MASTERVOLT
TAILOR MADE ENERGY

USERS MANUAL U.S.A. EDITION

WHISPER 3,5 -3600 RPM-

Marine diesel generating set 120V / 60 Hz

Digital Diesel Control

Art.no. 50200307

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This manual applies to the Mastervolt Whisper 3,5 marine generating set controlled by Digital Diesel Control. First launched in April 2004. For earlier models efer to other manuals available on our website; www.mastervolt.com

CONTENTS:

1 INTRODUCTION 4
1.1 General 4
1.2 Service and maintenance 4
1.3 Guarantee 4
1.4 Liability 5
1.5 Identification 5
1.5.1 Name plate 5

2 INFORMATION 6
2.1 Safety 6
2.1. General 6
2.1.2 Electrical safety 6
2.1.3 Earth insulation failures 6
2.1.4 Installation 7
2.1.5 Operation 7
2.1.6 Fire and explosion 7
2.1.7 Chemicals 7
2.2 Transport lifting and storage 8
2.3 The Whisper 3,5 generating set 8
2.3.1 Features 8
2.3.2 Remote control 8
2.3.3 Documentation 8
2.3.4 Accessorie included in the standard delivery 8
2.4 Components 9
2.4.1 Main components 9
2.4.2 Generator control panel 10
2.4.3 Remote control panel 10
2.5 Technical information 10
2.5.1 Alternator 10
2.5.2 Engine 10
2.5.3 DC electrical control system 10
2.5.4 Battery charger 11
2.5.5 Alarms and shut down 11
2.5.6 Control 11
2.5.7 Remote control 11
2.5.8 Hour counter 11
2.5.9 Load indicator 11
2.5.10 Fuel specification 11
2.5.11 Oil specification, oil viscosity, oil capacity,, oil pressure 11

2.5.12 Technical data 12
2.5.13 Wiring, codes and colours 13
2.5.14 Lay out control PCB 14
2.5.15 Electrical diagram 120V AC 15

3 OPERATION 16
3.1 General 16
3.2 Operating instructions 16
3.2.1 Summarised operating instructions 16
3.2.2 Extended operating instructions 16

4 MAINTENANCE AND CARE 19
4.1 Alternator 19
4.2 Engine 19
4.2.1 General instructions 19
4.2.2 Bleeding fuel lines 19
4.2.3 Valve clearance 19
4.2.4 Replacing fuel filter 20
4.2.5 Cleaning oil strainer 20
4.3 Regular maintenance 20
4.3.1 Maintenance schedule 21
4.3.2 Putting out of service 21

5 TROUBLE SHOOTING 22
5.1 Alternator malfucntions / AC trouble 22
5.1.1 General 22
5.1.2 Trouble shooting check list alternator 22
5.2 Engine faults 23
5.2.1 General 23
5.2.2 Trouble shooting check list engine 23
5.2.3 Warnings 26
5.2.4 Service address 26
5.3 Special procedures alternator 26
5.3.1 Residual voltage check / excitation procedure 26
5.3.2 Testing rotary diodes 26
5.3.3 Windings resistance values 27
5.3.4 Meggering 27
5.4 Special procedures engine 27
5.4.1 Readjusting RPM 27
5.4.2 Tightening torques 27
5.4.3 Measuring exhaust backpressure 27
5.4.4 Disassembly instructions 28

6 SPARE PARTS LIST 29
Maintenance log 31

1 INTRODUCTION

1.1 GENERAL

The Whisper 3,5 Marine Diesel Generating set is manufactured and marketed by Mastervolt.
It is important to read this manual before installing and operating the generating set. Both safety and durability rely very much on the correct identification, installation and a good understanding of ratings, features, design, maintenance and operation procedures.
The information, specifications, illustrations and statements contained within this publication are given with our best intentions and are believed to be correct at the time of going to press.
Our policy is one of continued development and we reserve the right to amend any technical information without prior notice.
Whilst every effort is made to ensure the accuracy of the particulars contained within this publication neither the manufacturer, distributor, or dealer in any circumstances shall be held liable for any inaccuracy or the consequences thereof.

WARNING:
A 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.

DANGER:
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.

1.2 SERVICE AND MAINTENANCE

Regular service and maintenance should be carried out according to the directions in this manual. For service and maintenance one can appeal to the manufacturer or the dealers.

1.3 GUARANTEE

Mastervolt guarantees that this generating set has been built according to good workmanship, according to the specifications in this manual and according to European Community safety regulations.
During production and prior to delivery, all of our generating sets are tested and inspected.
The functioning of this generating set is subject to guarantee. The period and conditions of this guarantee are laid down in the general conditions of delivery as registered with the Chamber of Commerce and Industries in Amsterdam number 33279951 and are available on request. For USA deliveries there are aditional conditions. these are available at MASTERVOLT USA. Some aspects of the warranty scheme are given here in more detail:
Guarantee period 1000 hours or 24 months whichever occurs first. Warrantee does not cover failures that are caused by misuse or a faulty installation.

Example 1. Faulty installation:
Seawater entering the engine is the most common cause of damage to combustion engines in boats. (Both to propulsion and generator engines.) The entry of water must be avoided under all conditions. Be aware that the conditions in blue water sailing can be extreme. Refer to the installation manual for instructions but remember these are for guidance only as many factors influence the installation of a generator. The ultimate responsibility will always be with the owner to ensure a safe and compliant installation.

DAMAGE CAUSED BY THE INGRESS OF WATER IS NEVER COVERED BY WARRANTEE.

Example 2: Misuse:
Long term running with no load or too little load can cause the exhaust to get choked with soot or carbon. Cleaning the exhaust is not covered by warrantee.

Example 3: Neglect
Sometimes the seal of the raw water pump starts leaking. Mostly this begins with a little drip and slowly gets worse. Regular visual inspection of the generator is necessary to prevent damage to occur from a leaking water pump. When one find serious damage after weeks of neglect warrantee claims will not be honoured.

Example 4: Neglect
Whisper generators have an option for an auto start/stop mode or interval mode.
Mastervolt cannot be held responsible for damage caused by the unattended running generator.

Warranty means that faulty parts are repaired or replaced free of charge. If necessary the whole generator unit will be exchanged. Labour necessary to complete repairs on board a vessel executed by an authorised service engineer is covered, but is limited to a reasonable number of hours and reasonable rates in relation to the actual repair work that has to be done.
Travel expenses and travel hours are not covered. Also not covered is the labour required to take a generator out of a boat or for reinstallation. There is no cover for labour needed to get access to the generator, for example to remove equipment or bulkheads etc. Refer to MASTERVOLT USA.
Goods to be delivered under warrantee will be invoiced. Only after the faulty goods are returned will the invoice be credited. Payment in advance may be required or guaranteed by credit card. If after the faulty goods are returned, it is indicated that the failure was not covered by warranty a credit will not be issued. For example if a Printed Circuit Board is returned with clear damage caused by seawater, warranty will be refused.
Freight costs to deliver spares by normal mail or carriers is covered under warranty. Special services like express mail, overnight delivery etc. are not covered. Taxes and duties are not covered. For shipments to remote off shore areas any additional costs incurred over normal carriage will be invoiced to the customer.
The cost for returning faulty goods is not covered under warranty.

If any problem arise which could be subject of guarantee, procedures should be followed as described in the guarantee certificate, unauthorised repairs could lead to further damage and violate the guarantee conditions.

Should work take place, which is not in accordance with the guidelines, instructions and specifications contained in this user's manual and the supplementary installation manual, then damage may occur and the generating set may not fulfil its specifications. In all these cases the guarantee may become invalid.

1.4 LIABILITY

Mastervolt does not accept responsibility for damage, injuries or casualties which are the result of operation of the generating set in specific conditions which brings dangers which could not be foreseen, or could be avoided by additional measures. Mastervolt does not accept liability for damage due to use of the generator, possible errors in the manuals and the results thereof.

Automatic start/stop

Mastervolt cannot be held responsible for damage caused by the unattended running generator using the auto-start/stop mode or interval mode.

1.5 IDENTIFICATION

1.5.1 General

Before using this generating set it is very important to identify the set correctly. To communicate for service or ordering parts it is also essential to correctly identify the generating set. Also for the daily operation of the generating set it is necessary that the operator knows the correct specifications.

1.5.2 Nameplate

All required identification data are on the nameplate.

1 The identity of the generating set is given by the SERIAL NUMBER.
When this number is available the manufacturer can trace the specifications of the generating set. On the nameplate are also some basic features of the set:

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Model	Whisper 3,5
Article number	050900500
Serial number	
Max. power	3.3 KVA / 3.3 kW cos phi = 1
Voltage	120V
Frequency	60 Hz
Currrent	27,5A
Phase	Single phase
Dimensions L x W x H	19,89x15,94x19,94 inches 505x400x500 mm
Weight	214 lbs. 97 kg

CE

Fig. 1: Nameplate.

2 POWER
The nameplate gives the nominal maximum load in kVA = kW calculated with power factor one. When calculating a load one should always take into account the power factor or Cos phi of this load. The power should never exceed the nominal Power in kW as shown on the nameplate. Power is rated at an ambient temperature of 104°F (40°C) and a seawater temperature of 77°F (25°C). For higher temperatures the generating set has to be derated.

3 VOLTAGE shows the nominal voltage.
This voltage should be within the specified tolerance at the nominal frequency.

4 FREQUENCY is shown in Hz and is determined by the speed of the engine (RPM). 60 Hz correlates with 3600 rpm.

5 CURRENT shows the maximum current that is acceptable at the specified frequency, voltage and power factor.

6 WEIGHT shows the net dry weight (approximately) . This is without fuel, oil, packing and external installation equipment.

7 The CE symbol shows that the generating set is build according to European Community safety regulations. This includes the regulations regarding the safety of pleasure craft, machinery, electric safety and electric magnetic compatibility (EMC) and other relevant directives.

Safety also relies on the installation, application and circumstances. See also the remarks in this manual under SAFETY

Before changing a factory setting you are advised to consult the manufacturer. When the generating set you have to identify is not new you have to take into account the possibility that former users changed the settings. Check the settings (voltage, frequency, rpm) when there is any doubt.

2 INFORMATION

2.1 SAFETY

2.1.1 General

When correctly installed and used in normal circumstances this generating set fulfils EC safety regulations. This generating set could be part of an installation or could be used in a way that additional regulations of the EC or other authorities have to be taken into account.

Circumstances could make it also necessary to take additional measures. Be aware of wet conditions and hazardous environments caused by explosive gasses etc.

2.1.2 Electrical safety

The voltage of 120 Volt generated by this generating set is dangerous and if instructions and procedures are not strictly observed may result in electrical shock which will result in severe personal injury or loss of life.

- Check all wiring at least once a year. Defects, such as loose connections, burned cables etc. must be repaired immediately.
- Do not work on the electrical system if it is still connected to a current source. Only allow changes in your electrical system to be carried out by qualified electricians.
- Connection and protection must be done in accordance with local standards.
- **Using the auto-start/stop (interval) mode the generator can start unexpectedly. When working on the electrical system, the 3 Amp fuse must be removed from the control panel and the battery plus cable must be removed from the battery.**

Warning signs indicate parts which could be live.

2.1.3 Earth insulation failures

According to local regulations and depending on the application it is necessary to take measures for protection against earth insulation failures. In the U.S.A. version neutral and ground are connected on the alternator. This requires an insulation protection device as commonly

used in the U.S.A. This installation is beyond the influence of Mastervolt and Mastervolt cannot held responsible for any consequence as a result of the installation.
In all situations the transfer switches between shore, inverter and generator should switch both neutral and line. Ofcourse this is the case when using a Mastervolt MASTERSWITCH.

2.1.4 Installation

Whisper generating sets are not self contained and have to be properly installed in enclosed areas such as a machine room.

Installation includes measures to be taken to outlet exhaust fumes which contain carbon monoxide and are extremely dangerous. Carbon Monoxide (CO) is an invisible odorless gas. Inhalation produces headache, nausea or death. installation includes measures for proper ventilation, safe electric connections, safe installation of the starting battery, proper fitting of the cooling system and fuel pipes etc. Refer to the installation manual.

2.1.5 Operation

The Whisper 3,5 generating set does not have any external moving parts like fans and V-belts and therefore is very safe.

Never the less take note of the signs on the generating set which show symbols in a triangle indicating danger.

- The generating set should be operated by authorised personnel only.
- Be aware of hot parts and especially parts of the exhaust system.
- If the generating set is unsafe, fit danger notices and disconnect the battery positive (+) lead so that it cannot be started until the condition is corrected.
- Do not attempt to operate the generating set with a known unsafe condition. Disconnect the battery positive (+) lead prior to attempting any repairs or cleaning inside the enclosure.
- Always consult the manual before carrying out maintenance.
- Do not change the settings without consulting the manufacturer. Keep a record of setting changes in this manual.

2.1.6 Fire and explosion

Fuels can be flammable. Proper handling limits the risk of fire and explosion.

- Avoid refilling the fuel tank while the engine is running. When oil or fuel is leaking do not use the generating set.
- Do not run the engine close to explosives or gasses.
- Hydrogen gas generated by charging batteries is explosive. Ensure for proper ventilation. Do not smoke or allow sparks, flames, or other sources of ignition around batteries.
- Keep a fire extinguisher on hand.
- Poor electrical connections or using wiring which is not suited for the rated currents can cause overheating and possibly fire.

2.1.7 Chemicals

- Fuels, oils, coolants, and battery electrolyte can be hazardous to personnel if not treated properly. Do not swallow or have skin contact with these liquids. Do not wear clothing that has been contaminated by fuel or lubricating oil.
- Gaskets may be manufactured from asbestos. Particles of this material should not be inhaled as this may result in fatal diseases.
- On no account allow any unprotected skin to come into contact with the injector spray as the fuel may enter the blood stream with fatal results.
- Engines may be fitted with seals or O-rings manufactured from "viton" or similar material. When exposed to abnormal high temperatures in excess of 750°F (400°C) an extremely corrosive acid is produced which cannot be removed from the skin. If signs of decomposition are evident, or if in doubt, always wear disposable heavy duty gloves.

2.2 TRANSPORT, LIFTING AND STORAGE

When lifting the generating set avoid any risk of personal injuries, do not stand under the generating set.

- Use soft slings to avoid damage.
- Included in the delivery is a lifting eye, only to be used to take the generator out of the capsule. Do not use to lift the set including the capsule and certainly not including the steel foundation plate !
- After transporting the generating set check for damage before installation.
- Long term storage can have detrimental effects on engine and alternator. The engine should be put through an engine preservation procedure. (Refer to the maintenance chapter)
- The alternator windings tend to condense. To minimise condensation, store the generating set in a dry and warm storage area.
- After removing the generating set from long term storage perform an insulation check. (Refer to the alternator maintenance paragraph for procedures)
- While the battery is stored it should be recharge every 12 weeks.

2.3 THE WHISPER 3,5

2.3.1 Features

This generating set includes a diesel engine which is connected by close coupling to an alternator in a sound attenuated capsule. The set is mounted on a steel base frame and mounted securely on anti vibration mounting pads to the capsule base. All cables and hoses are guided through the capsule's left side. The set is not self contained and is only operable after proper installation using additional accessories and installation materials.
Installation accessories are listed in the installation manual and are available through the supplier of the generating set. The full automatic Digital Control is based on microprocessor technology. Several automatic start/stop functions can be programmed and monitored. (refer to Digital Diesel Control users manual)

2.3.2 Remote control

The full automatic remote control panel including 15 mtr cable comes as standard with the Wisper 3,5.

2.3.3 Documentation

Included in the delivery is this users manual (number: 50200307) an installation manual (number: 50200314) and a users manual for DCC (number: 50200261).
Not included in the standard delivery but available as an option are:
- Parts manual; number: 50200180
- Workshop manual; number: 50200170

However in this manual there is a list of important parts for maintenance and spare parts as well as a chapter on maintenance and problem solving.

2.3.4 Accessories included in the standard delivery

- Fuelfilter
- Fuel lift pump
- Lifting eye
- Special hose connector for measuring exhaust backpressure
  (Refer to paragraph 5.4.3)

2.4 COMPONENTS

2.4.1 Main components to identify

1 Air inlet;
2 Starter motor;
3 Battery connection (positive);
4 Battery connection (negative);
5 AC 230 V wiring;
6 AC 230 V output connection box;
7 Fuel filter;
8 Fuel pipe inlet;
9 Fuel pipe return;
10 Bypass hose air vent;
11 Cooling water in;
12 Exhaust manifold (water cooled);
13 Thermo-switch exhaust;
14 Glow plug;
15 Injector;
16 Valve cover;
17 Decompression handle;
18 Oil filler cap;
19 Solenoid fuel valve;
20 Electric fuel lift pump;
21 Cooling water pump;
22 Oil pressure pump;
23 Fuel pressure pump
24 Oil pressure switch;
25 Oil sump pump;
26 Exhaust connection;
27 Fuel return;
28 Oil filler cap/ oil level indicator;
29 Control panel;
30 Capacitor;
31 Fuse 1;
32 Fuse 2;
33 Remote control cable;
34 Stop solenoid;
35 Oilstrainer cover;
36 Start button;
37 Digital Diesel Control unit;
38 RPM set screw;
39 Oil temp switch;
40 Plug screw;
41 Heat exchanger.

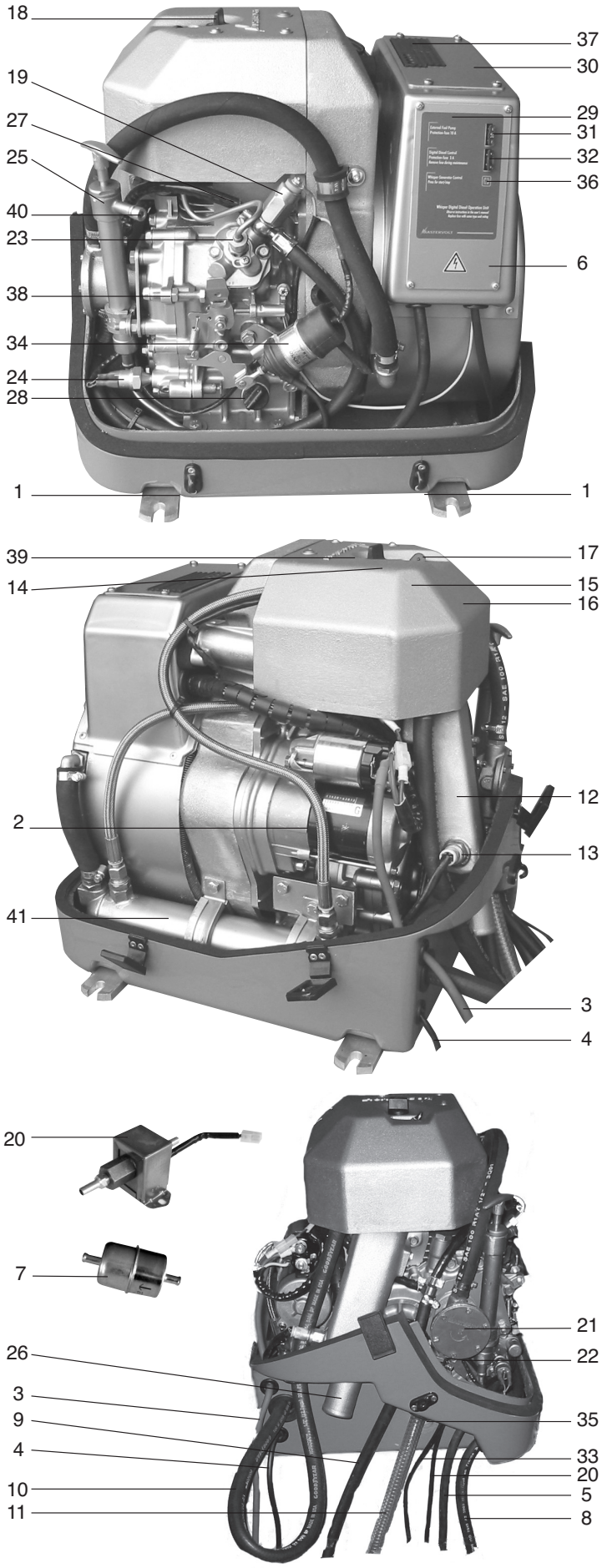


Fig. 2: Overview Whisper 3500.

2.4.2 Generator control panel

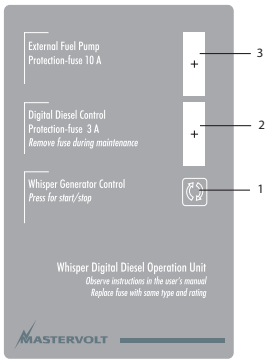


Fig.. 3: Control panel.

1 Start/stop button
2 Fuse;
3 Fuse.

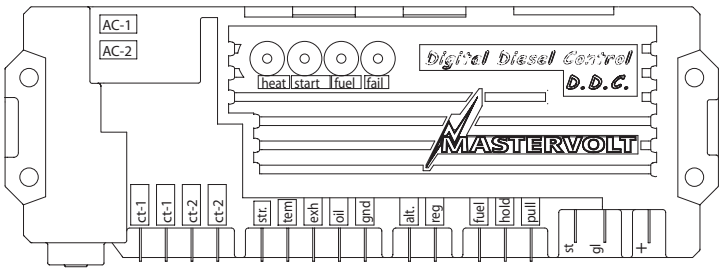


Fig.. 4: Digital Diesel Control unit

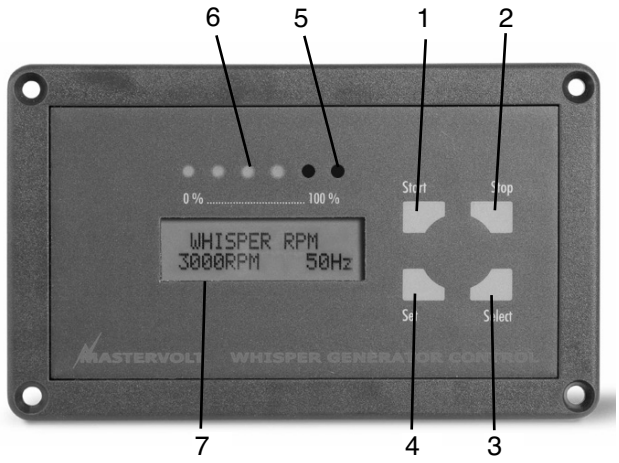


Fig. 5: Digital Diesel remote control panel.

2.4.3 Remote control panel

1 Start button;
2 Stop button;
3 Select button;
4 Set button;
5 Failure lamp;
6 Generator load indicator.
7 Display

2.5 TECHNICAL INFORMATION

2.5.1 AC alternator

The single phase synchronous alternator is directly coupled, one bearing, brushless, rotating field design, two pole (3600 RPM) and self regulating.
Residual magnetism causes a small voltage over the stator windings and allows a current to flow in the windings, which is magnified because of the feed back effect between rotor and stator. The field windings in the rotor are short-circuited over a diode to rectify the current. A capacitor over an additional winding in the stator which is at an angle with the power-winding keeps the voltage stable within 5 % at the specified rpm and provides voltage fall off with speed, preventing over-excitation at low engine speeds and softening the effect of load switching to relieve the burden on the engine.
Further technical data on the design of the alternator can be found in drawings and diagrams in this manual.

2.5.2 Engine

The Whisper 3,5 generating set is based on the Kubota OC60 1 cylinder diesel engine. The engine is indirectly injected. The engine is oil cooled and the oil is cooled by a heat exchanger and raw water. The heat exchanger and all other parts which are in direct contact with the raw (sea) water are made of seawater resistant material like naval brass and gunmetal.
The engine has been specially adapted for the Mastervolt application and is very different from the standard engine supplied for industrial applications!

2.5.3 Digital Diesel Control system

The standard electrical engine control system is 12 Volt negative earth, non earth return is available as optional. Check your identification data to determine which system is applied. The system is designed according to the "energise to run" system. The Digital Diesel Control is a very advanced microprocessor based full automatic system. Besides automatic start the system offers many monitoring options. Refer to the separate Digital Diesel Control users manual.

The microprocessor unit is located on top of the alternator.

2.5.4 Battery charger

There is an extra winding in the alternator generating 6 Amp 12 V. This current is rectified on the control PCB to charge the battery. Both the current and the voltage are regulated.

2.5.5 Alarms and shut down

In case of malfunctioning this will be indicated by the failure light and detail will be shown on the display the engine will be shut down. There are three functions guarded: oil pressure, oil temperature and exhaust temperature.
Exhaust temperature too high indicates the cooling water to be blocked.
All alarm switches are closed when no malfunction occurs. A contact is cut in case of an alarm. This means that the generating set will not work when the alarm switches are broken or there is a loose wire. The system therefore is intrinsically safe. The panel will display details about the alarm.

2.5.6 Control

The generating set can be operated by push buttons on the panel on the alternator or by the remote control. By pushing the start button the control system is activated and will start the engine automaticly. Pushing the STOP button will stop the engine and the electrical system will be deactivated. Stopping the engine is executed by the 'pull' solenoid, at the same time the fuel valve solenoid will shut off.

2.5.7 Remote control

All wiring connections from the remote control to the board are made by plug in connectors.
An intermediate communication cable is in the standard supply. If necessary an optional longer 8 wire twisted cable can be connected if the standard length does not suit the required distance. Numerous remote control units can be put in parallel by using the connectors on the back of the units. (Refer to installation instructions)

2.5.8 Hour counter

The remote control offers several timer functions and helps to schedule maintenance.

2.5.9 Load indicator

On the remote control the load will be indicated on the display and by the LEDbar. The load is measured by a current transformer on the alternator.

2.5.10 Fuel specification

The engine must only be used with diesel fuel oil which conforms to the standards for use in modern diesel engines. Fuel free from water and contaminants is of the utmost importance.

2.5.11 Oil information

1 Specification:
The oil must be suitable for oil changes as specified in the maintenance chapter. The Kubota engine must be run on heavy duty lubricating oil meeting the requirements of API class CC or CD.

It is very important to use the correct oil specification. Very often local oil suppliers recommend a higher class, because they assume that a higher class is allowed. This is not the case. One should not follow these recommendations.
Using the wrong specification will cause high oil consumption.

2 Oil viscosity:
We recommend a multigrade oil 15W40.

3 Oil capacity:
Excluding the oil cooler the content of the crankcase is 1,3 U.S. qts ≈ 1,3 l. Including the oil cooler it is 1,5 U.S. qts ≈1,5 l.
Do not overfill with lubricating oil as this may have a detrimental effect on engine performance and cause damage.

4 Oil pressure
- Minimum at idle 49 Kpa (0,5 kgf/cm2-7psi).
- Normal at 3600 rpm between 147 and 490 Kpa (1,5 up to 5 kgf/cm2- 21 up to 71 psi).
- Minimum at 3600 rpm 98 Kpa (1,0 kgf/cm2/ 14 psi).

2.5.12 Technical data

GENERAL	
Model	WHISPER 3,5
RPM	3600
Alternator	water cooled, synchronous
Engine	Kubota diesel, model OC60 (Japan)
Number of cylinders	1
Displacement	16,84 cubic inches (276 cm3)
Bore X stroke	2,83 x 2,68 inches (72x68 mm)
Combustion air consumption	15 cfm (0.42 m^3/min..) at nominal RPM
Continuous power engine/3600 RPM	DIN627OB 4,6 kW / 3600 RPM
Cooling system	indirect cooling by raw water.
Cooling water pump	pto driven Mastervolt self priming impeller pump, type K
Fuel lift pump engine	electric pump (12 V DC), additional pump available upon request
Starting battery (optional)	55-90 Ah
Fuel consumption	0,18 - 0,37 gph (0.7-1.4 litre/hour), load dependent
Control	Digital Diesel Control including automatic start/stop

ELECTRICAL SPECIFICATIONS	
Output voltage	120V 60 Hz alternating current (AC) single phase
Output rating	3.3 KVA = 3.3 kW at powr factor cos phi = 1
Power factor	1
Voltage tolerance	± 5%
Frequency tolerance	± 5%
Alternator	brushless, two pole, synchronous

MECHANICAL SPECIFICATIONS	
Supply includes	generating set, built into tugged GRP sound shield with steel base frame, mounted on rubber anti vibration mounts
Dimensions wxdxh	19,88 x 15,94 x 19,69 inches(505x400x500 mm)
Colour	top white, bottom green
Weight (dry)	214 lbs (97 kg) including sound shield
Max. installation angle	25 degrees
Standard supplies	Digital Diesel remote panel 45 ft (15 m) cable, fuel liftpump, fuel filter, lifting eye, user manual, installation manual
Optional	installation kits, mobile (vehicle) version, non earth return, spare part kits

2.5.13 Wiring codes and colours

AWG (American Wire Gauge)

	Cable code number	colour	AWG	cross section
battery > starter motor		red	4	16 mm2
starter motor > DCC	1	red	10	6 mm2
starter motor > LCP	13	red	14	2,5 mm2
battery > ground		black	4	16 mm2
ground > LCP ground (GND)	2	black	14	2,5 mm2
DDC > glow plug	3	brown	4	4 mm2
DDC > starter solenoid	4	yellow	14	2,5 mm2
LCP > fuel lift pump +	5	brown	16	1,5 mm2
LCP > fuel lift pump -	15	black	16	1,5 mm2
DDC > LCD	5	grey	16	1,5 mm2
DDC > oil pressure switch	6	purple	17	1 mm2
LCP > oil pressure switch	6	purple/black	17	1 mm2
DDC > oil temperature switch	7	blue	17	1 mm2
LCP > oil temperature switch	7	blue/black	17	1 mm2
DDC > exhaust temperature switch	8	blue/green	17	1 mm2
LCP > exhaust temperature switch	8	blue/rose	17	1 mm2
DCC > fuel valve solenoid	9	green	16	1,5 mm2
DCC > stop solenoid	20	pink	14	2,5 mm2
DCC > current measuring transformer	11	black	17	1 mm2
DCC > current measuring transformer	11	red	17	1 mm2
DCC > LCP	19	orange	16	1,5 mm2
DCC > LCP	12	black	16	1,5 mm2
DCC > LCP	14	red	16	1,5 mm2
DCC > LCP	16	red/green	16	1,5 mm2
DCC > generator AC output	33	brown	17	1 mm2
DCC > generator AC output	33	blue	17	1 mm2
LCP > battery charger winding generator	10	red	17	1 mm2
LCP > battery charger winding generator	10	red	17	1 mm2

DDC=Digital Diesel Control Unit
LCP=Local Control Panel

2.5.14 Lay out control PCB

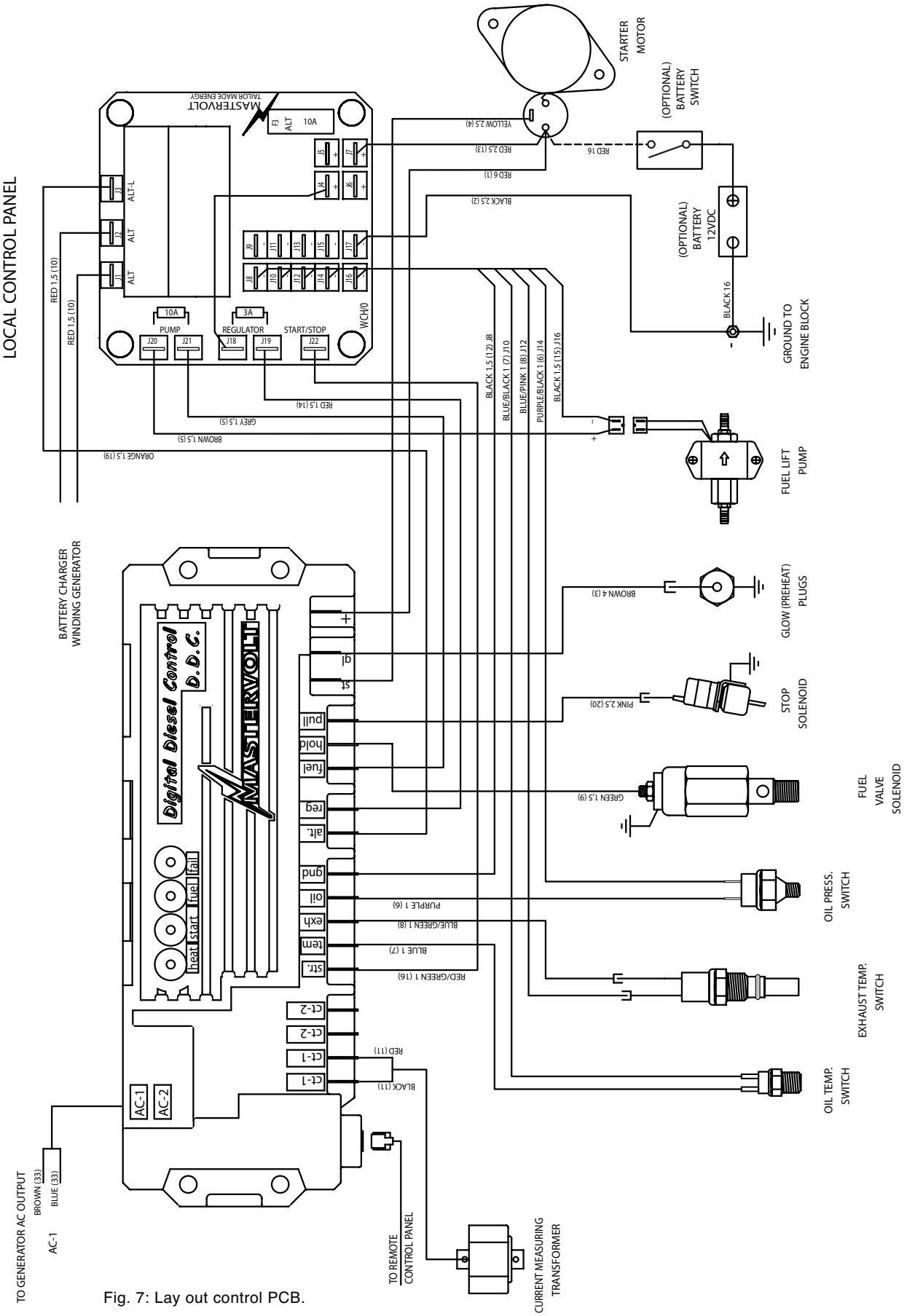


Fig. 7: Lay out control PCB.

2.5.16 Electrical diagram 120V AC 60Hz

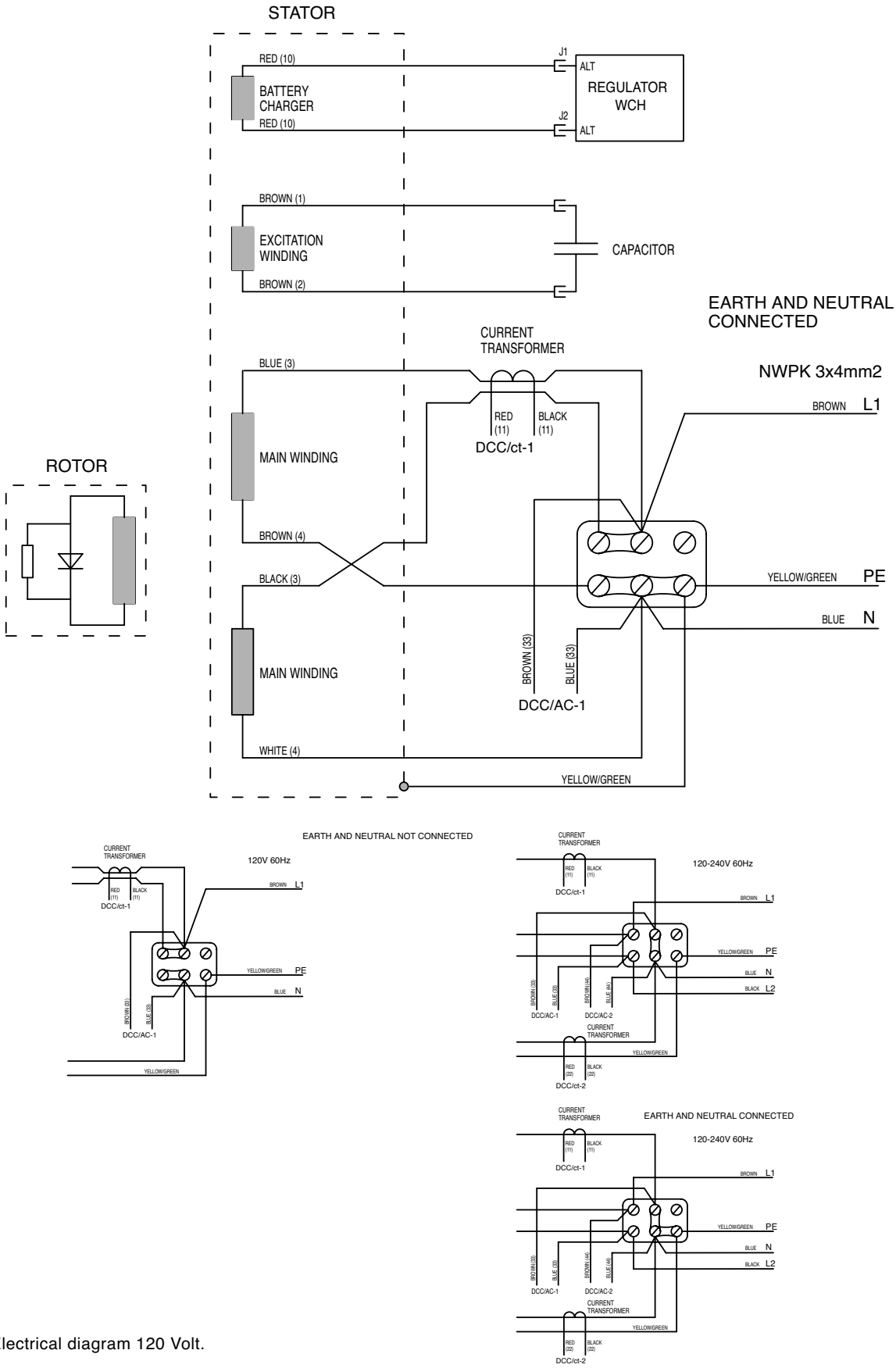
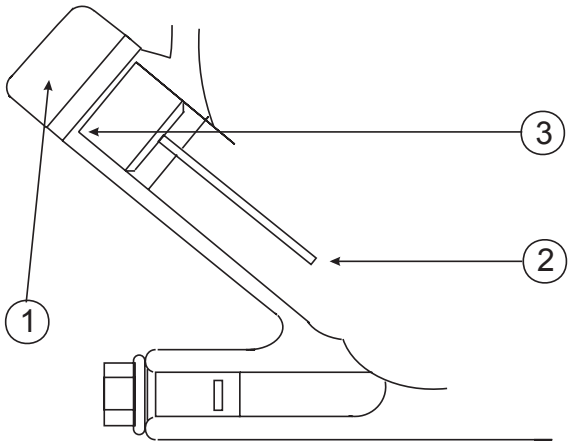


Fig. 8: Electrical diagram 120 Volt.

3 OPERATION

3.1 GENERAL

The generating set is operational after full installation and filling up with: fuel, engine lubricating oil and cooling liquid, filling the starter battery with acid, connecting the battery to earth and connecting the digital remote control panel.



1 Filling cap;
2 Min. oil level;
3 Max. oil level.
Fig. 9.

3.2 OPERATION INSTRUCTIONS

3.2.1 Summarised operating instructions (daily use)

Routine "pre-start" checks:

1 Check oil level (refer to fig. 9).
2 Engine cooling system (all valves open).
3 Power source selector switch (off/shore power/generator power). Switch to power source switch "OFF", or switch off all consumers in the usual way. If a MASTERSWITCH is installed, this operates automatically.
4 Switch on battery switch (when installed).
5 Fuel valve: open.

Starting:

Push the start button to initiate the full automatic starting procedure. You can monitor the procedure on the display.

In operation checks:

1 Check for abnormal noise or vibration
2 Check the voltage
3 Check sea water flow at exhaust outlet
4 Power source selector switch (off/shore power/generator power). Switch to power source generator. If a MASTERSWITCH is installed, this operates automatically.
5 Before loading the generating set up to maximum, have it run warm. Continuous load should be restricted to 70 % of maximum load.

Stopping generator:

1 Switch off all electrical devices (consumers). If the generating set has been running under full load for a longer period, do not shut it down abruptly. Reduce the electrical load to about 30% of the rated load (i.e. 30% of 3 kW is approx. 1000 Watt) and let it run for approx. 5 minutes.
2 Press the STOP button.
3 Close the inlet sea water cock.
4 Switch to an other 120V power source, if available. If a Masterswitch is installed, this is done automatically.

3.2.2 Extended operating instructions

Check when starting the first time or after a longer period of rest:

1 If there is any damage caused by transport or installation.
2 Check if installation conforms with the installation instructions.
3 Ensure the generating set is free to turn without obstruction.
4 Check all hoses and hose connections for leaks.
5 Check all cables and cable end terminal connections.
6 Check the engine and generator mounting bolts.

Routine "pre-start" checks:

1 Check engine oil level.
The generator switches off in case of insufficient oil-pressure. Even when the oil level is too low the oil pressure can be high enough. Do not run the generator with the oil below the lowest mark, because a smaller volume of oil will become contaminated considerably quicker than a larger volume. Therefore we recommend daily oil-checks.
Check oil level prior to starting the engine, or at least 5 minutes after the engine has stopped.

2 Check sea water cocks. Do not forget the valve of the water outlet in case of a water/exhaust gas separator.
3 Check the water strainer.
4 Check for leaks.
5 Regularly check the siphon vent in the cooling water supply.
6 If no MASTERSWITCH is used: Switch main Power Source Selector switch to "OFF" or switch off all devices.
7 Switch on the battery switch.

Starting the generator:

By pushing the start button briefly the electric system is activated, the fuel lift pump starts pumping and the starting procedure will begin. (By pushing the stop button the system is deactivated)

The Whisper 3,5 can even be started with an almost discharged battery using the cylinder compression release handle. The engine can then be rotated easily ("turned over") as the valves are opened i.e. in the decompression position.
You can also use the decompression handle to readjust the valve clearance and to fill the cooling system with anti freeze for conservation in winter time.

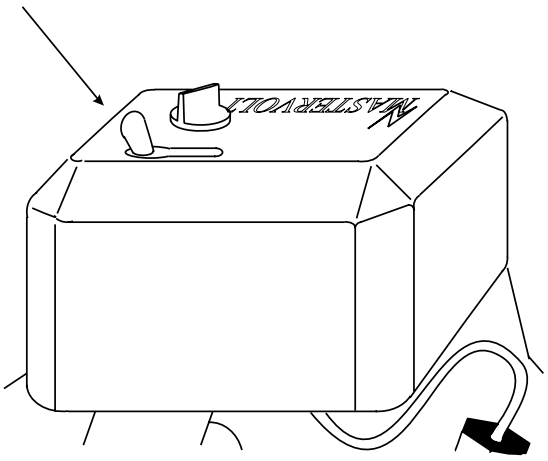


Fig. 10: Decompression handle.

A restart protection prevents trying to start the engine when it is already running, which could cause damage.

In the event of starting problems (numerous attempts are made), close the seawater inlet cock while cranking to prevent the outlet system and engine to fill up with water.

During the starting process, the cooling water pump is driven with the engine. The cooling water is discharged to the exhaust outlet, because the engine does not run, the exhaust pressure is not high enough to expel this water.
Open the valve directly when the engine starts to prevent damaging the impeller.
Water in the cylinder will cause serious damage to the engine. For instance; a bent piston rod or a cracked cylinder head. In fact water in the cylinder is the main cause for engine damage in pleasure craft.

Checks once the generator is in operation:
1 Check for abnormal noise or vibration.
2 Check the voltage.
3 Check coolant flow.
Always check immediately after starting the generator if cooling water flows at the exhaust outlet. If this is not the case, check the cooling water pump. After having become acquainted with the generator you will be able to recognise the coolant flowing through the system by listening for the noise of the water which is expelled.

Be aware that especially in harbours the coolant water inlet can easily be blocked by floating objects.

4 Power source selector switch (off/shore power/generator power). Switch to power source generator. If a MASTERSWITCH is installed, this operates automatically.
Before loading the generating set up to maximum, have it run warm. The first 50 hours of running the continuous load should be restricted to 70 % of maximum load. Running for long periods at no load or light load in the first 50 hours can cause cylinder glazing and high oil consumption.

Engine load during longer operation:
Please ensure that the generating set is not overloaded. Overloading occurs when the electrical load (demand) is so high that the generator cannot be turned around properly by the diesel engine. Overloading causes the engine to run rough, while using oil and excessive fuel and producing soot by the exhaust. The engine can even stop.
The generator should therefore only be loaded at the maximum rated power for short periods (2-3 hours) only!
The high peak current is meant for the ability to start

electrical devices, that need a high current for starting especially electric motors and compressors (from a still stand state).
In order to prolong the generating set's life expectancy, the nominal electrical demand on the system should be about 70% or the rated generating set's maximum load. Please note this when switching on your electrical devices!
Nevertheless, the Whisper 3,5 is designed so as not to overheat, even under extreme conditions.

Do not run the generator for very long periods at no load or at very low load. When this is necessary do load the generator at least one hour in 10 hours for minimum 70%. Long term running at too low load will cause the exhaust to be choked by carbon.

Never remove the battery while the engine is running, or any electrical cable while the battery is connected in the circuit. Only disconnect the battery with the engine stopped and all switches in "OFF" position.

Stopping the generating set:

1 Avoid stopping of the generator abruptly after a long period of operation at high load! Doing so, you avoid unnecessary thermal load to your generating set!
Act as follows:
Prior to switching off the generating set, decrease the generator load (i.e. turn off most electrical users) and let the generator run at low load for approx. 5 minutes to allow the engine to get properly cool (the influent sea water must flow through the system in order to cool the engine).
If the generator is operating in a hot environment and you do not act as given above, the excessive heat in the engine can trip the "high temp" alarms. In that case, a restart of the engine is not possible for some time. It is also recommended to switch off electrical users prior to stopping the generator because of the voltage drop that occurs as the engine comes to a halt. Such voltage drops may cause damage to electric motors, compressors (in refrigerators or air conditioners etc.).

2 Press the STOP button.

3 Close the inlet sea water cock.

4 Switch to an other 120V power source, if available. If a Masterswitch is installed, this is done automatically.

If the engine is not running and 'failure' and 'charging' LED is blinking, reset by stop button, otherwise it will drain the start battery.

4 MAINTENANCE

4.1 ALTERNATOR

The alternator does not require any maintenance. Periodic inspection and cleaning is recommended, depending on environmental conditions.
However when the alternator has been idle for a long period attention to winding condition is recommended.
The condition of windings can be assessed by measurement of insulation resistance to earth.
The CAPACITOR should be disconnected during this test. A 500V 'Megger' or similar instrument should be used. The insulation resistance to earth of all windings should be in excess of 1.0 MOhm. Should the insulation resistance be less than this value, drying out the generator windings is essential. Drying out can be carried out by direct warm air from a fan heater or similar apparatus into the generator air inlets or outlets.
All bearings are greased for life and not regreasable.

4.2 ENGINE

4.2.1 Preliminary instructions

All regular maintenance can be executed when the enclosure is open. For repairs we recommend to take out the generating set to a workshop. The enclosure can be completely removed by taking out the bolts form the aluminium bars below the bottom of the capsule.
When oil and dirt have gathered in the enclosure measures have to be taken to avoid spilling oil and polluting the environment.

The first service on the engine should be carried out after 25 hours of its life. This also applies after a major overhaul. In the first 25 hours the engine should receive special attention:
Long periods of light or no load running in the first 25 hours may lead to cylinder glazing and high oil consumption.

For the same reason it is of the greatest importance to use the right oil specification.

The first time starting up or after running out of fuel it could be necessary to prime the fuel system.

4.2.2 Bleeding fuel lines

Ensure there is sufficient fuel. The system is self bleeding. The first time starting up or after running out of fuel it could be necessary to prime the fuel system. Push the start button activating the electric system and activating the fuelpump. When more time is needed to bleed, push "start" and hold on the local control panel (so not on the remote panel) Hold as long as necessary to bleed the system. Retighten the bleed screw when no further air bubbles are expelled.

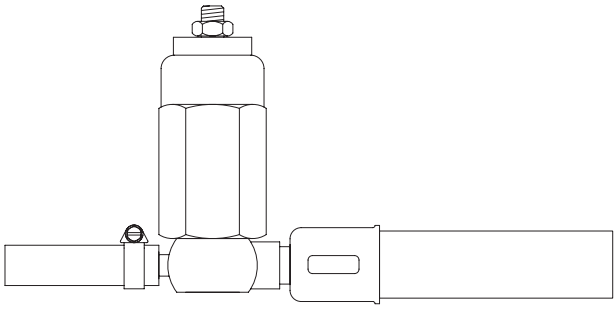


Fig. 11: Self bleeding fuel lines.

4.2.3 Valve clearance

Tightening torques, refer to § 5.4.2.
When the engine is in cold condition both valves should have a clearance between 0,0055 and 0,007 inches (0.14 and 0.18 mm). The adjustment has to be done at T.D.C. of the compression stroke. Using a pocket light one can check the position of the flywheel (refer to picture 12). By using the decompression handle one can crank the engine easily with a screwdriver to put the marks in line. Confirm that the valves do not move up or down when the crankshaft is turned about 20 degrees in normal and reverse direction of rotation. If the rocker arms move the piston is on the T.D.C. of the intake or exhauststroke. In such a case turn the crankshaft 360° in the direction of engine rotation again. The piston is now at T.D.C. of the compression stroke. After readjustment one should crank the engine for 20 rotations and check the valves again.

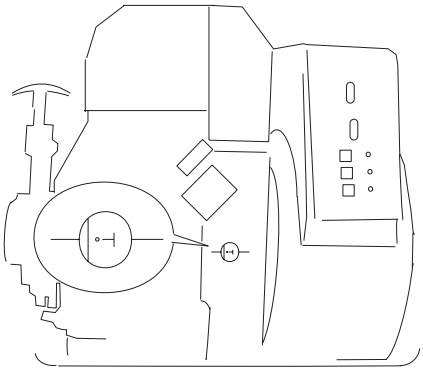


Fig. 12: Valve clearance.

4.2.4 Replacing fuel filter

Filter change depends on contamination of the fuel, but should be done however, at least every 300 running hours. Before changing the filter, clamp off the supply line. Remove the hoses from filter and attach them on the new filter again. The arrow on the filter housing indicates the direction of the flow. A clogged filter results in a lack of output of the generating set.

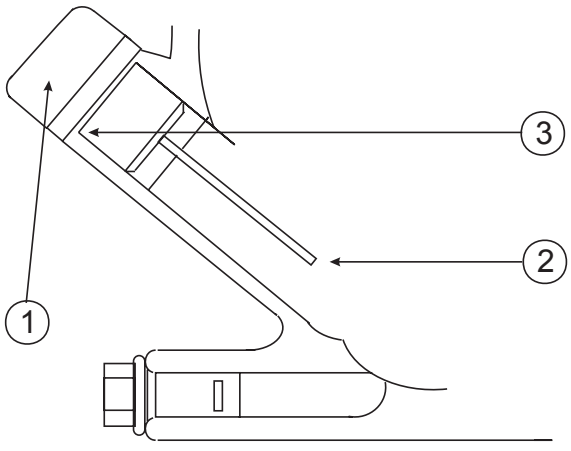
4.2.5 Cleaning oil strainer

The oil strainer is behind a plug on the bottom of the engine. In the strainer is a magnet to catch the metal parts which are in the lubricating oil. Once per 1000 hours or when the oil is contaminated one can clean the strainer by washing it with petrol or a solvent. A green rubber plug in the capsule gives access to the strainer. Before taking out the plug one should sump the oil. Use tissues to avoid spilling oil in the capsule.

4.3 REGULAR MAINTENANCE

CHECK DAILY:

- Oil level (see fig. 13)
  Take care the oil level is never below the mark.
- Hoses for loose connections or deterioration.
- Water inlet filter.



1 Filling cap;
2 Min. oil level;
3 Max. oil level.

Fig. 13.

AFTER FIRST 25 HOURS:

- Change oil.
  Have the engine run until it is on temperature and stop it. Drain oil by the sump pump into a suitable retainer and fill up with fresh oil. Start the engine again and have it run for 5 minutes. Stop the engine again and pause for a few minutes to let the oil gather in the crankcase. Check the level again and add oil when necessary.
- Check and tighten nuts, bolts, and unions, paying particular attention to the fuel system.
- Check the valve clearance.
- Observe the exhaust at the normal full load. The exhaust must be free from soot. Do not allow the engine to run with a dirty exhaust without investigating the cause as this may result in an expensive breakdown.
- Check the air vent on a regular basis.
  When the air vent is not working properly the engine can fill up with water by siphoning. Water in the combustion chamber causes serious damage to the engine.

EVERY 100 HOURS:

- Change oil.
- Check the battery acid level.
- Check battery terminals for corrosion
- Check impeller raw water pump (durability depends on the purity of the sea water. In sandy water and warm water wear will increase). When replacing the impeller the gasket between the pump case and the cover should be replaced as well. So when ordering a spare impeller order a gasket as well. (50209011 impellor + gasket)
  Remove the cover to get access to the impeller. Remove the old impeller with the help of two screwdrivers. Install the new impeller and add some grease. Turn the blades in the direction of rotation of the pump i.e. anti clockwise looking at the impeller.

EVERY 300 HOURS:

- Replace the impeller of the raw water pump.
- Check valve clearance.
- replace the fuel filter

EVERY 1000 HOURS:

- Clean the oil strainer.

EVERY 2000 HOURS:

- Check lubricating oil pressure
- Clean and check or replace fuel injector nozzles and check injection pressure.
- Check the air filter element:
  The air is taken in via the cover on the alternator. Below this cover is a spongy material which filters the air and holds some electrical components which are cooled by the inlet air. This filter does not require regular maintenance. Only in very dusty circumstances this filter should be cleaned. The spongy material can be washed in solvent or replaced.
- Check the cooling system:
  The engine oil is indirectly cooled by raw water via an oil cooler/ heat exchanger. The alternator is cooled by seawater which is pumped by the PTO driven impeller pump through the cooler elements in the generator housing.
  All parts of the cooling system are of corrosion free and seawater resistant materials such as brass and gunmetal. In case of gathering of dirt in the system it could be cleaned by compressed air. When overhauling the engine one could clean the parts thoroughly or replace.

When the generator set runs less than 100 hours a year the oil should be changed yearly.

4.3.1 Maintenance schedule

Check oil level	daily
Check water strainer	daily
Change oil	100 hours
Check air vent	100 hours
Check impeller water pump	100 hours
Check valve clearance	300 hours
Replace impeller waterpump	300 hours
Replace fuel filter	300 hours
Clean the oil strainer	1000 hours
Check injector and injection pressure	2000 hours
Check inlet air filter	2000 hours

4.3.2 Putting out of service

When not using the generating set for a longer period it is recommended to execute an engine preservation procedure.

1 Clean the engine.

2 Loosen the fuel suction pipe and fuel return and put them in a can with preservation diesel fuel. Start the engine and run the engine warm.

3 Drain the hot engine oil and refill with preservation oil.

4 Stop the engine and loosen the inlet of the raw water pump. Drain the water from the water lock. Lift the valves by the decompression handle to avoid the engine from starting and crank the engine having the raw water inlet sucking anti freeze from a can until the pump, heat exchanger and manifold are full.

5 Disconnect the battery and stove it in a place free of frost and dry and charge it regularly.

6 Close inlet- and outlet openings with tape.

7 Protect the generating set against the influences of bad weather conditions.

This method of preservation will be sufficient for 6 months. Repeat steps 2, 3, and 4, every 6 months. Change oil before using the engine again.

5 TROUBLE SHOOTING

5.1 ALTERNATOR/ ELECTRICAL FAULTS

Beware of parts which are live!

Remove 3 Amp. fuse in the control panel while working on the generator to prevent the engine to start.

5.1.1 General

If any problem should occur check basic conditions and examine all external wiring, switch gear and circuit breakers. Also check if measuring instruments give the correct value.

If in doubt measure directly on the alternator terminals with an independent instrument.

This should only be carried out by an experienced electrician.

Check if the engine is running correctly at 3600 (60 Hz) RPM according to its settings and does as well under load. A RPM drop of 5% at full load is acceptable. Therefore a no load setting should be at 3750 RPM = 62.5 Hz. Under no circumstances should the RPM under full load be below 3540 = 59 Hz.

When the problem is in the RPM refer to the engine fault finding paragraph.

Digital Diesel Control systemwill help to indicate failures and display causes.

5.1.2 Trouble shooting table

PROBLEM	CAUSE	SOLUTION
No output (Voltage) at all.	• Circuit breaker "off" or faulty fuse	Check switches and fuses and measure directly on the alternator to exclude external causes.
	• Low engine RPM.	Check the engine RPM and adjust (refer to special procedures).
	• Loss of residual magnetism.	Check the residual magnetism and flash the alternator (refer to special procedures).
	• Capacitor loose or broken.	Check by independent excitation if the problem is in the capacitor or in the windings.
	• Rotor diodes broken.	Check the diodes in the rotor (refer to special procedures) The Whisper 3,5 has two diodes in the rotor. It happens very rarely that both are broken. When only one diode is broken the voltage will be low but will not varnish completely.
Generator output voltage too low when no load is on it (less than 105V).	• No load at all or very low load.	Switch on a load and check voltage.
	• Engine is not reaching the rated RPM.	Refer to special procedures to readjust RPM.
	• Defective capacitor.	Check capacitor and replace if necessary (refer to special procedures).
	• Defective diode (one of the two)	Check the diodes in the rotor and replace (refer to special procedures).
Generator output voltage too low under load (less than 105V). In no load condition it is ok.	• Generator is overloaded.	Switch off a load; (part off) consumers.
	• Engine is not reaching the rated RPM.	Refer to engine RPM problems.
	• Defective capacitor.	Check capacitor and replace if necessary (refer to special procedures).
Generator voltage too high, (more than 130V).	• Engine is running too fast (RPM too high).	Check engine speed and adjust (refer to special procedures).
	• Over-energising due to defective capacitors.	Check capacitor specification and replace if necessary.
	• Presence of a strong capacative load (leading power factor).	Compensate for this capacity and seek for experts advice.
Generator voltage fluctuates.	• Disturbances on the electrical system/ user side.	Check if electrical load is fluctuating.
	• Engine runs irregularly.	When engine runs irregularly refer to section: "Engine runs irregularly".

Generator is not able to start an electric motor.	If the generator is unable to supply enough power to start an AC electric motor, this is usually because this motor draws too much current during starting.	Check the electric motor's current draw required for starting. This should not exceed the rated generator peak output current. This could be remedied by providing stronger capacitors to the motor or using a "soft-start". Inquire at your nearest Mastervolt dealer or directly at the manufacturer, Mastervolt in the Netherlands.

5.2 ENGINE FAULTS

Remove 3 Amp. fuse in the control panel while working on the generator to prevent the engine to start.

5.2.1 General

Most electrical problems relating to Voltage or Frequency are due to wrong engine speed.
Note that RPM and Hz are basically the same.
Use the problem solving table to find the cause. When there is no obvious cause one can adjust the RPM (refer to special procedures).

When the engine is not cranking well, starting problems almost always originate from battery problems or poor battery cable connections.
When the engine is cranking, well starting problems almost always originate from lack of fuel or air bubbles in the fuel pipes.

When the engine does not start instantly, prolonged cranking can fill up the exhaust system with cooling water because of the water injected exhaust. When the water enters the cylinder through the valves this will bring severe damage to the engine. When the engine does not start and repeated cranking is necessary shut off the seawater inlet. Open the valve immediately after the engine has started.

A failure code is displayed whe a hardware faillure at the generator is detected.

failure code	**problem**
Communication	Communication error between the panel end the generator
Low start bat	Starter battery voltage too low
Alternator	No output battery charging voltage
Exhaust temp	Exhaust temperature is too high
Water temp	Coolant temperature is too high
Oil pressure	Oil pressure failure
Low voltage	Generator AC output voltage is too low
High current	generator is in overload
Frequency	output frequency of the generator is too low

5.2.2 Trouble shooting check list engine

PROBLEM	**CAUSE**	**SOLUTION**
Diesel engine fails to crank, the starter makes clicking noises, or the engine cranks very slowly.	Almost certainly this is an electrical problem or the engine is locked by water in the cylinder or there is other severe damage. Display will indicate "low battery voltage"	Check on water in the cylinder and further damage by cranking while lifting the valves with the decompression handle. When there is water in the cylinder, then deactivate the control system, disconnect the battery, remove the glow plug. Crank the engine to remove the water through the opening of the glow plug. Check oil on the presence of water and change oil. Find out how the water entered the cylinder (check the air vent). Take precautions to prevent it from happening again. When there is no mechanical malfunction the problem must be an electric malfunction.
	• Starter battery switched "OF".	Check position of the battery switch and switch "ON".
	• Starter battery voltage insufficient (battery too weak).	Check battery voltage. Recharge the battery. Inspect battery terminals and cables for a good electrical connection (inspect against corrosion, tattered wires, etc.)
	• Faulty fuse on control panel.	Replace fuse.

PROBLEM	CAUSE	SOLUTION
	• Wiring control system faulty.	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 too deep.
	• Starter broken.	Repair the starter motor.
	• To thick engine lubricating oil.	Change oil for a lower viscosity.
Starter is turning engine smoothly, but engine fails to start.	• Out of fuel or faulty fuel, water in the fuel.	Fill up with fuel or replace with better quality.
	• Fuel inlet solenoid valve is not opening.	Check wire connections and circuitry to solenoid valve. (Refer to DC wiring diagram).
	• Fuel lift pump is not working. • Fuel filter is blocked. • Air in fuel lines.	Check fuel filter and fuel lift pump: clean or replace if necessary. Bleed air from fuel system (refer to maintenance section).
	• Wrong valve clearance.	Adjust valve clearance.
	• Low compression because of dirty valves.	Clean valves. Take off the injection bent and inspect the outlet port. When little rust is in the port one can clean the valve by taking of the valve spring and rotate the valve. When the outlet port is strongly affected by rust, the exhaust system is not properly installed. Water has entered the exhaust port or backpressure is too high. (refer to paragraph 5.4.3) Contact Mastervolt service department for advice.
	• Blocked injector.	Have the injector tested and cleaned if necessary.
Engine runs irregularly.	• Unsuitable contaminated fuel • Lack of fuel.	Fill up with fuel or replace by better quality.
	• Choked fuel filter.	Check fuel filter and fuel lift pump: clean or replace if necessary.
	• Faulty fuel lift pump.	Check and repair.
	• Choked air filter. • Lack of air.	Check the air intake.
	• Choked exhaust system, exhaust blocked, rubber exhaust hose kinked.	Check the exhaust hose.
	• Air in the fuel pipes.	Bleed air from fuel system (refer to maintenance section).
	• Blocked injector.	Have the injector tested and cleaned if necessary.
	• Wrong valve clearance.	Adjust valve clearance.
	• Temporarily hunting (this will disappear when engine has run in).	
Engine speed drops.	• Too much oil.	Drain oil to proper level.
	• Lack of fuel.	Check fuel supply system: fuel pump and filter.
	• Lack of intake air.	Check air intake.
	• Choked exhaust system, exhaust blocked, rubber exhaust hose kinked.	Check exhaust system.
	• Generator overloaded by over-energising.	Reduce the electrical load (switch off some consumers).
	• Generator over energised.	Check that the proper capacitor type is installed and that it is connected correctly.
	• Defective generator (windings, bearings, or other).	Generator must be sent to manufacturer for repair of damaged bearing or winding.
	• Damaged engine.	Repair by Mastervolt service.

PROBLEM	CAUSE	SOLUTION
Engine does not stop on command.	• Fuel inlet solenoid valve is not switching off. • Loss of control	Faulty Digital Diesel Unit on stop solenoid Stop the engine manually by the stop handle. Check wire connections to solenoid. Check valve function. Replace if necessary.
Engine exhaust smokes	• Faint blue smoke - generally the result of light load	Increase load.
	• Heavy blue smoke - caused by lubricating oil: Overfull oil sump or worn cylinder bore, stuck broken or worn rings.	Check the oil level. Check the compression.
	• Black smoke - incomplete combustion caused by: Overload, choked air filter, inlet temperature too high, unsuitable fuel or water in fuel.	Check the fuel . Check for overload.
Engine starts, but stops after 10 to 30 seconds	Display will help to identify failure • Protection system stops the engine; this can be caused by oil pressure failure, lack of coolingwater (exhaust temperature alarm) Loose wire or faulty alarm switch.	Refer to paragraph 2.5.5. and 3.2.2 for information on the alarmsystem. Bypassing the switches can help to identify the failure.
Engine stops by itself.	Display will help to identify failure • Overload or short circuit. • Lack of fuel.	Switch off the consumers and test for short circuit. Check fuel supply system: fuel lines, pump, filter, valves, tank level, etc.
	• Oil pressure low.(oil pressure switch tripped).	Check oil level. Check engine's oil pressure and have it repaired by Mastervolt.
	• Excess heat in cooling system (thermo-switch tripped). • Lack of cooling water (exhaust switch tripped). • Impeller broken. • Cooling water blocked. • Water strainer blocked. • Air or water in the fuel. • Blocked air or fuel filter.	Check cooling water system flow: water pump, inlet water filter, coolant flow.
	• Loss of compression by wear out or damage.	Repair by Mastervolt service.
Sooty, black exhaust.	• Generator is being overloaded. Digital Diesel Control will indicate "overload"	Check electrical load and switch off some consumers.
	• Insufficient intake air. • Choked air filter.	Check intake air paths and filter, clean and replace if necessary.
	• Fuel injector faulty.	Replace injector.
	• Valve clearance incorrect.	Readjust valve clearance.
	• Poor fuel quality.	Use better quality diesel.
	• Poor quality lubricating oil.	Use better quality oil.
	• Continuous running with very low load.	Increase load and have the engine run for a few hours.
Loss of power.	• Wrong measurement. Check if the load is measured correctly. Does the Amp meter show the correct value? When calculating the load by multiplying voltage and amps this should be done by using the exact values, taking into account the power factor of the consumers. When any doubt measure the power directly with an appropriate instrument.	
	• Overfull oil sump.	Bring the oil to the correct level.
	• Choked fuel filter.	Replace the fuel filter.
	• Choked air filter	Check air inlet openings; clean air filter.
	• Exhaust blocked.	Check the exhaust system.

	. Injector blocked.	Have the injector checked.
	. Loss of compression, sticking. damaged piston ring.	Have the compression measured. Clean or replace the rings.
	. Wear out of cylinder.	Have the compression measured and have the engine overhauled.
Over-temperature.	• Overload.	Take away the overload.
	• Low oil level.	Fill up with oil.
	• Water inlet system blocked.	Check the cooling system thoroughly.
	• Broken impeller.	
	• Water strainer choked.	
	• Heat exchanger choked.	
Engine stops very slowly	• Engine should stop within 3 seconds after pushing stopping button	When it takes more than 5 seconds the fuel solenoid could be faulty: engine is stopped by shut down fuel valve.

5.2.3 Warning

Generator must be shut off immediately if:

- Motor RPM suddenly rises or drops.
- Unusual noise comes from generating set.
- Exhaust gases suddenly colour dark.
- Engine failure warning light is on

5.2.4 Service address

If you cannot correct a problem with the aid of the malfunction table, contact your Mastervolt Service Centre or Mastervolt Amsterdam for an extended service list, tel: INT +31-20-3422100 www.mastervolt.com.

5.3 SPECIAL PROCEDURES ALTERNATOR

5.3.1 Residual voltage check / excitation procedure

When residual magnetism disappears there is no residual voltage. Residual magnetism can disappear after the generating set has been out of service for a long time or suffered a short circuit. This can be solved by charging the capacitor ("flashing") independently by a small 9 Volt battery. This can be done while the engine is stationary and the wiring is connected.

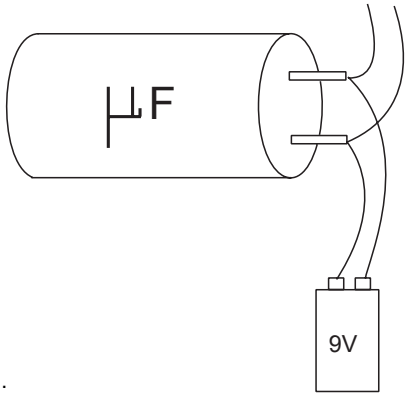


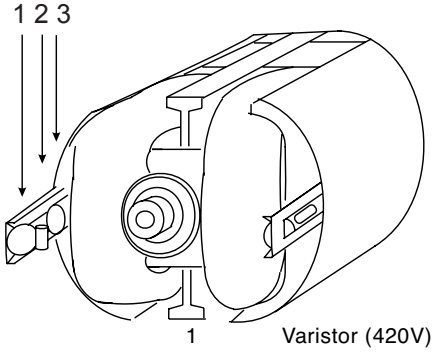
Fig. 14.

If the starter battery is used for flashing one must take care. A short circuit can cause heavy sparking, fire and injuries.

When flashing does not bring back voltage, the capacitor(s) should be renewed. When this does not help, the rotating rectifier diodes should be tested and a winding resistant test should be executed.

5.3.2 Testing rotary rectifier diodes

The diodes in the rotor can be checked with a multimeter. When both diodes are faulty the alternator will not generate any voltage. When only one diode is faulty the alternator will generate about half the normal voltage.
The flexible lead connected to the diode should be disconnected at the terminal end, and the forward and reverse resistance checked. A healthy diode will indicate a very high resistance (infinity) in the reverse direction, and a low resistance in the forward direction. A faulty diode will give a full deflection reading in both directions with the test meter on the 10,000 ohms scale, or an infinity reading in both directions. The problem can also be in a faulty surge suppressor (which is a metal-oxide varistor connected across the diodes) or the ESD capacitor. Replace the diodes, the suppressors and the capacitors.



1 Varistor (420V);
2 EMC capacitors (4,7nF - 630V);
3 Diodes (25A - 1200V).

Fig. 15.

5.3.3 Winding resistant values

If after establishing and correcting any fault on the capacitor and diodes output is still low when separately excited, then the main rotor, stator and exciter stator winding resistance should be checked as the fault must be in one of these windings. The respective leads must be disconnected before taking the readings.
Resistance values should be within 10% of the values given in the table below:

Resistance	60Hz
• Resistance both main stator windings in series	0.71 Ohm
• Resistance both rotor windings	2.1 Ohm
• Resistance battery charger winding	0.13 Ohm
• Resistance exciter stator winding	2 Ohm

5.3.4 Meggering

One can try to measure resistance between the housing and the windings by a multimeter which should read infinity.
When readings indicate infinity but a fault is suspected one can do a high voltage resistance test (MEGGERING) This procedure should be carried out by an expert

5.4 SPECIAL PROCEDURES ENGINE

5.4.1 Setting the RPM

RPM is set by the manufacturer and should not need readjustment! However a very slight offset after running in could occur. RPM can be measured by a frequency meter. Before readjustment check any other explanation for the wrong speed. Engine speed is set at the factory at nominal 3600 (60 Hz) RPM. A RPM drop of 5% at full load is acceptable. Therefore a no load setting should be at ± 3750 RPM = 62.5 Hz. Under no circumstances should the RPM under full load be below 3540 RPM = 59 Hz. When no cause can be found for a wrong speed, the setting can be adjusted:

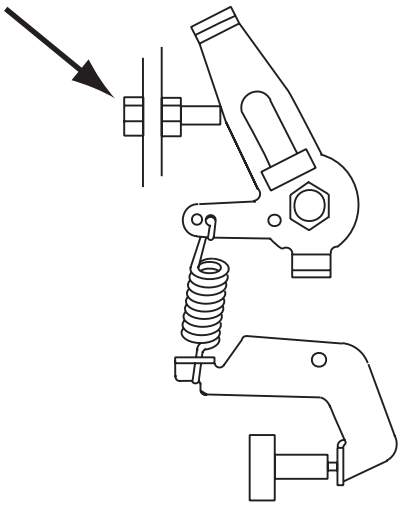


Fig. 16: Setting assembly.

It is very important to identify the correct setting assembly (refer to fig. 16).
The screw is to be locked in position with the lock-nut.

5.4.2 Tightening torques

Valve clearance Refer to Maintenance, §4.2.3.
Cylinder head screws M10x1.5 51.9 to 56.8 Nm; 5.3 to 5.8 kgf-m; 38.3 to 42.0 ft-lbs.
Rocker arm bracket mounting M8x1.25 23.5 to 27.4 Nm; 2.4 to 2.8 kgf-m; 17.4 to 20.3 ft-lbs.

5.4.3 measuring exhaust backpressure

The exhaust system must be of adequate size -
1 5/8"/ 40 mm no more-no less - and maximal length (refer to installation manual). This is true for all generators, but specially for the Whisper 3,5, because this small engine has a small gasflow that easily can be blocked by a water trap in the exhaust system. When any doubt; backpressure has to be measured. An easy way to measure for back-pressure is to use a water column.

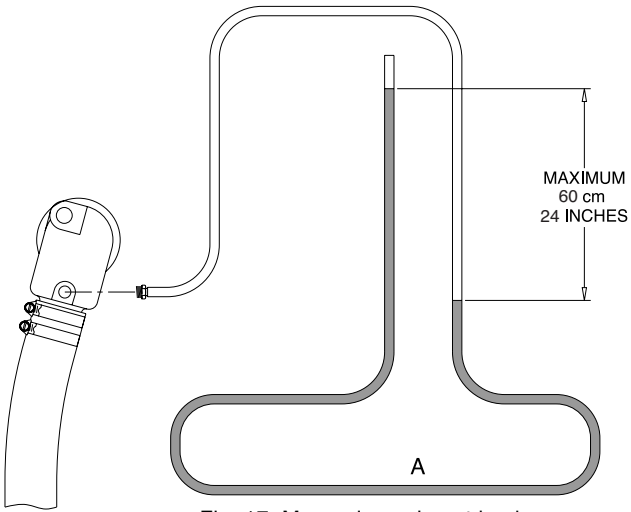


Fig. 17: Measuring exhaust backpressure

A water column can be made visible in a plastic tube along a yardstick and fitting the end to a hose connection to fit in the adaptor on the injection bent after removing the exhaust temperature switch.
The bent A hanging down should not be to short helping to damp the pulsating effect of the gas discharge, that is characteristic for a one cylinder engine. The water column should be no more than 24 inches (60 cm.) of water (0,87 PSI - 0,06 bar)

5.4.4 Disassembling instructions

It could be necessary for repair or checks to disassemble the generating set. One can take off the white cover easily for regular maintenance and inspection. For further repair or inspection one can take off the upper green part as well.
Following instructions will help:

1 When the generating set has to be taken out of its enclosure we strongly advise not to do this in a narrow space on a boat, but to take out the complete set and take it to a workshop.

2 To take out the generator all connections have to be taken off. The outgoing hose on the oil cooler is most difficult to get to, but can be reached from above by taking off the cover which is on the cylinder head of the engine. By taking out 4 screws from the aluminium bars the generating set will come loose from the capsule.

3 The easiest way to get the generator out of its capsule is by lifting the set using the lifting eye and removing the capsule downwards.

4 The cooler elements are welded to the alternator housing with silver and cannot be disassembled. However one can take off the complete alternator housing.

5 Before the alternator can be taken off one has to take out the fitting to the oil cooler to be able to take off the aluminium housing. All cables and wiring have to be loosened first.

6 The rotor can be taken off by removing the bolt which goes through the shaft (normal clockwise threaded). The end of the shaft is specially threaded to press off the rotor from the conic stub shaft, which is on the flywheel, using a 0,25 inches (6-mm) rod of 6,5 inches (165-mm) length and a M10 bolt.

7 Reassembling the generating set one should take care of alignment, cleaning the surfaces between engine and alternator and tighten the bolds crosswise and gradually.

8 Use Loctite 577 to seal the fittings, which should first be cleaned and made free of oil and grease.
Test the generating set first outside its capsule and check very carefully for leakages before putting it back in its enclosure.

6 SPARE PARTS LIST

A parts manual in English is available as an option number: 05-02-00180(***).
A work shop manual in English is available as an option number: 05-02-00170(***).

We recommend the following spares for service and maintenance.

- Kit A: parts for regular maintenance parts marked(*) article no 50201260
- Kit B: parts for maintenance + spare parts: all parts marked (*)+(**) article no 50201261
- Kit C: parts for "world travellers" all parts marked (*)+(**)+(***) article no 50201262

ARTICLE NO	DESCRIPTION
50209030	Fuel filter (*)
50201031	Fuel lift pump (**)
50201051	Fuel valve solenoid (**)
50221609	Banjo eye fuel valve (**)
50201034	Copper washer connection bolt, M10 x 16 (**)
50201035	Copper washer, M12 x 18 (**)
50202048	Stop solenoid
50201250	Raw water pump complete Mastervolt type K (***) (refer to fig. 17)
50209011	Impeller + gasket (3,4,5) (*)
50201012	Cover type K (**) (2)
50209018	Bolts cover (**) (1)
50201251	Pump repair kit A consisting of: - Shaft (13) - Bearings (2 pcs.) (10) - O-ring (9) - Seals (2 pcs.) (8) - Clips (1 set) (11, 12)
50209010	Pump repair kit B (**)(same as repair kit A excluding the shaft)
50201220	Oil cooler complete with appendages (***)
50201225	Oil pipes and fittings (***)
50201222	Water hoses with clamps (***)
50201060	Capacitor xx micro-farad (**) xx = give value when ordering
50209132	Measuring coil (***)
50201290	Rotary diodes (2 pcs) (including varistors and capacitors (**)
50201085	Alternator bearing including O-ring (**)
50209100	Digital Diesel Control unit (***)
50209104	Local control panel on the engine (***)
50212154	Fuses 3 Amps (*)
50212170	Fuses 10 Amps (*)
50201066	Wiring loom complete (***)
50209102	Remote control unit (***)
50209133	Cable remote control 10 mtr, including connectors
50202034	Gasket valve cover (**)
50202030	Cylinder head gasket kit
50202036	Overhaul gasket kit + seal kit (***)
50202040	Glow plug (**)
50202050	Nozzle injector (**)
50202160	Fuel pump (high pressure) complete (***)
50209051	Silicoone O-ring sound shield cover (**)

More extensive parts list on the internet: MASTERVOLT.COM (FAST MOVING PARTS)

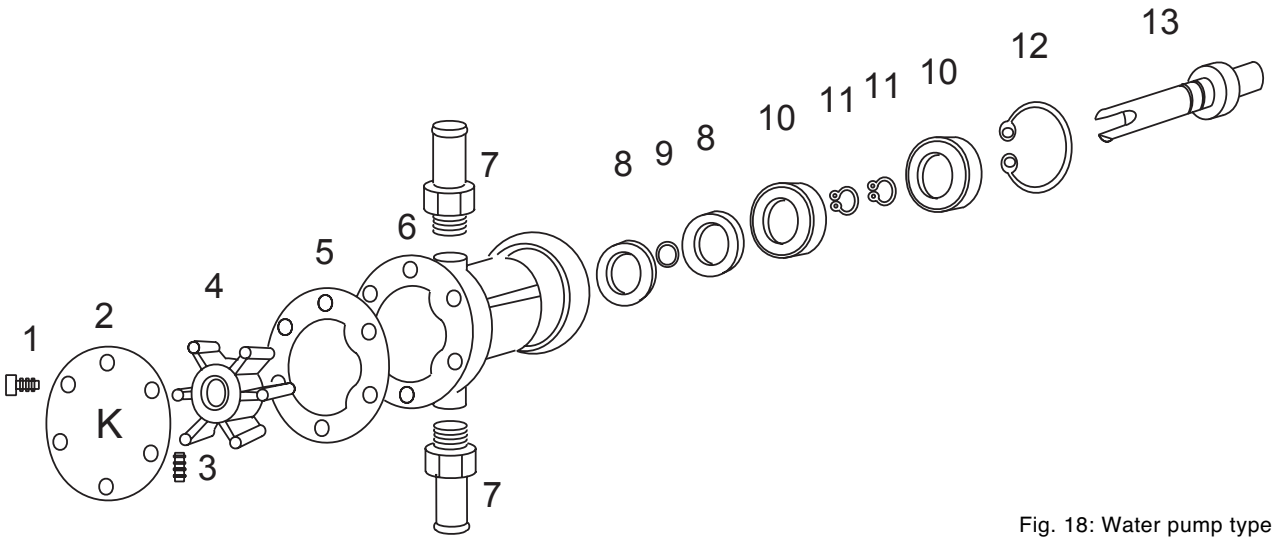


Fig. 18: Water pump type K.

Spare parts water pump type K, article no 050201250:

no	description	article no
1	screw cover, 6x	50209018
2	cover type K, 1x	50201012
3	screw impeller, 1x	refer to impeller
4	Impeller (1x), including screw (3)	50209013
5	Gasket, 1x	50209012
6	Pump housing, 1x	50201013
7	Hose connector, 2x, 12,5 MM x 3/8”	50221001
8	Seal, 2x	50209015
9	O-ring, 1x	50209017
10	Bearing, 2x	50209014
11	Clip, 2x	50209019
12	Clip, 1x	50209016
13	Shaft type K, 1x	50201011
	Impeller kit: impeller + gasket + screw	50209011

MAINTENANCE LOG

first service after 50 hours:	hour counter:	remarks:
next service (every 100 hours)	hour counter:	remarks:

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