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

Potential equalisation at Panda AGT DC generators.

Further information for your generator see capture installation.

1.6.1.4 Safety instructions concerning the cables

Cable Type

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

Cable Size

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

Cable Installation

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

1.6.2 Recommended starter battery size

Only use batteries which are certified as starter battery by the manufacturer.

Only use batteries with capacity recommended by the engine manufacturer.

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

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

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

1.6.3 Important Advice for Batteries - Starting batteries and Traction batteries

ATTENTION!!! Initial operation:

Installation of battery lines.

Consider the regulations and installation instructions of the battery manufacturer.

Consider ABYC regulation E11 AC and DC electrical systems on boats and/or EN ISO 10133:2000 small watercrafts, electrical systems, low voltage (DC) systems !

Ensure a professional battery installation.

The battery separation can be made mechanically or by an appropriate power relay.

Consider the appropriate notes of the battery manufacturer concerning fire and explosion prevention.

Install a right sized fuse in the positive battery line as close as possible to the battery, but max. 12 inch, 300mm from the battery.

The length of the cable to the fuse, the cable must be protected by a sheath or conduit against damage of the insu-

lation.

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

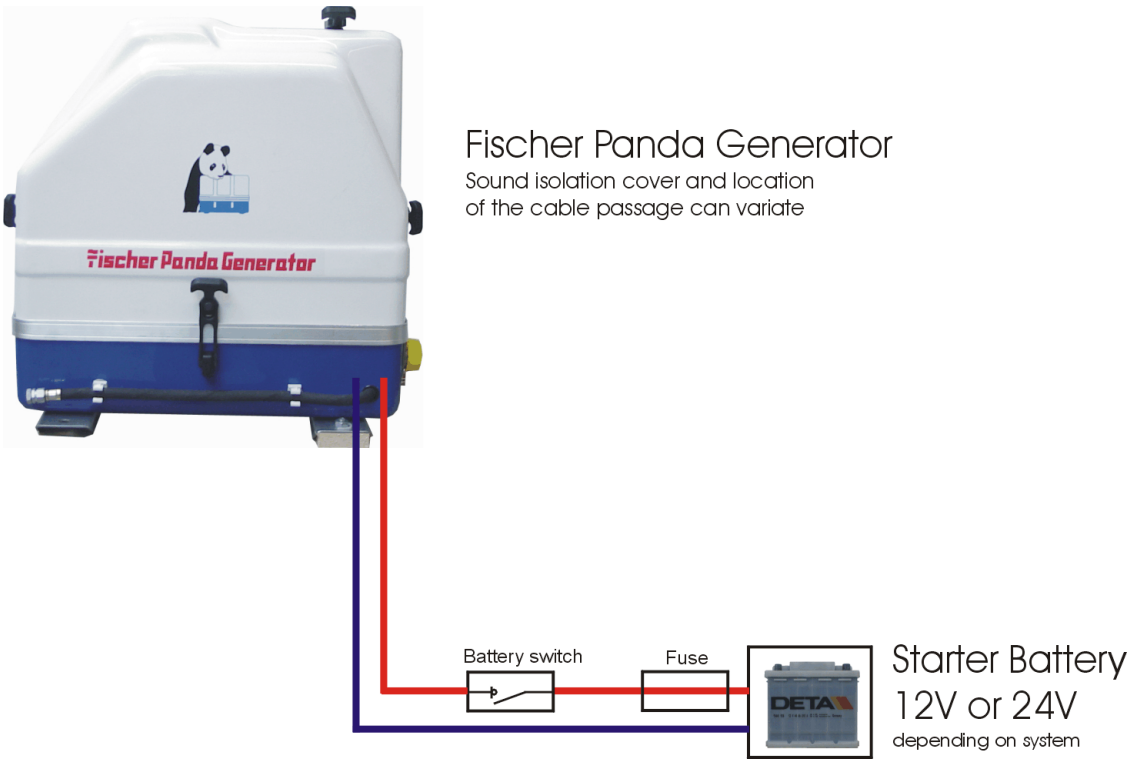
Install battery lines in a safe way that the cable insulation will not be shaved or damaged.

Battery poles must be protected against short circuits by error.

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

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

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



1.6.4 Safety Instructions for the Handling with Batteries

These instructions must be noticed additionally to the instructions of the battery manufacturer:

- If the batteries are working, someone should be in your near area to help you in a case of emergency.
- Water and soap must be hold ready if battery acid corrode your skin.
- Wear eye protection and protective clothing. During working with the batteries don´t touch the eyes.

- If you got a acid splash on your skin or clothing grow it with much water and soap out.
- If you got acid in your eyes rinse them immediately with clear water until no cauterization is noticeable. Visit immediate a doctor.

- Never smoke in the near of the batteries. Avoid naked flames or open fires. In the area of batteries exists danger of explosions.
- Pay attention that no tools fall on the battery poles, if necessary cover them.
- During the installation don´t wear a wrist watch or arm jewels, you can create under these circumstances a battery short-circuit. Burning of the skin could be the result.
- Protect every battery contact against unintentional touch.
- For battery banks: Use only cyclical profoundly dischargeable batteries. Starter batteries are not appropriate. Lead-gel batteries are commended. They are maintenance-free, profoundly dischargeable and not produce gas.

- Do not charge a frozen battery.
- Avoid a batterie short-curcuit.
- Take care of a good ventilation of the battery to drain off developing gas.
- The battery connection terminals must be checked of a tight contact at least before operating.
- The battery connection cable must be carefully mounted and checked about incorrect heating at operation with load. The vibrating devices must be regulary checked about scour points and flaw in the isolation.

Attention !! For battery charge generators (Fischer Panda AGT-DC)!

Check before installation if the battery bank voltage correspond with the generator output voltage

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2. Special notes and safety instructions for AGT- Generators

2.1 General safety references concerning operation of an AGT generator.

Special safety precautions must me made with all energy systems, in order to protect the environment of the components against fire.

It is very important to ensure that the main switch on the battery is well accessible, so that in case of danger, this main switch can immediately be separated. However, the main switch must also be mounted close to the battery. If the place is not well accessible, it is necessary to install a power relay instead of the main switch, which can eventually be controlled from different places. The switches for the power relay must be marked as main switch DC battery "switch off at danger".

2.1.1 Cooling of the rectifier block at the marine versions

The rectifier block is cooled with fresh water. A normal cooling of the rectifier block is therefore only possible, as long as the cooling water supply of the generator functions correctly.

Bus bars and radiator boxes are controlled by thermal relays. After a cooling system fault, the diodes must be examined. See chapter failure/maintenance in this manual.

Never start the generator with disconnected battery as the rectifiers can be damaged!

Warning! General Warning

Contact of the electrical contacts may be DANGER TO LIVE!

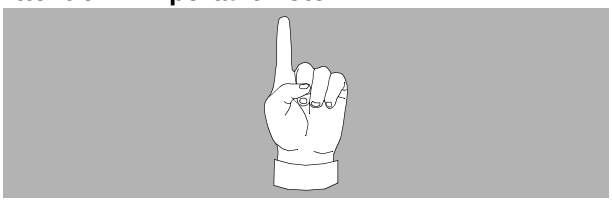
CAUTION! Danger of electrical impact during contact

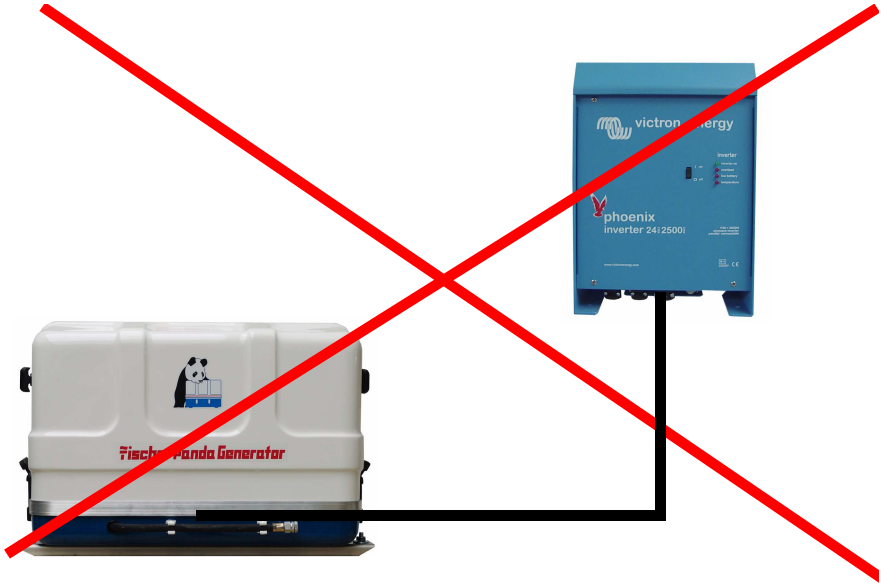
2.2 Sample System AGT DC Generator

The AGT-generator is not allowed to be connected to an inverter (without batteries)!

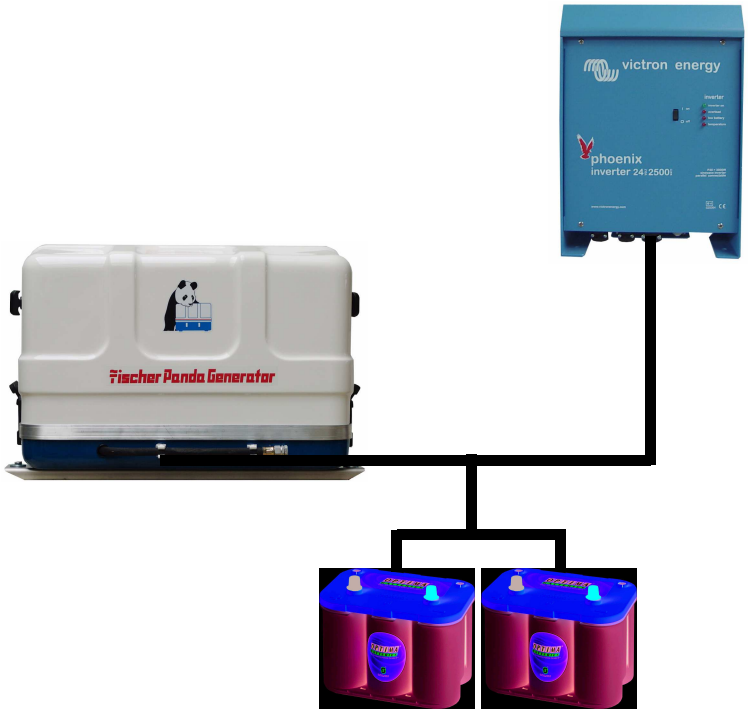
The Inverter generates voltage peaks, which can destroy the rectifier rectifiers of the generator!

Attention!: Important Note





A battery must always be connected to the inverter as a capacity!



Recommended capacity

- at 12V ≥ 240Ah

- at 24V ≥ 120Ah

The screws at the electric rectifier may be pulled tight only with a torque wrench. Recommend torque: see technical datasheet of the diodes (f.e. Torque 6 Nm mechanical and electrical connections of the diode DD171N)

The battery cable must be secured at the generator and at the batteries with appropriate safety devices.

The generator is also include into the CO_2 - fire-extinguishing system.

2.2.1 Measures to the fire protection.

All construction units in the environment of energized parts, which carry more than 50 Amp., must be fire protection-moderately secured.

All junction points at the energized parts must be examined regularly on heating up (infrared thermometers).

In particular temperature differences are a sign of high transition resistances or bad connections of the warmer contact.

2.3 Special Tools

This symbols are used throughout this manual to show which tool must be used at maintenance or installation.	
	Thermometer
	Infrared temperature mesuring pistol

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

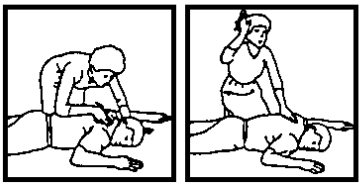
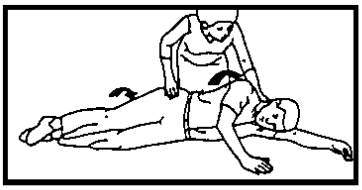
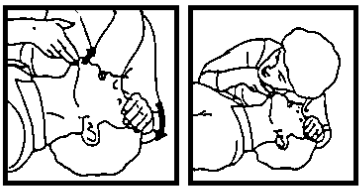
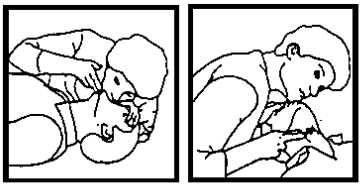


	First Aid in case of accidends by electrical shocks 5 Safety steps to follow if someone is the victim of electrical shock	
1	Do not touch the injured person while the generator is running.	
2	Switch off the generator immediately.	
3	if you cannot switch off the generator, pull, push, or lift the person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

3.1 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?		**2** Shout, "Help!"
Tap or gently shake victim. Shout, "Are you OK?"		Call people who can phone for help.
3 Roll Person onto Back.		
Roll victim toward you by pulling slowly.		
4 Open Airway.		**5** Check for Breathing.
Tilt head back, and lift chin. Shout, "Are you OK?"		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.		**8** Phone EMS for Help.
Feel for pulse for 5 to 10 seconds.		Send someone to call an ambulance.
9 Begin Rescue Breathing.		**10** Recheck Pulse Every Minute.
Keep head tilted back. Lift chin. Pinch nose shut. Give 1 full breath every 5 seconds. Look, listen, and feel for breathing between breaths.		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.

4. The Panda Generator

4.1 Type plate at the Generator

Fig. 4.1-1: Type plate

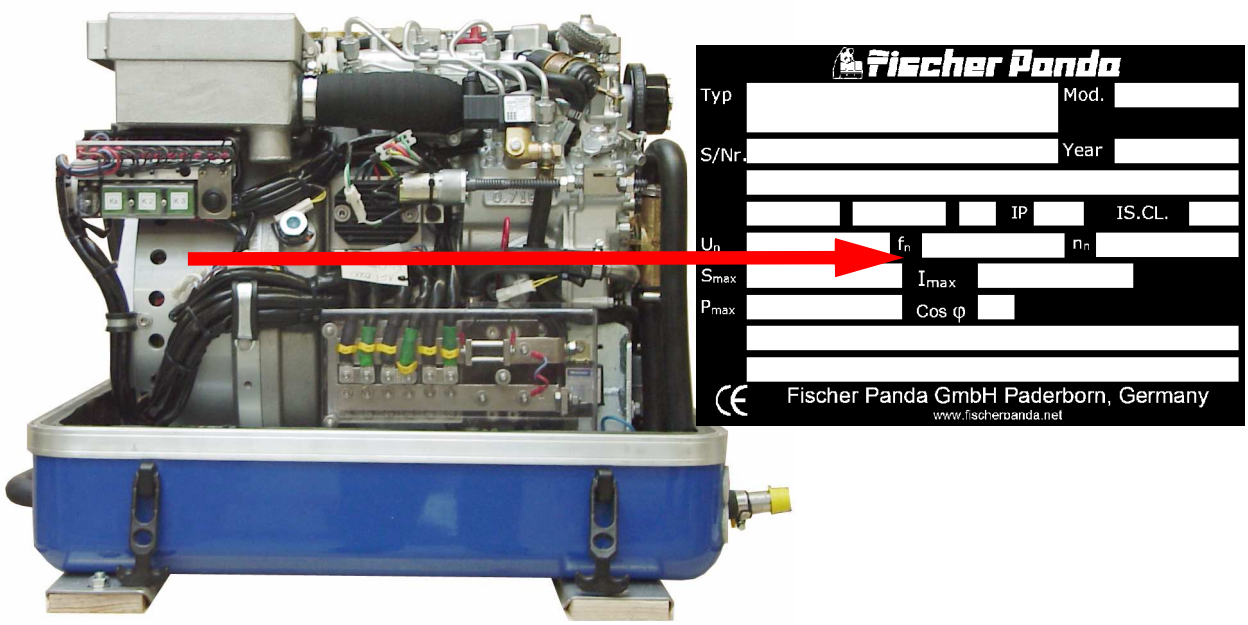
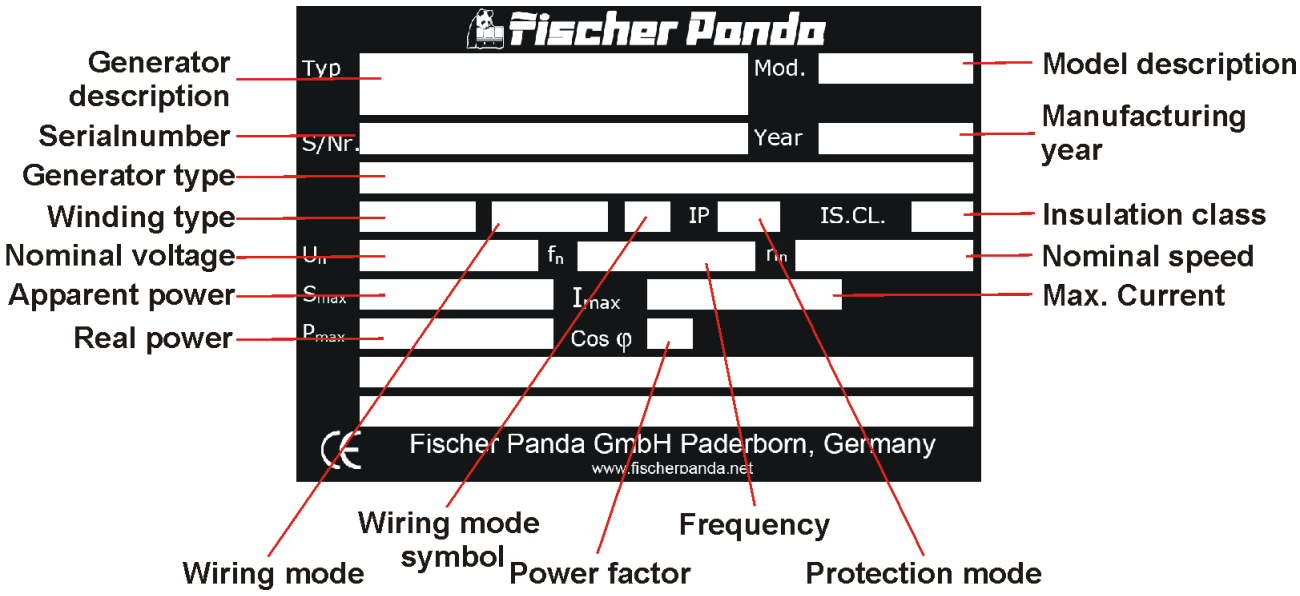


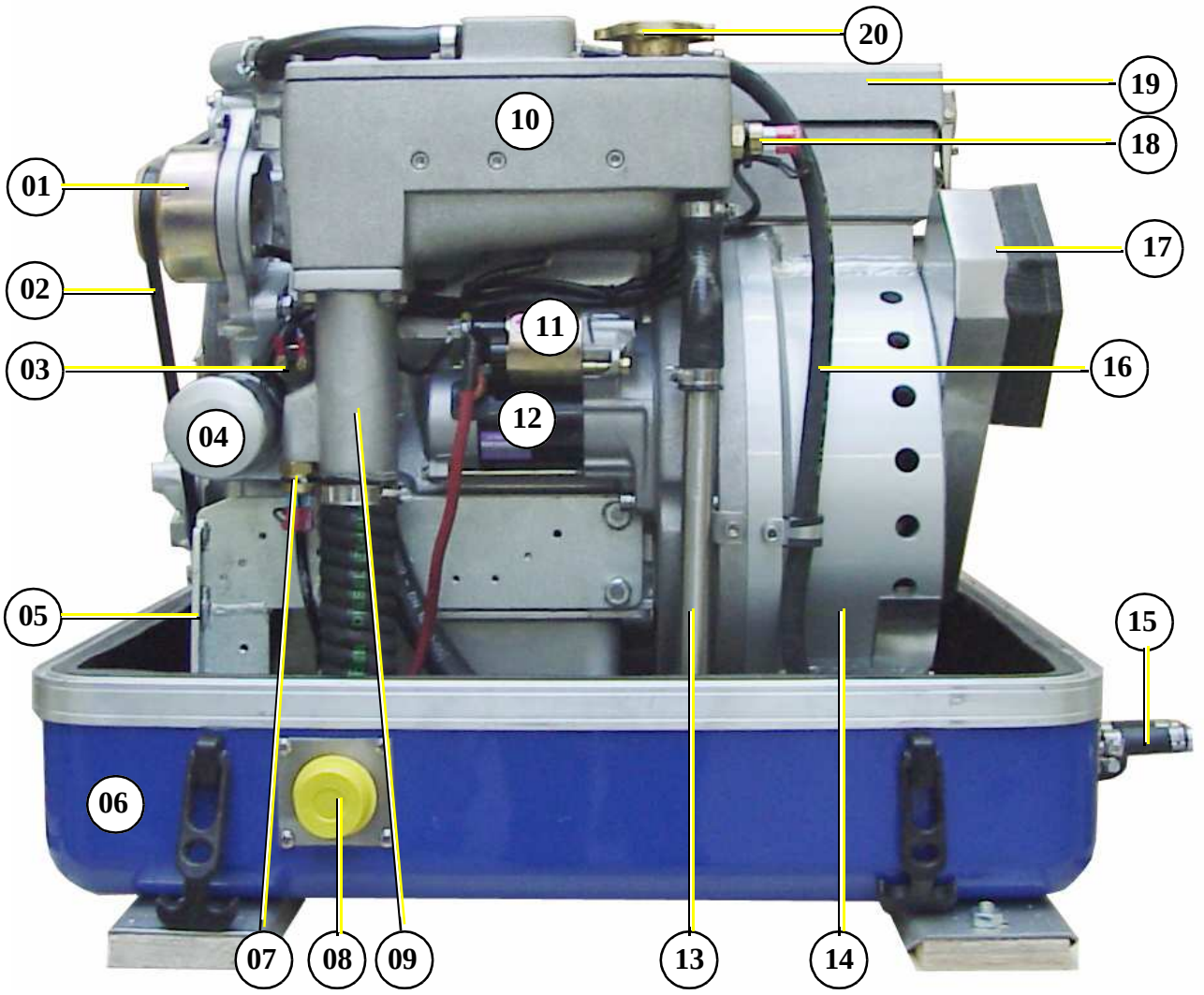
Fig. 4.1-2: Discription type plate



4.2 Description of the Generator

4.2.1 Right Side View

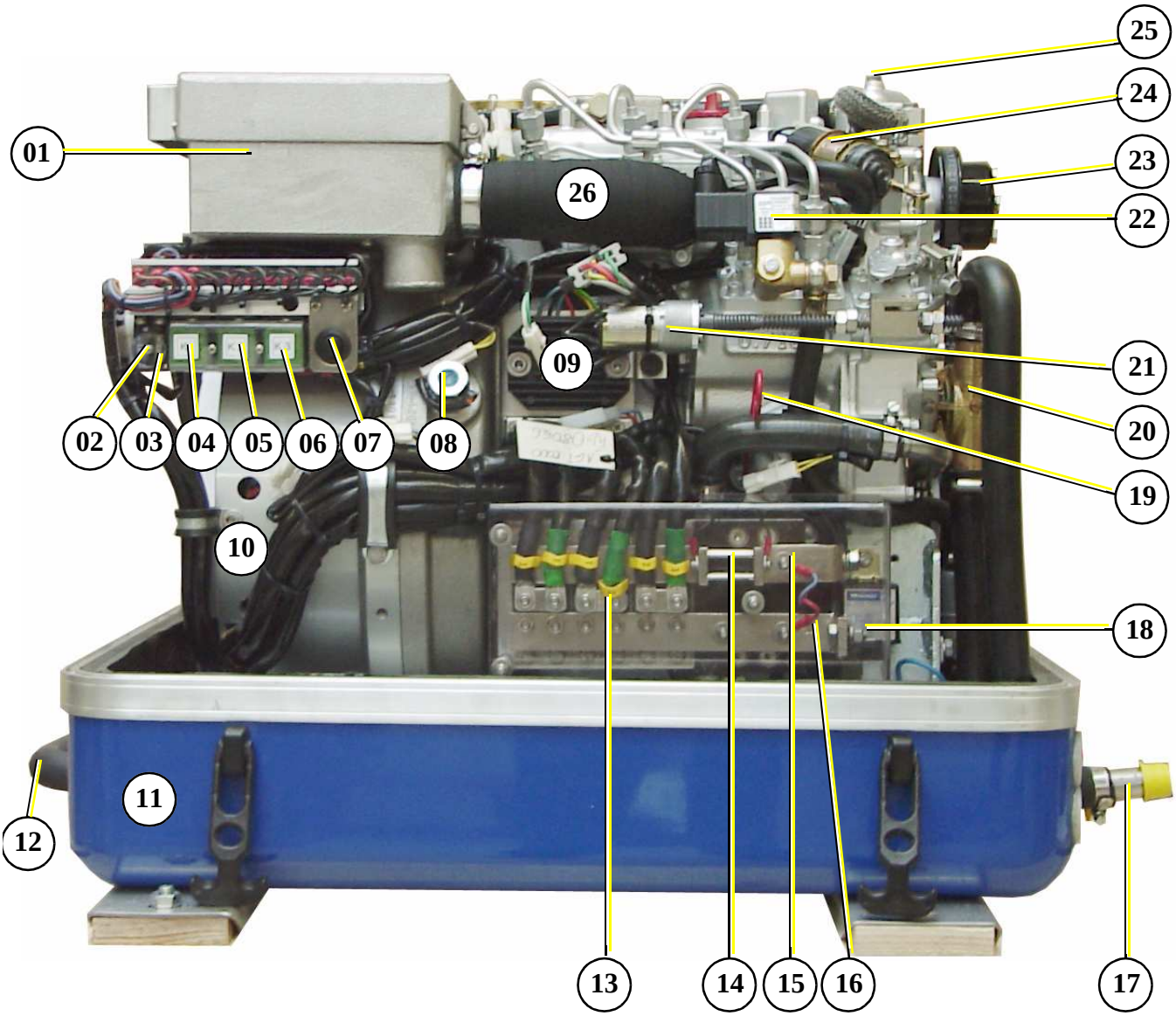
Fig. 4.2-1: Right Side View



01)	DC-alternator	11)	Solenoid fpr starter motor
02)	v-belt für DC-alternator and cooling water pump	12)	Starter motor
03)	Oil pressure switch	13)	Cooling water return pipe
04)	Oil filter	14)	Generator housing with coil
05)	Engine bracket	15)	Connections for external cooling water expansion tank
06)	Sound cover base part	16)	Coolant hose to the external expansion tank
07)	Thermo-switch exhaust	17)	Suction port for coil cooling
08)	Exhaust output	18)	Thermo-switch exhaust elbow
09)	Exhaust connection port	19)	Air suction housing with air filter
10)	Water-cooled exhaust elbow	20)	Coolant filler neck (not all models)

4.2.2 Left Side View

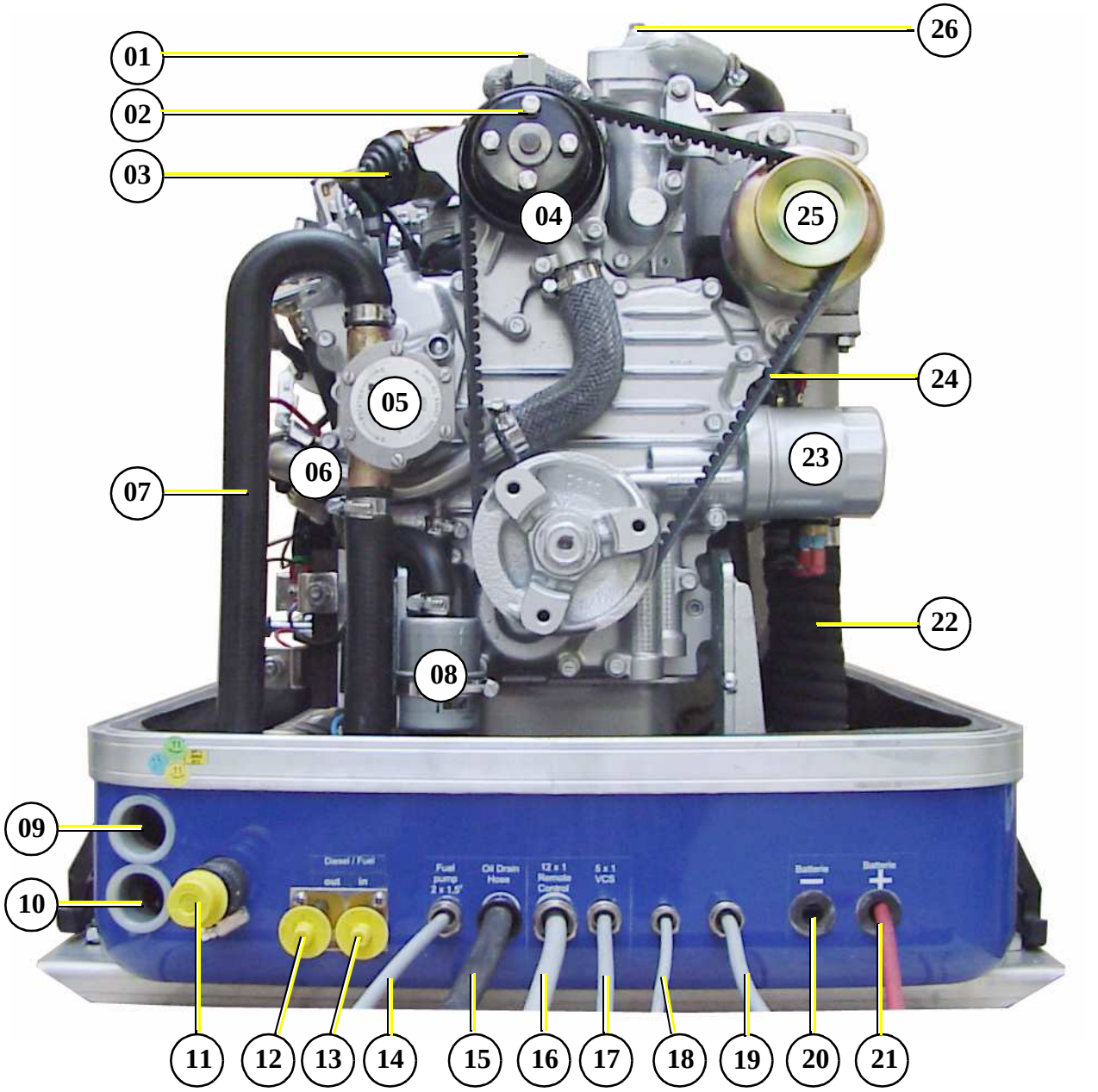
Fig. 4.2.2-1: Left Side View



01) Air suction housing with air filter
02) Electrical fuse 15A (blue)
03) Electrical fuse 25A (white)
04) Starter-relay Ks
05) Pre-glow relay (glow plugs) K2
06) Fuel pump start relay K3
07) Failure bypass switch
08) Speed sensor
09) Charge control for DC-alternator
10) Generator housing with coil
11) Sound cover base part
12) Connection for external ventilation valve
13) Diodes
14) Measuring shunt
15) Connection (-)
16) Connection (+)
17) Seawater intake
18) Time relay for stop solenoid
19) Oil dipstick
20) Seawater pump
21) Actuator for rpm-regulation
22) Fuel solenoid valve
23) Pulley for internal cooling water pump
24) Stop solenoid
25) Ventilation screw thermostat housing
26) Suction hose, air suction housing - induction elbow

4.2.3 Front View

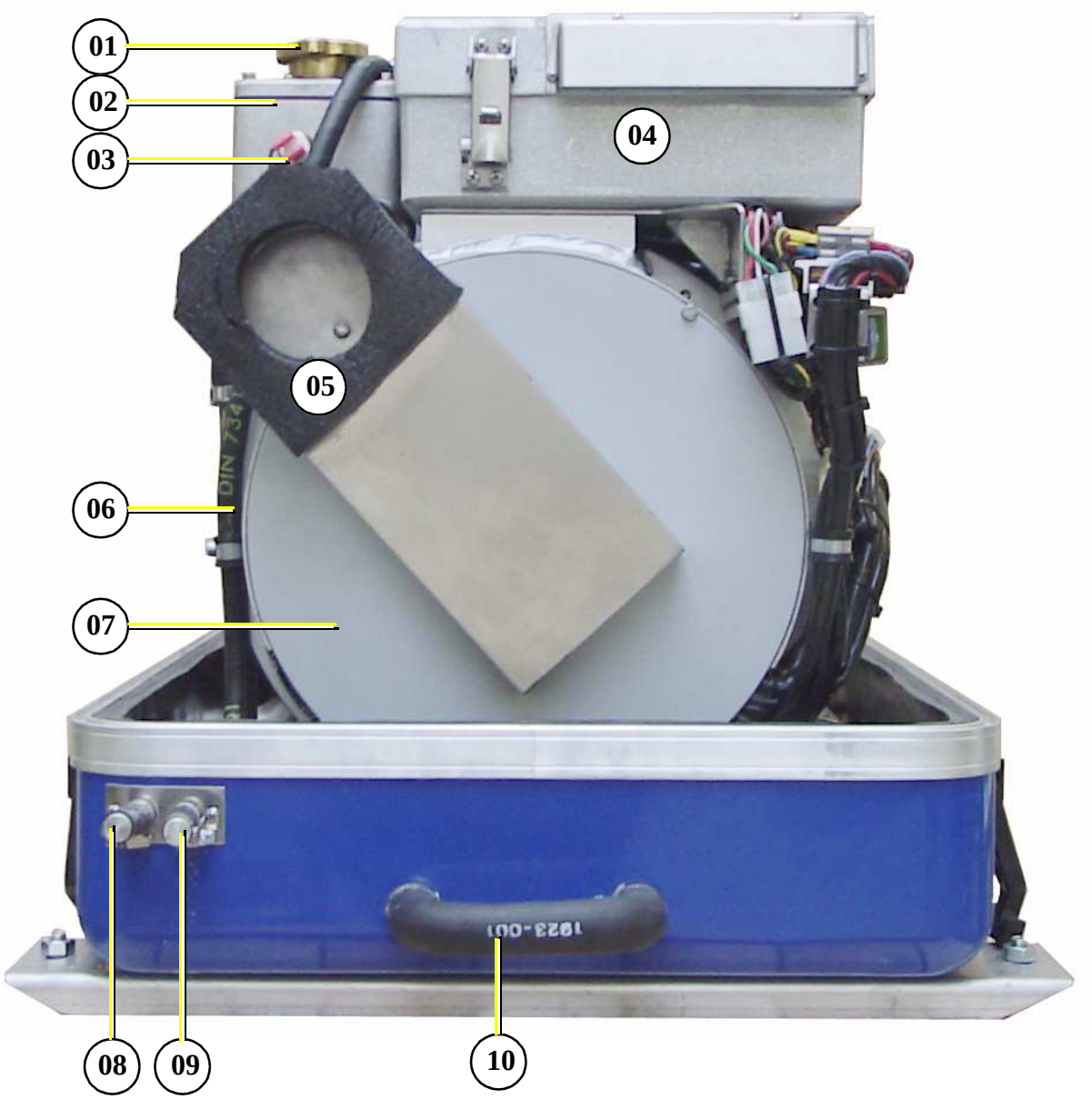
Fig. 4.2.3-1: Front View



01) Ventilation screw internal cooling water pump
02) Pulley for internal cooling water pump
03) Stop solenoid
04) Internal cooling water pump
05) Seawater pump
06) Pipe, formed, for cooling intake
07) Seawater intake hose
08) Fuel filter
09) Passage for battery cable
10) Passage for battery cable
11) Seawater intake
12) Connection fuel in
13) Connection fuel out
14) Cable fuel pump (2x1,5mm²)
15) Oil drain hose
16) Cable remote control panel (12x1mm²)
17) Cable voltage control VCS (5x1mm²)
18) Measuring shunt
19) Measuring voltage 24V (red/black)
20) Starter battery minus (-)
21) Starter battery plus (+)
22) Exhaust hose
23) Oil filter
24) V-belt for internal cooling water pump
25) DC-alternator 12V
26) Ventilation screw thermotast housing

4.2.4 Back View

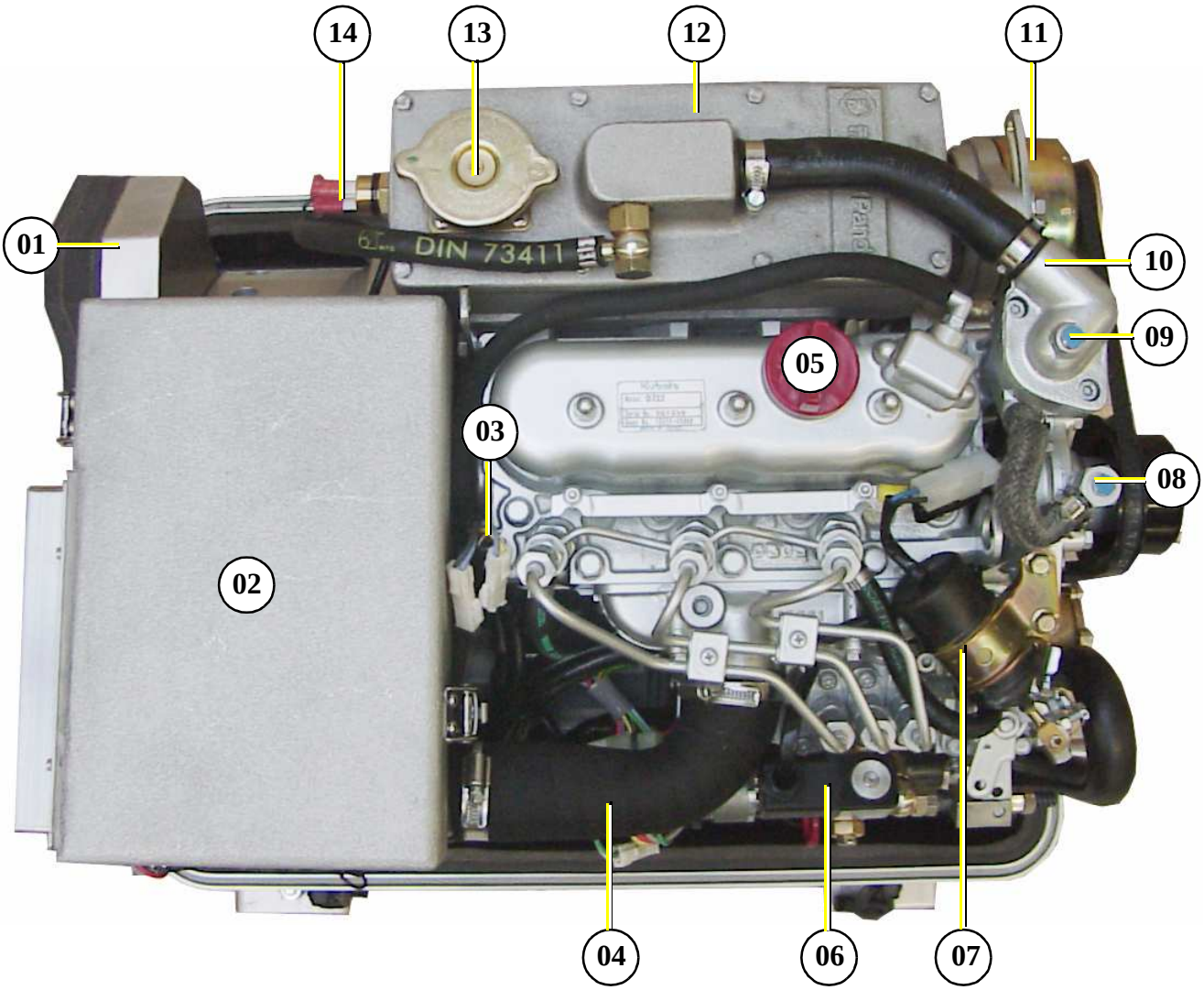
Fig. 4.2.4-1: Back View



01) Cooling water filler neck
02) Water-cooled exhaust elbow
02) Thermo-switch exhaust elbow
04) Air suction housing with air filter
05) Suction poet for coil cooling
06) Cooling water hose to external expansion tank
07) Generator front cover
08) In-flow external cooling water expansion tank
09) Return external cooling water expansion tank
10) Connection external ventilation valve

4.2.5 View from Above

Fig. 4.2.5-1: View from Above



01)	Suction port for coil cooling	08)	Ventilation screw internal cooling water pump
02)	Air suction housing with air filter	09)	Ventilation screw thermostat housing
03)	Thermo-switch cylinder head	10)	Thermostat housing with thermostat
04)	Suction hose, aie suction housing - induction elbow	11)	DC-alternator
05)	Oil filler neck	12)	Water-cooled exhaust elbow
06)	Fuel solenoid valve	13)	Cooling water filler neck
07)	Stop solenoid	14)	Thermo-switch exhaust elbow

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 (Seawater)

Seawater intake

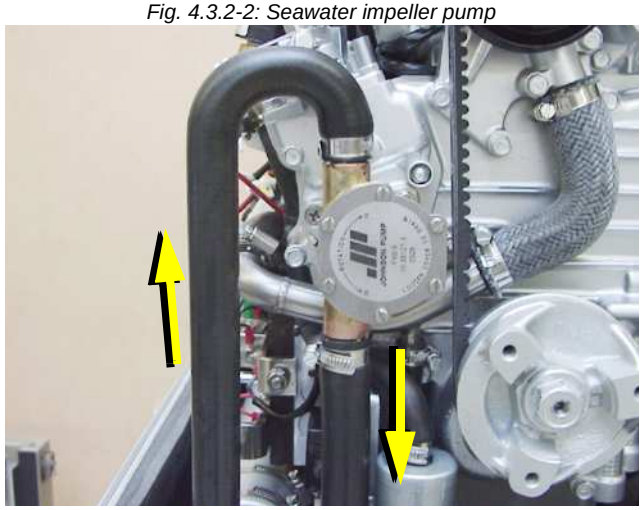
The diagram shows the supply pipes for the generator. The connection neck for the seawater connection is shown on the left hand side. The cross-section of the intake pipe should be nominally larger than the generator connection.

Fig. 4.3.2-1: Seawater intake

Raw water impeller pump

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

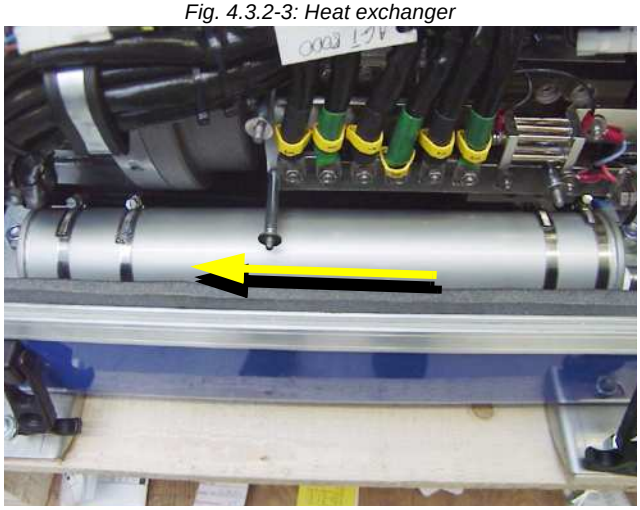
Fig. 4.3.2-2: Seawater impeller pump



Heat exchanger

Separates the seawater system from the freshwater system.

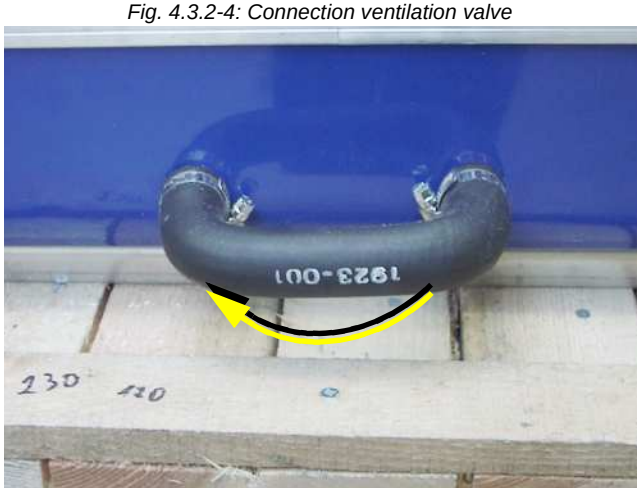
Fig. 4.3.2-3: Heat exchanger



Ventilation valve

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

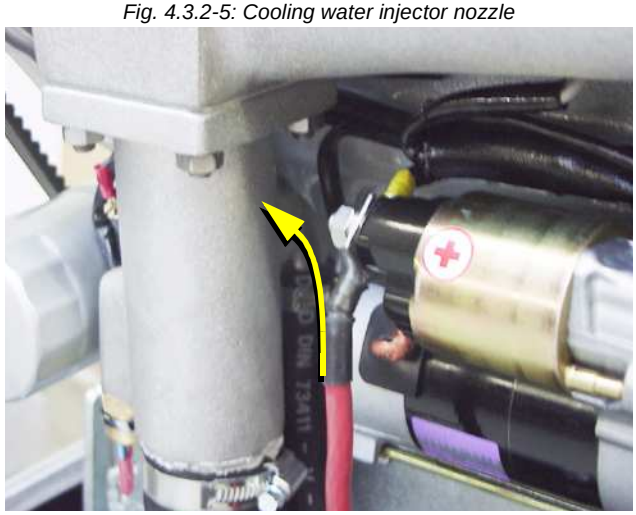
Fig. 4.3.2-4: Connection ventilation valve



Cooling water injector nozzle

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

Fig. 4.3.2-5: Cooling water injector nozzle



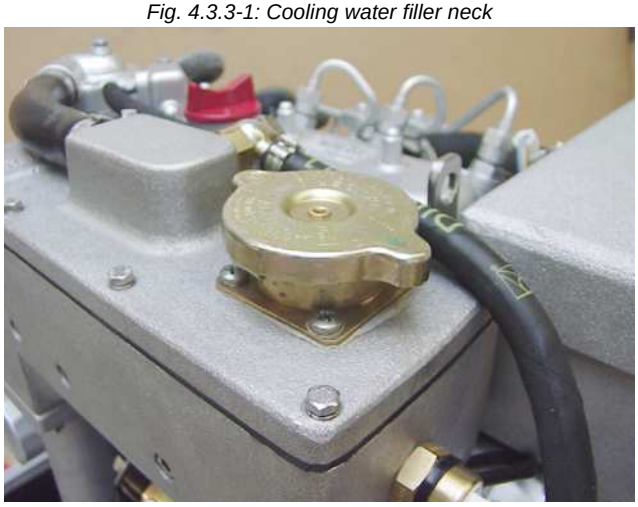
4.3.3 Components of Cooling System (Freshwater)

Cooling water filler neck

The cooling water filler nck situated at the water-cooled manifold are only used, when the generator is initially started. Since the generator is normally already filled with cooling water, these components are only by the user, if repairs are to be carried out. Topping up with cooling water may only carried out at the external cooling water compensation tank. Note that the water level in the cooling water compensation tank is only 20% of the volume in a cold state.

Not at all modells present

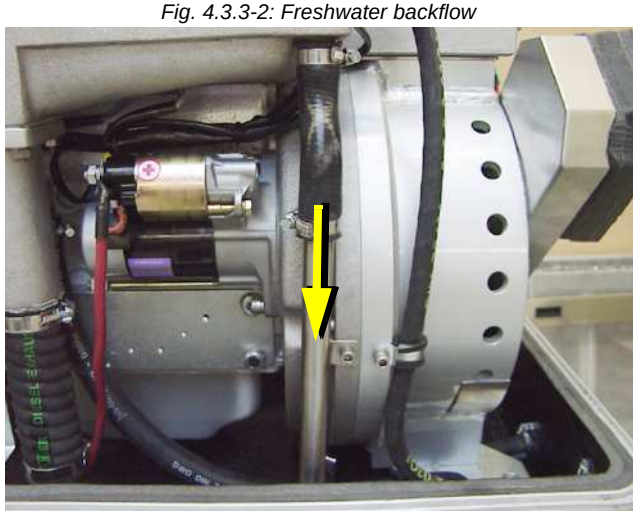
Fig. 4.3.3-1: Cooling water filler neck



Freshwater backflow

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

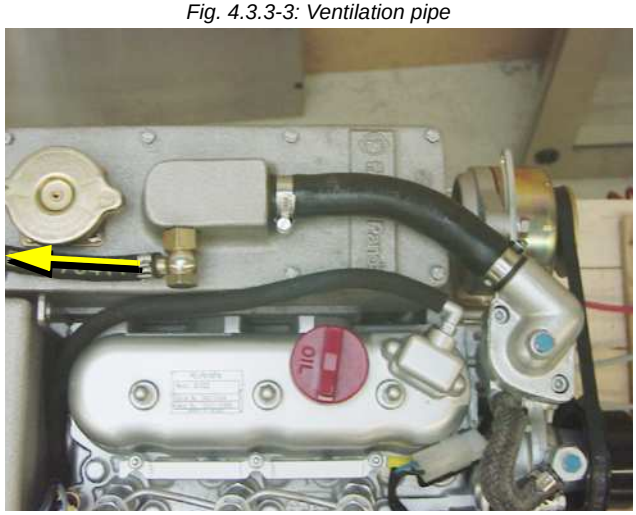
Fig. 4.3.3-2: Freshwater backflow



Ventilation pipe

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

Fig. 4.3.3-3: Ventilation pipe

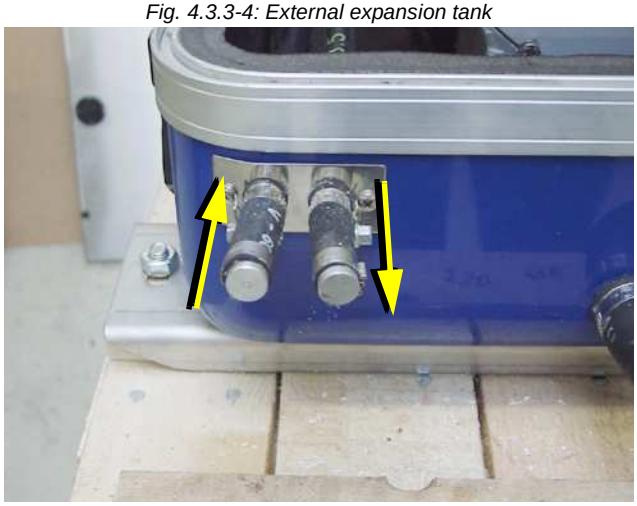


Hose connection pieces for the external expansion tank

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

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

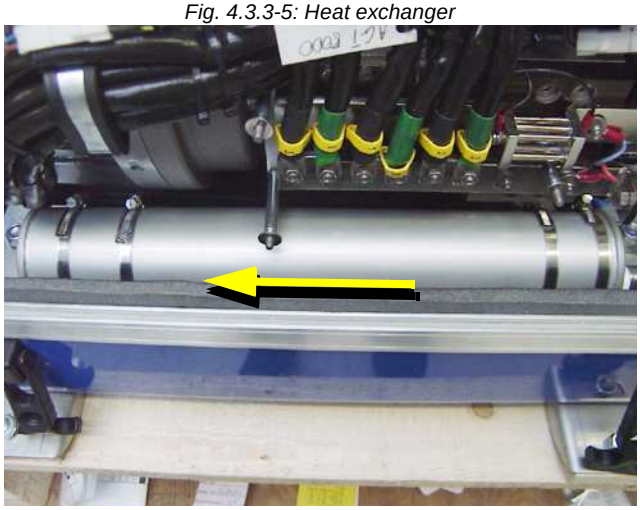
Fig. 4.3.3-4: External expansion tank



Heat exchanger

Separates the seawater system from the freshwater system.

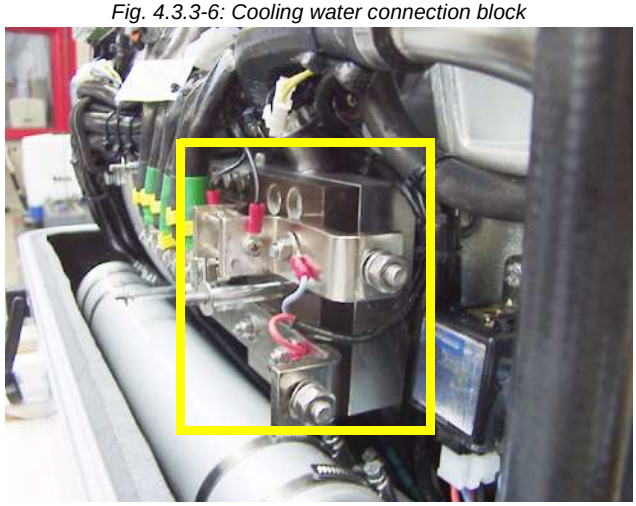
Fig. 4.3.3-5: Heat exchanger



Cooling water connection block

The diode plate is cooled with the cooling water connection block. The cooling water connection block must be regulary chekked about tightness and leakage.

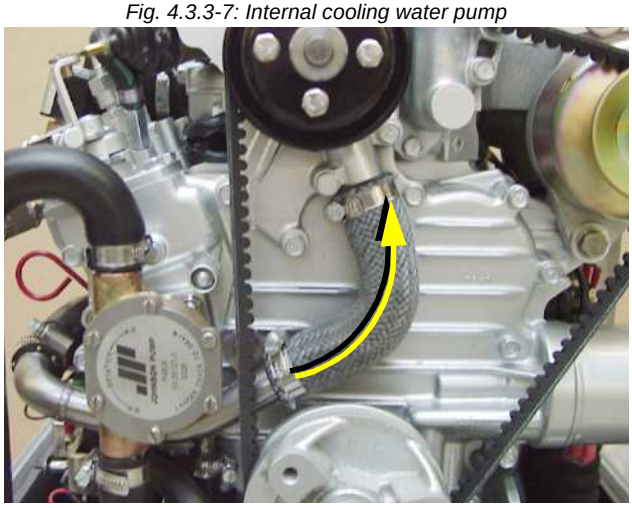
Fig. 4.3.3-6: Cooling water connection block



Internal cooling water pump

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

Fig. 4.3.3-7: Internal cooling water pump



Ventilation screw cooling water pump

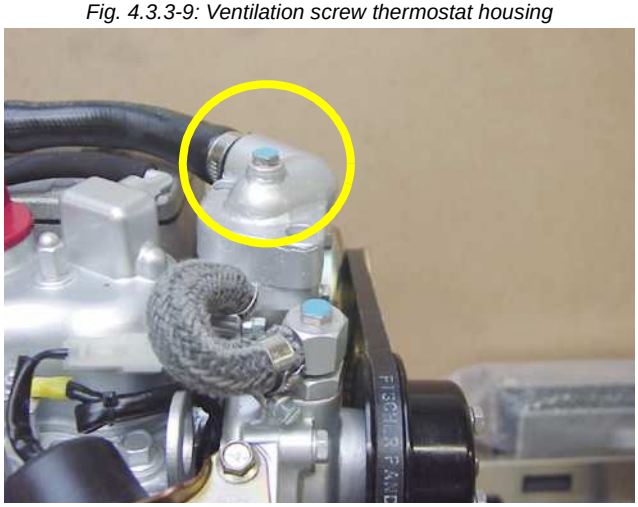
The ventilation screw above the cooling water pump casing may not be opened, whilst the generator is running. If this occurs by mistake, air will be drawn through the opening. Extensive ventilation of the whole system is then necessary.

Fig. 4.3.3-8: Ventilation screw cooling water pump

Ventilation screw thermostat housing

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

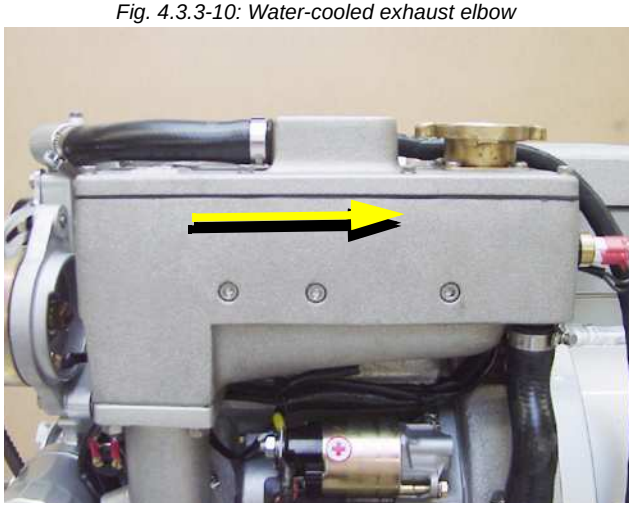
Fig. 4.3.3-9: Ventilation screw thermostat housing



Water-cooled exhaust elbow

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

Fig. 4.3.3-10: Water-cooled exhaust elbow



4.3.4 Components of the fuel system

External fuel pump

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

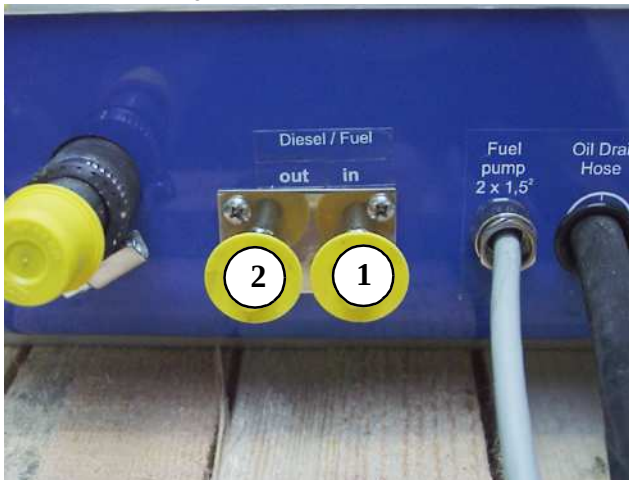
Fig. 4.3.4-1: External fuel pump

Connecting pieces for the fuel pipe

1. Fuel intake

2. Fuel backflow

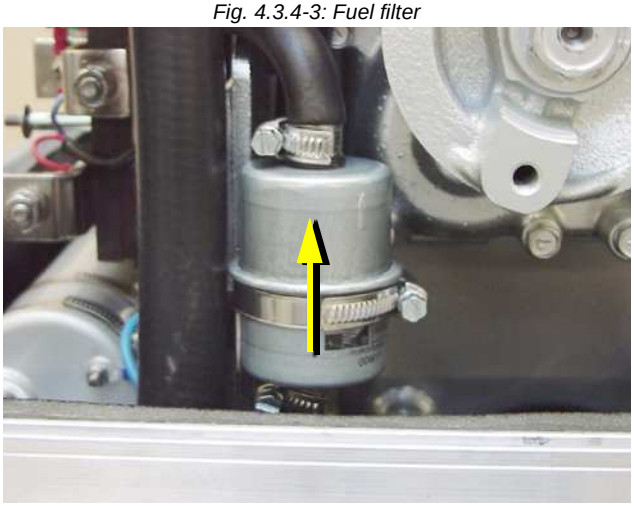
Fig. 4.3.4-2: Fuel connections



Fuel filter

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

Fig. 4.3.4-3: Fuel filter

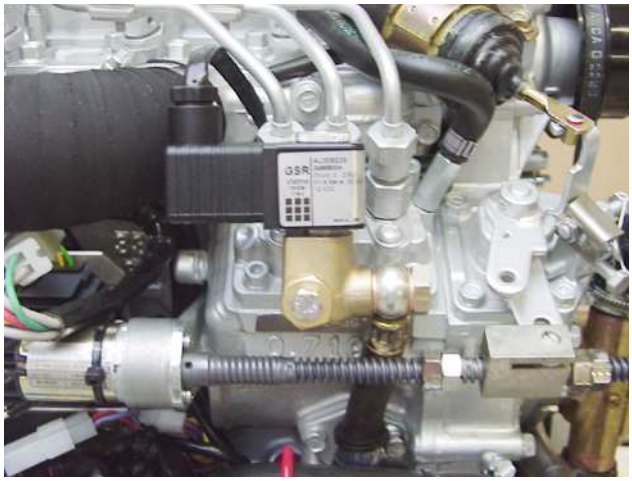


Fuel solenoid valve

The fuel solenoid valve opens automatically if „START“ is pressed on the remote control panel“. The solenoid closes, if the generator is switched to „OFF“ position.

It takes a few seconds before the generator stops. If the generator does not start or does not run smoothly (i.e. stutters), or does not attain full speed, then the cause is fore-mostly the solenoid.

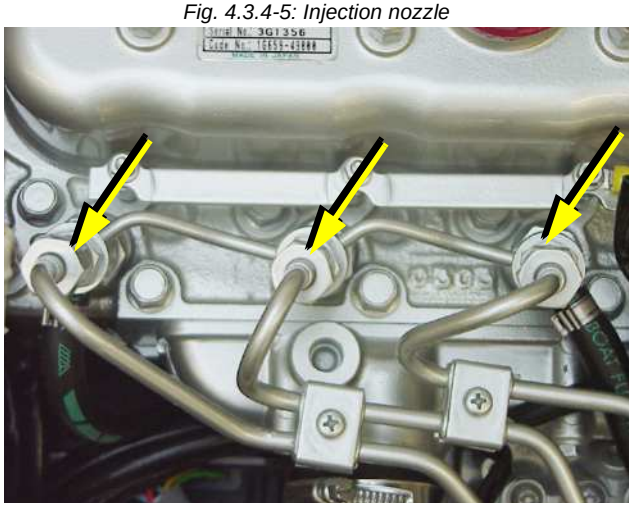
Fig. 4.3.4-4: Fuel solenoid valve



Injection nozzles

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

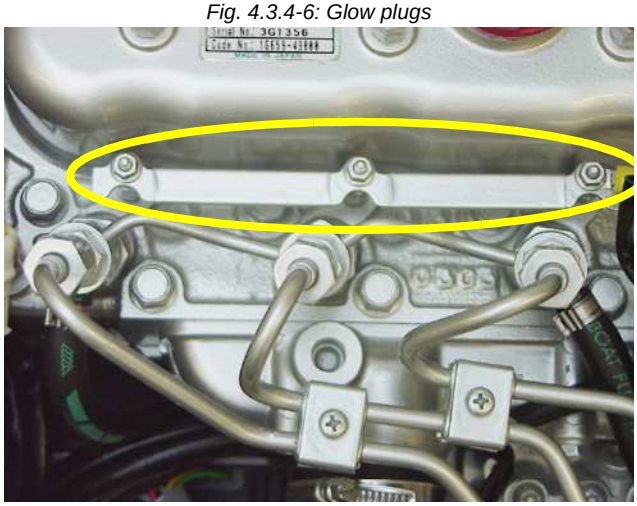
Fig. 4.3.4-5: Injection nozzle



Glow plugs

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

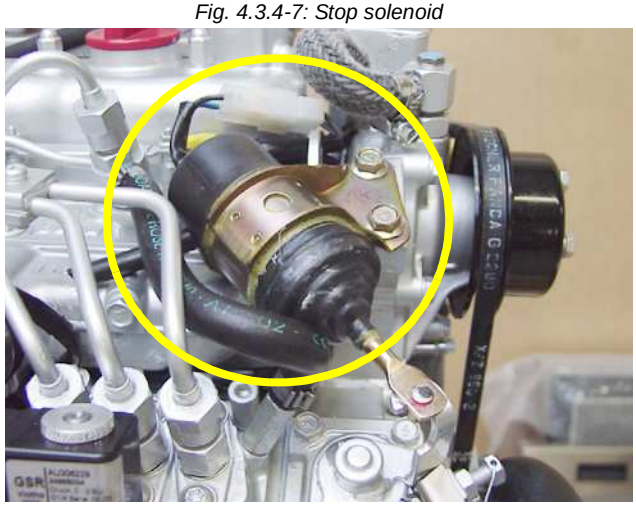
Fig. 4.3.4-6: Glow plugs



Stop solenoid for engine stop

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

Fig. 4.3.4-7: Stop solenoid



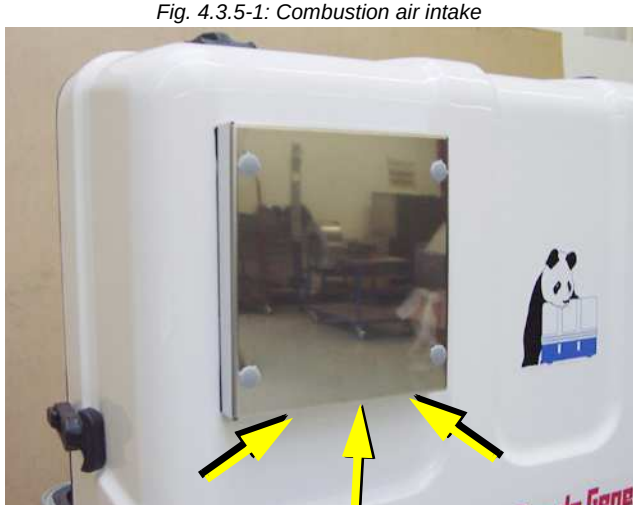
4.3.5 Components of combustion air

Air suction openings at the sound cover

The sound cover is provided at the upper surface with drillings, through which the combustion air can influx.

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

Fig. 4.3.5-1: Combustion air intake

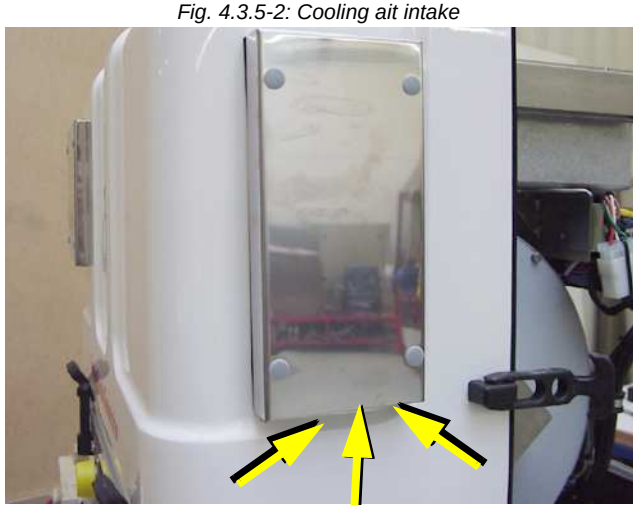


Cooling air for coil cooling

The sound cover upper surface is provided at back side with drillings, through which the cooling air can influx.

It must be consistently paid attention that the generator is installed in such a way that from no water can arrive into the proximity of these air openings.

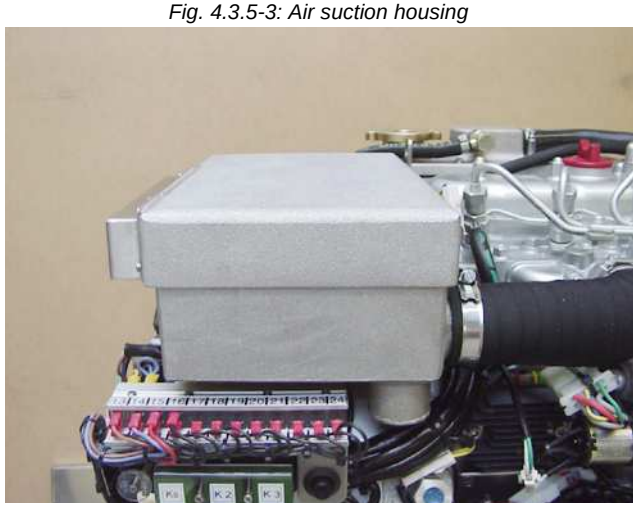
Fig. 4.3.5-2: Cooling ait intake



Air suction housing

Remove the cover to look indes the housing. There is a filter element. This must be checked from timt to time.

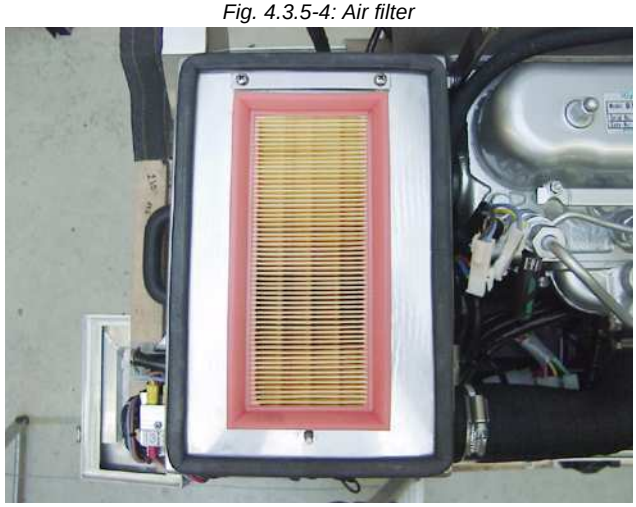
Fig. 4.3.5-3: Air suction housing



Air suction housing with air filter set

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

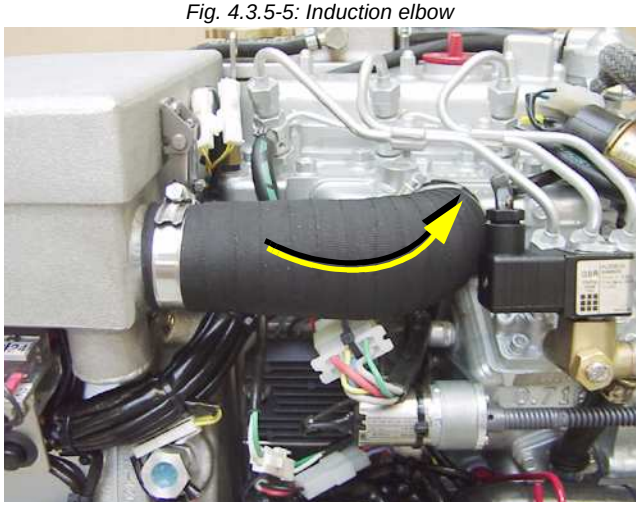
Fig. 4.3.5-4: Air filter



Induction elbow

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

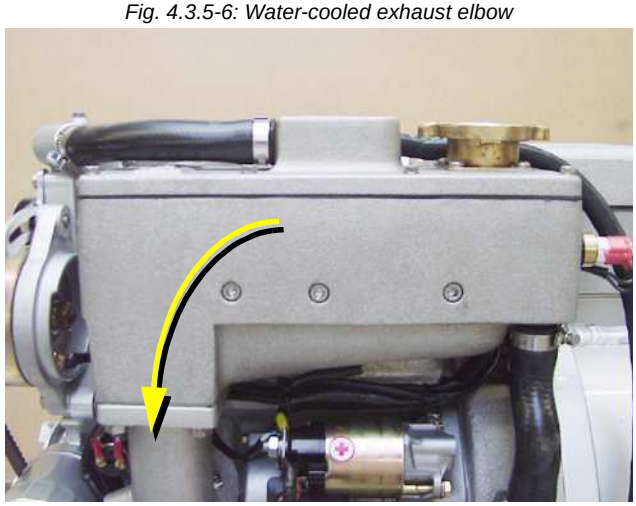
Fig. 4.3.5-5: Induction elbow



Exhaust elbow

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

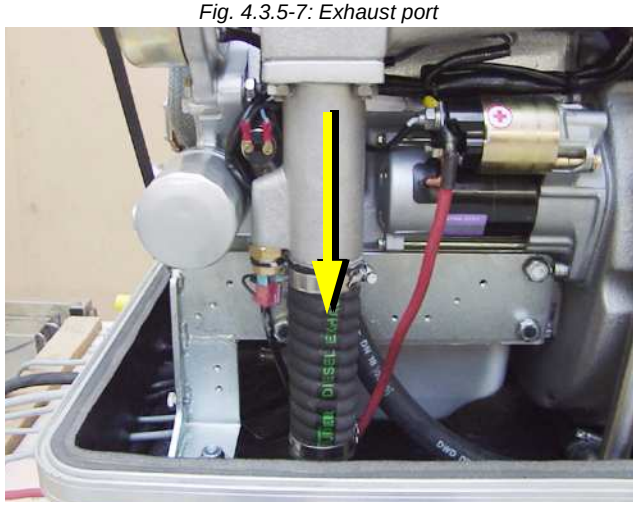
Fig. 4.3.5-6: Water-cooled exhaust elbow



Exhaust connection at the exhaust elbow

Seawater from the external cooling circle is fed here.

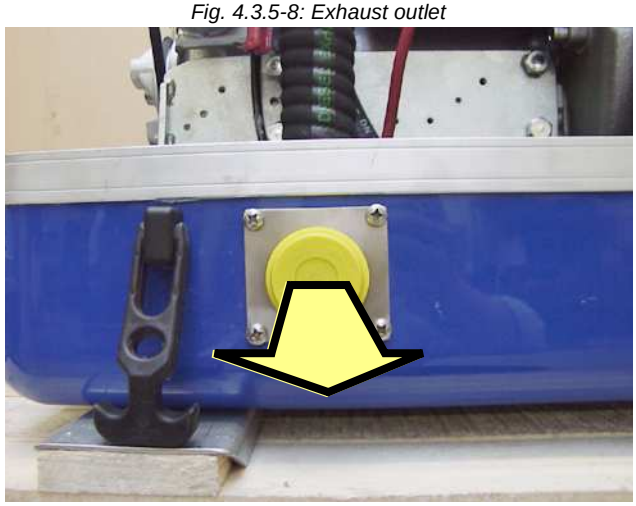
Fig. 4.3.5-7: Exhaust port



Exhaust outlet

Connect the exhaust pipe with the water lock.

Fig. 4.3.5-8: Exhaust outlet



4.3.6 Components of the electrical system

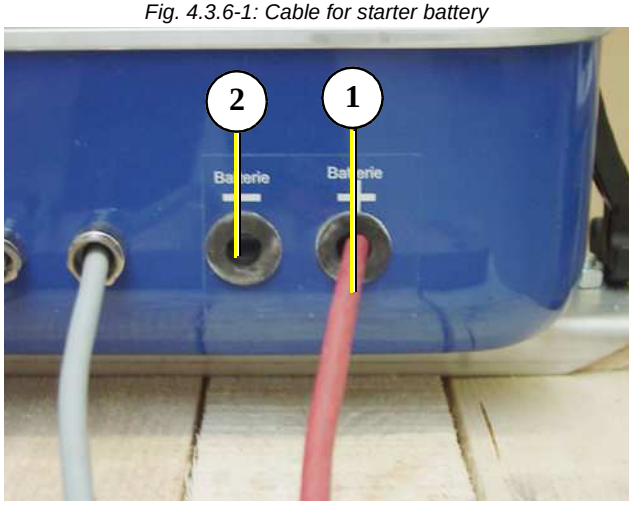
Connection starter battery

1. Cable for starter battery (plus)

2. Cable for starter battery (minus)

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

Fig. 4.3.6-1: Cable for starter battery



Main power

At the front of the sound cover is also the passage for the main power cable. Depending upon type of the generator are here also the cables for the connection of the external capacitors (see wiring diagram)

Fig. 4.3.6-2: Main power

Electrical connections for control

At the front of the generator also all remaining cables for the electrical connections are depending upon type. The allocation of the connections result from the plan for the AC-Control box. See here:

1. Fuel pump

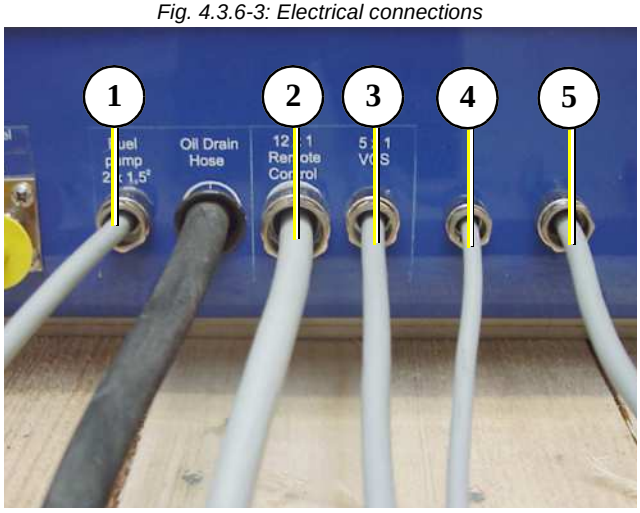
2. Remote control panel

3. VCS

4. Measuring shunt

5. Measuring voltage

Fig. 4.3.6-3: Electrical connections



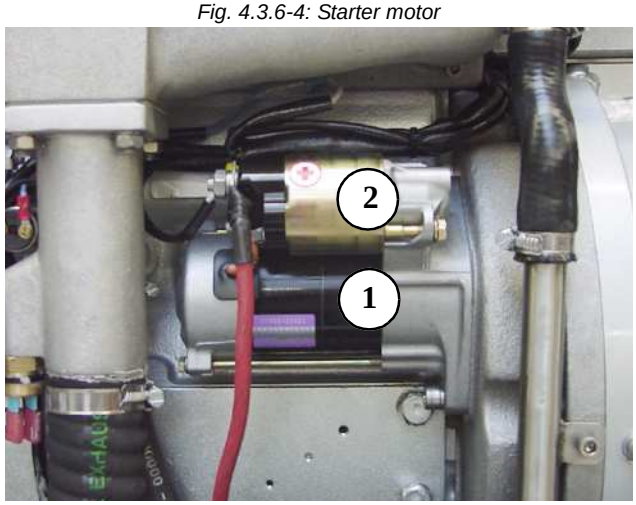
Starter motor

1. Starter motor and

2. Solenoid switch

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

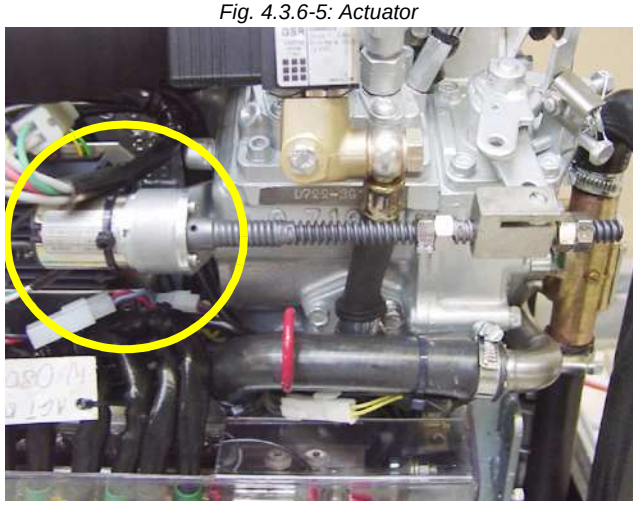
Fig. 4.3.6-4: Starter motor



Actuator for speed regulation

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

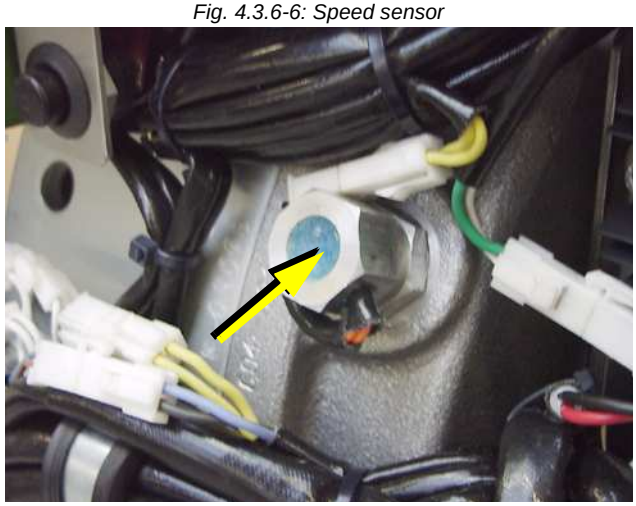
Fig. 4.3.6-5: Actuator



Speed sensor (optional)

All Panda generators can be equipped with an external automatic start. For the operation of this automatic starting system a separate speed sensor is necessary. At some models the speed sensor is standard installed.

Fig. 4.3.6-6: Speed sensor

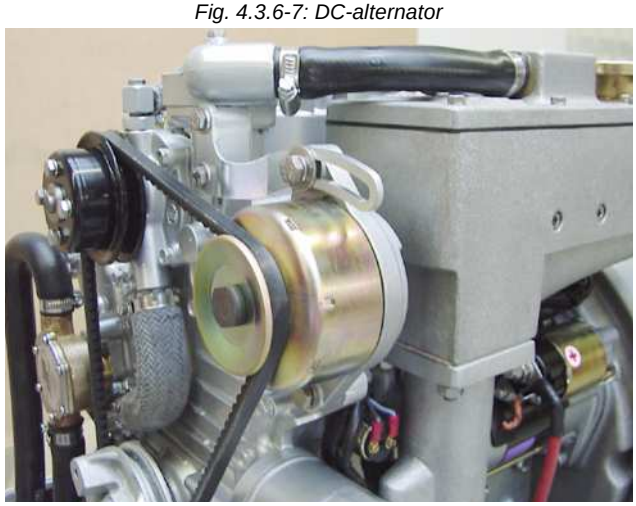


DC-alternator

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

The charge system may be used only for the generator-own starter battery.

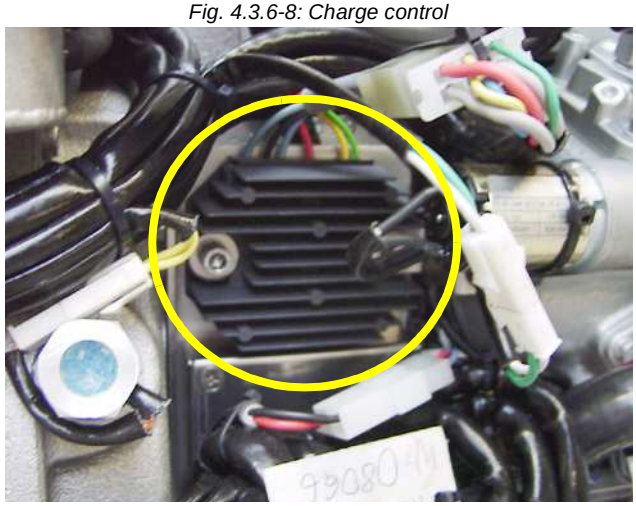
Fig. 4.3.6-7: DC-alternator



Charge control for DC-alternator

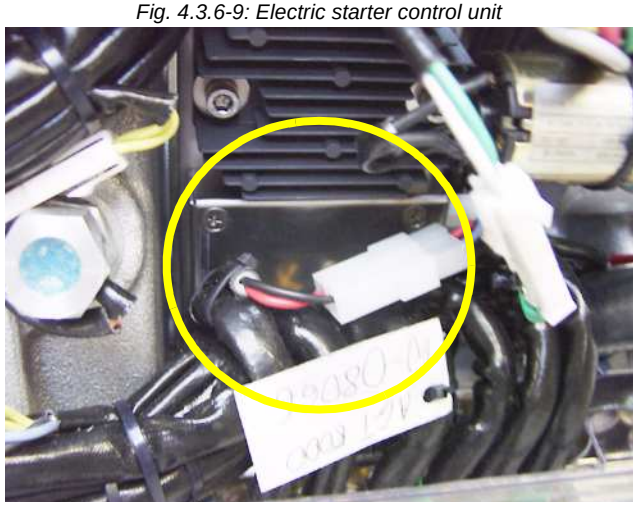
The voltage regulator for the 12V DC-alternator is on the back of the air suction housing. The housing is formed for cooling purposes. The voltage regulator may not be covered from the outside. The surface must be accessible for the cooling.

Fig. 4.3.6-8: Charge control



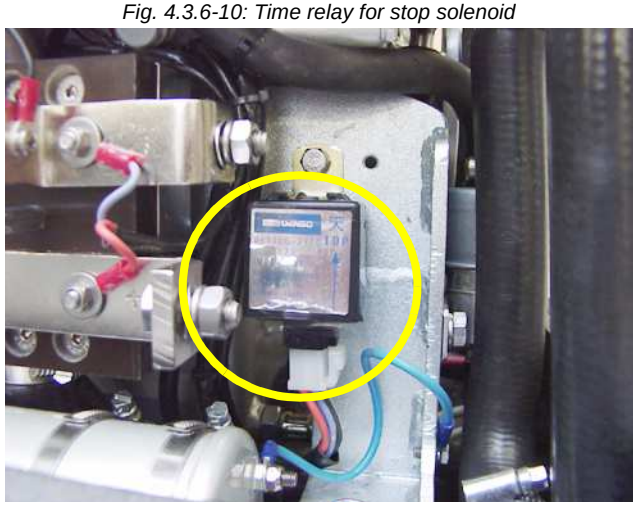
Electric starter control unit

Fig. 4.3.6-9: Electric starter control unit



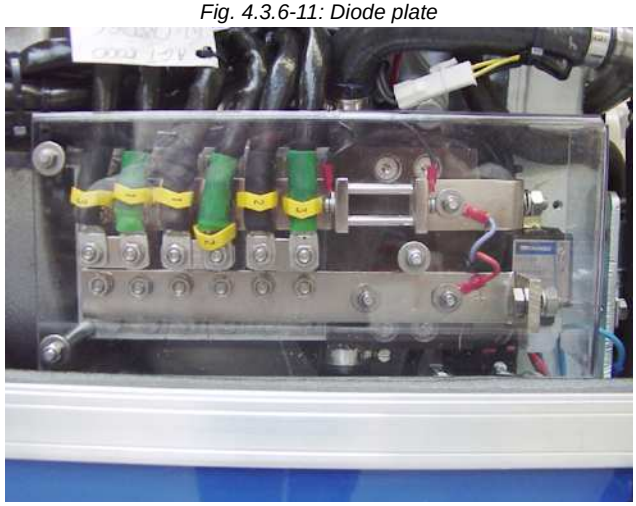
Time relay for stop solenoid

Fig. 4.3.6-10: Time relay for stop solenoid



Diode plate

Fig. 4.3.6-11: Diode plate



Terminal block for remote control cable with fuses and power relais

F1 fuse 15A for DC

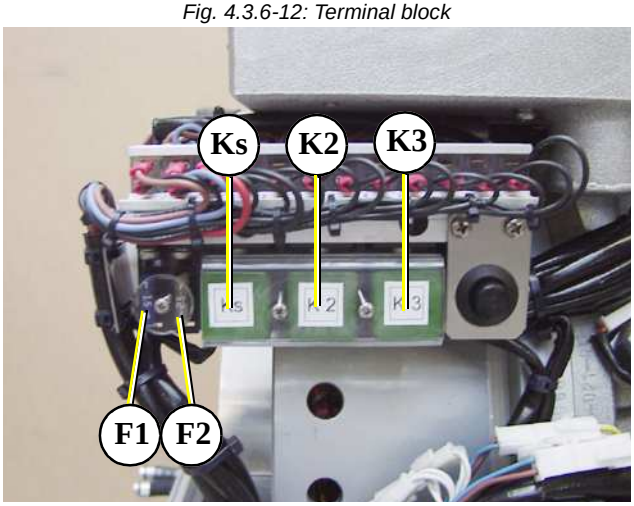
F2 fuse 25A for starter

Ks relay for starter

K2 relay for glow plugs

K3 relay for fuel pump

Fig. 4.3.6-12: Terminal block

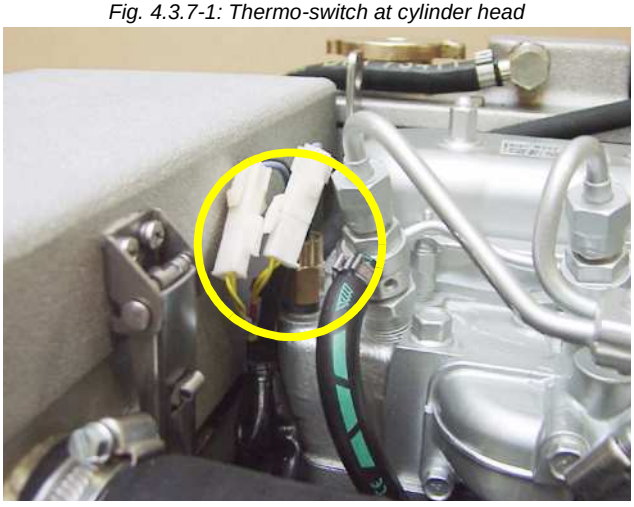


4.3.7 Sensors and switches for operating surveillance

Thermo-switch at cylinder head

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

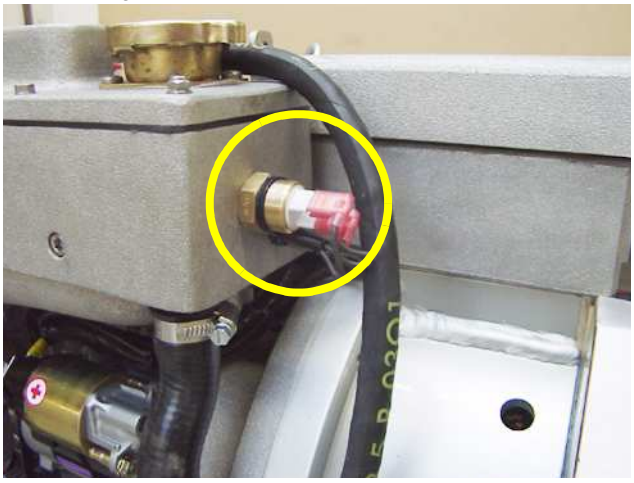
Fig. 4.3.7-1: Thermo-switch at cylinder head



Thermo-switch at water cooled exhaust elbow

This thermo-swich is located at the water-cooled exhaust elbow and monitors the temperature of the fresh water circuit. The switch measures at the hottest place, because the flue gases lead from the cylinder head into the exhaust elbow.

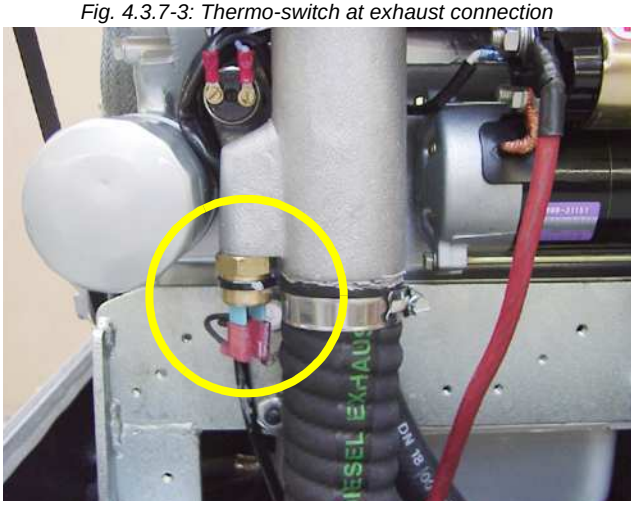
Fig. 4.3.7-2: Thermo-switch at exhaust elbow



Thermo-switch at exhaust connection

If the impeller pump drop out and deliveres no more seawater, the exhaust connection becomes extremely hot.

Fig. 4.3.7-3: Thermo-switch at exhaust connection



Thermo-switch in the generator coil

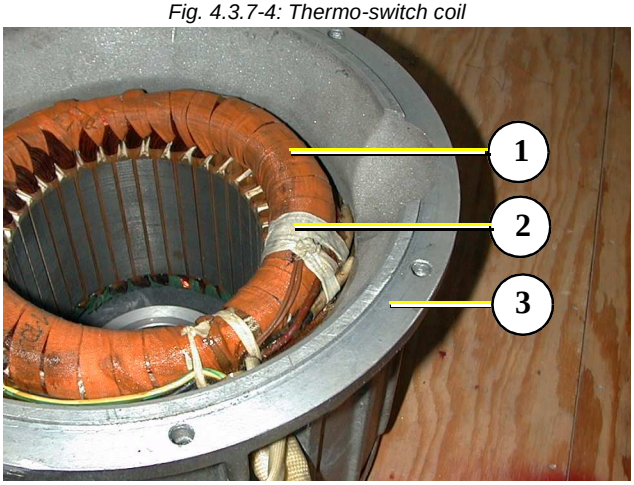
1. Generator coil

2. Thermo-switch

3. Housing

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

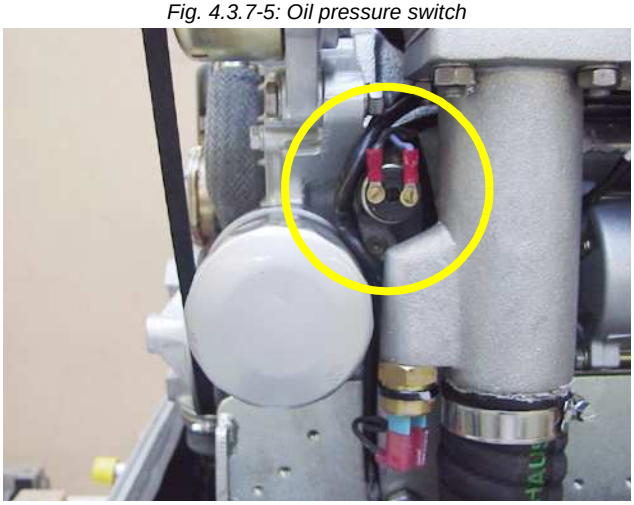
Fig. 4.3.7-4: Thermo-switch coil



Oil pressure switch

In order to be able to monitore the lubricating oil system, an oil pressure switch is built into the system. The oil pressure switch is on the back of the engine (before the electrical starter).

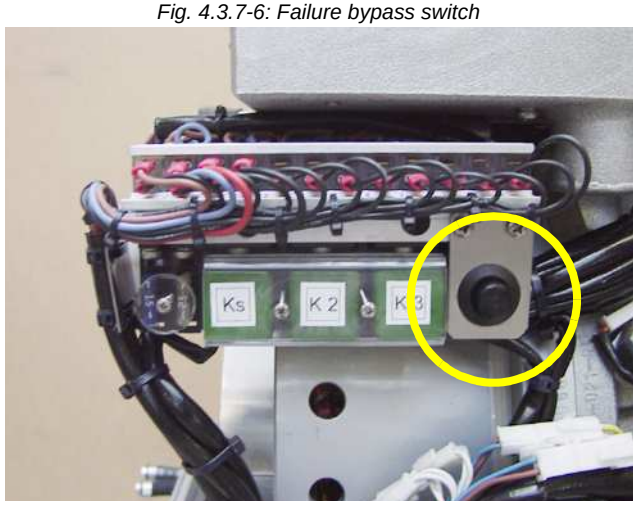
Fig. 4.3.7-5: Oil pressure switch



Failure bypass switch

The failure bypass switch offers the possibility of starting the generator if the electrical control switched off due to an error in the cooling system by overheating.

Fig. 4.3.7-6: Failure bypass switch



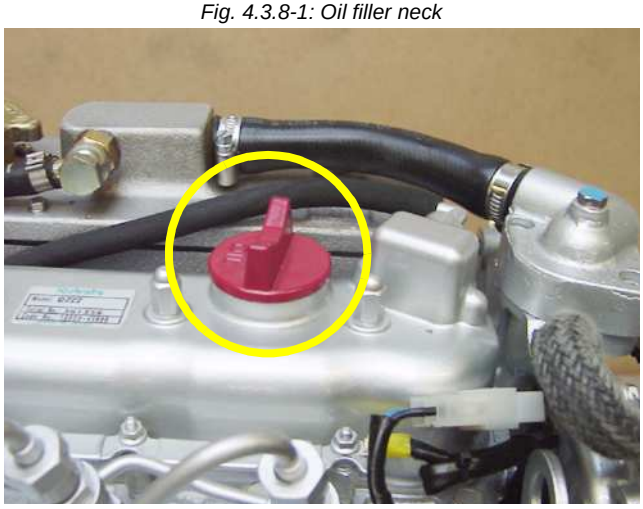
4.3.8 Components of the oil circuit

Oil filler neck with cap

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

Consider also the references to the engine oil specification.

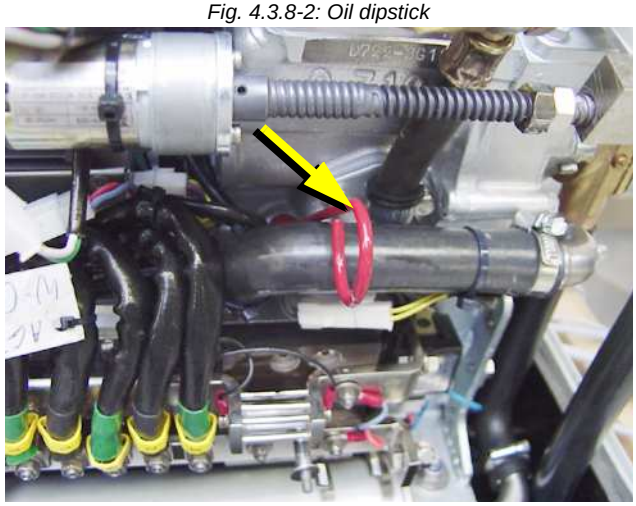
Fig. 4.3.8-1: Oil filler neck



Oil dipstick

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

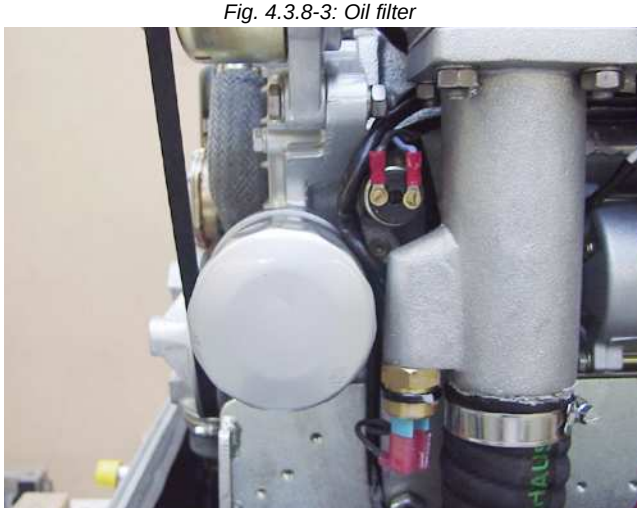
Fig. 4.3.8-2: Oil dipstick



Oil filter

The oil filter should be exchanged with an oil change.

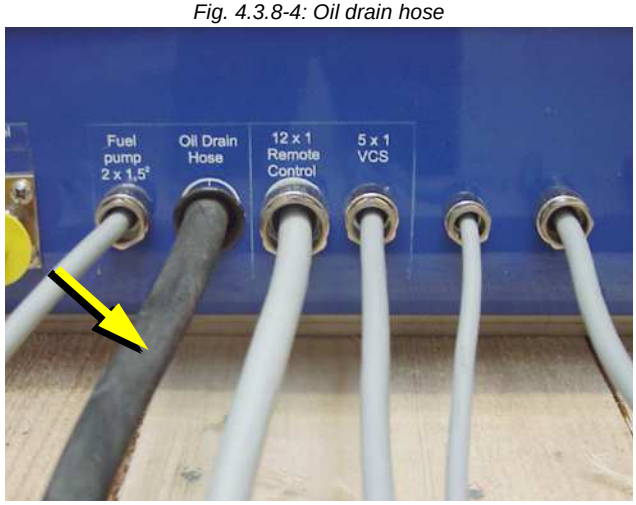
Fig. 4.3.8-3: Oil filter



Oil drain hose

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

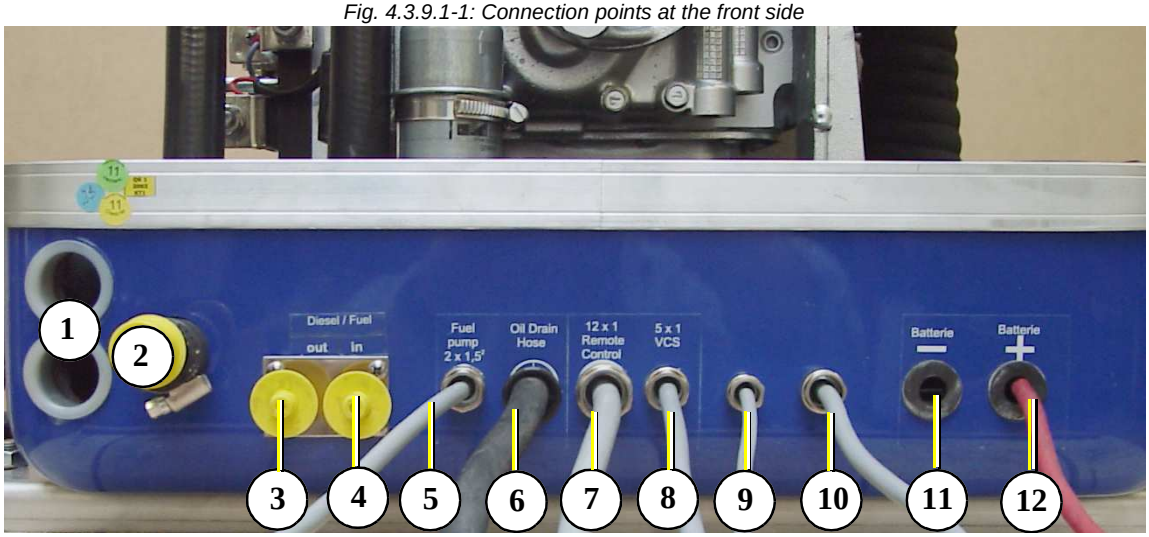
Fig. 4.3.8-4: Oil drain hose



4.3.9 Connection points at the Generator

4.3.9.1 Connection points at the front side

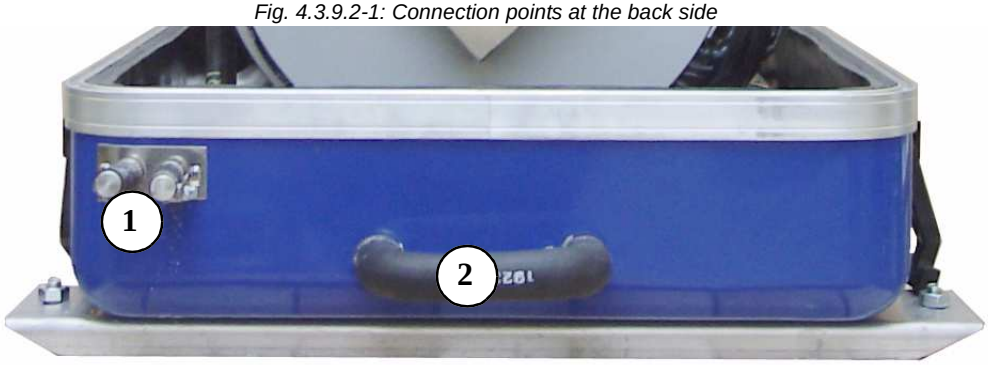
Fig. 4.3.9.1-1: Connection points at the front side



1. Passage for battery cable
2. Seawater inlet
3. Fuel return line (out)
4. Fuel supply (in)
5. Electrical cable for external fuel pump
6. Oil drain hose
7. Electrical cable to remote control panel
8. Cable to VCS-control
9. Cable for measuring shunt
10. Cable for measuring voltage 24V
11. Generator starter-battery negative (-)
12. Generator starter-battery positive (+)

4.3.9.2 Connection points at the back side

Fig. 4.3.9.2-1: Connection points at the back side



1) Connections for external expansion tank

2) External ventilation valve

4.3.10 External components

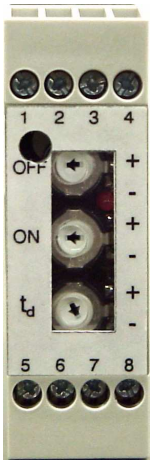
Voltage control VCS

Fig. 4.3.10-1: VCS

The figure shows the control printed board for the VCS voltage regulation. Over this control printed board the control signals are given for the actuator for speed regulation. On the VCS board are also adjustment possibilities for the control parameters.

Battery monitor (optional)

Fig. 4.3.10-2: Batrtery monitor



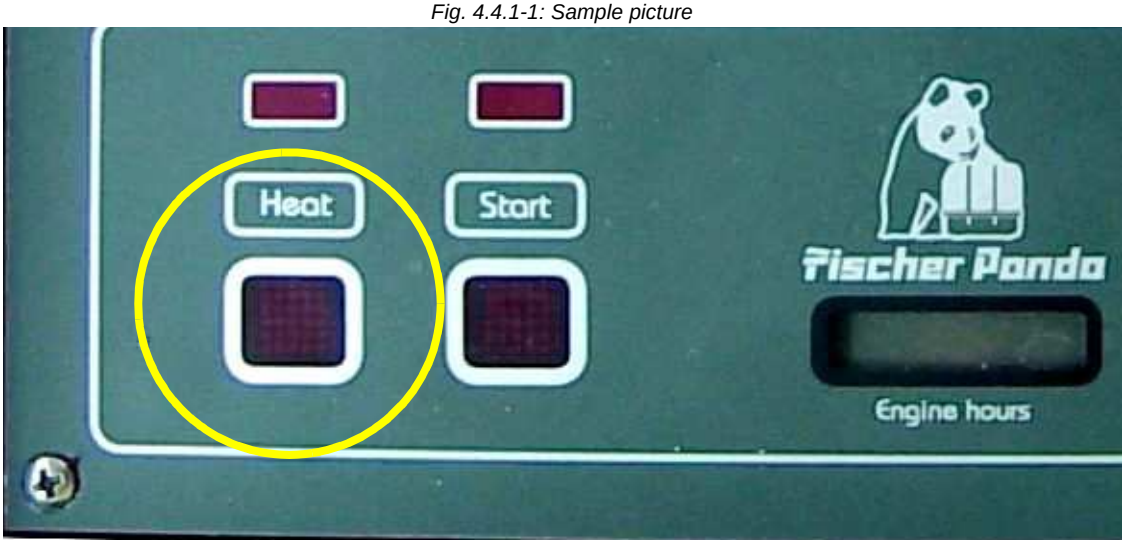
4.4 Operation Instructions

4.4.1 Preliminary remark

Pre-heating the diesel motor

The motor must be pre-heated, if the diesel motor is designed as a "pre-combustion chamber motor" for indirect fuel injection. A quick glow fitting is used for all Kubota-diesel motors. This glow fitting may only be used for a maximum of 20 seconds without a pause. A pre-glow period of 5 - 6 seconds suffices for ambient temperatures above 20℃ (plus). For lower temperatures the preglow period should be increased.

Fig. 4.4.1-1: Sample picture



Tips regarding Starter Battery

Fischer Panda recommends normal starter battery use. If an aggregate 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.

4.4.2 Daily routine checks before starting (Forts.)

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

OIL PRESSURE CONTROL!

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

AtTTENTION!

You should change the oil, regardless off the ambient temperature. Table 8.7, “Engine oil,” on Page 126. Engine oil amounts Table 8.5, “Technical Data Engine,” on Page 125.

2. State of Cooling Water.

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

3. Open Sea Cock for Cooling Water Intake.

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

4. Check Seawater Filter.

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

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

   Leaks at hose connections must be immediately repaired, especially the seawater impeller pump. It is certainly possible that the seawater impeller pump will produce leaks, depending upon the situation. (This can be caused by sand particles in the seawater 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 Consumers.

   The generator should only be started when all the consumers have been switched off. The excitation of the generator will be suppressed, if the generator is switched off with consumers 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).

4.4.3 Starting Generator

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

   The consumers are switched off, before the generator is switched off. The generator is not to be started with consumers connected. If necessary, the main switch or fuse should be switched off or the consumers should be individually switched off.
4. Press „ON“ button.

NOTE:

If the red control light for oil pressure illuminates if the panel is switched on, this is an sign that the panel has an error. In this case the generator can not stop automatically if there is a disturbance.

Control light for "ON" Button must light up.

5. Pre-heat engine.

   Pre-heating is necessary for every running temperature. Pre-heating is not necessary, only if the generator has just been run. The heating period should take at least 6 seconds, however, 20 seconds at the maximum. Heating must last for 20 seconds at a temperature of +5℃. If a second attempt is to be made, then a pause of at least 60 seconds is required.

   The generator can be started with the assistance of a pre-heating device at temperatures as low as - 20℃. Please note that the generator can only be run at temperatures below -8℃ with winter fuel and additio nal special additives.
6. Press „START“ button.

   The electric starter may only be used for a maximum of 20 seconds. Thereafter, a pause of, at least, 60 seconds is required. If the aggregate does not immediately start, then the fuel intake should be checked to ensure it is flowing freely. (For temperatures below - 8℃ check wh ether there is winter fuel)
7. Check if voltage and frequency and is within the tolerance rage (Frequency and voltage).
8. Switch on load.

4.4.4 Stopping the Generator

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

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

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

NOTE:

Never switch off the battery until the generator has stopped.

4. If necessary, close sea cock.

4.4.5 Starting the Generator by a „Failure bypass switch“

There is a "pressure switch" at the terminal block. Faults (e.g. caused by overheating) can be manually overcome by means of this switch. The generator can be started by using the remote control panel. The operating temperature can be reduced for a short period of time (without stress of course), so that the fault switch returns to the original position should overheating cause the generator to shut down because of overheating.

Before using the failure bypass switch, it is important to check the oil level, since the oil gauge is deactivated by the switch.
For a further reason it is important to switch off the generator electrical load before the generator is shut down: **ATTENTION:**

Before stopping the generator it is highly recommended that electrical devices (e.g. refrigerating compressors, air conditioning compressors etc) are switched off, because the voltage drops as the rotational speed (rpm) decreases as the engine comes to a halt.

(Also see information regarding voltage control with automatic shut-off for protection of consumers when over or undervoltage occurs).

This is also the case when the generator is started when consumers are switched on.

Normally the generator will no longer excitate if a certain amount of base load is stepped up. The electrical load should also be shut-off before starting the generator.

If started under electrical load, the engine will still run but the generator will not generate the proper voltage (or even no voltage) since the stator windings do not have the chance to reach full excitation. Electrical units which are switched on in this condition could possibly be damaged (special caution should be practised with electric motors to avoid burnout).

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 boot hull specifications, maximum boot 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 may 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!

5.1 Personal requirements

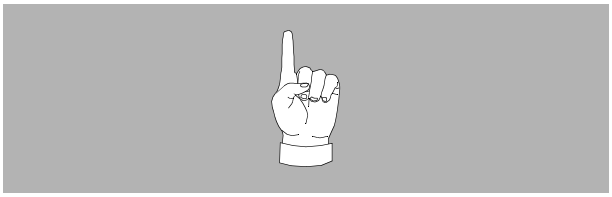
The described installation must be done by a technical trained person or a Fischer Panda service point.

5.1.1 Safety instructions

see “Safety instructions - Safety first!” on Page 18.

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

Notice!:



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

Make shure that the generator ist stopped and the starter battery is dicon-nected 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 can result in servere personal injuries or material damage.

- 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 avalilable tools and spe-cial tools. incorrect or damaged tools can result injuries.

Warning!: Risk of injury

Oil and fuel vapours vcan ignite on contact with ignition sources. Therfore:

- 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 immediatlly.

- Do not inhale oil and fuel vapours.

Danger!: Danger of poisoning

Danger for Life. Improper handling, operation, installation and maintenance can result in sévere persoanl 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/mainenance personal protective equipment is required to minimize the helth hazards.

- Protective clothing

- safety boots

- protective gloves

- Ear defender

- safety glasses

Instruction!: Personal protective equipment necessary.

Disconnet all load during the work atthe generator to avoid damages at the load.

Attention!: Disconnect all load

5.2 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.). 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.

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 decline 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 th ese effects as small as possible, the temperature in the engine room should not be higher than 15 °C in rel ation to the outside temperature.

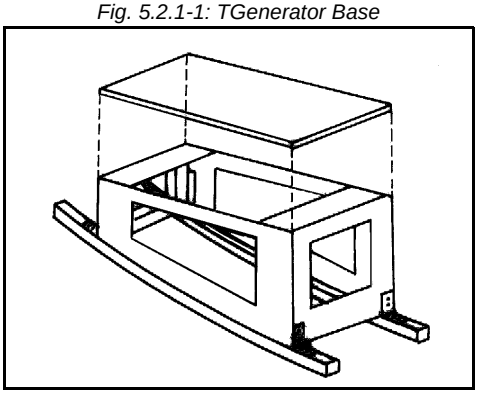
5.2.1 Advice for optimal sound insulation

The convenient base consists of a stable framework, on which the generator is fastened by means of shock-mounts.

Since the aggregate is "free" downward, the combustion air can be sucked in unhindered.

In addition are void the vibrations, which would arise with a closed soil.

Fig. 5.2.1-1: TGenerator Base



5.3 Generator Connections

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

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

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

ATTENTION!

5.4 Cooling System Installation - 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:

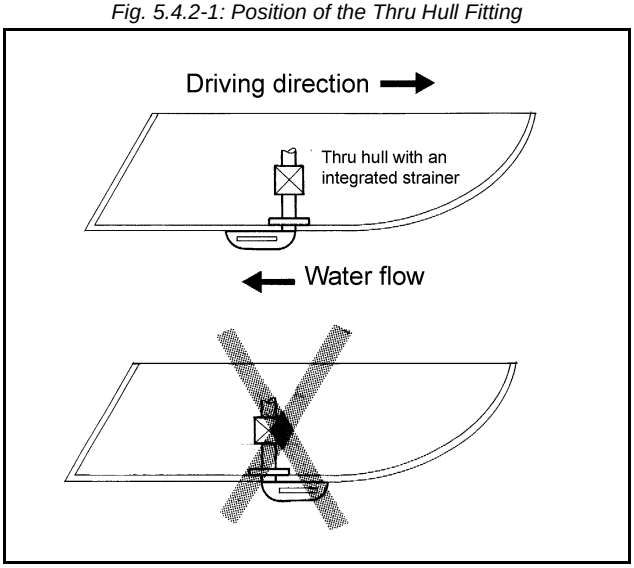
For the avoidance of galvanic corrosion, refer to the chapter "Service instruction for marine generators (corrosion protection)".

5.4.2 Installation of the thru hull fitting in Yachts

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

For Panda generators, the thru 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. 5.4.2-1: Position of the Thru Hull Fitting



5.4.3 Quality of the Raw Water sucking in line

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

This applies also to installation components such as thru-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 8.3, “Cable cross section,” on page 121

5.4.4 Generator Installation above waterline

The Panda is equipped with a direct drive water intake pump mounted directly on the motor. Since the intake pump is an impeller pump there are wearing parts which are likely to require replacement after 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.

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

The impeller pump will remain intact longer, if an electrical booster pump is installed, and is strongly recommended in order to preserve the impeller pump.

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

NOTE:

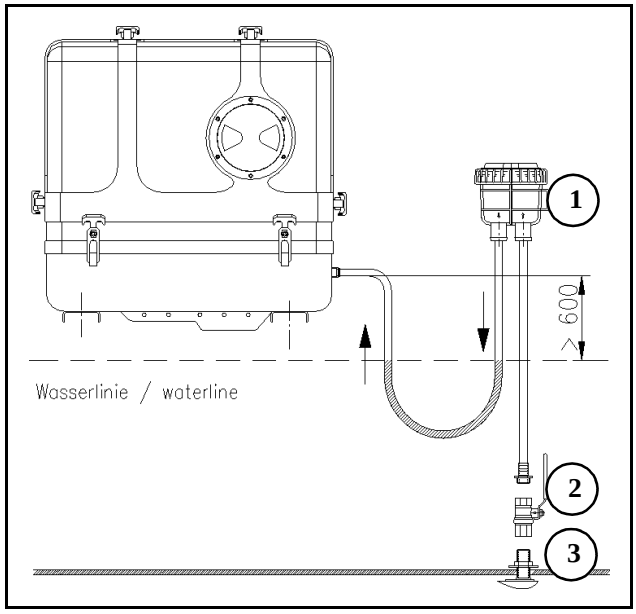
Replacement impeller and also a spare pump should always be on board. The old pump can be sent back to Fischer Panda.

1. Raw water filter
2. Water cock
3. Thru hull

Make certain that the raw water filter lies above the water level, otherwise with cleaning water can penetrate by the thru hull. An external pre-pump can relieve the impeller.

An external pre-pump can relieve the impeller.

Fig. 5.4.4-1: Generator installation above waterline



5.4.5 Generator Installation below Water-Line

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 cover. 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 to one point, 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.

The vent valve must be installed directly behind the water pump.

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

Attention:

Fig. 5.4.5-1: Vent Valve

The de-aeration valve must be regularly controlled. If the water pump stops, the valve spring ensures that air enters. It must be opened, cleaned and greased.

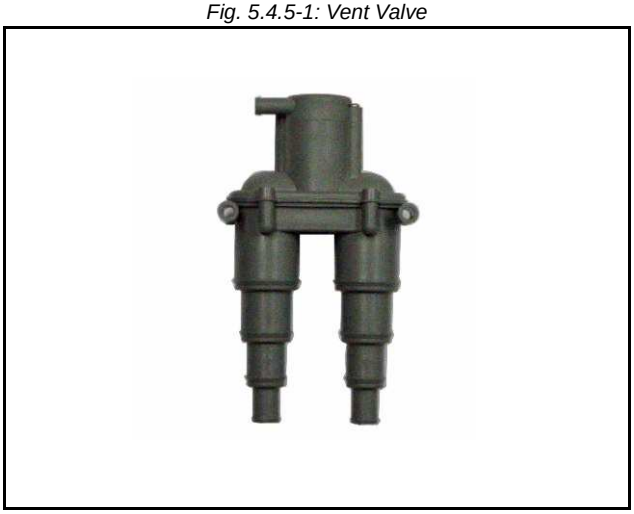
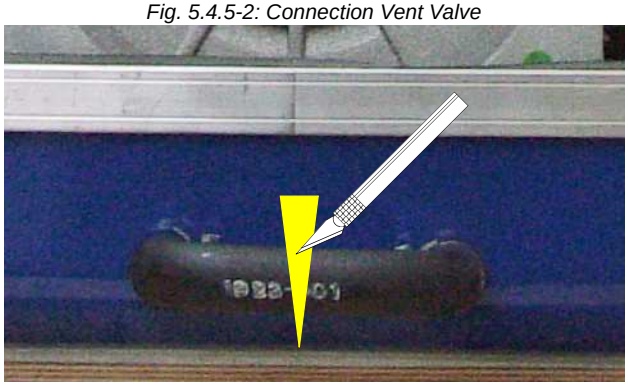


Fig. 5.4.5-2: Connection Vent Valve

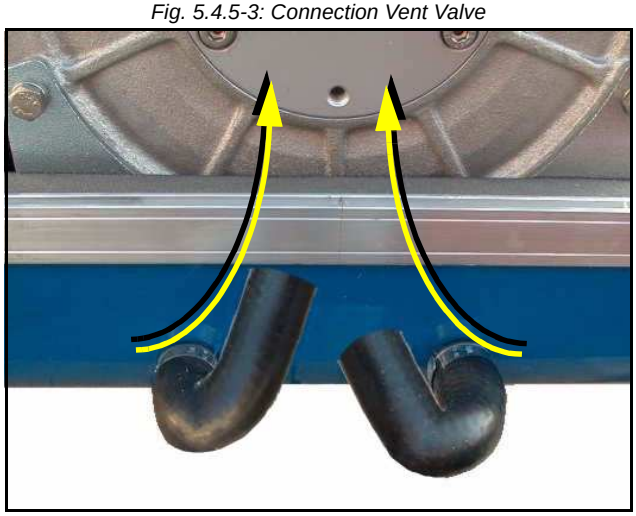
Cut the hose for the external vent valve....



...and bend it upwards.

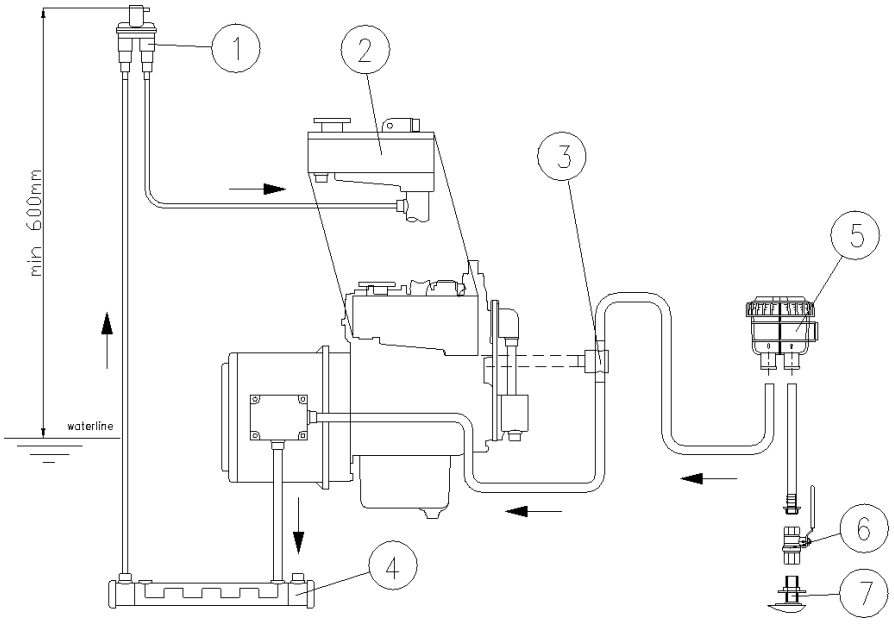
Both hose ends must be led out outside of the sound cover to one point, if possible 600 mm over the waterline at the mid-ships line. The valve is connected at the highest place with the two hose ends.

Fig. 5.4.5-3: Connection Vent Valve



5.4.6 Generator Housing cooled by Raw Water

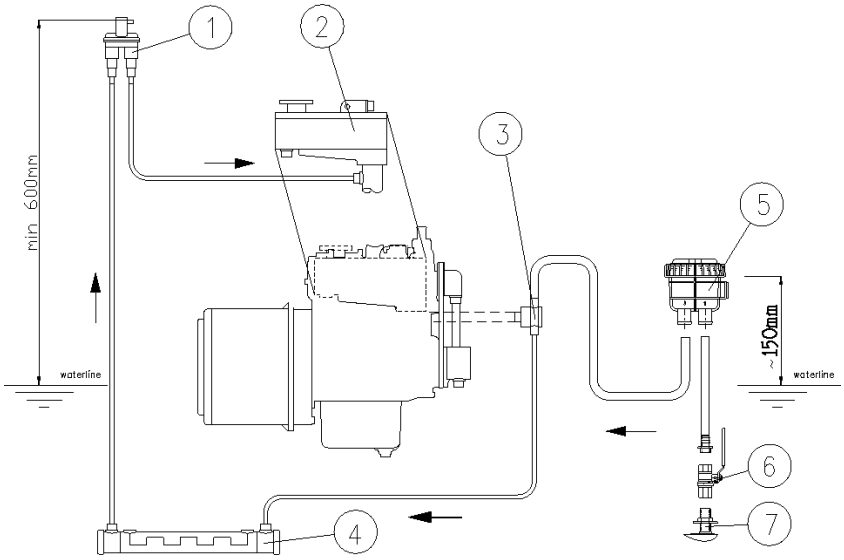
Fig. 5.4.6-1: Installaton Scheme for Direct Cooling - schema



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

5.4.7 Indirect Cooling of the Genset Housing (by the Heat Exchanger)

Fig. 5.4.7-1: Installation Scheme Indirect Cooling of teh Genset Housing



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

5.5 The Freshwater Coolant Circuit

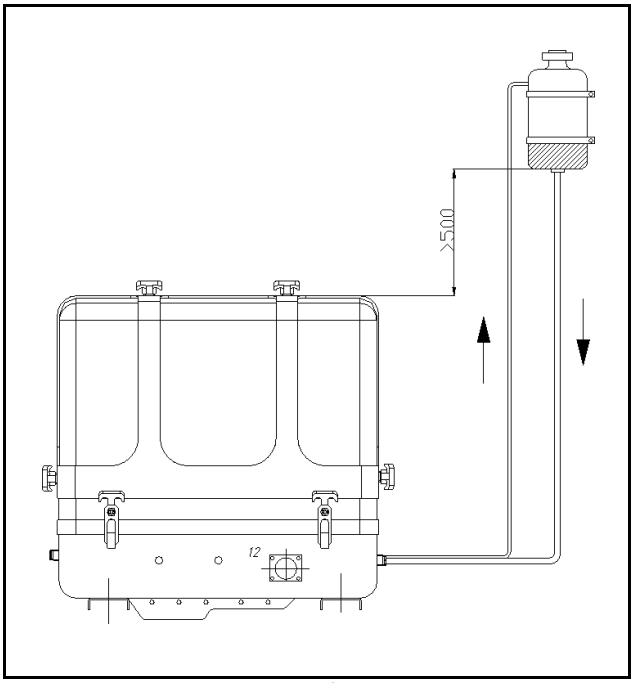
5.5.1 Position of the external cooling water expansion tank

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 Ventilating at the first filling of the Internal Cooling Water Circuit

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

Fig. 5.5.2-1: Expansion ttank

maximum fill level = „max.“- mark.

ATTENTION:

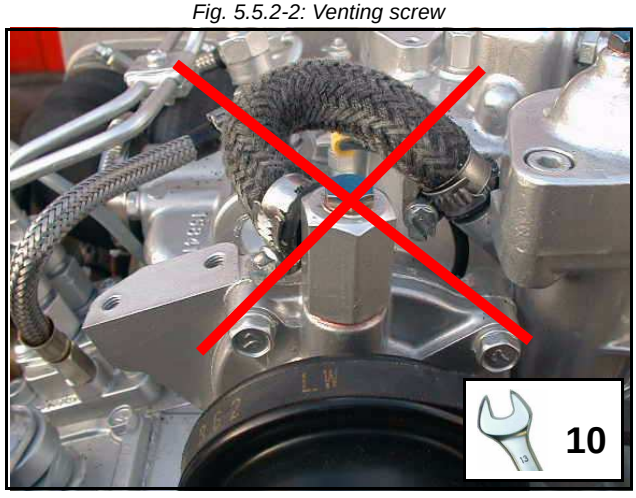
The cover of the external expansion tank temporarily must be opend (all other closures are now closed!).

2. Open vent screw on the pipe socket of the internal cooling water pump. Close the vent screw when air free water comes out

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

Never open the vent screw at the water pump while the generator is running

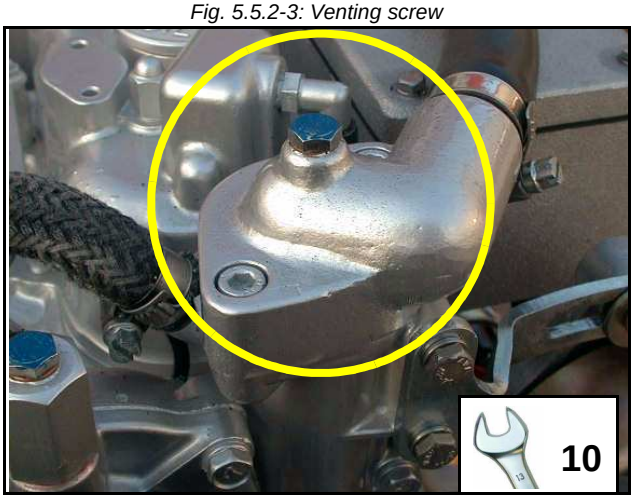
Fig. 5.5.2-2: Venting screw



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

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

Fig. 5.5.2-3: Venting screw



4. **Start the Generator**

After filling the generator it must be started. During this first phase of start-up, the generator may not be loaded. Switch the generator off after about 10 sek. of operation!

5. Repeat the steps 1-4 till no air comes out of the vent screw at tthermostat housing.

Close the vent screws.

Fill up the expansion tank.

Close the expansion tank.

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

Also after the first implementing a small amount of air can be reside in the cooling circuit. To ensure an imaculate und actual operating of the cooling system the 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 could be that the cooling water is not circulating. The generator will heat up very quickly and switch off, because of overheating.

ATTENTION!

Anti-freeze

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

5.5.3 Pressure Test for Controlling the Cooling Water Circuit

Check if a temperature difference exists between cooling water in-flow and cooling water return flow by use of the hand.

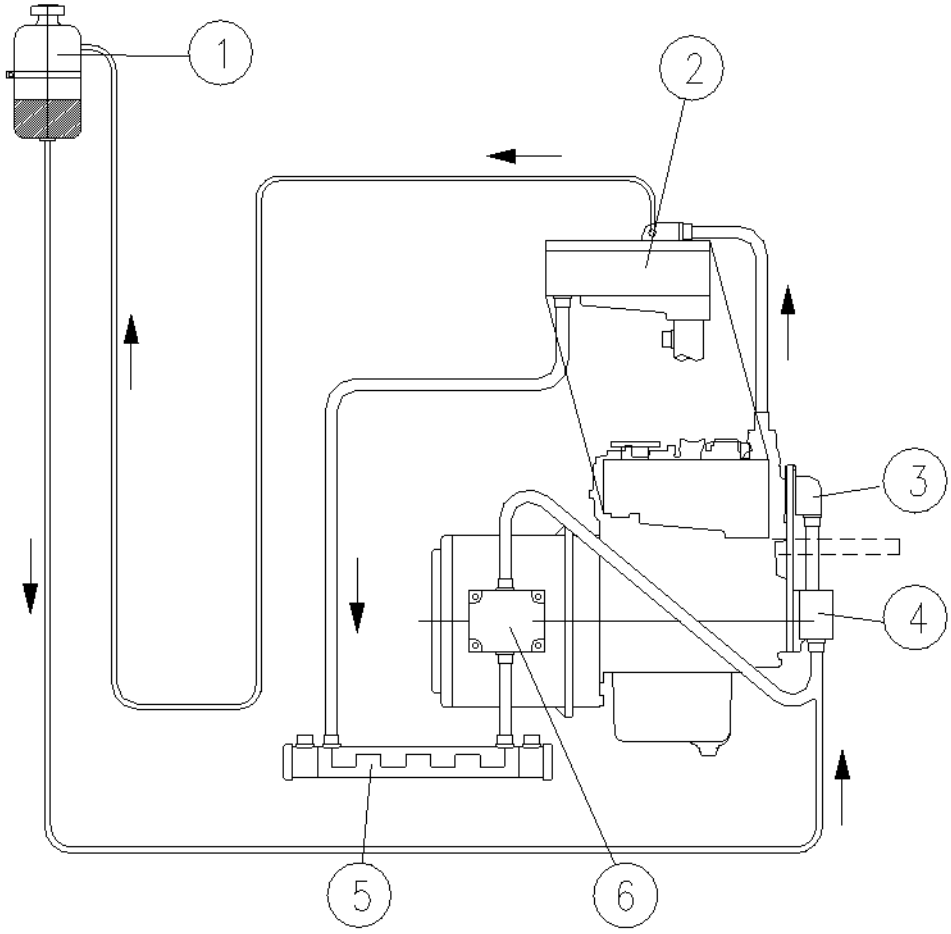
Feel the cooling water in-flow line at the internal cooling water pump.

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

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

5.5.4 Scheme for Freshwater Circuit at Two Circuit Cooling System

Fig. 5.5.4-1: 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

5.5.5 Pressure Test for Controlling the Cooling Water Circuit

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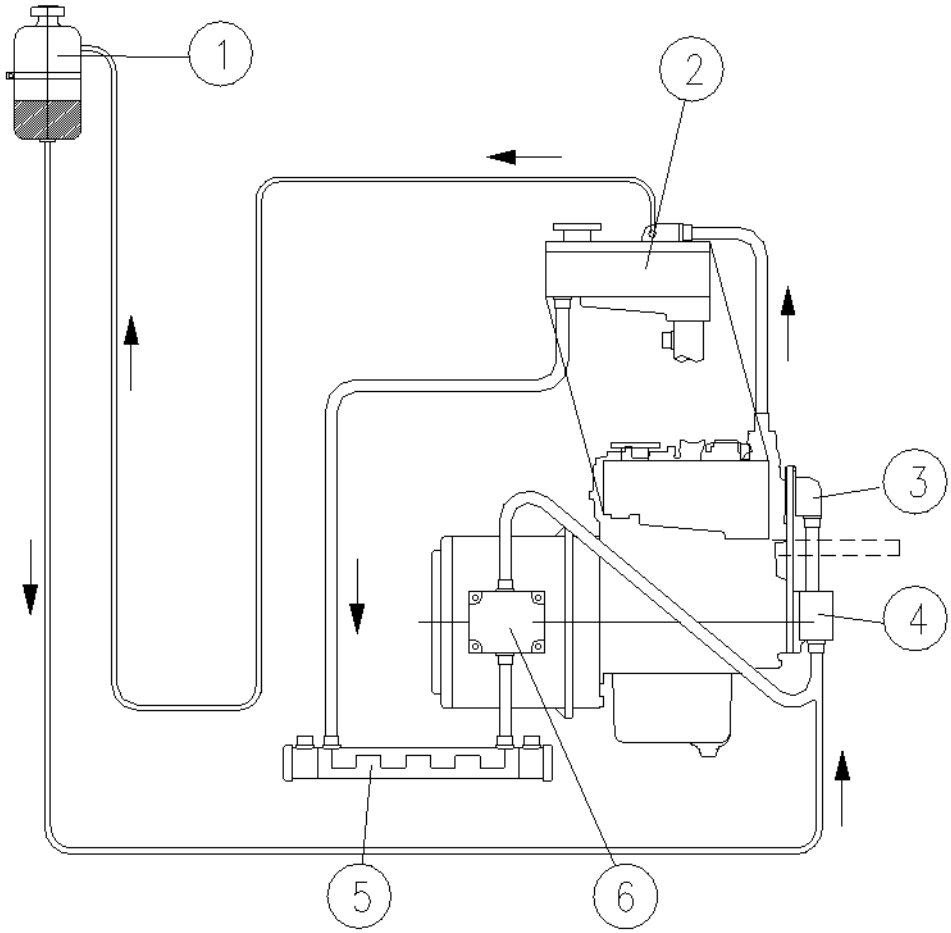
Fig. 5.5.6-1: Scheme for Freshwater Circuit at Two Circuit Cooling System



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

5.6 Water Cooled Exhaust System

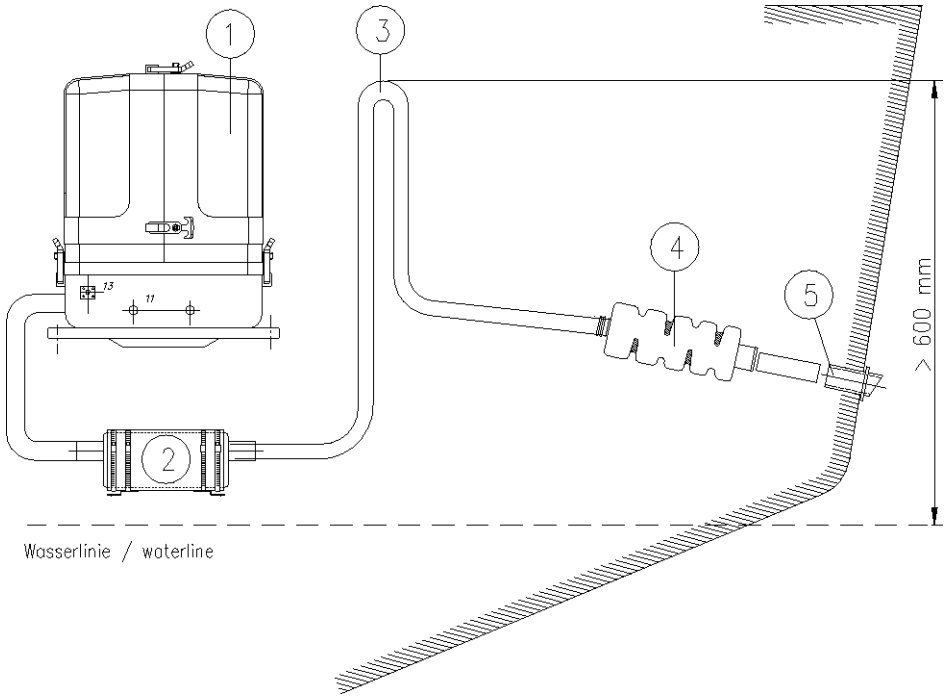
By injecting the outlet raw water into the exhaust manifold, the exhaust gases are cooled and the noise emissions from the exhaust system are reduced.

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 exhaust hose has an inner diameter of 30 mm. 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 m (20 ft.).

Exhaust diameter see section 8.3, “Cable cross section,” on page 121.

Fig. 5.6.1-1: Installation Scheme Standard Exhaust System



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

5.6.2 Exhaust / Water separator (optional)

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 thru-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".

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

Fig. 5.6.2-1:

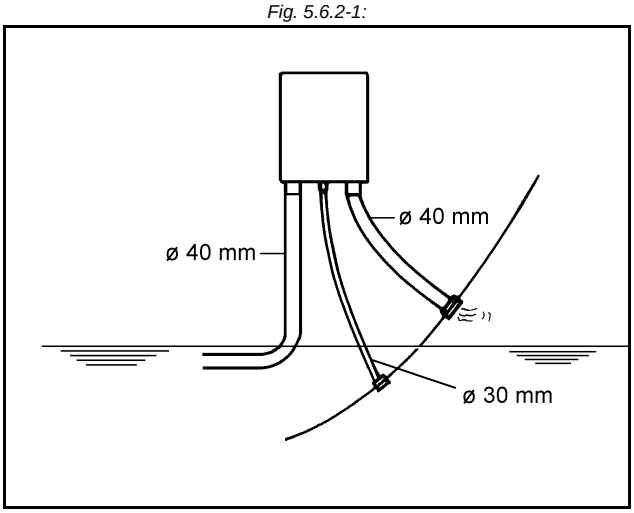
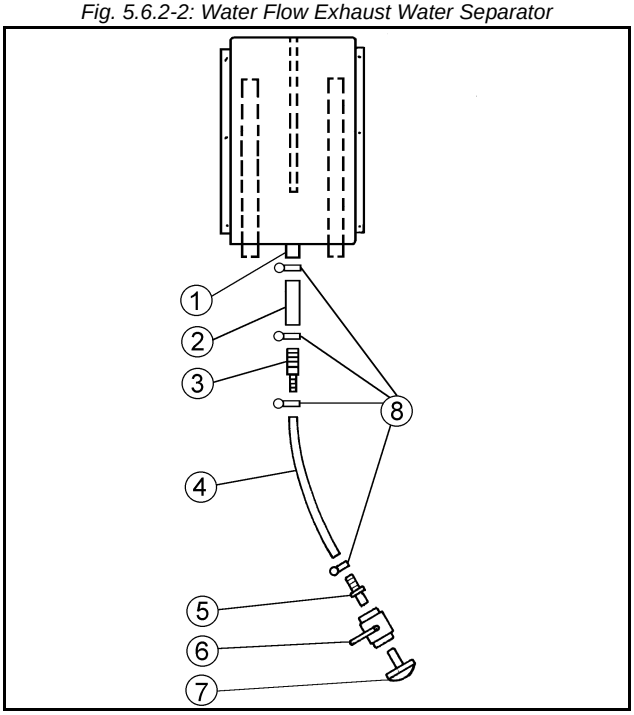


Fig. 5.6.2-2: Water Flow Exhaust Water Separator



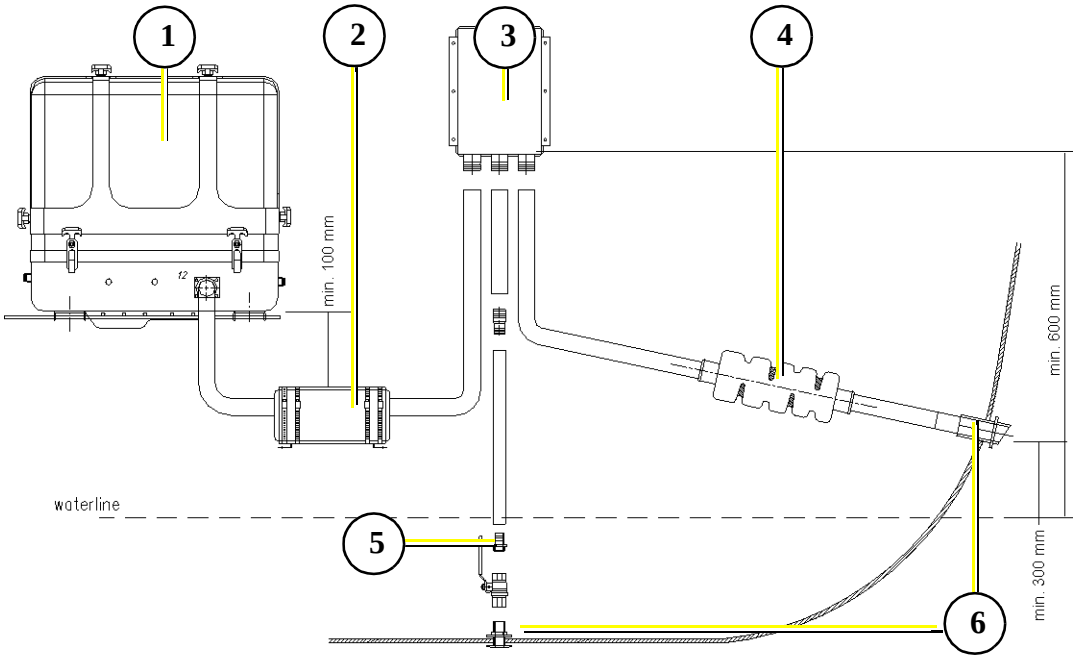
1. Raw water outlet ø 30mm
2. Hose connector ø 30mm
3. Reducer 30/20mm (if required)
4. Hose
5. Hose connector
6. Sea cock
7. Hull outlet

8.Hose Clips

5.6.2.1 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.

Fig. 5.6.2.1-1: (Installation Exhaust-Water-Separator)

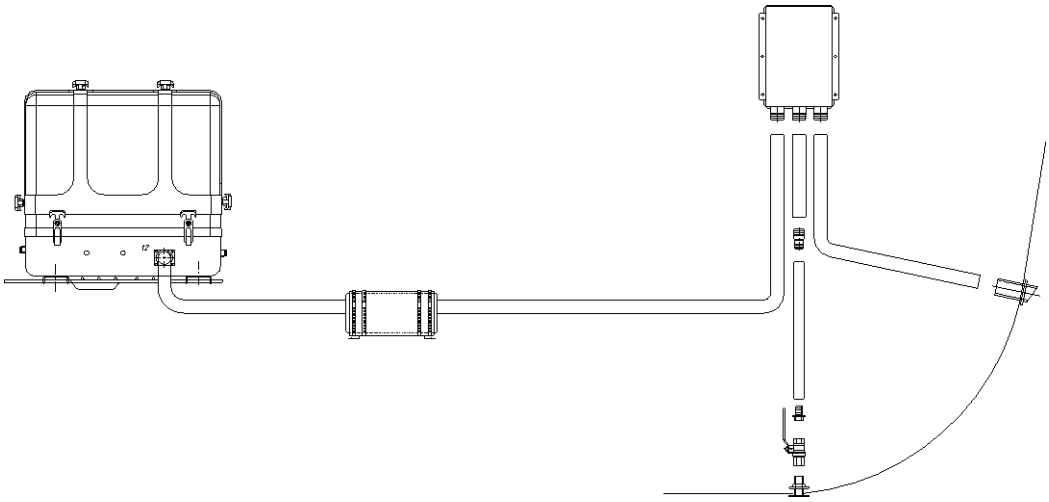


1. Generator
2. Silencer / Water lock
3. Exhaust-Water-Separator
4. Silencer
5. Sea cock
6. Hull outlet

If the thru-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 is the thru-hull outlet. For such long exhaust routes, the exhaust hose diameter should also be increased from NW40mm to NW50mm in order to reduce the back-pressure. The exhaust may have a length of over 10m (32 ft.) if the exhaust hose diameter is increased to 50mm. An additional outlet exhaust muffler close to the hull outlet will help further to reduce noise emissions.

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. 5.6.2.1-2: Expample for an unfavourable Installation



Example of an unfavourable installation:

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

5.7 Installation of the Fuel System

5.7.1 General References

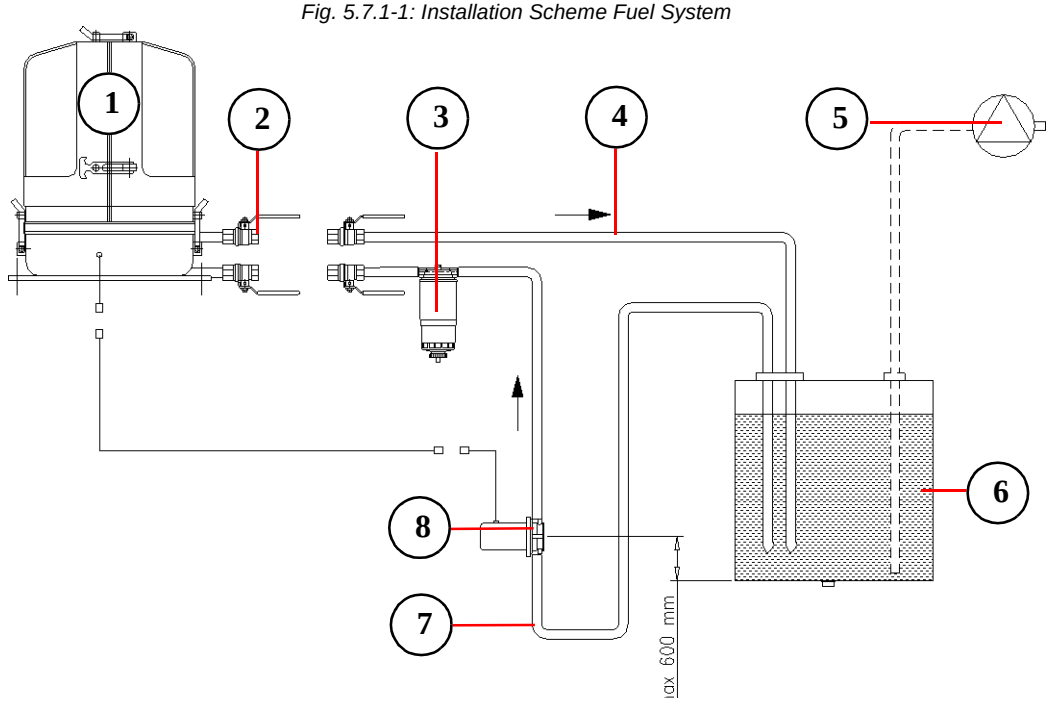
Inside the generator capsule itself, there is the fuel filter installed (exception: Panda 4200 and 4500). Additional fuel filters (with water separator) must be mounted outside the capsule in easily accessible places in the fuel lines between the tank intake fuel pump and the diesel motor's fuel pump.

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

- The following items need to be installed:
- Fuel supply pump (12 V - DC)
- Pre-filter with water separator (not part of the delivery)
- Fine particle fuel filter
- Return fuel line to fuel tank (unpressurized)

The fuel supply pump should be mounted as close to the fuel tank as possible. The electric cable for the fuel pump is already installed on the generator (length 5 m).

Fig. 5.7.1-1: Installation Scheme Fuel System



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

5.7.2 The Electrical Fuel Pump

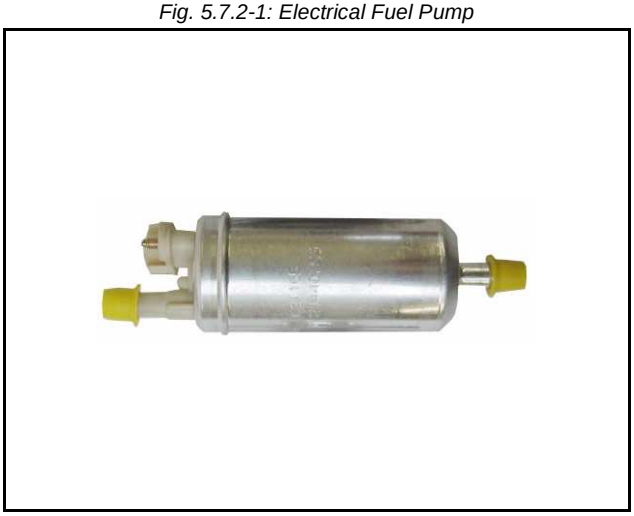
Electrical Fuel Pump

With the Panda generator is usually supplied an external, electrical fuel pump (12 V DC). The fuel pump must be installed close at the fuel tank. The electrical connections are preloaded at the generator with the lead planned.

- Suction hight of the pump: max. 1,2 m at 02, bar

Diameter of fuel lines: section 8.3, “Cable cross section,” on page 121.

Fig. 5.7.2-1: Electrical Fuel Pump



5.7.3 Connection of the Fuel Lines at the Tank

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

The return pipe connected to the tank must be dropped to the same depth as the suction pipe, 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!

5.7.4 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).

Fig. 5.7.4-1: Pre-Filter with Water Separator

5.7.5 Ventilating Air from the Fuel System

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

1. Switch main power switch on control panel "ON".

2. Push failure bypass switch and hold tight.

The electric fuel pump has to be run audibly. By moving the failure bypass switch you can hear the solenoid valve of the generator starting and stopping (when the sound insulation cover is taken off).

3. After the fuel pump has been running 3 to 4 minutes, because the failure bypass switch has been pressed down, the bleeding screw of the solenoid valve has to be unscrewed. The switch has to be continuously depressed, when opening the screw. A piece of cloth or absorbent paper should be put under the connection to avoid fuel entering the sound insulation cover.

4. The air vent screw can be screwed in again, as soon as fuel runs out without bubbles. Then release the depressing the failure bypass switch.

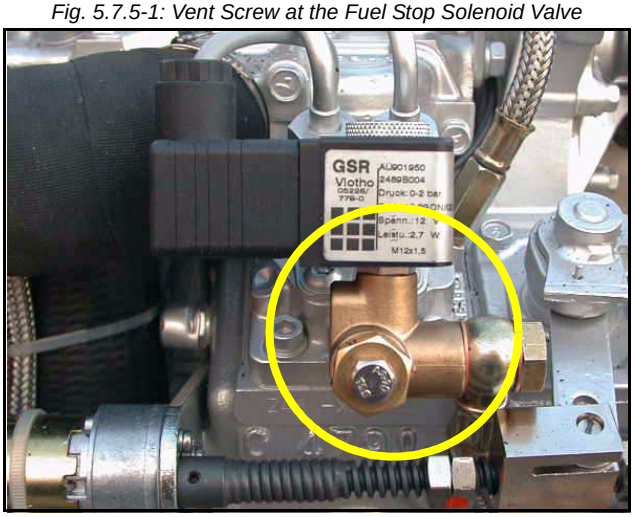
5. Starting the generator

Now the generator can be started by pushing the "START"-button. The generator should start after a short while. One of the pipe union nuts of an injection hose has to be unscrewed, should the unit not start; then try to restart the generator. After the generator has started, the pipe union nut has to be tightened again.

Main power switch "OFF"

Vent Screw at the fuel stop solenoid valve

Fig. 5.7.5-1: Vent Screw at the Fuel Stop Solenoid Valve



5.8 Generator DC 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 lightnening conductor, personal protection switch, fuses etc.

ATTENTION!

5.8.1 Connection to the Starter Battery-Block

It is necessary to install a starter battery for the generator. The generator has its own alternator to charge a starter battery.

It must be ensured that the cable is firstly attached to the generator and finally to the battery. Furthermore, the battery should be fitted as close as possible to the generator, in order to avoid greater voltage deviation. The positive pole is connected to the red lead and the negative pole to the blue lead. The positive wire must be secured with corresponding fuses.

ATTENTION!Consider correct connection sequence

Battery Bank Connection

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

ATTENTION! Right connection of the battery bank .

Install an appropriate fuse and a battery circuit breaker in the plus pole cable of the batterie, 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 ℃, 195 ℉.

The batteries must be layed 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.

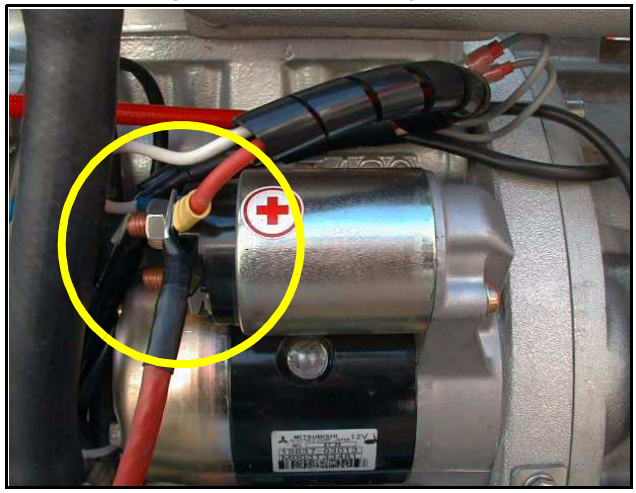
Examine regularly the cable layings and the electrical connections.

5.8.2 Connection of the Starter Battery

It is necessary to install a starter battery for the generator. The generator has its own alternator to charge a starter battery.

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

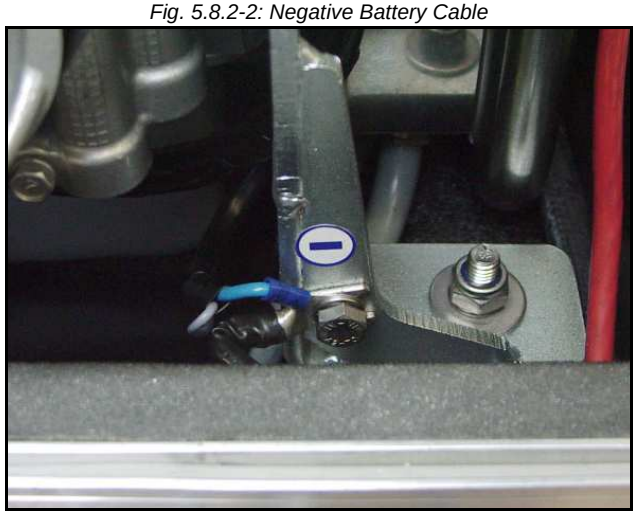
Fig. 5.8.2-1: Positive Battery Cable



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 installation!

Fig. 5.8.2-2: Negative Battery Cable

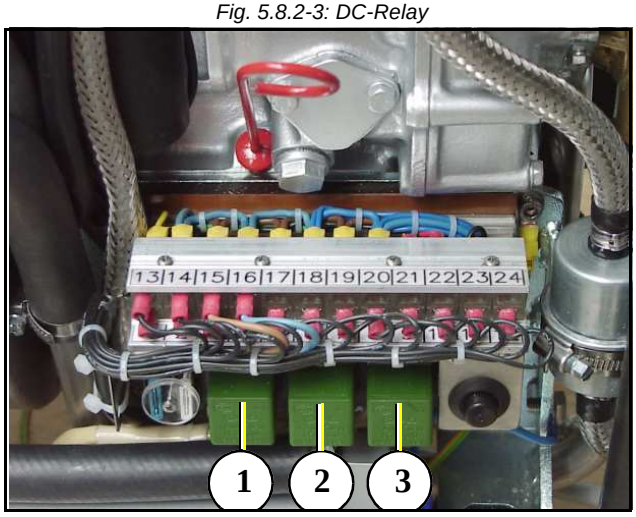


The Panda generators 8000 to 30 are equipped with various DC-relays, which can be found under the terminal strip. The various relays have the following tasks (also see the DC circuit diagram)

- Starter motor relay
- Pre-glow relay (glow plugs)
- Fuel pump relay

see wiring diagram

Fig. 5.8.2-3: DC-Relay

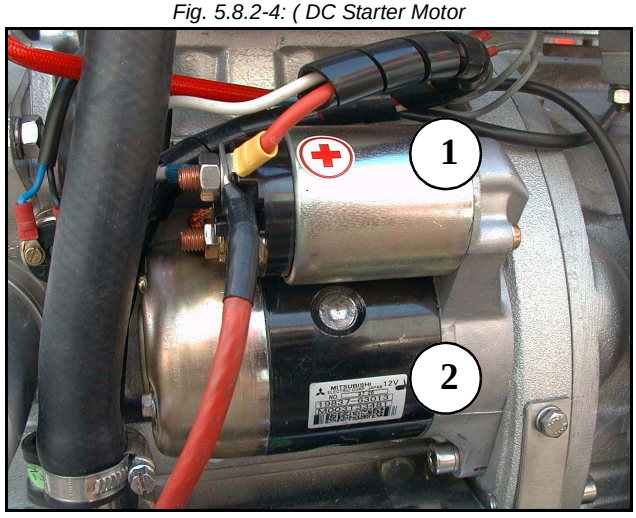


Panda generators are equipped with an independent DC starter motor. The connecting lines cross-section from the battery to the DC system should measure 25 mm² or more depending on system.

1. Solenoid switch for starter motor

2. Starter motor

Fig. 5.8.2-4: (DC Starter Motor



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

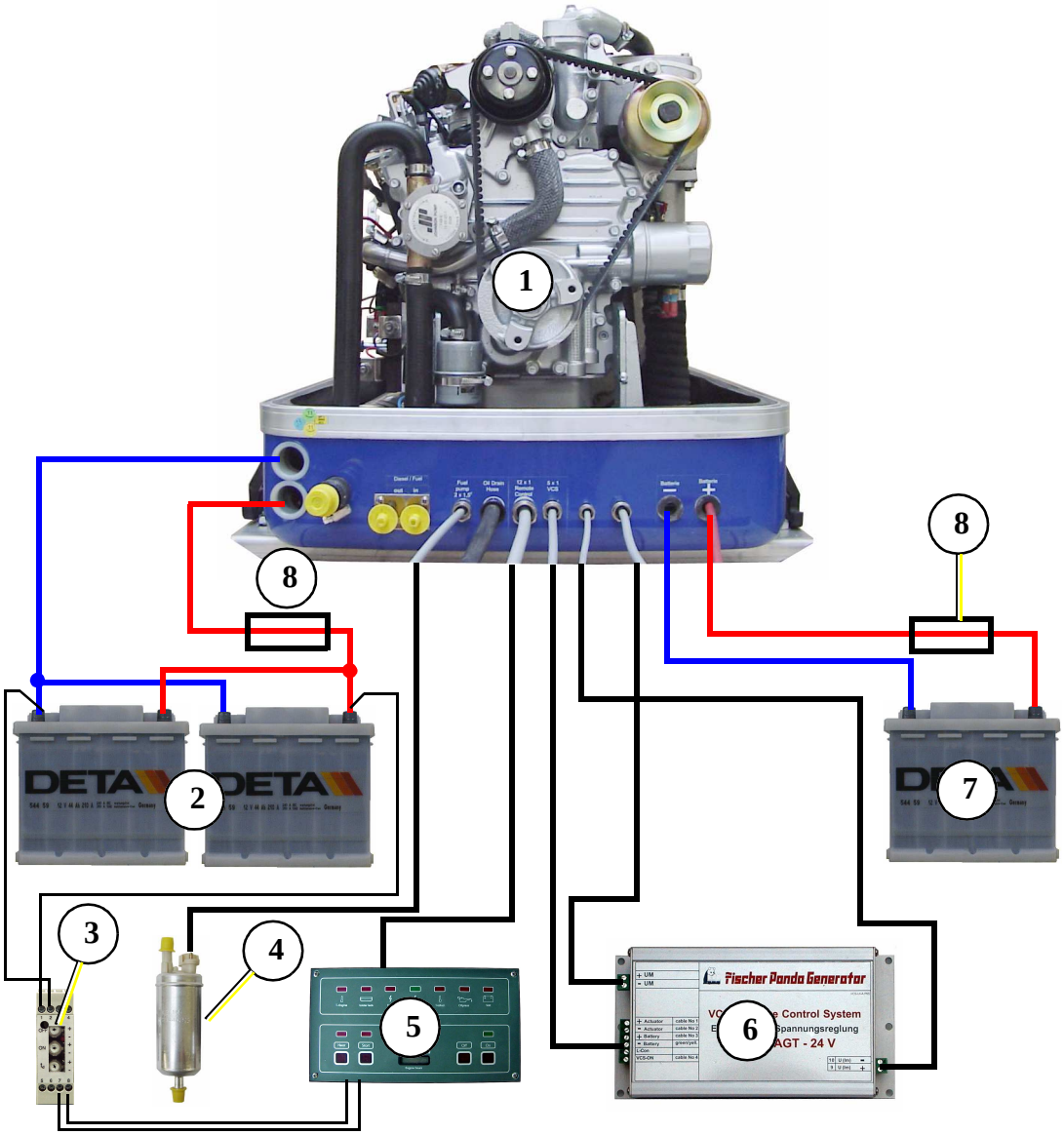
As standard a 12 core connection-cable is included in the supply. Cores are numbered from 1 to 11 and the 12th core is coloured (yellow/green). The control cables are securely connected to the genset. On the back of the control panel there are terminals numbered from 1 - 12. Connect the cores of the control-cable in respective order.

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

5.8.4 Installation Panda AGT 12V-system with 12V DC output, 12V starter system and internal rectifier unit - sample schema

Sample schema for a standard installation

Fig. 5.8.4-1: 24V DC output, 12V starter system and internal rectifier unit



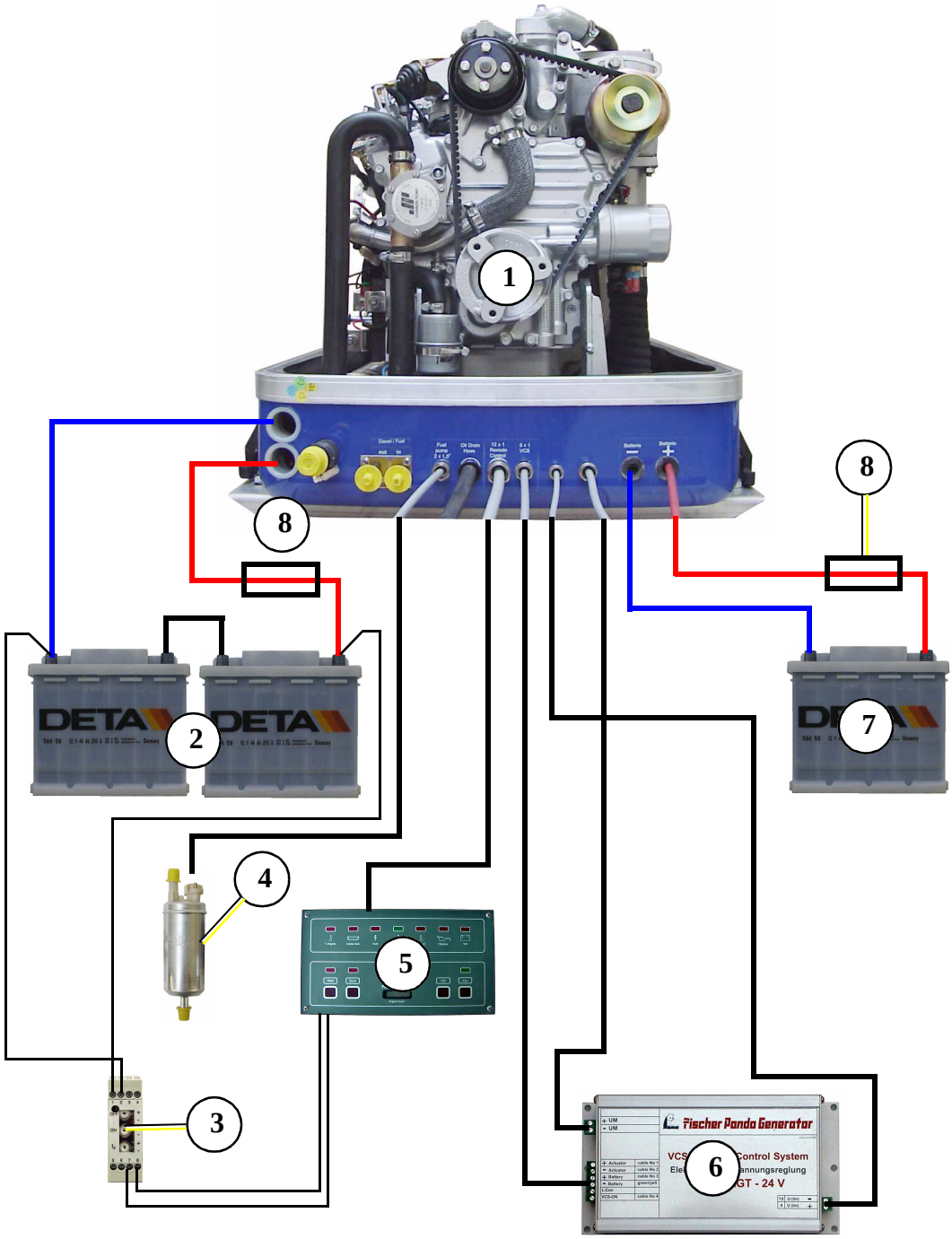
1. Generator
2. Battery block 12V
3. Battery monitor (optional unit)
4. Fuel pump
5. Remote control panel
6. Voltage control VCS
7. Starter battery 12V
8. Fuse

All electrical safety installations have to be made on board.

5.8.5 Installation Panda AGT 24V-system with 24V DC output, 12V starter system and internal rectifier unit - sample schema

Sample schema for a standard installation

Fig. 5.8.5-1: AGT 24V DC output 12V starter system



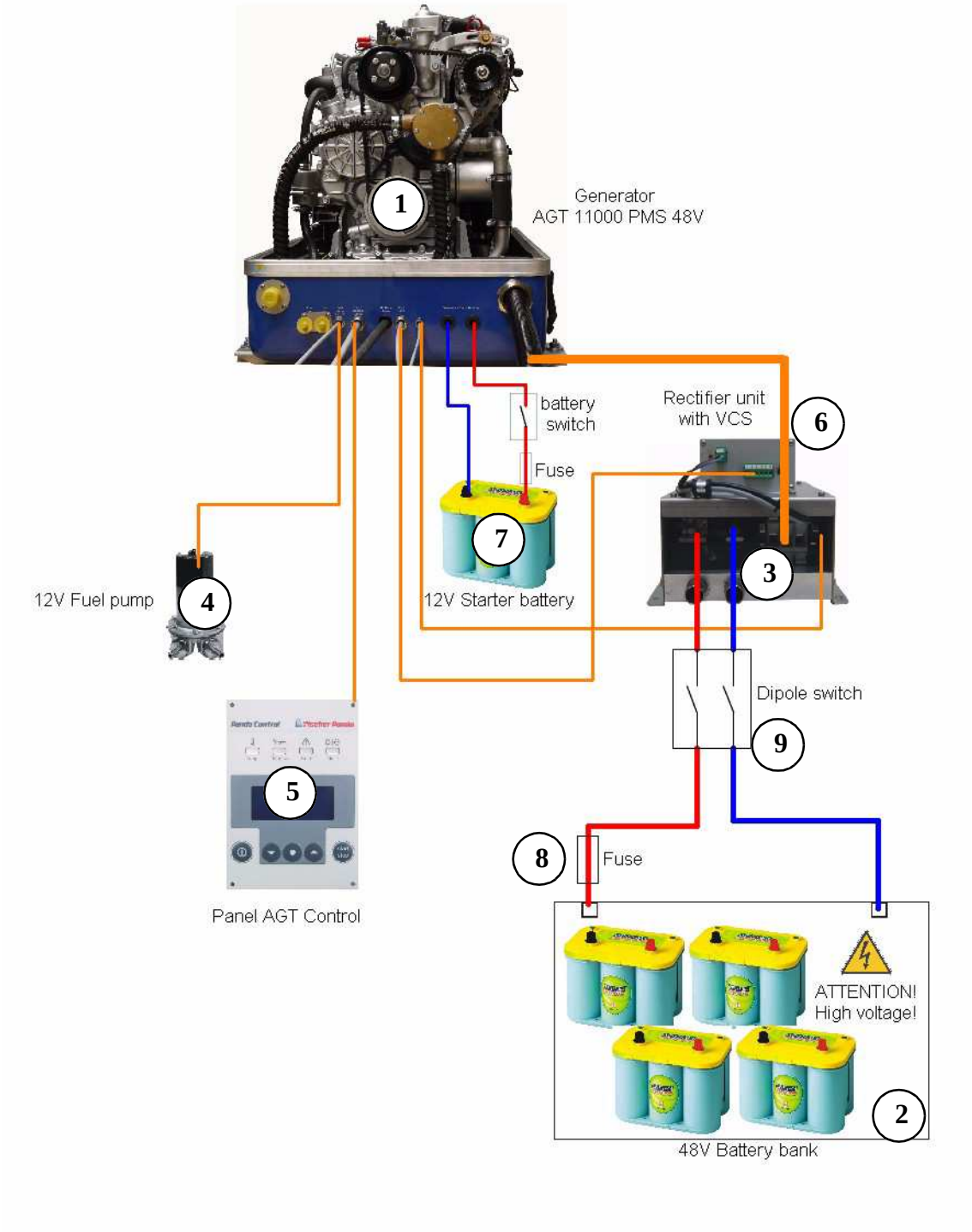
1. Generator
2. Battery block 24V
3. Battery monitor (optional unit)
4. Fuel pump
5. Remote control panel
6. Voltage control system VCS
7. Starterbatterie 12V
8. Fuse

All electrical safety installations have to be made on board.

5.8.6 Installation Panda AGT 48V-system with 12V start system and external rectifier unit - sample schema

Sample schema for a standard installation

Fig. 5.8.6-1: AGT 48V DC output 12V starter system and external rectifier



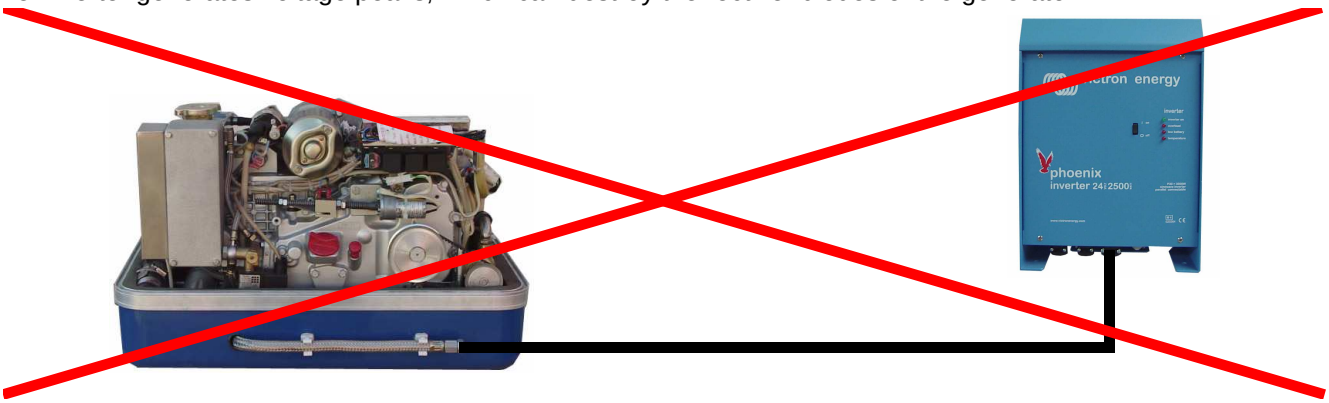
1. Generator
2. Battery block 48V
3. external rectifier unit
4. Fuel pump
5. Remote control panel
6. Voltage control system VCS
7. Starterbatterie 12V
8. Fuse

Dipole switch

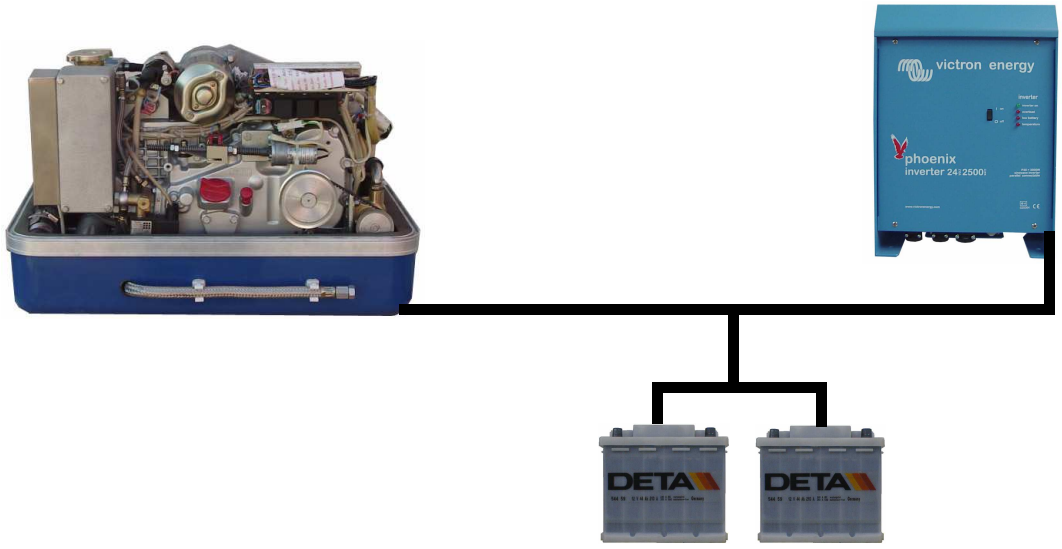
The AGT-generator is not allowed to be connected to an inverter (without batteries)!

CAUTION!

The Inverter generates voltage peaks, which can destroy the rectifier diodes of the generator!



A battery must always be connected to the inverter as a capacity!



Required cable cross-sections

The following recommended electrical cable dimensions (cross sections) are the minimum required sizes for a safe installation.

Länge/length	1 - 3 m	4 - 6 m	7 - 10 m	11 - 15 m	16 - 20 m
16 mm²	70 A	63 A	55 A	48 A	42 A
25mm²	112 A	100 A	88 A	75 A	63 A
35mm²	155 A	140 A	125 A	110 A	95 A
50mm²	225 A	200 A	175 A	150 A	125 A
70mm²	315 A	285 A	250 A	220 A	190 A
95mm²	425 A	380 A	340 A	300 A	260 A
120mm²	540 A	490 A	440 A	400 A	360 A

All electrical safety installations have to be made on board.

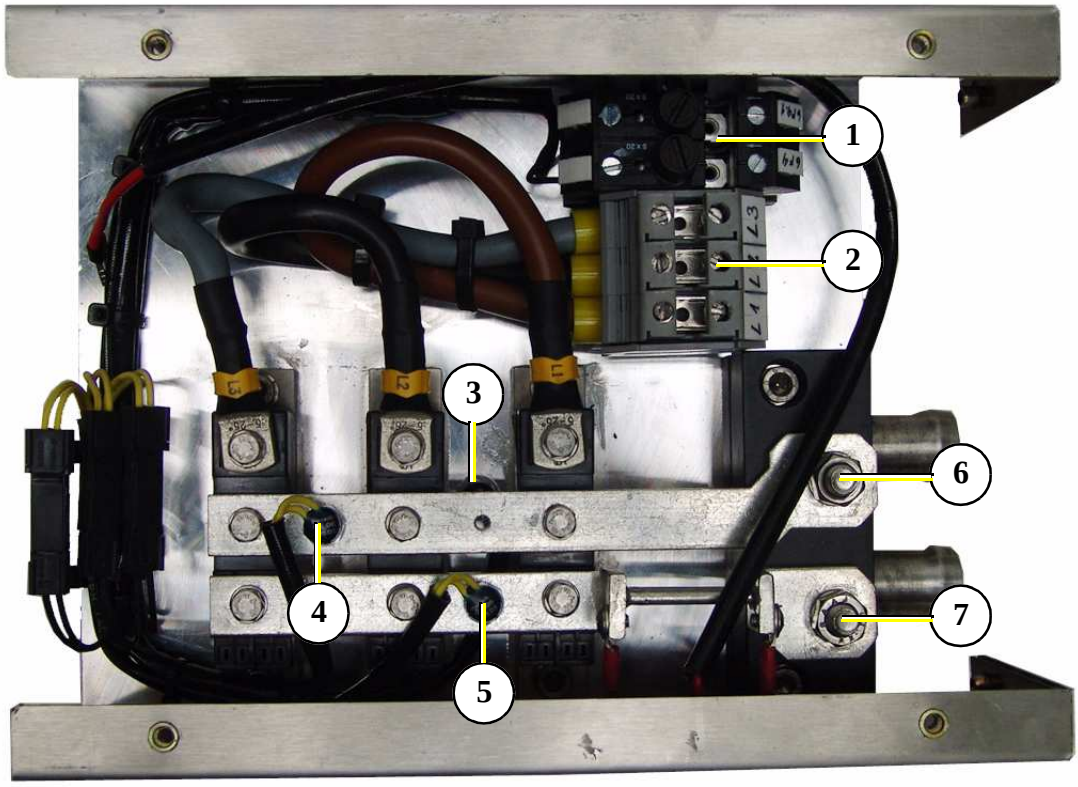
5.8.6.1 Electrical fuses - Dipole switch at battery bank

It is absolutely essential that the electrical system installation is inspected by a qualified electrical technician. The generator should have its own DC fuse and battery switch in the connection line rectifier unit to battery bank. The fuses should be sized such that the rated current of the generator is not exceeded by more than 25%.

The fuses must be of the slow type.

5.8.7 Generators with external rectifier unit

Fig. 5.8.7-1: External rectifier unit



1. Electrical fuses and connection thermo-switch heat sink
2. Main terminal block
3. Thermo-switch heat sink
4. Thermo-switch (+) rail
5. Thermo-switch (-) rail
6. Connection storage batteris (+)
7. Connection storage batteris (-)

The external rectifier unit must be installed in a fireproof protected area!

ATTENTION!

5.8.7.1 Installation of the rectifier unit

Cooling water connection.

If the generator has no special connection points, the external rectifier unit can be installed in line with the external venmtilation valve.

see Fig. 5.4, “Cooling System Installation - Raw Water,” on

Page 65

5.9 Voltage Control System - see VCS datasheet

The VCS control is used for the adjustment of the number of revolutions of the engine and thus the voltage of the generator. It belongs to the accessories and is externally attached.

6. Maintenance Instructions

6.1 General maintenance instructions

6.1.1 Checks before starting

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

Once a month

- Lubrication of actuator-trapezoid thread spindle

For Maintenance Intervalls see „General information for PMS-Generators.“

6.1.2 Hose elements and rubber formed component in the sound cover

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

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

6.2 Oil circuit maintenance

The first oil change is to be accomplished after a period of operation from 35 to 50 hours. Afterwards the oil is to be changed after 100 hours. For this the oil SAE30 for temperatures over 20℃ and SAE20 for temperatures between 5℃ and 20℃ is to be used. At temperatures under 5 ℃ oil of the viscosity SAE10W or 10W-30 is prescri bed.

Type and amount of required oil see:

See Table 8.7, “Engine oil,” on Page 126 and Table 8.5, “Technical Data Engine,” on Page 125

6.3 Checking and refilling engine oil

6.3.1 Checking oil-level

You require:

paper towels / cloth for the oildipstick

The generator must be placed at level.

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

- with PSC generators: Place the generator on a leveled 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.

Caution: Burn hazard; !

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

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

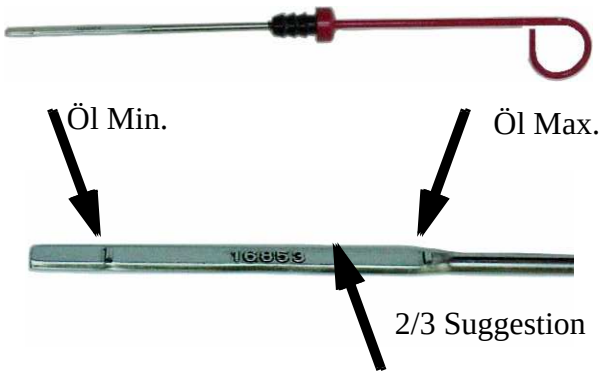
Oildipstick

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

We recommend an oil-level of 2/3.

Sample picture

Fig. 6.3-1: Oildipstick - Sample



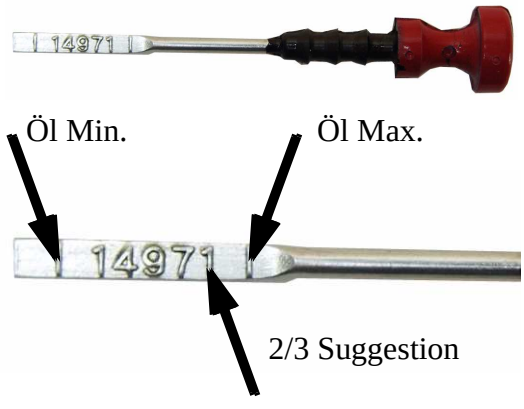
Oildipstick EA 300 Engine

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

We recommend an oil-level of 2/3.

Sample picture

Fig. 6.3-2: Samplepicture Oildipstick



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 servicepoint.

- if the oil is cloudy or even „creamy“, coolant might have mixed with the oil. See a garage or a Fischer Panda servicepint immediately.

6.3.2 Refilling Oil

You require:

Engine oil

1. Check oil-level as described under „Checking oil-level“ on page 1.
2. Oildipstick is pulled out of the check rail.
3. Open the oil filler cap.
4. Fill in oil (approx. 1/2 liter) and wait for about 2 min. so this it can flow into the oil pan.
5. Wipe off the oildipstick and put it into the check rail.
6. Pull the oildipstick out of the checkrail 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.

6.3.3 After the oil level check and refilling the oil

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

6.4 Exchanging engine oil and engine oil filter

You require:

- Engine oil. See attachment.

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

- Sealings 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 leveled surface.

- with PSC generators: Place the generator on a leveled 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 oild 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. 6.4-1: Oil filling cap

3. Open oil drain screw.

   Unsrew the oil drain screw by means of the open-ended wrench from the oil drain hose (rotating direction left). Schrauben Sie die Ölablassschraube mithilfe der Maulschlüssel vom Ölablassschlauch (Drehrichtung links). Use a second open-ended wrench to lock. Make sure to do this over the container..

Fig. 6.4-2: Oil drain hose

4. Discharge used oil.

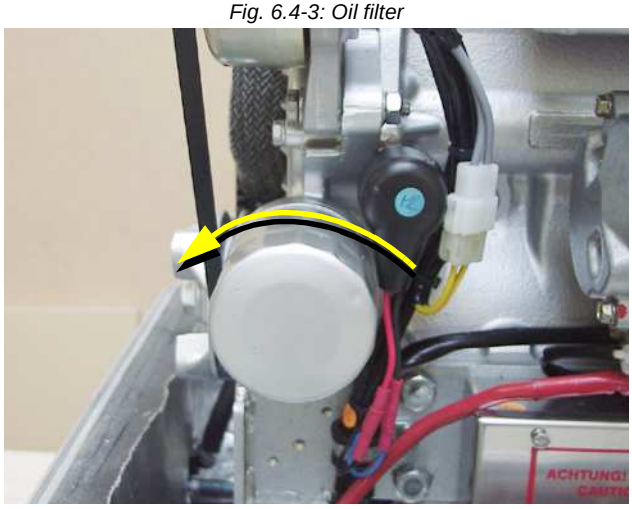
Let the entire amount of oil drain out of the engine. 'This can take several minutes.

5. Remove used oil filter / clean oil screen

   Release the oil filter by turning the filter wrench counter-clockwise. The filter might be full of oil. Make sure to not spill anything and avoid skin contact.

Sample picture

Fig. 6.4-3: 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.

Sample picture

Fig. 6.4-4: Oil screen

6. Preparing a new filte

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

Fig. 6.4-5: Oil screen sealing ring

7. Mounting the new filter

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

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

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

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 oildipstick. If it is too low, refill some oil.

10. Clean up

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

6.4.1 After the oil change

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

11. Duly disposure 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).

6.5 Verifying the starter batterie and (if necessary) the battery bank

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

6.6 Checking the water separator in the fuel supply

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

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

Fig. 6.6-1: Fuel filter with water seperator

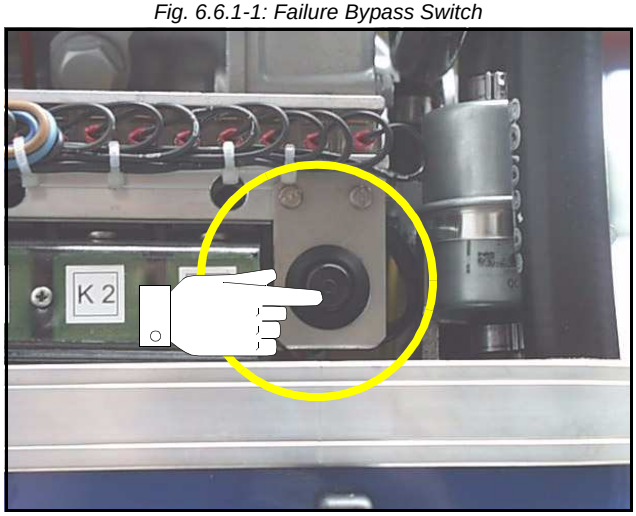
6.6.1 Ventilating the Fuel System

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):

1. Main power switch "OFF"

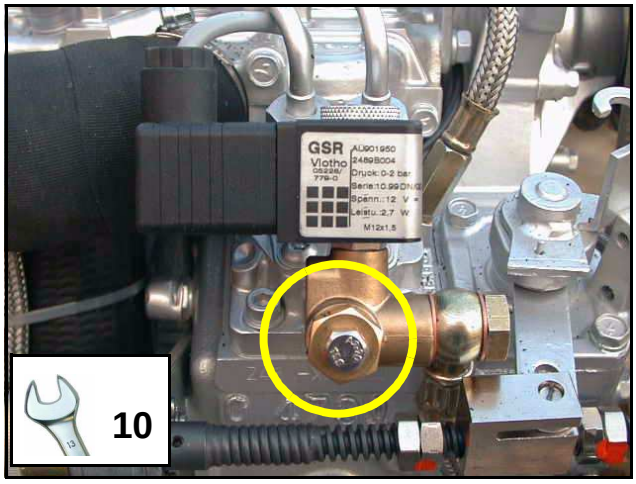
2. Press failure bypass switch and keep firmly pressed. The electrical fuel pump must be audible. Switching on and off the solenoid valve at the generator will be audible by pressing the failure bypass switch (if capsule removed).

Fig. 6.6.1-1: Failure Bypass Switch



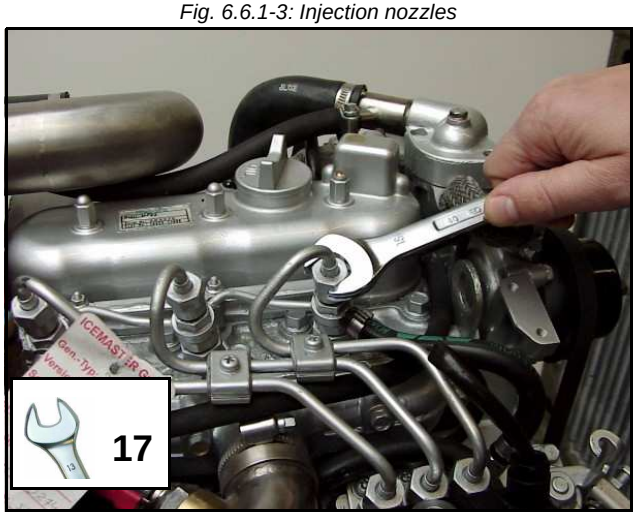
3. Pressing the failure bypass switch for approx 3 - 4 minutes will loosen the ventilation screw located at the fuel solenoid valve. The button must continue to be pressed, whilst opening the screw. A large cloth or Kleenex tissue must be laid beneath the connection to prevent escaping fuel running into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

Fig. 6.6.1-2: Ventilation Screw at the fuel solenoid valve



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.
6. Switch main switch "OFF"

Fig. 6.6.1-3: Injection nozzles



6.6.2 Exchange of the Fuel Filter

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

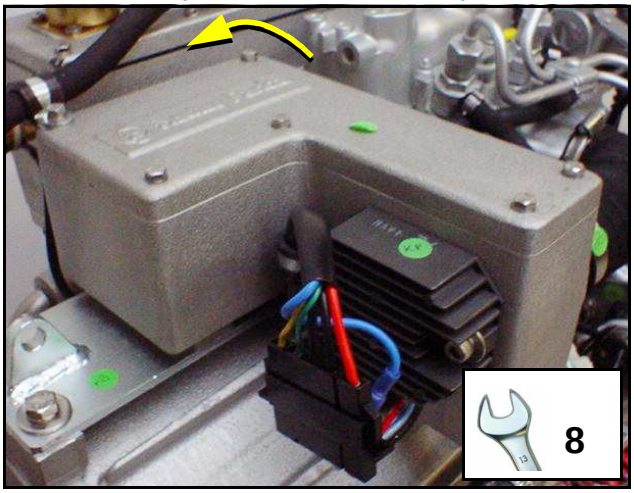
Remove the hoses from the used filter and fasten them to the new filter. The arrow on the filter housing indicates the direction of the fuel flow. A clogged filter causes a decreased power output of the generator.

Fig. 6.6.2-1: Fuel Filter

6.6.3 Exchange the Air Filter Mat

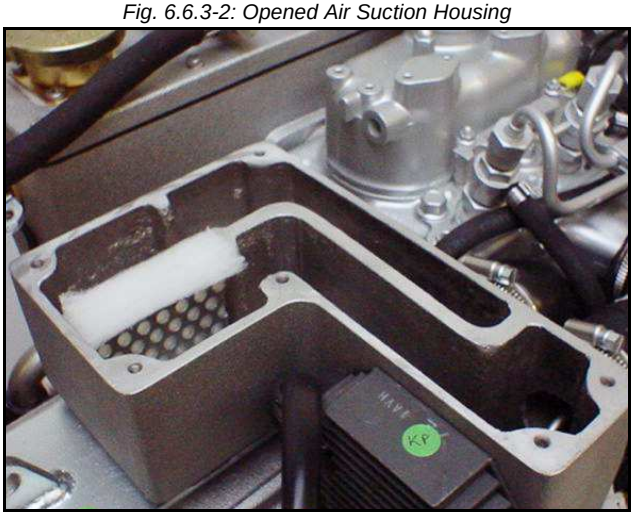
1. Open the air suction housing by loosen the six screws on the housing cover.

Fig. 6.6.3-1: Air Suction Housing



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

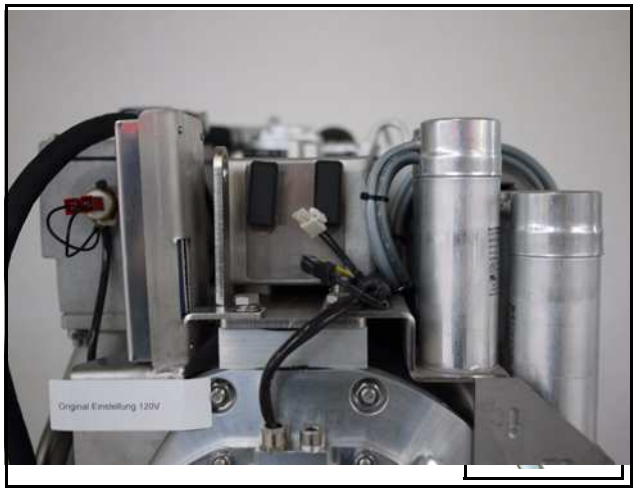
Fig. 6.6.3-2: Opened Air Suction Housing



6.6.3.1 Alternative exchange the air filter mat with pull out holder

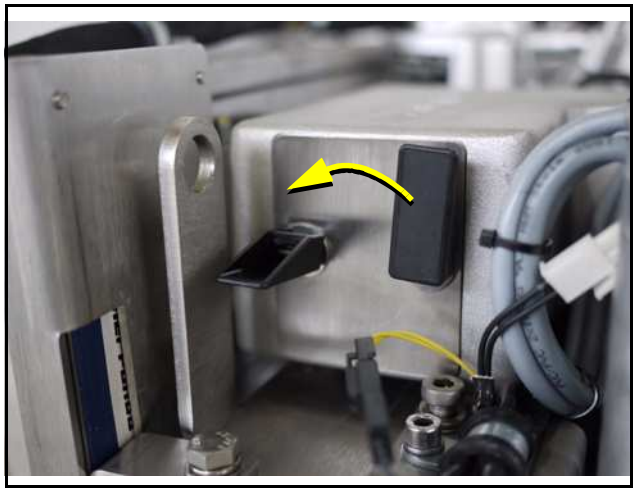
1. Air filter housing with pull out holder

Fig. 6.6.3-1: Air Suction Housing with pull out holder



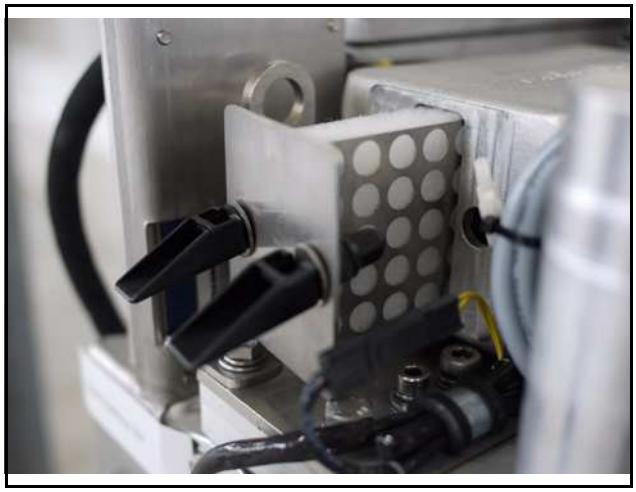
2. Tip the two fasteners 90°

Fig. 6.6.3-2: Air Suction Housing with pull out holder



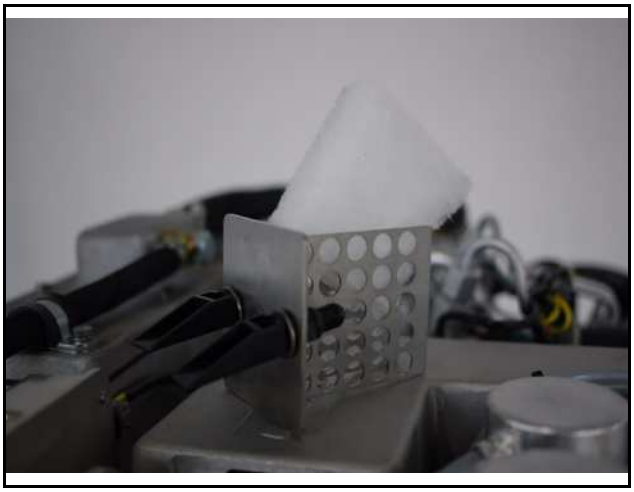
3. Pull the filter mat holder out

Fig. 6.6.3-3: Air Suction Housing with pull out holder



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

Fig. 6.6.3-4: Air Suction Housing with pull out holder



6.6.4 Ventilation of the Coolant Circuit / Freshwater

Special notes for the ventilation of the cooling system

If the cooling water is drained, or if other air has entered the cooling system, it is necessary to ventilate the cooling system.
This ventilating procedure must be repeated several times:

The generator must be switched off before opening the ventilating points!

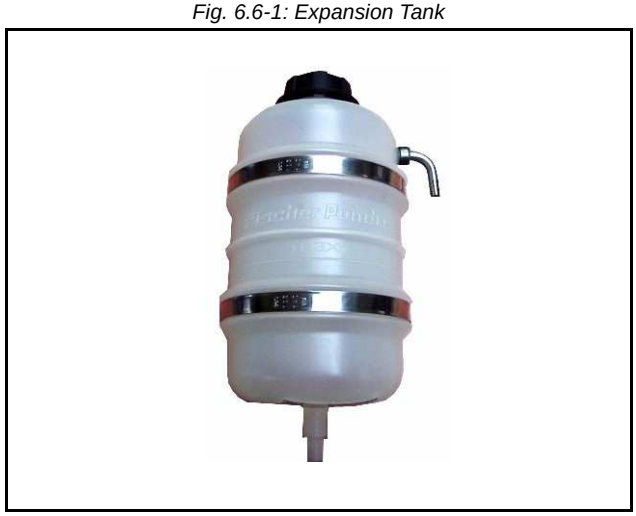
Pay attention that the external coolant expansion tank is connected with the generator by the intended connection point.

Further it should be guaranteed that the expansion tank is attached in sufficient height (600 m) over the level of the generator exhaust elbow union.

Attention

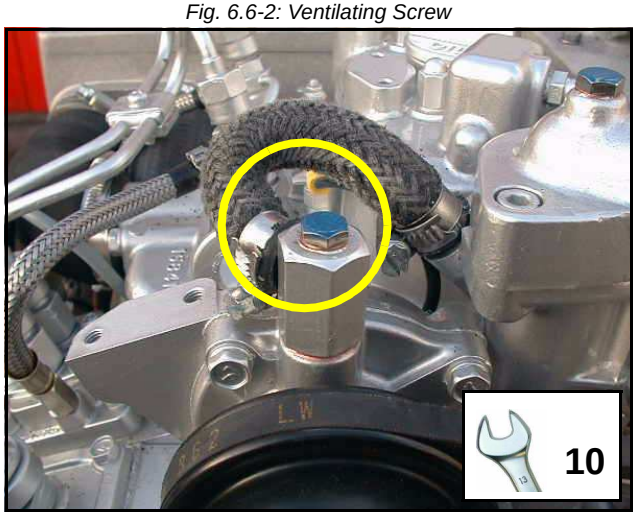
Expansion Tank

Fig. 6.6-1: Expansion Tank



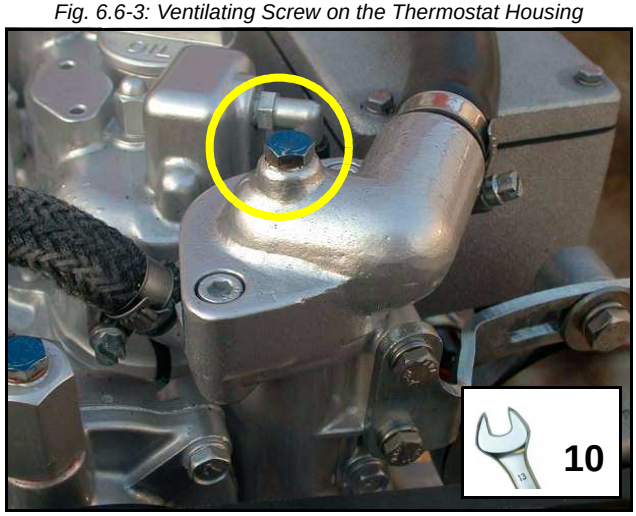
1. Open the ventilating screw above the cooling water pump casing.

Fig. 6.6-2: Ventilating Screw



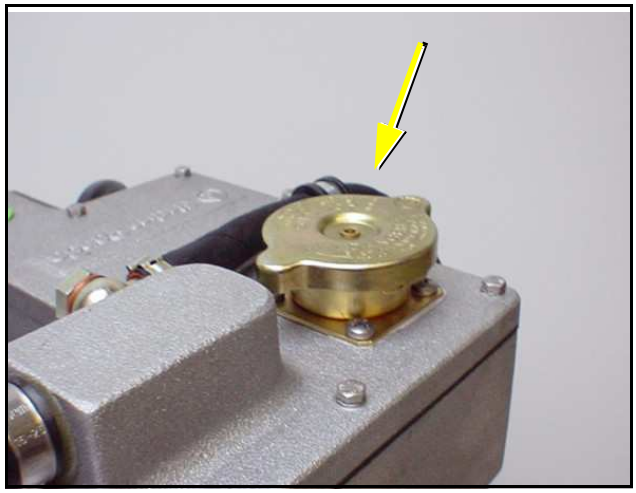
2. Open the ventilating screw on the thermostat casing.

Fig. 6.6-3: Ventilating Screw on the Thermostat Housing



3. Pour cooling water into the cooling water filling necks. (At generators without filler, The cooling water can be filled into the external expension tank instead)
4. If the cooling water level no longer drops (the cooling water level in cold waters must cover the tin in the exhaust elbow), close the filler cover and the cooling water screws and then start the generator.
5. Run the generator for approx. 60 Seconds, then switch off
6. Refill cooling water via the compensation tank.
7. The compensation tank is connected to the generator by two hoses.

Fig. 6.6-4: Cooling Water Filler Cap



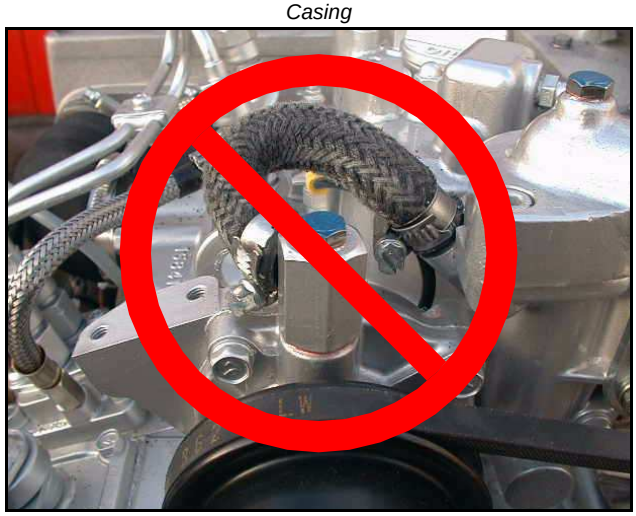
The external compensation tank should be filled to a max 20% in a cold state. It is very important that a larger expansion area is maintained above the cooling water level.

8. Repeat this procedure 1 - 5 times.

If there is no change to the state of the cooling water level, the generator is re-started for 5 minutes. Thereafter the de-aeration must be repeated two to three times.

The ventilation screw above the cooling water pump casing may not be opened under any circumstances, whilst the generator is running. Air will be sucked through the opening, if this should happen by mistake. Venting the whole system afterwards is necessary and very difficult.

Fig. 6.6-5: Ventilation Screw above the Cooling Water Pump Casing

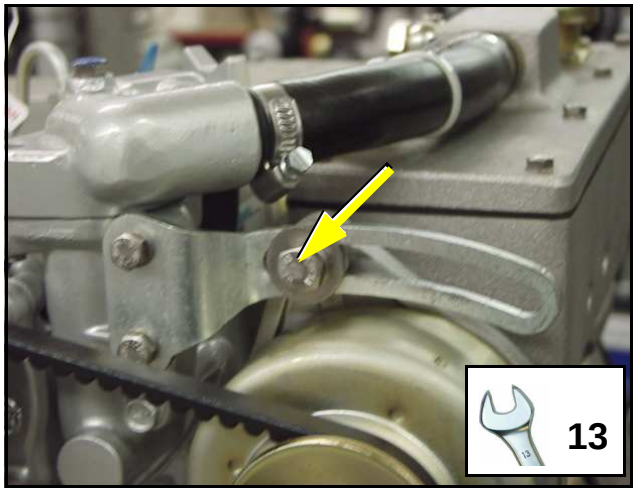


6.6.5 Exchange of the V-Belt for the Internal Cooling Water Pump

The relative high ambient temperature in the closed sound insulated capsule (about 85℃) can be a reas on for a reduced lifespan of the v-belts. It is possible that the "softener" in the rubber compound lose their effect after a short operating time because the air in the sound insulated capsule can be relative warm and dry. The v-belt must be controlled at very short time intervals. It may be required to change the v-belt after several weeks because of unfavourable conditions. Therefore, control should be carried out after an interval of 150 operating hours. The v-belt is a wearing part. There should be enough spare v-belts on board. We recommend that you have the respective manual within reach.

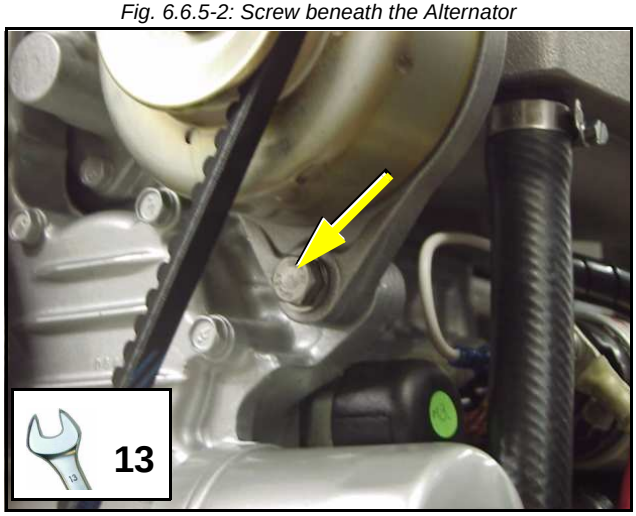
1. Loosen the screw on the deflection pulley bracket

Fig. 6.6.5-1: Screw on the deflection pulley bracket



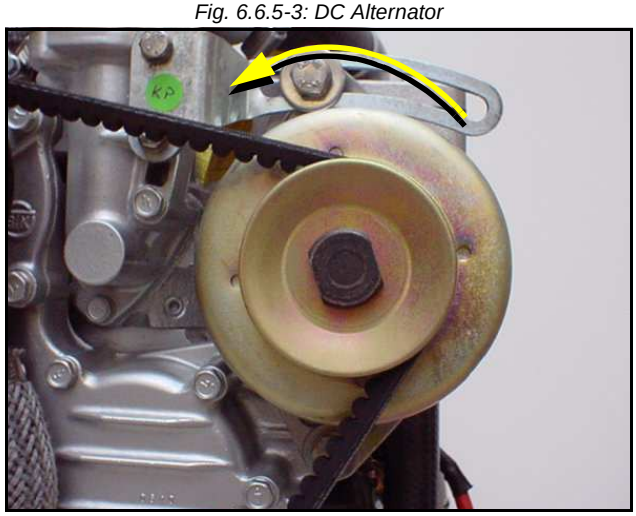
2. Loosen the screw beneath the alternator

Fig. 6.6.5-2: Screw beneath the Alternator



3. Press the alternator in the direction of the thermostat casing
4. Exchange Belt Pulleys

Fig. 6.6.5-3: DC Alternator

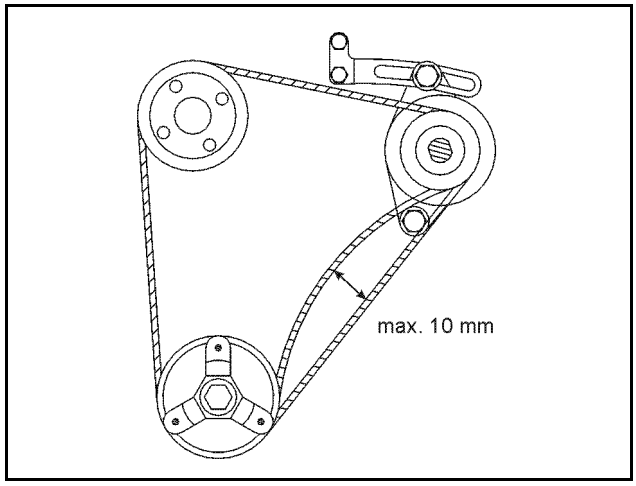


5. Re-tighten Belt Pulleys

The belt pulleys should only be tightened to the extent that it can be pushed to the length of a thumb (approx. 10 mm).

6. Re-tighten the screws above and below the alternator

Fig. 6.6.5-4: Drawing belt pulley



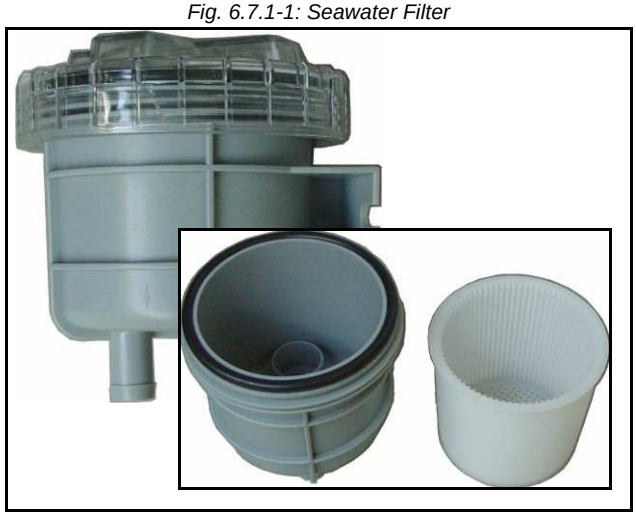
6.7 The Seawater Circuit

6.7.1 Clean Seawater Filter

Residue should be regularly removed from the seawater filter. The seacock must, in each case, be closed first. It often suffices to merely hit the filter punnet.

If water should seep through the cover of the seawater filter, this may never be sealed with adhesive or sealant. The cause for the leakage must be sought. The sealing ring between caps and filter holders must be exchanged in the simplest cases.

Fig. 6.7.1-1: Seawater Filter



6.8 Reason for Frequent Impeller Wear

1. Unreasonable operating conditions

The Cooling water pump Impeller must be regarded as a wearing part. The life expectancy of an impeller can vary greatly and depends exclusively upon the operating conditions. The PANDA Generator cooling pumps are so designed that the speed of the pump in comparison to other generators is relatively low. This has a positive effect on the life expectancy of the pump.

2. **Longer Suction Distance of Cooling Water**

If the cooling water suction distance is long, or is blocked, this has a negative effect on the impeller, so that an underpressure occurs in the cooling water suction area. This can reduce the efficiency of the impeller and place strain on the blades. This can greatly reduce the life expectancy.

3. **Operating in contaminated waters**

The impeller is placed under great strain in waters with high contamination. The use of the impeller in coral waters is also critical. There are known cases, whereby the impeller was so fatigued after 100 hours use, that the lip seals were grinded away by the shaft. In these cases sharp crystal parts from the coral press into the rubber seals and act as a grinding material on the stainless steel shaft of the impeller pump.

4. **Generator mounted above the water level**

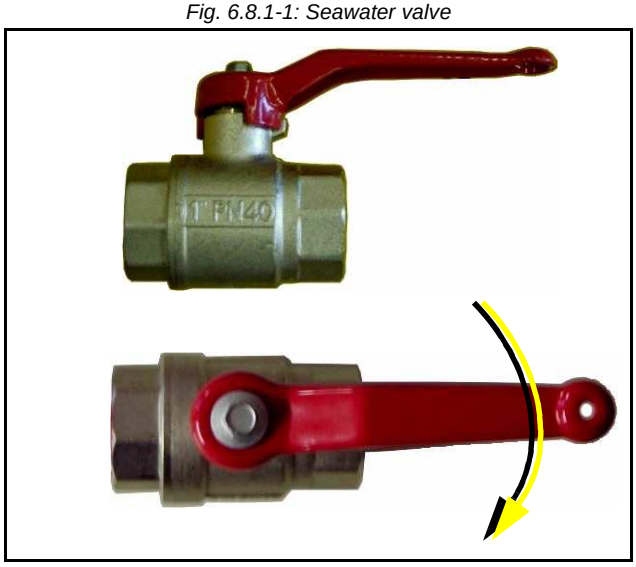
It is especially disadvantageous for the impeller pump, if the generator is mounted above the water level. This means that a few seconds will pass before the impeller can suck in cooling water. This short dry running period damages the impeller. The increased wear can also lead to a breakdown. (See special instruction: "Effect on the impeller pump, if the generator is mounted above the water line").

6.8.1 Exchanging the Impeller

Seawater valve

1. Close the seawater valve.

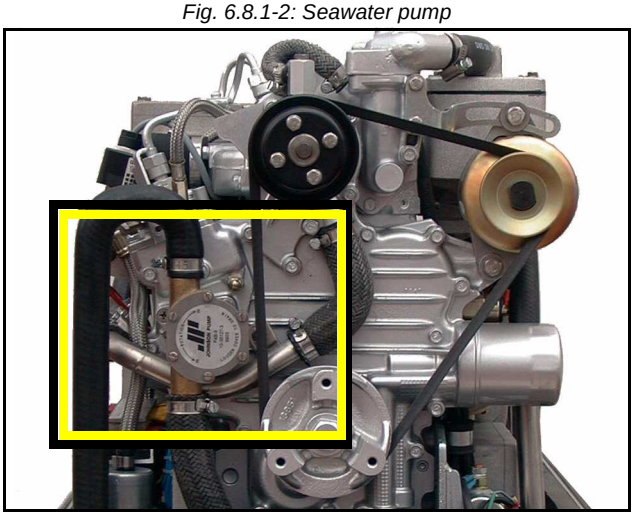
Fig. 6.8.1-1: Seawater valve



Seawater pump

The seawater pump is located on the front side of the genset.

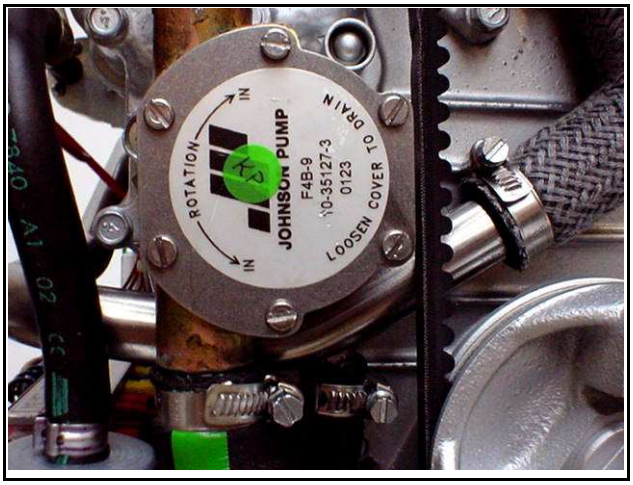
Fig. 6.8.1-2: Seawater pump



Cover Seawater Pump

2. Remove the cover of the seawater pump by loosen the 4 wing screws from the housing.

Fig. 6.8.1-3: Cover Seawater Pump



Impeller

3. Remove the impeller from the shaft by means of multi grip pliers..
4. Mark the impeller, to make sure that it is in the correct position when re-installation is carried out.

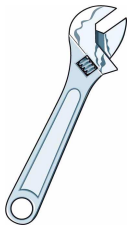
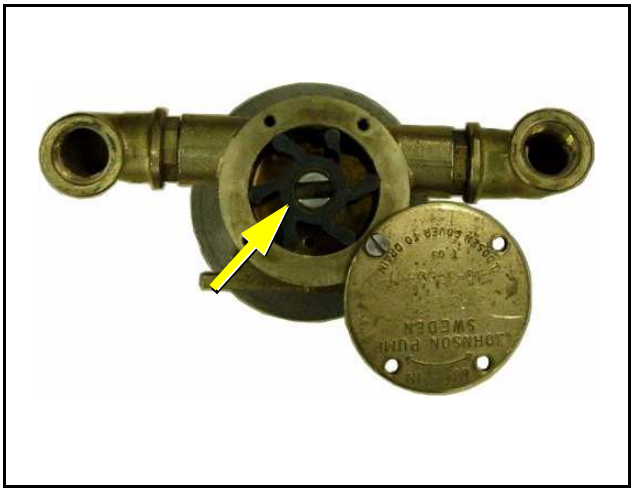


Fig. 6.8.1-4: Impeller



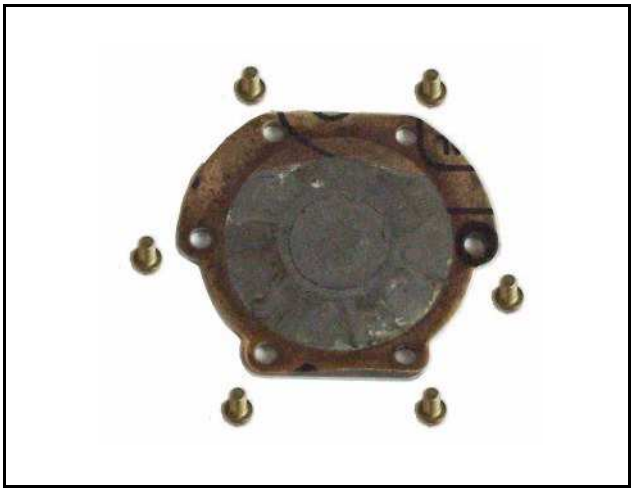
5. Check the impeller for damage and replace it if necessary.
6. The impeller should have been lubricated with glycerine or with a non-mineral oil based lubricated e.g. silicone spray, before re-insertion into the housing. Attention: This is very important, because the impeller can quickly be damaged.

Fig. 6.8.1-5: Impeller

Cover Pump Shaft

7. Attach the impeller to the pump shaft (if the old impeller is re-used, initially check the marking).
8. Fastening the cover and use a new seal.

Fig. 6.8.1-6: Cover Pump Shaft



6.9 Additional maintenance

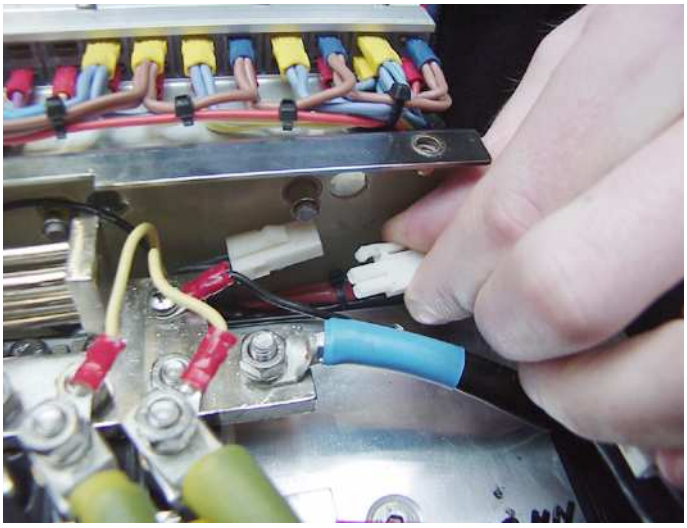
Furthermore in addition to the standards checks according to the manual following points of the generator have to be checked:

- Automatic shut down of the generator in case off high heating temperature

  This shall be done by disconnecting the thermo-switch of the heat sink. Next to the rectifier you will find a 2-pole connector. If you disconnect this connector from the opposite socket, the generator shall shut down – or, when the generator is not running you will get a signal on the panel.

Figures similar!

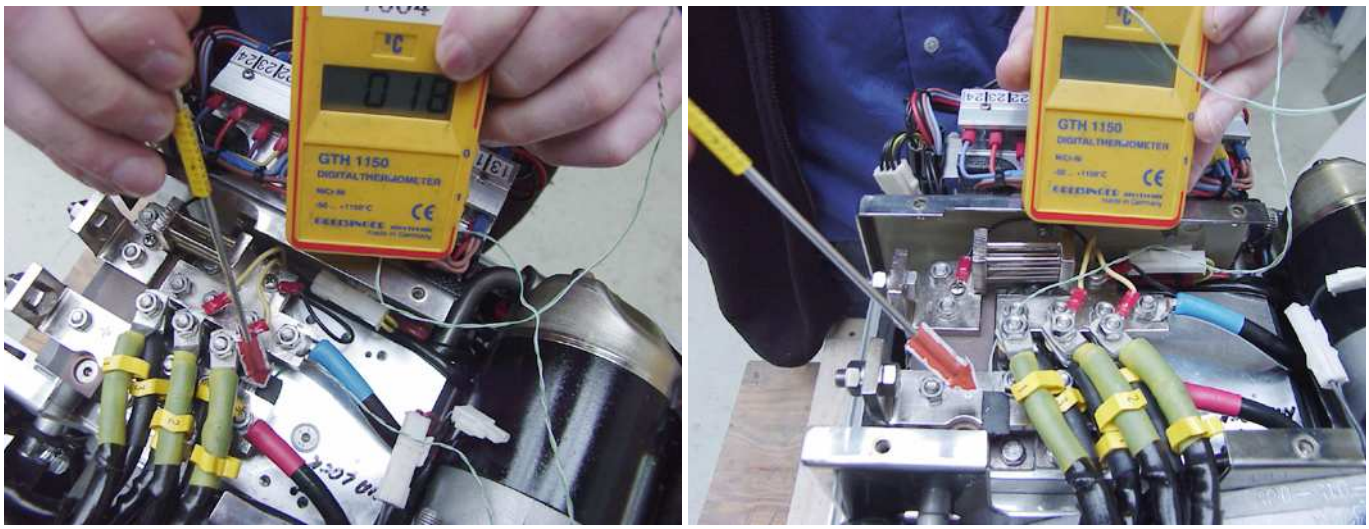
Fig. 6.9-1: Plug thermo-switch cooling plate



Temperatures of the rectifier and heating

- Apply a thermocouple meter to the heat sink and the copper bars and monitor the maximum temperatures of the rectifier.

Fig. 6.9-2: Measuring the temperature



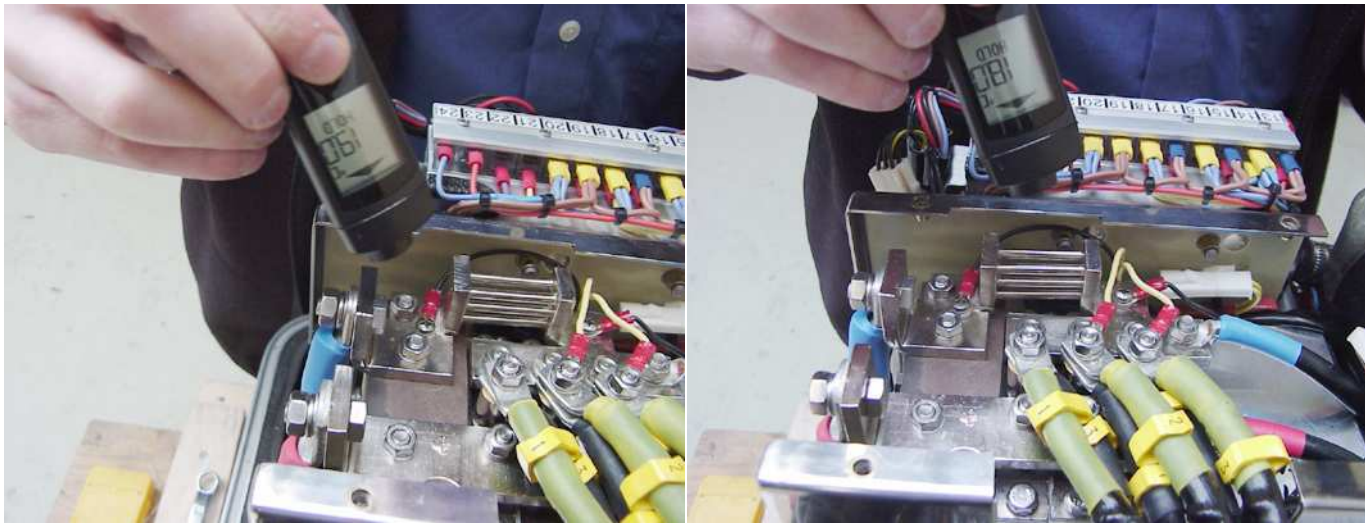
- With the help of the infrared thermometer you can check all the temperatures on the rectifier.

  Check all the cable connections of the DC- wiring.

  The temperature of the heat sink shall never exceed 95℃.

  The temperature of the copper bars shall never exceed 120℃

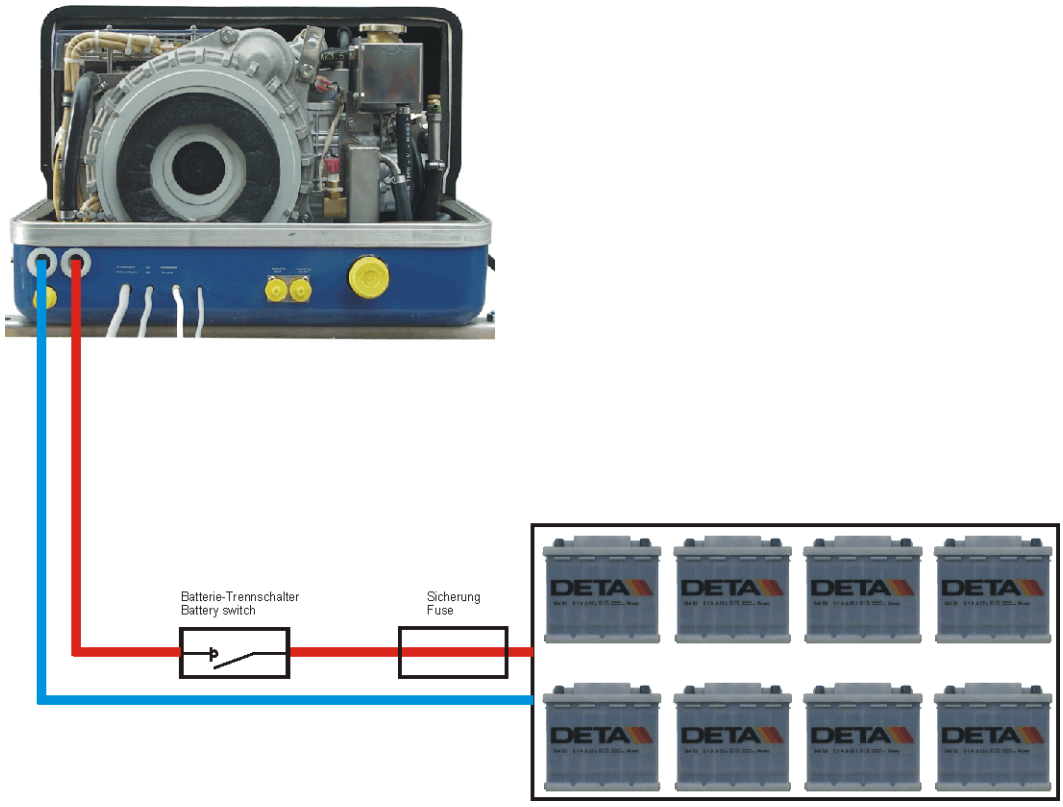
Fig. 6.9-3: Measuring the temperature



Ensure, that a fuse next to the battery is installed in the battery line for the generator output cable.

Ensure that a battery switch is installed in the battery line. Never leave the generator behind without the cover mounted over the heat sink and capsule not closed.

Fig. 6.9-4: Connection example



Remind the customer

- to run the generator only with closed capsule.
- not to run the generator unattended
- to ask for regular service

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7. Generator Failure

7.1 Personal requirements

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

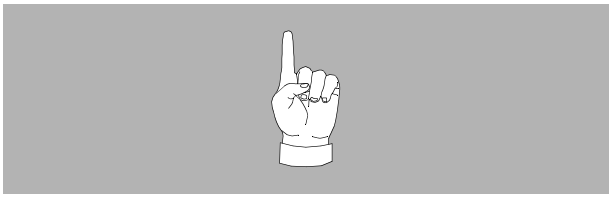
More Irepair work may be performed only by specially trained personnel or by authorized repair shops (Fischer Panda service points). This is especially for working on the valve timing, fuel injection system and the engine repair.

7.2 Safety instructions for this chapter

see “Safety instructions - Safety first!” on Page 18.

Also consider the general safety instructions at the first pages of this manual.

Notice!:



Danger for life! - The generator can be equipped with a automatik 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 disconected before start working at the generator.

Warning!: Automatic start

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

Make shure that the generator ist stopped and the starter battery is diconnected 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 servere 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 avalilable tools and special tools. incorrect or damaged tools can result injuries.

Warning!: Risk of injury

Oil and fuel vapours vcan ignite on contact with ignition sources. Therfore:

- 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 immediatlly.

- Do not inhale oil and fuel vapours.

Danger!: Danger of poisoning

Danger for Life. Improper handling, operation, installation and maintenance can result in severe persoanl 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/mainenance personal protective equipment is required to minimize the helth hazards.

- Protective clothing

- safety boots

- protective gloves

- Ear defender

- safety glasses

Instruction!: Personal protective equipment necessary.

Disconnet all load during the work atthe generator to avoid damages at the load.

Attention!: Disconnect all load

7.3 Tools and measuring instruments

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

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

7.4 Overloading the Generator

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

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

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

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

Effects of Short Circuiting and Overloading on the Generator

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

Overloading the Generator with Electric Motors

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

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

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

7.4.1 Automatic Voltage Monitoring and Auto-Shut Down

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

7.5 Adjusting Instructions for the Spindle of the actuator

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.

01. Actuator

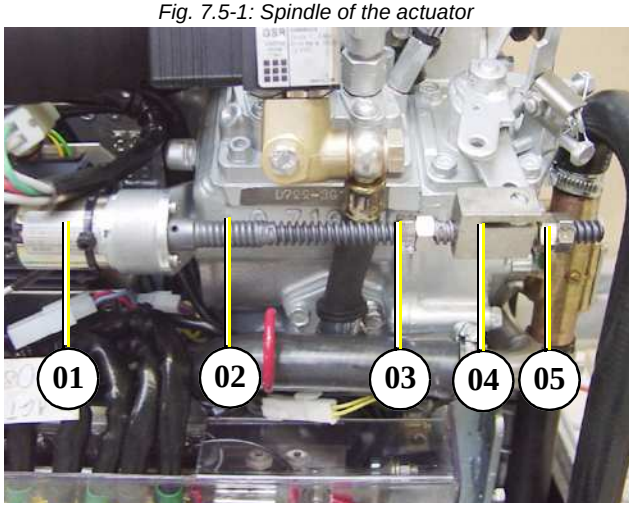
02. Spiral thread spindle

03. Regulating nuts for max. speed

04. Spindle nut with speed regulator level

05. Regulating nuts for min. speed

Fig. 7.5-1: Spindle of the actuator



During any operation at the generator all load have to be switched off to avoid damages at the equipments.

7.5.1 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 100V DC to clamp 7 and 8 of the VCS.
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 33V.
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. 33V without load.

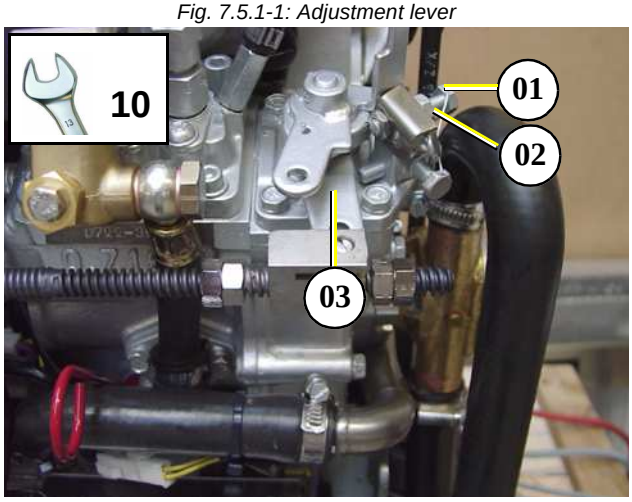
The adjustment of the upper limitation of the rev serves an additional safety. The value of the max. voltage lies 5V above the normal operating border.

01. Countering nut

02. Adjusting screw for upper limitation

03. Speed regulator lever

Fig. 7.5.1-1: Adjustment lever



This adjustment should not be changed, otherwise the warranty expires.

7.5.2 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 13.
3. Connect an electrical voltage instrument (voltmeter) with a display range until 100V DC to clamp 7 and 8 of the VCS.
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 23V.
7. Both nuts must be screwed tight.
8. Check again if the lower voltage of the generator is limited to min. 23V without load.

Adjusting the upper limitation:

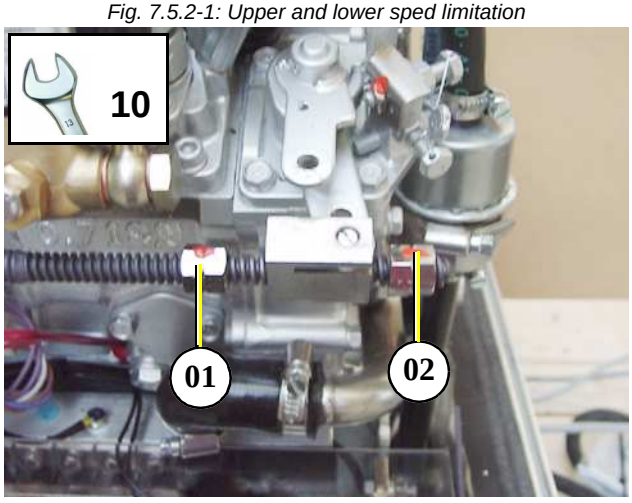
1. Proceed like before and tighten the countering nuts at a voltage of max. 33V without load.
2. Check again if the upper voltage of the generator is limited to this value.

Upper and lower speed limitation at the actuator thread spindle

01. Adjusting nut for upper speed limitation

02. Adjusting nut for lower speed limitation

Fig. 7.5.2-1: Upper and lower sped 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 VCS were also be disconnected.

7.5.3 Lubrication of the spiral thread spindle

The spiral thread spindle must be lubricated carefully and regularly. Please only use a temperatur independence lubricant (up to 100℃) witch is also equiped with "em ergency run qualities". Spread also lubricant to the end of the nuts.

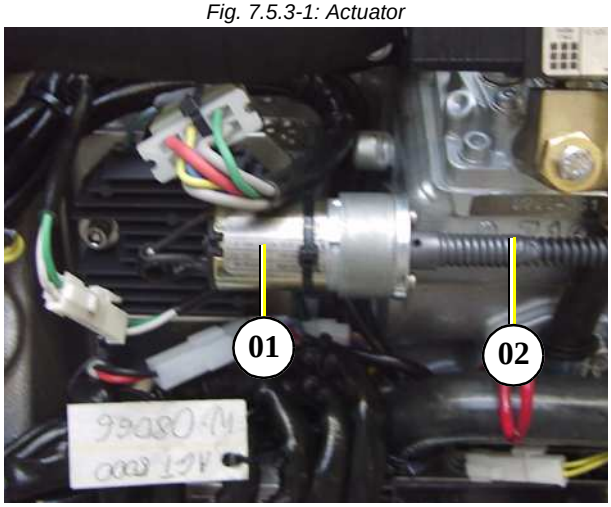
It is possible that the spindle could clamp if the spindle is not enough lubricated. Then the generator can be switched off by over- or undervoltage.

All screws at the actuator and the spindle must be ensured "solveable" with a screw safety grease.

01. Speed actuator

02. Spiral thread spindle

Fig. 7.5.3-1: Actuator



7.5.4 Effects of a overload to the actuator

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 consecuence 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.

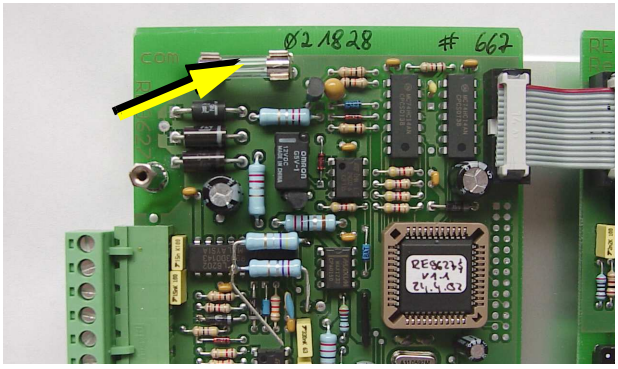
If you notice that the spindle of the actuator doesn´t run faultless, first check if the aggregate was overloaded for a short time and if thereby the winding of the actuator was damaged. Then the actuator has to be changed.

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. 7.5.4-1: Fuse at 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 load are endangered because a lower voltage can damage them by order.

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 DC missing. limiting nut jams the spindle.
Fuse on the printed circuit board of the VCS control is melted.	constant overload of the generator.

Steps to check the voltage control by a disturbance:

1. Switch off all electrical load.
2. Disconnect the plug of the actuator.
3. Turn the actuator manually to check if the adjusting nut is jamed to the limit stop points.
4. Turn the actuator manually to check if the adjusting nut on the spindel 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.

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 und 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 circiut board if the points above carries no clearance.

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 load.
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 23V.
7. Turn the actuator manually to the upper limit stop point. The max. voltage is 260V (130V).
8. A new adjustment is necessary in case of deviants.

7.6 Low Generator-Output Voltage

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

7.7 Testing Generator Stator Windings

Before working on the system read the see “Safety instructions - Safety first!” on page 18.

ATTENTION!

7.7.1 Testing Generator Stator Winding for "Shorts" to Ground

The generator stator windings can be tested as follows:

1. Ensure that the generator is "OFF" and cannot be accidentally started. Disconnect the battery.
2. Remove the cover of the power treminal box.
3. All terminal box connections are to be removed. (See appropriate circuit diagram.)
4. Remove all cables.
5. A check of the power terminal box is made by means of a multimeter to determine whether there is continuity between the individual windings connections.

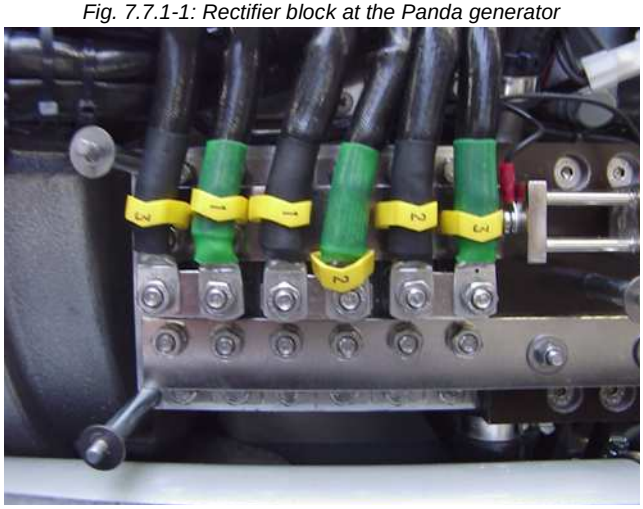
If continuity is detected for any of the combinations, the generator must be sent to the factory for inspection and repair. If this is not possible, the stator can be rewound by a qualified tradesperson/technician. Winding diagrams can be obtained from Fischer Panda GmbH, Germany.

This test, unfortunately, is carried out at very low voltage (9V) when a normal multimeter is used. Therefore only positive short circuits will be displayed. There is the possibility that a short circuit will occur in spite of a negative test result (i.e. moisture). A reliable check can only be carried by using an essentially higher voltage (approx 500V). This type of measuring instrument is normally only used by experts.

If in doubt an electrician must check the winding for a short circuit with an isolation meter.

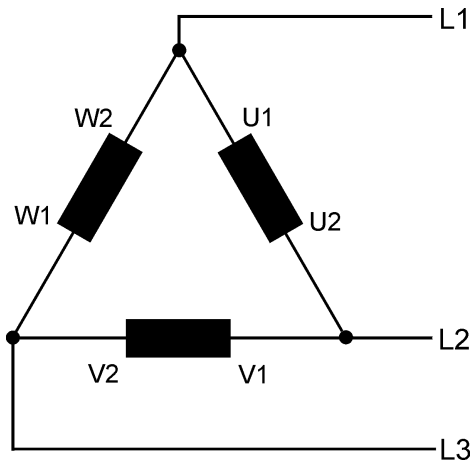
Rectifier block at the Panda generator

Fig. 7.7.1-1: Rectifier block at the Panda generator



Wiring diagram

Fig. 7.7.1-2: Wiring diagram



7.7.2 Coil Resistance Measurements in Stator Windings

If the testing set determined no earthing, the coil windings of the generator must be controlled with a resistance measuring instrument (ohm meter). To measure coil resistance a meter capable of measuring low resistances (Milli-Ohm resolution if possible) accurately. The measured resistance values should be close to the same between the following terminals:

U1-U2, V1-V2, W1-W2

Checking windings.

- Disconnect all connections from the power terminal box. Loose the nuts and deduct the cables.
- Remove all winding connections from the power terminal box.
- Switch your meter in resistance range. When you put the probes of you meter together, you should get a reading of 0.00Ohm. When you isolate the probes, the reading will be Overflow. Please do this tests to check your meter.
- Measure of the resistance within the individual windings. The values should be very small. It mainly depends on the relation between the values. Some measuring instruments operate very inaccurately, if the measured values are very small.
- Resistance measure between different windings. If the value is in the Giga ohm area, the coil is correct.

If you find any anormality, when doing this test, please ask your Fischer Panda dealer.

If strong deviations are measured in the individual coil windings, there is a coil short-cut in one coil. No voltage is induced.

The actual values between the coil windings are not determined so exactly. It depends on the fact that the values of all three measurements are as alike as possible. Deviations among themselves refer to a coil short-cut. In this case the generator must be newly wound by a specialist.

7.7.3 Measuring the Coil Inductive Resistance

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

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

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

An alternative test method to check the stator windings can be performed as follows:

1. Ensure that the connection to the circuit system is disconnected.
2. All electrical wires in the power terminal box must be disconnected.
3. Reconnect the battery connections.
4. Start the generator.
5. Measure the voltages between the following terminals and compare for symmetry:

U1-U2, V1-V2, W1-W2

7.8 Starting Problems

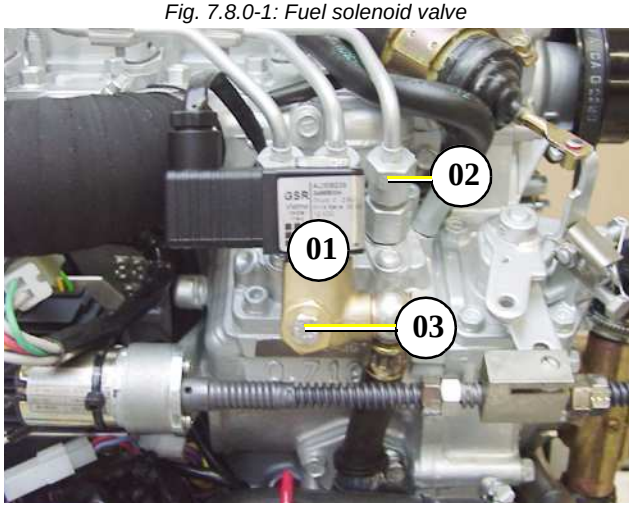
Fuel solenoid valve

01. Fuel solenoid valve

02. Fuel injector nozzles

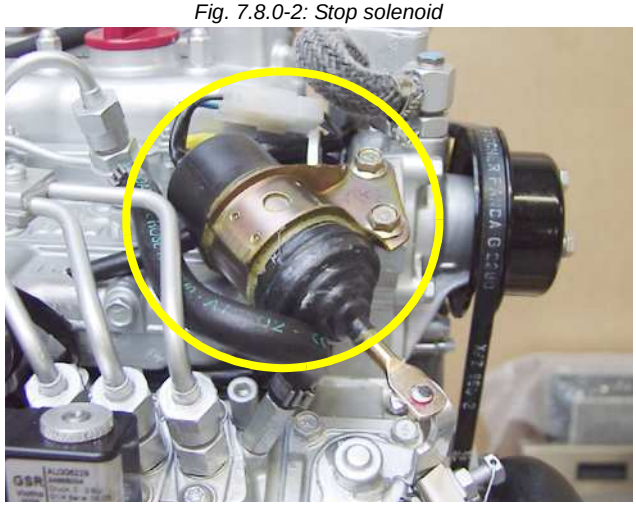
03. Ventilation screw

Fig. 7.8.0-1: Fuel solenoid valve



Stop solenoid for engine stop

Fig. 7.8.0-2: Stop solenoid

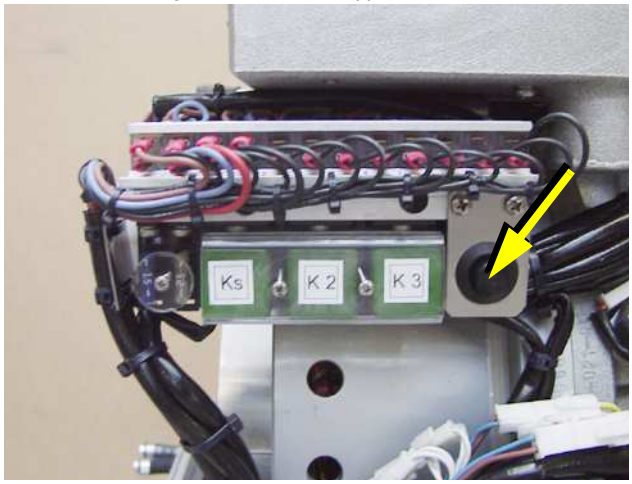


7.8.1 Failure Bypass Switch

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. 7.8.1-1: 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.

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.

Note:

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 ist has been switched off.

8. Tables

8.1 Table uf conduit

Fig. 8.1-1: Table of conduit

Generatortype	Ø Cooling water conduit		Ø Exhaust conduit [mm]	Ø Fuel conduit	
	Fresh water [mm]	Seawater [mm]		Supply [mm]	Return [mm]
Panda PMS AGT 8000	20	20	40	8	8

8.2 Technical Data Generator

Fig. 8.2-1: Technical Data Generator

Type	Nominal power [kW]	Continuous power [kW]	Nominal voltage [VDC]	Dauer-charging current[A]	Nominal char-ging current [A]
AGT 2500-12	2,5	2,5	12	180	180
AGT 2500-24	2,5	2,5	24	90	90
AGT 4000-12	4	3,2	12	220	280
AGT 4000-24	4	3,2	24	110	140
AGT 6000-12	5,5	4,8	12	290	360
AGT 6000-24	5,5	4,8	24	170	210
AGT10.000-24	10	8	24	290	360
AGT15.000-48	15	12	48	208	260
AGT20.000-48	20	16	48	290	360
AGT25.000-72	25	20	72	240	300
AGT30.000-96	30	24	96	208	260
AGT40.000-96	40	30	96	290	360

8.3 Cable cross section

Fig. 8.3-1: Cable cross section

Length	1 - 3 m	4 - 6 m	7 - 10 m	11 - 15 m	16 - 20 m
16 mm²	70 A	63 A	55 A	48 A	42 A
25mm²	112 A	100 A	88 A	75 A	63 A
35mm²	155 A	140 A	125 A	110 A	95 A
50mm²	225 A	200 A	175 A	150 A	125 A
70mm²	315 A	285 A	250 A	220 A	190 A
95mm²	425 A	380 A	340 A	300 A	260 A
120mm²	540 A	490 A	440 A	400 A	360 A

8.4 Trouble shooting

8.4.1 Generator Voltage too low

If the generator delivers undervoltage, there can be various reasons for this:

Cause	Solution
Generator is overloaded.	Reduce the electrical load. (Switch off load)
Motor is not reaching the rated rpm.	Refer to "motor faults" section.
Actuator is not in maximum position.	Check actuator resp. renew.
VCS-voltage controler defective or wrong adjusted.	Check resp. renew.

8.4.2 Generator voltage too high

The following reasons may be the cause, if the generator delivers overvoltage:

Cause	Solution
The engine is running at the wrong speed.	Check the speed of the motor with a rev or frequency counter, set the correct speed.
VCS-voltage controler defective or wrong adjusted.	Check resp. renew.
Actuator defective.	Check resp. renew.

8.4.3 Generator voltage fluctuates

Cause	Solution
1. Fault or defect on the load side. 2. A motor fault.	1. Check if the power requirement of the load fluctuates. 2. See "Motor running irregularly".

8.4.4 Motor does not turn over when starting

Cause	Solution
Battery main switch is switched off.	Check the position of the battery main switch, if necessary switch on..
Battery voltage not sufficient.	Check that connection is firm and whether corrosion has occurred..
Starting current fault.	The voltage of full batteries fall to a maximum of 11V. The wiring is severed if the voltage does not drop. The battery is discharged if the voltage drops further.

8.4.5 Motor turns over but does not start

Cause	Solution
Stop solenoid valve not opening.	Check wire connections and circuitry to solenoid valve. (ref. DC wiring diagram: Relay K2, Fuse)
Fuel pump does not operate.	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 "Air-bleeding of the Fuel System").
Fuel filter blocked.	Replace fuel filter.
Low compression pressure.	See Kubota motor-manual.

8.4.6 Motor does not turn over at normal speed during the start process

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

8.4.7 Motor runs irregularly

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

8.4.8 Motor speed drop down

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

8.4.9 Motor switches itself off

Cause	Solution
Fuel solenoid valve or throttle shut solenoid is not switching off.	Check wire connections to solenoid. Check valve functions as in the "Inlet Fuel Solenoid Valve" or in the trottle shut off solenoid sections. Replace if necessary.

8.4.10 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).	Check oil-level and if necessary top up. Check motor's oil-pressure and have repaired by Kubota-Service if necessary.

8.4.11 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 nozzles faulty.	Replace injector nozzles.
Valve clearance incorrect.	Readjust valve clearance to correct value (refer to Kubota-manual).
Poor fuel quality.	Use better quality diesel (recommended: 2-D Diesel).
Poor combustion.	Incorrect AFR (air/fuel ratio) due to motor timing adjustment. Have motor serviced by Kubota.
Low compression pressure.	See Kubota motor manual.

8.4.12 Generator must be shut off immediatly if

Cause	Solution
- motor rpm suddenly rises or drops - unusual noise comes from genset - exhaust colour suddenly becomes dark - motor overheats - oil pressure drops, oil light suddenly flashes	Refer to respective section of manual and if necessary, have repaired by Kubota-Service, or Panda representative.

8.4.13 Troubleshooting VCS system

Cause	Solution
Actuator does not move.	Check voltage supply and wire connections to actuator. Motor connected? Check connection to VCS.
Actuator sets throttle too high or too low.	Check that the wires to the actuator are connected properly (±). Check connection to VCS.
If the VCS electronics are faulty, the generator can still run by over-riding the system. To override the VCS, disconnect the plug and jumper the contacts. Loosen the connecting rods motor from the injection pump regulator and turn screw to a max. voltage of 33V.	

8.5 Technical Data Engine

Fig. 8.5-1: Technical Data Engine

	Panda AGT 8000 PMS
Type	D722
Govenour	VCS
Automatic startbooster	yes
Cylinder	3
Bore	67mm
Stroke	68mm
Stroke volume	719cm^3
max- power (DIN 6271-NB) at 3000 rpm	14,0kW
Rated speed 50Hz	3000rpm
Idle running speed [a]	2900rpm
Valve clearance (engine cold)	0,2mm
Cylinder head torque	42Nm
Compression ratio	23:1
Lubrication oil capacity	3,8l
Fuel consumption [b]	ca. 0,84 - 2,24 l
Oil consumption	max. 1% of fuel consumption
Cooling water requirement for seawater circuit	16-28l/min
Permissible max. permanent tilt of engine	a) 25°across the longitudinal axis b) 20°in the longitudinal direction

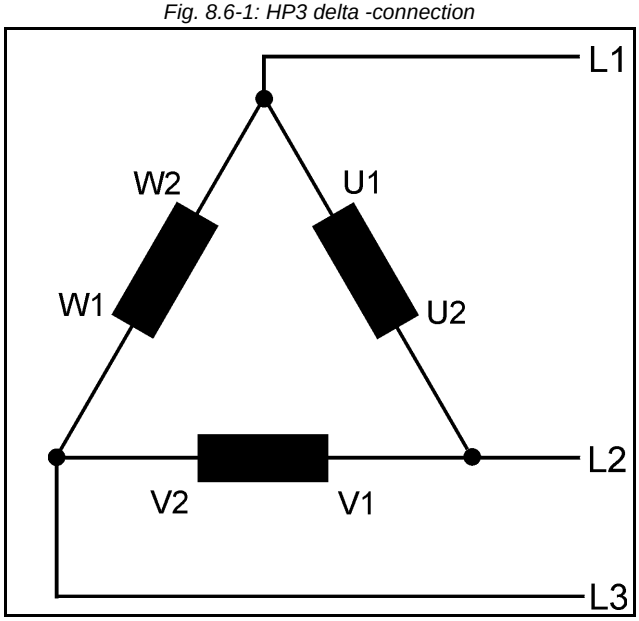
a. progressive speed by VCS

b. 0,35l/kW electrical power, the randomized values between 30% and 80% of the nominal power

8.6 Types of Coil

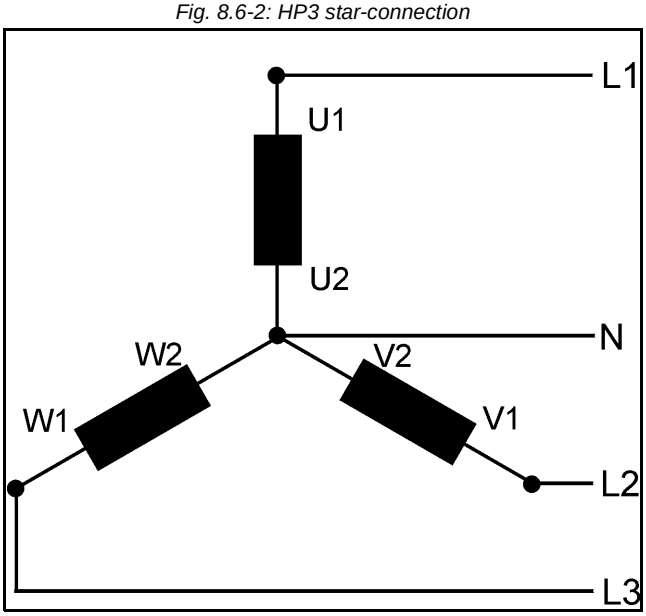
HP3 delta-connection

Fig. 8.6-1: HP3 delta -connection



HP3 star-connection

Fig. 8.6-2: HP3 star-connection



8.7 Engine oil

8.7.1 Engine oil classification

8.7.1.1 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..

8.7.1.2 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

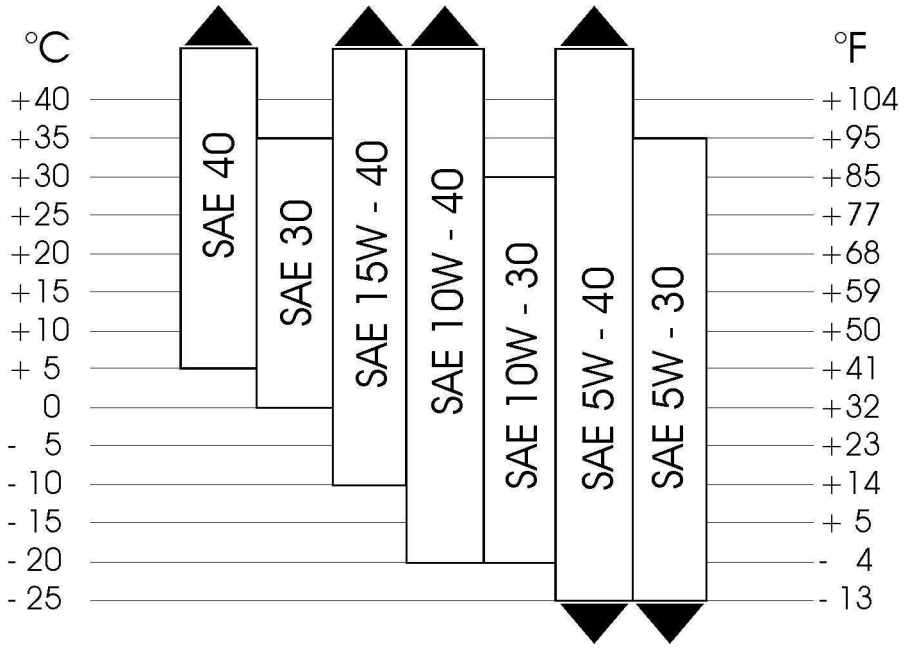
API CGEngine oil for highest demands, turbo-tested

For the Fischer Panda Generator the API CF Oil is needed.

Engine oil type	
over 25℃	SAE30 or SAE10W-30 SAE10W-40

Engine oil type	
0℃ to 25℃	SAE20 or SAE10W-30 SAE10W-40
below 0℃	SAE10W or SAE10W-30 SAE10W-40

Fig. 8.7.1-1: Temp. range of the SAE classes



8.8 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℃	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

8.8.1 Coolant mixture ratio

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

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Fischer Panda Datenblatt / Datasheet

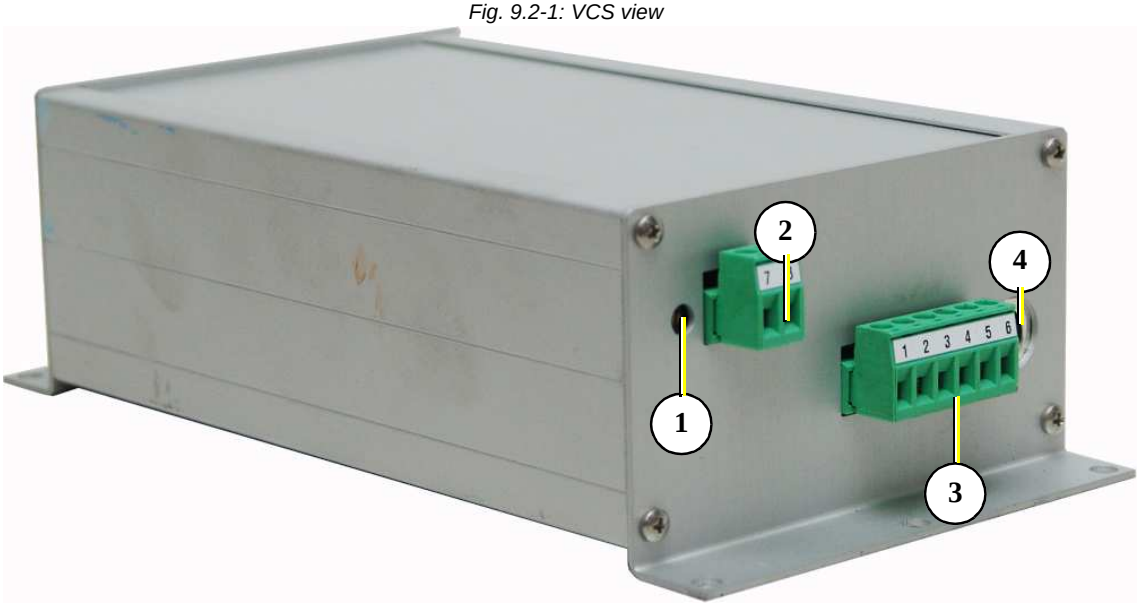
9. VCS-AGT-U/I

9.1 Delivery versions

Art. No.	Art. Type
21.02.01.066H	VCS-AGT-U/I 12 V= @60 mV
21.02.01.070H	VCS-AGT-U/I 24 V= @60 mV
21.02.01.071H	VCS-AGT-U/I 36 V= @60 mV
21.02.01.072H	VCS-AGT-U/I 48 V= @60 mV
21.02.01.073H	VCS-AGT-U/I 72 V= @60 mV
21.02.01.074H	VCS-AGT-U/I 80 V= @60 mV
auf Anfrage / on request	VCS-AGT-U/I 96 V= @60 mV
21.02.01.075H	VCS-AGT-U/I 120 V= @60 mV
21.02.01.076H	VCS-AGT-U/I 144 V= @60 mV
21.02.01.077H	VCS-AGT-U/I 180 V= @60 mV
auf Anfrage / on request	VCS-AGT-U/I 300 V= @60 mV
auf Anfrage / on request	VCS-AGT-U/I 320 V= @60 mV
auf Anfrage / on request	VCS-AGT-U/I 336 V= @60 mV

9.2 Voltage control system

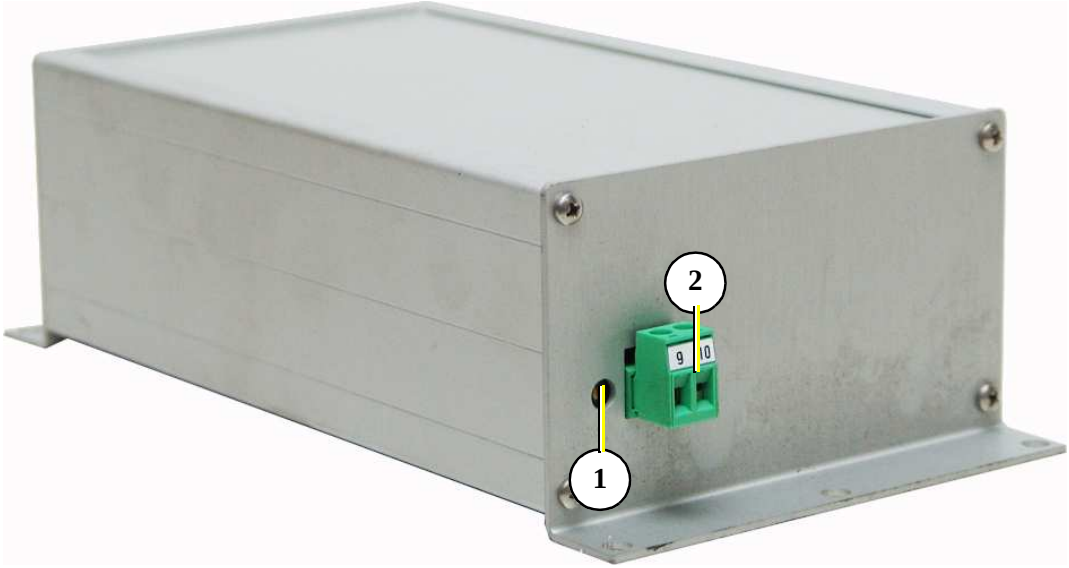
Fig. 9.2-1: VCS view



1. Terminals 7+8
2. Potentiometer for the charging voltage
3. Terminals 1-6
4. Programming

Fischer Panda Datenblatt / Datasheet

Fig. 9.2-2: Electronic Voltage Control



1. Terminals 9+10
2. Potentiometer for the charging current

The VCS control is used for the adjustment of the number of revolutions of the engine and thus the voltage of the generator. It belongs to the accessories and is externally attached.

Fig. 9.2-3: Terminals of the VCS

No.	Short mane	IN/OUT	Function
1	+ Actuaror	O	Out (+) for actuator
2	- Actuator	O	Out (-) for actuator
3	+12V	I	Operation voltage(+); 12V-Automotive
4	0V	I	Operation voltage(-); 12V-Automotive
5	AC Controllamp	O	to 0V - Optional
6	VCS on	I	12V: VCS is on / open : VCS is off
7	Mesurement voltage +	I	Mesurement voltage (+) from the generator
8	Mesurement voltage -	I	Mesurement voltage (-) from the generator
9	Mesurement current +	I	Mesurement current (+) from the generator
10	Mesurement current -	I	Mesurement voltage (-) from the generator

The potentiometer next to clamp 7/8 is needed for adustment of the measurement voltage and should be done by an service technican only.

The potentiometer next to clamp 9/10 is needed for adustment of the measurement current and should be done by an service technican only.

9.2.1 Gerneral working of the VCS

When the VCS is active (+12V on clamp 6) the VCS controls the actuator to reach the exact voltage.

The output current of the generator is seized over a shunt, with an output voltage of 60 mVs rated current. (The output voltage is linear to the output current).

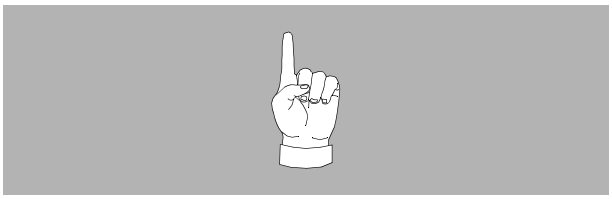
9.3 Personal requirements

The described installation must be done by a technical trained person or a Fischer Panda service point.Safety instructions for the voltage control

9.3.1 Safety References concerning current

A broken cable in the mesurement line will be notice by the VCS and the generator will slow down and stop.

NOTE!: Broken cable in the measurement line



A short-circuit in the measuring line or a wrong pole connection is not recognized by the VCS and is handled as “no voltage“.

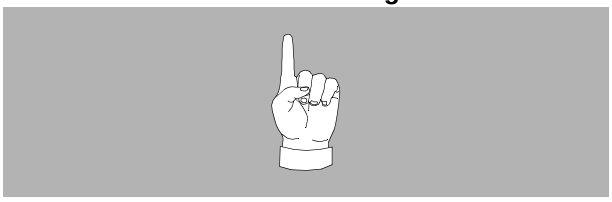
In this case the VCS is out of function. Therefore, it is necessary to check the right working of the VCS at the installation. Also a second overvoltage protection must be installed.

Warning!: Short circuit in the measurement line

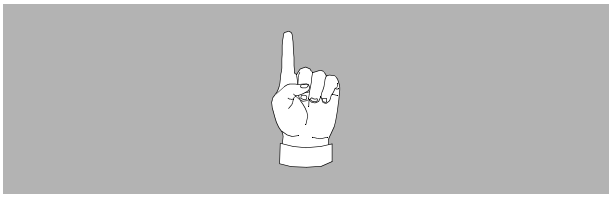
A shielded cable is needed for the mesurement voltage.

The cable should not be longer than 5 meters. The shield should be connected to ground at one side.

NOTE!: Cable for the measuring line



Note the safety instruction in the generator manual!.



9.3.2 Checking of the VCS voltage control when the generator is not running

1. VCS-cable connected?
2. Cable for measuring voltage connected to the VCS?
3. Cable for current measuring input connected to the VCS?
4. Actuator spindle lubricated with anti-seize?

Requirements:

Checking the actuator

1. Disconnect clamp 50 at the starter

2. Switch the remote control panel on and press the start button.

As long as the relay of the starter is controlled, the VCS regulates the accelerator in the maximum position (over the starter motor). When the start relay is not active, the accelerator goes to zero (over the actuator).

Check the right working of the actuator.

Fig. 9.3.2-1: Clamp 50

9.3.3 Function of the VCS

The current regulation barrier can be finely adjusted over a potentiometer, which is accessible at the back of the VCS (+5 % / -24 %).

9.3.4 Checking the VCS voltage regulation

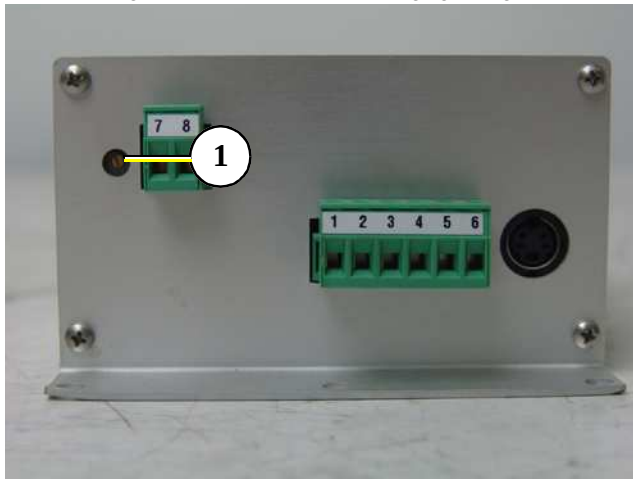
Connect clamp 50 to the starter motor again und start the generator. Control the battery voltage and check if the generator regulates the voltage. Check, if the generator regulates the voltage exactly by switching on and off load.

Readout potentiometer for the charging voltage

1. Potentiometer for setting the charging voltage

Turn to the right for increasing the charging voltage.

Fig. 9.3.4-1: Potentiometer charging voltage



9.3.5 Checking the current limiting

For this test an ampere plier is needed (DC or a multimeter mV/V) in order to control the generator output current, as well as a multimeter with a DC milivolt range. The batteries must be unloaded (avoid deep discharge of the batteries) to make sure, that the generator is able to supply the maximum output capacity. Keep the generator running and control the DC output current. Measure the voltage signal at the clamps 9 and 10 of the VCS cover by means of a multimeter, which measures milivolt. Check the polarity of this signal. With generators older than 2003, the maximum DC voltage is 60 milivolts. With generators from 2003 upwards the DC voltage is 48 milivolts - this is 80 % of the maximum permanent current. If this signal is exceeded, check the correct connection of the shunt signal cable and the polarity of the shunt signal to the VCS cover.

For setting the charging current resp. the voltage, load should be switched on with a nominal capacity of the generator. Now, the charging current must be measured and set to 100 amps by the potentiometer, in order to operate the engine in its nominal capacity range.estrom

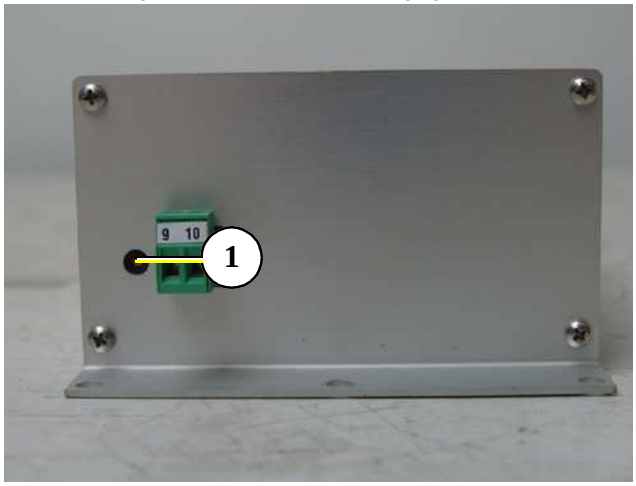
Readout potentiometer for the charging voltage

1. Potentiometer for setting the charging voltage

Turn to the right for increasing the charging voltage.

The factory setting is only to be changed by a technician.

Fig. 9.3-1: Potentiometer charging current



Leere Seite / Intentionally blank

Power - wherever you are

Manual

Generator Control Panel P6+

12V version - 21.02.02.046H

24V special version - 21.02.02.047H

Option automatic adapter - 21.02.02.016H

Option master-slave adapter - 21.02.02.015H

Fischer Panda GmbH

Current revision status P6+ manual

	Document
Actual:	Panel Generator Control P6+ RE0703_Kunde_eng.R06_26.11.10
Replace:	Panel Generator Control P6+ RE0703_Kunde_eng.R05

Revision	Page
Upgrade the whole manual	
Safety instruktion See valve added	
Hole pattern changed	
New display foil	

10. Safety Instructions Generator Control P6+

10.1 Personal requirements

The settings described here can by performed by the operator, unless otherwise indicated.

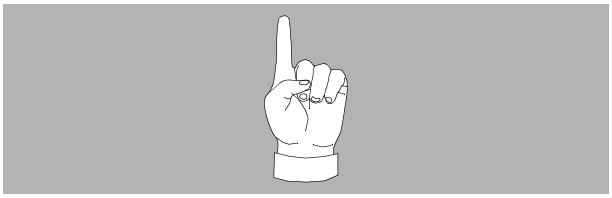
The installation should be carried out by specially trained personnel or by authorized repair shops (Fischer Panda service points).

10.2 Safety instructions for this chapter

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

If these not exist, they can be requested at Fischer PandaGmbH, 33104 Paderborn.

Note!:



Danger for life! - The generator can be equipped with a automatik 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 disconected before start working at the generator.

Warning!: Automatic start

The generator must not be put into operation with cover removed

If the generator is mounted without sound cover, the rotating parts (pulley, belt, etc.) must be covered and protected so that an injury is excluded.

All service, maintenance or repair work on the unit may be made only while the motor is off.

Warning!:

Danger for Life. Improper handling, operation, installation and maintenance can result in severe persoanl 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.

Warning!: Danger of Life - High voltage

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.

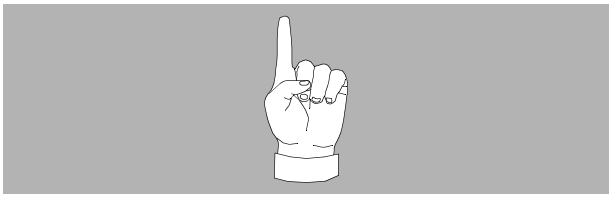
This is especially true for systems with an automatic start function. The automatic start function is to be deactivated before the work.

Sea valve must be closed. (only PMS version)

Attention!:

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

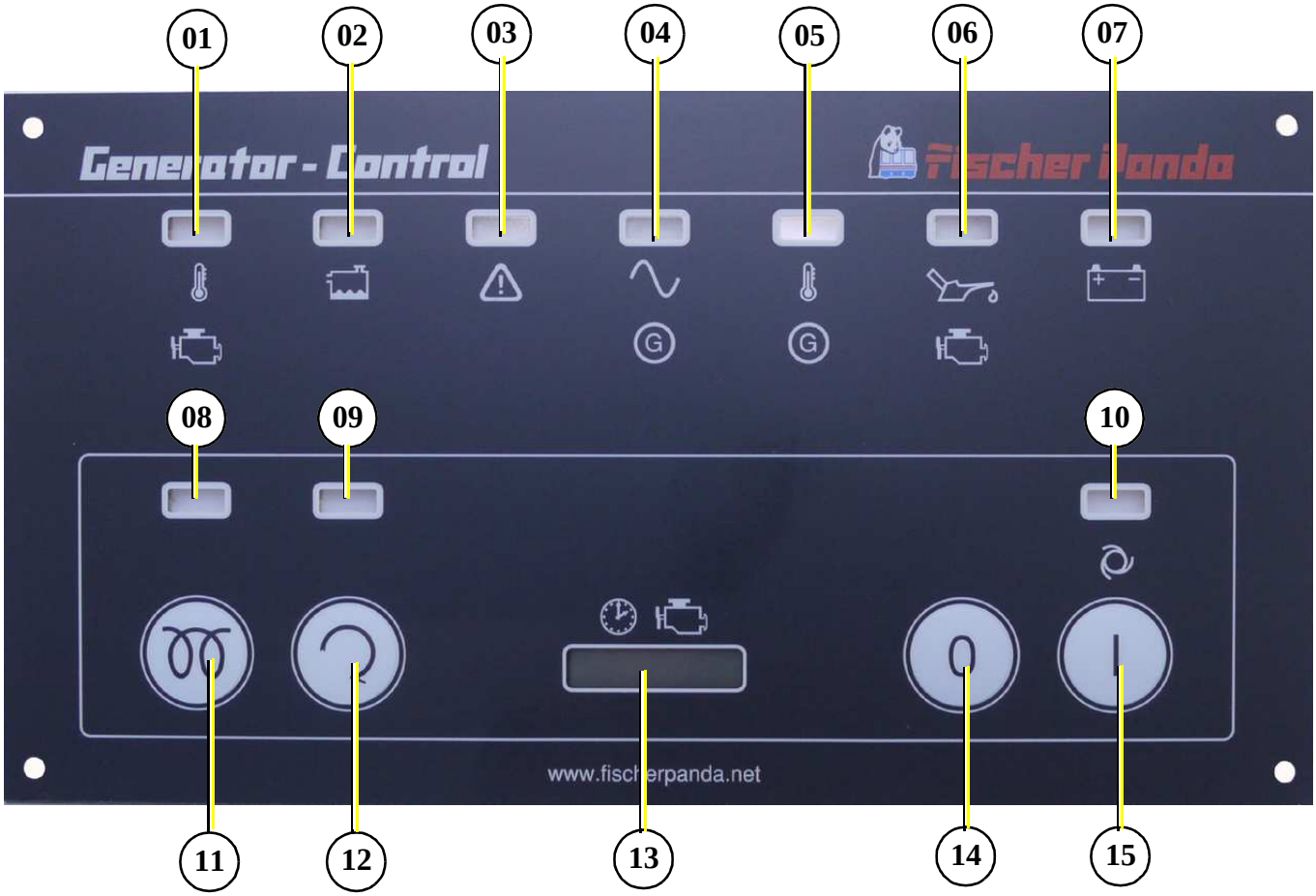
Note!:



11. General operation

11.1 Panel Generator Control

Fig. 11.1-1: Panel front



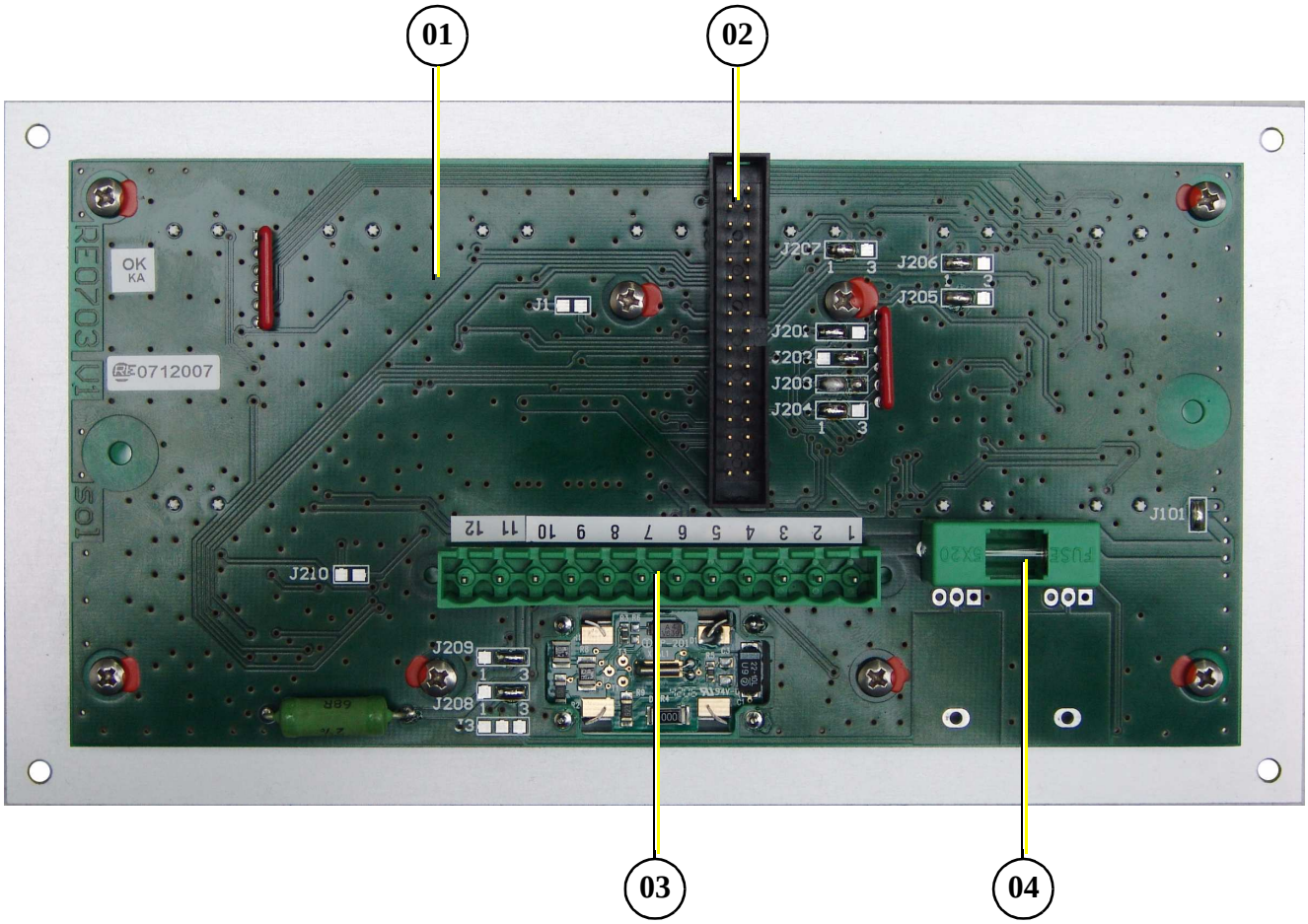
01. LED for coolant temperature red[1]
02. LED for waterleak red/yellow[1] (sensor optional)
03. LED for AC-voltage fault red/yellow[1]
04. LED for AC-voltage ok green[1]
05. LED for winding temperature red[1]
06. LED for oil pressure red[1]
07. LED for battery charge voltage fault green/red[1]
08. LED for pre-glow „heat“ orange[1]
09. LED for Generator „start“ green[1]
10. LED for Generator „stand-by“ green[1]
11. Push button for pre-glow „heat“
12. Push botton for Generator „start“
13. Operating hours counter
14. Push button panel „off“
15. Push button panel „on“

Fischer Panda Art. No. 21.02.02.009H

[1] *LED green: normal operation mode, LED red: fault, LED yellow: warning, LED orange: active*

11.2 Rear view 12V-version

Fig. 11.2-1: Panel rear view 12V-version

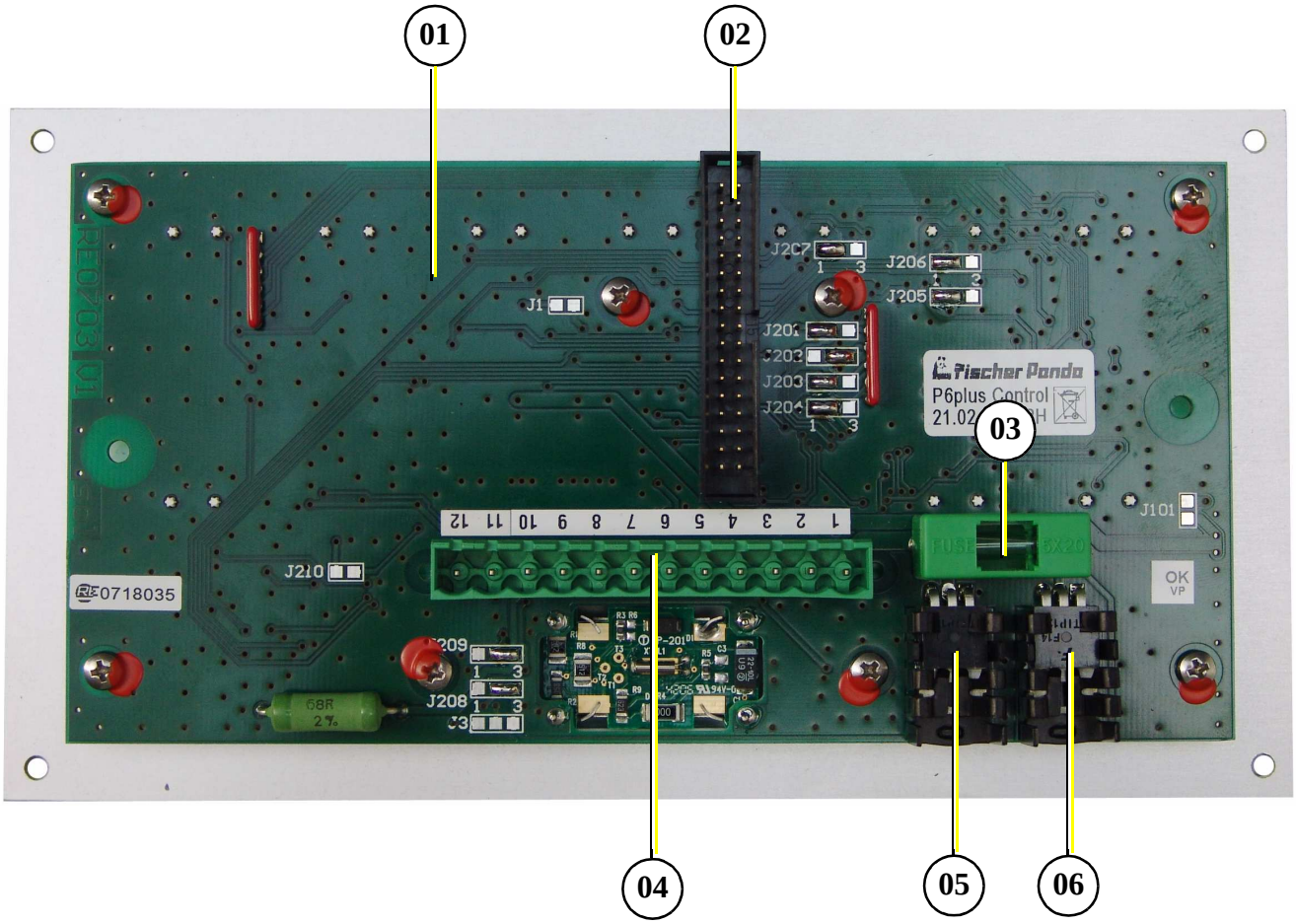


01. Control board
02. Terminal block (master-slave adapter: left row; automatic adapter: right row)
03. Terminals 1-12 (see Kapitel 11.4.2, “Terminal connections,” auf Seite 142)
04. Fuse 630mA slow-blow

Fischer Panda Art. No. 21.02.02.009H

11.3 Rear view 24V-version

Fig. 11.3-1: Panel rear view 24V-version



01. Control board
02. Terminal block (master-slave adapter: left row; automatic adapter: right row)
03. Fuse 630mA slow-blow
04. Terminals 1-12 (see Kapitel 11.4.2, “Terminal connections,” auf Seite 142)
05. Linear controller 24V
06. Linear controller 24V

Fischer Panda Art. No. 21.02.02.012H

11.4 Installation of the remote control panel

11.4.1 Placement.

Install the remote control panel at a dry, good accessible and shady place.

Connect the remote control panel to the standard 12 core cable at the generator. (1:1)

11.4.2 Terminal connections

Standard for NC temperature switch configured i.e. in case of failure „open“.

Fig. 11.4.2-1: Terminal connections

Clamp no.	Clamp name	IN / OUT	Description
1	Vbat	IN	Current supply + 12V (or optional 24V, must be adjusted by jumper)
2	GND	IN	Current supply -
3	T-Engine	IN	Error “coolant temperature”. Input for thermo-switch to GND. The input is adjustable for NC/NO (N = no error) (must be adjusted by solder Jumper). The input loads the switch with ≥22mA to +12V (with 24V-operated internally generated). The occurrence of an error is delayed, for analysis and displayed, around 100ms. Omission not. The in/out status is indicated with red LED.
4	Water leak (Replace air filter)	IN	Error “water leak”. Input for sensor switch to GND. The input is adjustable for NC/NO (N = no error) (must be adjusted by solder Jumper). The input loads the switch with ≥10mA to +12V (with 24V-operated internally generated). The occurrence of an error is delayed, for analysis and displayed, around 100ms. Omission not. The input status is indicated with red LED. The input can be used alternatively for the signal “Replace air filter” (must be adjusted by solder Jumper). Then the signal does not lead to switching off and is indicated with yellow LED.
5	Oil-Press	IN	Error “oil pressure“. Input for oil pressure switches to GND. The input is adjustable for NC/NO (N = no error) (must be adjusted by solder Jumper). The input loads the switch with ≥22mA to +12V (with 24V-operated internally generated). The occurrence of an error is delayed, for analysis and displayed, around 1s. Omission not. The input status is indicated with red LED.
6	DC-Control	IN / OUT	Load control display. Input for signal of the dynamo. The input is adjustable for GND = OK or 12V/24V = OK (must be adjusted by solder Jumper). The input loads the signal with 5mA at 12V and 10mA at 24V. The input status is indicated with red and green LED. The connection can supply an energizing current for the dynamo over a fixed resistor with 68R. Either with the control panel switched on or with “Fuel pump” switched on (must be adjusted by solder Jumper). This function is available only in 12V-operation.
7	AC-Control	IN	AC control display. Input for NC-open-collector-sensor-switch to GND (N = OK). The input loads the switch with ≥2,5mA to +12V (with 24V-operated internally generated). The input status is indicated with red and green LED´s.
8	Heat	OUT	Output for pre-glow relays. The output is so long active, as the button “Heat” is pressed. The output supplies, if active, the voltage of clamp 1. Additionally the output can be operated via the button “start” (must be adjusted by solder Jumper). Consider (notes 1-4).
9	Fuel-Pump	OUT	Output for fuel pump relay. The output is active, if no error is present (inputs 3, 4, 5, 11 and 12, if configured accordingly). The button “start” suppresses the error analysis and the output is then also active in the case of error, if the button “start” is pressed. The output supplies, if active, the voltage of clamp 1. Consider (notes 1-4).
10	Start	OUT	Output for starting relay. The output is active, as long as the button “start” is pressed. The output supplies, if active, the voltage of clamp 1. Consider (notes 1-4).

11	AC-Fault (Fuel Level) [former T-Oil]	IN	Error generator AC input for NC-open-collector-sensor-switch to GND (N = no error). The input loads the switch with ≥2,5mA to +12V. (with 24V-operated internally generated). The occurrence of an error is delayed, for analysis and displayed, around 100ms. Omission not. The input status is indicated with red LED. The input can be used alternatively for the signal “Fuel level” (must be adjusted by solder Jumper). The signal does not lead to switching off and is indicated with yellow LED. The input can be used alternatively for the signal “error oil-temperature”. The input is adjustable for NC/NO (N = no error) (must be adjusted by solder Jumper). The load of the sensor switch is adjustable to ≥10mA by +12V (must be adjusted by solder Jumper).
12	T-Winding	IN	Error “winding temperature”. Input for thermo-switch to GND. The input is adjustable for NC/NO (N = no error) (must be adjusted by solder Jumper). The input loads the switch with ≥22mA to +12V (with 24V-operated internally generated). The occurrence of an error is delayed, for analysis and displayed, around 100ms. Omission not. The input status is indicated with red LED.

Notes:
Power rating of the output: max. 0,5A in continuous operation and briefly 1,0A.
The supply of all output currents may not exceed (less 0,2A power consumption) the rated current of the safety device of the control panel.
The output has a free wheeling diode, which short circuits negative voltages (related to GND).
The output has a Z-diode, which prevents a supply of positive voltage (related to GND) into the output.

11.4.3 Function of the jumpers

Fig. 11.4.3-1: Function of the solder jumper

Jumper	Status	Description
J1	closed	during operation of the start button heat is along-operated
	open	Function deactivated
J3	1-2	Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3	Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	Dynamo excitation resistor is deactivated
J101	closed	12V - operation
	open	24V - operation (optional)
J201	1-2	T-Engine-input, for contact, which opens in case of error (2)
	2-3	T-Engine-input, for contact, which closes in case of error (2)
J202	1-2	Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2	Oil-Press-input, for contact, which opens in case of error (2)
	2-3	Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2	AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3	AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2	T-Winding-input, for contact, which opens in case of error (2)
	2-3	T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	Input Water leak has red LED and switches off
	2-3	Input Water leak has yellow LED and does not switch off
J207	1-2	Input AC-Fault has red LED and switches off
	2-3	Input AC-Fault has yellow LED and does not switch off
J208	1-2	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	DC-Control-Signal (+) = OK three-phase DC-alternator

J209	1-2	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed	Input AC-Fault has Pull-Up-current ≥10mA
	open	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.4.4 Configuration and adjustment

11.4.4.1 Configuration and setting sheet KE01

Standard jumpering for generators with three-phase DC-alternator (Kubota Super 5 series).

Panel only for 12V-operation.

The safety device is installed with the value 0,63AT.

The circuit parts for 24V-operation are not equipped.

Fig. 11.4.4.1-1: Settings of soldered jumper for this configuration (column Conf.)

Jumper	Status	Conf.	Description
J1	closed		during operation of the start button heat is along-operated
	open	X	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	X	Dynamo excitation resistor is deactivated
J101	closed	X	12V - operation
	open		~~24V - operation~~ (not possible)
J201	1-2	X	T-Engine-input, for contact, which opens in case of error (2)
	2-3		T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	X	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2	X	Oil-Press-input, for contact, which opens in case of error (2)
	2-3		Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2	X	AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3		AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2	X	T-Winding-input, for contact, which opens in case of error (2)
	2-3		T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	X	Input Water leak has red LED and switches off
	2-3		Input Water leak has yellow LED and does not switch off
J207	1-2	X	Input AC-Fault has red LED and switches off
	2-3		Input AC-Fault has yellow LED and does not switch off
J208	1-2		DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	X	DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2		DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	X	DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	X	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.4.4.2 Configuration and setting sheet KE02

Standard jumpering for generators with three-phase DC-alternator.

Panel for 24V-operation (over attitude of solder jumper J101 alternatively 12V-operation is possible).

The safety device is installed with the value 0,63AT.

The circuit parts for 24V-operation are not equipped.

Fig. 11.4.4.2-1: Einstellung der Lötjumper für diese Konfiguration (Spalte Konf.)

Jumper	Status	Conf.	Description
J1	closed		during operation of the start button heat is along-operated
	open	X	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	X	Dynamo excitation resistor is deactivated
J101	closed		12V - operation
	open	X	24V - operation
J201	1-2	X	T-Engine-input, for contact, which opens in case of error (2)
	2-3		T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	X	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2	X	Oil-Press-input, for contact, which opens in case of error (2)
	2-3		Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2	X	AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3		AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2	X	T-Winding-input, for contact, which opens in case of error (2)
	2-3		T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	X	Input Water leak has red LED and switches off
	2-3		Input Water leak has yellow LED and does not switch off
J207	1-2	X	Input AC-Fault has red LED and switches off
	2-3		Input AC-Fault has yellow LED and does not switch off
J208	1-2		DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	X	DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2		DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	X	DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	X	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.4.4.3 Configuration and setting sheet KE03

Standard jumpering for generators with DC-alternator.

Panel only for 12V-operation.

The safety device is installed with the value 0,63AT.

The circuit parts for 24V-operation are not equipped.

Fig. 11.4.4.3-1: Einstellung der Lötjumper für diese Konfiguration (Spalte Konf.)

Jumper	Status	Konf.	Description
J1	closed		during operation of the start button heat is along-operated
	open	X	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	X	Dynamo excitation resistor is deactivated
J101	closed	X	12V - operation
	open		~~24V - operation~~ (not possible)
J201	1-2	X	T-Engine-input, for contact, which opens in case of error (2)
	2-3		T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	X	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2	X	Oil-Press-input, for contact, which opens in case of error (2)
	2-3		Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2	X	AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3		AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2	X	T-Winding-input, for contact, which opens in case of error (2)
	2-3		T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	X	Input Water leak has red LED and switches off
	2-3		Input Water leak has yellow LED and does not switch off
J207	1-2	X	Input AC-Fault has red LED and switches off
	2-3		Input AC-Fault has yellow LED and does not switch off
J208	1-2	X	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3		DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2	X	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3		DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	X	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.4.4.4 Configuration and setting sheet KE04

Standard jumpering for generators with DC-alternator.

Panel for 24V-operation (over attitude of solder jumper J101 alternatively 12V-operation is possible).

The safety device is installed with the value 0,63AT.

The circuit parts for 24V-operation are not equipped.

Fig. 11.4.4.4-1: Einstellung der Lötjumper für diese Konfiguration (Spalte Konf.)

Jumper	Status	Konf.	Description
J1	closed		during operation of the start button heat is along-operated
	closed	X	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	closed	X	Dynamo excitation resistor is deactivated
J101	closed		12V - operation
	closed	X	24V - operation
J201	1-2	X	T-Engine-input, for contact, which opens in case of error (2)
	2-3		T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	X	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2	X	Oil-Press-input, for contact, which opens in case of error (2)
	2-3		Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2	X	AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3		AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2	X	T-Winding-input, for contact, which opens in case of error (2)
	2-3		T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	X	Input Water leak has red LED and switches off
	2-3		Input Water leak has yellow LED and does not switch off
J207	1-2	X	Input AC-Fault has red LED and switches off
	2-3		Input AC-Fault has yellow LED and does not switch off
J208	1-2	X	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3		DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2	X	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3		DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	X	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.5 Starting preparation / Checks (daily)

11.5.1 Marine version

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

   The level should be about 2/3 of the maximum level of a cold engine.
   Further, if installed, the oil level of the oil-cooled bearing must be controlled before each start - see sediment bowl at generator front cover!.
2. State of cooling water.

   The external expansion tank should be filled up to 1/3 of the maximum in a cold state. It is very important that a large expansion area remains above the cooling water level.
3. Check if sea cock for cooling water intake is open.

   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. Visual inspection.

   Control fixing bolts, check hose connectors for leakages, control electrical connections.
6. Switch off the load.

   The generator should only be started without load.
7. Open fuel valve, if installed.
8. Close battery main switch (switch on).

11.5.2 Vehicle version

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

   The level should be about 2/3 of the maximum level of a cold engine.
   Further, if installed, the oil level of the oil-cooled bearing must be controlled before each start - see sediment bowl at generator front cover!.
2. State of cooling water.

   The external expansion tank should be filled up to 1/3 of the maximum in a cold state. It is very important that a large expansion area remains above the cooling water level.
3. Visual inspection.

   Control fixing bolts, check hose connectors for leakages, control electrical connections.
4. Switch off the load.

   The generator should only be started without load.
5. Open fuel valve, if installed.
6. Close battery main switch (switch on).

11.6 Starting and stopping the generators

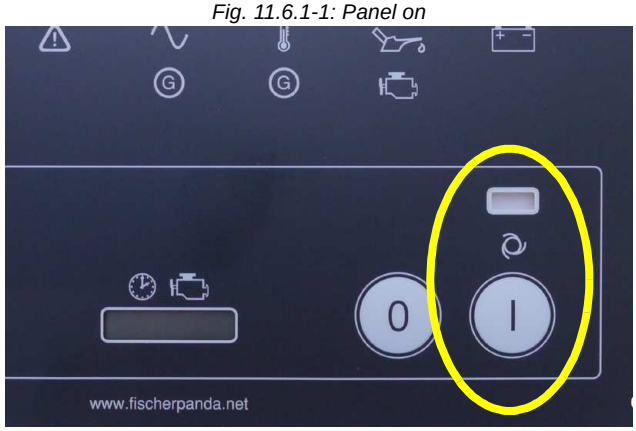
11.6.1 Starting the generator

Danger for life! - The generator can be equipped with a automatik 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 disconected before start working at the generator.

Warning!: Automatic start

1. Press button „on“ (switch on).
   LED for "on“ = green.

Fig. 11.6.1-1: Panel on

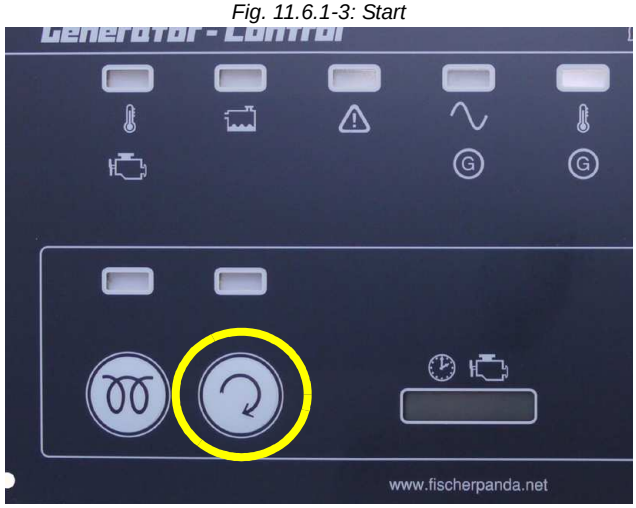


2. Press button „heat“ (preglow engine).
   LED for "heat“ = orange.
   Depending upon engine type and execution pre-heating can be necessary. Pre-heat is necessary at an operating temperature <20℃.

Fig. 11.6.1-2: Preglow

3. Press button „start“ (start engine).
   LED for "start“ = green.
   The electric starter may only be used for a maximum of 20 seconds. Thereafter, a pause of at least, 60 seconds is required. If the genset does not immediately start, then the fuel intake should be checked to ensure it is flowing freely. (For temperatures below - 8℃ check whether there is winter fuel)
4. Switch on load.
   The load should only be switched on if the generator voltage is within the permissible range. Parallel connection of several loads should be avoided, especially if there are loads with electric motors, such as air-conditioning units in the system. In this case, the load must be connected Step by Step.

Fig. 11.6.1-3: Start



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!:

11.6.2 Stopping the generator

1. Switch off load.
2. Recommendation: With turbo engines and during load more than highly 70% of the rated output, stabilize generator temperature at least 5 minutes with load switched off.

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

3. Press button „off“ (switch off).

   LED for "on“ = off.

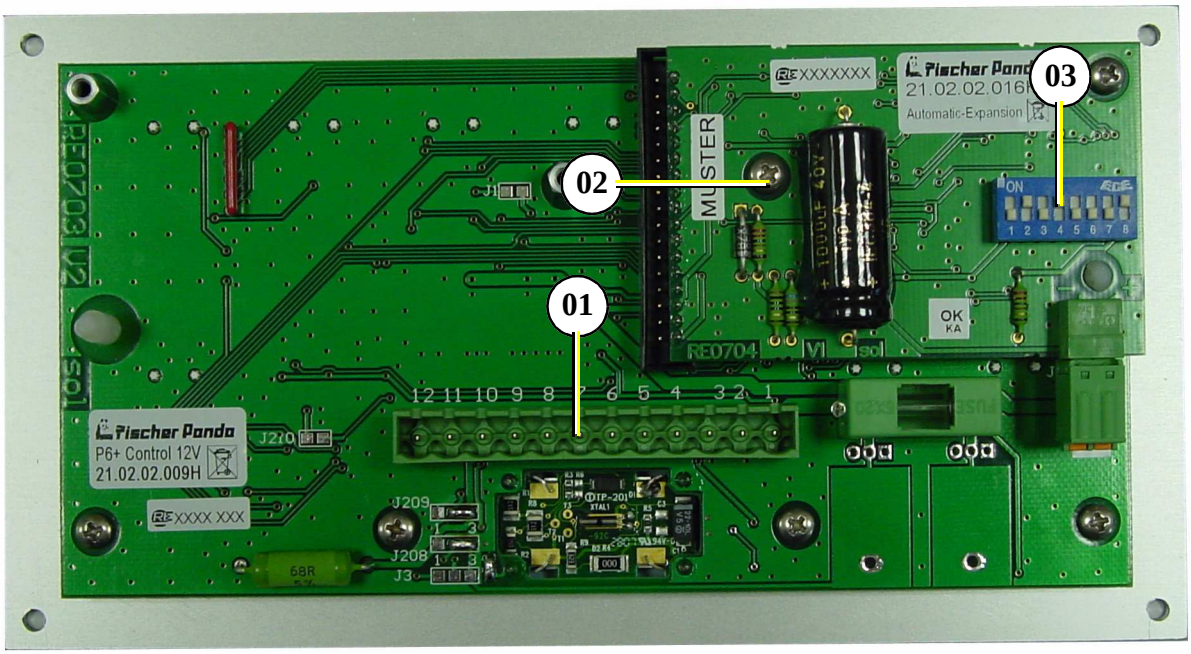
Fig. 11.6.2-1: Stop

Never switch off the battery until the generator has stopped, if necessary close fuel valve!

Attention!:

11.7 Automatic adapter - optional

Fig. 11.7-1: Panel 21.02.02.009H with Automatic adapter 21.02.02.016H



01. Main terminals
02. Automatic adapter 21.02.02.016H
03. 8-pole DIP-switch

Fischer Panda Art. No. 21.02.02.016H

11.7.1 Function:

The automatic adapter RE0704 extends the generator control panel P6+ with an automatic input. A potential-free contact can be attached to this input. If this contact is closed, then the generator, which is attached to the generator control panel P6+, is started automatically. If the contact is opened, then the generator is stopped automatically.

The automatic starting procedure consists of pre-heating (heat) and operating the starter (start). It can be again aborted at any time by opening the contact at the automatic input.

For automatic stopping (stop) the output “Fuel pump” (clamp 9 generator control panel) is switched off. The time for the automatic stop procedure can be terminated only by switching off generator control panel prematurely.

The times for “heat”, “start” and “stop” are separately adjustable (see below).

The additional automatic adapter switched on and off using the generator control panel with its push buttons “on” and “off”.

If the contact at the automatic input is connected, while the generator control panel is switched on, then the automatic starting procedure is carried out.

If the current supply is attached or switched on using the generator control panel, while the contact of the automatic input is closed, then the automatic starting procedure won´t be carried out, because the generator control panel is always switched off after attaching the current supply (generator the control panel must have been separate from the current supply for at least 60s).

11.7.2 The mechanism entrance:

With (-) characterized connection is connected to GND.

With (+) characterized connection is the input.

The input is connected through a resistance to 12V (with 24V-operated internally generated). If the two connections are short circuited over a potential-free contact, then the input current flows.

To be considered for an electronic contact the low input current and the polarity is to be selected.

The high input current is to be selected for an electromechanical contact.

The input is debounced (delay time approx.1s).

On the input an external voltages must not be set.

Fig. 11.7.2-1: Data

Data:	
Parameter	**Information**
Operation voltage	The automatic adapter power is supplied via the generator control panel P6+. The same absolute maximum ratings obtain as with the generator control panel P6+.
Operation temperature	The same absolute maximum ratings obtain as with the generator control panel P6+.
Proper power consumption	10mA - 20mA
Tolerance of times	± 10%

Fig. 11.7.2-2: Settings

8-pole DIP-switch S1 settings (S1.1 to S1.8):										
		standard	S1.1	S1.2	S1.3	S1.4	S1.5	S1.6	S1.7	S1.8
Heat-time	2,5s		OFF	OFF						
	5s		ON	OFF						
	10s	X	OFF	ON						
	20s		ON	ON						
Start-time	8s	X			OFF					
	16s				ON					
Stop-time	16s					OFF	OFF			
	32s	X				ON	OFF			
	64s					OFF	ON			
	128s					ON	ON			
Operation-mode	Normal	X						OFF		
	Test (all times over 16)							ON		
Input current	1,25mA									OFF
	7mA	X								ON

The automatic adapter must only be used together with a device. The starter should only be switched on when the generator stationary (shut-down)!

Attention:

11.7.3 Terminal connections

Connection for the automatic adapter X2 (row with odd pin numbers // I/O viwe from operating panel)

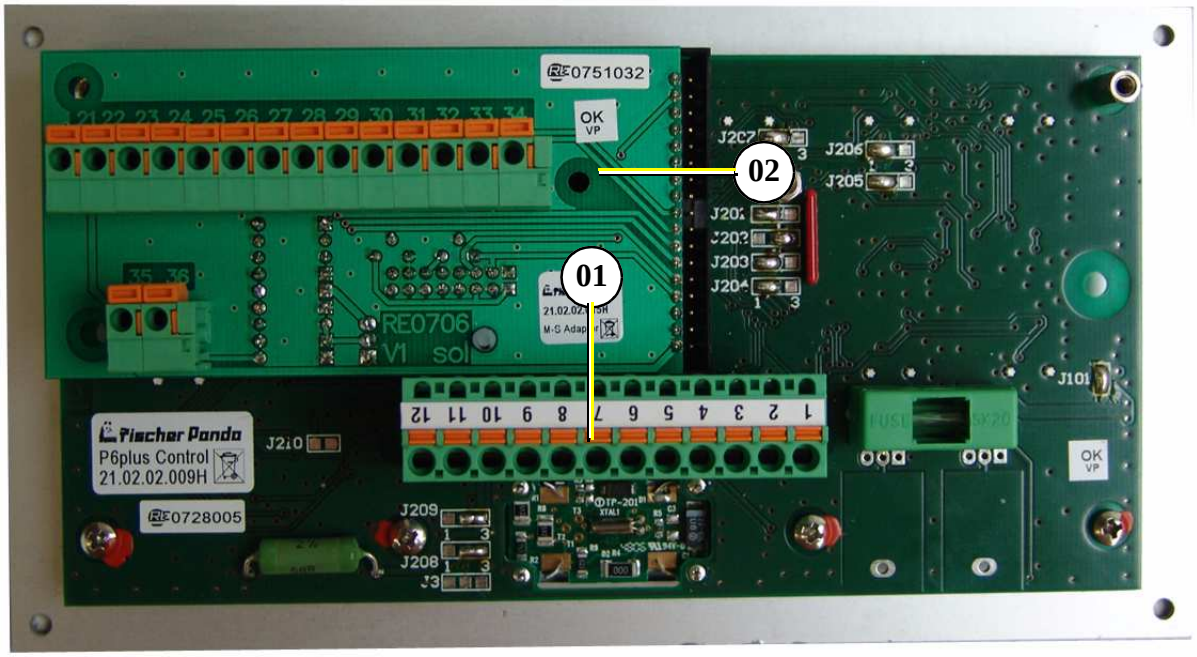
Fig. 11.7.3-1: Terminal connections automatic adapter

Pin-no.	Pin-name	I / O	Description
1	VBF	O	Current supply + (operation voltage behind fuse)
3	GND	O	Current supply - (ground)
5	VBFS	O	Current supply + switched (voltage Pin 1, with panel switched on)
7	12V	O	Current supply + switched, at 12V-operation over closed soldered jumper J101 connected with VBFS (at optional 24V-operation: VBFS over internal voltage regulator at 12,9V regulated)
9	GND	O	Current supply - (ground)
11	GND	O	Current supply - (ground)
13	/Heat-signal	I	Heat is active, if the input is switched to GND
15	/Start-signal	I	Start is active, if the input is switched to GND
17	GND	O	Current supply - (ground)
19	GND	O	Current supply - (ground)
21	GND	O	Current supply - (ground)
23	GND	O	Current supply - (ground)
25	GND	O	Current supply - (ground)
27	/Stop-signal	I	The Fuel pump signal is switched off, as long as the input is switched to GND, (also when starting)
29	FP-Int	O	Fuel pump signal internally, decoupled over diode from external signal
31	/Fault-signal	O	Output is switched to GND, if an error is present (inputs 3, 4, 5, 11 and 12, if configured and generally for 2s, after switching on the panel)
33	GND	O	Current supply - (ground)

11.8 Master-Slave adapter - optional

11.8.1 Fischer Panda Art. No. 21.02.02.015H 12V-version

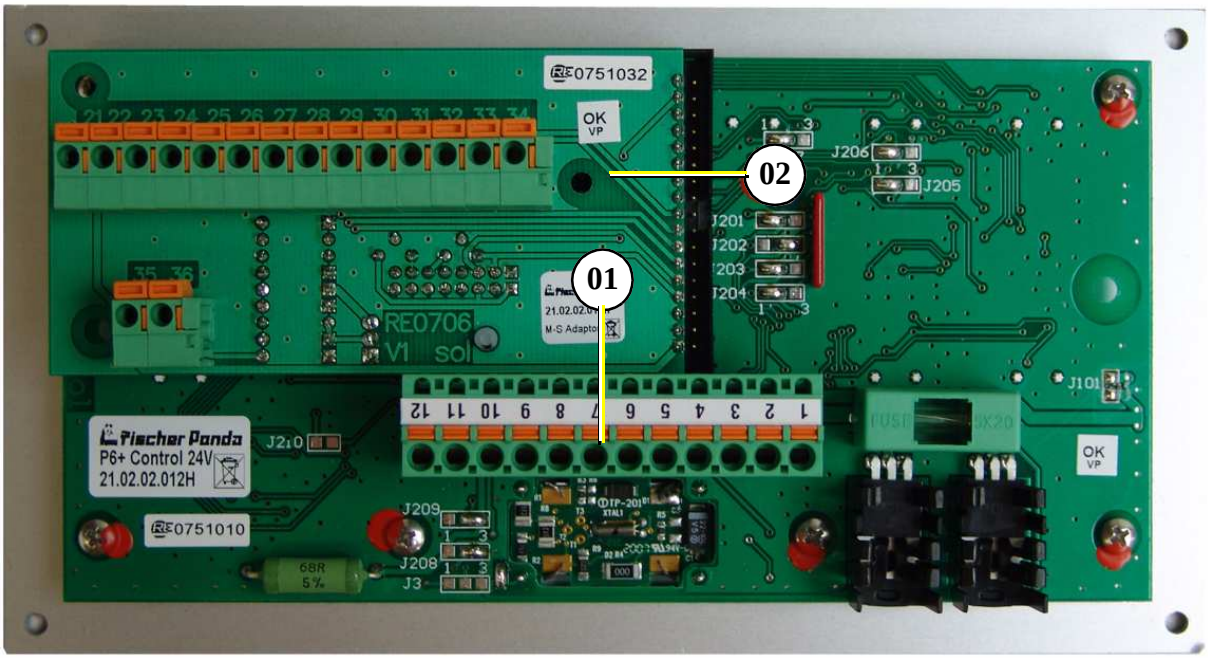
Fig. 11.8.1-1: Panel 21.02.02.009H with master-slave adapter 21.02.02.015H



01. Main terminals
02. Master-slave adapter 21.02.02.015H

11.8.2 Fischer Panda Art. No. 21.02.02.01H 24V-version

Fig. 11.8.2-1: Panel 21.02.02.012H with master-slave adapter 21.02.02.015H



01. Main terminals
02. Master-slave adapter 21.02.02.015H

With the Master-Slave-Adapter RE0706 two Generator Control Panels P6+ RE0703 can be connected to a Master-Slave-Combination. In addition on each Generator Control Panel P6+ an Master-Slave-Adapter RE0706 is installed. The Generator Control Panel P6+ is interconnected by the 14pole connecting terminals on the Master-Slave-Adapters 1:1. The Master-Panel is hereby defined when the generator is connected to the main connector. Thus, the main connector of the Slave-Panel should not be occupied (unconnected).

The solder jumpers on the Master-Panel have to be coded in the same manner as for a Master-Panel without a Slave-Panel as in normal operation. The solder jumpers on the Slave-Panel are coded as for slave operation (please see the appropriate adjustment pages for the Generator Control Panel P6+ RE0703).

The Master-Panel and Slave-Panel are identical, and only differs as a result of the coding. Both Master-Slave-Panels are also identical.

11.8.3 Terminal Connections:

X2: (14polig, 21 - 34) master Slave connection (1:1 wire)

X3: (2polig, 35 - 36) 35: Panel on signal of the Generator Control Panel P6+ RE0703

36: Error signal of the Generator Control Panel P6+ RE0703

The Panel-ON-Signal is active when the panel is switched on.

The error signal is so long active, as the panel recognizes an error, which must lead to switching the generator off.

The output voltage corresponds to the operating voltage of the Generator Control Panel P6+ less 0,7V - 1,4V. Each output has a free wheeling diode which short circuits externals voltage supplies under 0V and a decoupling diode which decouples the circuitry from external power feeding.

11.8.4 Fuse:

A 0,8AT fuse must be installed on the Master-Panel.

11.8.5 Terminal connections

11.8.5.1 Terminal X2 (IN/OUT from view Master-Opearating-Panel)

Fig. 11.8.5-1: Terminal connections terminal X2 (IN/OUT from the view of the master-control-panel)

Pin-No.	Pin-name	IN / OUT	Description
21	VBF	O	Current supply + (operation voltage behind fuse 12Vdc or 24Vdc depending on system)
22	GND	O	Current supply - (ground)
23	ON-Signal	I / O	Panels are switched on, if the connection is switched using a push button (on master or slave) to VBF
24	OFF-Signal	I / O	Panels are switched off, if the connection is switched using a push button (on master or slave) to VBF
25	/Heat-Signal	I / O	Heat is active, if the connection is switched over a push button (on master or Slave) to GND
26	/Start-Signal	I / O	Start is active, if the connection is switched over a push button (on master or Slave) to GND
27	LED-T-Engine	O	Output for LED T-Engine on the Slave panel, is switched to GND, if the LED is illuminated
28	LED-Water-leak (Replace Airfilter)	O	Output for LED Waterleak on the Slave panel, is switched to GND, if the LED is illuminated
29	LED-Oil-Press	O	Output for LED Oil-Press on the Slave panel, is switched to GND, if the LED is illuminated

30	LED-AC-Fault (Fuel Level)	O	Output for LED AC-Fault on the Slave panel, is switched to GND, if the LED is illuminated
31	LED-T-Win-ding	O	Output for LED T-Winding on the Slave panel, is switched to GND, if the LED is illuminated
32	DC-Control	O	Output for LED DC-Control-display on the Slave panel. The DC control signal is ground through 1:1.
33	AC-Control		Output for LED AC-Control-display on the Slave panel. The AC control signal is ground through 1:1.
34	VBFS	O	Current supply + switched (otherwise like 21, VBF)

The use of these connections for other purposes, other than the master-slave connection of two generator control panels, is generally forbidden. In individual cases, after consultation and clarifying the technical details, a release for another use can, if technically possible, be allowed.

11.8.5.2 Terminal X3

Fig. 11.8.5.2-1: Terminal connections terminal X3

Pin-No.	Pin-name	IN / OUT	Description
35	Panel ON	O	With panel (ON/OFF) switched voltage of clamp X2.1 (VBF). (Consider notes 1-4)
36	Error	O	Output is switched on, if a ceitical error is present. (Consider notes 1-4)

Notes:

1.Power rating of the output: max. 0,5A in continuous operation and briefly 1,0A.

2.The supply of all output currents may not exceed (less 0,2A power consumption) the rated current of the safety device of the control panel.

3.The output has a free wheeling diode, which short circuit negative voltages (related to GND).

4.The output has a Z-diode, which prevents an overvoltage (related to GND) into the output.

11.8.6 Configuration and adjustment

11.8.6.1 Configuration and setting sheet KE05

Standard Jumperung for use as Slave-Panel in connection with **two** Master-Slave-Adapters RE0706 and a Generator Control Panel P6+ RE0703 as Master-Panel. Panel only for 12V-Betrieb.

The safety device is installed with the value 0,63AT. The circuit parts for 24V-operation are not equipped.

Fig. 11.8.6-1: Settings of soldered jumper for this configuration (column Conf.)

Jumper	Status	Conf.	Description
J1	closed		during operation of the start button heat is along-operated
	open	XM	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	XM	Dynamo excitation resistor is deactivated
J101	closed	M	12V - operation
	open	M	~~24V - operation~~ (not possible)
J201	1-2		T-Engine-input, for contact, which opens in case of error (2)
	2-3	XM	T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	XM	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2		Oil-Press-input, for contact, which opens in case of error (2)
	2-3	XM	Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2		AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3	XM	AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2		T-Winding-input, for contact, which opens in case of error (2)
	2-3	XM	T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	M	Input Water leak has red LED and switches off
	2-3	M	Input Water leak has yellow LED and does not switch off
J207	1-2	M	Input AC-Fault has red LED and switches off
	2-3	M	Input AC-Fault has yellow LED and does not switch off
J208	1-2	M	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	M	DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2	M	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	M	DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	XM	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

X = Jumper must be so set

XM = Jumper, function must be so set on the master panel is selected

M = Jumper must be set exactly the same, as on the master panel,

(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

11.8.6.2 Configuration and setting sheet KE06

Standard jumpering for use as Slave-Panel in connection with **two** Maste-Slave-Adapters RE0706 and a Generator Control Panel P6+ RE0703 as Master-Panel. Panel for 24V-operation. (over attitude of solder jumper J101 alternatively 12V-operation is possible)

The safety device is installed with the value 0,63AT.

The circuit parts for 24V-operation are not equipped.

Fig. 11.8.6.2-1: Settings of soldered jumper for this configuration (column Conf.)

Jumper	Status	Conf.	Description
J1	closed		during operation of the start button heat is along-operated
	open	XM	Function deactivated
J3	1-2		Dynamo excitation resistor 68R is switched on with Fuel-Pump (1)
	2-3		Dynamo excitation resistor 68R is switched on with Panel-ON (1)
	open	XM	Dynamo excitation resistor is deactivated
J101	closed	M	12V - operation
	open	M	24V - operation
J201	1-2		T-Engine-input, for contact, which opens in case of error (2)
	2-3	XM	T-Engine-input, for contact, which closes in case of error (2)
J202	1-2		Water leak-input / Replace air filter, for contact, which opens in case of error (2)
	2-3	XM	Water leak-input / Replace air filter, for contact, which closes in case of error (2)
J203	1-2		Oil-Press-input, for contact, which opens in case of error (2)
	2-3	XM	Oil-Press-input, for contact, which closes in case of error (2)
J204	1-2		AC-Fault-input / Fuel level, for contact, which opens in case of error (2)
	2-3	XM	AC-Fault-input / Fuel level, for contact, which closes in case of error (2)
J205	1-2		T-Winding-input, for contact, which opens in case of error (2)
	2-3	XM	T-Winding-input, for contact, which closes in case of error (2)
J206	1-2	M	Input Water leak has red LED and switches off
	2-3	M	Input Water leak has yellow LED and does not switch off
J207	1-2	M	Input AC-Fault has red LED and switches off
	2-3	M	Input AC-Fault has yellow LED and does not switch off
J208	1-2	M	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	M	DC-Control-Signal (+) = OK three-phase DC-alternator
J209	1-2	M	DC-Control-Signal (-) = OK dynamo 12V at Kubota Z 482 / D 722 engines
	2-3	M	DC-Control-Signal (+) = OK three-phase DC-alternator
J210	closed		Input AC-Fault has Pull-Up-current ≥10mA
	open	XM	Input AC-Fault has Pull-Up-current ≥2,5mA

The solder jumpers are marked on the printed circuit board (with jumper no. and at three-part solder jumper with soldering surface no.)

X = Jumper must be so set

XM = Jumper, function must be so set on the master panel is selected

M = Jumper must be set exactly the same, as on the master panel,

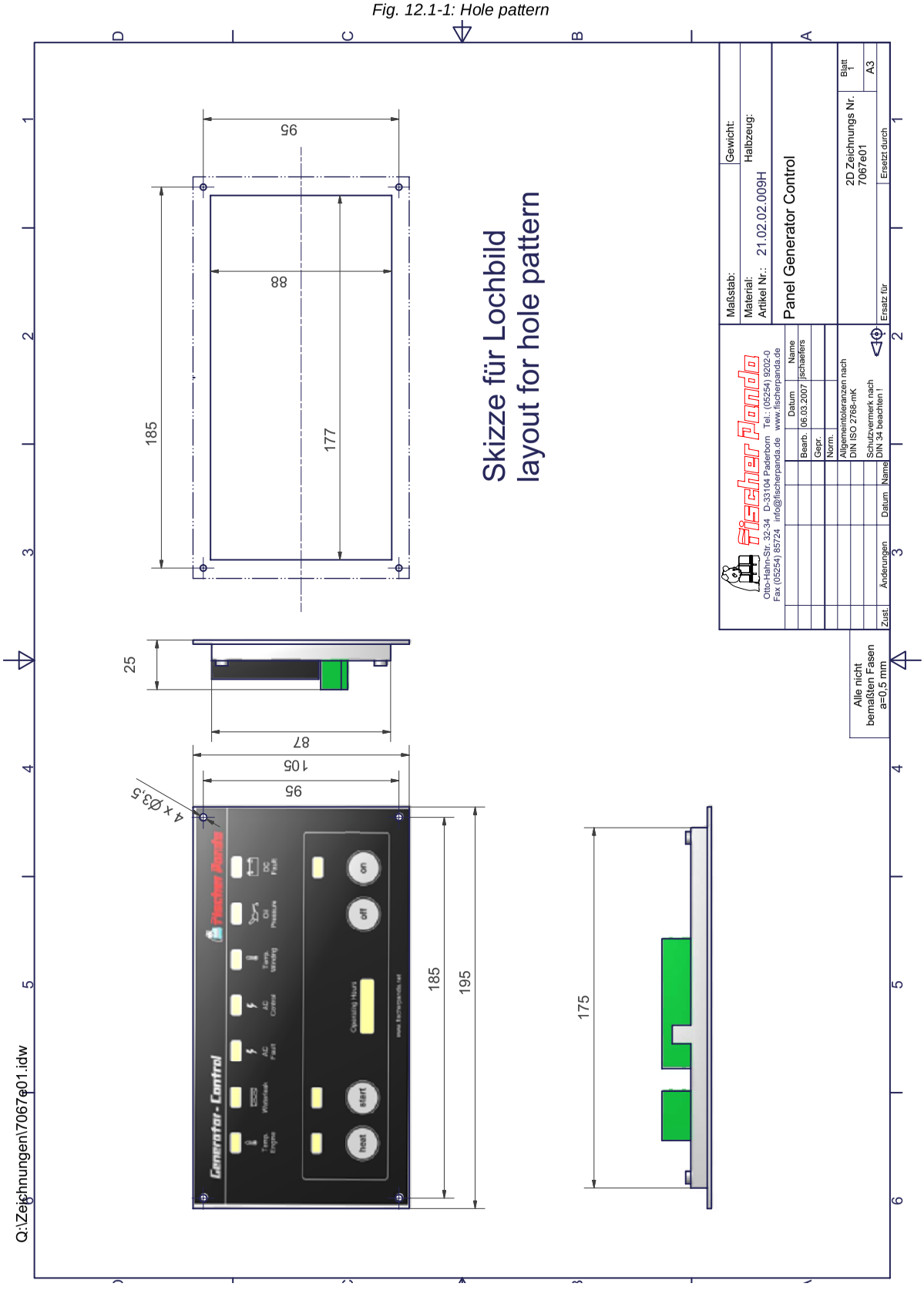
(1): Equivalent resistance for load control lamp e.g. for use with three-phase alternator also integrated automatic controller of Bosch. The resistance value is 68Ω 3W, i.e. only for 12V.

(2): A closed contact switches the appropriate input to GND.

12. Measurements

12.1 Hole pattern

Fig. 12.1-1: Hole pattern



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