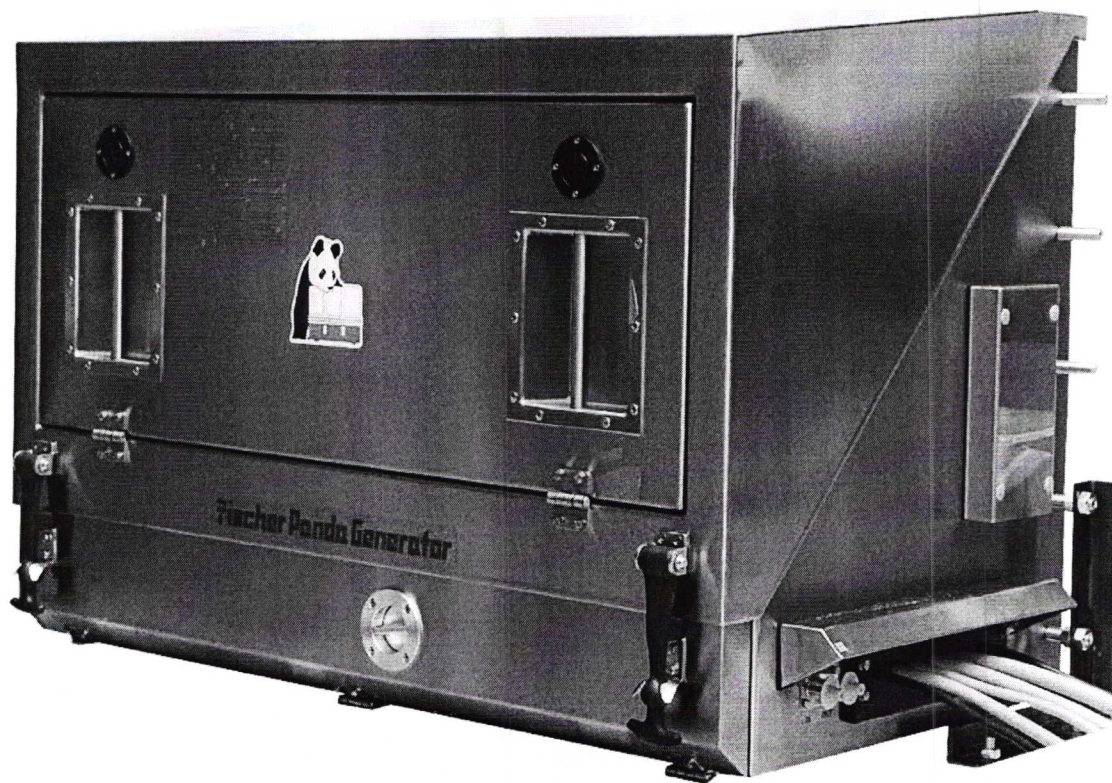


Fischer Panda

Operation and Installation Instructions



28.6.06

Panda_8mini_PVK-U_s01125_Book.V01

Panda 8mini PVK-U Super silent technology






120/240V - 60Hz / 7,0kW

Icemaster Fischer Panda GmbH

Current revision status

	Document
Actual:	Panda_8mini_PVK-U_s01125_Book.V01_28.6.06
Replace:	

Revision	Page

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

Fischer Panda

FISCHER GENERATOREN - have been established since 1978 and are well-known as a manufacturer of first-class water-cooled diesel generators provided with extremely effective sound-insulation. Ever since, FISCHER PANDA has been leading manufacturers for quality and know how.

FISCHER was the first manufacturer of modern diesel generators world-wide to develop the sailor-silent series, a GRP synthetic soundinsulated capsule, thus laying the foundation of new techniques in the field of sound-insulated generator construction.

In 1988 the firms FISCHER and ICEMASTER amalgamated, in order to concentrate on the development of new products. Production was moved to Paderborn. The combination of know-how of two such experienced companies meant it was possible to produce and develop a brand new programme within a very short period of time. The gensets developed at that time set the technical standards worldwide for the whole branch of industry. The gensets have become more efficient and produce far higher performances than other gensets in the same nominal performance range. Following several tests carried out by highly respected international institutes and magazines, the FISCHER PANDA generator was able to prove its vast superiority.

Due to the patented, voltage control system 'VCS' and 'ASB' the FISCHER PANDA generators are able to fulfill the highest demands with regards to voltage stability and starting performance.

A water-cooled PANDA generator produces up to 15% more effective output with the same driving motor than the majority of conventional generators. This efficiency superiority also produces a fuel saving at the same ratio. Various versions of the 100% watercooled PANDA gensets are currently produced in a performance range from 2 to 100kW.

Fast running motors are preferred for the performance range up to approx. 30kW (nominal speed 3000 rpm). Heavier slow runners are preferred for the higher performance range. Especially the fast running aggregates have proved, during many thousands of applications that they are able to meet the requirements of yachts and vehicles, and enable a saving of up to 50% in weight and space in comparison to slow running generators.

ICEMASTER also supply the super compact high-tech battery charging genset from the sound insulated PANDA AGT series, in addition to the PANDA series, which proves to be an interesting alternative solution for generating power in the mobile range.

The new HTG alternator guarantees a charge rate of 285A, which until now has scarcely been attainable in this compact form. This alternator replaces a separate on-board generator (230V AC up to 3500W from the main machine in constant use).

All rights concerning text and illustrations of this publication are reserved by ICEMASTER GmbH, 33104 Paderborn. The details, thereof, were given to the best of their knowledge. No liability is accepted for the correctness of this publication. It must be explicitly pointed out that technical alterations or improvements to the product may ensue at any time without prior notice. Before each installation it must be ensured that the illustrations, descriptions and drawings match the supplied genset. The supplier must be contacted in case of doubt.

Safety first

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.



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



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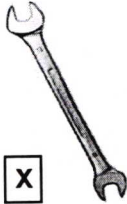





This warning symbol draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in damage or destruction of equipment, severe personal injury or loss of life.



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

Tools

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

	<p>Spanners X = number of spanner</p>
	<p>Hook wrench for oil filter</p>
	<p>Screw driver, for slotted head screws and for recessed head screws</p>
	<p>Multimeter, multimeter with capacitor measuring</p>
	<p>Socket wrench set</p>
	<p>Hexagon wrench keys</p>

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.



Attention, important advice for the operation!

1. During the operation the starting-in protocoll is to be filled and must be certified by signature.
2. The starting-in protocoll has to be send to ICEMASTER within two weeks after the starting-in date.
3. After receipt of the starting-in protocoll ICEMASTER will issue a gurantee confirmation and send it to the custo-mer.

If the above conditions are not carried through ore only some parts of them, there will be no warranty claim against ICEMASTER.

Manufacturer declaration in terms of the machine guideline 98/37/EG.

The generator is in such a way developed that all assembly groups correspond to the CE guidelines. If machine guideline 98/37/EG is applicable, then it is forbidden to bring the generator into operation until it has been determined that the system into which the generator is to be installed in also corresponds to the regulations of the machine guideline 98/37/EG. This concerns among other things the exhaust system, cooling system and the electrical installation.

The evaluation of the "protection against contact" can only be accomplished in connection with the respective system. Likewise among other things responsibility for correct electrical connections, a safe ground wire connection, foreign body and humidity protection, protection against humidity due to excessive condensation as well as the over-heating through appropriate and inappropriate use in its installed state on the respective machine lies within the responsibility of those who undertake installation of the generator in the system.

Use the advantages of the customer registration:

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

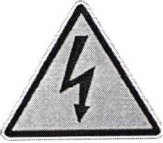
Far advantages:

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

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

Technical Support by Internet: info@fischerpanda.de

Safety Precautions



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

- By working at the electrical system of the generator the battery must be disconnected to avoid an unintentional start of the generator.
- All contacts must be carefully checked for correctly and right installation (expansion compensation, control if all washer are present, etc.).
- After the installation or an maintenance or repair every contacts must be checked about heat bridges.
- The contacts must be keep free from combustible materials to avoid the arise of a crossover resistance that will be affect the operation of the generator.

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

The rotating parts (belt-pulley, belts, etc) must be so covered and protected do that there is no danger to life and body!

If a sound insulation covering must 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.

Protective Conductor:

The generator is „earthed " as standard (The centre and earth are connected by means of a bridge in the generator terminal box). This is a basic safety function, which offers basic safety as long as no other component has been installed. It is, above all, conceived for supply and an eventual test run.

This "earth" (PEN) is only effective, if all parts of the electrical system is earthed, and has a common "potential". The bridges can be removed, if this is required for technical reasons and another protection system has been installed.

The full voltage is exploited at the AC-control box, when the generator is run. It must therefore be ensured that the control box is closed and cannot be tampered with, if 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.

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, 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.

GROUND THE EQUIPMENT.

To minimize possibility of electric shock, the equipment chassis and electrical cabinet must be properly earthed. Power output cables connecting the equipment must be installed correctly and the locking mechanisms fully engaged.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate electrical or electronic equipment in the presence of flammable gases or fumes. Operation of any electrical system in such an environment presents a safety hazard.

RESPECT LIVE COMPONENTS.

Only qualified maintenance personnel may make module or component replacement and carry out internal adjustments.

USE ONLY APPROVED REPLACEMENT COMPONENTS.

Non-approved components or equipment must not be installed or connected. The system must not be modified in any manner.

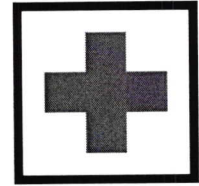
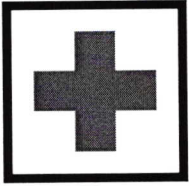
DO NOT DISCONNECT OR CONNECT CABLES BEFORE SWITCHING OFF PRIMARY POWER FROM THE SYSTEM.

To prevent the creation of high-level transient voltages when a connection is made or broken, primary power must be switched off before connecting or disconnecting cables.

BEWARE OF HOT EXHAUST.

Exhaust gas temperatures may reach 300°C and steel exhaust connections will become hotter than that. Ensure the exhaust extension is not positioned too close to dry grass and that combustible material is kept well clear of exhaust pipes and gases.

Be sure that all electrical installations (including all safety systems) comply with all required regulations of the regional authorities. This includes lightning conductor, personal protection switch etc. The electrical links must be absolutely shifted and executed after the valid Regulations in each case. This applies also to the used cable materials. The provided cables are certified only for a "protected" transfer (e.g. in the pipe) at a temperature up to max. 70°C (160°F). The electrical system must be likewise equipped with all necessary protections.



5 Safety steps to follow if someone is the victim of electrical shock



Do not try to pull or grab the individual.



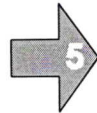
Send for help as soon as possible.



If possible, turn off the electrical power.



If you cannot turn off the electrical power, pull, push, or lift the person to safety using a wooden pole, rope, or some nonconductive material.



After the injured person is free of contact with the source of electrical shock, move them a short distance away and immediately start necessary first aid procedures.

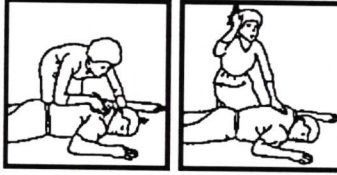
WHEN AN ADULT STOPS BREATHING

WARNING

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

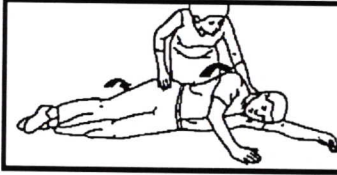
1 Does the Person Respond?

- Tap or gently shake victim.
- Shout, "Are you OK?"



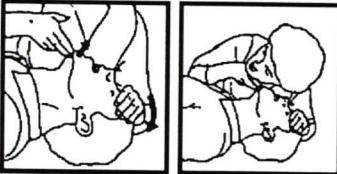
3 Roll Person onto Back.

- Roll victim toward you by pulling slowly.



4 Open Airway.

- Tilt head back, and lift chin.
- Shout, "Are you OK?"



6 Give 2 Full Breaths.

- Keep head tilted back.
- Pinch nose shut.
- Seal your lips tight around victim's mouth.
- Give 2 full breaths for 1 to 1½ seconds each.



7 Check for Pulse at side of Neck.

- Feel for pulse for 5 to 10 seconds.



9 Begin Rescue Breathing.

- Keep head tilted back.
- Lift chin.
- Pinch nose shut.
- Give 1 full breath every 5 seconds.
- Look, listen, and feel for breathing between breaths.



2 Shout, "Help!"

- Call people who can phone for help.

5 Check for Breathing.

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

8 Phone EMS for Help.

- Send someone to call an ambulance.

10 Recheck Pulse Every Minute.

- Keep head tilted back.
- Feel for pulse for 5 to 10 seconds.
- If victim has pulse, not breathing, continue rescue breathing. If no pulse, begin CPR.

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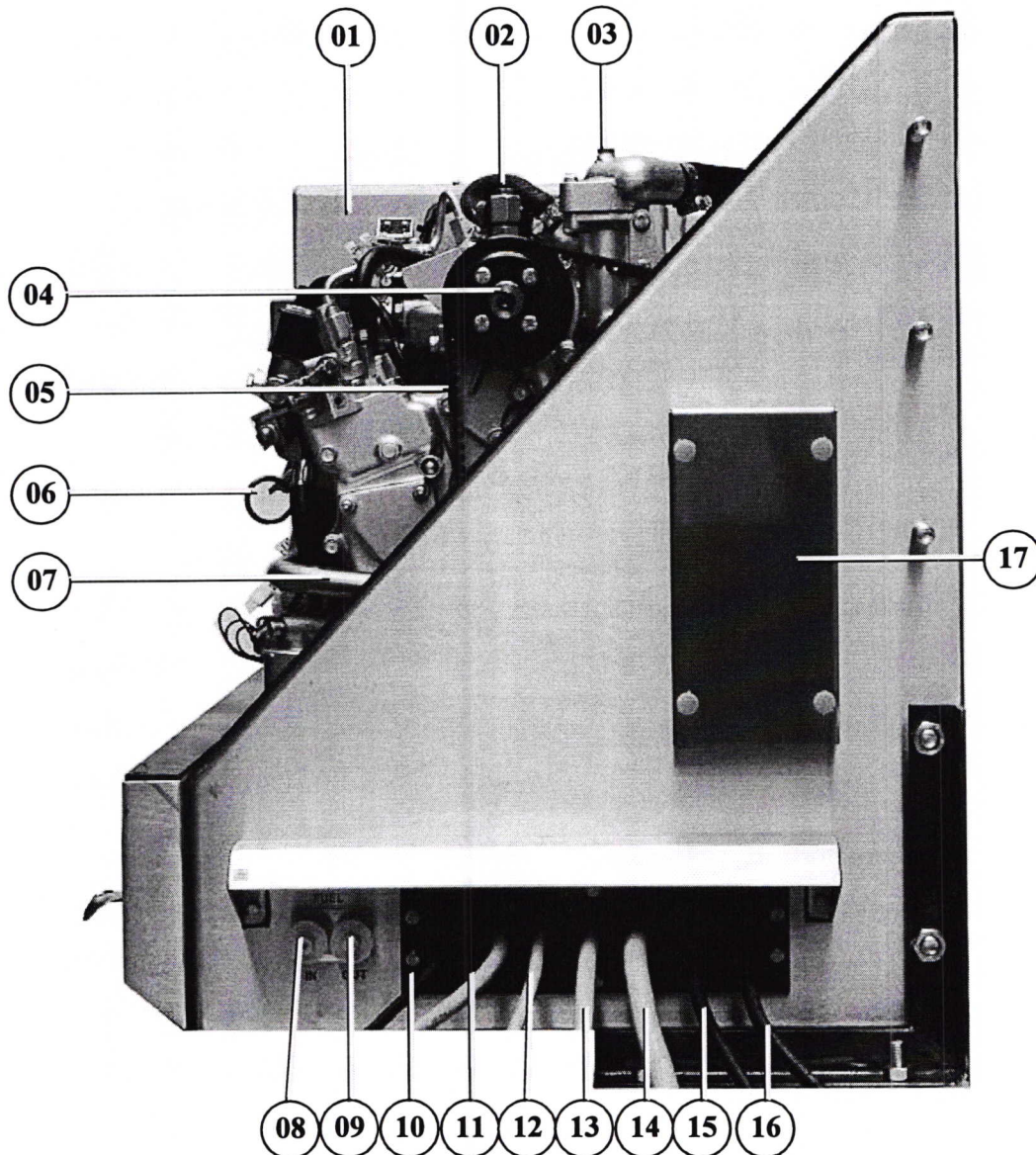
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A. The Panda Generator

A.1 Component Location and Identification

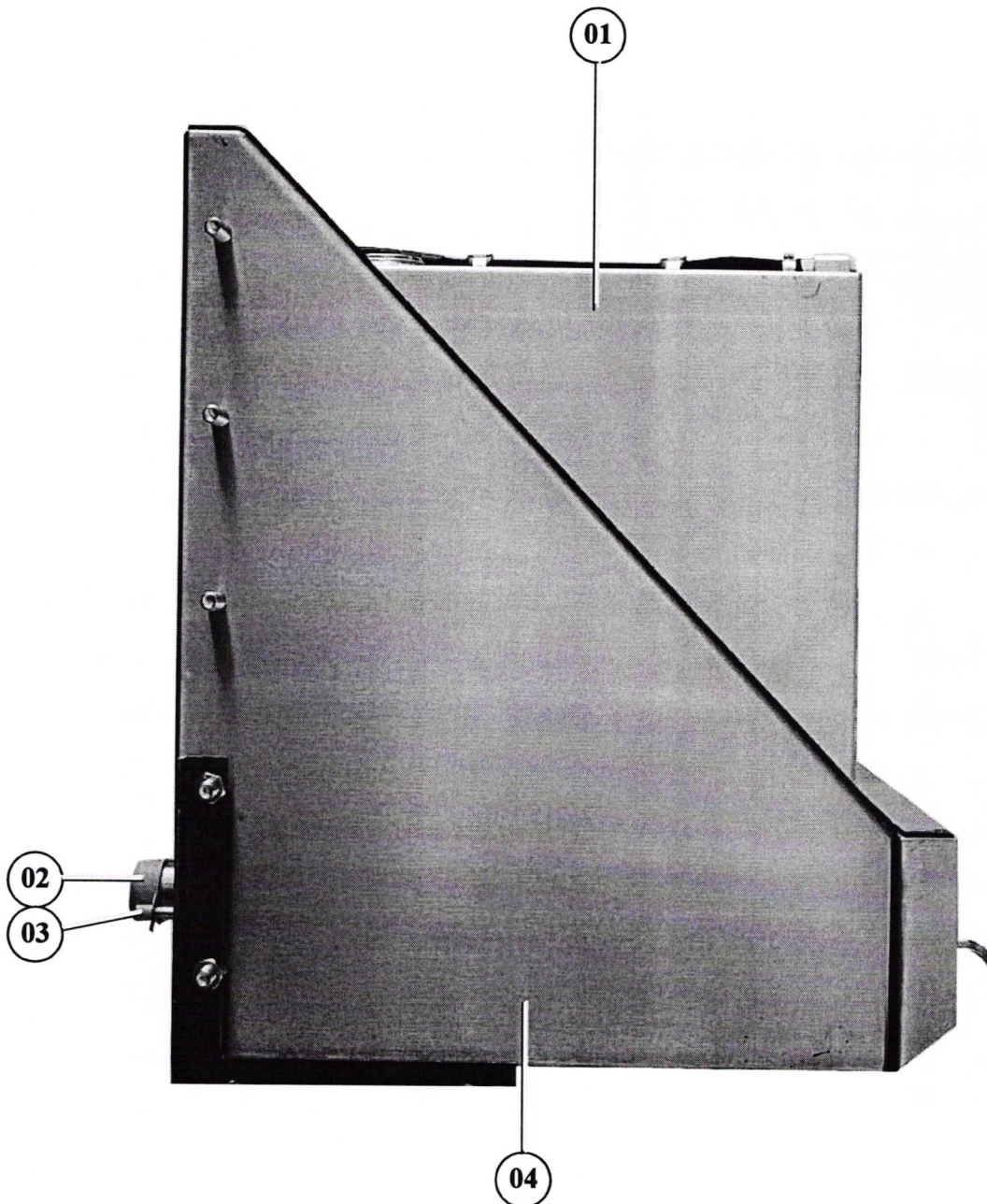
A.1.1 Right side view



- 01. Air suction housing with air filter
- 02. Ventilation screw water pump
- 03. Ventilation screw thermostat housing
- 04. Pulley for internal water pump
- 05. V-belt
- 06. Oil dipstick
- 07. Cooling water pipe to water pump
- 08. Fuel in
- 09. Fuel out

- 10. Cable for fuel pump
- 11. Cable for remote control panel
- 12. Cable for VCS
- 13. Cable for AC-Control box
- 14. Cable for load
- 15. Cable starter battery minus (-)
- 16. Cable starter battery plus (+)
- 17. Air suction intake

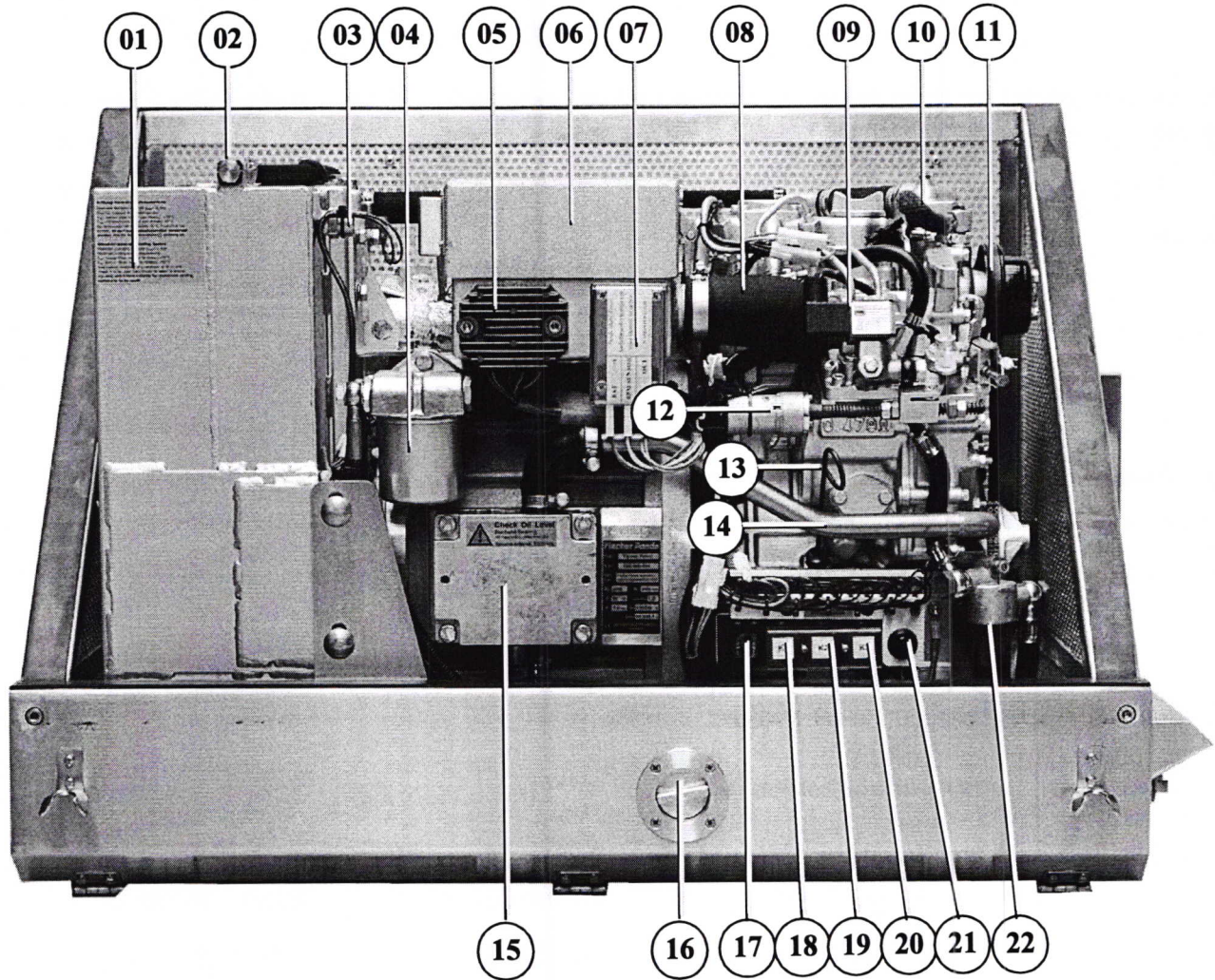
A.1.2 Left side view



01. Water-cooled silencer
02. Exhaust outlet

03. Connection external expansion tank
04. Sound cover

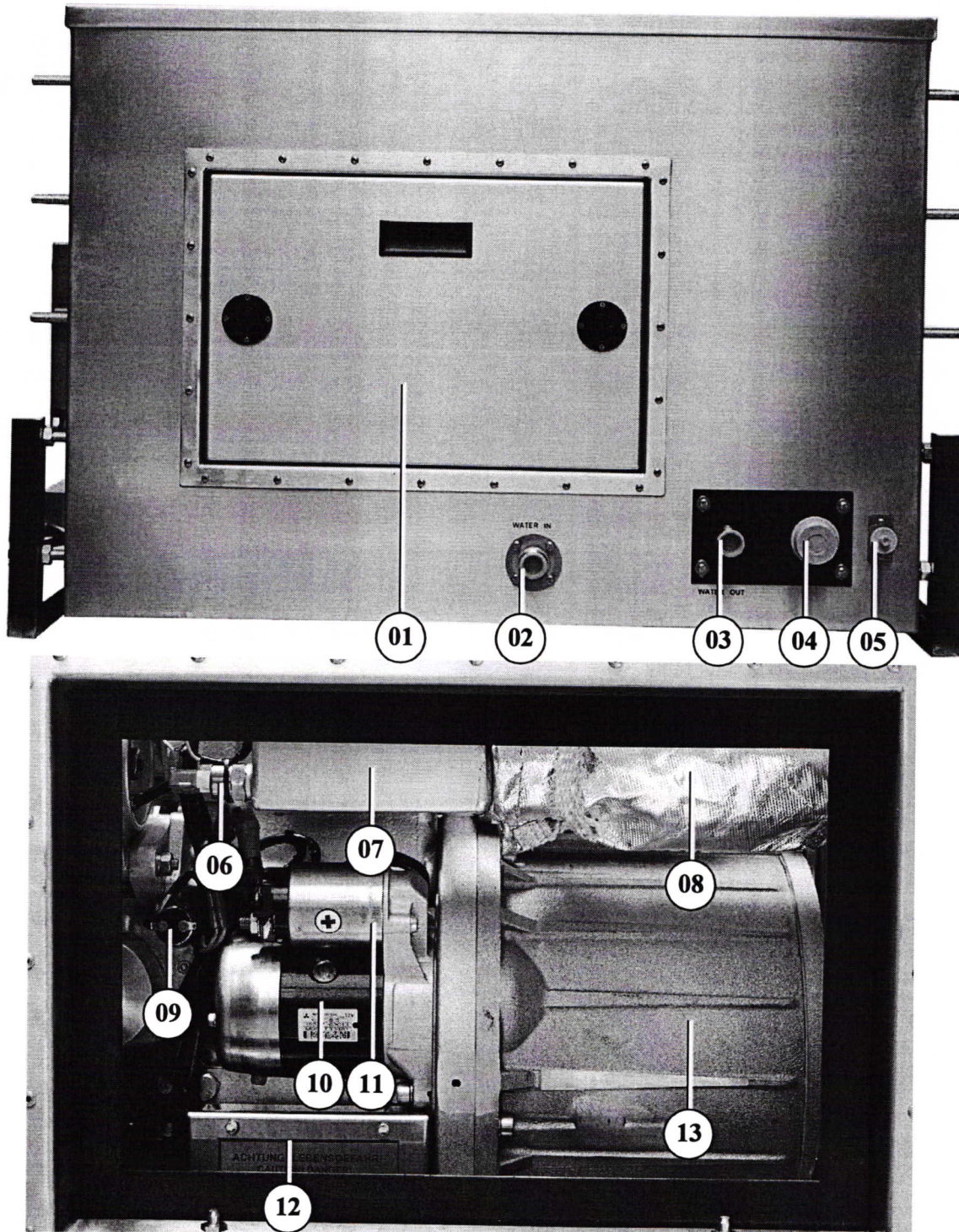
A.1.3 Front view



- 01. Water-cooled silencer
- 02. Ventilation screw silencer
- 03. Thermo-switch silencer
- 04. Oil filter
- 05. Charge controller for DC-alternator
- 06. Air suction housing with air filter
- 07. Electronic starter control unit
- 08. Air suction hose, housing - induction elbow
- 09. Fuel solenoid valve
- 10. Thermostat housing
- 11. Pulley for internal water pump

- 12. Actuator
- 13. Oil dipstick
- 14. Cooling water pipe to water pump
- 15. Cooling water connection block
- 16. Oil drain hose
- 17. Electrical fuses (blue=15A; white=25A)
- 18. Ks relay for starter motor
- 19. K2 relay for glow plugs
- 20. K3 relay for fuel pump
- 21. Failure bypass switch
- 22. Fuel filter

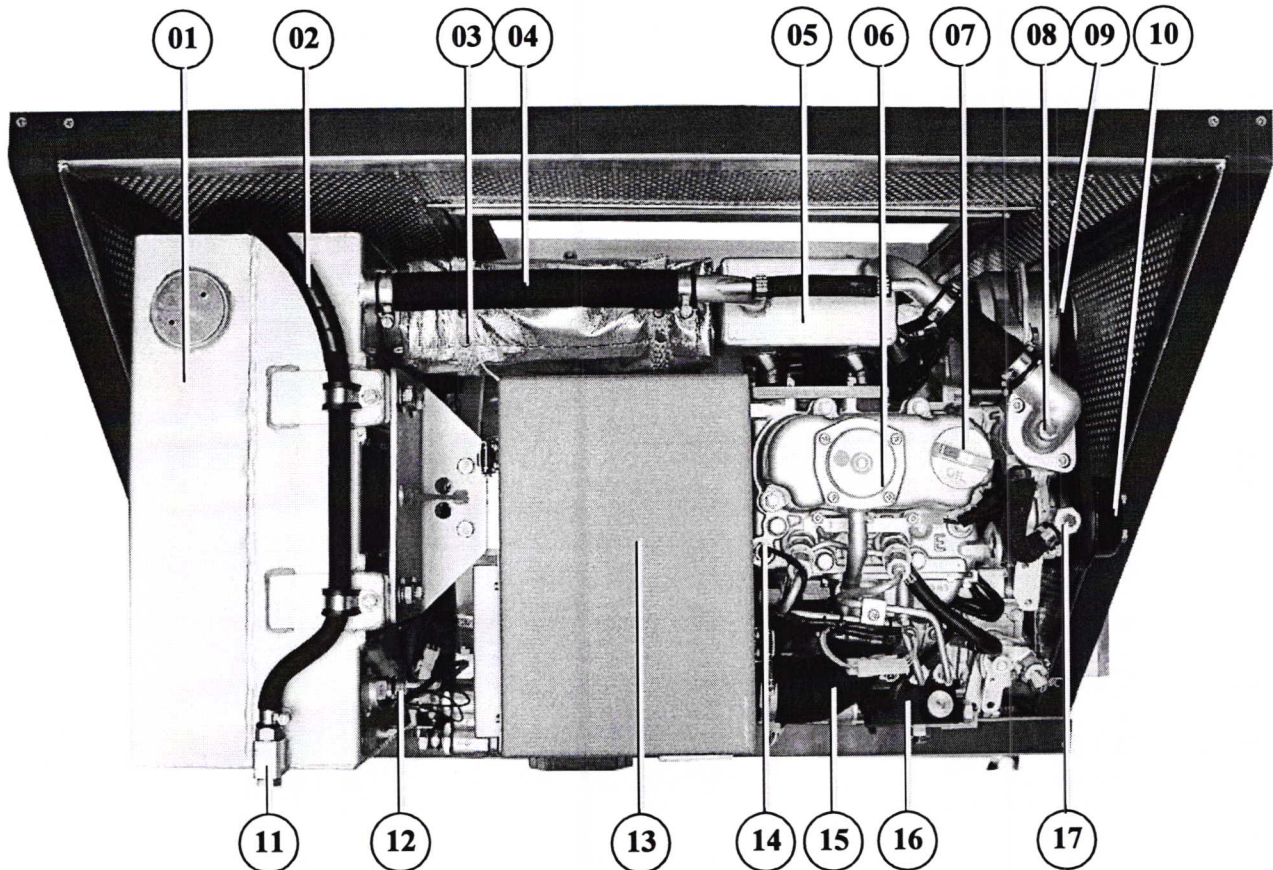
A.1.4 Back view



- 01. Inspection luke
- 02. Connection cooling water in
- 03. Connection cooling water out
- 04. Exhaust output
- 05. Connection external expansion tank
- 06. Thermo-switch exhaust elbow
- 07. Water-cooled exhaust elbow

- 08. Compensator under heat isolation
- 09. Oil pressure switch
- 10. Stator motor
- 11. Solenoid for starter motor
- 12. Power terminal box
- 13. Generator housing with coil

A.1.5 View from above



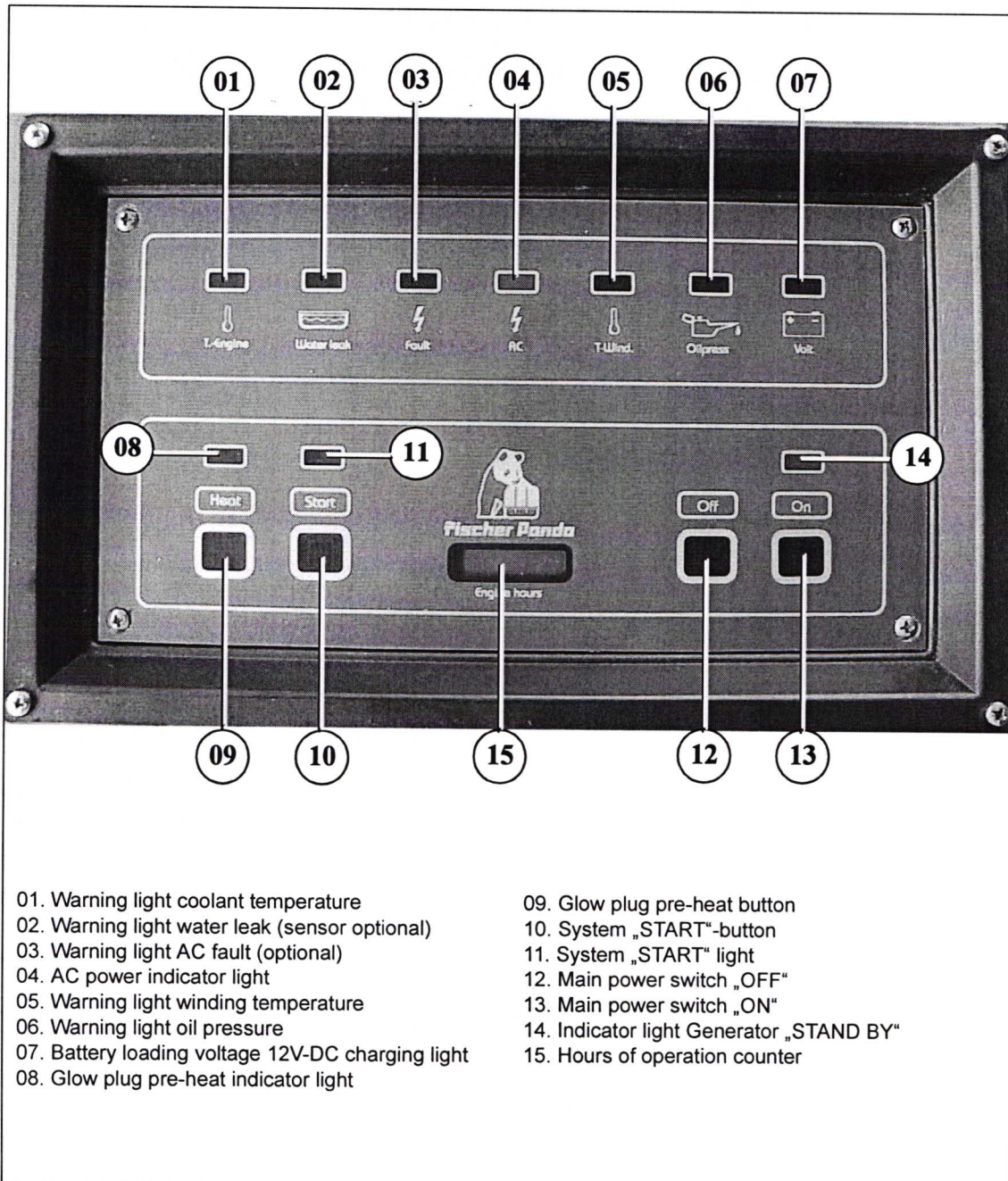
- 01. Water-cooled silencer
- 02. Cooling water ventilation hose
- 03. Compensator under heat isolation
- 04. Cooling water hose
- 05. Water-cooled exhaust elbow
- 06. Valve cover
- 07. Oil filler neck
- 08. Ventilation screw thermostat housing
- 09. DC-alternator

- 10. Pulley for internal water pump
- 11. Ventilation screw silencer
- 12. Thermo-switch silencer
- 13. Air suction housing with air filter
- 14. Thermo-switch cylinder head
- 15. Air suction hose, housing - induction elbow
- 16. Fuel solenoid valve
- 17. Ventilation screw

A.2 Details of functional units

A.2.1 Remote control panel

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



- | | |
|---|--|
| 01. Warning light coolant temperature | 09. Glow plug pre-heat button |
| 02. Warning light water leak (sensor optional) | 10. System „START“-button |
| 03. Warning light AC fault (optional) | 11. System „START“ light |
| 04. AC power indicator light | 12. Main power switch „OFF“ |
| 05. Warning light winding temperature | 13. Main power switch „ON“ |
| 06. Warning light oil pressure | 14. Indicator light Generator „STAND BY“ |
| 07. Battery loading voltage 12V-DC charging light | 15. Hours of operation counter |
| 08. Glow plug pre-heat indicator light | |

Fig. A.1: Remote Control Panel

A.2.2 Components of Coolant system (Freshwater)

Coolant intake

This port is to be connected with the external radiator. From here the cold coolant flows to the coolant connection block.

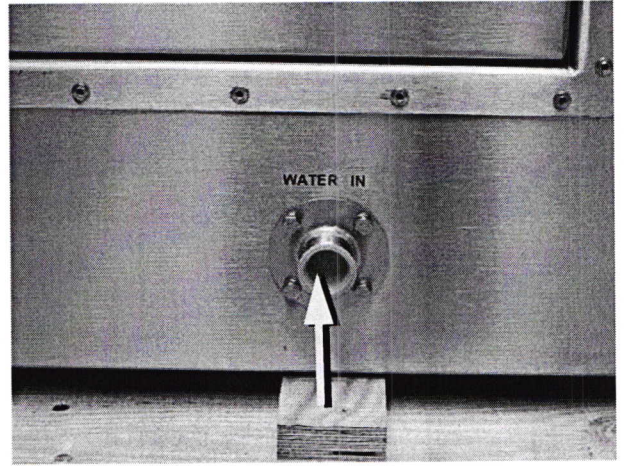


Fig. A.2: Coolant intake

Cooling water connection block

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

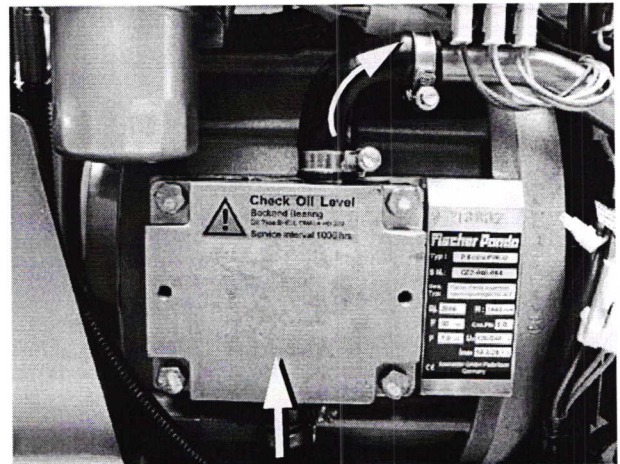


Fig. A.3: Cooling water connection block

Cooling water pipe

From the cooling water connection block the water leads to the internal cooling water pump.

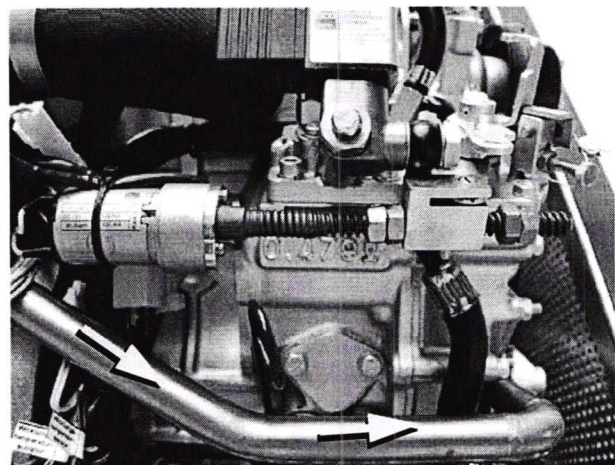
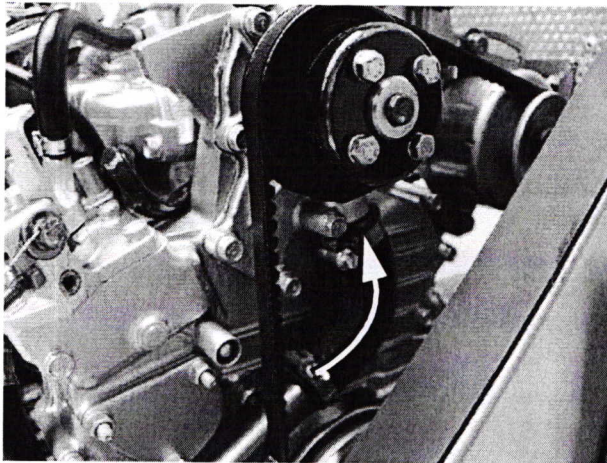
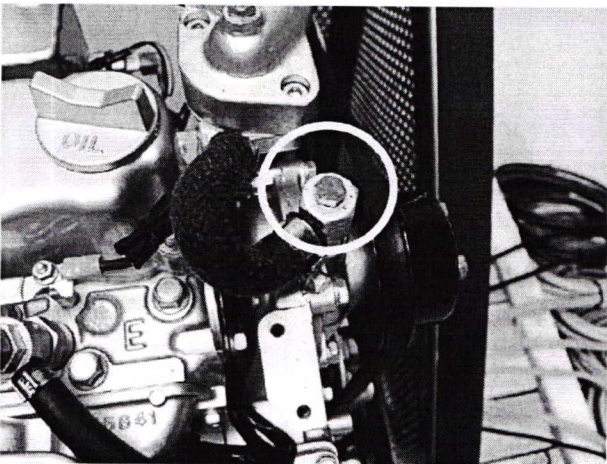


Fig. A.4: Cooling water pipe

**Internal cooling water pump**

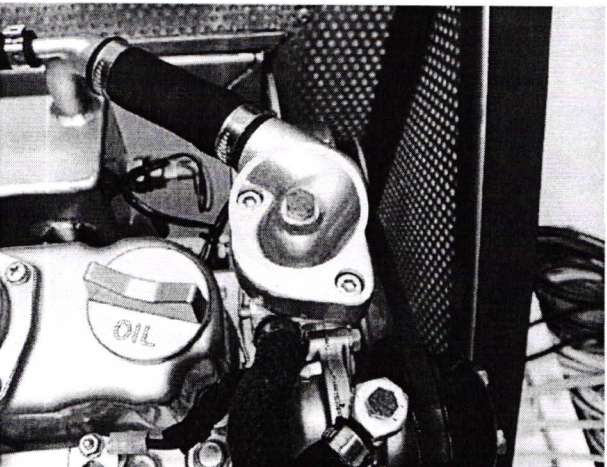
The diesel motor cooling water pump (see arrow) aids the circulation of the internal freshwater system.

Fig. A.5: 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. A.6: Ventilation screw water pump

**Ventilation screw thermostat housing**

This ventilation screw must be opened at the ventilation procedure of the cooling system. The ventilation screw may not be opened, while the generator runs. If this happens inadvertently, by the opening air sucked in. Thereafter a very complex ventilation of the entire system is necessary.

Fig. A.7: Ventilation screw thermostat housing

Water-cooled exhaust elbow

The exhaust elbow is cooled by means of the internal cooling system.

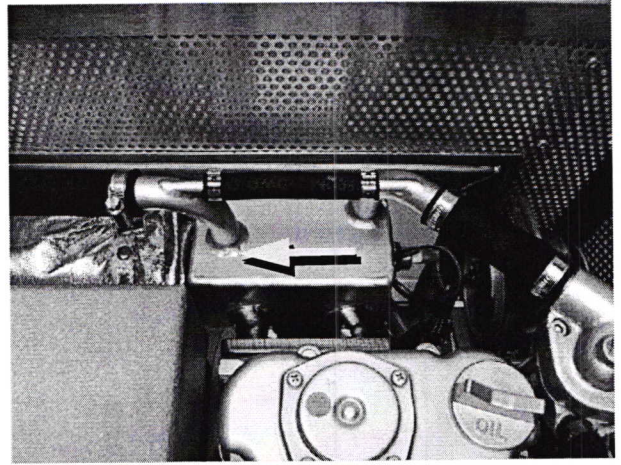


Fig. A.8: Water-cooled exhaust elbow

Cooling water pipe

The cooling water gets out down at the engine and is led to the water-cooled exhaust elbow.

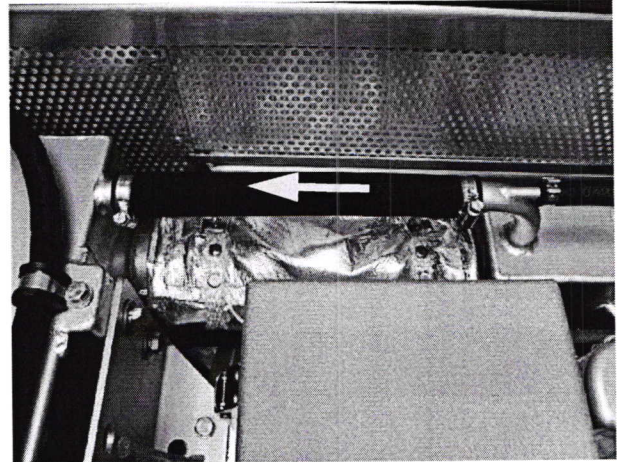


Fig. A.9: Cooling water pipe

Water-cooled silencer

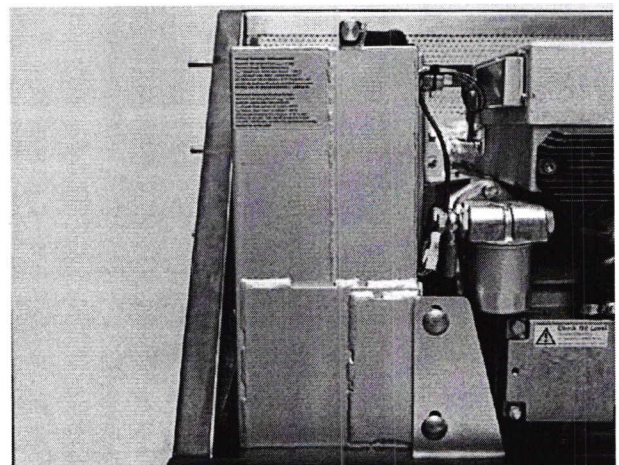
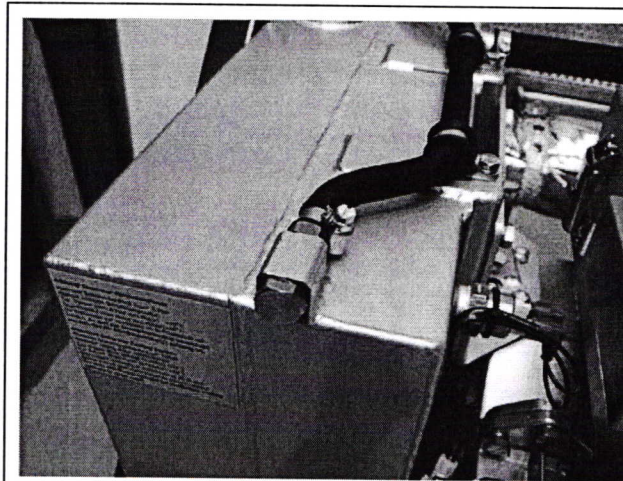
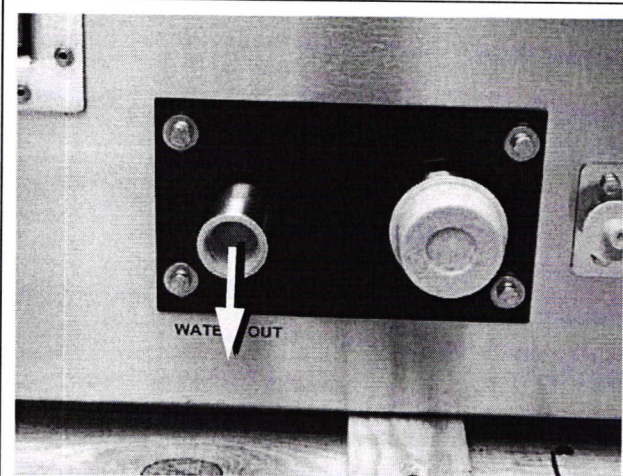


Fig. A.10: Water-cooled silencer

**Ventilation screw silencer**

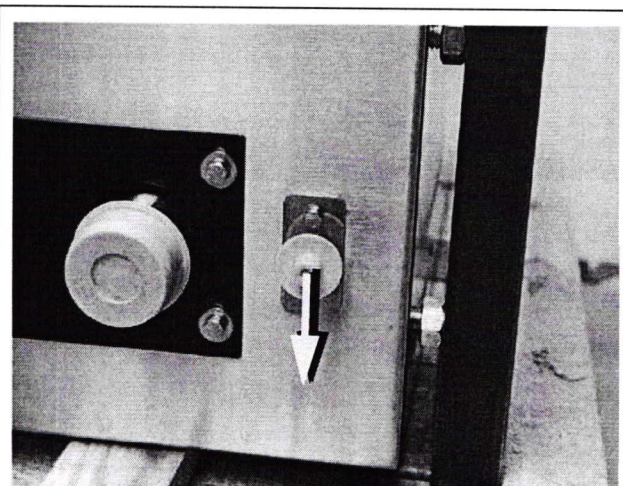
The de-aerating screw at the water-cooled pre-silencer is used at first time filling or after repair work.

Fig. A.11: Ventilation screw silencer

**Coolant out**

From here the cooling water heated up flows into the radiator.

Fig. A.12: Coolant out

**Ventilation flow expansion tank**

The breather pipe at the water-cooled pre-silencer leads to the external expansion tank.

Fig. A.13: Ventilation flow

A.2.3 Components of fuel system

Electrical fuel pump

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

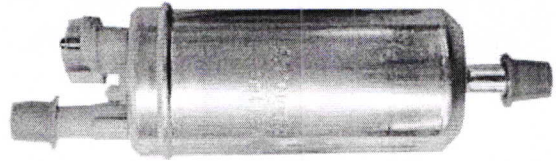


Fig. A.14: Electrical fuel pump

Connecting pieces for the fuel pipe

1. Fuel intake
2. Fuel backflow

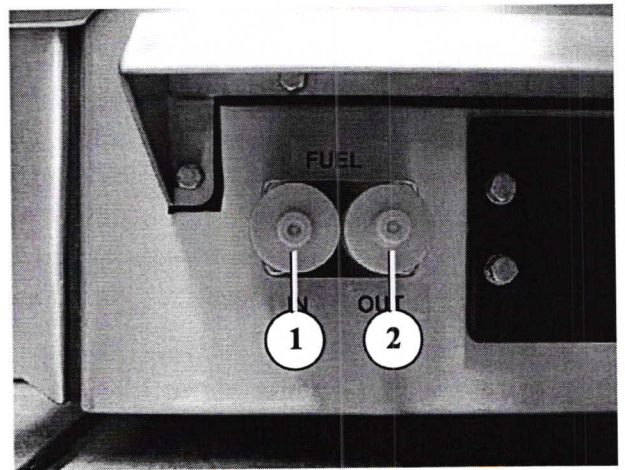


Fig. A.15: Fuel connections

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.

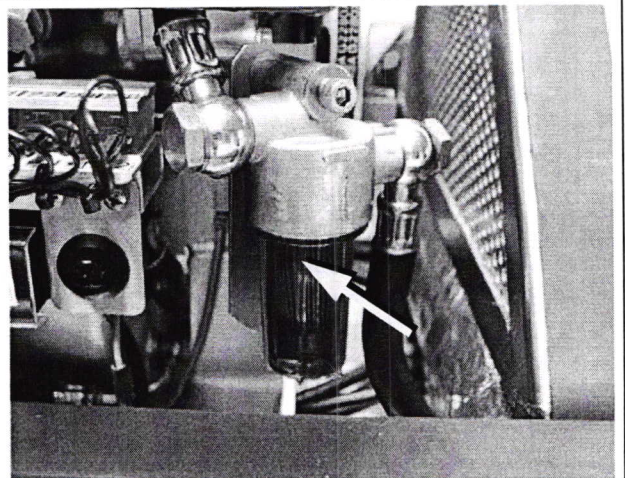
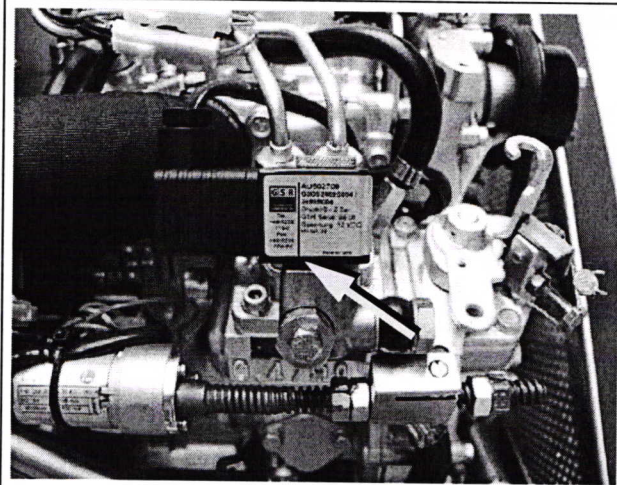
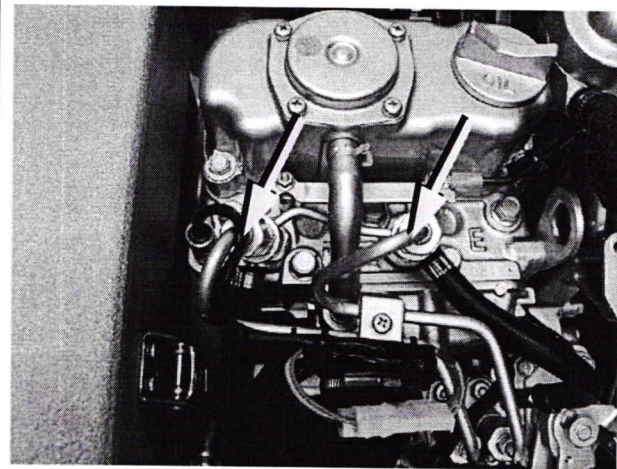


Fig. A.16: Fuel filter



Fuel solenoid valve

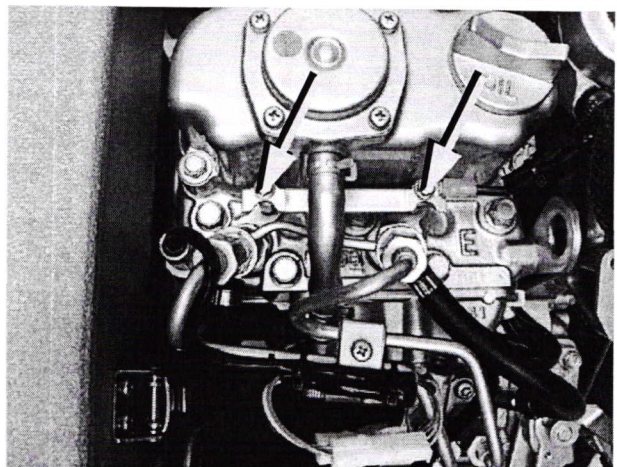
Fig. A.17: Fuel solenoid valve



Injection nozzles

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

Fig. A.18: Injection nozzles



Glow plugs

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

Fig. A.19: Glow plugs

A.2.4 Components of Combustion air

Combustion air intake (back side)

The sound cover top is provided at the 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 the combustion air intake is not covered.

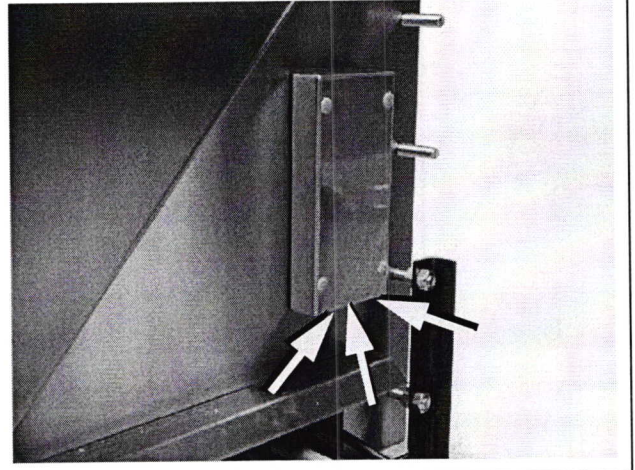


Fig. A.20: Combustion air intake (back side)

Air suction housing

The air suction housing sucks in fresh air from the sound cover.

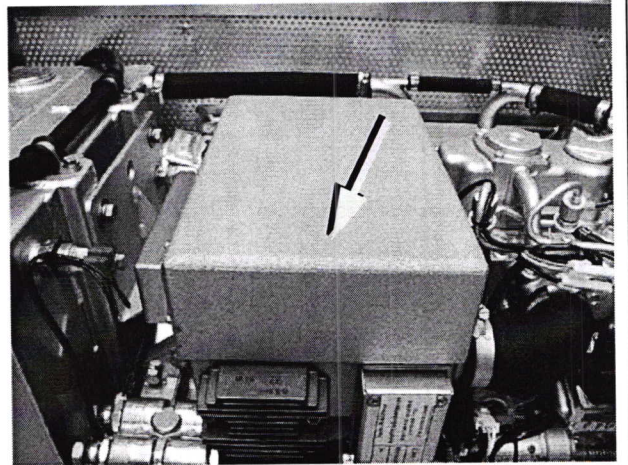


Fig. A.21: Air suction housing

Air suction housing with air filter

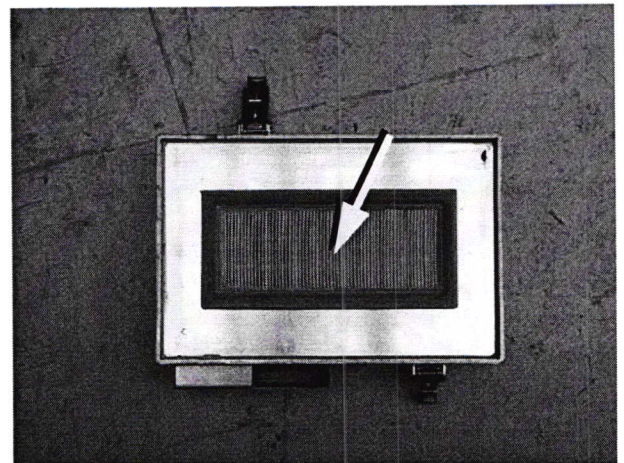


Fig. A.22: Air filter

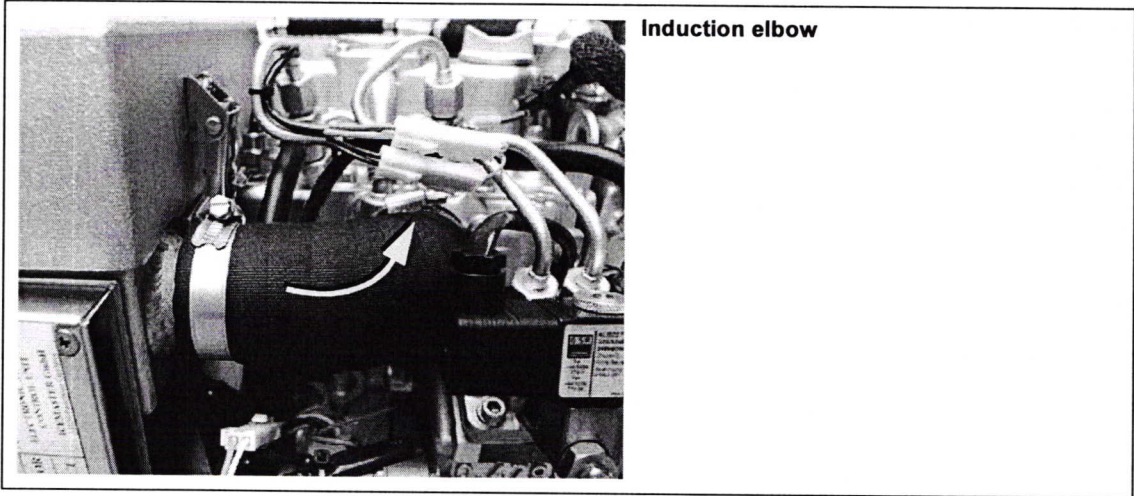


Fig. A.23: Induction elbow

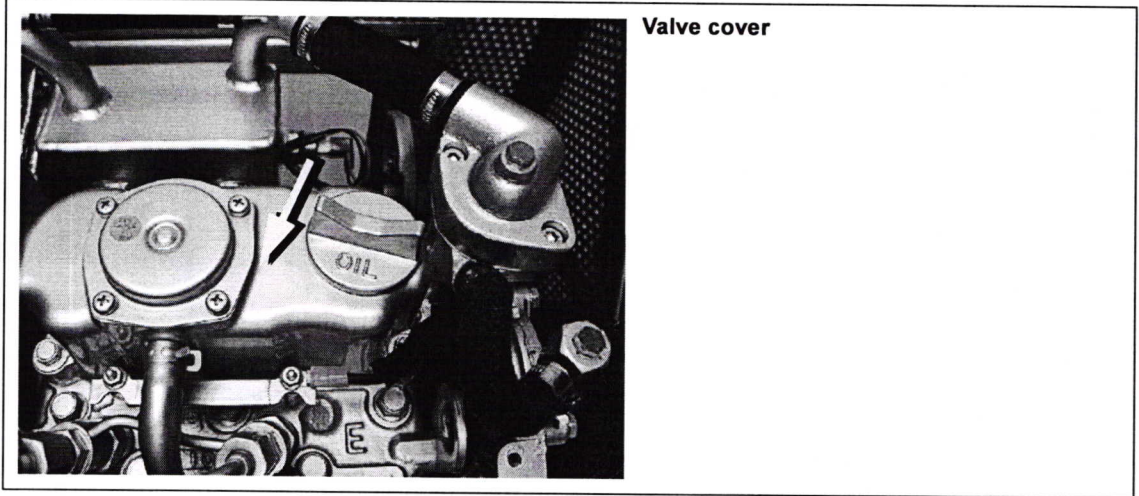


Fig. A.24: Valve cover

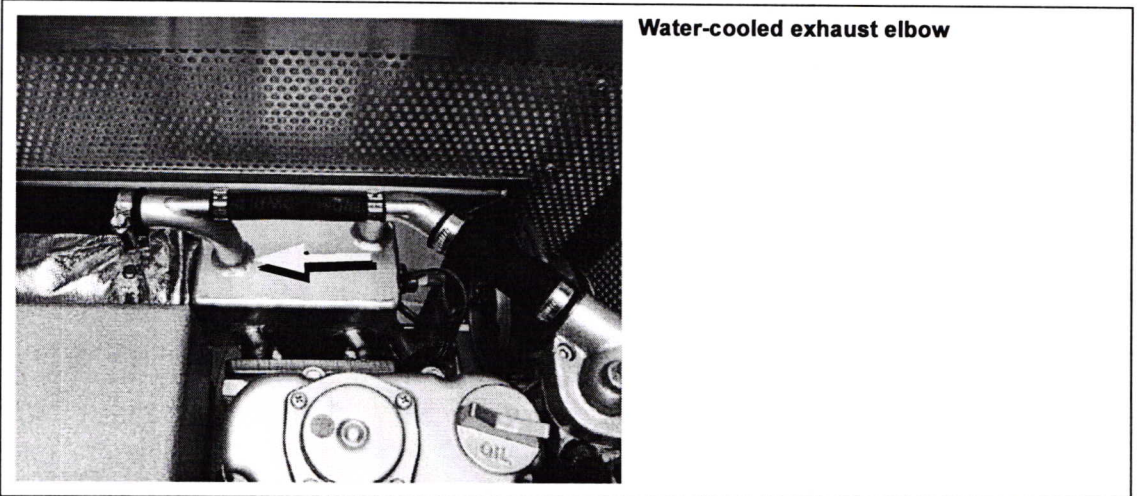


Fig. A.25: Water-cooled exhaust elbow

Compensator

This part is flexible by the internal structure and compensates vibrations.

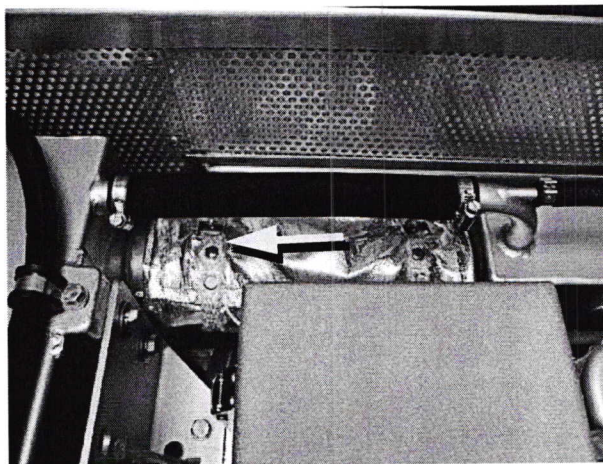


Fig. A.26: Compensator

Water-cooled silencer

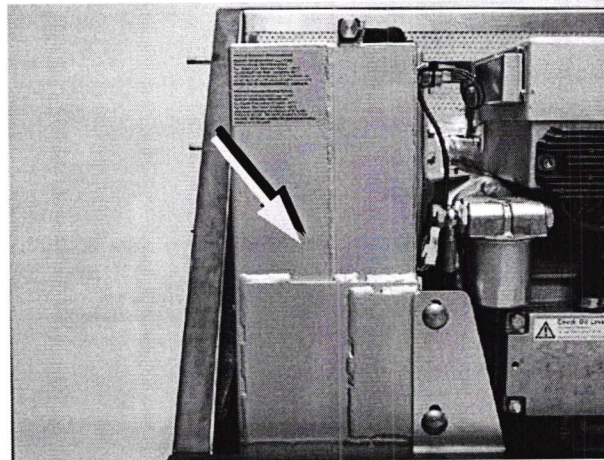


Fig. A.27: Water-cooled silencer

Exhaust outlet

The pre-silencer must be attached here.

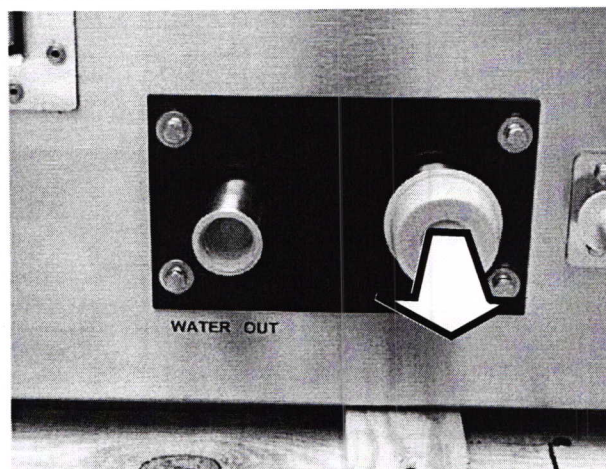


Fig. A.28: Exhaust outlet

A.2.5 Components of electrical system

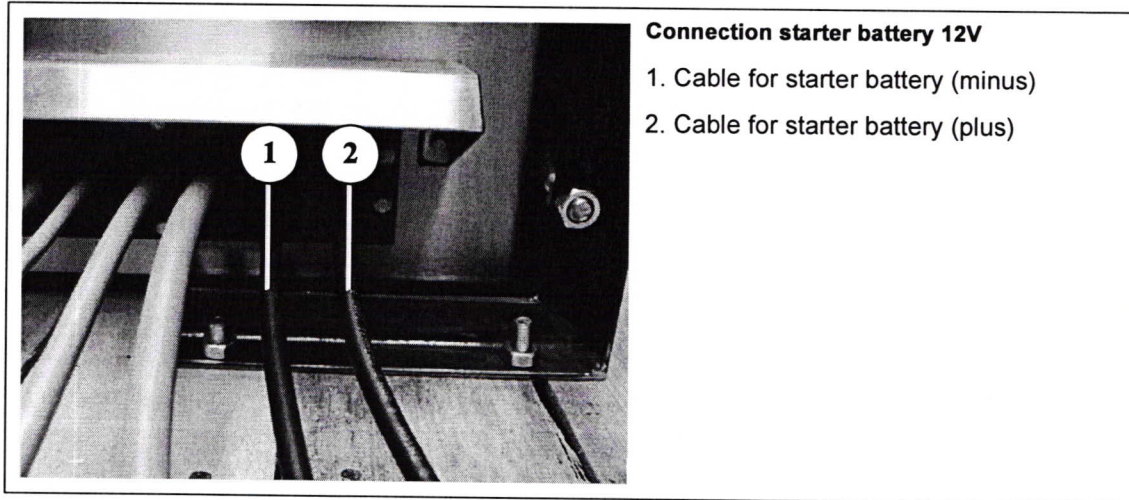


Fig. A.29: Cable for starter battery 12V

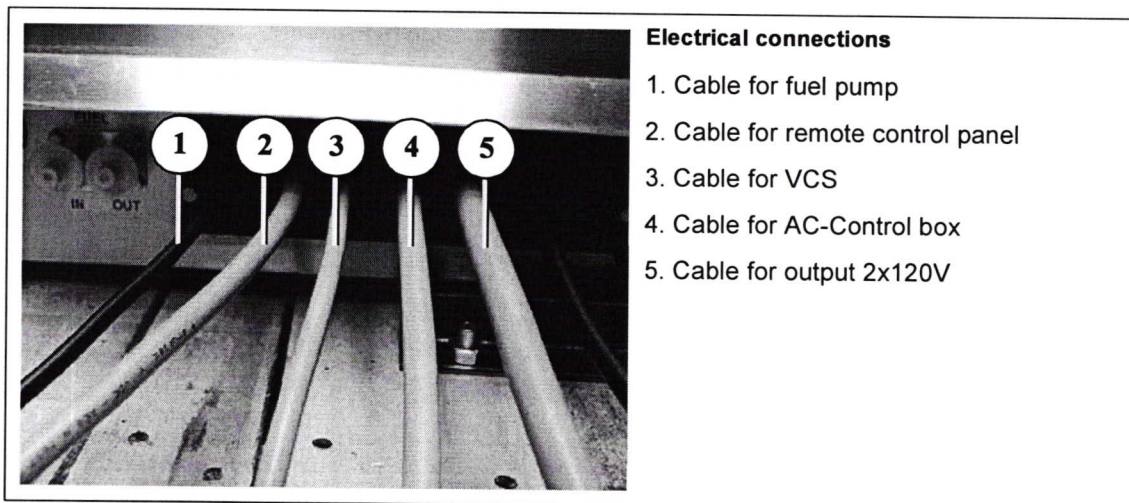


Fig. A.30: Electrical connections

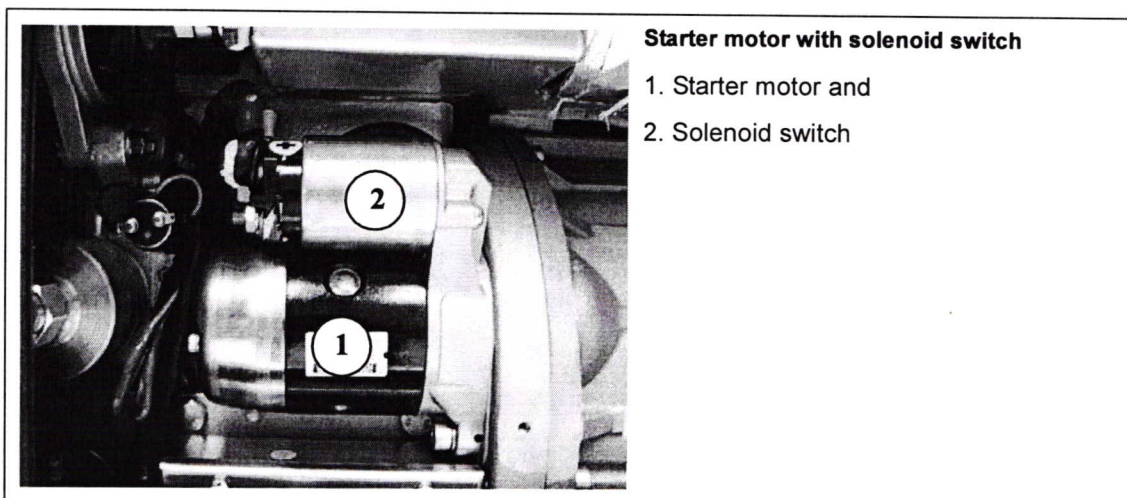


Fig. A.31: Starter motor

Actuator for rpm-regulation

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

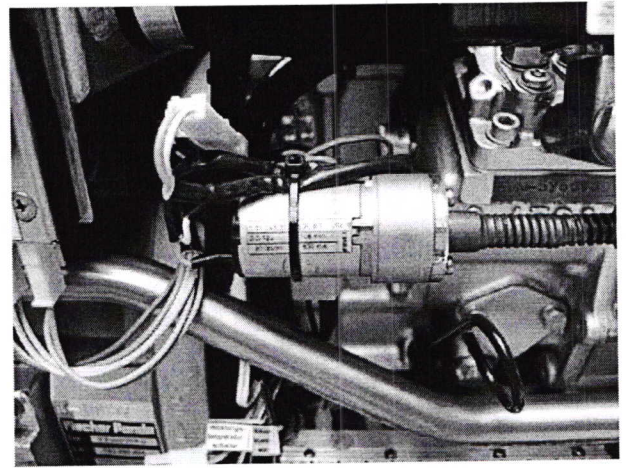


Fig. A.32: Actuator

Speed sensor

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. At other models the opening for the speed sensor is locked by a plug.



Fig. A.33: Speed sensor

Electronic starter control unit

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

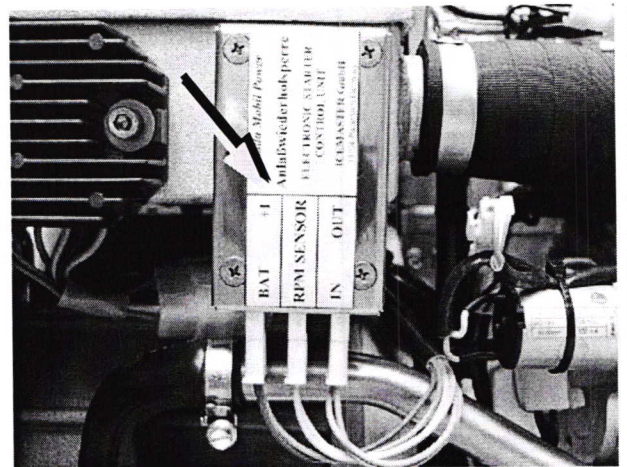
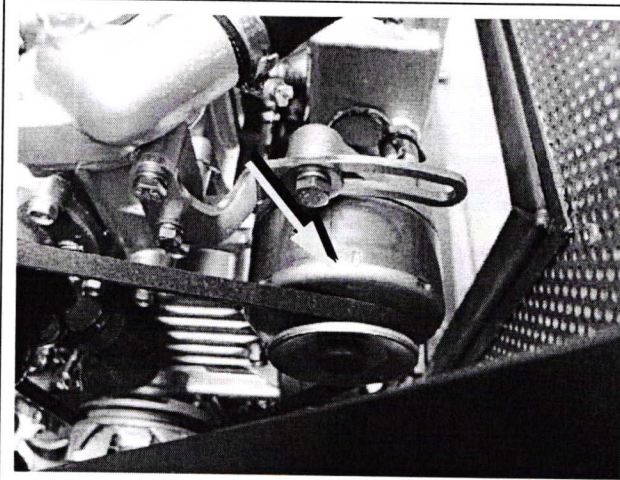


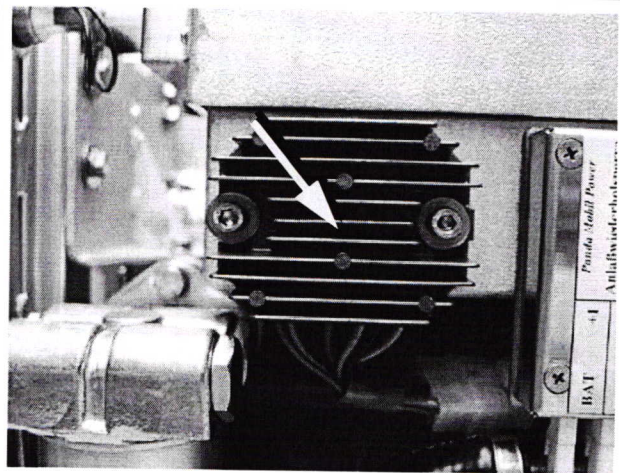
Fig. A.34: Electronic strter control unit



DC-alternator

All Panda generators from Panda 6.000 are provided with its own charge system for the 12V DC mains. This DC-alternator is powered over a v-belt together with the internal cooling water pump. The 12V charge system may be used only for the generator-own starter battery.

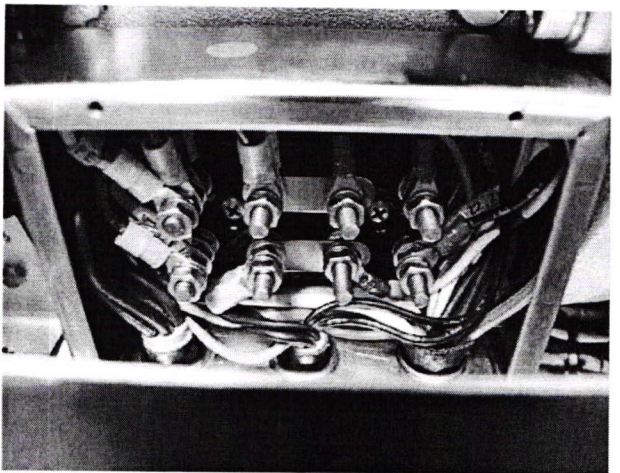
Fig. A.35: DC/alternator



Charge control for DC-alternator

The voltage regulator for the 12V DCalternator 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. A.36: Charge control for DC-alternator



Generator power terminal box

Fig. A.37: Generator power terminal box

**Terminal block for remote control cable
with fuse and power relais**

- F1 fuse 15A for DC wiring
- F2 fuse 25A for starter relay
- Ks power relay for Starter motor
- K2 power relay for Glow plugs
- K3 power relay for Fuel pump

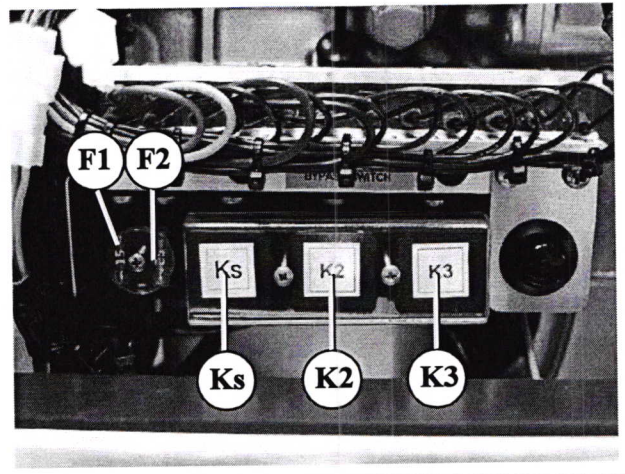


Fig. A.38: Terminal block

Failure bypass switch

1. Failure bypass switch

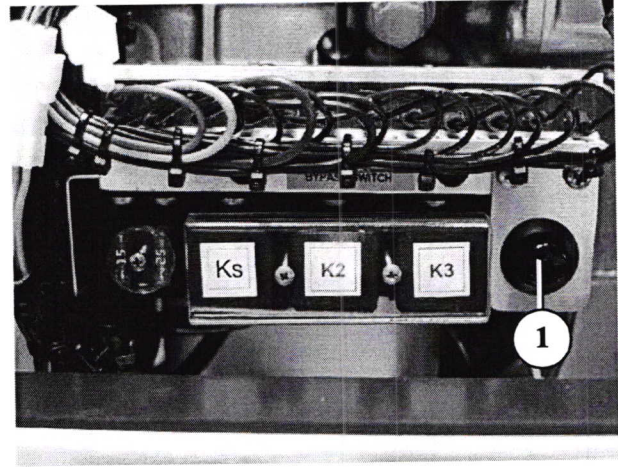
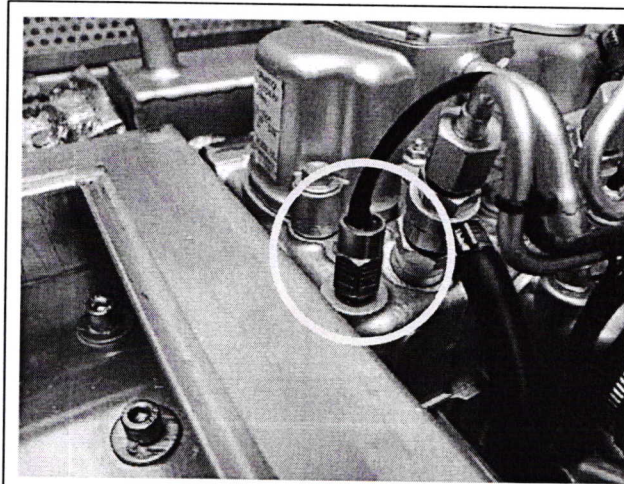


Fig. A.39: Failure bypass switch

A.2.6 Sensors and switches for operating surveillance



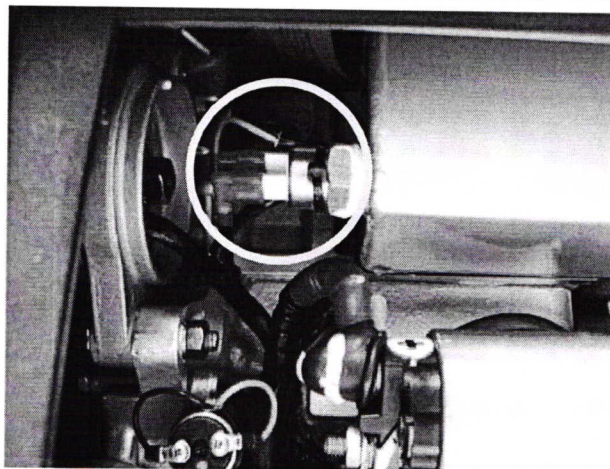
Thermo-switch at cylinder head

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

110°C

130°C

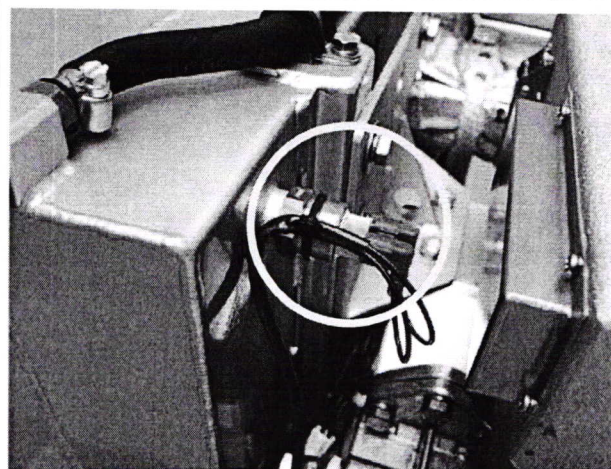
Fig. A.40: Thermo-switch cylinder head



Thermo-switch at water-cooled exhaust elbow

120°C/105°C

Fig. A.41: Thermo-switch at exhaust elbow



Thermo-switch at pre-silencer

At this point the coolant usually achieves its highest value. From here it flows back into the radiator.

105°C/90°C

Fig. A.42: Thermo-switch at water-cooled silencer

Coil thermo-switch

1. Generator winding
2. Thermo-switch winding 4x165/175°C
3. Generator 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.

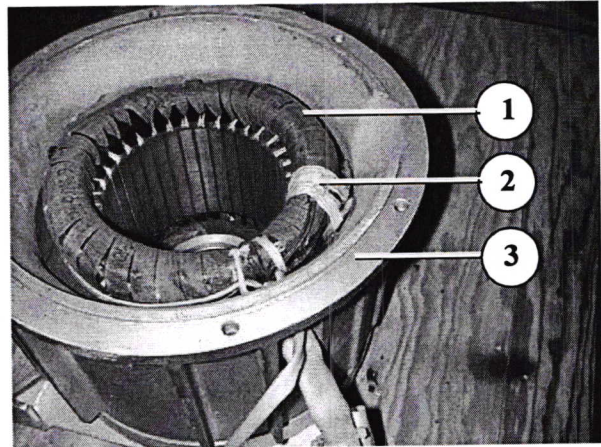


Fig. A.43: Coil thermo-switch

Thermo-switch at the backend bearing

The generator bearing is equipped with a thermo-switch, which switches the engine off if the oil temperature becomes to high. Also a NTC is installed in the backend bearing.

130°C

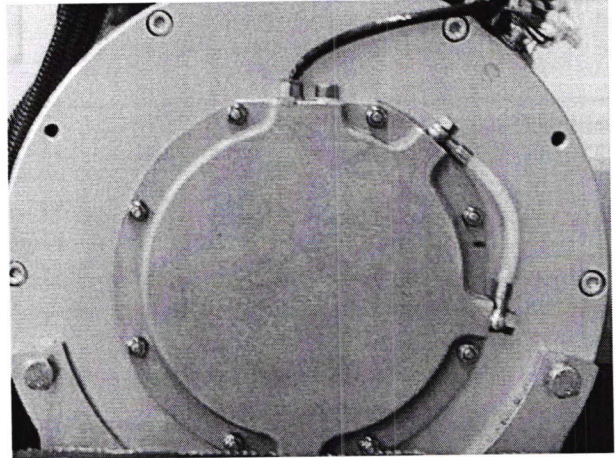


Fig. A.44: Thermo-switch backend bearing

Oil pressure switch at engine

In order to be able to monitor the lubricating oil system, an oil pressure switch is built into the system. The oil pressure switch is on the right side behind the starter motor of the engine.

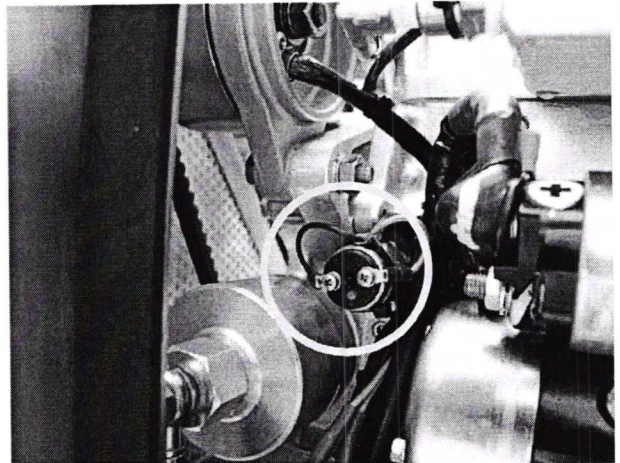
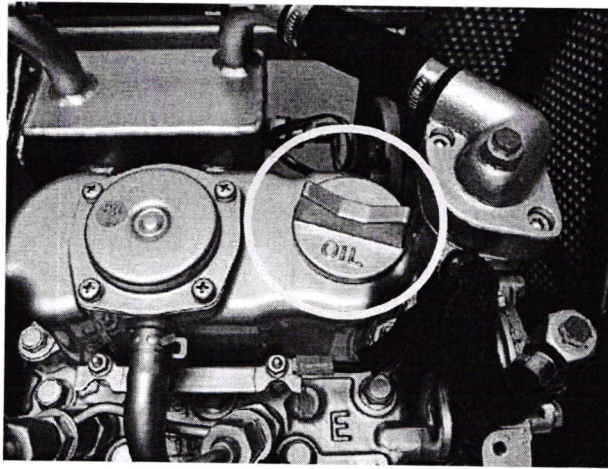


Fig. A.45: Oil pressure switch

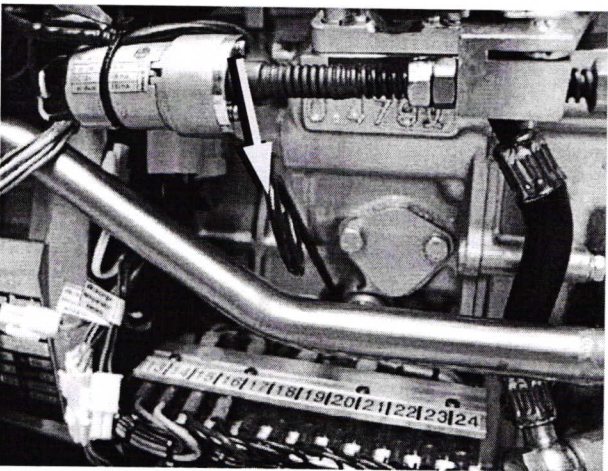
A.2.7 Components of oil circuit



Engine oil filler neck with cap

Normally the filler neck for the engine oil is on the top side of the valve cover. Please pay attention that the filler neck is always well locked after filling in engine oil. Consider also the references to the engine oil specification.

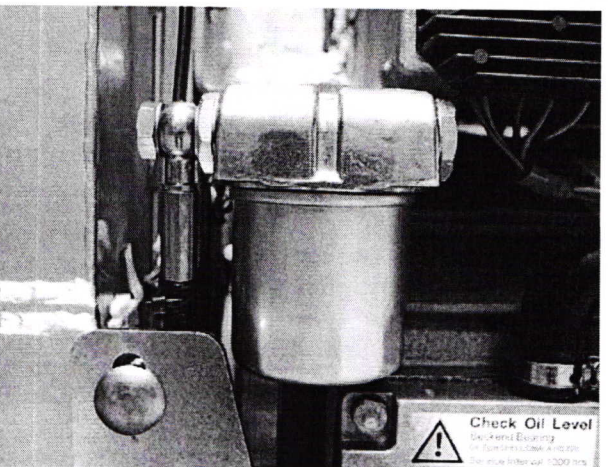
Fig. A.46: Engine oil filler neck with cap



Engine 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. A.47: Engine oil dipstick



Oil filter

The oil filter should be exchanged with an oil change.

Fig. A.48: Oil filter

Engine oil drain hose

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

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

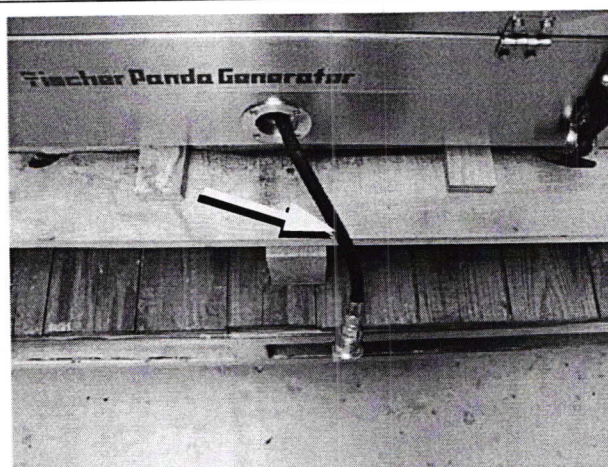


Fig. A.49: Engine oil drain hose

Insprction hose for oil level in backend bearing

The oil level of the oil cooled bearing must be checked at every operation day before the first starting - see inspection hose at the generator backend.

Service interval 1000hrs.

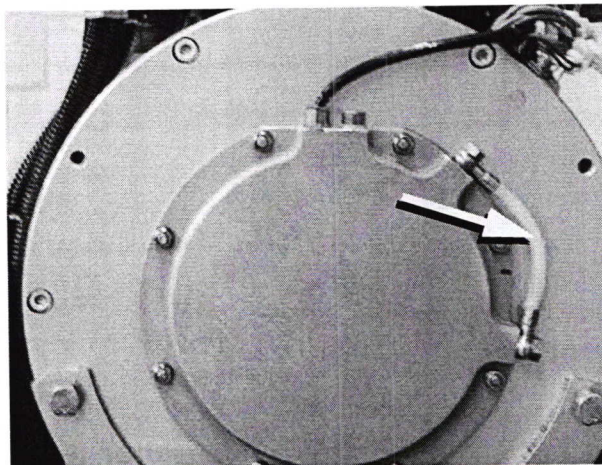
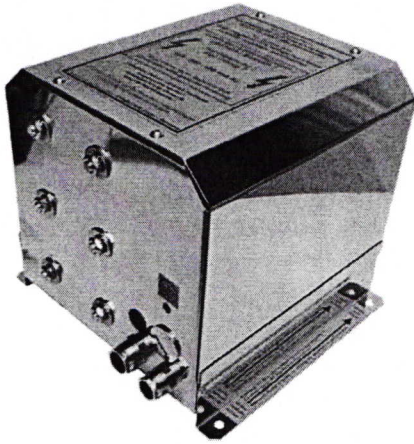


Fig. A.50: Engine oil drain hose

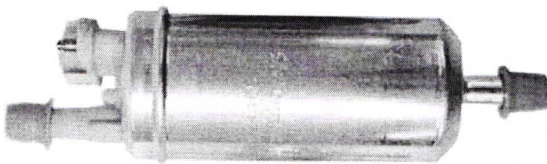
A.2.8 External components



AC-Control box

At operating the generator the operating voltage 110/220V lies at the AC-Control box. It must be guaranteed that the generator cannot be inadvertently started, if the Control box is opened. For this reason the negative pole of the starter battery is to be disclamped with all work on the electrical system.

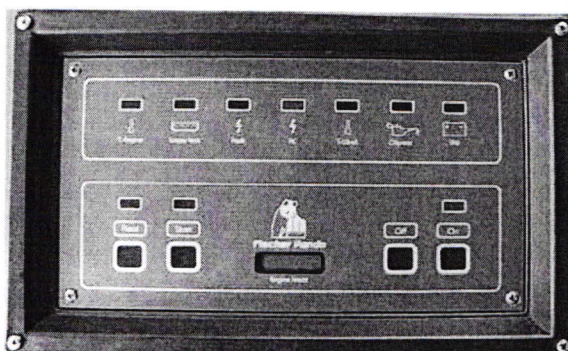
Fig. A.51: AC-Control box



Electrical fuel pump

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

Fig. A.52: Electrical fuel pump



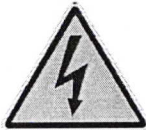
Remote control panel

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

Fig. A.53: Remote control panel

B. Generator Operating Instructions

B.1 Preliminary remarks



ATTENTION! Before working on the System read the "Safety Precautions" on Page vii.

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°C (Plus). For lower temperatures the pre-glow period should be increased.

The motor can be started for temperatures up to minus 20°C, as long as running conditions are suitable. The fuel must be suitable for such conditions, as conventional diesel fuel can produce a paraffin coating at temperatures lower than minus 8°C, which blocks all filters and pipes. It is normal in Europe to use an additive, obtainable from gas stations to ensure use at temperatures as low as minus 15°C. If a generator is to be used for temperatures below minus 8° C, then it must be ensured the fuel is suitable for winter. By use of extra additive, the fuel can also be used at lower temperatures. The appropriate regulations can be obtained from the fuel suppliers. The mineral oil trade have stocks of fuel, which are suitable for use for temperatures below minus 20°C.

Use of the cold-start equipment

If the generator is being used in cold weather conditions it is important to make sure the correct fuel grade is used for the temperatures forecast. If the tank has been drained and then filled with cold weather fuel, always run the generator for 10 minutes to ensure the new fuel is present throughout the system. If this is not done, gelling of the old fuel may occur in and around the injectors and prevent successful starting.

Always ensure that the fuel is correct for the temperature range, before attempting a cold-start.

Pre-heating the diesel motor

A quick glow-plug is fitted to all Kubota diesel engines. This glow plug may be used for a maximum of 20 seconds without a pause. A glow period of 5 - 6 seconds suffices for ambient temperatures above 20°C. Below 20°C the glow period should be increased.

The Glow Plug pre-heating system can be used for starting in temperatures down to minus 20°C. The fuel must be suitable for such conditions, as conventional diesel fuel can gel at temperatures below minus 8°C so blocking filters and pipes. Military grade fuels are available for operating in temperatures down to minus 35°C and below.

Pre-heating procedure

If the engine is to be started at a temperature below minus 15°C, then the pre-heating device must be pressed for 20 seconds before starting. Pre-heating must be continued whilst the generator is being started. The starter motor should not be used for a period longer than 20 Seconds without interruption. If the engine does not start after 20 seconds, then a pause of at least one minute should be made. Then a further start can be attempted.

If the diesel motor does not start as expected, then an initial check should be made to check whether the fuel intake is correct.

Tips regarding Starter Battery

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

Motor Oil Quality during extreme Winter Conditions

Suitable motor oil is recommended for extremely low temperatures. The advice of mineral oil dealers is recommended. Normally, synthetic oil with the appropriate viscosity is especially suitable for this type of cold start.

Improvement by using additional cold start sprays is not recommended.

B.1.1 Overloading of Engine during longer Operation

Ensure the generator is not overloaded. Overloading occurs when the electrical load (normally the Wide Band Data Link) imposes a load on the generator which is greater than the engine can provide. Overloading may cause rough running, high oil consumption, increased emissions and perhaps the engine to labour or even stall. The generator was supplied to match a known load a wide spread of military and environmental conditions. If additional equipment is added to the electrical load, Fischer Panda should be provided with details before attempting to power the new total load. Modifications to the generator might be required to ensure correct generator output and uninterrupted, efficient military operations.

The generator should only be run at peak load for short periods. A high peak current is required start many electrical devices, especially electric motors and compressors and the generator should deal easily with those specified in the original requirement.

B.1.2 Daily routine checks before starting



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

ATTENTION! OIL PRESSURE CONTROL!

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

You should change the oil, regardless off the ambient temperature. See section F.2, "Engine oil," on page II. Engine oil amounts see section F.5, "Technical data engine," on page III.

The oil level of the oil cooled bearing must be checked at every operation day before the first starting - see inspection hose at the generator backend. Service interval 1000hrs.

2. State of Cooling Water.

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

3. 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.

4. 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.

5. 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.

6. Switch the Land Electricity/Generator Switch to Zero before Starting or Switch Off all the Load.

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

7. 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).

B.1.3 Starting Generator

1. If necessary, open the fuel valve.
2. If necessary, close the main battery switch.
3. Check if all the load have been switched off.
The load is switched off, before the generator is switched off. The generator is not to be started with load connected. If necessary, the main switch or fuse should be switched off or the load should be individually switched off.
4. Press „ON“ button.
Control light for "ON" Button and "OILPRESSURE" must light up. Note: If the red control light for oilpressure does not turn on if the panel is switched on, this may be caused by a faulty installation of the generator as a sign that the panel or the oil pressure switch has got an error. In this case the generator may have problems to stop automatically if there are any disturbances at the generator.
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°C. 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°C. Please note that the generator can only be run at temperatures below -8°C with winter fuel and additional 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 genset does not immediately start, then the fuel intake should be checked to ensure it is flowing freely. (For temperatures below - 8°C check whether there is winter fuel)
7. Check circuit-voltmeter, to test whether there is AC-voltage and is within the tolerance rage (Frequency and voltage).
The AC voltage should be within a tolerance of ± 3 Volt without load at the nominal voltage. When running without load, the generator frequency should be 4% below the nominal voltage. The generator should be checked, before the load is switched on, if the current remain at this level.
8. Switch on load.
The load should only be switched on if the generator voltage is within the permissible range. Parallel connection of several load should be avoided, especially if there are load with electric motors, such as air-conditioning units in the system. In this case, the load must be connected Step by Step.

B.1.4 Stopping the Generator

1. Switch off load.
2. If the load is higher than 70% of the nominal load, the generator temperatures should be stabilised by switching off the load for at least 5 minutes.
At higher ambient temperatures (more than 25°C) the generator should always run for at least 5 minutes without load, before it is switched off, regardless of the load.
3. Press „OFF“ button and switch off the generator.
4. Activate additional switches (Battery switch, fuel stop valve etc.).
NOTE: Never switch off the battery until the generator has stopped.

B.2 Starting the Generator when overheated

There is a "pressure switch" at the terminal bar next to the relays. 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. If the generator switches off by overheating, the operation temperature can be reduced by pressing this switch in combination with the START-button. This procedure has to be done without load.



ATTENTION:

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:

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 load when over or undervoltage occurs).

This is also the case when the generator is started when load is switched on.

Normally the generator will no longer excite 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).

Failure bypass switch

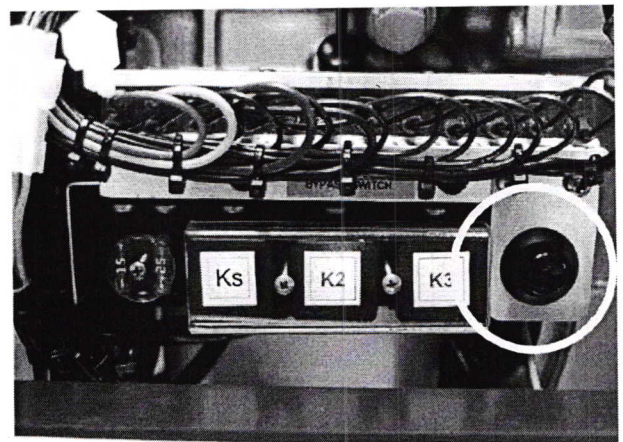


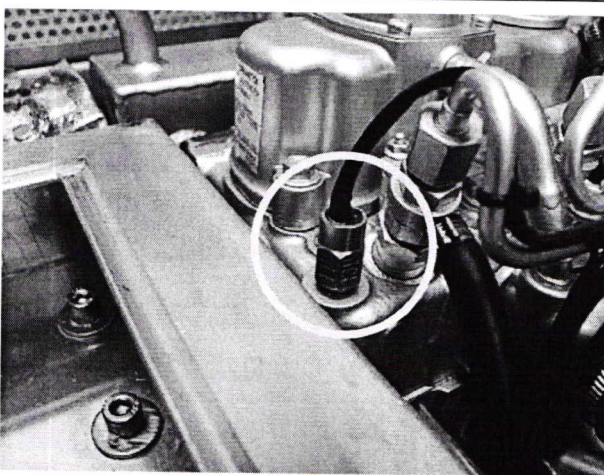
Fig. B.1: Failure bypass switch

B.3 Operating Control System

Panda generators are equipped with various sensors. One of these sensors is to stop excitation should a short circuit occur. The combustion engine is further equipped with a oil pressure control switch, which switches the motor off, if the oil pressure sinks to a particular level. Apart from this, all generators are equipped with three temperature switches.

The thermo-switches are placed at the following locations:

1. Thermo-switch fitted to the engine
2. Thermo-switch fitted to the exhaust elbow
3. Thermo-switch fitted to the silencer
4. Thermo-switch in the genset coil
5. Thermo-switch fitted to the backend bearing
6. Oil pressure switch



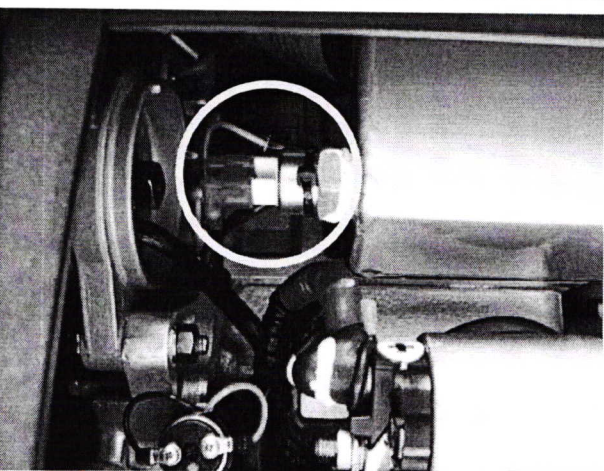
Thermo-switch at cylinder head

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 laid out as "openers".

110°C

130°C

Fig. B.2: Thermo-switch cylinder head



Thermo-switch at water-cooled exhaust elbow

120°C/105°C

Fig. B.3: Thermo-switch at exhaust elbow

Thermo-switch at pre-silencer

At this point the coolant usually achieves its highest value. From here it flows back into the radiator.

105°C/90°C

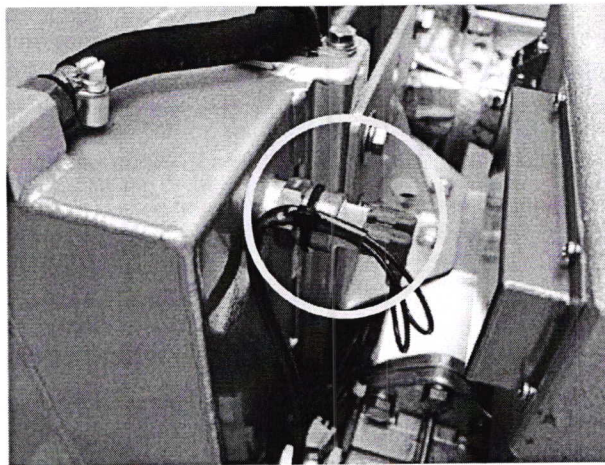


Fig. B.4: Thermo-switch at water-cooled silencer

Coil thermo-switch

1. Generator winding
2. Thermo-switch winding 4x165/175°C
3. Generator 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.

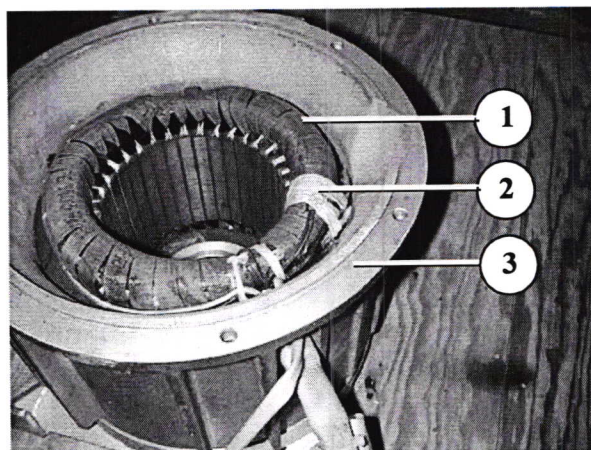


Fig. B.5: Coil thermo-switch

Thermo-switch at the backend bearing

The generator bearing is equipped with a thermo-switch, which switches the engine off if the oil temperature becomes too high. Also a NTC is installed in the backend bearing.

130°C

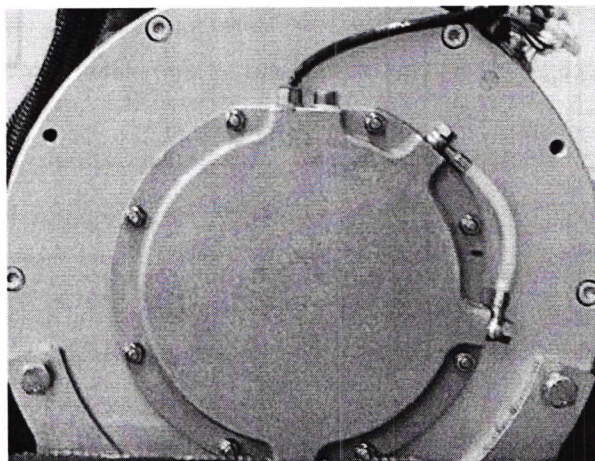
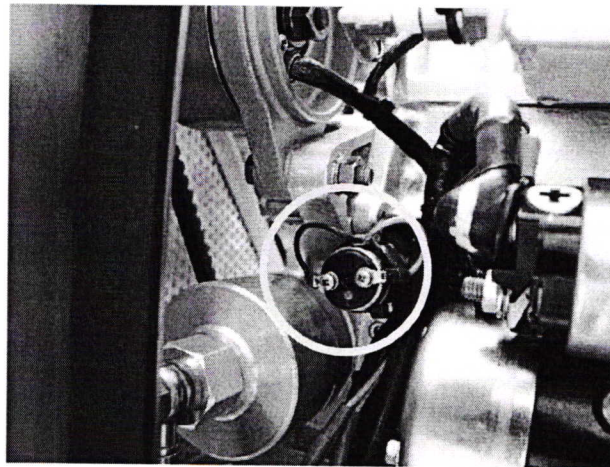


Fig. B.6: Thermo-switch backend bearing

**Oil pressure switch at engine**

In order to be able to monitor the lubricating oil system, an oil pressure switch is built into the system. The oil pressure switch is on the right side behind the starter motor of the engine.

Fig. B.7: Oil pressure switch

C. Maintenance Instructions

C.1 Maintenance Requirements

Control before starting

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

Once a month

- Lubrication of actuator-trapezoid thread spindle

For Maintenance Intervals see section F.1, "Inspection checklist for services," on page I.

C.2 Oil Circuit Maintenance

The laid down intervals must be heeded in order to avoid serious damage to the motor!

The first oil change should be carried out 35 hours after running time. Thereafter every 100 hours. Type of required oil see:

section F.5, "Technical data engine," on page III.

An oil drainage hose is fitted in the sound cover for changing the oil. This is fed through the capsule to the outside.

Open the pass-through cover at the sound cover for the oil drain hose.

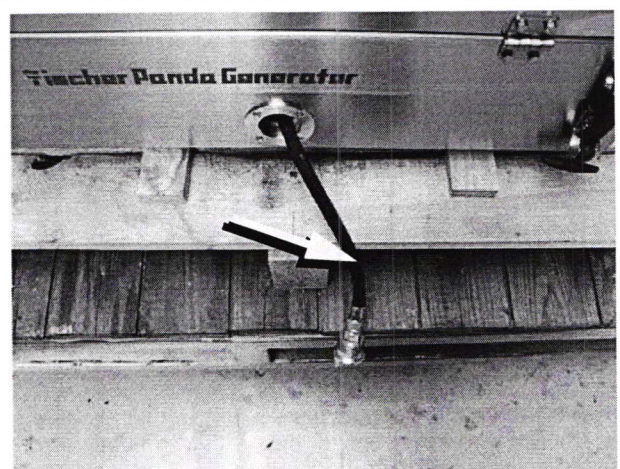
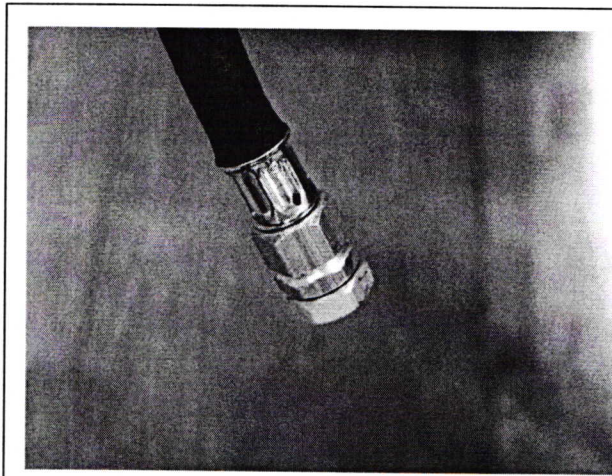


Fig. C.1: Oil drain hose

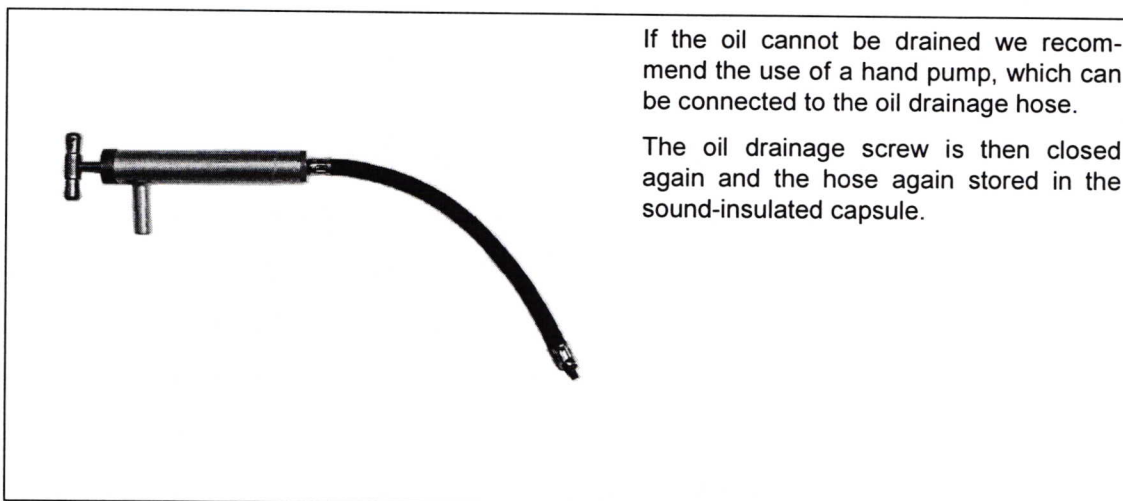


The oil can then be drained by opening the oil drainage screw.

Use a spanner size 17mm.



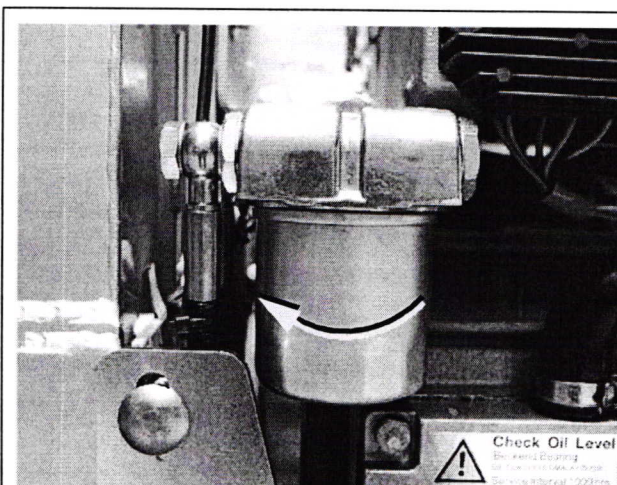
Fig. C.2: Oil drainage screw



If the oil cannot be drained we recommend the use of a hand pump, which can be connected to the oil drainage hose.

The oil drainage screw is then closed again and the hose again stored in the sound-insulated capsule.

Fig. C.3: Hand pump



The oil filter could be loosened by a tool (oil-filter strap)

Fig. C.4: Oil filter

New oil is poured in after removing the oil filling cap and the oil level checked with the use of a dipstick. Do not exceed the "maximum" mark.

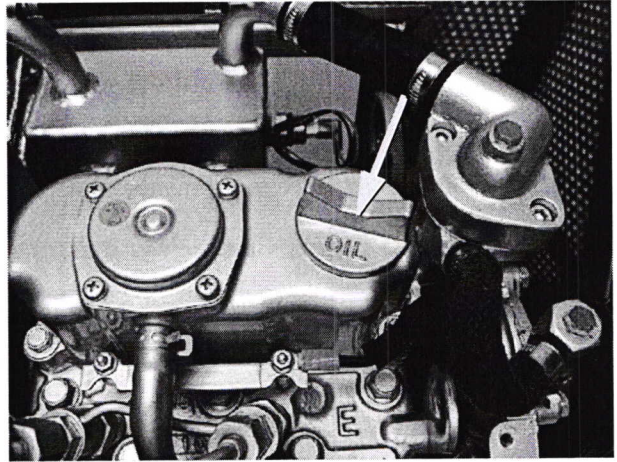


Fig. C.5: Oil filler neck

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

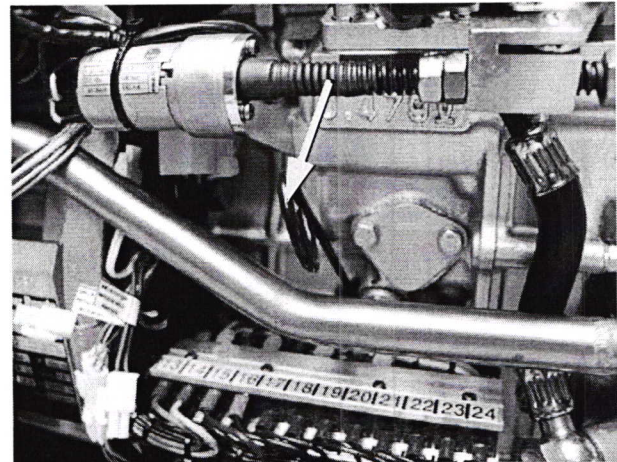
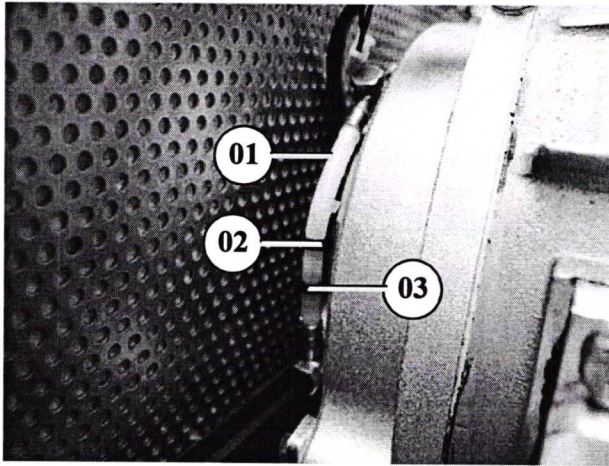


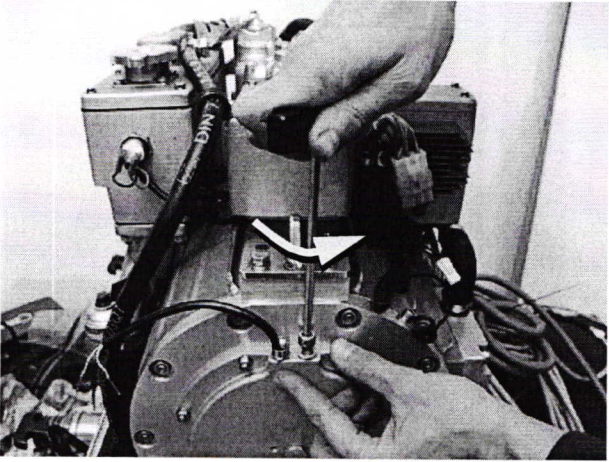
Fig. C.6: Oil dipstick

C.2.1 Oil level check of the oil-cooled bearing


Check level of oil in the oil-cooled bearing
At the generator endshield is a clear hose for checking the oil level in the oil-cooled bearing. The oil level should be between the min. and max. marking

- 01. Clear hose
- 02. Max. marking
- 03. Min. Marking

Fig. C.7: Clear hose for oil level check



Suction cleaning or draining of oil.

The access to the drain plug is difficult.
Therefore we recommend to suction clean the oil with an injection with rubber hose. Operate the generator for about 3-5 minutes so that the oil gets thinner.

Unscrew the ventilation screw (tool: hexagonal spanner SW6)


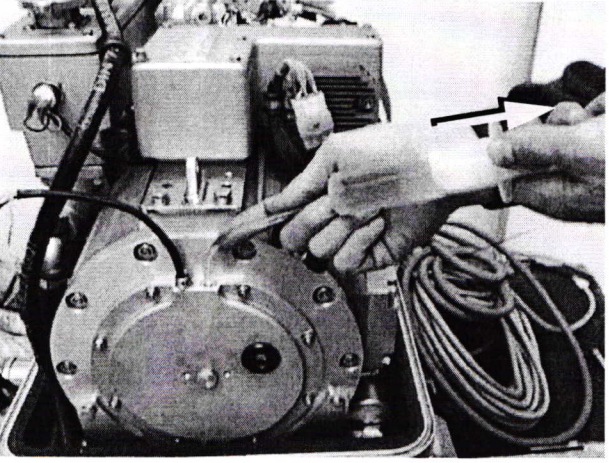


Fig. C.8: Draining oil



Insert the hose through tapping hole.
Suction cleaning of oil.

Fig. C.9: Draining oil

18. Refill oil

Until half of inspection hose.

Oil:

Shell Omala HD 220 *

Shell Omala HD 320 (temperature over 35°C)*

Mobil 1 0W-40 **

Suitable oils are specified as followed:

synthetic gear oil (PAO)

viscosity class 220 to 320

minimum required gear oils: CLP HC

You can get these oils at any industrial lubricant shops as well as at Fischer Panda.

* oil changing intervals are every 1000 hours

** oil changing intervals are every 250 hours

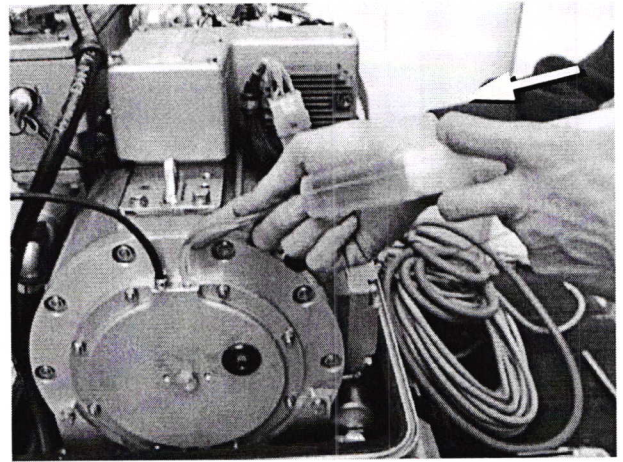
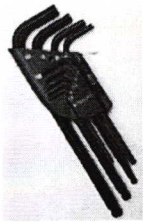


Fig. C.10: Refill oil



Turn in ventilation screw and tighten (tool: hexagonal spanner SW6) (20Nm).

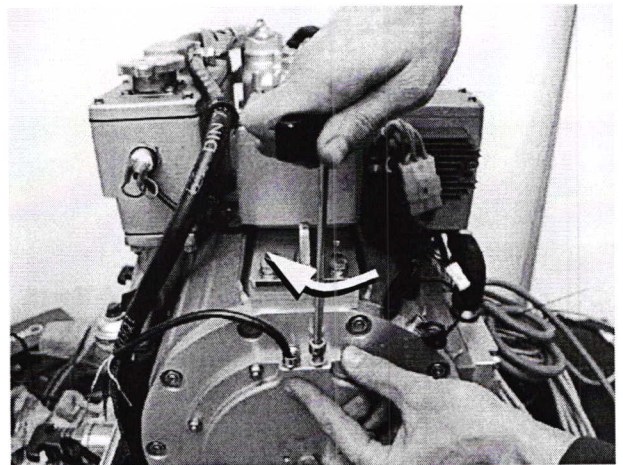


Fig. C.11: Refill oil

C.3 Bleeding the cooling water system

Internal temperature monitoring switch

The operating temperatures are monitored at the remote control panel and the generator will switch off automatically when temperatures exceed limits set for:

1. Windings temperature
2. Cylinder head temperature
3. Coolant temperature

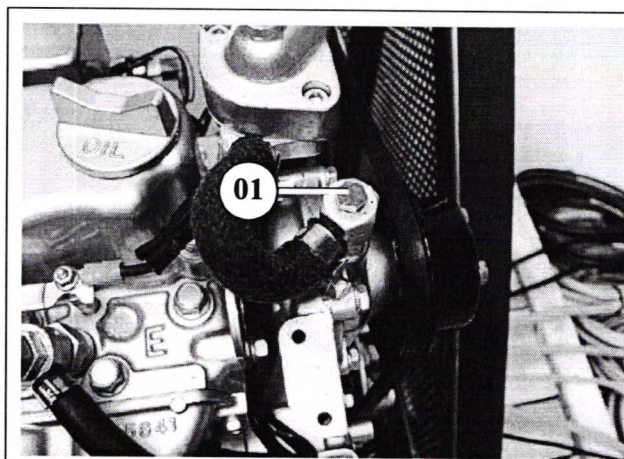
The following fault switches are also integrated into the system and will automatically switch off the generator, even if a fault is not shown on the panel, they are redundancy direct switches:

1. Motor oil temperature of cylinder head T=130°C NC
2. Generator winding T=165°C NC

Bleeding the cooling system

If the coolant has been drained or if air has permeated into the cooling system by other reasons, the cooling system should be bled to remove any trapped air which might cause airlocks and consequent overheating.

The bleeding process should be carried out several times to ensure no air is left in the system.



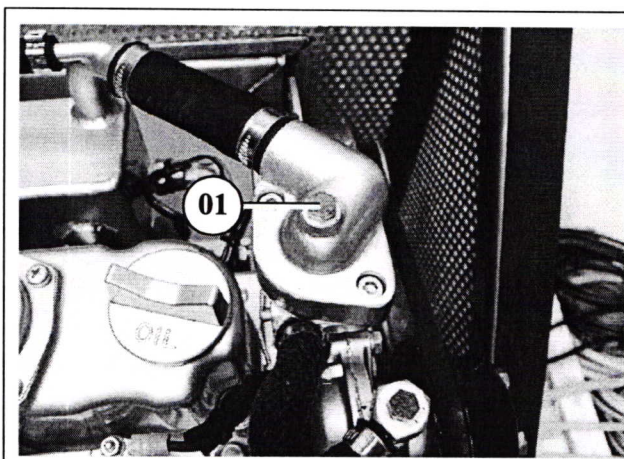
1.) Open ventilation screw at the water pump.

Use a spanner size of 10mm.

01. Bleed valve screw



Fig. C.12: Bleed valve water pump



2.) Open ventilation screw at the thermostat-housing

Use a spanner size of 10mm.

01. Bleed valve screw



Fig. C.13: ventilation screw thermostat housing

3.) Pour in coolant through the radiator filler cap to full level mark. This is a slow process.

01. Coolant filler

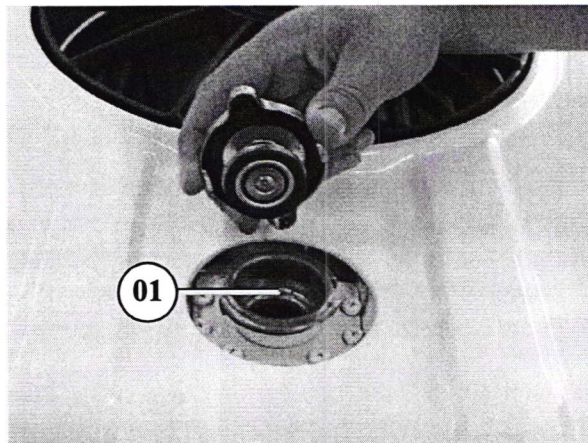


Fig. C.14: Coolant filler

4. When the coolant level in the radiator is steady, close all the bleed valves, start the generator and let it run for about 60 seconds.

5. Switch generator OFF.

6. Open radiator filler cap and open bleed valves again.

7. Top up with coolant until level is steady once more.

Repeat this procedure several times.

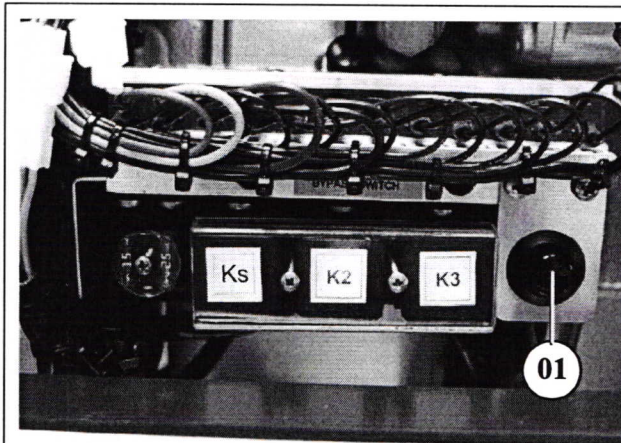
Run the generator for 5 minutes, turn it off and repeat the bleeding process.

Make sure the hose from the engine becomes warm, that the radiator also becomes warm and that the fan activates.

C.4 Bleeding the Fuel System

In normal operation the fuel system is designed to bleed trapped air automatically. It is nevertheless essential to bleed the system as follows prior to the first operation of the generator after the system has been drained of fuel for any purpose.

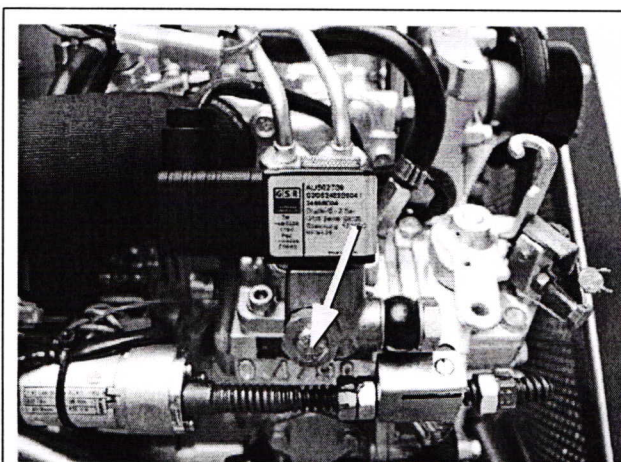
1. Push the standby switch on control panel to "ON".
2. Push failure bypass switch and hold tight. The electric fuel pump has to be running audibly. By moving the failure bypass switch you can hear the solenoid valve of the generator starting and stopping (when the sound cover is taken off).
3. The generator can then be started by pushing the "Start"-button. Press the „Start“ button only for 20 seconds. After this 20 seconds a pause of 60 seconds must be made. Repeat this procedure. The fuel pump is working now. Check there are no leaks from the bleed screw. Open the bleed screw at the fuel solenoid valve (see Fig. C.16, "Bleed screw at the fuel solenoid valve," on Page 42). To avoid fuel getting in the sound cover a piece of cloth or absorbent paper should be put under the connection. As soon as fuel is running out without bubbles the air bleeding screw can be screwed in again.
4. If the generator is new and is being run for the first time, it may not start. In this case loosen the injector pipe union nuts and lift the injection pipe a few millimeters. Re-tighten and repeat the start procedure.
5. Standby switch „ OFF“ .



Push the failure bypass switch upwards and hold tight.

01. Failure bypass switch

Fig. C.15: Failure bypass switch

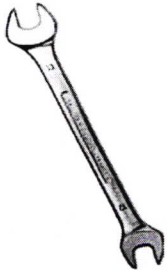


Open bleed screw at the fuel solenoid valve.

Use a spanner size 10mm.



Fig. C.16: Bleed screw at the fuel solenoid valve



Loosen the pipe union nuts of the injection nozzles.

01. Spanner size 17mm

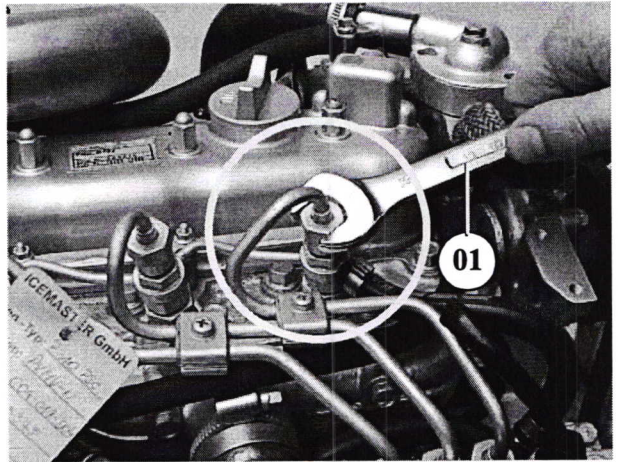


Fig. C.17: Injector union nuts

Lift the injection pipe a few millimeter.

Start the engine and as soon as fuel is running out without bubbles the pipe union nut can be screwed again.

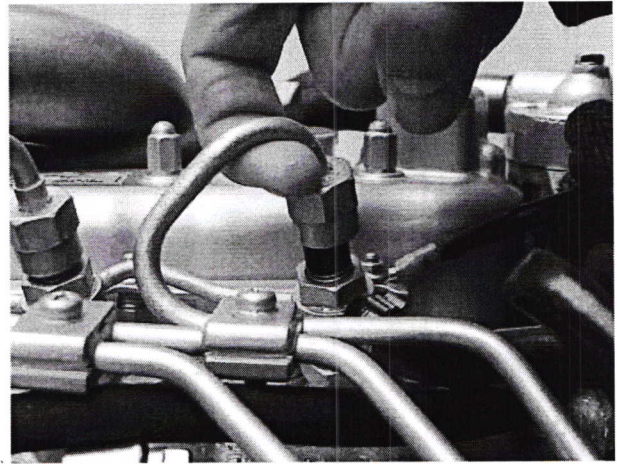


Fig. C.18: Lifting injection pipe

C.4.1 Replacing fuel filter

Filter replacement depends on the amount of fuel contamination build up, but should take place, as a minimum, every 300 operation hours.

- 01. Fuel filter housing
- 02. Fuel filter element
- 03. See-through bowl

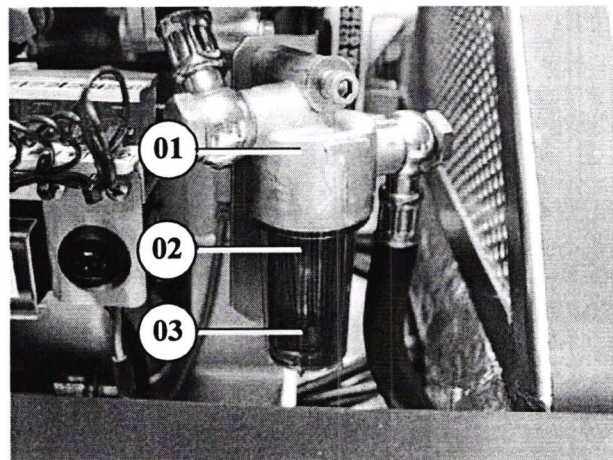


Fig. C.19: Fuel filter

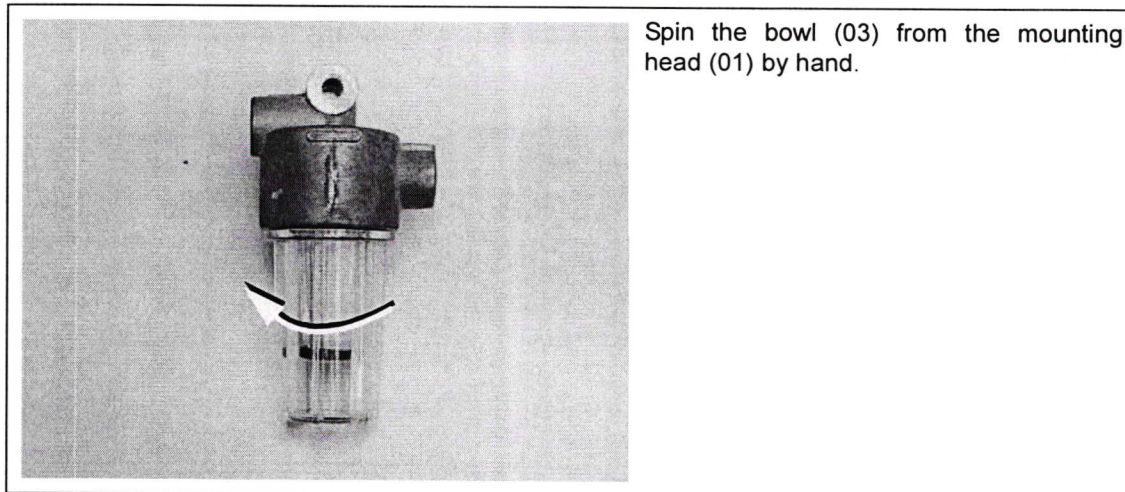


Fig. C.20: Fuel filter

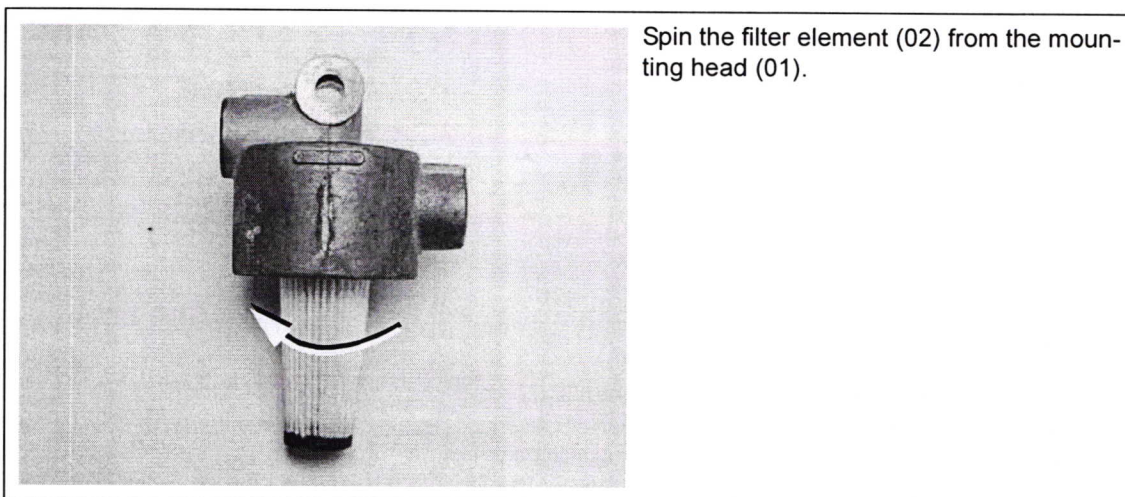


Fig. C.21: Fuel filter

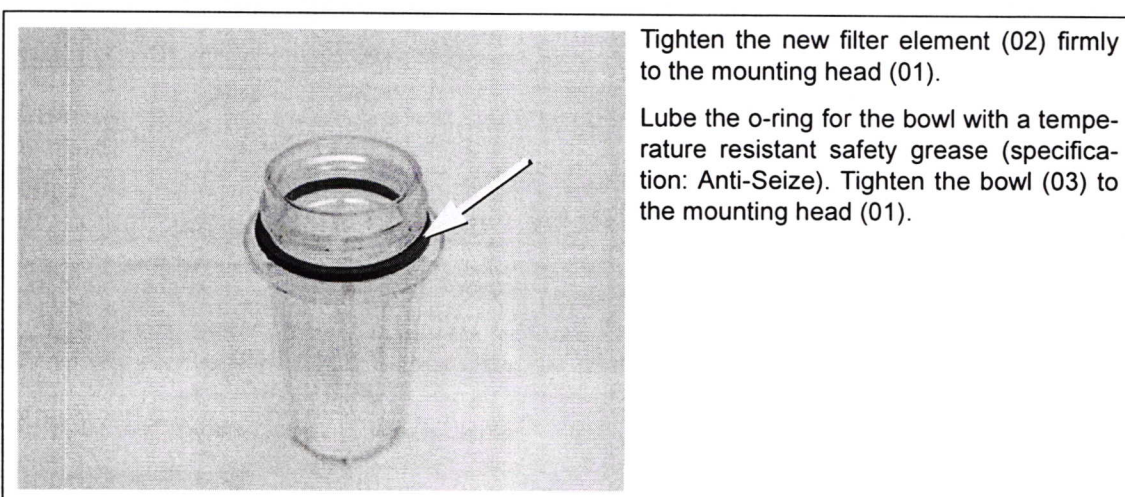


Fig. C.22: Fuel filter

C.5 Replace the air filter

Open the combustion air housing by loosening the closure of the housing.

01. Closure

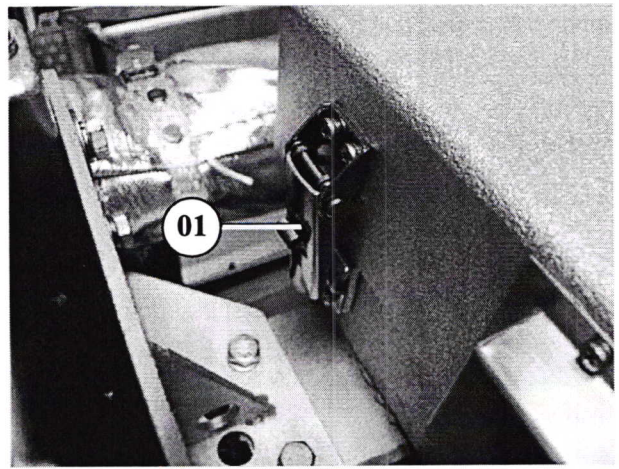


Fig. C.23: Exchange air filter

Open the combustion air housing by loosening the closure of the housing.

01. Closure

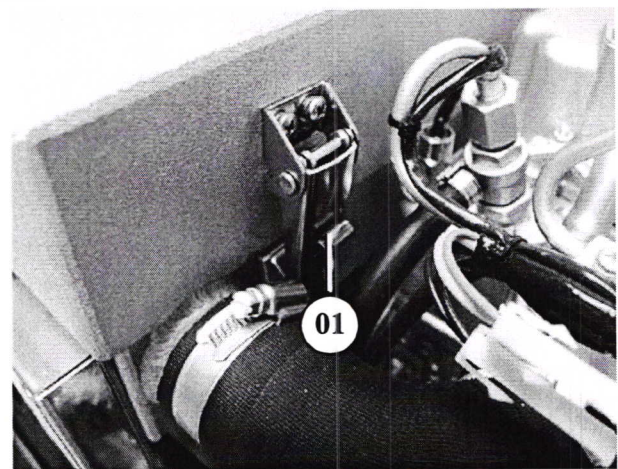


Fig. C.24: Exchange air filter

Open the air housing by pulling the cover.

Lift out the air filter element of the cover of the air filter housing.

(Knecht LX266, part number: G2170LX266 or alternative MANN C2039, part number: G2160C2039).

Replace cover in reverse procedure.

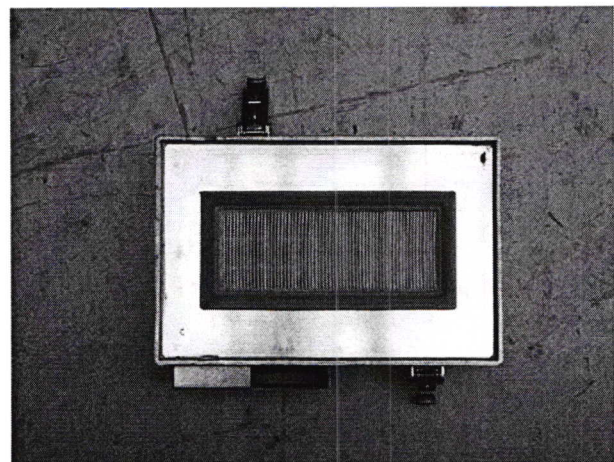
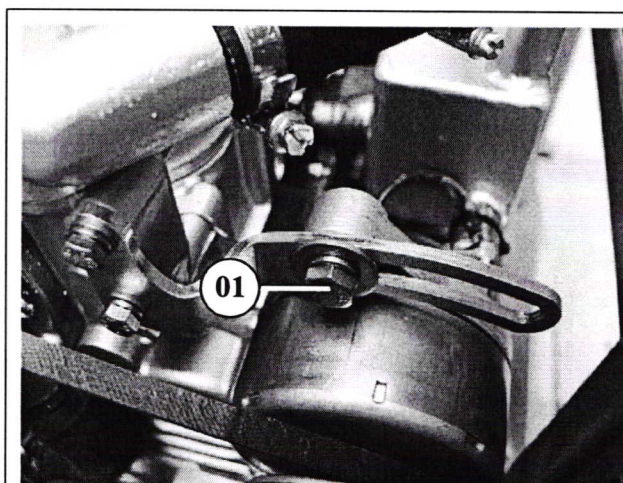


Fig. C.25: Exchange air filter

C.6 Replace of the V-belt for alternator and water pump

The high ambient temperature in the closed sound insulated capsule (about 85°C) can be a reason for a reduced lifespan of the v-belts.

The v-belt must be regularly replaced to avoid the possibility of failure during operation. The worst conditions are frequent short periods of use where the belts heat up and are then cooled down again. This appears to induce stress where the belts cool down around the pulleys. As part of the daily inspection, always scan the belt for any signs of cracks or splits and change it if there is any doubt about its serviceability.



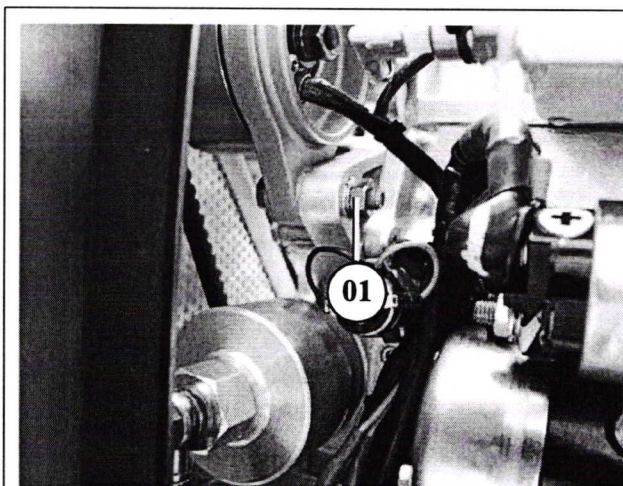
Loosen the fixing screw above the alternator slightly.

Use a spanner size 13mm.

01. Fixing screw



Fig. C.26: Alternator fixing screw



Loosen the fixing screw below the alternator.

Use two spanners size 13mm.

01. Fixing screw



Fig. C.27: Alternator fixing screw

Press the alternator to the direction of the thermostat housing. Now the v-belt can be changed (Quad Power II XPZ 850, part number: G2280XPZ850-2).

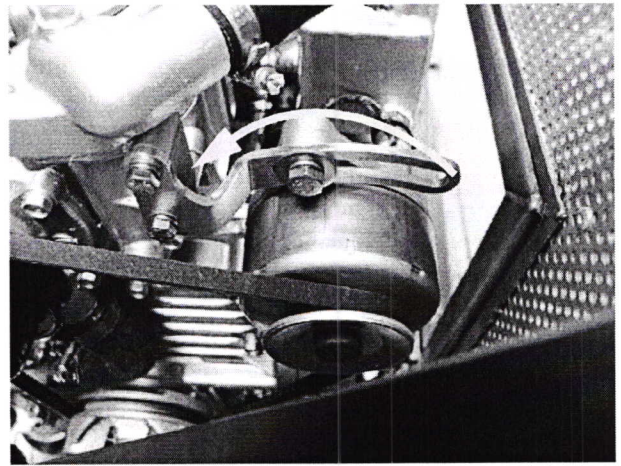


Fig. C.28: Alternator belt replacement

Stretch the v-belt by pulling the alternator back. The v-belt should be able to be pressed approx. 1cm with the thumb.

Tighten the fixing screws above and below the alternator.

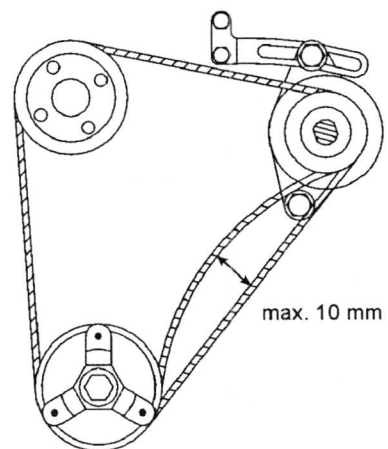


Fig. C.29: Alternator belt replacement

C.7 Replacing Water pump

1. Unscrew the water pump mounting screws (2), and remove the water pump (1) from the gear case cover. Use a spanner size 10mm.

When reassembling

- Apply liquid-type gasket (Three Bond 1215 or its equivalent) to both sides of the new water pump gasket.

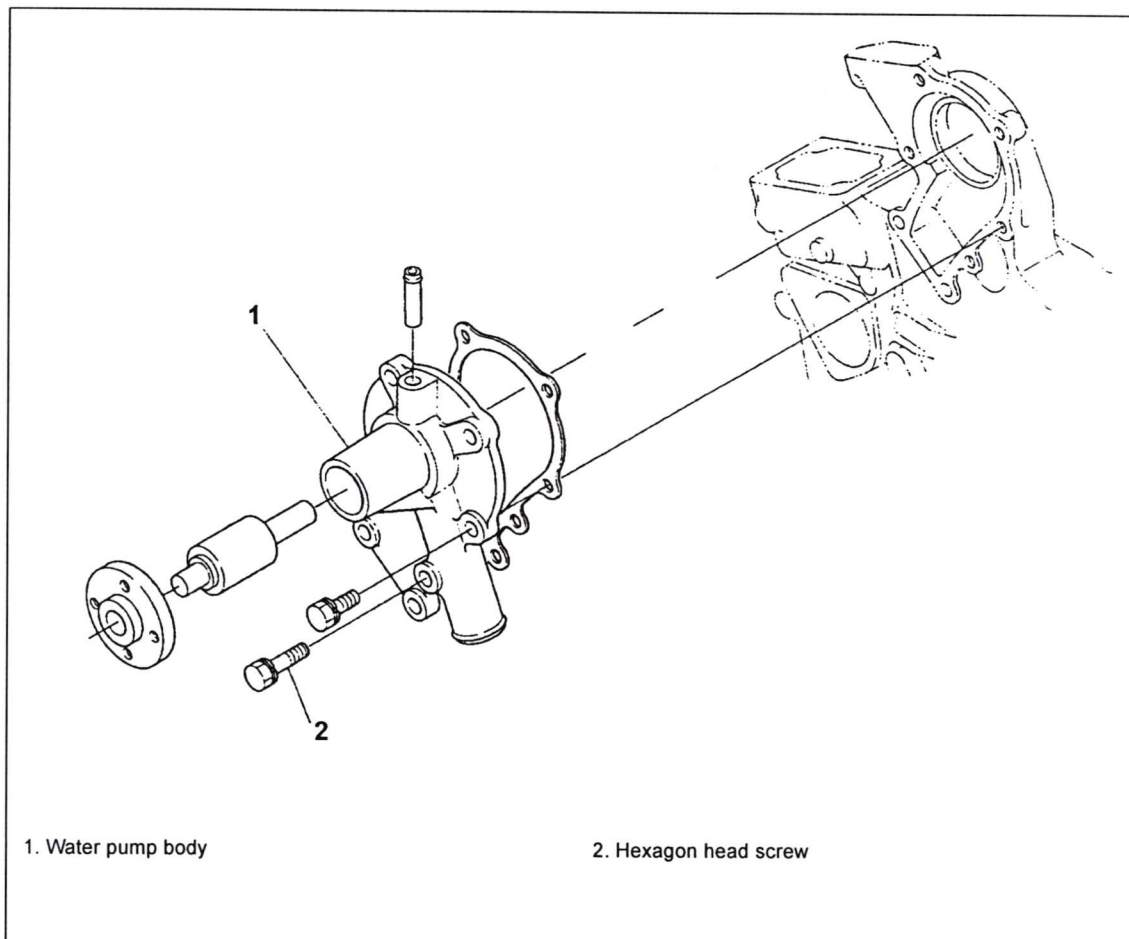
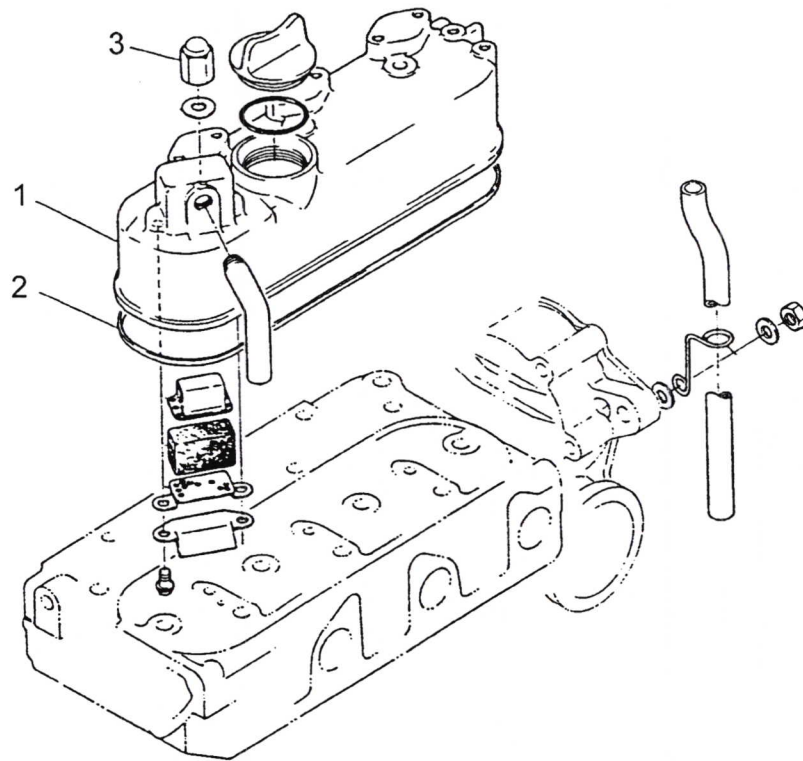


Fig. C.30: Water pump

C.8 Replacing Valve cover gasket



1. Remove the valve cover cap nuts (3). Use a spanner size 10mm.
2. Remove the valve cover (1).
3. Check to see that the valve cover gasket (2) is defective.
4. Replace the valve cover gasket (3) with a new one.
5. Install the valve cover (1), using care not to damage the o-ring.
6. Tighten the valve cover cap nuts (3). Tighten torque: 3,9 to 5,9Nm.



1. Valve cover
2. Valve cover gasket

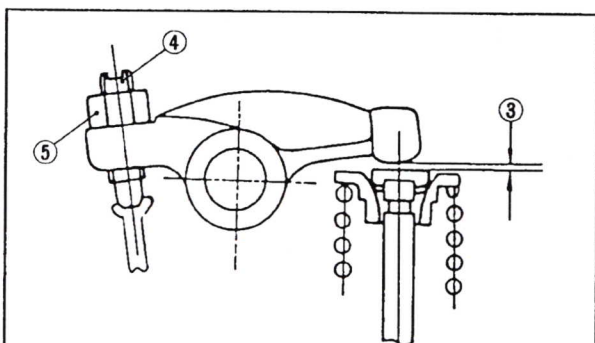
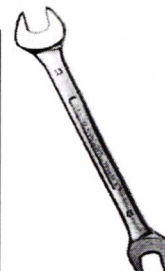
3. Hexagon cap nut

Fig. C.31: Valve cover

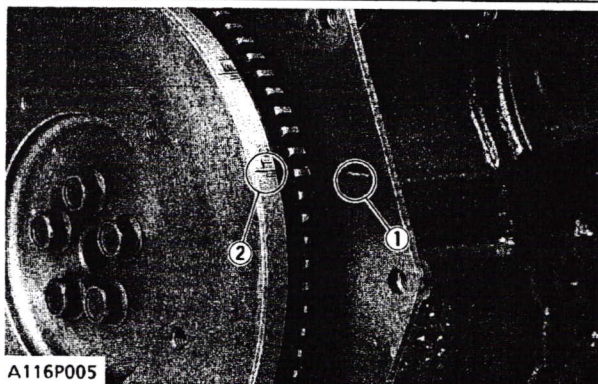
C.8.1 Adjustment of the valve clearance

Tools:

- Spanner for valve cover, spanner size 10mm
- Spanner for counter-nut, spanner size 11mm
- Screw driver for adjusting screw
- Thickness sheet gauge (sliding suction must be between rocker arm and valveshaft)



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- | | |
|--------------------|--------------------|
| 1. Notched Portion | 4. Adjusting Screw |
| 2. TC Mark Line | 5. Lock Nut |
| 3. Valve Clearance | |

Checking Valve Clearance
IMPORTANT

Valve clearance must be checked and adjusted when engine is cold.

1. Loose the lock nut (5) and the adjusting screw (4).
2. Turn the adjusting screw (4) to adjust the valve clearance.
3. Tighten the lock nut (5) and check the valve clearance again after several turns of the flywheel.

Valve clearance	Factory-spec.	0.145 to 0.185 mm 0.0059 to 0.0073 inch
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Fig. C.32: Valve Clearance

D. Generator Faults

D.1 Overloading the Generator

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

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

In order to prolong the genset's life expectancy, the nominal electrical demand on the system should not be more than 80% of the rated genset power.

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

Continuous performance is the uninterrupted running of the generator for many hours. The genset can be run for several hours at partial load (i.e. 2/3 of rated power), however it is not advised that it is run for more than 2-3 hours at full load.

The Panda is designed so as not to overheat even under extreme conditions. Note: The exhaust gas will become sooty during peak-load operation.

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

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

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

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

D.1.1 Generator Voltage Fluctuations and Monitoring

ATTENTION! Before working on the System read “Safety Precautions” on Page vii.

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

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

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

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



D.1.2 Automatic Voltage Monitoring and Auto-Shut Down

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

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

D.2 Adjusting Instructions for the Spindle of the actuator

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

Two independent devices limit engine speed range. They are:

- a. Regulating nuts on the spindle of the actuator left and right of the spindle nut.
- b. An adjusting screw at the base of the rev regulator lever. (only upper revs limit)

- 01. Actuator
- 02. Spiral thread spindle
- 03. Max speed adjusting & lock nuts
- 04. Spindle nut with rev regulator lever
- 05. Min speed adjusting and lock nuts

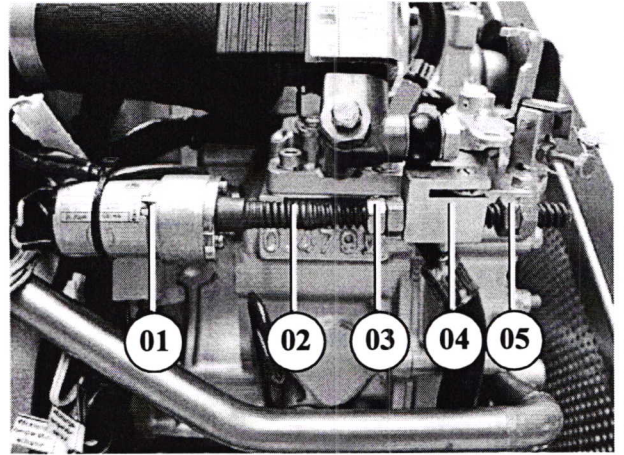


Fig. D.1: Actuator

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

D.2.1 Adjustment of the maximum engine speed:

- 1. Disconnect the electrical supply line to the actuator.
- 01. Electrical supply

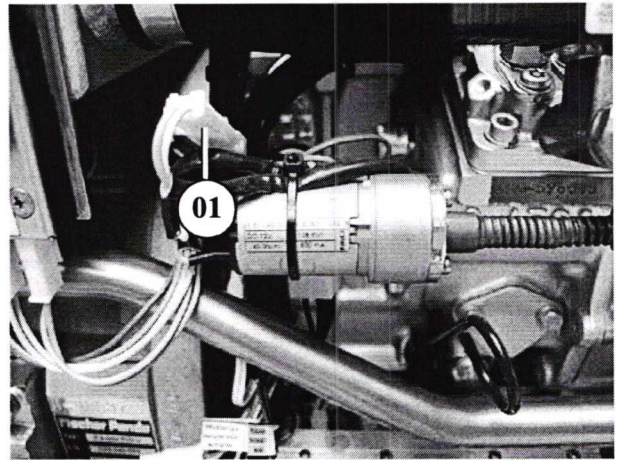


Fig. D.2: Electrical supply actuator

- 2. Loosen the max speed lock nut with two spanners size 14mm.
- 01. Spanner size 14mm
- 02. Spanner size 14mm

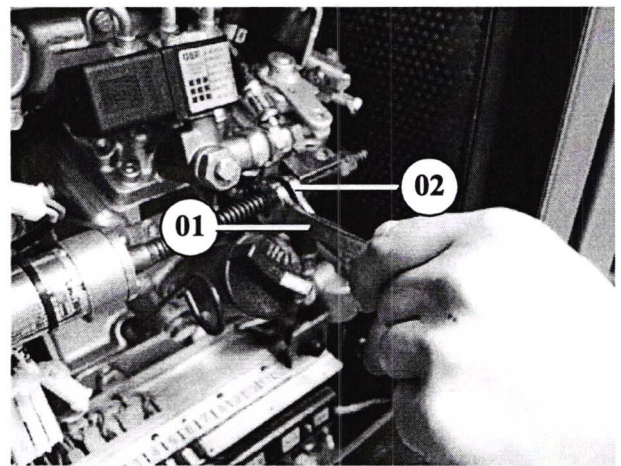
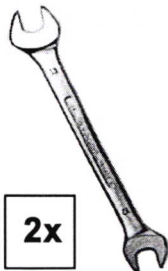


Fig. D.3: Max. speed lock

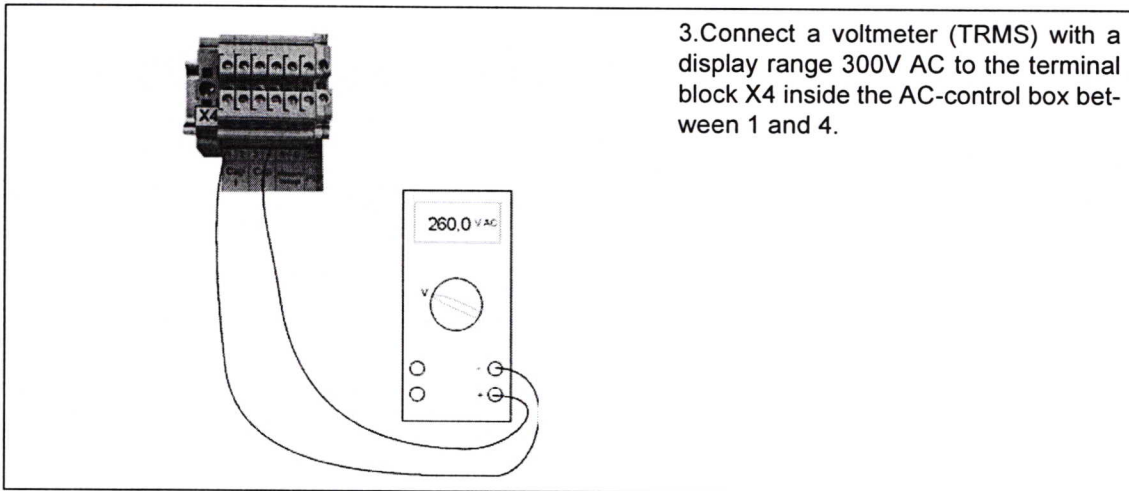


Fig. D.4: Connect voltmeter

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

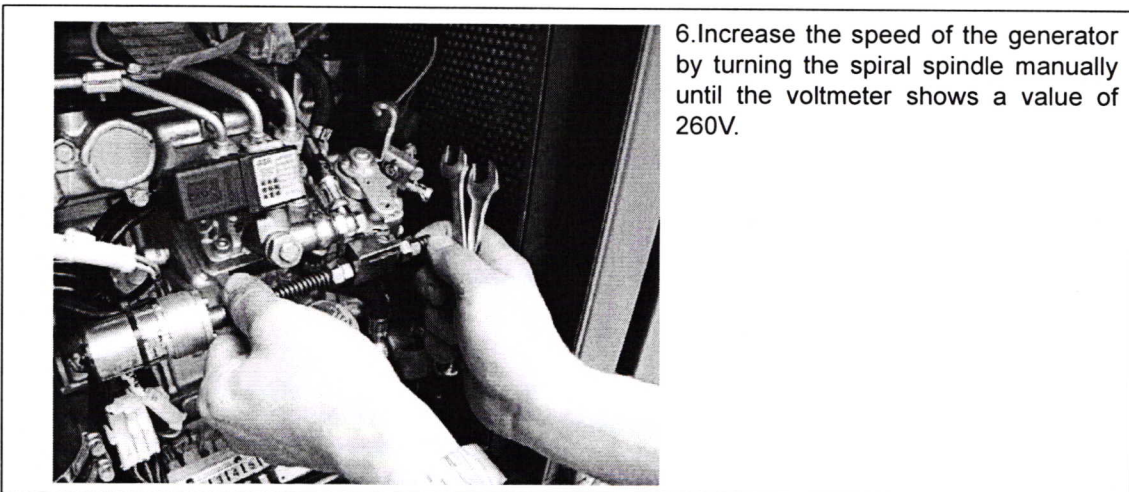


Fig. D.5: Turning spindle

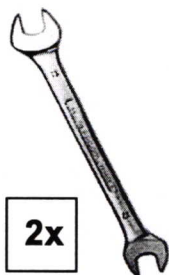
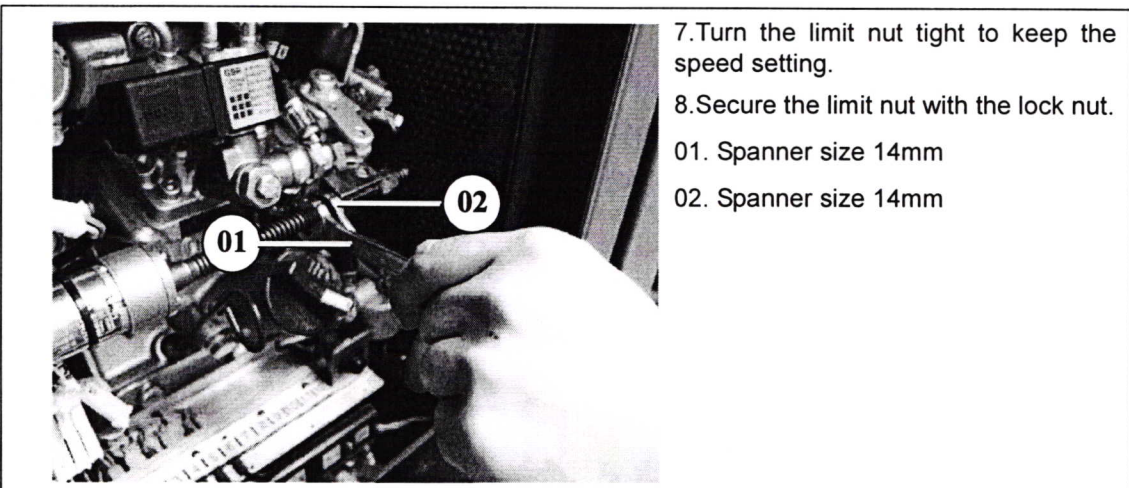


Fig. D.6: Max speed lock

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

D.2.2 Adjustment of minimum engine speed

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

D.2.3 Lubrication of the spiral thread spindle



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

Spread also lubricant to the end of the nuts. It is possible that the spindle could clamp if the spindle is not enough lubricated. Then the generator can be switched off by over- or undervoltage.

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

01. Actuator
02. Spiral thread spindle

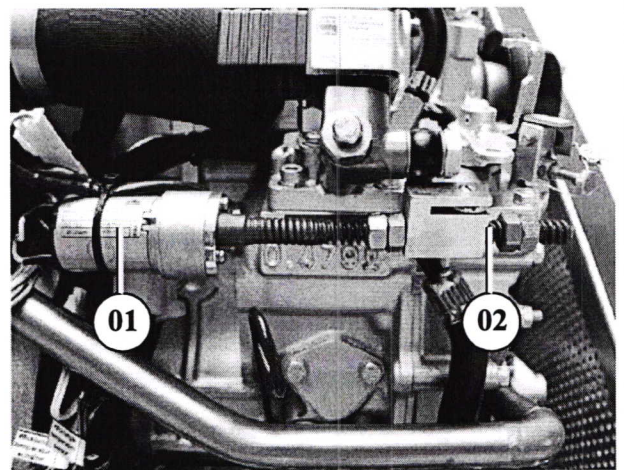


Fig. D.7: Actuator spindle

D.2.4 Effects of a longer overload of the generator to the actuator

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

If the actuator does not turn at all, first check the electrical fuse (miniature slow-to-blow fuse 1,6A) on the control printed circuit board

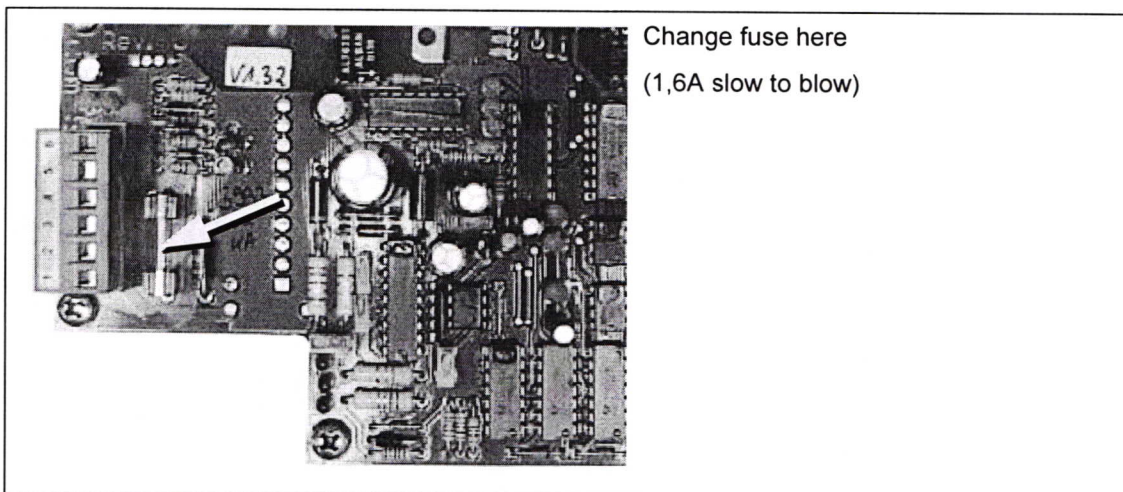


Fig. D.8: Fuse on VCS circuit board

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

If the actuator does not move:

1. The actuator does not move but the spindle can be turned manually. Disconnect the power to the actuator and connect an external 12V-DC source to the actuator.
 - a. If the actuator still does not operate it is defective and must be replaced
 - b. If the actuator works properly with the external voltage source:
 1. Check the fuse on the VCS printed circuit board.
 2. Check if the alternator voltage sensor (X3) is properly connected to the VCS circuit board.
 3. Check if the VCS DC supply voltage is properly connected (clamp 3(+)) and clamp 4(-) of X1).
 4. Check if the VCS output to the actuator is properly connected (clamp 1(+)) and clamp 2(-) of X1).

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

Voltage control check procedure:

1. Switch off load.
2. Disconnect the power to the actuator.
3. Turn the actuator spindle manually to check if an adjusting nut is jammed.
4. Turn the actuator spindle manually to check if the adjusting nuts allow smooth spindle operation.

If no fault is found from these checks there is nothing mechanically wrong. Proceed to check electrical functions:

1. Reconnect the power to the actuator.
2. Start the generator.
3. Turn the actuator spindle by hand and check if the spindle is returned by the actuator motor.
4. If the motor reacts strongly (the motor can normally be halted with the fingers) the drive is working properly.
5. If the motor is weak or hesitant there are short circuits in the actuator windings and the actuator must be replaced.

Check the limits of the generator voltage

The mechanical voltage limitation should be checked regularly as follows:

1. Disconnect the electrical supply line to the actuator.
01. Electrical supply

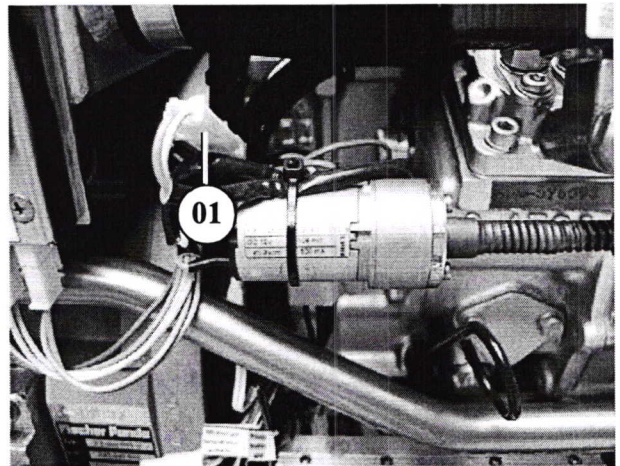
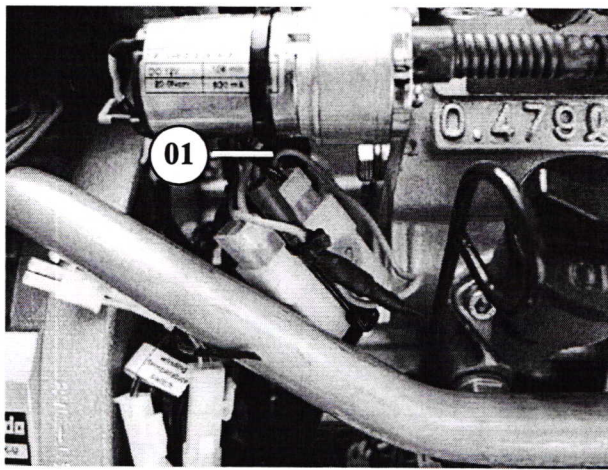


Fig. D.9: Electrical supply actuator

2. Switch off any 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 200V between L1 and N.
7. Turn the actuator manually to the upper limit stop point. The max. voltage is 260V.
8. A new adjustment is necessary if there is a variation from these figures.

D.2.5 VCS By-Pass Facility

If there is a problem in the VCS which cannot be cured (e.g. awaiting parts), the generator can be run safely and normally with the VCS generator output monitor disconnected. Connect the blue cables as shown in Figure below to activate this. The engine speed can then (if necessary) be adjusted as already described to produce the required voltage and the generator will run normally. Once the necessary repairs have been made, disconnect the blue cables to re-activate the full VCS system.



Closed Bypass-Cable VCS
(VCS-Control is deactivated)
01. Blue cable

Fig. D.10: VCS by-pass

D.2.6 Low Generator Output Voltage

ATTENTION! Before working on the System read the "Safety Precautions" on Page vii.

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

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

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



D.3 Checking the Generator Voltage

In order to check the generator for faults, stop the generator and disconnect the connection cables between generator and system. Remove the cables at the connection terminal of the generator or, if installed, at the system distribution box. Make sure, there is no voltage on the cables before disconnecting. The capacitors also are to be discharged.



ATTENTION! Never work at the electrical cabinet, while the generator runs! Do not contact the capacitor. Before working on the system read the "Safety Precautions" on Page vii.

Capacitors for
 01. booster 2x40 μ F
 02. excitation 2x100 μ F (4x50 μ F)

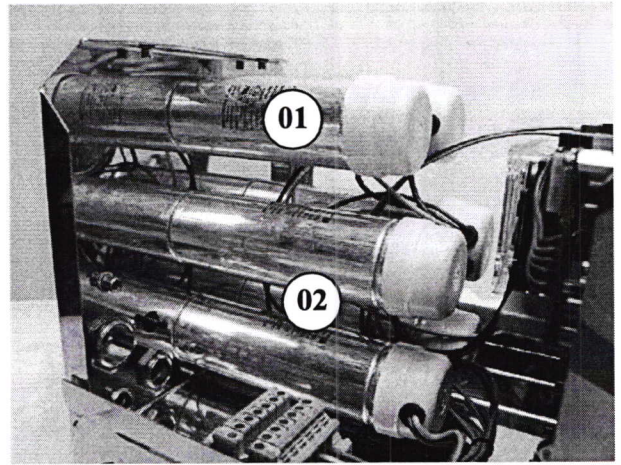


Fig. D.11: Capacitors

After that, the generator should be restarted and the voltage checked at the terminals.

If the generator still does not supply sufficient voltage, the following steps must be undertaken:

1. Check the engine speed. If the r.p.m. is too low, the generator may not be able to achieve full magnetic excitation and thus the required output voltage. If the engine rotational speed is too high, the generator excitation will improve, but the generated voltage can also be too high.
2. If the rev-speed is normal and the output voltage is still outside the acceptable range, the capacitors should be inspected. Do not contact the capacitor terminals! Normally, however, it is highly unlikely that more capacitors than one are faulty. In the event that one or more of the capacitors are indeed faulty, the generated voltage will always be too low.

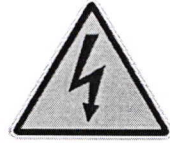
With the system (electrical load) disconnected, and with the generator motor running, a weak generator voltage is a sure sign that at least one of the capacitors is faulty.

An unusually warm capacitor is also a sign that it is faulty or near the end of its life span.

D.3.1 Checking the Capacitors

ATTENTION! Before working on the System read the "Safety Precautions" on Page vii.

Do not check the capacitors whilst the generator motor is running! Charged capacitors can be lethal. Do not contact the capacitors with bare fingers or non-insulated metallic objects! In order to test the capacitors, the terminal lead wires have to be disconnected using pliers or a screwdriver with insulated handle(s). Once the wires have been removed, the capacitors must be discharged by bridging the capacitor terminals together with a slot screwdriver with an insulated handle.



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

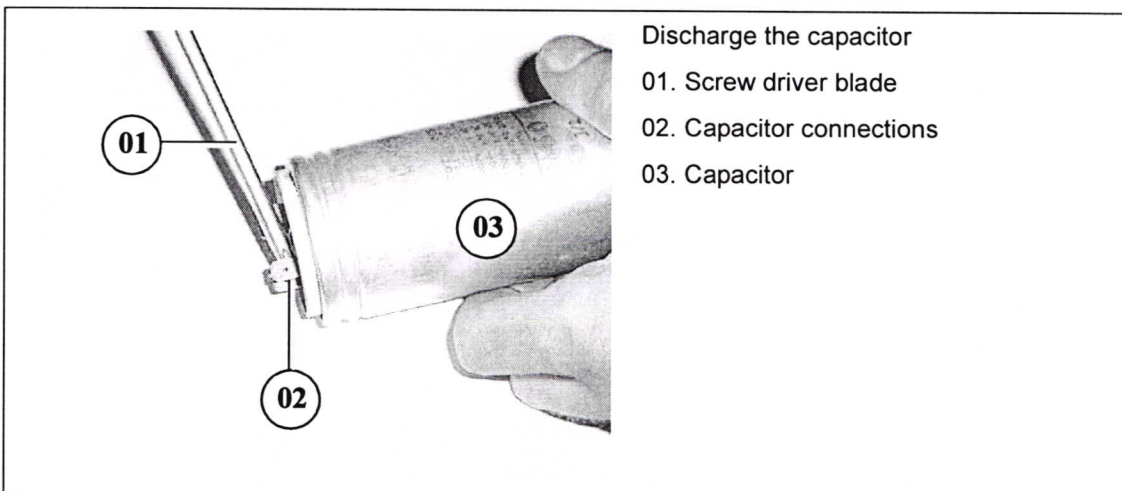


Fig. D.12: Capacitor safety

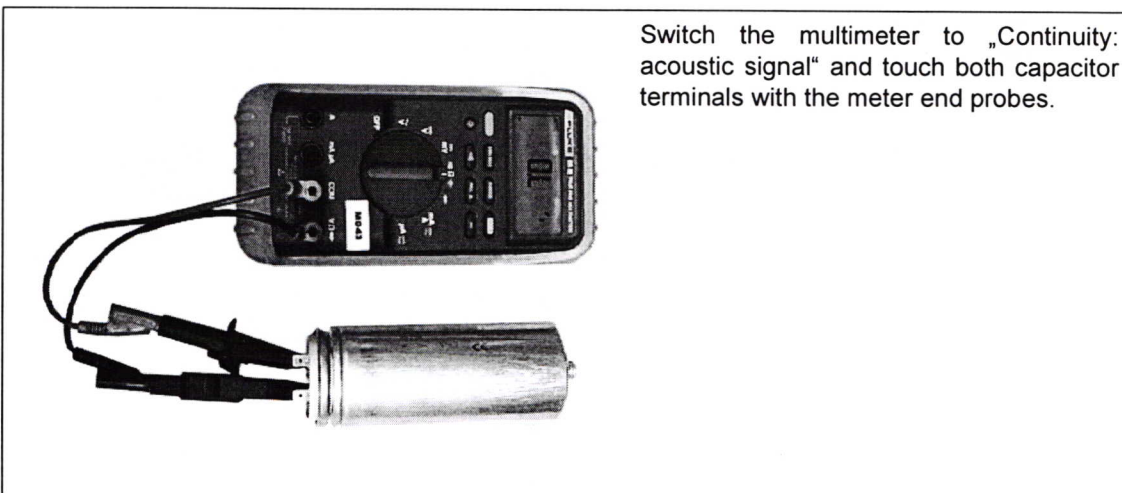


Fig. D.13: Capacitor checking

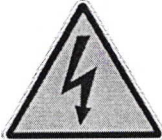
Check all capacitors in the AC-Control box

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

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

Checking the electrical connections to the Capacitor

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



ATTENTION! Do not contact the capacitor. Before working on the System read the "Safety Precautions" on Page vii.

D.4 Testing Generator Stator Windings

D.4.1 Testing Generator Stator Winding for "Shorts" to Ground

If no faults are found with the capacitors and the generator is still not performing correctly, the generator stator windings must be tested for "shorts" to ground as follows:

1. Ensure that the generator is "OFF" and cannot be accidentally started. Disconnect the battery.
2. Remove AC output terminal box lid (mounted on generator casing).
3. All terminal box connections are to be removed. (See appropriate circuit diagram.)
4. Remove all cables (also earth lead).
5. A check of the generator terminal box is made by means of a multimeter to determine whether there is continuity between the individual windings connections and ground.

60Hz-System : Z1.1-Z1.2, Z2.1-Z2.2, H1.1-H1.2, H2.1-H2.2.

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 ICEMASTER 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.

AC Output Terminal box

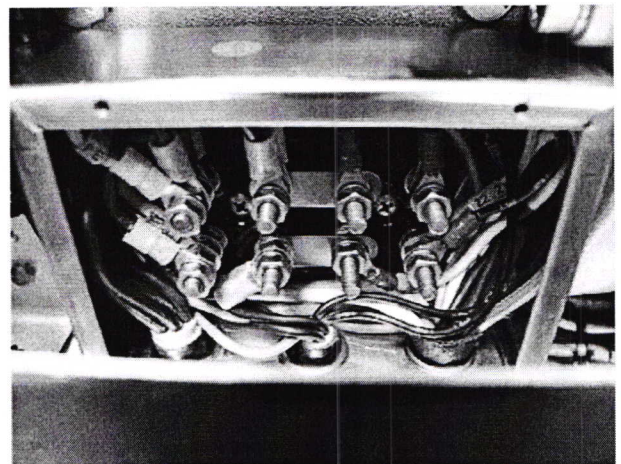


Fig. D.14: Generator output terminal box

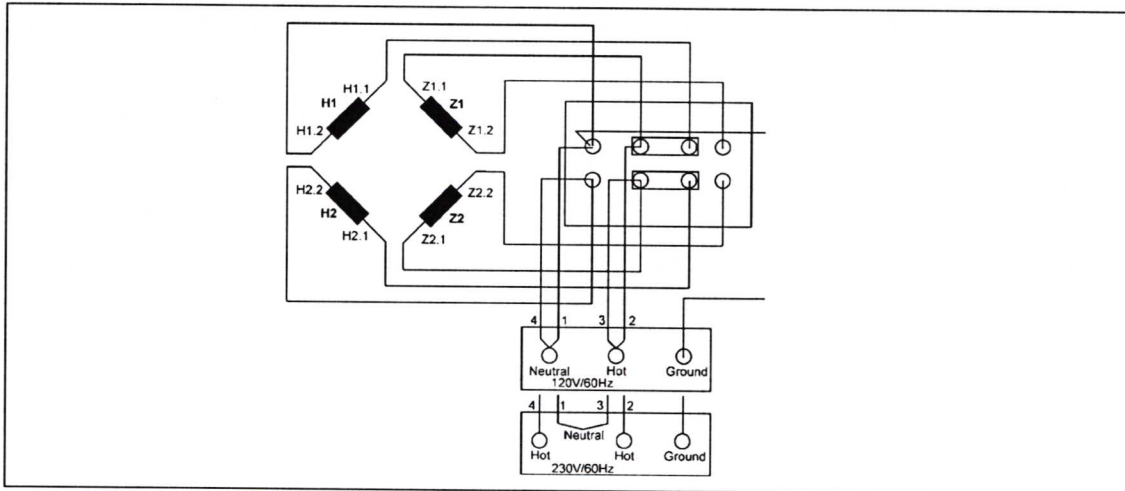


Fig. D.15: Wiring diagram

D.4.2 Coil Resistance Measurements in Stator Windings

When there are neither faults with the capacitors nor any low or high voltage "shorts" in the windings to ground, the windings should then be tested for the correct coils resistance (for shorts between wires within the coils). 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:

Z1.1-Z1.2, Z2.1-Z2.2, H1.1-H1.2, H2.1-H2.2.

Checking windings.

- Disconnect all the cables from the terminals in the AC-connection box.
- Remove the Neutral- Ground connection.
- Take all the winding connection cables from the terminal bolts.
- 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 the resistance between the separate windings. Maybe the readings of your meter do not comply with the values of the table in the appendix. In every case the relation between the values should be the same. Some meters do not work fine, when values are very small.
- Measure the resistance between the different windings. When you find a value in the 20 Mega-Giga Ohm range, the winding is ok.
- Measure the resistance between the different windings and housing of the alternator. Here you should also find a value in the Giga-Ohm range. When the winding is shorted to ground, maybe you are not able to measure this, because the voltage of your meter is a few volts. In this case to get a save reading, use a MEGA-meter with a high test voltage

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

If the measured resistance values deviate from each other significantly, then there is probably a short within the coils. A short within the coils can prevent the generator from achieving the required excitation and therefore from reaching the rated power output. The values listed in the above table, represent the approximate range of acceptable resistances. Most important is that the measures values do not deviate significantly from one another. Large resistance value deviations between phases indicate a short-circuit in the windings. In this case the generator must be newly wound by a qualified technician.

D.4.3 Measuring the Coil Inductive Resistance

Unfortunately a reliable assessment of the winding's performance cannot be attained through checking only coil resistances. However, the symmetry of the coil resistances is a good indicator of winding performance. If the coil resistances are symmetric, the next step is to measure the winding's inductive resistance using a special meter (capable of measuring milli-Henrys).

The coil induction is measured and compared in the same manner as the electrical resistance (i.e. the windings are compared for symmetry). These parts must have the same values.

Note: These values strongly depend on the method of measurement (e.g. used instruments)

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 generator terminalbox must be disconnected.
3. Reconnect the battery connections.
4. Start the generator.
5. Measure the voltages between the following terminals and compare for symmetry:
Z1.1-Z1.2, Z2.1-Z2.2, H1.1-H1.2, H2.1-H2.2.

D.4.4 Rotor Magnetism Loss and "Re-magnetizing"

After having stood idle for a longer period of time, or after having been shut down abruptly from operating under a heavy electrical load, most asynchronous generators have difficulties achieving full excitation independently. The remaining rotor magnetism is lost.



ATTENTION ! Before working on the System read the "Safety Precautions" on Page vii.

The magnetism required for excitation can be easily restored using a simple DC Battery. The generator must be stopped to do this, that means the starter may not be actuated. DC is fed to a desired part of the winding from the exterior for a short period. This can, for example, be carried out for by feeding DC to the windings from both terminals of a 230V socket of the vehicles system. (This, of course, can only happen if there is no connection to any power source). There must be a connection between socket and the generator (see diagram below). It suffices if DC is applied for a short period (1-2 seconds). The remaining magnetism can be restored and the generator can be started in the normal manner again.



ATTENTION! - Before this procedure is performed to restore the magnetic field, it is crucial to ensure that the generator is not running! (otherwise, it is very DANGEROUS TO LIFE!)

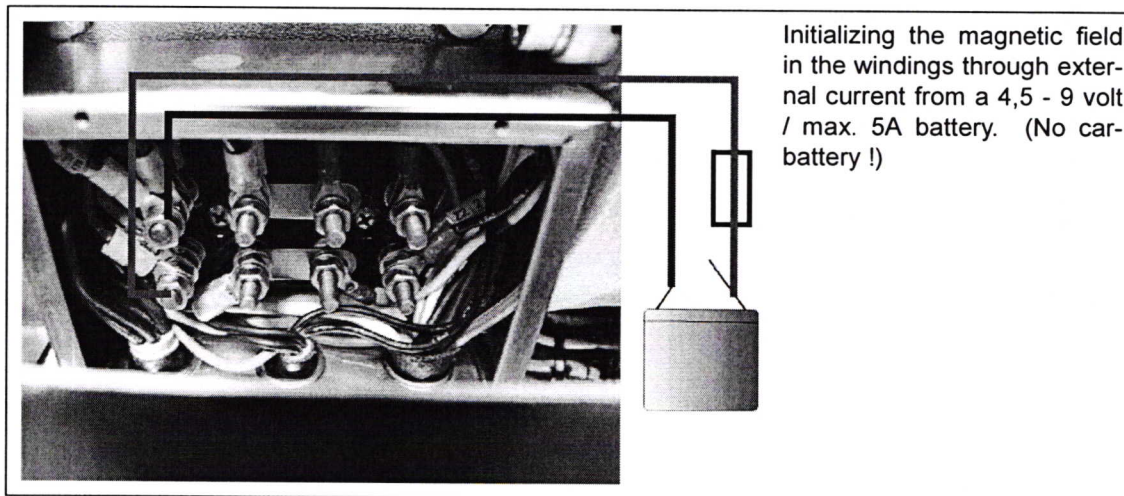


Fig. D.16: Re-magnetizing points

D.5 Starting Problems

D.5.1 Fuel Solenoid Valve

All engines are equipped with an electric inlet fuel solenoid valve (12V) which switches off the motor. The fuel solenoid valve is located in front of the injection pump. It opens automatically, if the "START"-button is pressed on the remote control panel. The solenoid valve is CLOSED when the generator main power is switched "OFF". For this reason, it requires a few seconds before the motor comes to a full halt. If the generator fails to start, runs rough, does not reach the proper RPM, or does not stop properly, the first item to suspect in most cases is the fuel solenoid valve. A check of the fuel solenoid valve by removing the power connection from the fuel solenoid valve for a short period whilst in operation (first remove the small retention screw) and replace it immediately. The motor should "react immediately" by revving high. If the motor does not react sharply when the power is reconnected, it is a sign that the solenoid valve could be faulty.

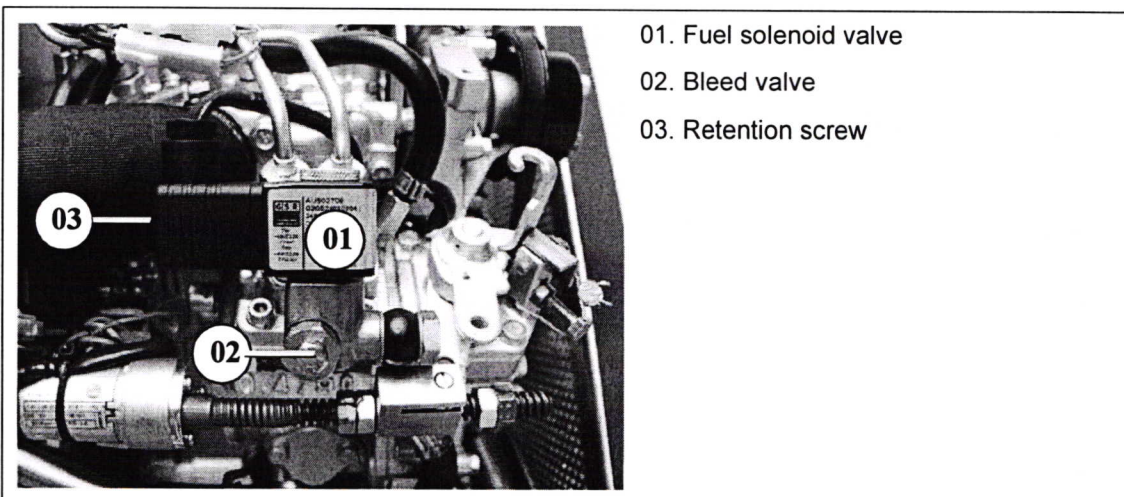


Fig. D.17: Fuel solenoid valve

D.5.2 Failure Bypass Switch

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

01. Failure bypass switch

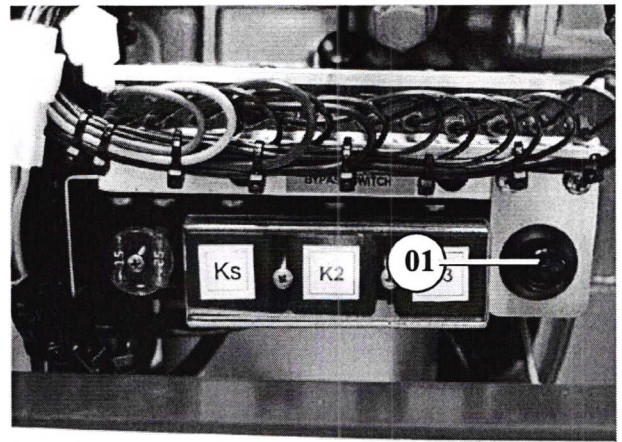


Fig. D.18: Failure bypass switch

D.5.3 Dirty fuel filter

If the fuel filter is dirty change the filter element.

For replacing the filter element see section D.6.1, "Replacing fuel filter," on page 78

01. Fuel filter element

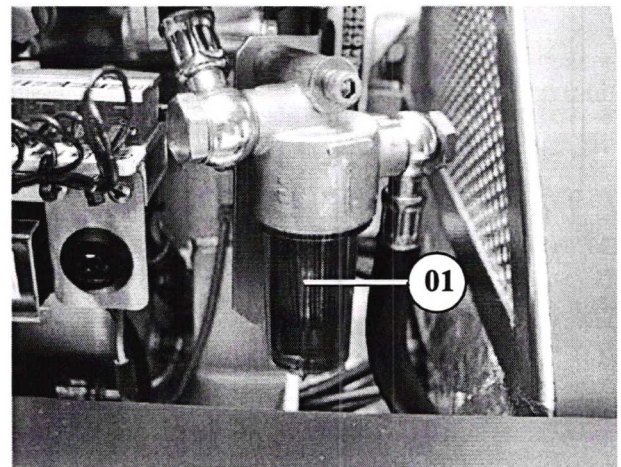


Fig. D.19: Fuel filter

D.6 Troubleshooting Table

For Troubleshooting see section F.4, "Troubleshooting," on page IV.

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E. Installation Instructions

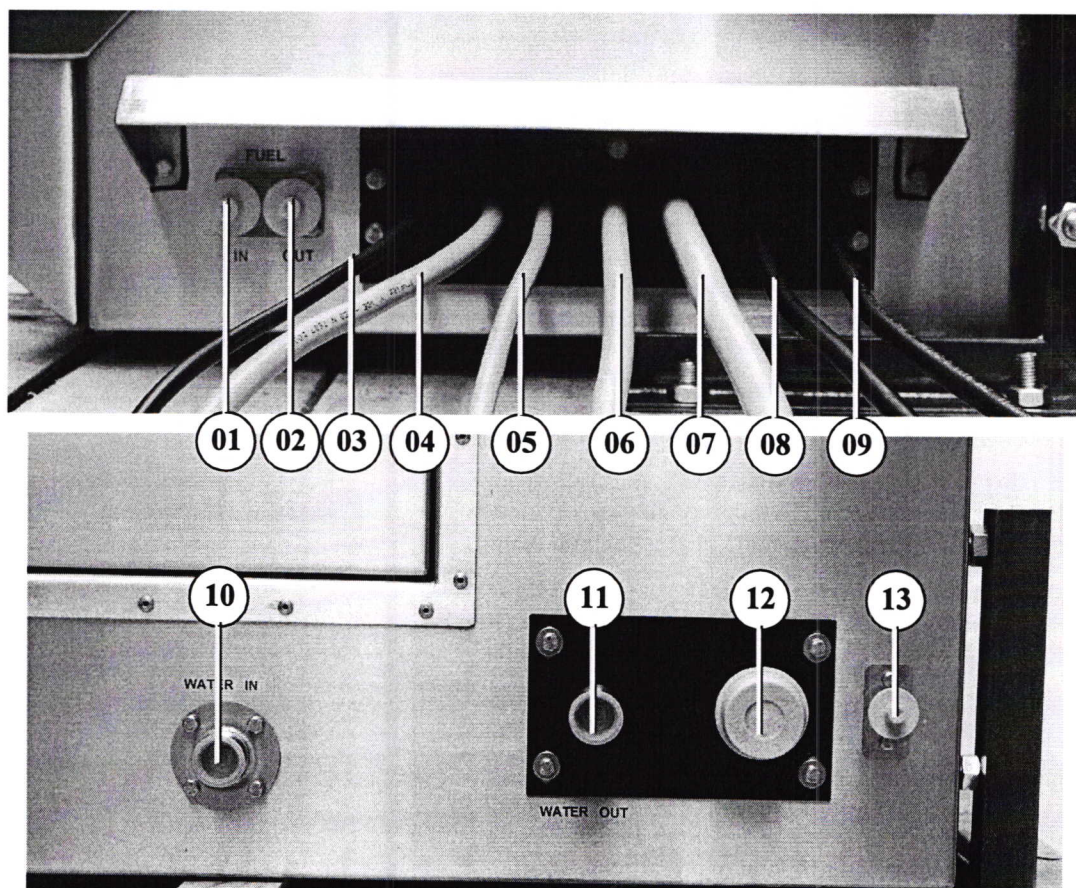
E.1 Generator Connections



ATTENTION! Before working on the System read the "Safety Precautions" on Page vii.

E.1.1 General Instructions

- It is important to pay attention to the fresh air intake.
- The radiator may not be covered.
- Untrained personnel should never open the generator.
- Protect the generator from overheating.



- 01. Fuel IN
- 02. Fuel OUT
- 03. Cable for fuel pump
- 04. Cable for remote control panel
- 05. Cable for VCS
- 06. Cable for AC-control box
- 07. Cable for generator output

- 08. Cable for starter battery minus (-)
- 09. Cable for starter battery plus (+)
- 10. Cooling water intake
- 11. Cooling water output
- 12. Exhaust output
- 13. Connection external expansion tank

Fig. E.1: Connections

E.1.2 Fuel System Installation

A fuel filter with water separator is fitted on the interior of the generator capsule itself. Generally fuel forward and back flow must be connected to the diesel tank by means of its own induction pipe. Attention must also be paid that the fuel back flow pipe leads to the tank floor, in order to prevent emptying of the fuel pipe.

Generally, the Panda generator bleeds the fuel lines automatically. Before starting your generator for the first time (or after the genset has been sitting idle for a longer period of time), follow

section C.4, "Bleeding the Fuel System," on page 42.

The following items must be installed:

1. Fuel feed pipe from the tank to the generator
2. External fuel suction pump (12V DC) is useful
3. Return pipe to the tank (no pressure)

The fuel suction pump should be mounted as close to the fuel tank as possible.

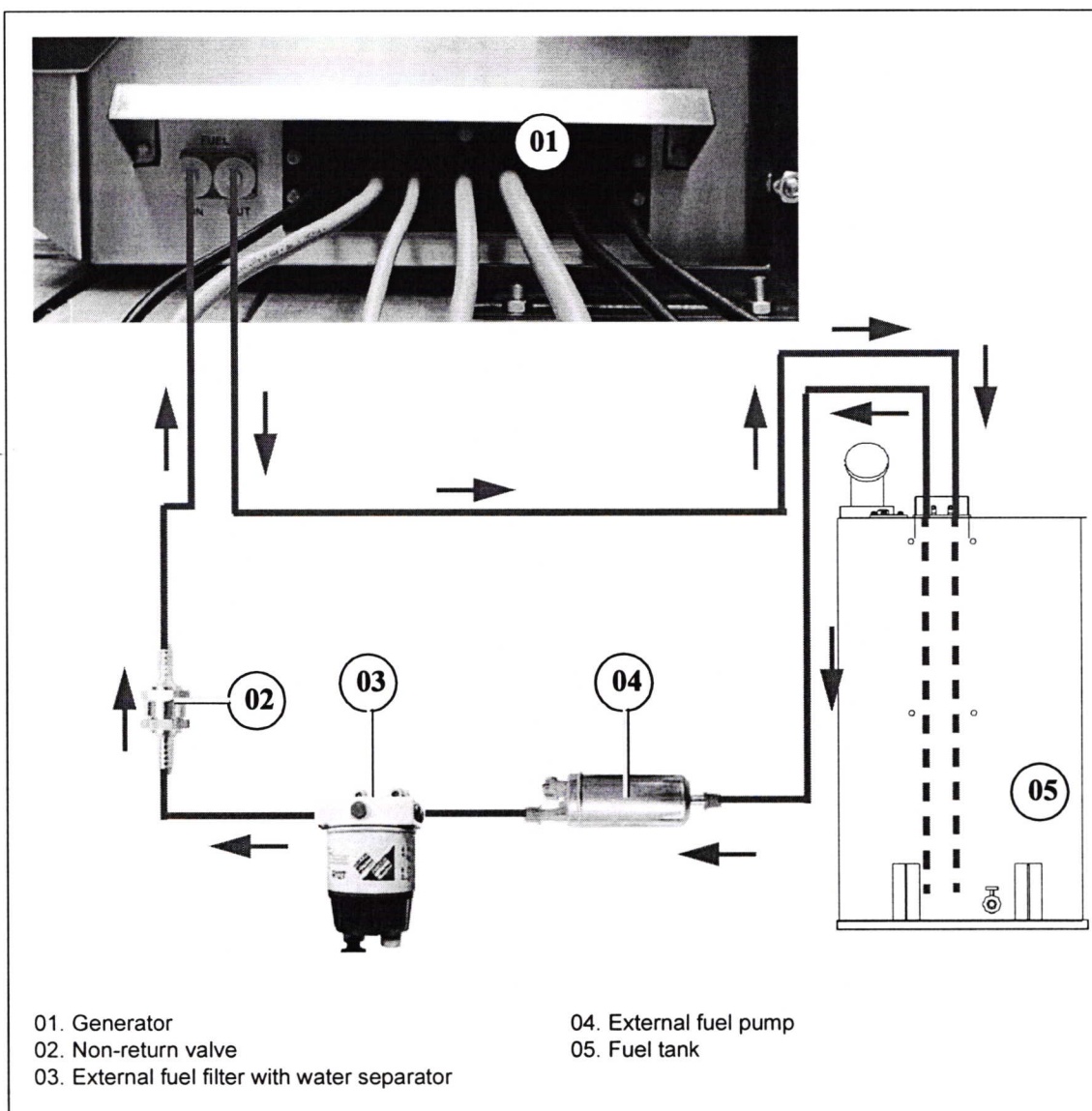


Fig. E.2: Fuel installation - example

E.1.3 Connection to 12V Starter Battery-Block

It is necessary to install a 12V starter battery for the generator. The generator has its own alternator to charge a 12V starter battery.



ATTENTION!

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 12V 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.

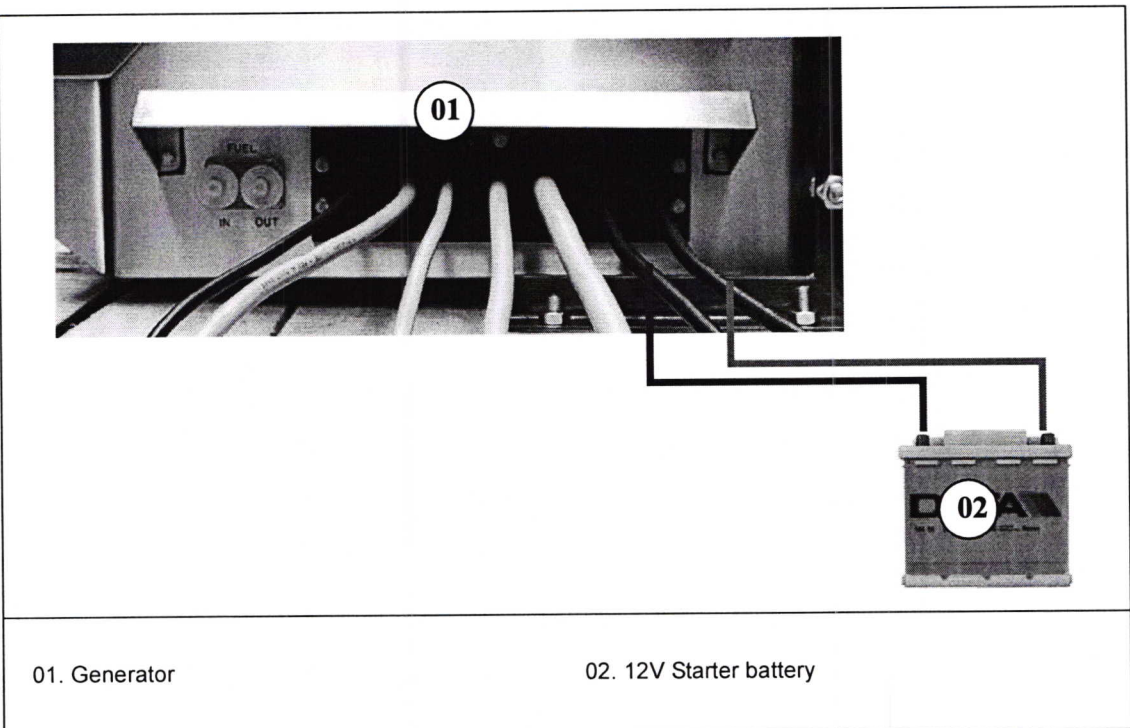


Fig. E.3: Starter battery installation - example

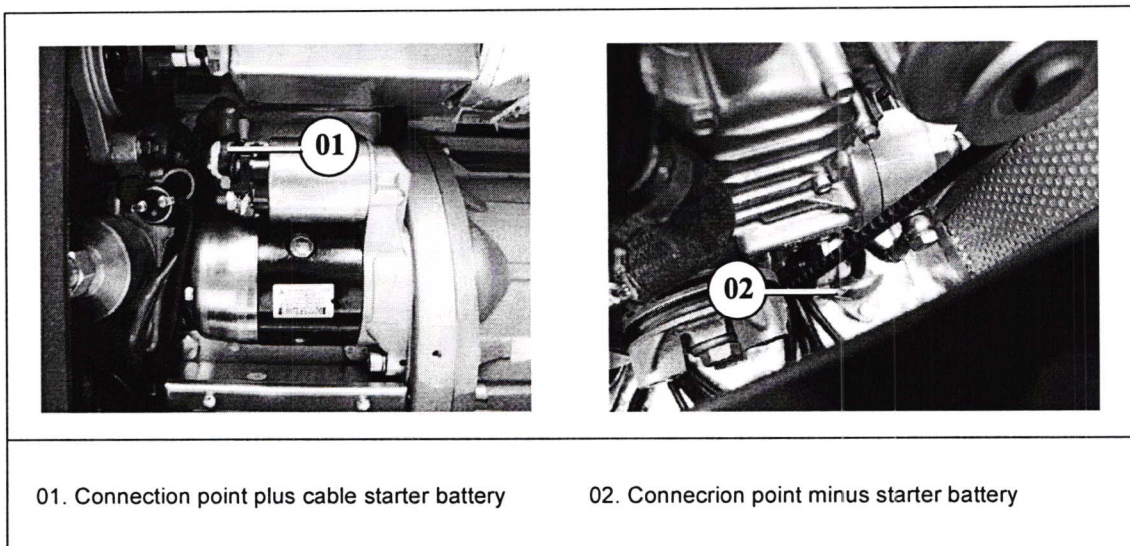


Fig. E.4: Connection points starter battery

E.1.4 Connection of electrical components

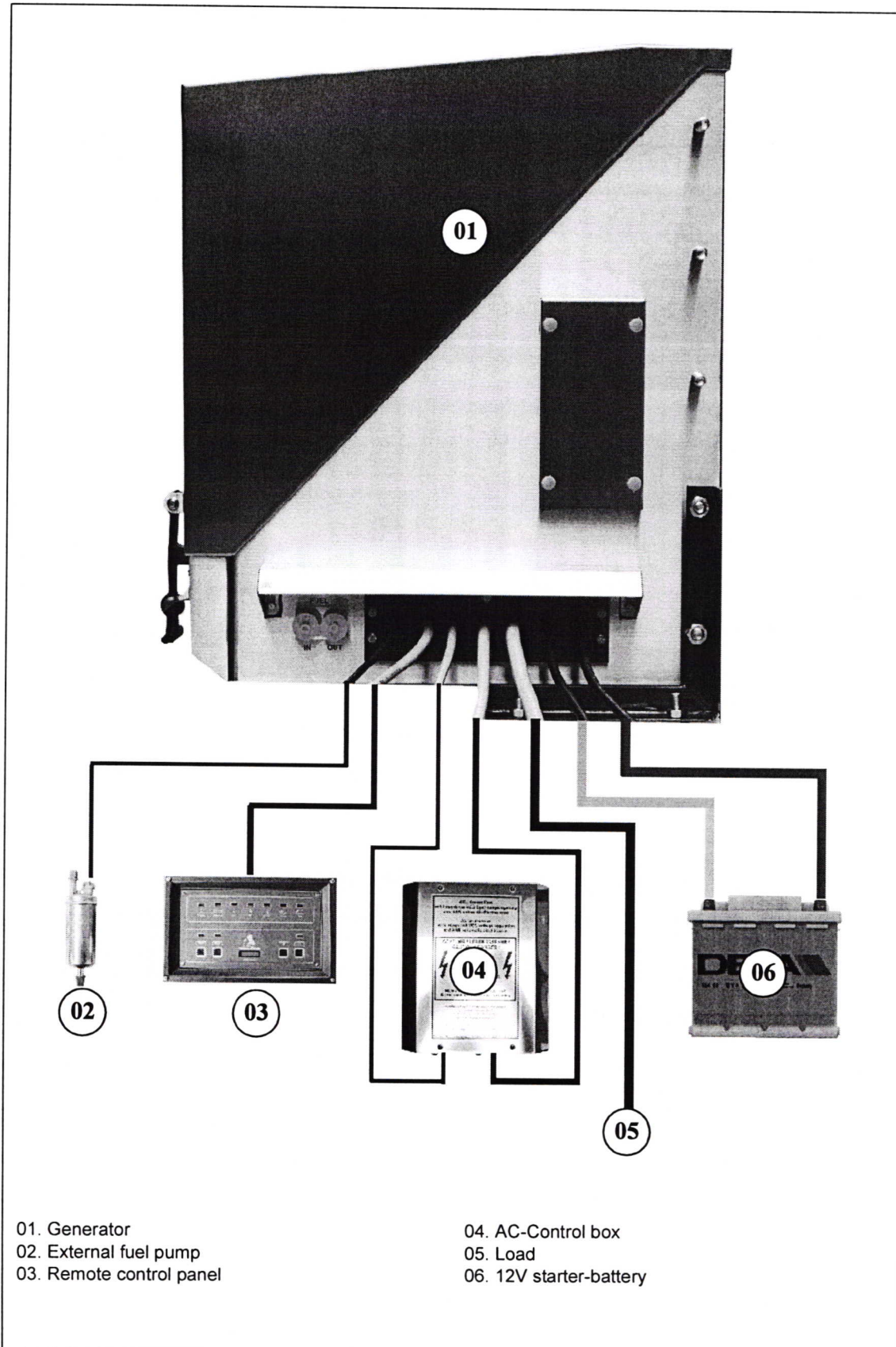


Fig. E.5: Electrical components installation - example

E.1.5 Connection of external radiator

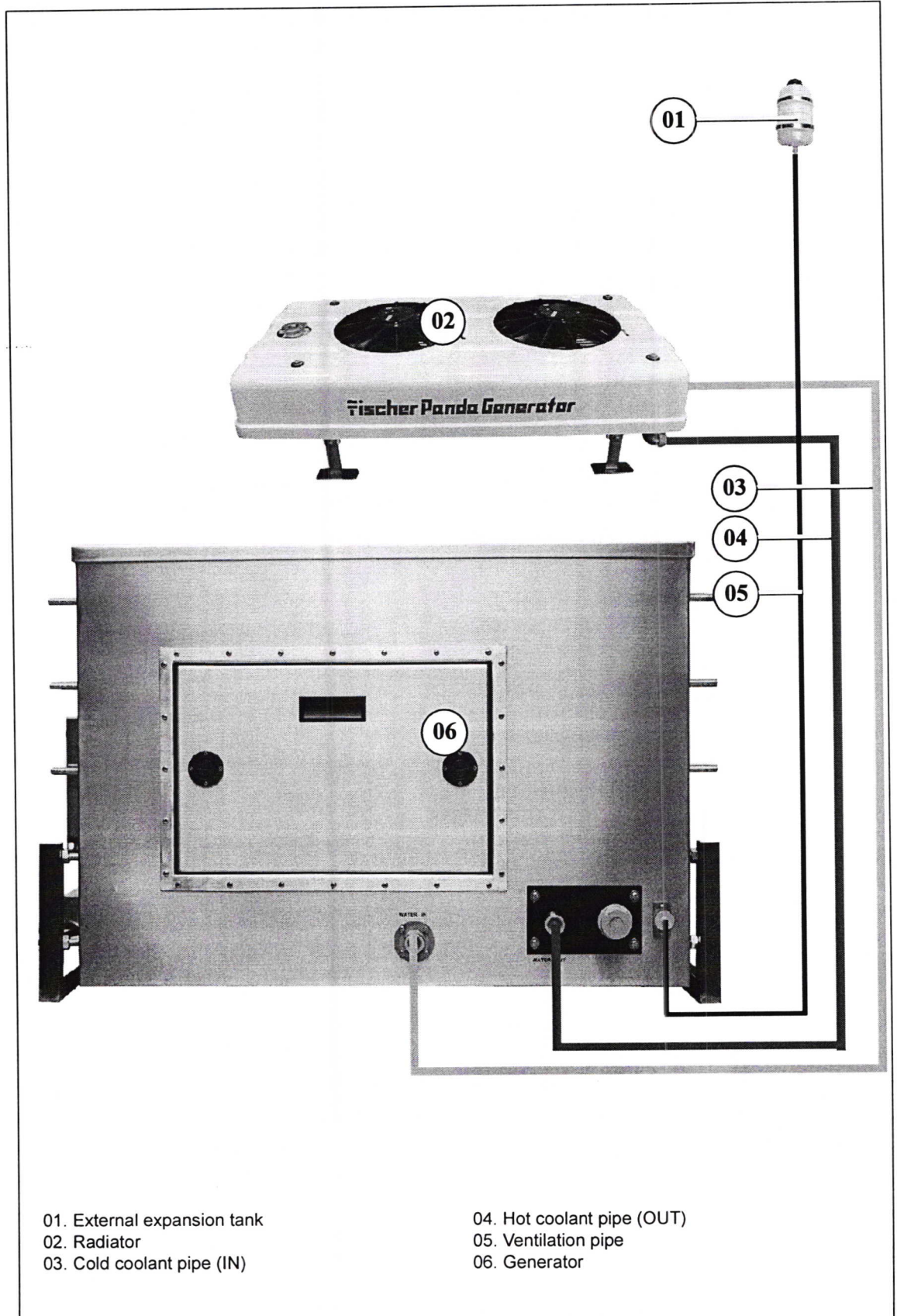


Fig. E.6: External radiator installation - example

E.2 AC-Control box with VCS

In the AC-Control box the needed capacitors for the excitation of the generator are placed as well as the electronic control for voltage/speed regulation VCS and the starting current reinforcement ASB. The AC-Control box must be connected with the conductions (high voltage and low-voltage) to the generator.

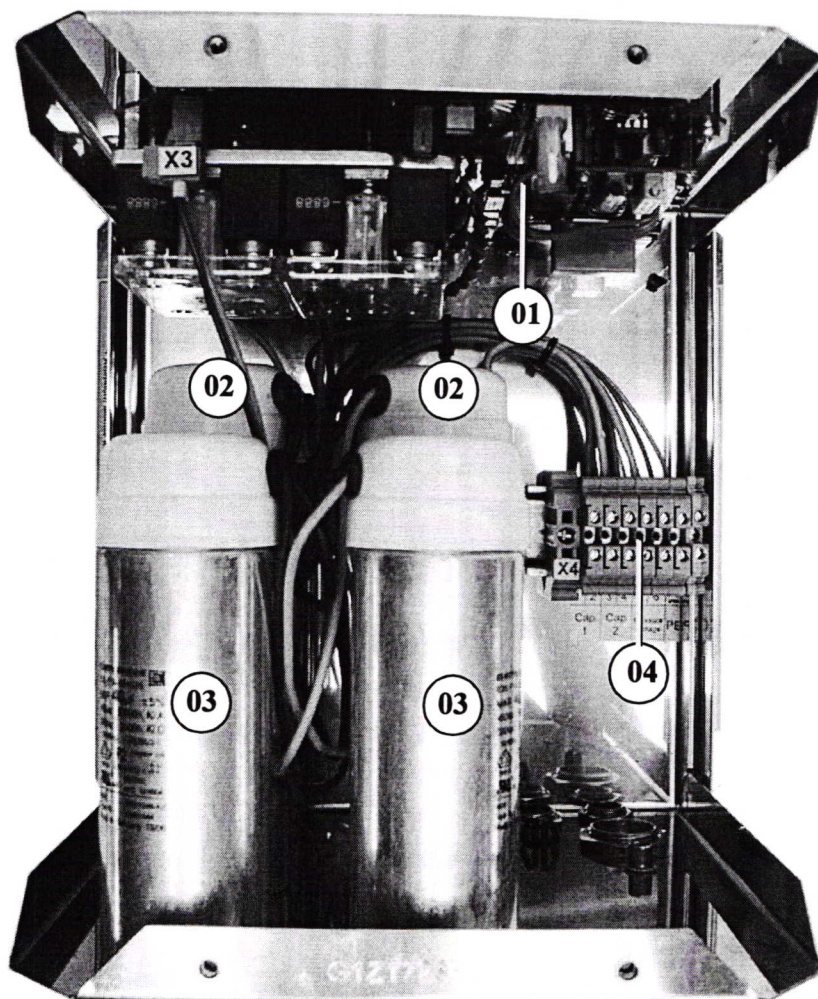
The front panel must always be closed, since the AC-Control box produces 400V during operation.

The negative pole and the ground are connected to the housing.

Ensure that the power supply system installation conforms to all of the required electrical system safety regulations of your local authorities. Only a qualified electrician should install the electrical system. Especially adherence to the regulations regarding conductors, safety switches etc.

ATTENTION ! Danger to Life - High voltage

Before working on the System read the "Safety Precautions" on Page vii.



01. VCS circuit board
02. Capacitor 50 μ F

03. Capacitor 40 μ F
04. Terminal block for excitation cable

Fig. E.7: AC-Control box - inside

E.2.1 The VCS-Control

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

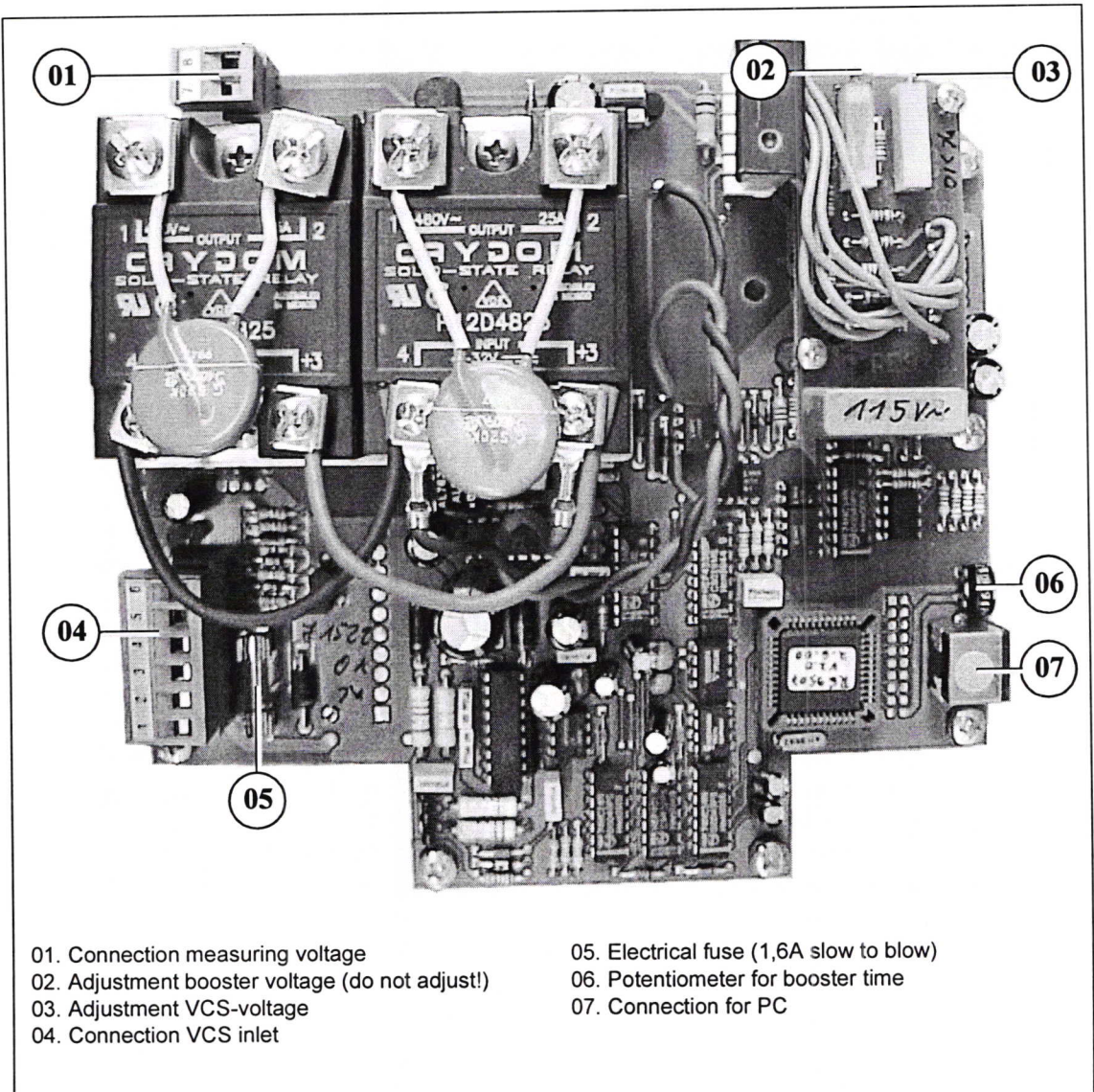
The VCS controls the generator voltage and motor speed. A servo motor on the injection pump can increase the engine speed by up to 8%.

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

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

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

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



- | | |
|---|---|
| 01. Connection measuring voltage | 05. Electrical fuse (1,6A slow to blow) |
| 02. Adjustment booster voltage (do not adjust!) | 06. Potentiometer for booster time |
| 03. Adjustment VCS-voltage | 07. Connection for PC |
| 04. Connection VCS inlet | |

Fig. E.8: VCS circuit board

ATTENTION!

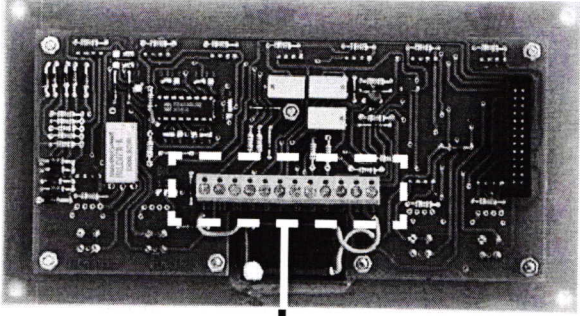
The wire for the measuring voltage must be connected direct to the battery, and is not to be connected to the output side of the generator rectifier.

Because of the drop in voltage, the exact voltage is only received directly to the battery. A wrong connection can lead to damage to the battery!

E.3 Installation of the Remote Control Panel

As standard a 12 core connection-cable, 7m long, 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.



Remote Control Panel rear side

Check cables are numbered to pair with terminals.

01. Connector number

02. Cable number

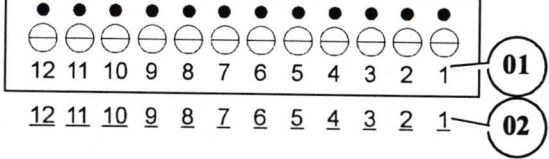


Fig. E.9: Remote control panel

E.4 Cooling system

General instructions

The PANDA vehicle generator is supplied as standard without a radiator. Various radiators are available according to the customer's requirements; these can be chosen according to the appropriate operating and installation situation. The cooling system can also be assembled together with a normal commercial vehicle radiator.

Determining the size of the radiator

Consideration must be paid to the total heat load when determining the size of the unit. This equates to the generator nominal performance without the water-cooled pre-silencer. The heat resistance is 1.8 times the generator nominal capacity, when the water-cooled pre-silencer is used (i.e. Panda 12000 PVMV-N has a total heat capacity of approx. 18kW). The radiator can be serviced by any usual radiator servicing agency. It should, however, be pointed out that the radiator possesses high safety levels. The radiator is often manufactured too small. ICEMASTER also has various radiators available (for horizontal and vertical installation) as standard generator components.

Radiator position

The place and fitting position of the radiator must be carefully considered. It is especially important that the warm air can escape. For this reason, the best place for the radiator is in a vertical position on the vehicle roof (if one take into account that an obstruction could arise in narrow entrances).

The manufacturer is only too happy to give suggestions on how to install the radiator. It must, however, be expressively pointed out that all recommendations of this type are **not binding**. It continually occurs that special influencing factors are not recognised from the start. The customer or the technician making the installation must always take changes to the position or radiator's place of installation into consideration. The manufacturer cannot accept liability for the recommendations given to the best of his knowledge. As a precaution, attention should always be paid that the air outlet for escaping warm **is as large as possible**. The vehicle paint sprayer is often not in agreement with this, but the person making the installation must make the aim clear. **The fitter** must make his position clear.

Radiators which are installed vertically, and the warm air is blown **downwards**, must be twice the size of such radiators, by which the warm air rises through its own thermal energy. It must also be considered that a build up of heat results through the emission of warm air in the direction of the ground, whereby the warm air is once again forced to rise to the area of the radiator. Freely escaping warm air cannot be guaranteed in this case. Additional ventilators may be necessary should the warm air need to be channelled through pipes.

It must be ensured that warm air is extracted out of the radiator.

Permitted coolant temperatures

The performance of the radiator must be so measured that the coolant temperature of the Panda generator does not exceed more than 70°C. The coolant intake must be fitted direct to the coolant pump.

There must be a large amount of water circulating to ensure that the difference in temperature when compared to the temperature of the water leaving the generator (full load) does not exceed 12°C. The difference may also amount to 17K if a pre-silencer is installed.

The hoses must be so laid out that knots and other obstructions are avoided. If necessary, the amount of coolant must be measured. As a minimum the following values are necessary:

Essential coolant amounts:

Panda 4500	min. ca. 10 l/min
Panda 8000 - 9000	approx. 16 to 22 l/min
Panda 12000 - 14000	approx. 24 to 28 l/min
Panda 18 - 24	approx. 32 to 38 l/min
Panda 30 - 32	approx. 40 to 45 l/min
Panda 42 - 65	approx. 50 to 60 l/min

The greater the amount of coolant circulating, the lower the difference in temperature. If the necessary cooling performance cannot be achieved, the amount circulating can be increased by adjusting the pulley on the pump and thereby raising the performance.

ATTENTION! The coolant pressure may, however, not exceed 0.7 bar!

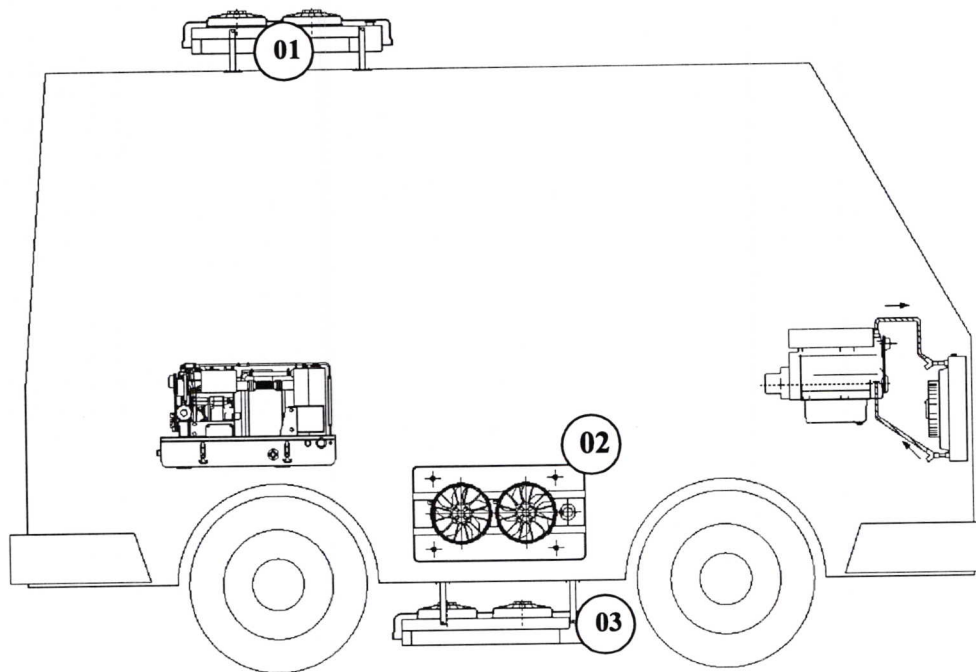
Construction and position of the radiator

The radiator can be assembled away from the generator in a well ventilated position. Attention must be paid that the radiator emission direction is completely free of obstruction. Turbulence is to be avoided. There is often a clash between the streamline appearance of the chassis and the technical requirements.

The radiator can be installed (vertically) or (horizontally). Consideration must be given to the fact that air is drawn in via a fan motor.

The best result is achieved if the radiator is fitted vertically on the vehicle roof.

Possible positioning of the external radiator



01. Radiator on the roof
02. Radiator vertical

03. Radiator under the vehicle

Fig. E.10: Possible position of the external radiator

Pay attention to the following item at the horizontal assembly of the radiator:

To avoid damages of the fan motor please bore some holes on the backside of the fan (diameter approx 4mm). Because water can enter the fan (rainwater, condenswater, sweatwater etc.). The water can run out through these holes. (see below 02) Generally a fan is a wearing part and should be changed one time a year.

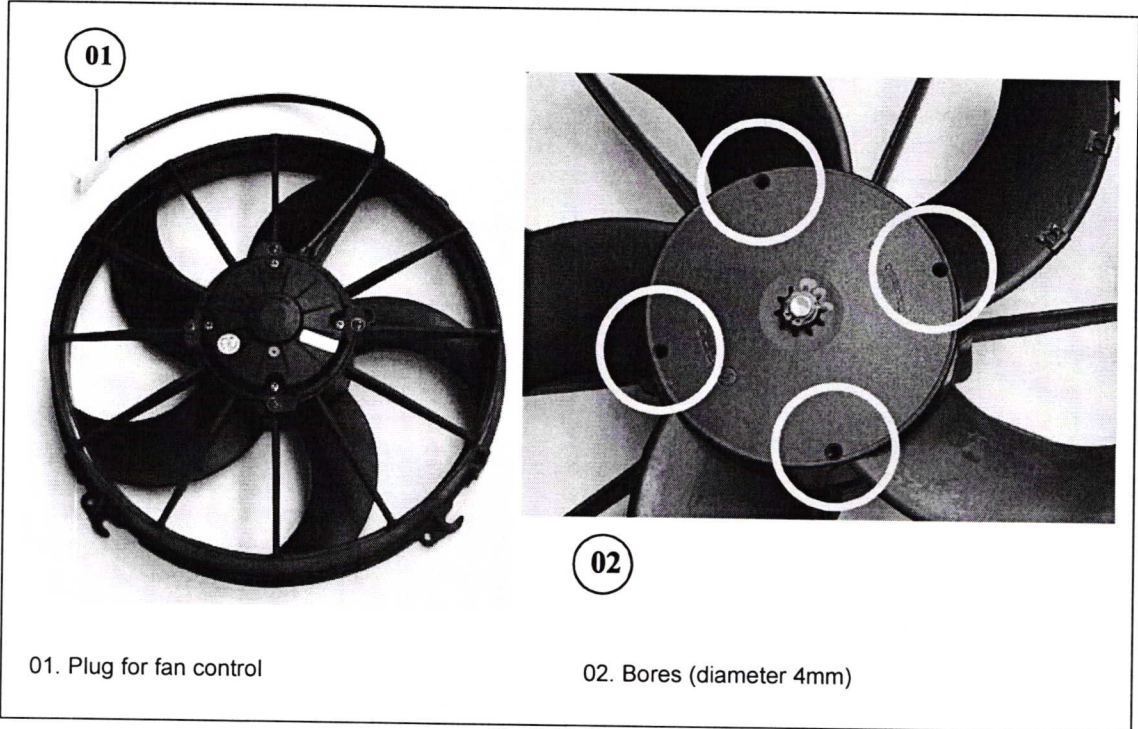


Fig. E.11: Bores

Distance from the radiator to the unit

The coolant water pump mounted on the generator is so laid out that a distance of up to 5 mtrs length from the radiator is possible. The hose cross-section must be laid out accordingly. The minimal internal diameter amounts to 18mm (Panda 4500). A hose must be used for both sides (forward and back flow) which is resilient to pressure and high temperatures (at least 120°C).

Minimum hose diameter for cooling lines:

Panda 04 kW	.....	Ø18mm (¾")
Panda 12 - 20 kW	.....	Ø25mm (1")
Panda 25 - 30 kW	.....	Ø32mm (1¼")
Panda 40 - 50 kW	.....	Ø38mm (1½")
Panda 50 - 60 kW	.....	Ø44mm (1¾")

Coolant expansion tank

It is absolutely essential, that a exoansion tank, that can be aerated, is fitted adjacent to the radiator. The ventilation pipe should, if possible, be fitted to the radiator's highest position. For this, a pipe with a maximum diameter of 10mm suffices, which must be fed to the expansion tank. A further pipe, which must be fitted to the floor of the expansion tank, can be fitted to the cooling system in any desired place (i.e. T-piece). Frequently a connection is provied on the radiator itself. The coolant expansion tank is not normally supplied by ICEMASTER. For this a standard vehicle expansion tank is the most suitable. Vehicle accessory range is the most suitable.

Coolant Pump

This is normally equipped with a independent impeller suction pump. This pump suffices if the cooling water pipes etc equate to the normal standard. ICEMASTER can give no guaranty. It must be determined whether the amount of cooling water circulating is sufficient. Consideration must always be given to the fact that the water flow is supported by an external pump.

Antifreeze

The **antifreeze** concentration must be regularly checked in the interests of safety. The antifreeze solution supplied from the factory provides protection to -15°C. If lower temperatures are occasioned during transportation or storage, then the coolant must be drained. The cooling system is, however, so arranged that the draining of the coolant is only possible in the assembled state, when air under pressure is blown into the system. Air pressure of approx. 0.5b suffices, in order to blow out the water.

Suction filter as a source of noise

The external suction filter (not included on delivery) must always be used if the generator is to be used in a dust-free environment. This filter is connected by means of a hose with a connecting piece to the generator housing. The filter can be the source of considerable noise. If this is the case, an air intake muffler with the appropriate nominal width should be ordered from ICEMASTER. This is a cylinder, which takes up relatively large amount of room (Total length approx 700mm, Diameter 100mm).

Vehicle Generator with Centrifugal Coolant Pump

An impeller pump can also be provided if the radiator, for technical reasons, is to be installed relatively distant from the radiator and additionally requires a number of changes to the direction of the pipe. This coolant impeller pump is mounted on the generator as an additional pump, and is driven by pulleys. The pump action is carried out by a "rubber impeller".

ATTENTION! Temperature restriction!

This pump may only be used if it is ensured that the temperature of the coolant entering the pump does not exceed 70°C during continual duty. 75°C is permissible for short periods. These may, however, in no case be for longer periods. If the coolant temperature exceeds the permissible rate, this can lead to the impeller blades being torn off. The advantage of this impeller pump is that this pump, as a "positive displacement pump", is self-suctioning and is therefore very sensitive to air bubbles etc.

Ventilating the cooling system with the aid of a self suction impeller pump is very simple. In some cases the pump is additionally installed for this reason alone. Unfortunately the operating noise of these pumps is very loud.

In spite of this attention must be paid that a zone is available at a high point, where the air bubbles in the coolant are able to escape to. As a rule, this is the expansion tank, as long as this is connected direct to the tank. If the coolant expansion tank is, however, so integrated in the system that it cannot be reached by circulating water, then an air release valve must be fitted in the circulation pipe at a place of your own choice, which can then also be connected to the expansion tank (see next page).

In case of doubt, you should send a diagram of the required coolant system to ICEMASTER and let this be checked there.

Installation with special air separator

An "air separator" must be fitted at all critical places in the circulation system, in case a perfect automatic ventilation on account of obstacles in the pipe passage cannot be achieved. A self-actuating ventilation valve must be fitted to each air separator.

Monitoring the Temperature

You are expressly advised to measure the temperature of the circulating coolant after installation. Two remote thermometers must be used for this. A connection must be fitted to the motor coolant inlet; the second on the coolant outlet. After a short warming-up period, the generator must have a load of at least 75% of the nominal capacity placed on it. The coolant circulating is to be checked. The values must lie within the following limits:

1. Coolant inlet, max 70°C during constant duty at maximum load
2. Coolant outlet, max 85°C during constant duty
3. Difference of both values: This point is especially important and gives an indication of the coolant circulating. The difference should amount to a maximum of 17°C for a water-cooled system with an integrated water-cooled pre-silencer, as a rule it should, however, lie between 10 - 12°C.

The circulating coolant is not sufficient, if the difference amounts to more than 15°C, and the amount of water circulating must be increased. This can be solved, for example, if the pipe passage is improved or the pulley diameter is reduced. It is absolutely essential to measure the performance of the cooling system after installation of the generator. The above named values should be considered as the maximum permissible values. They are also valid for operation at high temperatures. During constant duty at normal temperatures (20°C), the values should be well below the above named data.

Installing a Coolant Temperature Display

A remote display unit for coolant temperatures should be installed, when fitting sensitive systems (i.e. Television broadcasting vehicles, ambulances or other vehicles) with sensitive measuring instruments. In this case a standard coolant **display device** with remote thermometer can be used. It is absolutely essential that two display instruments are installed:

1. Cooling water **inlet**
2. Cooling water **outlet**

It does not matter at which place the measurement is made. T-pieces for hose elements can be obtained from ICEMASTER into which the usual trade sensors can be installed.

Monitoring of temperature:

1. Temperature at the cylinder head
2. Temperature at the manifold
3. Temperature in the generator winding area (only Panda 8000 upwards)

The winding temperature monitor is not fitted with a special display unit. The fuel solenoid valve is switched on as a circuit breaker for the motor stop solenoid or the fuel pump. If the generator switches off because the winding overheats, nothing is displayed. In this case a long period of waiting can, in circumstances, be necessary. This can be bridged by using the switch. This must be carried out by an electrician who should use the circuit diagram for this. It suffices in this case when the plug which leads to the gauge wire is opened and both conductors in the plug are bridged. This shut down should, however, be a last resort! It is only applicable, if the generator temperature exceeds the permissible value on account of inaccessible working conditions. It must then be explained which measures are necessary to restore normal operating conditions.

Recording the temperature values

Installation records are delivered with every handbook, which must be completed after installation and returned to the manufacturer (Copy). The generator should be tested at 70% of its maximum performance. The temperature values must be checked at the maximum possible performance. The external temperature must be taken into consideration when doing this check. The values for T1 (see additional installation record for the vehicle version) may not exceed 85°C, even at high external temperatures and maximum load. If necessary the maximum permissible performance must be reduced (i.e. by the use of fuses).

Connection of the Generator to the Vehicle Cooling System

The Panda can in many cases be connected to the original vehicle system (vehicle-drive motor), without a problem. The amount of time required to do this is minimal, if the vehicle radiator is fitted with an electric fan. Should that not be the case, an electric fan is to be additionally placed in front of the radiator, which is monitored by a thermostat. The coolant pipes are connected directly with the pipes leading from the motor to the radiator. This installation is comparable with the installation of an additional hot water heating system, as long as this includes the motor cooling system. The manufacturer should be consulted in cases of doubt. The generator can be fitted to the vehicle cooling system via a heat exchanger, should there be any objections.

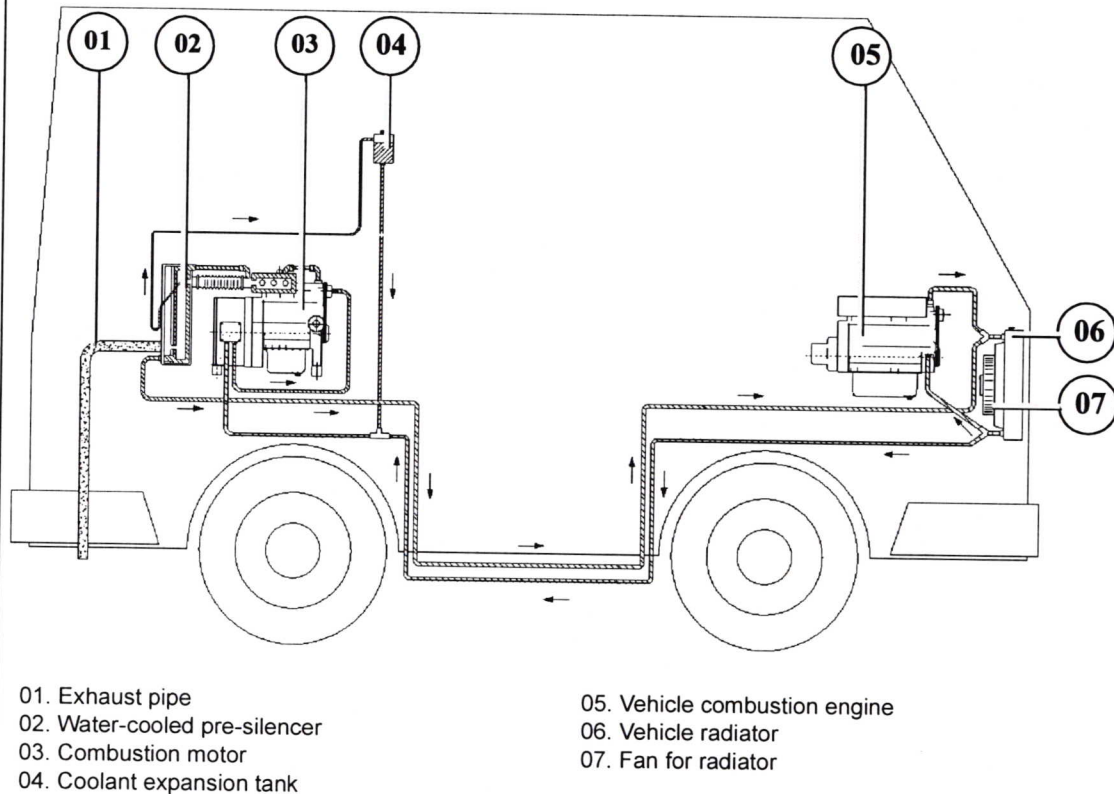
Connection of the Generator to the Vehicle Cooling System


Fig. E.12: Connection to the vehicle cooling system

Connecting the Generator Cooling System with the Vehicle Cooling System can bring the following advantages:

1. Pre-warming of the vehicle motor in winter (The generator can also be automatically started via a time switch).
2. Exploitation of the generator heat for vehicle heating systems (i.e. buses, conference vehicles, promotion vehicles etc.).
3. Otherwise saves the required space and the cost for an additional generator radiator.

We must, however, point out that connection of the vehicle cooling system to the motor cooling system requires a relative amount of experience of vehicle cooling systems. Various requirements must be considered. For example, it must be considered that the system acts as a "Bypass" when opening the cooling system thermostat. In some cases heating systems are connected to the system, which can then also operate as a "Bypass".

No liability is assumed, when a recommendation is made by the generator manufacturer to connect the generator to the motor cooling system. The person making the installation must also ensure in this case that all conditions of this type are considered.

It should also be considered that the vehicle thermostat or the thermo switch must be adjusted to the starting point for the radiator fan. In certain circumstances it is also essential to use additional thermostats for switching on the fan, which are installed in the generator's coolant pipes.

ICEMASTER can accept no liability if the cooling system does not function correctly.

Chassis construction companies and companies manufacturing vehicle assemblies should be aware that there could be problems with the motor or vehicle manufacturer regarding the warranty, if consequential damage occurs to the motor because of coolant pipe leaks. ICEMASTER will not accept any liability, if further units (i.e. vehicle motor) are damaged, when a part of the generator cooling system itself breaks down.

External radiator should be installed when initially being put into operation or after repairs

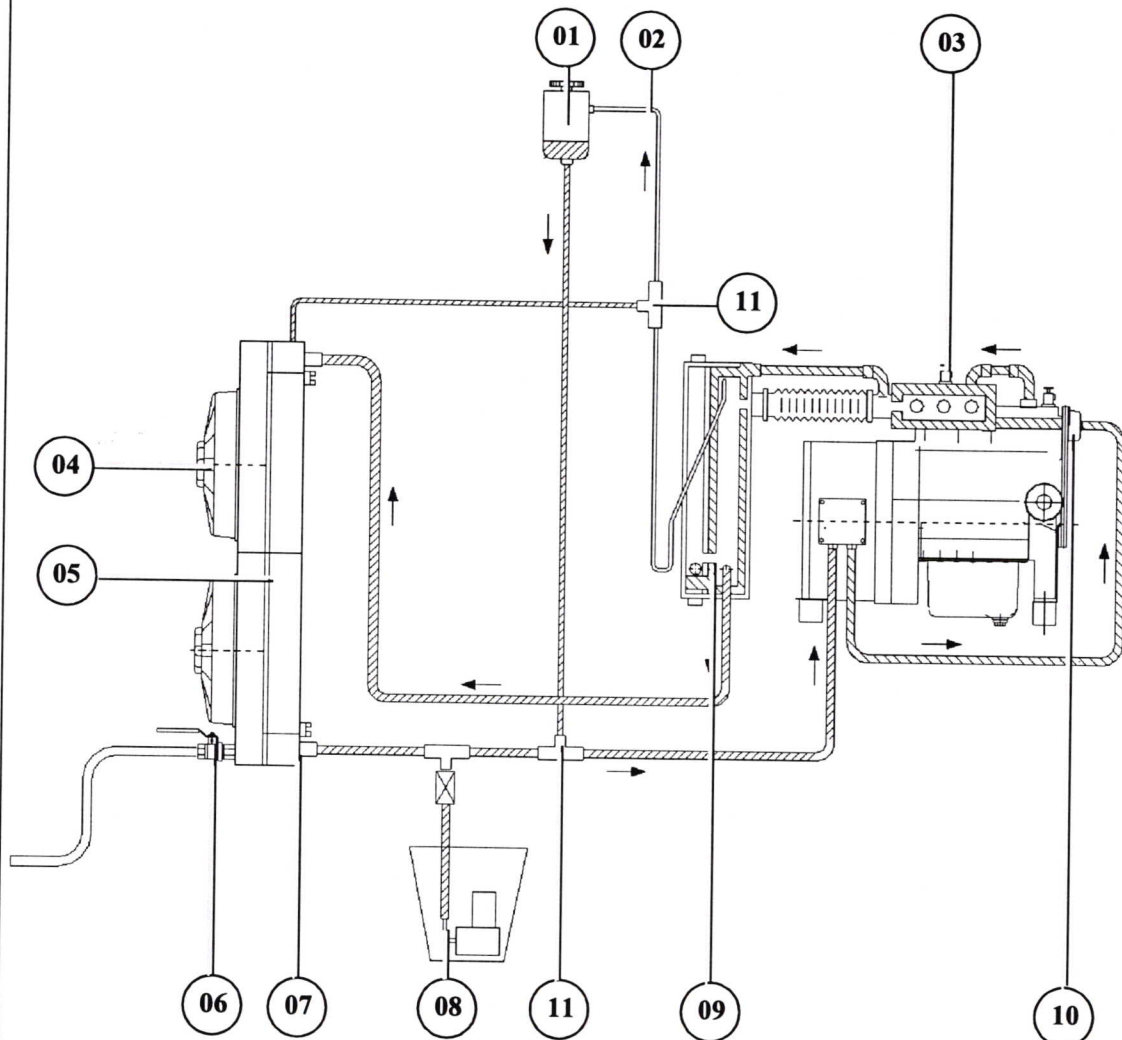
A ventilating valve is fitted, as a rule, to all units manufactured since the Spring 1995. A hose must be placed on the connecting nozzle ventilation valve to aerate the unit (nominal width 6-8mm). A transparent hose is recommended, since the ventilation process is easy to observe. The hose is to be fixed with light hose clips to the connecting nozzle. The hose must be sufficiently long to be able to feed the other end into the open coolant expansion tank during operation.

The coolant expansion tank is initially filled with coolant. The air valve must be completely opened before the following procedure is carried out. You should assure yourself whether the connecting pipe has been connected correctly to the coolant backflow pipe by means of a T-piece. This pipe should have an internal diameter of 12mm. Since the coolant pipes, for technical reasons, can only be gradually laid out with difficulty, resistance builds up during refilling, which can only be displaced with difficulty by the air in the generator or motor. This process can be made easier by producing excess pressure by means of the above mentioned ventilation pipe. The process is eased considerably, in that a transparent ventilation hose draws in air (this can also be carried out by mouth, if done cautiously). Meanwhile the coolant expansion tank should, at the same time, be refilled with water. The generator can be started as soon as the drawn in water is seen in the ventilation pipe (all other measures must, of course, be considered, for example, checking whether the motor oil has been topped up etc., as stipulated in the generator operating instructions).

During the starting process, the coolant expansion tank must be continually refilled with coolant so that no further air can force its way into the system from above. The other end of the ventilation pipe should be laid in the open coolant expansion tank filling opening, so that outflowing coolant runs back into the tank.

During the starting process the open coolant expansion tank must continually be filled with coolant so that no further air can force its way into the system. The ventilation pipe should be laid in the open filler cap of the coolant expansion tank during the starting procedure, so that escaping coolant runs back into the tank.

Decisive for the success of this procedure is that sufficient water enters to internal coolant pump, so that the coolant pump can function. The coolant pump cannot draw water as long as there is air in the casing.

Installation diagram for vertical radiator


- | | |
|----------------------------|---------------------------------|
| 01. Coolant expansion tank | 07. Thermoswitch |
| 02. Ventilation pipe | 08. Bucket with submerged pump |
| 03. Ventilation screw | 09. Water-cooled pre-silencer |
| 04. Fan for radiator | 10. Internal cooling water pump |
| 05. Radiator | 11. T-piece |
| 06. Stop valve for coolant | |

Fig. E.13: Vertical radiator

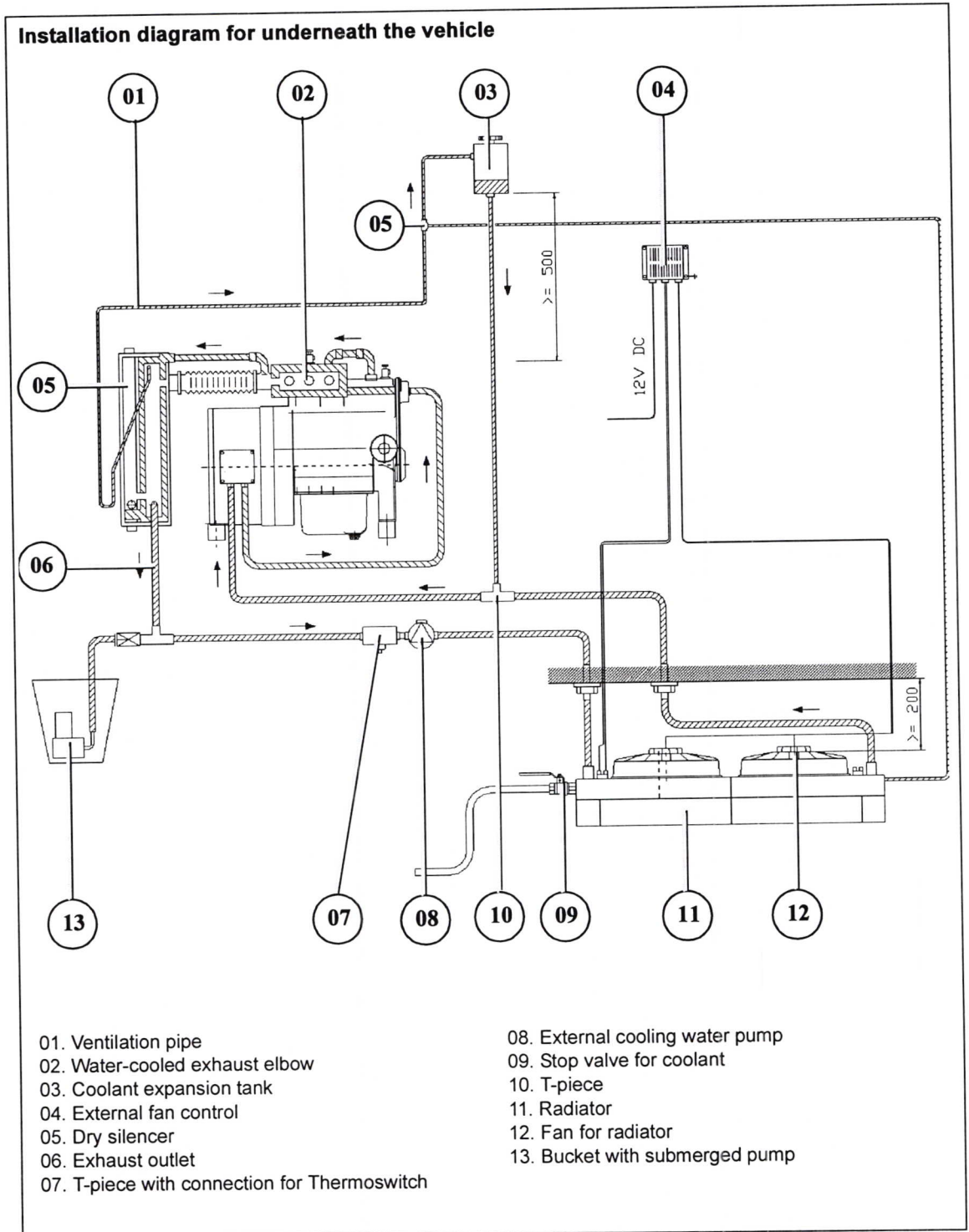


Fig. E.14: Installation underneath vehicle

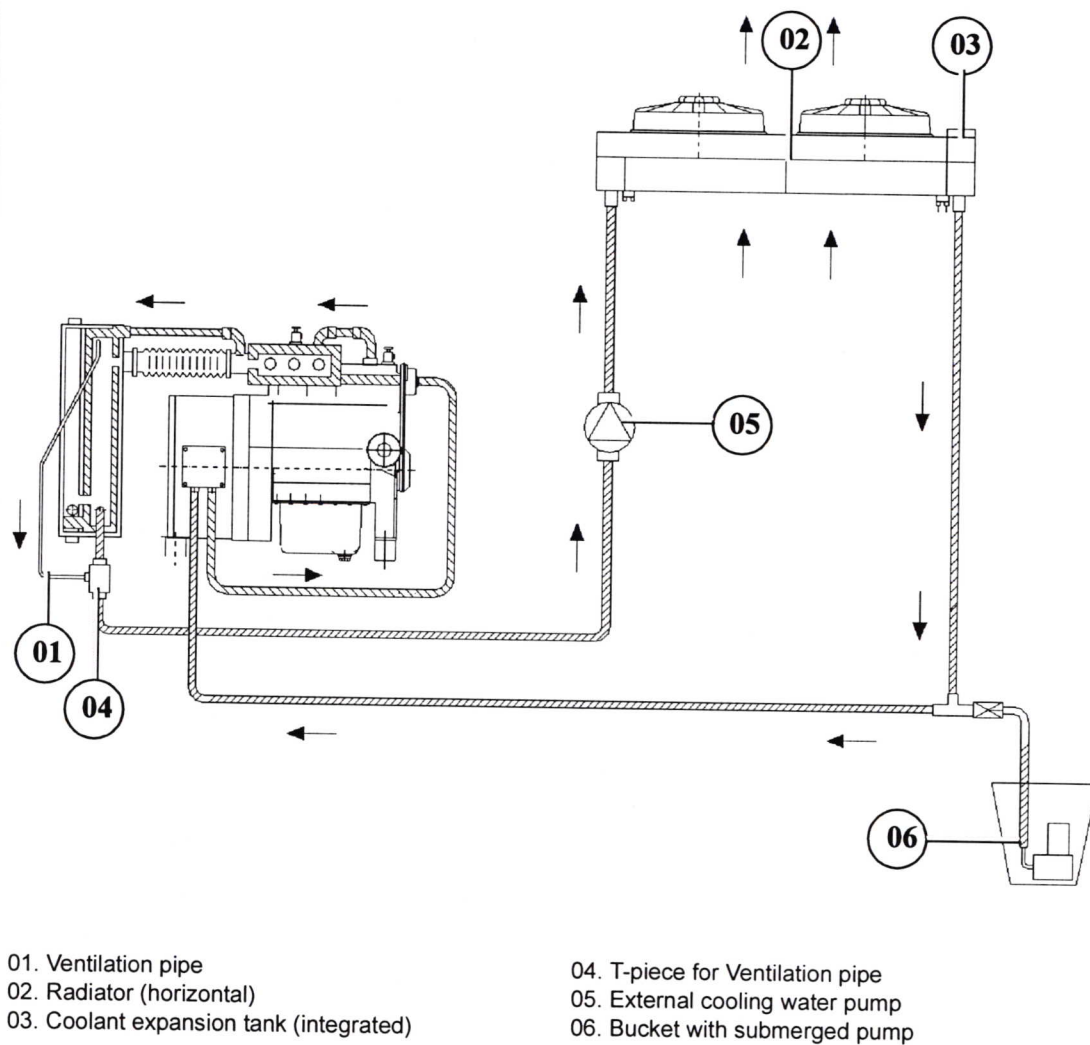
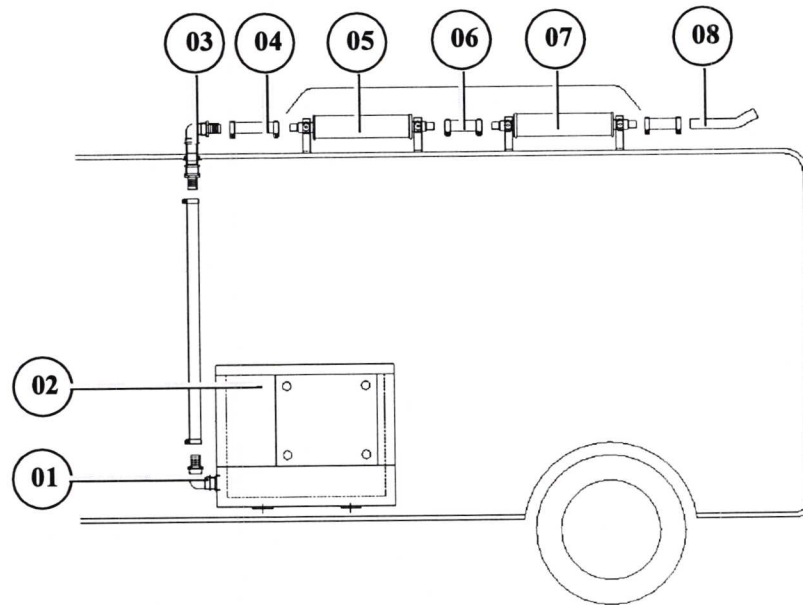
Installation diagram for radiator on the roof


Fig. E.15: Installation on the roof

E.5 Exhaust installation

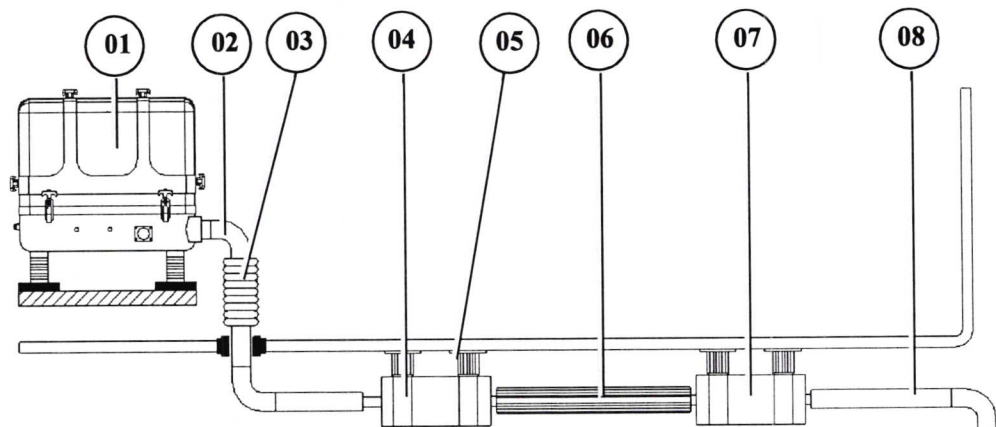
Exhaust connection for roof outlet



- | | |
|----------------------------------|---------------------------|
| 01. Exhaust port | 05. External pre-silencer |
| 02. Generator | 06. Connection pipe |
| 03. Roof outlet for exhaust pipe | 07. External silencer |
| 04. Shock absorber | 08. Exhaust pipe |

Fig. E.16: Exhaust connection on roof - example

Exhaust connection for mounting below the vehicle



- | | |
|---------------------------|-----------------------|
| 01. Generator | 05. Shock absorber |
| 02. Exhaust port | 06. Connection pipe |
| 03. Compensator | 07. External silencer |
| 04. External pre-silencer | 08. Exhaust pipe |

Fig. E.17: Exhaust connection below - example

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F. Appendix

F.1 Inspection checklist for services

Inspection-Category			Inspection work				
A	Installation check	D	100 h	1)	check	4)	change
		E	500 h	2)	measure	5)	sealing
B	daily	F	1000 h	3)	clean	6)	check isolation
C	35 - 50 h	G	5000 h				

	Inspection-Category							Inspection work
	A	B	C	D	E	F	G	
01.	5)	5)	5)	5)	5)	5)	4)	coolant water hoses
02.	1)	1)	1)	1)	1)	4)	4)	external (fan-) cooler
03.	1)	1)	3)	3)	3)	3)	3)	water separator / fuel pre-filter
04.	1)	1)	4)	4)	4)	4)	4)	engine oil
05.			4)	4)	4)	4)	4)	oil filter
06.	1)	1)	1)	4)	4)	4)	4)	air filter
07.	1)	1)	1)	1)	1)	1)	1)	fuel lines (leaks)
08.	1)	1)	1)	4)	4)	4)	4)	fine particle fuel filter
09.	1)		1)		1)	1)	1)	valve clearance
10.	1)	1)	4)	5)	4)	4)	4)	valve cover gasket
11.			1)		1)	1)	1)	coolant therm (sensor)
12.			1)		1)	1)	1)	exhaust temp sensor
13.			1)		1)	1)	1)	oil pressure sensor
14.		1)	1)	1)	1)	1)	1)	belt tension
15.	1)	1)	1)	1)	4)	4)	4)	"V" belts
16.						1)	1)	Thermostat
17.	1)	1)	1)	1)	1)	1)	1)	generator & engine screws
18.	1)	1)	1)	1)	1)	1)	1)	unit's base mount screws
19.	6)	6)	6)	6)	6)	6)	6)	check electrical cables
20.	1)	1)	1)	1)	1)	1)	1)	motor reinforced mountings
21.	1)	1)	1)	1)	1)	1)	1)	actuator mounting
22.	1)	1)	1)	1)	1)	1)	1)	starter motor mounting screws
23.	1)	1)	1)	1)	1)	1)	1)	screws generator-engine
24.	1)	1)	1)	1)	1)	1)	1)	voltage output of alternator 12 V
25.	2)		2)	2)	2)	2)	2)	input temp of coolant under load
26.	2)		2)	2)	2)	2)	2)	outlet temp of coolant under load
27.						4)	4)	generator rotor bearing
28.			1)	1)	1)	1)	1)	signs of corrosion to generator
29.			1)	1)	1)	1)	1)	check generator coolant block
30.			1)	1)	1)	1)	1)	capacitors in AC-Control box
31.	1)		1)	1)	1)	1)	1)	ASB function test
32.	1)		1)	1)	1)	1)	1)	VCS function test
33.	2)		2)	2)	2)	2)	2)	voltage without load
34.	2)		2)	2)	2)	2)	2)	voltage under load
35.	2)		2)	2)	2)	2)	2)	generator output under load
36.	2)		2)	2)	2)	2)	2)	engine speed (rpm)
37.						1)	4)	injector test
38.						1)	1)	compression
39.	1)	1)	1)	1)	1)	1)	1)	hose clips

F.2 Engine oil

Engine oil classification

Operating range:

The operating range of an engine oil is determined by SAE class. "SAE" is for the union of American 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..

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

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

F.3 Coolant specifications

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

ICEMASTER recommend to use the product: GLYSANTIN PROTECT PLUS/G 48

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

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

F.4 Troubleshooting

GENERATOR OUTPUT VOLTAGE TOO LOW

For 50Hz versions: less than 200V / For 60Hz versions: less than 100V

Cause	Solution
Generator is overloaded.	Reduce the electrical load. (Switch off load)
Motor is not reaching the rated rpm.	Refer to "motor faults" section.
Defective capacitor(s).	Check capacitors and replace if necessary.

GENERATOR VOLTAGE TOO HIGH (MORE THAN 240V-50Hz / 135V-60Hz)

If the generator is providing excessively high voltage, the following potential causes should be investigated:

Cause	Solution
Over-energizing due to wrong capacitors.	Check capacitors type and replace if necessary.
Measuring voltage on the VCS circuit board is missing.	Check VCS System, check cable connections.
Motor is running too fast (rpm too high).	Check motor speed with rpm-meter or frequency meter and adjust to proper speed under "zero" electrical load: (3120 rpm-50Hz / 3720 rpm-60Hz). Inspect ESC or VCS Systems if installed.

GENERATOR VOLTAGE FLUCTUATES

Cause	Solution
<ol style="list-style-type: none"> Disturbances on the electrical system/user side. Motor disturbances. 	<ol style="list-style-type: none"> Check if electrical load is fluctuating. Refer to section: "Motor runs irregular".

GENERATOR NOT ABLE TO START ELECTRIC MOTOR

Cause	Solution
If the generator is unable supply enough power to start an electric motor (120V-60Hz or 231V-50Hz), it is usually because the motor draws too much current during starting process.	<p>Check the motor's current draw required for starting (switch to 380V if possible). This could be remedied by providing stronger capacitors or installing an optional "Easy Start Booster Set". (See App. G)</p> <p>Enquire at your nearest Panda dealer or directly at the manufacturer.</p>

DIESEL MOTOR FAILS TO START

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

STARTER IS TURNING MOTOR, BUT FAILS TO START

Cause	Solution
Fuel inlet solenoid valve not opening.	Check wire connections and circuitry to solenoid valve. (ref. DC wiring diagram: Relay K2, Fuse)
Fuel pump not working.	Check fuel-filter and pump: clean if necessary.
Lack of fuel.	Check fuel supply.
Glow-plugs not working correctly.	Check glow plugs and heating time.
Too much air in fuel lines.	Test fuel system for leakage. Bleed air from fuel system (refer to section "Bleeding Air from Fuel System").
Fuel-filter blocked.	Replace fuel filter.
Low compression pressure.	See motor-manual.

MOTOR DOES ACHIEVE ENOUGH SPEED DURING STARTING PROCESS

Cause	Solution
Starter battery voltage insufficient.	Check battery.
Damaged bearing(s) piston (seized).	Repairs need to be carried out by engine manufacturer-Service. (refer to motor-manual)
Cooling water in combustion chamber.	<ol style="list-style-type: none"> 1. Turn generator "OFF" at control panel. 2. Remove the glow plug (see engine-manual). 3. Rotate the motor by hand carefully. 4. Check if there is water in the oil and change both oil and filter if necessary. 5. Determine cause for excess water in the combustion chamber. The excess water can be caused by a defective air vent in the cooling water system, which should be checked and cleaned, or replaced if faulty.

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

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

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

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

Over-/undervoltage. Is indicated on the remote control panel.	Switch-off the remote control panel, reduce the electrical load (switch-off load), start again.
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SOOTY, BLACK EXHAUST	
Cause	Solution
Generator is overloaded.	Check electrical load and switch off unnecessary load.
Insufficient intake air.	Check intake air filter; clean if necessary.
Fuel injector faulty.	Replace injector.
Valve clearance incorrect.	Readjust valve clearance to correct value (refer to motor-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 manufacturer.
Low compression pressure.	See motor-manual.

GENERATOR MUST BE SHUT OFF IMMEDIATELY IF:

Cause	Solution
<ul style="list-style-type: none"> - motor rpm suddenly rises or drops - unusual noise comes from genset - exhaust colour suddenly becomes dark - leakage in the cooling water system. 	Refer to respective section of manual and if necessary, have repaired by motor manufacturer-Service, or Panda representative.

Troubleshooting VCS System:

Cause	Solution
Throttle control servo motor does not move.	Check voltage supply and wire connections to servo motor. Motor connected? Check 230V connection to VCS.
Servo motor sets trottle too high or too low.	Check that the wires to the servo motor are connected properly (\pm). Check 230V 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.	
1. Loosen the connecting rods motor from the injection pump regulator and turn screw to a max. voltage of 240V. or	
2. Loosen the connecting plugs of the Motor VCS electronic and turn the motor direct by hand.	

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F.5 Technical data engine

	Panda 8 mini PVK-U
Type	Z 482
Govenour	mechanical + VCS
Cylinder	2
Bore	67mm
Stroke	68mm
Stroke volume	479cm ³
max. Power (DIN 6270-NB) at 3600rpm	8,9kW
Rated speed 60 Hz	3600rpm
Idle speed running ^a	3510rpm
Valve clearance (engine cold)	0,145 - 0,185mm
Cylinder head torque	37,3 - 42,2Nm
Lubrication oil capacity	2,1l
Fuel consumption ^b	approx. 0,74 - 1,96l

a. progressive speed by VCS

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

F.6 Technical data generator

Output power	7,0 kW
Output voltage	120/240 V
Output Current	58,3/29,1 A
Frequency	60 Hz
Speed	3600 rpm
Stator Da	240 mm
Stator Di	135 mm
Rotor Lfe	100 mm
Inductive resistance	Z1-Z2: 4,98mH H1-H2: 0,65mH
Ohmic Resistance	Z1-Z2: 0,77Ohm H1-H2: 0,21Ohm

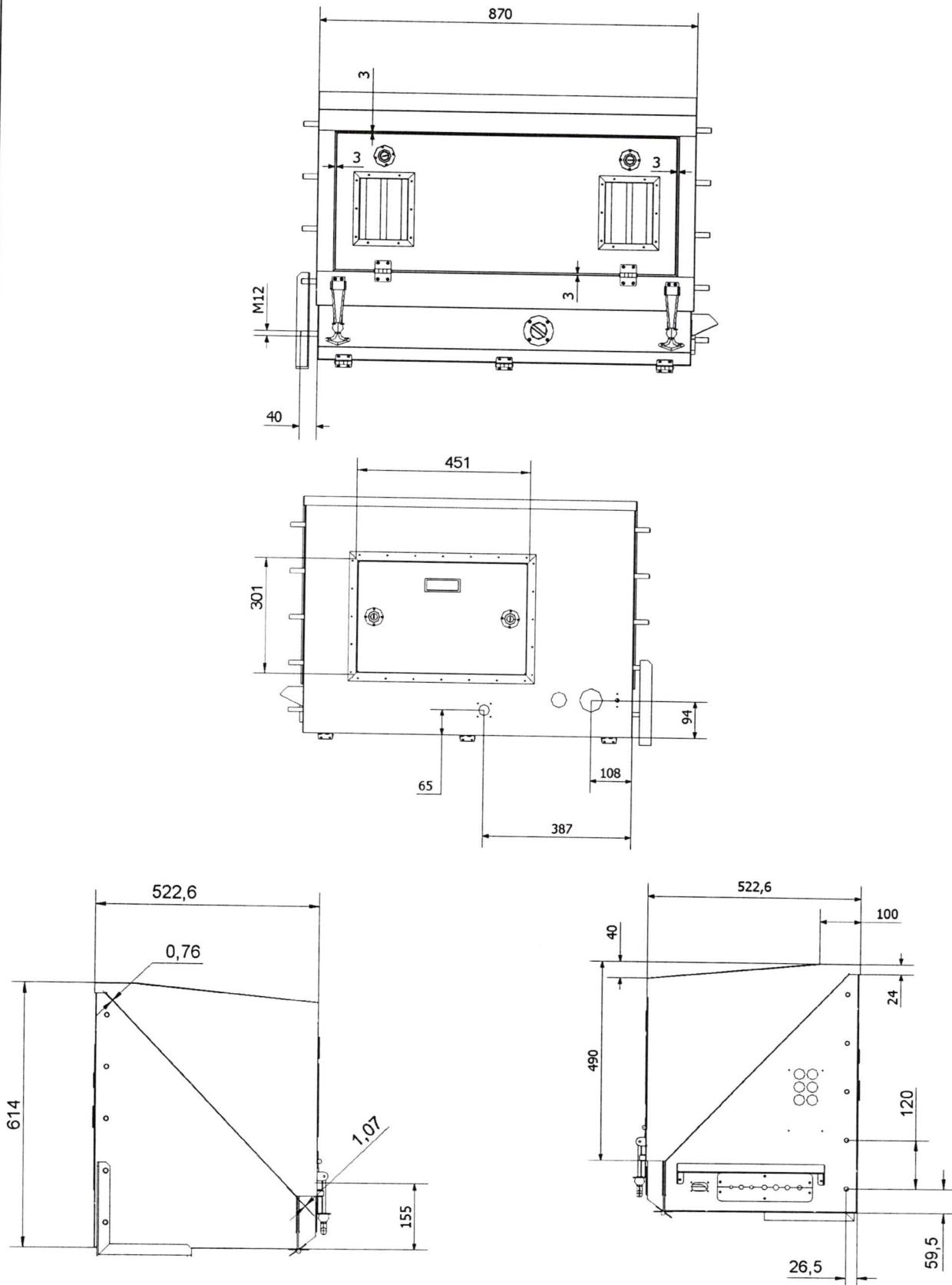
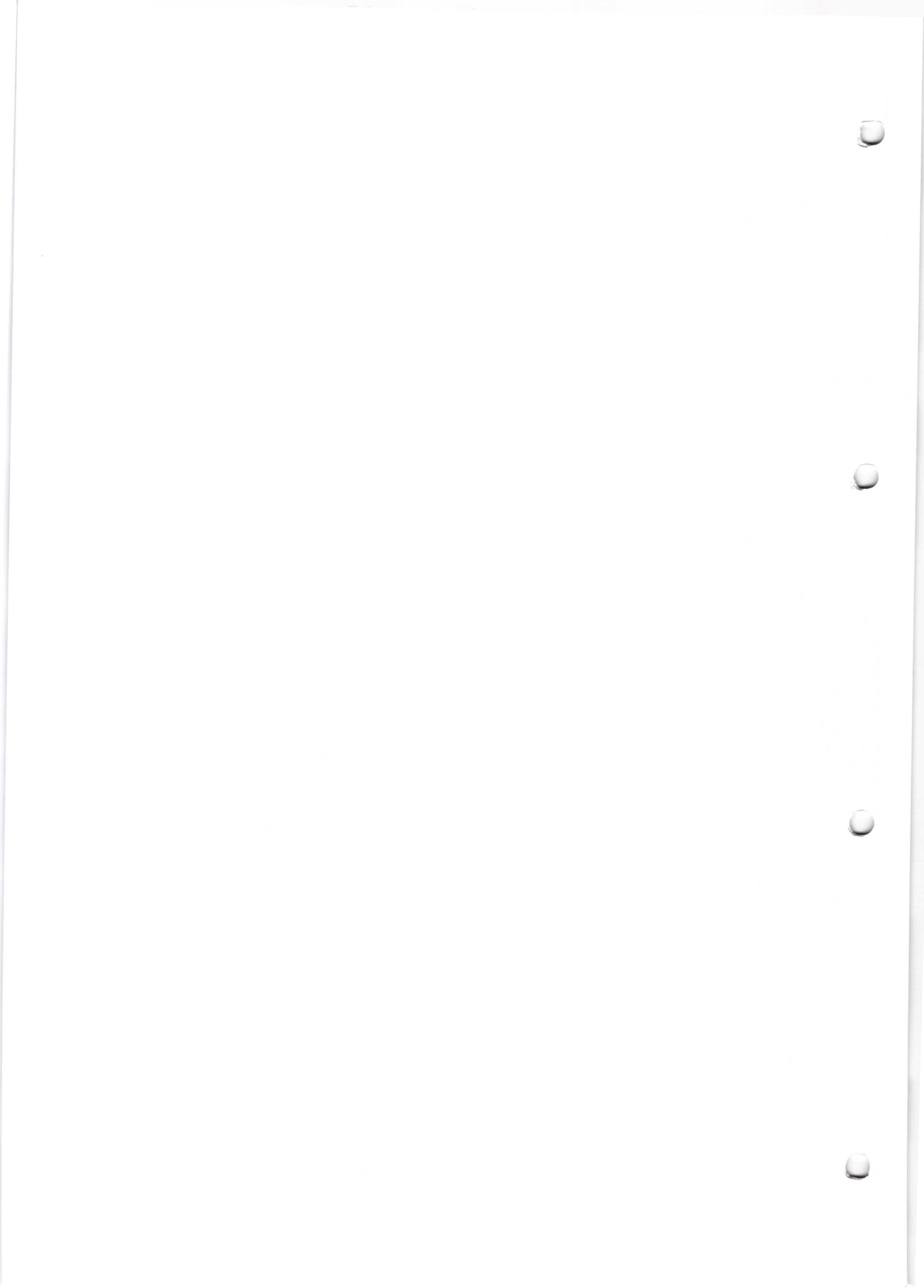
F.7 Capsule measurements


Fig. F.1: Capsule measurements





Inspektionstermine mit Bestätigung für Panda Generatoren

Confirmation du respect des délais fixés pour les inspections des groupes électrogènes Panda

Die Inspektionsarbeiten müssen von einem qualifizierten Fachmann gemäß der Checkliste ausgeführt werden. Sie sind auf der Checkliste und auf diesem Formular zu protokollieren. Dieses Formular verbleibt ebenso wie die Checkliste an Bord. Im Falle eines Schadens ist eine Kopie an den Hersteller einzuschicken.

The inspections must be done by a qualified technician according to the checklists. This form and the checklists must remain with the generator. In the event of manufacturer's defects, a copy of this form has to be sent to the manufacturer in order to validate the warranty.

Les inspections doivent être effectuées par un homme du métier qualifié et conformément au bordereau de contrôle, dans lequel elles doivent être décrites en détail. Le présent formulaire et le bordereau de contrôle sont à conserver à bord. En cas de dégât, adresser une copie au fabricant.

	Vorges. bei Betriebsstd.: Inspection required at: Inspect. exigée après:	Stand: Betriebsstunden- zähler / Hours on indicator at time of inspection / Etat du compteur d'heures	Prüfer: Inspected by: Contrôleur:	Datum: Date:	Stempel bzw. volle Adresse der Service- firma: Seal, stamp & full address of responsible inspection firm: Cachet et adresse complète du service- clients:
01 Einbauprotokoll und Einbaukontrolle / Installation inspection / Compte-rendu d'installation et de contrôle	0 h				
02 35-Stunden-Inspektion laut Liste / First 35 hour inspection acc. to checklist/ Première inspection selon borde-reau, après 35 heures de marche	35 h				
03 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	100 h				
04 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	200 h				
05 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	300 h				
06 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	400 h				
07 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	500 h				
08 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	600 h				
09 Standard-Inspektion laut Liste Standard inspection acc. to checklist / Inspection standard selon bordereau	700 h				
10 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	800 h				
11 Standard-Inspektion laut Liste / Standard inspection acc. to checklist / Inspection standard selon bordereau	900 h				



Checkliste für die alle 100 Stunden durchzuführenden Inspektionen

Checklist for the recommended inspections every 100 hours

Fill out the inspection checklist and keep it with the generator. In case of defects send it to the manufacturer

Die Inspektionsarbeiten müssen von einem qualifizierten Fachmann gemäß dieser Checkliste ausgeführt werden. Dieses Formular verbleibt ebenso wie das Protokoll für die Inspektionstermine an Bord. Im Schadensfall ist eine Kopie an den Hersteller einzuschicken. Die Wartung des Motors ist ggfls. gemäß der Motor Bedienungsanleitung durchzuführen.

The service inspection must be done by a qualified technician. All inspection checklists must remain with the generator. In case of defects, a copy of these forms has to be sent to the manufacturer to validate the warranty. For diesel engine maintenance, refer to the separate diesel engine operating manual.

1.	Überprüfen der Kühlwasserschläuche / <i>check all coolant and water hoses</i>				
2.	Kontrolle der Wasserpumpe / <i>check waterpump</i>				
3.	Entleeren Wasserabscheider/Kraftstoffvorfilter / <i>empty water separator/fuel pre-filter</i> (wenn vorhanden / <i>if present</i>)				
4.	Motorölwechsel / <i>change motor oil</i>				
5.	Motorölsieb reinigen / <i>clear of oil sifter</i>				
6.	Kontrolle der Luftzufuhr / <i>check air intake suction & flow, air filter, intake manifold, etc.</i>				
7.	Überprüfen der Kraftstoffleitung / <i>check fuel lines</i>				
8.	Einstellen der Ventile (nur alle 500 Std.) / <i>readjust valve clearance (every 500 h only)</i>				
9.	Erneuern der Ventildeckeldichtung (nur alle 500 Std.) / <i>replace valve cover gasket (every 500 h only)</i>				
10.	Überprüfen der Schalter / <i>check all sensors & switches</i>				
	a) Kühlwasser / <i>coolant temp. sensor</i>				
	b) Abgassystem / <i>exhaust temp. sensor</i>				
	c) Öldruckschalter / <i>oil pressure sensor</i>				
11.	Überprüfen aller Schrauben am Motor: / <i>check all securing and fastening screws:</i>				
	a) Motorfundament / <i>all base mount screws</i>				
	b) Abgaskrümmen / <i>exhaust manifold screws</i>				
	c) Anlasserbefestigung / <i>starter fixing</i>				
	d) Verbindung Generator/Motoranbauflansch / <i>connection screws generator/engine</i>				
12.	Überprüfen aller elektrischen Kabel / <i>check all electrical cables</i>				
13.	Überprüfen der Batterie / <i>check battery</i>				
14.	Leerlaufspannung in Volt / <i>Idle run voltage (Volts)</i> U=				
15.	Spannung unter Last / <i>Voltage under load (Volts)</i> U=				
16.	Stromstärke unter Last / <i>current under load (Amperes)</i> I=				
17.	Motordrehzahl (U/min) oder Frequenz (Hz) / <i>engine speed (rpm) or frequency (Hz)</i>				
18.	Kraftstofffilter wechseln / <i>change of the fuel filter</i>				
19.	Luftfilter wechseln / <i>change of the air filter</i>				
20.	Kühlerlüfter Spannung unter Vollast bei überbrücktem Temperatursensor/Temperaturschalter / <i>cooler fan under load at bridged temperature sensor/temperature switch</i> U=				
21.	Kühlerlüfter Strom unter Vollast bei überbrücktem Temperatursensor/Temperaturschalter / <i>cooler fan current under load at bridged temperature sensor/temperature switch</i> I=				
22.	Aufnahme der Umgebungstemperatur / <i>uptake of the ambient temperature</i> T=				
23.	Wassertemperatur EIN/AUS, bei Vollast und Kühler max. Drehzahl, überbrücktem Temperatursensor/Temperaturschalter / <i>watertemperatur IN/OUT, at full load and max. speed of cooler, bridged temperature sensor/temperature switch</i> T _{FIN} = T _{AUS} =				
24.	Betätigen aller Entlüftungsventile -schrauben / <i>actuate all ventilation valves -screws</i>				
25.	Durch betätigen der Fehlerüberbrückungstaster prüfen ob Wasserpumpe einwandfrei arbeitet (nur bei Generatoren ohne keilriemenbetriebene Wasserpumpe) / <i>with actuate the failure override switch check if the waterpump works faultless (only at gents without v-belt driven waterpump)</i>				
26.	Abdrücken der Einspritzdüsen (alle 2000 Std.) / <i>squeezing off the injection nozzle (every 2000 h)</i>				
27.	Keilriemen überprüfen (nicht bei AGT4000, Panda4,5ND, Panda5000LPE) / <i>check v-belt (not at AGT4000, Panda4,5ND, Panda5000LPE)</i>				
28.	Zahnriemen überprüfen (nur bei VW-Motoren) / <i>check toothed belt (only VW-engine)</i>				

Note:

- The „TC“ marking on the flywheel is just for No. 1 cylinder. There is no „TC“ marking for the other cylinders.
- No. 1 piston comes to the T.D.C. position when the „TC“ marking is aligned with the projection in the window on flywheel-housing. Turn the flywheel 15° (0.26 rad.) clockwise and counter-clockwise to see if the piston is at the compression top dead center or the overlap position. Now referring to the table below, readjust the valve clearance. (The piston is at the top dead center when both the IN. and EX. valve do not move; it is at the overlap position when both the valves move.)
- Finally turn the flywheel 360° (6.28 rad.) and aligne the „TC“ marking and the projetion perfectly. Adjust all the other valve clearances as required.
- After turning the flywheel counterclockwise twice or three times, recheck the valve clearance.
- After adjusting the valve clearance, firmly tighten the lock nut of the adjusting screw.

Number of cylinders	1		2	
	IN.	EX.	IN.	EX.
When No. 1 piston is compression top dead center	0	0		0
When No. 1 piston is overlap position			0	

Table C.1: Adjusting the valve clearance



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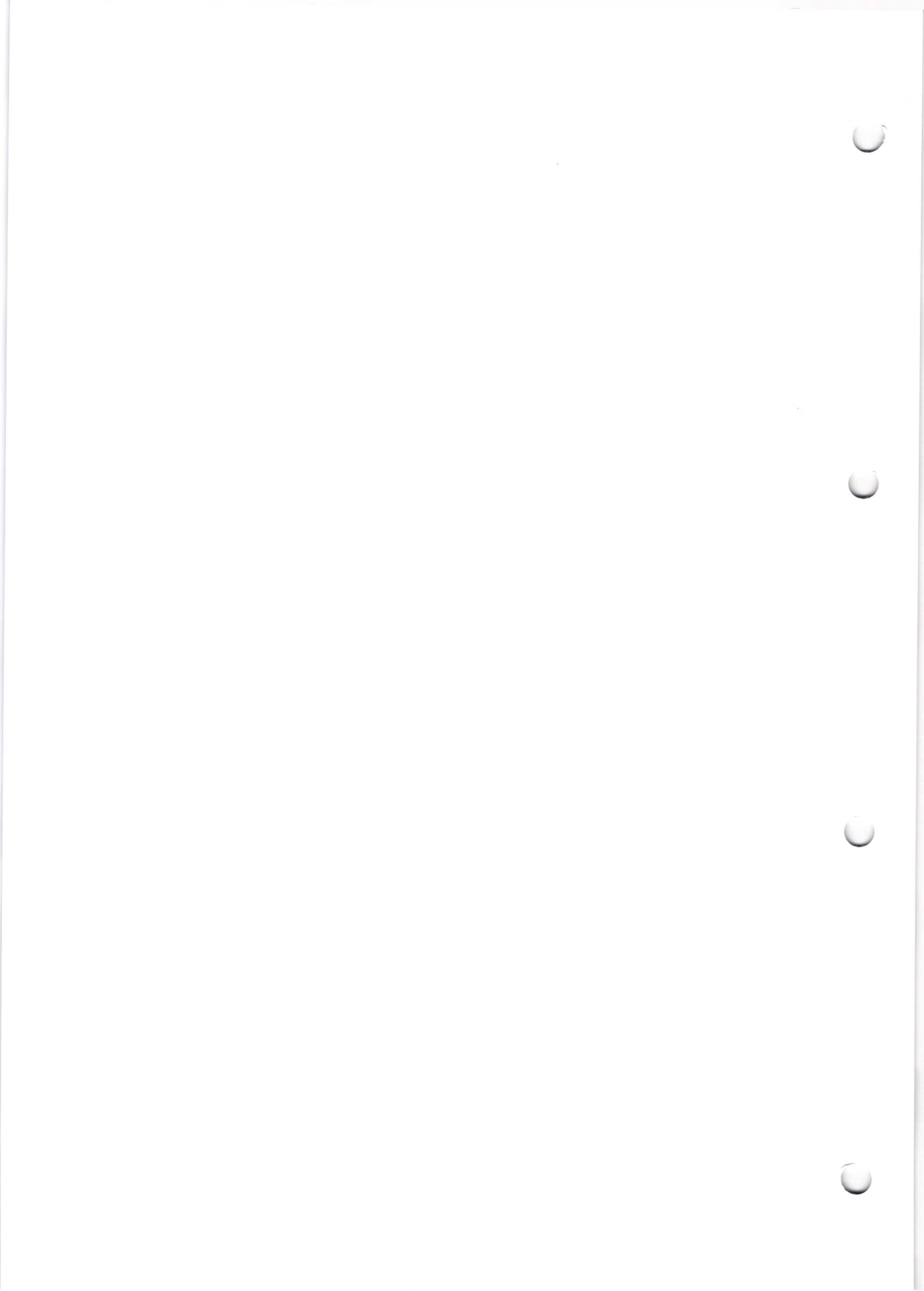
KUBOTA Vertretungen/Dealer/Représentations- International

Diese Liste enthält die Adressen der Kubota-Vertretungen (Importeur) in dem entsprechenden Land. Bei Motorstörungen kann es zweckmäßig sein, sich direkt an den Motor-Kundendienst zu wenden. Die Adressen der Fischer Panda Importeure können Sie der entsprechenden Liste an anderer Stelle entnehmen.

The following list contains the addresses of all official Kubota representatives/importers in the respective country. In the event of engine faults, it is recommended to contact the dealer directly. you will find the addresses of Fischer Panda importers in a further list.

Liste de agents ou importateurs Kubota de chaque pays. En cas de problème il vous sera recommandé de prendre contact avec ces agents directement. Et vous trouverez l'adresse des importateurs Fischer Panda. Plusieurs adresse.

EUROPE	AMERICA	AMERICA	ASIA
France Kubota Europe S.A.S. 19-25, Rue Jules Ver- crucy, Z.I. BP 88, 95101 Argenteuil, Cedex, France Phone: 1-3426-3434 Fax: 1-3426-3499	U.S.A. Kubota Tractor Corporation 3401 Del Amo Blvd., Torrance, CA 90503, Phone: 310-370-3370 Fax: 310-370-2370	Canada Kubota Canada Ltd. 5900 14th Avenue, Markham, Ontario L3S 4K4 Phone: 905-294-7477 Fax: 905-472-6143	China Kubota Construction Machinery (SHANGHAI) Co.,Ltd. G Unit , 16Floor,Pudong Development Mansion, 588 Pudong South Road, Pudong New Area, Shanghai,200120 Phone: 021-5879-4630/ 4631 Fax: 021-58794632
Germany Kubota (Deutschland) GmbH Senefelder StraBe 3-5, 63110 Rodgau/Nieder- Roden, Germany Phone: 6106-873-0 Fax: 6106-873-198	Kubota Credit Corporation U.S.A. 3401 Del Amo Blvd., Torrance, CA 90503, Phone: 310-370-3370 Fax: 310-370-2370	Kubota Metal Corporation 25 Commerce Road, Orillia, Ontario L3V 6L6 Phone: 705-325-2781 Fax: 705-325-5887	Korea Kamco #3FI,Bently Bldg' , 106-2 Yangjac-Dong Seocho-Ku Seoul137-130 Korea Phone: 2-2058-1028 Fax: 2-2058-1029
Kubota Baumaschinen GmbH Steinhauser Straße 100 66482 Zweibrücken Germany Phone:6332-487-0 Fax: 6332-487-101	Kubota Manufacturing of America Corporation Gainesville Industrial Park North, 2715 Ramsey Road, Gainesville, GA 30501 Phone: 770-532-0038 Fax: 770-532-9057	AUSTRALIA Kubota Tractor Australia Pty Ltd 100 Keilor Park Drive, Tul- lamarine,Victoria 3043 Phone: 3-9279-2000 Fax: 3-9279-2010	Thailand The Siam Kubota Industry Co., Ltd. 101/19-24 Navanakorn, 10 Rd.Klongneung, Amphur Klongluang, Pathumthani 12120, Phone: 2-529-0363 Fax: 2-529-2791
United Kindom Kubota (U.K.) Ltd. Dormer Road, Thame, Oxfordshire OX9 3UN, Phone: 1844-214500 Fax: 1844-216685	Kubota Industrial Equipment Corporation 1001 McClure Industrial Drive, Jefferson, GA 30549 Phone: 706-387-1000 Fax: 706-387-1300	ASIA Taiwan Shin Taiwan Agricultural Machinery Co., Ltd. 16 Fengping 2nd Road, Taliao Shiang Kaohsiung Hsien 83107 Phone: 7-702-2333 Fax: 7-702-2303	Indonesia P.T. Kubota Indonesia Jalan Setyabudi 279, Semarang Phone: 24-7472849 Fax: 24-7472865
Kubota Membrane Europe Ltd. 8 Hanover Street, London W1S 1YE Phone: 020-7290-2731 Fax: 020-7290-2733	Kubota Engine America Corporation 505 Schelter Road, Lincolnshire, IL 60069 Phone: 847-955-2500 Fax: 847-955-2501	China Kubota Agricultural Machinery (SUZHOU) Co.,Ltd. No.220, Xing Ming Street,Suzhou Industrial Park, Suzhou Municipal- ity,Jiangsu Province, Phone: 512-6716-3122 Fax: 512-6716-3344	
Spain Kubota Espana S.A. Calle de las Flautas 11, 28044 Madrid Phone: 91-508-6442 Fax: 91-508-0522	Kubota Membrane U.S.A. Corporation 2018-156th Avenue NE, Suite 100 Bellevue, WA 98007 Phone: 425-748-5011 Fax: 425-644-2185		



Vertretungen / Distributors

International

ANTIGUA

Marine Power Services Ltd.(AD)

P.O. Box 663, St. Johns, Antigua,
Tel.:001-268-460-1850
MPS@candw.ag

Cay Electronics(SO)

English Harbour, Antigua,
Tel.:001-268-460-1040
Fax.:001-268-460-1227

AUSTRALIA

Power Protection Solutions Pty Ltd.(ED)

P. O. Box 122, QLD 4020, Redcliff, Australia,
Tel.:0061-7-32837800
Fax.:0061-7-32837811
office@powersolutions.com.au
www.powersolutions.com.au

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Tel.:+43 5332 7629212
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a.jordan@wegscheider.or.at

BAHAMAS

Machinery & Energy Ltd.(SO)

P.O. Box 3238, Nassau, Bahamas,
Tel.:001-242-323-5701
Fax.:001-242-502-3993

BAHRAIN

Systems & Technology Enterprises(ED)

13 First Floor, Com Bldg
2931 Road 2251,
522, Barbar, Bahrain,
Tel.:00973-691414
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CARIBBEAN

Proper Yachts(SO)

520 Mongoose Junction,
St. Johns, Caribbean,
Tel.:001-340-779-4445
Fax.:001-340-693-9841

Regis Electronics(SO)

Rodney Bay, St. Lucia,
Caribbean,
Tel.:001-758-452-0205
Fax.:001-758-452-0206

Rimco Inc(SO)

San Juan, Caribbean,
Tel.:001-787-792-4300

Viso Marine(SO)

San Juan, Caribbean,
Tel.:001-787-782-9513

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huabin@instec-video.com.cn

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Guaranty Conditions for mobile and stationary Fischer Panda Generators

The manufacturer guarantees faultless material and a perfectly running generator for a period of 24 months. (This period is limited to 12 months, should the generator be required for commercial use). The period of guaranty starts from the generator delivery date and expires once 1000 operating hours have been exceeded. The guaranty is further extended for 4 years for the water-cooled electrical Panda asynchronous generator, subject to restrictions that are defined elsewhere.

The guaranty period for replaced parts, which were exchanged under the conditions of the guaranty, finishes on the day that the guaranty period for the generator expires. The conditions of the guaranty for motor parts applies to the motor manufacturers conditions (currently only 6 months). In addition, the following motor manufacturer's conditions are binding. No claim may be made for a breakdown or replacement in respect of consequential damage.

The conditions of the guaranty become null and void if

- the customer does not bring the fault to the manufacturer's attention immediately.
- the customer does not give the manufacturer the opportunity to repair the fault immediately. (The customer is obliged to assist in repairing the fault. Included within this obligation is the requirement to remove any defective parts by their own means and despatch or deliver, at own cost, the parts to the manufacturer for repair.)
- the fault is caused by overloading or through incorrect operation.
- the essential service and maintenance has not been carried out.
- the control and shut down functions could not effectively operate due to disconnection of a cable, a defective cable, or for other reasons.
- The installation instructions have not been complied with.

A claim under the conditions of the guaranty also becomes null and void if

- a non-authorized dealer undertakes repairs of the generator (minor repairs are excluded).
- Parts are used which have not been supplied by the manufacturer, or parts are used which have been modified and not checked by the manufacturer.
- The cooling system of installed generators does not meet requirements (maximum temperature difference between forward and reverse flow under normal operating conditions is 14°C and by extreme conditions 18°C. The highest permitted temperature for the forward flow under normal conditions is 70°C and under extreme conditions 75°C.
- The external coolant compensator reservoir has not been expertly fitted.
- The application to register and for the issuing of a guaranty certificate has been submitted incorrectly or belatedly.
- The installation record with the essential test data sheet has not been correctly completed and signed immediately after operation by the manufacturer.
- Temperature data in the test record deviate from the manufacturer's prescribed maximum levels.
- The essential works inspection for aggregates with a nominal capacity of 25kVA has not been carried out.
- Regard has not been paid to the essential parts of the installation instructions.

Further, a claim may also not be made under the conditions of the guaranty in cases of disorder or effects of war.

In addition to this, owing to the specified legal requirements of the conditions of the guaranty, the prevailing law of the Federal Republic of Germany is additionally applicable to all cases not covered by the conditions of the guaranty. The court of jurisdiction, if not determined otherwise by law, is Paderborn (Federal Republic of Germany).

The customer is obliged, in accordance with the manufacturer's choice, to place the generator with a respective individually named customer service outlet authorised by the manufacturer, or despatch it direct to the manufacturer, at own cost.

Provided that the generator is installed as an integral part of the vehicle (road vehicle, amphibious vehicle etc.) agreement is to be made with manufacturer to determine exactly where and how the repairs will be undertaken in the case of the guaranty being afforded.

Dealers are available at the most important marinas so that the necessary repairs can be carried out on yachts. Contact with the manufacturer is essential for individual cases.

In each case the manufacturer can decide, where the repairs are to be carried out. Expert knowledge as well as costs must be considered in this respect. If the customer requests a fitter to travel to the object, then the travelling costs must be met by the customer. This also includes necessary working hours as well as travel expenses (overnight stays, and petty cash).

Provided that work under the conditions of the guaranty is undertaken at the place where the vessel or vehicle is situated, the customer must ensure that the unit is fully accessible and that appropriate working conditions prevail. Accessible means that the vehicle must be available for repair daily for the period from 7 am to 8 pm.

After agreement with the manufacturer the customer may remove defective parts at the location of the unit. These must be despatched on request to the manufacturer at no cost, or be despatched to another address as authorised by the dealer. After being tested they will be replaced or repaired and returned to the customer, at the customer's own risk. The costs for installation and removal will be for a fully accessible unit as per a fixed amount in the price list. Additional expenditure for impeded accessibility will not be reimbursed or additionally calculated if a technician from ICEMASTER carries out the repairs. Should a part be replaced, then that part becomes the property of the manufacturer.

The firm of ICEMASTER Fisher Panda is endeavouring to expand its servicing network and for this reason the list of authorised service outlets is continually being updated. This is especially the case with yachts, in order that there is a central servicing outlet available in each important customer area. The manufacturer should be contacted in every instance, before approaching the service outlet to establish the whereabouts of the nearest respective place of repair or those with the more suitable facilities.

If the repairs are to be carried out elsewhere, then the customer himself must carry all costs in advance. A decision as to which repair costs can be accepted will be made only after receipt of the defective parts and subsequent checking of the facts.

4 Years Extended Guaranty for Panda Generators

There is a four year guaranty for the electrical parts of the generator (stator with windings, generator casing, casing seals and all water bearing parts).

The extended guaranty includes repair of defective parts at no cost, or in accordance with the manufacturer, the delivery of new parts. The manufacturer decides whether he should repair the defective part or provide a spare part at no cost. All transport and packing costs under the conditions of this extended guaranty are borne to the full extent by the customer.

Labour time etc. for installing and removing the unit is not covered by this extended guaranty. Damage which occurs because of overheating of the generator caused by the failure of periphery units, such as the water pump, water inflow, automatic shut down devices etc., is also excluded.

Damage caused by a third party is also excluded as well as damage that occurs because of improper compensation or over compensation with capacitors.

Important provisions of the guaranty:

1. Included in the technical document sent with generator is a form "Application for the registration and issuing of a guaranty certificate". This form must be carefully completed and despatched to the manufacturer within 2 weeks after installation. This is valid for all aggregates also those that are installed in vehicles or which are stationary.
2. Correct installation in accordance with installation and safety directions of the manufacturer's manual.
3. Implementation of the prescribed check of the coolant's temperature during forward and backward flow at nominal load, 2 hours after initial operation.
4. Repairs, excluding minor repairs, may only be undertaken with the prior authorization of the manufacturer.
5. Damaged parts or the whole units are delivered to the manufacturer at no cost to the manufacturer.
6. Further inspections (every 100 operating hours respectively) must be carried out in accordance with regulations and entered on the inspection record form.
7. The user is obliged to daily check the oil level and carry out a "visual inspection" in accordance with the operating instructions or the check list.

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Fischer Panda General Delivery and Payment Conditions

A. Tender

The documents required for tender such as illustrations, diagrams, weight and measurement details are only generally binding in so far as this has not been expressly stated.

ICEMASTER reserves rights on all estimates, diagrams and other documents, which may not be made available to a third party. ICEMASTER is obliged to make confidential plans accessible to a third party, only on the agreement of the customer.

Construction documents are charged as extra, provided they are completed on instructions or orders of the customer. This is also the case if the order does not materialize.

B. Extent of delivery and place where a contract is to be fulfilled

Written confirmation of an order is the binding authority for the scope of delivery. All tenders submitted by ICEMASTER are subject to alteration, unless otherwise expressly stated. Only the contents of the confirmation order are valid, so long as it is the case that it expressly pertains to the tender. Additional verbal agreements and amendments require written confirmation from ICEMASTER.

Paderborn is deemed the place of delivery and fulfilment of contract. Should the manufacturer assist the technician assigned to install the unit, then this will be considered as additional work. This does not change the place where the contract is to be fulfilled for the delivery of the unit.

C. Price and Payment

1. The prices are ex works, if no other agreement has been made, including loading at the factory, but excluding packing. VAT is added to the prices for the respective legal amount for deliveries within national borders.
2. A deposit amounting to 40% of the total sum of the order is due within 8 days after confirmation of the order for all individual deliveries, especially aggregates that are built according to customer specification. Subsequent delivery dates will be extended by the period for which payment of deposit is delayed.
3. Withholding payment or charges to the account because of possible contested claims by the customer placing the order is not permitted.

D. Delivery Time

1. The delivery schedule commences from the day of despatch of the confirmation of the order to the day that the order is confirmed, however, not before the necessary documents, agreements, and clearance, as well as receipt of the agreed sum, has been made.
2. The delivery schedule has been adhered to, if the goods for delivery has left the factory or notification of goods being ready for despatch has been made.
3. The delivery schedule is appropriately extended within the context of industrial action, especially strikes and lockouts as well as unforeseen hindrances, which are not under control of ICEMASTER, as long as the hindrances can be proven to be the cause of delay for the production or delivery of the goods. This is also valid, if these circumstances occur at a subcontractor. ICEMASTER is, also, not liable for the aforementioned circumstances if they occur during a delay that has already occurred. In such circumstances ICEMASTER will inform the person or company placing the order without delay of the start and finish of the strife.
4. If a delay occurs, then the customer placing the order may set an appropriate expiry date on which ICEMASTER must deliver the goods, with the expressive proviso that they (the customer) can refuse acceptance of the goods, if delivery is overdue. If delivery does not occur by the end of the extended period, then the person or company placing the order may withdraw from the contract. Claims made by the persons or companies placing the orders for financial reimbursement or damages on account of non-fulfilment of order are expressly excluded.

5. At least 1.5% of the total sum will be added to the invoice, one month after notification of despatch, whilst the goods are held in storage at the ICEMASTER factory, if despatch is delayed at the request of the customer placing the order. ICEMASTER is entitled, after an appropriate set period has expired, to otherwise determine disposal of the goods for delivery and thus make delivery after an appropriate extended period.

6. The delivery schedule will be adhered to, provided the conditions of the contract are fulfilled by the customer.

E. Third Party Risks and Acceptance of Delivery

1. Third party risks are passed to the customer on delivery of the parts, also when partial delivery is made or if ICEMASTER assume further obligations, i.e. despatch costs or delivery and installation of the unit at a designated place. A consignment by ICEMASTER can be insured for theft, glass, transportation, fire and damage caused by water, as well as other insurable risks, at the cost and request of the customer, in writing.
2. If despatch is delayed as a consequence of circumstances borne by the customer, then the third party risk passes to the customer from the day the goods are ready for despatch.
3. Delivered goods are to be accepted by the customer, even if there are minor defects, regardless of the conditions stated at Section G.

F. Rights of Ownership

1. ICEMASTER retains the rights of ownership for goods for delivery until all contractual demands, including future claims that have arisen from simultaneous or subsequent contracts, placed on the customer by ICEMASTER have been fulfilled. This is also valid if individual or collective claims by ICEMASTER are included and added to the balance on a current invoice. The customer is entitled to resell the goods under legal conditions. However, he transfers all claims to ICEMASTER which have arisen from resell to the purchaser or third party, and it is of no relevance if the goods are resold before or after agreement. The customer is entitled to make these claims, even after transfer. The authority from ICEMASTER to themselves make the claims hereby remains unaffected, however, ICEMASTER is obliged not to make the claims themselves, if the customer has made payment correctly. ICEMASTER can demand that the customer informs them of the transferred claims, the debtor and all relevant details required to make a demand as well as the relevant documents. If the delivered article is sold with other goods which do not belong to ICEMASTER, then the customer demands placed on the purchaser for the amount determined between ICEMASTER and the customer are deemed as being transferred. If the delivered article is combined with one or several mobile articles into one unit, and if the other article or one of the other articles is considered the main part, then it is agreed that the customer transfers partial ownership, in so far as the main part is his property. The rights of ownership and further assurances placed by ICEMASTER, which ICEMASTER undertakes in the interests of the Customer, are deemed to be obligations until otherwise stated. ICEMASTER is obliged to allow those assurances placed by them to be released, if the value of the claims to be made do not exceed 25%.
2. ICEMASTER is entitled to insure the article to be delivered against theft, glass, fire, water and other damage, so far as the customer has himself not taken out an insurance policy.
3. The customer may neither pawn the delivered article or retain it as security. If pawning as well as confiscation or further disposal is made by a third party, then ICEMASTER must be informed immediately of this in writing.
4. ICEMASTER is entitled to take back the goods after a reminder and the customer is obliged to release the goods, if the contract has been breached by the customer, especially in the case of delayed payment. Enforcement of the rights of ownership as well

as pawning of the delivered article by ICEMASTER are not considered as a withdrawal from contract, as long as the repayment clause is not applied.

G. Liability for Defects on Delivery

ICEMASTER is liable for defects on delivery which includes the absence of expressly assured features on the following grounds:

1. All those parts, that are deemed by Icemaster to be necessary for modification or new replacement as a consequence of the situation that occurred before the transfer of risk, because they cannot be used or are considerably hindered in their use, when this occurs within 6 months of the transfer of risk, will be replaced at no cost, especially faults, bad materials or defective parts. ICEMASTER is to be informed immediately of such defects. Replaced parts are the property of ICEMASTER. Liability will cease after 12 months from the date of the invoice, if the installation of an aggregate is delayed. In the case of installed aggregates this period starts from the day of operation, at the latest, however, 9 months after delivery.
2. The rights of the customer to enforce claims for defects, lapses in all cases after 6 months from the legal reprimand, however, not later than expiry of the guaranty.
3. No liability is accepted for damages, which have arisen for the following reasons:
Unsuitable or improper use, faulty assembly or operation by the customer or a third party, of course, wear, poor or negligent treatment, unsuitable operating material, replacement parts or other outside influences,
4. The customer must, after agreement, allow ICEMASTER the necessary time and opportunity to carry out all the necessary improvements and delivery of spare parts, otherwise ICEMASTER is free of liability for any defects. In pressing cases whereby operating safety is endangered and to prevent a relatively large amount of damage, or when ICEMASTER experiences a delay in removing the defect, the customer can be given the right to sort out the defect themselves or pass the right to a third party and demand reimbursement of the necessary costs, however, not before written confirmation from ICEMASTER.
5. If a claim against the guaranty is made, then the customer must as a rule remove the unit and despatch it to the manufacturer, or if the unit is installed in a vehicle, deliver the vehicle as a whole unit to the manufacturer in Paderborn.
In special circumstances, the repairs may be carried out by a suitable firm at a designated place after agreement with ICEMASTER, if the customer organises the necessary work. (However, see para. G9).
The actual costs, these are the costs for spare parts as well as appropriate costs for installation and removal, which arise from modification or replacement will be borne by ICEMASTER, if the complaint proves to be justified.
6. The amount of reimbursement for other services must have the prior approval of ICEMASTER before measures are taken. Supplementary charges for night work, work during holidays or extra costs which arise, especially because of customer haste, will not be reimbursed. If the repairs have been carried out by an engineer from ICEMASTER, then the appropriate extra costs must be borne by the customer for the aforesaid reasons. This is also valid in the case of para G9.
7. Only despatch costs for spare parts by normal freight means may be claimed, and only in the country where ICEMASTER made delivery, if in special cases these are assumed by ICEMASTER. (As a rule FRG).
8. The appropriate costs for the installation and removal of a new part can only be sanctioned, if the unit is freely accessible. Further costs which arise because of the inaccessibility of the unit cannot be considered or if the repairs must be carried out by ICEMASTER, then additional costs will be added.
9. It is emphasised that the customer despatches the delivered article, the unit or the defective parts to the factory of the manufacturer, as agreed, at no cost. Parts will only be despatched to the designated place after repair, or in the case of replacement, at cost and at

the customer's own risk.

10. The guarantee period for spare parts and modification is three months; it runs at least until the expiry date of the original guarantee for the original delivered article.
11. If modifications or repairs are undertaken by the customer or a third party, without the prior approval of ICEMASTER, then the liability for the consequences thereof will be removed.
12. Further claims by the customer, especially for damages which did arise to the delivered article are excluded.
13. On acceptance of the rebate, the buyer, and especially the retailer are obliged to accept all customer service conditions on their own or customer's account, especially in the case of a claim against the guarantee to carry out and organise repairs themselves on the directions of ICEMASTER, and if required, train their personnel accordingly.
In the case of a repair, defective parts are to be removed or if necessary the complete unit is to be returned to the manufacturer for repair.
Freight costs are borne by the customer in this case.
14. After Panda generators have been installed, an inspection must be carried out on receipt, according to the manufacturer regulations, and tested for at least two hours under nominal load. The temperature levels for coolant forward and return flow must be established and recorded. The values must correspond to the details in the handbook. Every customer must ensure that an aggregate, which they have installed themselves, is checked when taken into operation, in accordance with the above regulations.
15. After installation, an application must be made to register and issue a guaranty certificate. An appropriate form is appended to the operating instructions. The application must be completed fully and submitted to the manufacturer within 2 weeks after it has been installed. The official guaranty will be issued by ICEMASTER after receipt of the application. The possession of a valid guaranty certificate is a prerequisite for acknowledging claims against the guaranty.
16. All aggregates with a nominal capacity of 25kVA (generators that are delivered in kit form, which are those cooling systems that have an appropriately installed external pipe) must be collected from the factory. Before operation of the system, or, transfer to a third party collection from the factory on behalf of ICEMASTER is obligatory. The aggregate must be ready for use of this date. It must be possible for the technician collecting the aggregate to run the aggregate at its prescribed nominal capacity. All temperature levels must be in accordance with the operating regulations, so that the guaranty conditions can be adhered to.
All costs, travel costs, costs that arise through delays and technician expenses will be passed to the customer.
17. Agreement can be made, should generators and other aggregates and integrated components, which prove to be relatively difficult to remove, or are difficult to despatch to the factory because of the size of the object, for a technician from Icemaster or approved sub contractor to assist the customer in repairing a defect. In these cases the Fischer Panda guaranty conditions, as well as special conditions for work and assembly, ex works, are applicable. It is also stated that travel costs, also within the constraints of the guaranty, must be borne by the customer.

H. Liability for Associated Obligations

If due to ICEMASTER the delivered article cannot be used by the customer, in accordance with the contract, as a consequence of a defective finish or missing parts, suggestions or advice as well as other contractual obligations made either before or after the contract has been agreed, then excluding further claims by the customer, the provisions of sections G and I are applicable.

I. The Right of the customer to withdraw from the Contract and further Exclusions of Liability

1. The customer has the right to withdraw from the contract if Icemaster does not carry out modification or replacement, within the appropriate extended period as stated by the company to carry out the repairs of a defect as defined in the delivery conditions, for which it liable.

2. All further extensive customer claims are excluded, especially modification, notice to withdraw from, or reduce, the terms of the contract, as well as reimbursement of any type, and also such damages that were not present on delivery.
3. The cost that arise for delivered goods that are returned by the customer may be appropriately charged to Icemaster, also in good-will. It is agreed that Icemaster accept 20% of such costs, included lost profit without individual proof. The return of special models, as per contract, is excluded.

K. Settlement if contract not fulfilled

Icemaster has the right to reclaim reimbursement for all costs and further damages, should the contract not be fulfilled by the customer. In addition a 20% margin in respect of the total value of the order. If proof of cost is waived, the quote for compensation amounts to a flat rate of 50%.

L. ICEMASTER's right to withdraw from the contract

The contract will be appropriately reviewed in the event of unforeseen occurrences, in so far as they have a considerable effect on the running of ICEMASTER and in the case that it later proves impossible to implement.

ICEMASTER has the right to partially or fully withdraw from the contract so far as this is economically justifiable.

The customer does not have the right to claim for damages on account of such a withdrawal. If ICEMASTER wish to make use of their right to withdraw, then ICEMASTER must immediately inform the customer upon recognising the extent of the occurrences, and also if an extension of the period for delivery has been agreed with the customer.

M. Purchasing Conditions

Conditions contrary to or deviating from the purchasing conditions are valid only, if, and as far as ICEMASTER has given its written agreement. Contrary in this context means those conditions that are excluded and limited if the General Delivery and Payment Conditions of ICEMASTER are instigated, as well as purchasing conditions, after the order has been carried out in recognition of the customer's conditions.

N. Application of Law and Court of Jurisdiction

The agreement between ICEMASTER and the customer is subject to German Law. To institute proceedings at the district court in Paderborn the customer must be a Director or a person with special public and legal judicial powers for all conflicts of law that arise from the contract. Icemaster is, however, also justified to bring an action at the seat of the customer's central office.

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Technical Definitions and Abbreviations

in conjunction with generators and power systems

A-Ampere

A measurement of the flow of current. One ampere is equal to the electrical force of one Volt acting across the resistance of one Ohm.

AC

Electricity as produced by the electrical components (utility). The unique characteristics of this form of electricity is that it reverses direction at regular intervals. For example, 120 V AC 60 Hz power reverses flow 60 times a second, hence the rating 60 Hz (cycles). In Europe is typically 50 Hz, in the USA, parts of South America and the Caribbean 60 Hz (120 volt current).

Ampere Hour (AH)

One amp of electrical current flowing for one hour. Expresses the relationship between current (A) and time (Ohms law $A = VR$). AH is the measurement for battery capacity.

AGT -Advanced Generator Technology

All Fischer Panda generators, which are constructed as permanent electro-magnetic generators, are made from ceramic "Hightech" electro magnetic materials. These materials are also known as "rare earth". Icemaster, especially uses the high quality material Niodym. The AGT generators are used as battery charging generators or as propulsion generators.

AGT-DC

Panda AGT generator high frequency permanent electro-magnetic synchronous generator (12 - 24 pole). This type of generator is especially effective. AC is transformed to DC by means of an especially effective rectifier. The aggregate is especially effective for charging batteries.

AGT-DE

This version of the AGT Generator version supplies a 3-phase output voltage (without diodes) and is used in the variable speed operation for supplying diesel-electric drives.

AGT-HD AGT Heavy Duty

The AGT-HD supplies direct voltage in the same way as the AGT-DC generators. An enhanced cooling system, external diodes and the ability to restrict maximum performance makes these generators suitable for driving DC motors (e.g. electro motors with heavy loads) over extended periods of time.

ASB-Automatic Start Booster

An electronically controlled high starting current in the control box. Suitable for all Panda asynchronous generators, to compensate the high starting current of electric motors (i.e air conditioning units etc). ASB should always be chosen if a generator is to be driven by an inductive load (electric motors, air-conditioning units etc). All generators from Panda 8000 up to Panda 14.000 are fitted, as a rule, with ASB as standard.

Current

The amount of electrical charge. The flowing current measured in amperes.

Consumer

All devices that require electricity.

DAPS-DC-AC-Power-System

The very efficient power supply system is battery supported. The generator supplies direct current to charge the batteries, whilst the accumulative current is produced via an inverter. The generator runs intermittently and charges the battery, and at the same time the inverter is provided with power.

DC

Term for DC (direct current). DC is generated by alternators and battery charging devices or Panda AGT generators with auxiliary rectifier, or DC is drawn from a battery.

DZ

ICEMASTER abbreviation for Deutz motors.

EK: Single Circuit Cooling

Cooling system for generator and motor. Both components are either cooled by seawater (marine generators) or by cooling liquid (standard for vehicle / stationary generators)

FAR

ICEMASTER abbreviation for Farymann motors.

FC - Freshwater Cooling

Motor and generator are cooled with freshwater by the heat exchanger. This cooling version avoids galvanic corrosion and is standard for Panda 4500 FCB and from Panda 5000 LPE / AGT upwards (see ZK).

Hz - Hertz

Hertz denotes the frequency within one second. The frequency is determined by the number of periods in which flow of current changes. The frequency in Europe is normally 50 Hz, the USA is 60 Hz.

JD

ICEMASTER abbreviation for John Deere motors.

KUB / KU

Icemaster abbreviation for Kubota motor.

kVA - Kilovolt Ampere

Unit for apparent power, reactive current. The value is the combination of voltage and current.

kW - Kilowatt

Physical unit for real output. The value is the combination of voltage and current. It concerns the effective electrical performance available. So-called apparent power which is affected reactive current is not taken into consideration.

kWh

One kW per hour.

LED - Light Emitting Diode

Very small electrical lamp with an extremely low power consumption. It is used, in order to represent the operating systems on displays, remote control panels or other indicators.

LK

The abbreviation used by Icemaster for all systems that use air-cooling (contrary to water-cooling).

LP

Low Profile (special low style).

MB

Term used for MTU motors.

ND

Generator without VCS voltage regulation system.

NE

Generator with VCS voltage regulation system.

Overload

A consumer attached to an inverter or generator, which requires too much current thereby overloads the device. Panda generators are internally protected against overloading.

PK

ICEMASTER abbreviation for Perkins motors.

PM - Permanent Magnetic Synchronous Generator

A synchronous generator. An electrical field is achieved by permanent electro magnets. These generators are, as a rule, high pole version, i.e 12 to 24 poles, the frequency is 6 - 12 times higher than 2 pole standard generators of the same speed. (Frequency is 3000 rpm, 6 pole: 300 Hz, 24 pole: 600 Hz). With this "High frequency technology" various additional components are more efficient than conventional generators. In view of the size and weight, a PM generator is up to 60 % larger and 40% lighter than a standard asynchronous generator. The PM technology is also used for the Fischer Panda electric drive motors.

PMS - Panda Marine Standard

This is the term used for standard marine generators.

PMS-HD-Panda Marine Standard Heavy Duty

Marine generators with an operating speed of 1500 or 1800 rpm.

PSA - Panda Standard Asynchronous Generator

An extremely robust generator, with many positive features, that has been developed by Icemaster. Extremely stable temperature because of effective water-cooling, self exciting because of external capacitors, diodes that do not revolve, no rotor windings, all windings are externally fitted to the stator and can therefore be cooled perfectly by means of an external cooling jacket, voltage stability by means of "VCS", noise depression, excellent sinus curve and therefore suitable for all charging devices, closed construction gives a high level of protection. The PSA generators in conjunction with the ASB-Startbooster system supply an especially high starting current for starting electric motors (see ASB).

PVK-U-Panda Vehicle Compact Underbody

A sound-proof capsule for underbody assembly is supplied, that especially stands out because of its compact form.

PVMV-N-Panda Vehicle Module Vertical

Panda vehicle generator, assembled in module form with vertically mounted water-cooled pre-silencer and with integrated, vertically mounted, rear silencer.

SC - Seawater Cooling

Generator and engine are directly cooled by seawater. This cooling system is very efficient, as the very cold seawater can directly be used for the cooling of the generator. However, in warmer river areas this cooling system could lead to faster corrosion.

Sacrificial Anode

Metal component with negative electrical potential (aluminium, magnesium etc), which is mounted on.

Sound Insulation Capsule 3D

Standard sound-insulation capsule with 3 layered sound-insulation material, total thickness of the sound insulation material: 20mm.

Sound Insulation Capsule 4DS

Special version for all sound-insulation capsules that place great demands on the thickness of the sound-insulation material 4 layers, thickness approx. 40 mm.

Sound Insulation Capsule 6DS

Special version for sound insulation capsules that suffices to meet the greatest demands on the sound-insulation. Sound insulation material, 6 layers, total thickness approx. 60 mm.

Sound Insulation Capsule GFK

Sound insulation capsule GFK version (reinforced glass-fibre polyester) hand laminated.

Sound Insulation Capsule MPL

Sound insulation capsule, made from stainless steel, painted sheet steel or aluminium.

Sinus Wave

The output wave of an electrical alternating current. An optimum sinus curve is shown by a smooth wave going above and below zero. The Panda asynchronous generators produce a sinus wave with an almost perfect wave (equates the current drawn from the public electricity network)

SC - Seawater-cooling

Direct cooling system, by which means the generator and the motor are cooled direct by seawater. Cooling of the SK cooling system is essentially more effective, since colder seawater is used to directly cool the generator.

VCS - Voltage Control System

Regulates the speed of the motor and also the generator voltage. The speed of the motor is at the lowest point

of tolerance. The speed is adjusted to the highest point of tolerance as performance decreases. This enables a voltage tolerance up to ± 3 volts. Even with very high load alternation, the adjustment time amounts to less than 1.2 seconds. Voltage peaks are limited to a very short period. In the case of VCS, the frequency has a tolerance of ± 2 Hz.

W - Watt

Measuring unit for electrical performance. Product of current and voltage.

Wh - Watt/hour

Measuring unit for electrical performance per hour.

Whisperprop

Synonym for the Diesel-electric Drive Systems from Fischer Panda. The main components are the AGT Generator, the PM Electromotor, a motor controller and include a DC-AC power system (if applicable).

YA

ICEMASTER abbreviation for Yanmar motors.

ZK - Dual circulation cooling

Cooling system for generator or motor, by which an internal cooling system (freshwater cooling) is cooled by an external cooling system (seawater cooling) with the assistance of a heat exchanger. In the case of twin circulation cooling, the generator and motor are cooled with freshwater. The seawater only comes in contact with the heat exchanger and the exhaust supports. As a rule, the heat exchanger is made from high quality material (copper/nickel - CuNi10Fe) (see FC).



Fischer Panda

Mobile Supersilent Diesel Generatoren

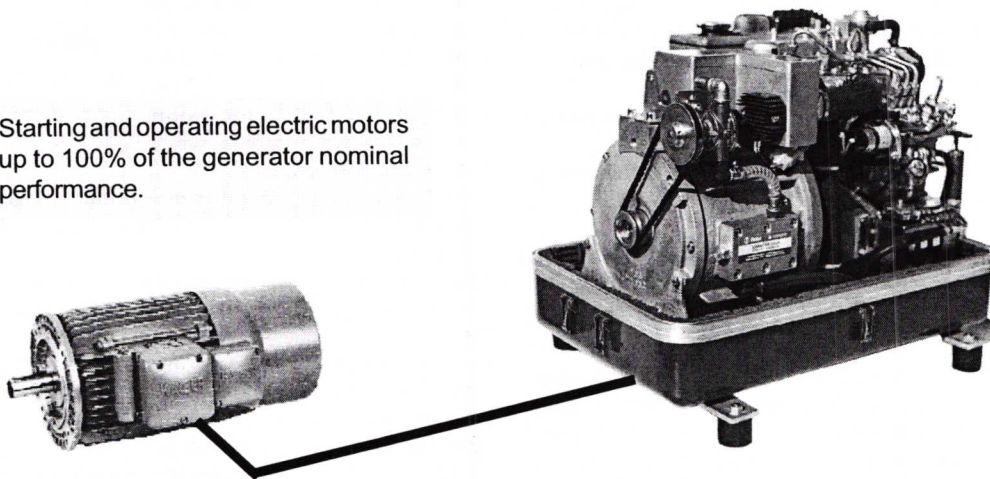
Operation Instructions for Generators with Inductive Loads

Reactive Current Compensation and Boost Start for Electric Motors with a high Starting Current

The Panda generators have, for several years, been fitted with an electronic voltage control (VCS), which controls the generator voltage in the range up to 80% of the nominal load with a tolerance of ± 3 volts. The starting current booster ASB has been in series production since 1988. Panda generators are superior in conventional aggregates and are, of course, in the position to start all normal inductive loads, such as electric motors, air conditioning system, without special assistance. **Compensation of individual machines is therefore, as a rule, no longer necessary.**

The following tips are useful information since a correct reactive current compensation always considerably improves the efficiency of a system, especially if an optimum electrical system, from an economical viewpoint, is required.

Starting and operating electric motors
up to 100% of the generator nominal
performance.



Running the Generator with an inductive load (Reactive current compensation/Phase correction)

**ATTENTION! Before carrying out these measures,
read the safety instructions in the handbook**

A reactive current occurs, which has an effect on the effectiveness of the whole system, if an AC electrical circuit (Generator or Load current) is connected to an electric motor or another inductive load (i.e. Transformer etc.)

These changes are always disadvantageous, since the reactive current places stress on the conductor in the same way as "active current". The effect, by the way, can be corrected by adding capacitors.

A compensated circuit is always more effective than a circuit burdened by reactive current. This is the case, in respect of public electricity circuits. For this reason factories are, as a rule, obliged to improve the effectiveness of their plants by means of automatic reactive current compensation.

In the case of a very small circuit, for example, a generator, it is advisable to use reactive current compensation, if the total stress with inductive load is greater than 30 to 40% of the generator nominal load.

Reactive current compensation by means of an Automatic-Start-Booster (ASB):

An automatic reactive current compensation has been built into most Panda generators in series, from 1998, which operates independently, when starting the electric motor, if the set voltage is exceeded, because of the high starting current during starting. The Panda generator in comparison to conventional asynchronous generators supplies an essentially higher starting current.

Automatic Voltage Regulation VCS:

The voltage regulator VCS enables an enormous increase of the starting current, in addition to the ASB-control, by which the reactive current in peak load range is compensated, since the output voltage of the generator is always within the range of the nominal voltage (231 Volt / 50 Hz circuit or 120 Volt / 60 Hz circuit). "A drop in voltage" is avoided immediately by means of the intelligent VCS. Even the speed of the motor is increased, in order to be able to meet the peak starting current.

The generator voltage is maintained at the set level in the range up to 80 % of the nominal load.

The gradual reduction of the voltage by switching on the electric motors is not possible in the case of a Panda generator.

Explanation regarding reactive current compensation:

Following must be considered, in spite of reactive current compensation.

The performance details kW for the Panda generator have been stated, with the provision, that the generator carries an "Ohm burden" (i.e. Heating elements, hot plate, Boiler etc.) are connected, which does cause an opposition of currents. The performance factor in this case is 1.0, and a loss of reactive current does not occur. **The active performance is therefore the same as the Generator-Nominal performance.**

However, if an inductive load (i.e. an electric motor, a transformer or a desired device, which contains a coil) is to be connected, an opposition of phases is effected by the reactive current, as explained above, between the current and the voltage curve, by which the efficiency level (Power factor or Cos phi) of the system (consisting of the generator and motor) is modified. The reactive current, in addition, produces an opposition of phases. The reactive capacity, which arises from this cannot be used. The reactive capacity must be deducted from the generator nominal capacity.

The Formula is:

$$\text{Active performance} = \sqrt{\text{apparent performance (nominal performance)}^2 - \text{reactive performance}^2}$$

This is not a special feature of the Panda-Generator, every electrical system has this, household, factory etc., for example, must also be considered.

A correctly reactive current compensation improves the efficiency of the system

In the case of a small "power plant", such as an AC Panda Generator, an improvement to the system efficiency of 20% can be enormously advantageous.

This results in a compensation of the circuit inductive electrical consumers and the interaction with the generator is decidedly improved.

The compensation even for the Electric motor is itself improved. The source of energy is of no consequence (Load current, generators or inverter). Sometimes you hear (even from so-called "experts"), that the installation of capacitors to an electric motor would damage the motor for the purpose of reactive current compensation. That, however, is a false conclusion, which can only be explained by a lack of knowledge.

The efficiency of a generator, or, a public AC circuit and Motor performance are always improved by reactive current compensation.

The Panda asynchronous generator is more effective than a conventional generator (especially as a synchronous generator), since the inductive direct reactive current influences the excitation of the generator, if the circuit is well compensated. The effectiveness produced by the Panda generator, in conjunction with a well compensated circuit, can scarcely be achieved by any other type of generator.

The compensation, for example, means that electric motors can be started with a performance of up to 80% of the nominal capacity of the generator.

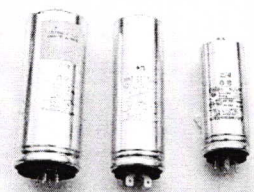


Diagram 1: Various capacitors for compensating the inductive load

Compensation of 1 phase AC consumers

Capacitor values can be taken from the appended table. If a certain capacitor of the correct size is not available, then several capacitors can be connected in parallel; The values increase ($C = C1 + C2 + C3 \dots$) Capacitors can be contained in a centrally mounted "capacitor adaptor box". Boxes of various sizes can be

ordered from Icemaster for this purpose. In this case the wires must be laid to the consumer. Generally it can be assumed that, especially in the case of a one phase AC consumer, a single capacitor can be attached to the motor.

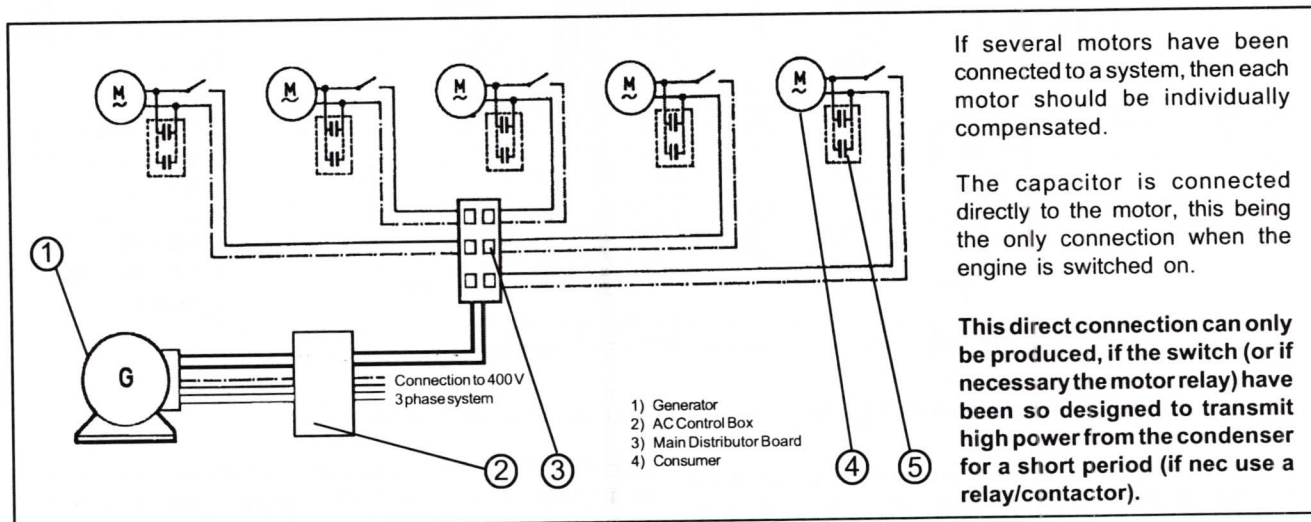


Diagram 2: Example for the compensation of several 1-phase motors direct to the motor

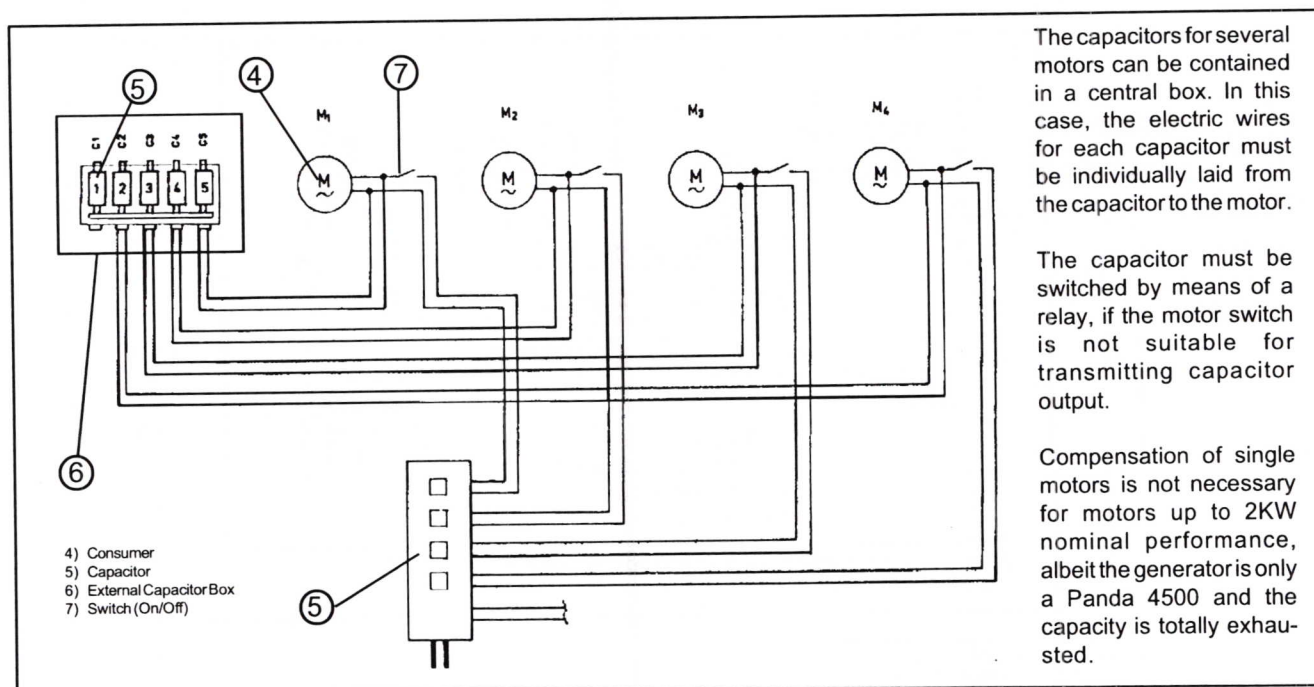


Diagram 3: Example of an insulation with central capacitor box with wires leading to the motor

Compensation for Aggregates with (VCS) Voltage Control System

As is the case with all generators fitted with **VCS voltage control system**, the drop in voltage can be **reset** by VCS. The drop in voltage caused by inductive consumers can be immediately determined.

For this reason the plug must be removed when testing, so that the control does not function temporarily.

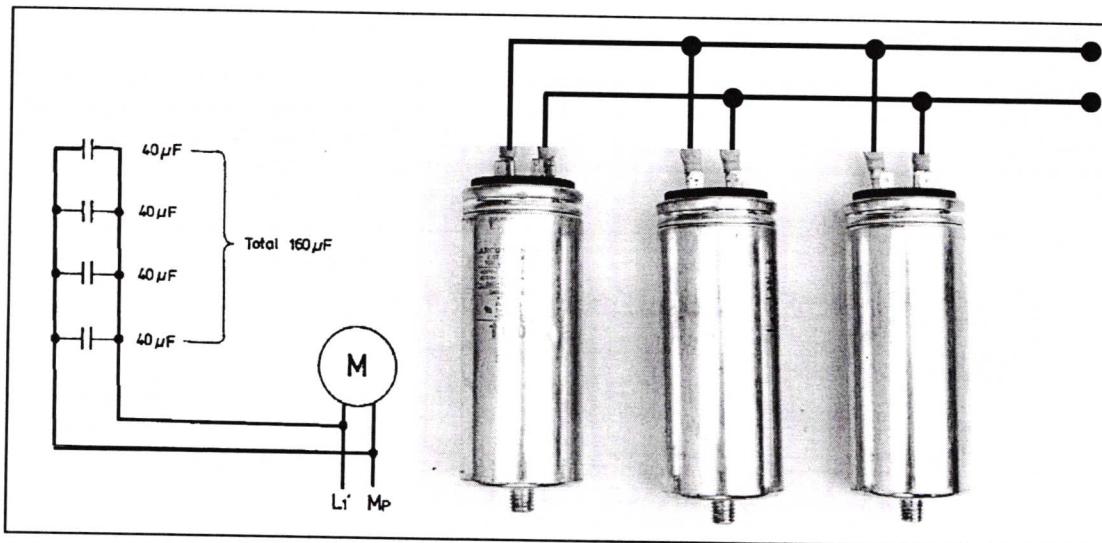


Diagram 4: Capacitors in parallel to increase the capacity

Several capacitors can be connected in parallel, as shown in diagram 4, if a capacitor of the correct size is available. The capacitance of the capacitors is increased.

This means that, with 5 capacitors for each $20\mu\text{F}$, it is just as easy to achieve $100\mu\text{F}$, with one $100\mu\text{F}$ capacitor.

Compensation of 3 phase rotary current

3 capacitors of the same size are required to compensate a rotary current motor, which must be tuned according to the size of the motor. The values are also listed in the table appended to this information sheet. The capacitors for rotary motors must be connected in a triangle. Further details can be

taken from the diagram below.

Diagram 5 shows the compensation of several rotary motors on a circuit. The capacitors are respectively connected to the motor and are actuated when the motor is switched on. An additional external capacitor box can be used, if it is not possible to attach the capacitors direct to the motor, which

centrally incorporates all capacitors. The group of capacitors must be connected to the respective motor by means of wires (3 core).

The contactor must be modified, if the motor starting contactor is too weak to actuate the capacitors.

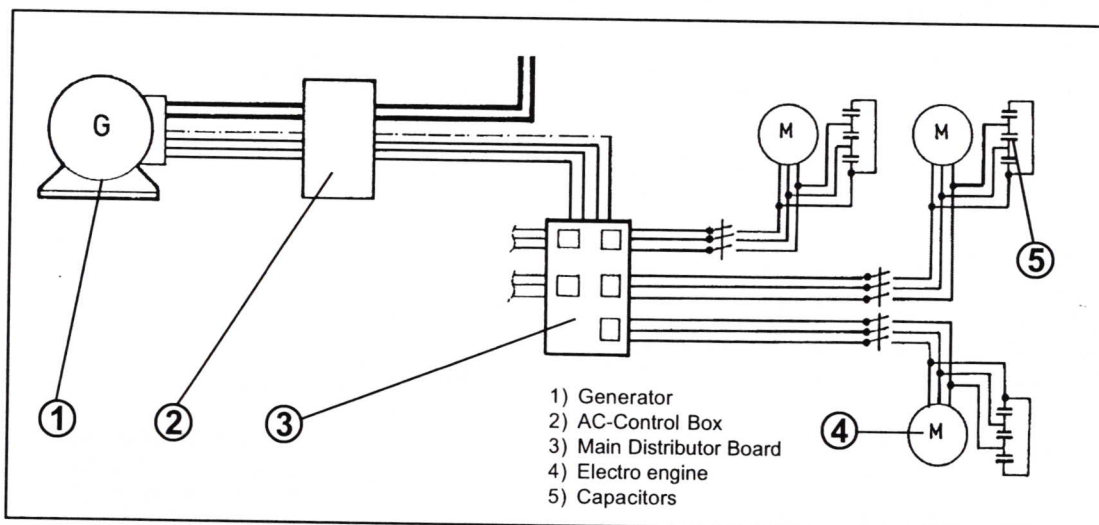


Diagram 5: Compensation of 3 phase rotary current

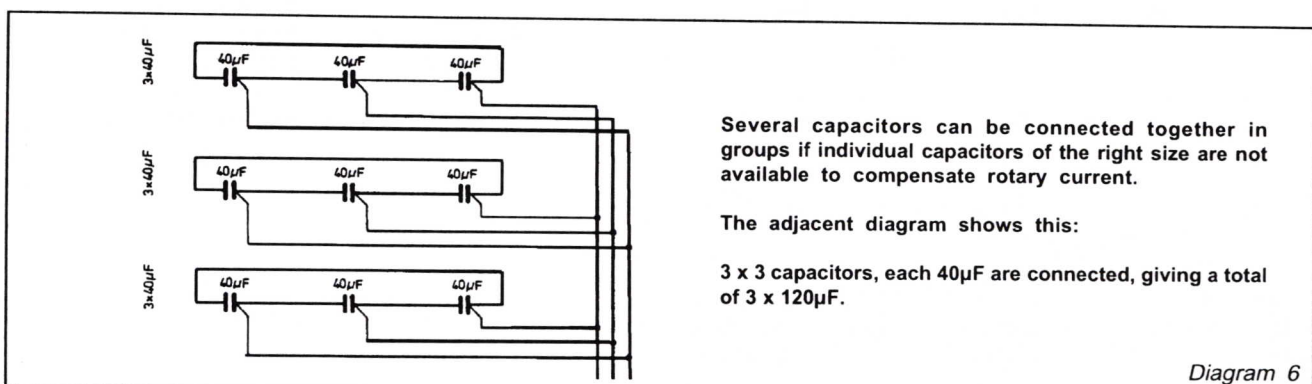


Diagram 6

The compensation of electric motors, in the case of a Panda generator, is not necessary, because of VCS control with ASB booster (in series from early 1998). This is not necessary as a rule, if the individual stress does not exceed 40% of the generator nominal load or the sum of all electric motors does not exceed 75% of the generator nominal capacity.

The engines (air conditioning units etc.) will also start without compensation and the voltage will be regulated to a constant point.

The effectiveness of the system, however, is continually improved through compensation.

Die Kompensation kann sehr einfach durch das Anschließen von Kondensatoren, die bei ICEMASTER bezogen werden können, durchgeführt werden. Die Kondensatoren werden am besten **direkt** an den Verbraucher angeschlossen. Sie müssen zwischen dem Motorschalter und dem Motor installiert sein. Sie sind dann automatisch eingeschaltet, wenn der betreffende Motor eingeschaltet wird. Dies gilt sowohl für 1-Phasen-Wechselstromverbraucher als auch für 3-Phasen-Drehstromverbraucher.

ATTENTION!

The reactive current must be correctly compensated. Over compensation can destroy the generator (or even the motor) in a very short period of time.

Higher starting current for electric motors

Very powerful starting current can be produced by the Panda asynchronous generator for powerful electric motors. It is even possible to start electric motors with up to 100% of the nominal capacity. The generator design and $\cos\phi$ should be considered when make calculations. If the $\cos\phi$ amounts to 0.8, only 80% of the generator capacity for driving electric motors is available. This means that the actual **effective capacity** of the generator with inductive load is only **80%** of the **nominal load** and accordingly only if electric motors run at this consumption rate. **Compensation** improves this situation.

High starting current for air conditioning systems

If the air conditioning systems are to be switched on and off for short periods by means of the thermostat, i.e. before the pressure in the cooling system is compensated, a considerably more powerful starting current than usual is produced. (Air cooling systems should principally be switched on again after a period of at least 60 seconds). Problems always occur if several air-conditioning are switched on in quick succession. For this reason a time lag relay from specialist shops are available for air conditioning systems from trade sources. An ideally compensated system can increase the starting current in such difficult cases, thereby minimizing the problem.

Voltage Control

A **voltage control** should always be integrated in the electrical circuit to prevent damage to motors and other consumers because of overloading or insufficient current, so that the circuit in the case of overloading or insufficient current is switched off or it is brought to the attention of the user by means of an alarm. Regards must always be given to voltage fluctuations. This, for

example, can occur when there is a lack of fuel or other engine problems.

Switching off non essential consumers when the generator is overloaded.

This is very rarely used, but can protect the complete circuit with little effort. If the running voltage drops (i.e. when the generator is overloaded, it is possible in one or two stages to switch off "non essential consumers" by means of a load discharge relay. "Non essential" consumers can be chosen, so that a temporary disconnection does not make a difference. This, for example, could be the battery charging devices, heating devices, hot water boilers or individual air conditioning systems at the lower level or could even be a desalination unit.

Usually the total circuit collapses, if a generator is run close to the limit and additionally an oven or a micro wave oven is switched on. Temporary disconnection of parts of the circuit is essentially an intelligent solution. The temporary disconnection is maintained until the oven is switched back to a lower rate or switched off.

Boosting the starting current by means of a Start Booster

It is possible that the generator, in spite of compensation, does not start an electric motor, because the starting current is too powerful. The starting current is normally 4 to 6 times that of the motor nominal current, but can, in certain circumstances, reach 20 times this level. Electric motors with especially high current pick up on starting, i.e fans, compressors for diving systems or compressors for refrigeration and air-conditioning systems. **In this case an additional measure, a so-called "start booster" is necessary.**

The required starting current can be temporarily increased for a short period.

The **start booster** is connected **direct** to the 3 phase side of the **Panda generator**. It can be used for any type of motor, as long as several motors with a high starting current are part of the electrical circuit.

BEWARE!

The start booster may only be connected for a short period to the generator circuit.

Damage can be caused to the generator within a short period, if a generator booster switch is used, before a high inductive load is phased up. The compensation phase" may only be connected in a manner, which will only place stress on the generator, if a motor is running at the same time.

The start booster can be installed as per diagram 8. In this case the booster is switched on by means of a manual switch for the short period when the motor is started.

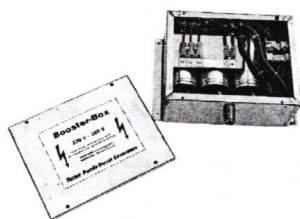


Diagram 9: Opened "Booster Box" with contactor, capacitors and connecting plate

In order to be certain that the start booster can be connected to the circuit whilst the motor is being started, should the booster box to be used for this purpose be provided with a key, this means the key automatically returns to the original position after it has been released. This connection, however, is only possible if the motor is manually started. This is the case with large diving compressors, fans etc. The starting booster is only used to assist starting. Once the motor is started the aggregate continues to run with normal compensation.

Start booster with automatic connection

Diagram 9 shows how the start booster is automatically connected by means of a relay. In this case, a **time switch**, in combination with the drive contactor of the appropriate motor, is connected, which switches on the start booster for a fixed period of time (as a rule 3 to 5 secs suffices), in order to produce the necessary increased capacity during the starting phase.

Further starting assistance for electric motors with heavy starting loads

Normally only 3 phase 2KW electric motors are suitable. One of the greatest advantages of the Panda generators is a **DVS-System** (Dual Voltage System), which is a genuine 3 phase generator combined additionally with a fully adequate AC generator that produces the total nominal performance on the one phase side. Three phase generators are more simply constructed, are more reliable, but also more effective and especially powerful when starting. It is therefore absolutely important when choosing accessories to ensure that 3 phase motors are used. This is also the case for performance classes greater than 750 watts.

A **Hartley oscillator circuit** must be used for starting should the generator, as a single consumer, produce a greater capacity than 40%. This makes it easier to start the engine. But even the "basic compensation" is effective in conjunction with the Hartley oscillator circuit, which is connected direct to the motor. Additionally a "start booster" should be used if it is necessary, but this depends upon the size of the motor.

Electronic Assistance

Electronic Starting Booster are absolutely necessary if extremely large electric motors are used (under certain circumstances this can achieve the full nominal capacity of the generator). By means of the frequency conformer the 3 phase motor can be gently revved up to a set speed (see the installation diagram on page 11). The frequency conformer also has the advantage that the 3 phase motor can be set at any desired

speed and therefore serves a greater range of speeds, which would normally not be possible with the set frequency of 50Hz. The starting current is only increased slightly during the total starting phase. ICEMASTER is only too willing to advise you on the choice available and deliver such machines accordingly.

Which Starting Currents can be achieved with the Panda Generator

In many cases, even without an inverter, up to 100% of the generator nominal performance can be met by the use of inductive consumers if the appropriate electric motor is correctly tuned and the load is spread across several consumers. The inductive consumers can even be switched on and off as desired. The generator voltage, within a very slight tolerance, remains stable.

How can the correct capacitor size be determined?

The simplest method is to test all consumers in sequence. This must be done in stages, i.e the one phase AC consumer and the 3 phase consumer must be tested in sequence.

a) Determining the size of the capacitors in the case of one phase AC motors

If a normal circuit with sockets is installed, it is possible that the capacitors are initially provisionally connected parallel to the motor by means of a plug. A socket should be chosen that is easily accessible. The Panda generator VCS (voltage control system) must be temporarily switched on. A capacitor, which has previously been tuned according to the size of the engine, as per the table supplied by ICEMASTER, is plugged into the circuit (which must be connected to the capacitor).

The voltage will increase after the capacitor has been plugged into the socket.

The voltage will have sunk below the pre-start value (230 volts). This depends on the size of the electrical motor and make a difference of 20 volts. By plugging in the capacitor, the voltage should reach approx. two thirds of the output. If this is not achievable with the chosen capacitor, a somewhat larger capacitor can be chosen. The capacitor should be just large enough for the voltage to be slightly below the idling speed originally set. When testing the motor, the VCS should be disconnected (remove the plug from the servo motor) (over compensation must be avoided!).

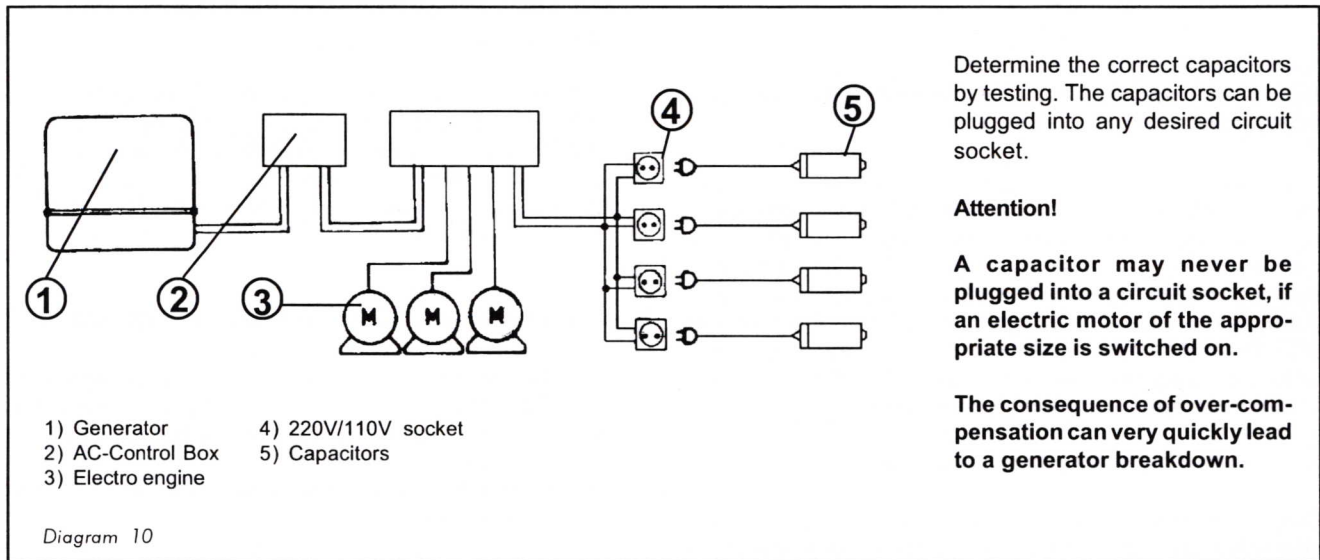
ATTENTION!

After removing the capacitors, the contacts have a high voltage. It is essential that you do not touch the contacts with your bare hands!

The capacitors must be discharged by short-circuiting before they are touched!

Continue in the same manner. All motors are switched on in series and a suitable capacitor tested and entered in the table. If all inductive consumers are to be tested individually, the consumers should also be connected in groups when testing. The corresponding capacitor capacity in sum with the connected motors, as appropriate.

The generator voltage, including capacitors, may not exceed the permitted highest limit.

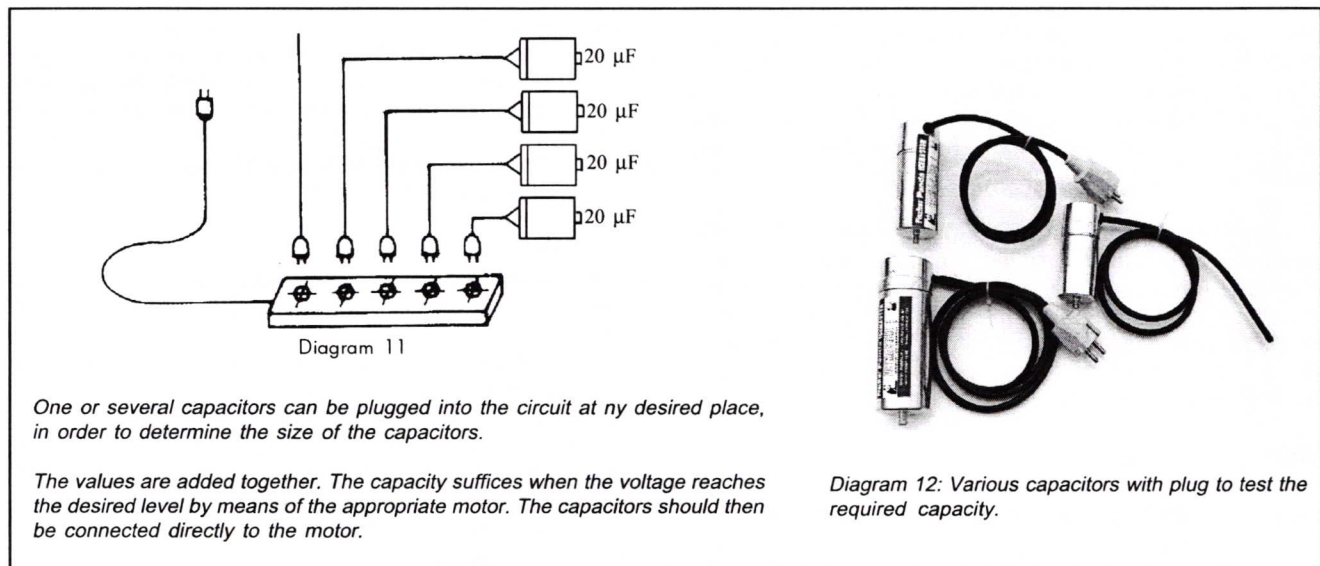


b) Determining the capacitors for the 3 phase side

It is possible to use an insulating screw joint in order to carry out a test (when testing VCS, make a connection to the servo motor), since a normal multi-purpose plug with a triple contact is not available. The motors are switched on, in series, in the same manner as previously described, and the appropriate group of capacitors are determined by the size of the motor.

Starting the Capacitors in separate Capacitor Boxes

Casings are available from Icemaster for both the AC and DC sides, which can take capacitors, if it is not possible to install them in the motor. In this case, the casing can be screwed on in a protected place and the capacitor connection is made to the motor by means of a cable.



Values for the choice of capacitors to compensate electric motors

Nominal Capacity	1 phase AC current			3 phase DC current	
	Nominal Current		Capacitors µF	Nominal Current 400 V	Capacitors µF
	230 V	115 V			
500 Watt	2,2 A	4,4 A	30	0,8 A	3x5 µF
1000 Watt	4,4 A	8,8 A	60	1,5 A	3x10 µF
1500 Watt	6,6 A	12,2 A	90	2,2 A	3x15 µF
2000 Watt	8,8 A	17,6 A	120	3,0 A	3x20 µF
2500 Watt	10,8 A	21,6 A	150	3,8 A	3x25 µF
3000 Watt	13,2 A	26,4 A	180	4,5 A	3x30 µF
4000 Watt	17,6 A	35,2 A	240	6,0 A	3x40 µF
5000 Watt	22,0 A	44,0 A	-	7,6 A	3x50 µF
6000 Watt	26,4 A	25,8 A	-	9,1 A	3x60 µF
7000 Watt	30,4 A	60,8 A	-	10,6 A	3x70 µF
8000 Watt	44,0 A	88,0 A	-	15,2 A	3x90 µF

Experimental values for Marine air conditioning units. Obtained from Lun Air Marine Air Conditioning Units

BTU	Engine Capacity, approx.	Stromaufnahme 50 Hz 220 V	Stromaufnahme 60 Hz 110 V	Kondensatoren Kapazität
6.000	800 Watt	3,5 A	7,0 A	40 - 50 µF
9.000	1.200 Watt	5,2 A	10,4 A	60 - 80 µF
12.000	1.400 Watt	6,2 A	12,0 A	80 - 100 µF
16.000	1.600 Watt	7,0 A	14,2 A	120 - 140 µF
24.000	2.600 Watt	10,4 A	-	160 - 200 µF

An additional capacitor should never be switched on, if the generator is running without load. This can cause the generator to break down, by melting down the windings.

Additional capacitors are just as critical if only the ohm load is turned on. In this case, the generator temperature must be controlled.

The generator can break down in each case, if higher capacity loads are unnecessarily used (This is the only possibility of causing damage to the generator).

List of the most important hints for the compensation of inductive consumers

- 1) Electric motors can be compensated by adding a capacitor. This is applicable for every single motor.
- 2) To compensate single phase AC motors the capacitor is connected **parallel** to the motor on the net supply side (after on/off switch).
- 3) To compensate 3-phase motors the capacitors must be connected in "**triangle**". They are connected directly to the motor as well.
- 4) At increased starting current an additional "start booster system" (starting current boosting) has to be installed. This occurs on the three phase side of the generator and is connected directly to the generator. Thus this starting current boost can be used for every consumer which is installed in the system.
- 5) The start booster may only be connected to the generator supply for a short time to assist in starting. Because of this it only should be switched on by use of a push button which has to be pressed as long as required to switch on the additional capacitors. If the motor is to be automatically started, the start booster can be coordinated with the motor by means of a time delay relay.
- 6) Capacitors for the compensation may only be connected directly to the consumers. They may **not** be switched on if the generator is **not connected with the respective consumers**.
- 7) **If additional capacitors are connected to the generator and no loads are switched on at the same time, this can cause the generator to be damaged (destruction of the winding).**
- 8) The compensation of the motors has to be carried out such a way that the permitted maximum voltage of the generator is exceeded in any combination. Therefore after installation a test operation (with voltage control system) has to be carried out for each single consumer and collectively.
- 9) To protect the motors and other consumers a voltage control system which signalizes alarm at excess voltage and undervoltage or which switches off the consumers should be planned in the electric board supply.
- 10) If the generator performance is insufficient, the power supply should be installed in such a way that unimportant consumers are switched off automatically, if the maximum performance is reached.
- 11) 3-phase motors should be used wherever possible, if electric motors are used. This is applicable to motors with a relatively small performance absorption, as well.
- 12) The Panda generator is normally supplied with the "**Dual Voltage System (DVS)**". Therefore **only the additional** connection determined for the 3-phase AC current supply should be used.
- 13) The three-phase connections L1, L2 and L3 should only be used for the 3-phase part.
The phases L1, L2 and L3 supply a voltage of approx. 230 volts on the neutral conductor, this single phase can, however, not be loaded by the nominal performance of the generator (max. 50%) and causes one-sided to the generator.
- 14) In the main, all Panda generators, starting with 8000, are fitted with a VCS (electronic voltage control). As from 1998, an automatic start booster (ASB) will be installed.
- 15) **All generators with this fitting are in a position to start inductive consumers with an individual performance of 2 to 3KW, as long as this does not exceed 40% of the nominal performance of the generator.**
- 16) It is therefore no longer necessary to compensate small air conditioning units and other consumers individually. If an individual electric motor reaches 40% of the generator performance, this motor should be compensated in advance.
- 17) In this case of electric motors with an especially high starting current, an automatic booster switch (ASB) is integrated from 1998 as standard, and it is necessary in certain circumstances for the booster switch to conform to the size of the motor. The manufacturer's advice must be obtained in this case.
- 18) If you have an electric motor with a large capacity in your consumer network and this motor cannot be started by means of a Panda generator, you are requested to contact your supplier or the manufacturer. As a rule, it is always possible to start the motor by additional measures.
- 19) **Marine-Air conditioning units**
All Panda generators with integrated VCS and ASB are in a position to start air conditioning systems without compensation, since individual marine air conditioning units seldom exceed a nominal capacity exceeding 2kW. Almost the full nominal capacity of the generator can be exploited by using several air-conditioning units started in series.

Speed Control or Start Boost for 3 Phase Motors with the assistance of a Frequency Conformer

Modern frequency conformers offer the users of 3 phase motors a series of advantages. It is especially simple to control the speed of 3 phase motors almost at will. For example the control of a bow thruster. With the assistance of a control lever, which controls the 3 phase motor and allows fine tuning. "Programming" of the frequency conformer by means of individual parameters is possible, as well as automatic mode. The running state of almost all 3 phase motors is maintained and life expectancy improved. Starting current, which is very high in the case of normal electric motors is very high, is balanced out by the frequency conformer, so that the booster switch can normally be discarded.

ICEMASTER deliver various frequency conformers, as well as the appropriate accessories on request, in almost all performance classes.

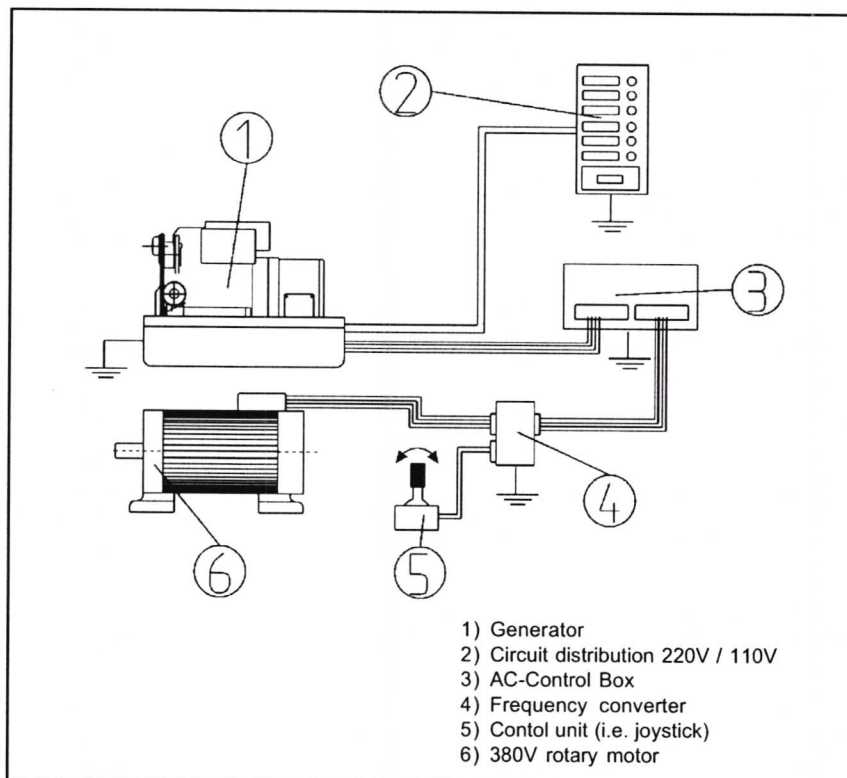


Diagram 13: Installation diagram for 3 phase motor with Frequency Conformer

