WEICHAI

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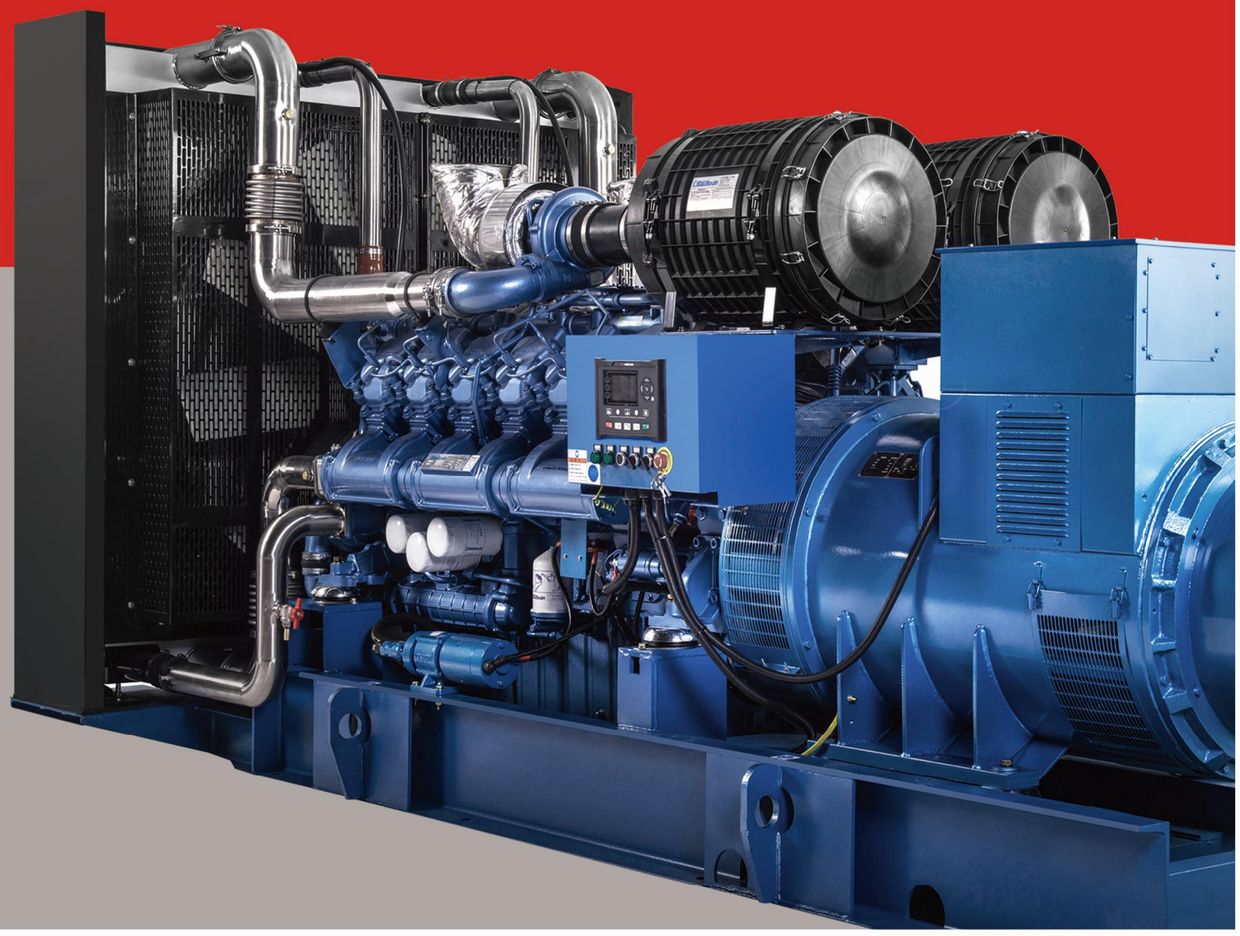
WEICHAI GENSET OPERATING MANUAL



CONTENTS

safety tips

Before starting the generator set, the operator must read the Manual carefully to get familiar with the equipment. Only correct operation and maintenance can realize safe and effective running of the equipment. The cause of many accidental injuries is usually the failure to comply with the basic safety regulations. The generator set can only be operated by a professionally trained electrician. The following content is to remind operation and maintenance personnel of possible dangerous conditions:

1. An electric shock will cause death or severe injuries to an operator

1.1 The generator set housing must be grounded to prevent live housing from risking the operator's personal safety. Each Weichai generator set is designed with a safe grounding system, and customers only need to install the system as per the local electricity regulations.

1.2 It is prohibited to open the alternator cover while set is in running condition. It may cause electric shock leading loss of lives or personal injuries.

1.3 When an operator checks or repairs the equipment line, the air switch shall be opened, and the set shall be shut down. Otherwise, an electric shock may be cause leading loss of lives or personal injuries.

1.4 Do not wear damp clothing (especially shoes) while handling e any electrical fault.

2. A fire will cause death or severe injuries to an operator

2.1 Smoke and fire are forbidden in the generator set room. Both the batter and fuel of the set are flammable. Particularly, when a lead-acid battery is being charged, it will generate explosive hydrogen, which will cause an explosion if contact with an electric arc or spark, leading to loss of lives or personal injuries.

2.2 When the set is running or is in a hot state, please do not add fuel in the fuel tank. It is very dangerous if the fuel contacts with hot diesel engine block and exhaust pipe.

3. A rotating part may cause death or injuries to an operator

3.1 Each rotating part, such as flywheel, fan and charging alternator, of the generator set shall be equipped with a protective cover, and shall be checked regularly for the tightening condition;

3.2 Do not get close to any rotating part when you wear loose clothes because loose clothes may be drawn in the rotating part, leading to death or injuries of the operator;

3.3 When the generator set is running, keep your hands away from any rotating part.

4. A hot component may cause injuries to an operator

4.1 It is prohibited to open the radiator cover when the set is running and during a certain period after the set is shut down because hot liquid splash

may injure the operator;

4.2 Do not try to touch the set exhaust pipe, turbocharger, hot coolant and other hot components with hands when the set is running; otherwise, the hands will be scalded;

4.3 Because the exhaust pipe is hot, to prevent scalds, it shall be insulated and wrapped with heat-resisting materials—glass fiber or aluminum silicate. The exposed part of the exhaust port and exhaust pipe shall not contact with timber or other flammable substances (especially the fuel pipeline).

Safety signs

The following safety signs found throughout this manual indicate potentially hazardous conditions to the operator, service personnel or the equipment. Failure to comply with such warnings will cause severe personal injuries or great property losses. The meanings of the safety signs are shown in Tab. 1-1.

Tab. 1-1 Meanings of safety signs for Weichai generator set

S/N	Graphic sign	Name	S/N	Graphic sign	Name
1		No hoisting	8		Anti-winding
2		No fire	9		Grounding must
3		No closing	10		Hoisting set here
4		Prevention of hot splash	11		Transportation by forklift here
5		Caution! Hot surface	12		No climbing
6		Danger! Electric shock	13		Effluent drain outlet
7		Caution! Rotating part	14		Fuel filler

1 Introduction

Overall introduction

The Operation Manual is mainly used to guide customers in using the equipment. The Manual describes the structural composition, operation & use, daily maintenance, fault diagnosis and measures taken of the equipment, and it is helpful for operation and maintenance personnel to use and maintain the set correctly and to analyze, judge and eliminate faults if any to ensure that the equipment can be put into use normally and quickly.

When you read the Manual, please read and refer to the Operation Manual of Diesel Engine, Operation Manual of Alternator, Operation Manual of Control Panel and other data accompanied with the equipment to prevent mis-operation and misjudgment on faults.

The notes in the Manual are basic principles that must be complied with by users and shall be strictly implemented.

How to get services

To ensure proper operation and maintenance of the generator set, please read this Operation and Maintenance Manual of Generator Set carefully and always operate as instructed. In case of any failure of the generator set, please contact Weichai Maintenance Service Center or Customer Service Center of the Company. We will provide timely and effective maintenance service.

Weichai Heavy Machinery Co., Ltd.

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Service Philosophy

To take “customers’ maximum satisfaction” as our aim

Service Commitment

In the service area covered by the maintenance service center of our Company, if the maintenance service center receives the user information and then confirms that the user really needs its service, it will arrive at the service site within 3 h for the center-located city, within 24 h for the general region and within 48 h for the remote area (except for force majeure).

"Warranty" service principle and regulations

On the premise of complying with the "Genset Operation Manual" by the user, if the exported set is damaged due to poor manufacturing and its damage is recorded within 3 years from the date of delivery or 2 years from the date of sale by the agent or operation for 4,000h in total (whichever comes first), we are responsible for repairing or replacing the damaged parts free of charge. If the machine fails due to improper operation, the Company will not undertake any compensation. However, the Company can provide technical services and timely provide parts to be purchased for the user, so as to help the user remove the fault timely.

Hoisting and storage of set

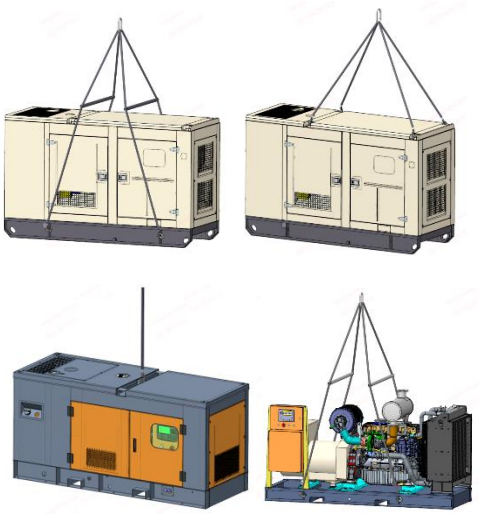
1. Hoisting precautions

The generator set is designed with a structure at its base for convenience of handling. If an incorrect handling method is used, the generator set components will be seriously damaged. When a forklift is used to carry the generator set, the generator set shall be hoisted slowly or pushed or pulled carefully on its base. If the set is pushed or pulled, wood must be placed between the forklift and the set base frame to prevent collision and weight dispersion.

Wire rope slings shall have sufficient strength, and the bearing capacity of hoisting tools shall comply with safety regulations. The length of each wire rope shall be consistent to prevent inclination during hoisting.

Note: Never use the lifting eyes on the engine or alternator to hoist the generator set.

Note: Check whether the lifting equipment and supports are in good condition and whether the load capacity of the lifting equipment is appropriate.



Warning: When the set is hoisted, no one shall get close to it.

If the generator set needs to be hoisted for installation, wire ropes shall be used to well connect the lifting eyes designed for hoisting and on the periphery of the base. Check whether the set is firmly hung, whether there are cracks in the welds and whether the screws are tightened. Cross bars are needed to prevent the slings from contacting with the set. The set shall be hoisted horizontally and slowly to prevent the set swinging and wire rope knotting during lifting.

Caution! Do not hoist the set outdoors when the wind is strong.

When a set packed in box is hoisted, the wire ropes shall be hung at the lifting positions at the base of the set packing box.

2.Transportation requirements and precautions during transportation

Necessary safety protection shall be provided for diesel generator sets during transportation. Besides, the set shall be firmly fixed in the carriage to prevent the components from loosening or damaging due to vibration. During the transportation of diesel generator set, no person or object is allowed to apply force on the set to avoid damaging its components. When the set is loaded on or unloaded from a vehicle, a forklift or crane shall be used to prevent set from tilting or descending to the ground, thus breaking the set.

3.Conditions and precautions for product storage

If the set will not be used for a long time, the engine and alternator will be damaged. Proper storage of the set can minimize such damage.

3.1 Storage of engine

1) Clean the diesel engine.

Before preservation, remove all rust with proper methods and positions to be treated with protective agent (such as lubricating oil pipeline, fuel system and turbocharger) must be cleaned thoroughly.

2) Protection procedure

a) Drain off oil completely after warming up and wash the oil filter. Add anti-rust oil in the oil pan of the diesel engine.

b) Drain off the diesel in the fuel system completely and add the mixture of 90% diesel and 10% anti-rust oil again to protect the whole fuel circuit. The mixture must be thoroughly mixed before addition.

c) If no cooling emulsion is used in the diesel engine, after the cooling water is drained, cooling water emulsion and anti-rust oil shall be added for protection of cooling water chamber. Before preservation, add the emulsion and start the engine as per starting procedures. Keep the engine idling for 15~25 min.

d) Remove the cover on the end of the intake pipe, spray anti-rust oil into the intake pipe with a pressure nozzle, and turn the crankshaft manually while spraying oil to open the valve and make the anti-rust oil seep into the combustion chamber. Once the preservation is completed, do not turn the crankshaft any more to prevent the oil film attached to the cylinder wall from being scraped off.

e) Drain the oil/fluid in the diesel engine. Drain or pump out the anti-rust fluid from the engine base. Drain emulsion from the cooling system. Keep all drain switches at open positions.

f) Remove the rocker arm cover and spray anti-rust oil to the valve spring and rocker arm.

g) All machined parts and parts liable to rust of the diesel engine shall be applied with preservative oil.

h) The intake and exhaust pipe (silencer) openings are wrapped with plastic cloth to prevent foreign matters and moisture.

With all procedures above done, the engine is under preservation.

3) Protection measures during storage

To avoid moisture and foreign matters entering in the diesel engine, during transportation and storage, the open ports of intake, exhaust, cooling water pipes and other parts of the engine shall be covered up and the diesel engine shall be coated by plastic shield.

3.2. Storage of alternator

If the alternator is not being used for a long time, moisture will enter the coil and cause corrosion. To minimize moisture condensation, the alternator shall be placed in a dry place. If possible, a moisture eliminator shall be used to keep the coil dry. When the generator set is moved from the storage place to the installation place, check its insulation degree first. If the reading is lower than that before storage, dry the coil.

3.3. Storage of control panel

There are precision instruments and components in the control panel; thus, it shall be placed in an environment with ambient temperature of 20℃~25℃, relative humidity of 20%~70% and air pressure of 70 kPa~106 kPa.

3.4. Storage of battery

Care shall be taken for battery storage: It shall be kept in a dry, clean and well-

ventilated room with room temperature of 5~25℃, away from direct sunlight, heat sources, liquids and harmful substances, and it shall not be placed upside down, impacted or stressed.

If the battery is not used for a long time, it will slowly discharge until it is scrapped. Therefore, to ensure that the battery is always in good working condition, it shall be charged at regular intervals.

The recommended charging interval is:

6 months at storage temperature less than or equal to 20℃;

3 months at storage temperature of 20~30℃.

Installation requirements for set

The following matters shall be determined before the set is installed:

1. Total usable area and limitations. The machine room shall have enough space to accommodate the following equipment: generator set, related control cabinets (such as remote control cabinets, parallel cabinets, automatic switching cabinets, etc.) of generator set, air inlet and ventilation systems, smoke exhaust systems (exhaust pipes, silencers, etc.).
2. Any limitation to noise, and requirements on noise in operating environment such as office or residential area.
3. The feasibility of machine room passage, set transportation and installation shall meet the requirements on the space for set operation, installation, service and maintenance.
4. Accessibility of service vehicle

Foundation

The generator set does not need a specific foundation. The set can be directly installed on horizontal concrete ground with sufficient strength. It is recommended to add a proper floor mat between the base frame and the ground, because the floor mat can not only make up for the slight unevenness on the ground, but also increase the resistance between the set and the ground and improve the shock absorption function. The ground must be able to bear the static weight of the generator set.

1 Concrete foundation

The concrete foundation shall have a period of not less than seven days from the beginning of pouring to the installation of the set for drying and solidification. The foundation level shall be controlled within a ±0.5°plane, and the foundation shall be built on a compacted hard ground. The concrete thickness is selected according to the set power. For generator sets of 120kW and below, the concrete thickness is 100mm or above. For generator sets of 150kW-1000kW, the concrete thickness is 200mm. Although this data is applicable to most foundations, it is recommended to determine the foundation bearing capacity after consulting local regulations and foundation analysis reports of buildings.

2 Connection

Fuel, water and exhaust pipes transmit vibration for long distances. All piping and electrical connections shall have flexible connections as a transition to prevent damage to the set or ancillary equipment caused by set vibration.

Installation of the generator set

1. Size of machine room

In order to meet the requirements on maintenance around the set, it is suggested that the distance between the machine room and any wall, cabinet or control cabinet should be at least 1 m.

2. Intake and vent louvers

□ The effective ventilation area of intake and vent louvers shall not be less than 50%, with good flow line and low air flow resistance.

□ Bird/pest protection nets shall be installed inside the louvers, but shall not hinder cooling and air flow.

□ The vent louvers shall be connected to the set radiator tank through a flexible connection resistant to heat and oil.

3. Smoke exhaust system

In the layout of the machine room, the smoke exhaust system is fixed by the hangers fixed on the ceiling. If this method is not applicable to the structure of the building, the exhaust pipe needs to be supported from the ground. The exhaust pipe shall be at least 2.3 m from the ground to ensure the safety of people in the room and to prevent sudden contact.

□It is suggested that corrugated pipes should be installed at the exhaust outlet of the set and then connected with the smoke exhaust silencer through a rigid pipe.

□In order to lower the temperature in the machine room, the exhaust pipe shall be wrapped with thermal insulation materials with high density and high insulation performance. If possible, the silencers and exhaust pipes shall be installed outside the machine room to the greatest extent.

4. Cable system

The output cable from the set output switch to the distribution box shall be of flexible structure. It is suggested that the flexible power output cable should be laid on the rack in the cable duct of recommended size and be separated from the control cable.

The flexible single-core power cable that enters any control cabinet must pass through a nonmetallic sealing sleeve and plate.

5. Switching screen

It is divided into wall-mounted type and floor type.

Wall-mounted type: The screen below 600A can be mounted directly on the wall of the cable trench;

Floor type: Certain space is required for installation of the screen above 800A.

Certain space and operator access shall be reserved around the switching screen.

6. Generator set

□ The length of the duct between the radiator tank and the air duct shall not be less than 300mm.

□ The air inlet shall be behind the motor end of the generator set to obtain good air circulation.

7. Door of machine room

The door of machine room shall be opened outward so that the door can be closed better during the operation of the set, but a door button or handle for evacuation must be provided in the machine room to facilitate the rapid evacuation from the machine room.

2 Parameters

Description of set power

Rated power (PRP): refers to the maximum power that the generator set can continuously use within 24 hours in the specified maintenance period and under the specified ambient conditions, which is also called continuous power.

Standby power (LTP): refers to the maximum power when the generator set can overload 10% of the rated power for 1h every 12h within a certain period of time in the specified maintenance period and under the specified ambient conditions.

Environmental adaptability of set

1. The set shall be able to work normally at ratings under the following environmental conditions and be able to run for 1 h with 10% overloaded.

- Ambient temperature: 5~25℃
- Altitude: 100 kPa
- Relative air humidity: 30%~60%

2. The set shall be able to run under the following environmental conditions, but the set power must be corrected.

- Ambient temperature: 25~40℃
- Altitude range: 1000~4000 m
- Ambient humidity: 5%~90%

3. The set shall be able to work normally with a heating (low-temperature start) device under the following environmental conditions.

- Ambient temperature: -40~5℃
- Altitude range: 1000~4000 m
- Ambient humidity: 5%~90%

Correction of set power

If the ambient temperature is higher than 25℃, the atmospheric pressure is lower than 100kPa, and the relative humidity is higher than 60%, the rated power of the generator set shall be corrected. If the loaded power of the generator set is higher than the corrected value of rated power when it is running, black smoke and overheating will be generated from and caused to the diesel engine. If the generator set runs under such conditions for a long time, the diesel engine will have major faults and damage. Please take the situation seriously.

When the ambient temperature is too high, the air density, the oxygen quantity and the combustion efficiency decrease correspondingly, and thus the mechanical output power of the diesel engine is reduced. When the alternator works, it needs cold air to cool the windings. If the ambient temperature is too high, the cooling effect decreases and the internal temperature of the alternator windings increases. In order to ensure that the winding temperature of the alternator is within the allowable range, the output power of the alternator must be reduced.

The air density will decrease with the increase in altitude, and the output power of diesel engine and alternator will also be affected.

Although the output power of generator set will not be decreased when it is used in low temperature and high humidity conditions, the factors that may affect the normal functioning of the set due to the different site conditions must also be considered during model selection.

When the set is used under non-

standard environmental conditions, users shall correct the set power according to the changes in environmental conditions. For detailed correction coefficients, you can consult Weichai Heavy Machinery Co., Ltd.

Main configuration of the set

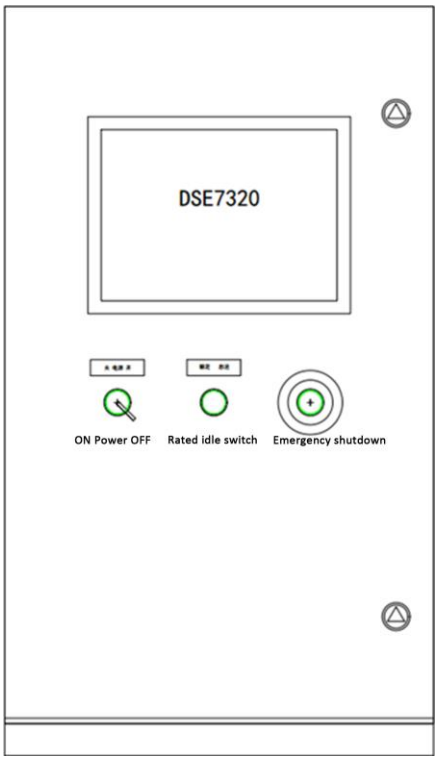
See the data sheet of the set for details.

3 Control Panel Operation

Overall introduction

The control panel of generator set is designed and manufactured for Weichai alternators of each power section. It is designed with full consideration of easy operation and complete functions. There are special control modules for generator set on the control panel, which can display water temperature, oil pressure, oil level, rotating speed, battery voltage, working time, power generation voltage, power generation current, power generation frequency, active power, reactive power and mains supply. When the generator set has such symptoms as high alternator water temperature, low oil temperature, low oil level, overspeed, overvoltage, undervoltage, over-frequency and underfrequency, the control panel will send out corresponding audible and visual alarm signals. When the generator set has such symptoms as excessively high water temperature, excessively low oil pressure, overspeed shutdown, overcurrent, overload, and short circuit, the control panel will also send out corresponding audible and visual alarm signals, and the generator set will be shut down. Please read the Manual carefully when operating the control panel, and perform operations in strict accordance with regulations of the Manual.

Note: The controller may send a signal to start the engine due to external influence. Therefore, the engine may be started without warning. If you are to perform maintenance on the system, it is recommended to turn off the power supply or put the controller in the stop mode.



Inspection before startup

1. The area around the generator set shall be cleaned, and unsafe objects shall be moved away to avoid affecting operation or causing danger. Ensure that the air inlet and ventilation ducts of the machine room are not blocked.
2. Before checking, make sure that the power switch of the control panel is opened (the control panel is not powered), the control switch/key switch is off, and the emergency stop switch is on.
3. Check all electrical circuits to see if there is any potential electric leakage in the wire harness due to broken insulation layer and aging, and replace the wires when necessary. Check whether the joint is loose or damaged, and tighten or replace it when necessary.
4. Check the reliability of fasteners and throttle adjusting system, confirm that each operating mechanism is flexible, light and reliable, and check the pre-tightening condition of water pump belt, charger belt and fan belt.
5. Check the control panel and generator set for dust accumulation, and clean them if necessary to prevent the dust or pollutants from causing electric shock or affecting the cooling effect of the generator set.
6. Check the battery electrodes for corrosion, and remove it if necessary.

Caution! Prevent short circuit of positive and negative electrodes of the battery.

Caution! Turn on the power switch, and check the battery voltage from the control panel. If it is less than 9V (12V system) or 19V (24V system), the battery needs to be charged.

7. Check the blockage indicator of the air filter, and replace the filter if it indicates blockage.
8. Check the level of engine lubricating oil, coolant and diesel, and add appropriate amount if insufficient.
9. Ensure that the air switch of the set is in the open position.

Control panel switch

Panel switch: see the following description for details
Power switch: for power supply input and switching of 24V control circuit of set control panel.
Rated/idle knob: used to switch the engine between idle state and rated state.
Emergency stop: emergency shutdown.

Control button

Icon	Description
	**Stop/Reset mode** This button indicates that the controller gets into the Stop/Reset mode  . Once this button is pressed, any alarm signal triggered will be eliminated and removed. If the engine is running, you press the Stop/Reset button, and the controller will automatically control the circuit breaker to unload the generator set (*alternator closing and delay load outputs 1, 2, 3 & 4 will be invalid (if defined)*). The fuel output will be stopped by the controller, and at the same time the generator set will be shut down. In this mode, the controller monitors the remote start signal, and the generator set is still in the stop mode.
	**Manual mode** This button indicates that the controller gets into the manual mode  . Once you select the manual mode  and then press the button  , the generator set will be started and run without load. You can use the "Switchover to generator set" button  to let the generator set run with load. The controller will automatically switch the load to the generator set (*'generator set closing' and delay load outputs 1, 2, 3&4 will be valid (if defined)*). The generator set will be unloaded by switching to the mains supply button  or disconnecting the generator set button  . The controller will automatically unload the set (*alternator closing and delay load outputs 1, 2, 3 & 4 will be invalid (if defined)*). These functions can be set at the user-defined digital input port. If the engine runs without load in the manual mode  and at the same time a remote start signal is valid, the controller will perform automatic

	switchover to let the set run with load (*'generator set closing' and delay load outputs 1, 2, 3 & 4 will be valid (if defined)*). When the remote start signal is released, the set still runs with load until the Stop/Reset button or AUTO mode button is pressed.
	**Test mode (only applicable to DSE6020 MKII)** This button indicates that the controller gets into the test mode . Once the controller gets into the test mode , you press the button , and the generator set will be started and run without load. Once the set is started, it will run with load automatically (*'generator set closing' and delay loads 1, 2, 3&4 will be outputted in the sequence from low to high (if defined)*).

	**AUTO mode** This button indicates that the controller gets into the AUTO mode . In this mode, the controller can automatically control the set. The controller will monitor the remote start input, and the set will automatically start with load once the start request is sent (*'generator set closing' and delay loads 1, 2, 3&4 will be outputted in the sequence from low to high (if defined)*). When the start signal is released, the controller will automatically unload the set. The set will be shut down after the signal passes through the delay timer and the cooling timer *('generator set closing' and delay load outputs 1, 2, 3&4 will be valid (if defined)).* The controller will wait for the next start signal.
	**Alarm mute/indicator test** This button will mute the alarm buzzer (if defined) and will be used to turn on all the indicators on the panel.
	**Start** This button is only valid in the Stop/Reset mode , manual mode and test mode . In the stop/reset mode , press the start button , and ECU will be powered on but the engine will not be started. It can be used to check the

	status of CAN communication and the fuel system. In the manual mode  or test mode  , press the start button  , and the generator set will be started. It will run without load in the manual mode  or run with load in the test mode  .

Icon	Description
	**Menu navigation button** It is used to check meter parameters, event records and the user-defined interface. For more information, refer to the "Operation" section of this manual.
	**Switchover to generator set** This button is only valid in the manual mode  , which allows the load to be switched to the generator set.
	**Alternator opening (only applicable to DSE6010 MKII)** This button is only valid in the manual mode  , which allows the operator to open the alternator switch and remove the load.
	**Switchover to mains supply (only applicable to DSE6020 MKII)** This button is only valid in the manual mode  , which allows the operator to switch over the load to mains supply.

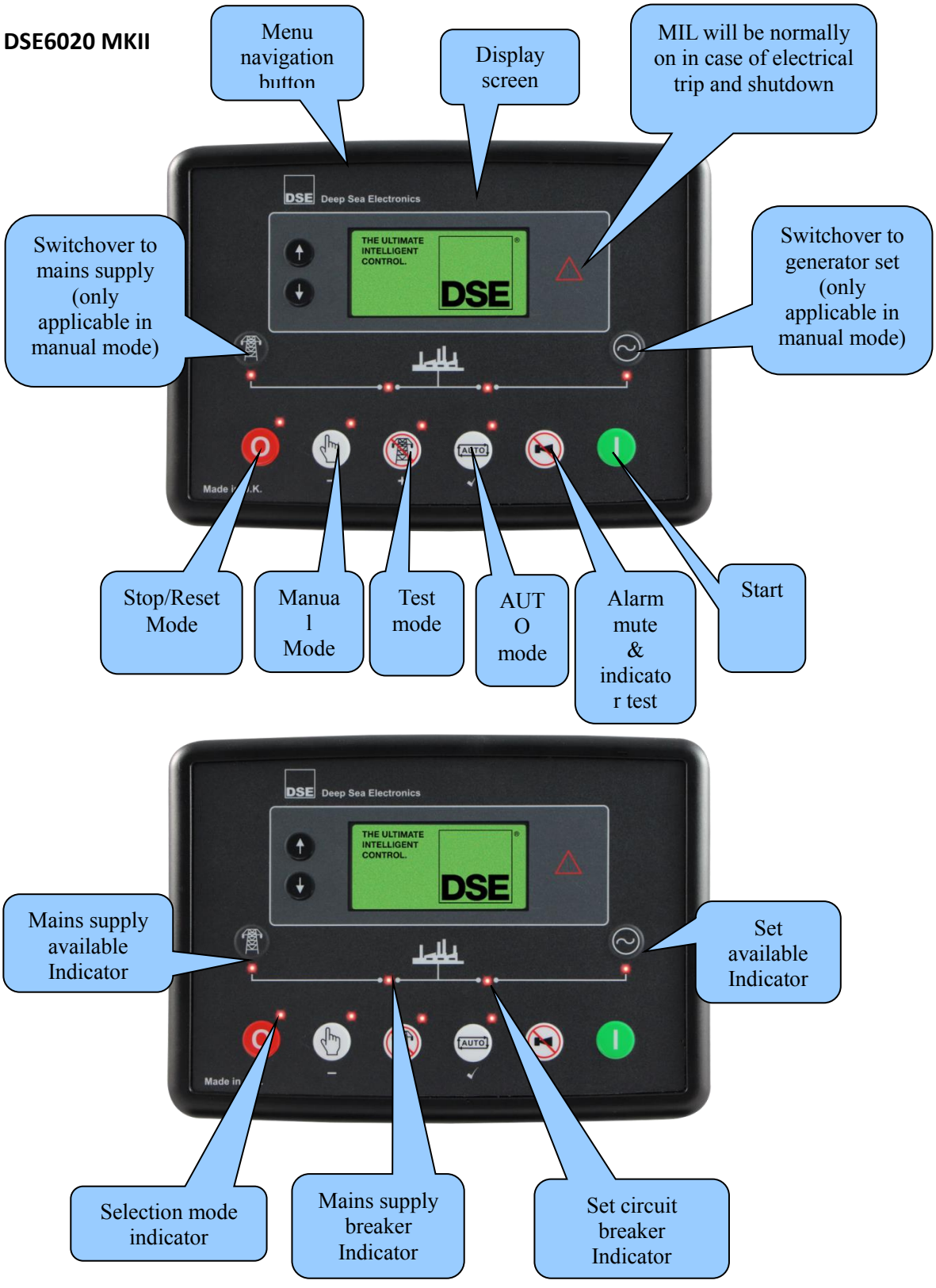
Meter icon

Icon	Description
	Voltages of set and mains supply that will be displayed on the home page by default (only applicable to DSE6020MKII)
	Voltage and frequency of set
	Voltage and frequency of mains supply (DSE6020 MKII only)
	Current of set
	Current of mains supply (only applicable to DSE6020 MKII, when the current transformer is on the load side)
	Load power
	Engine speed
	Operating hours

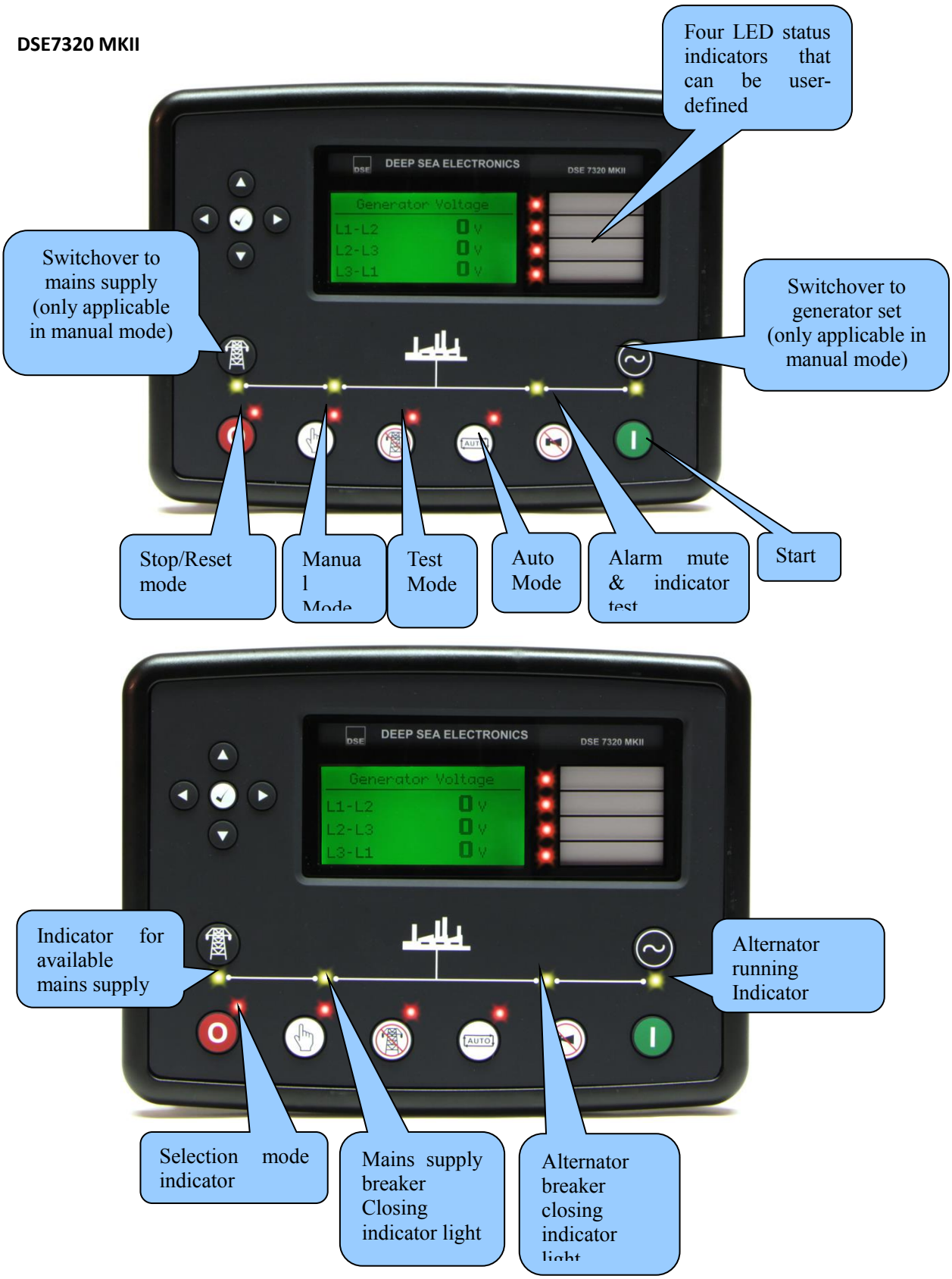
	Battery voltage
	Oil pressure
	Coolant temperature
	Flexible sensor
	It will pop up when you check event records.
	Current time
	Running hours set
	ECU DTC
	Oil filter maintenance timer
	Air filter maintenance timer
	Fuel filter maintenance timer

Front control panel

DSE6020 MKII

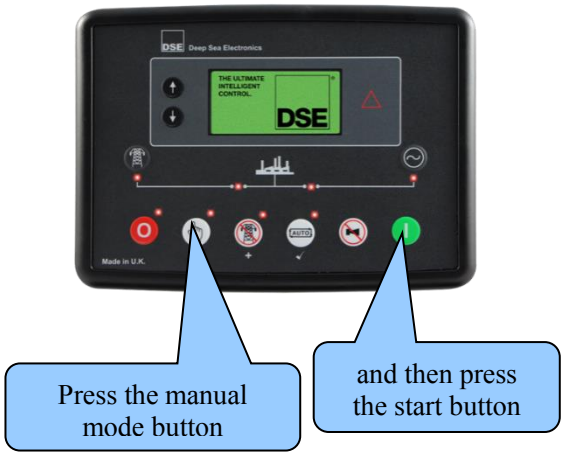


DSE7320 MKII



Start

6020MKII



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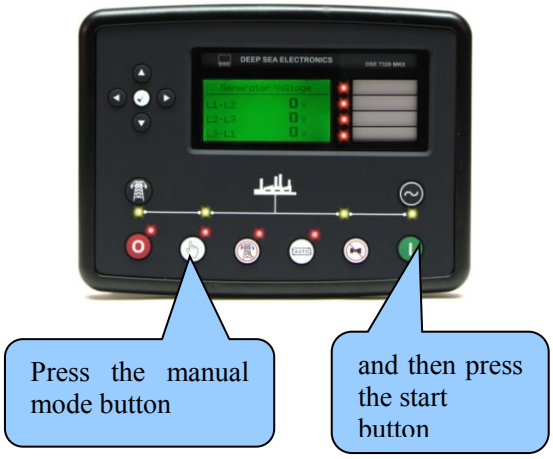


1. Manual mode

Press the manual mode button to get into the manual mode .

The manual mode icon will pop up on the display.

In the manual mode , the set will not start automatically.

To start the set, please press the start button .

2. Test mode

Press the test mode button to get into the test mode.

The test mode icon will pop up on the display.

In the test mode , the set will not start automatically.

Press the start button to activate the starting sequence.

3. Auto mode

Press the AUTO mode button to get into the manual mode.

The AUTO mode icon will pop up on the display.

In the AUTO mode, the set can run fully automatically without manual operations for start and stop.

Caution! It is forbidden to start the set with load.

Caution! Press the start button. If the set is not started successfully, wait for about 20s and try again. If the set is not started for 3 consecutive times, stop starting, and eliminate the fault causes such as those in battery voltage or fuel circuit before another try.

A set with electronic speed control shall idle first after being started to automatically rise to the rated speed. When the set runs at the rated speed till the diesel engine reaches the hot engine state, press the "close" button to load.

Preparations must be made if the set is to be started in a severely cold environment.

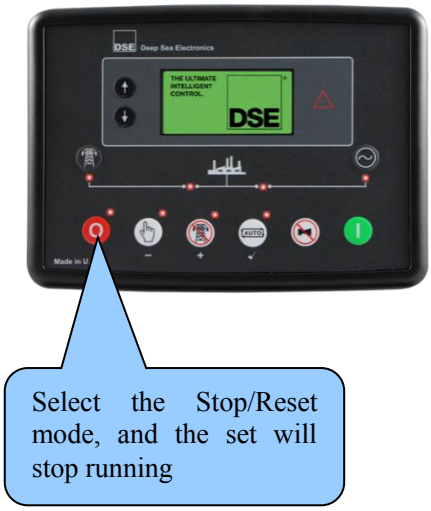
The battery must be in good condition. Low temperature will reduce the capacity of the battery. It may be necessary to increase the capacity of the battery according to the actual situation.

Caution! It is not recommended to run the set with high load when it is in the cold state.

Caution! Sets are not allowed running continuously with no load or less than 30% load for more than half an hour to prevent lubricating oil leakage.

Stop

6020MKII



7320MKII

1. Manual mode

In the manual mode , the set will stop running in following cases:

Press the Stop/Reset button – the delay load output will be released immediately, and the set will stop running immediately.

Press the AUTO mode button, The set can monitor all start orders in the AUTO mode and stop the timer before the stopping sequence in the AUTO mode starts.

2. Test mode

In the test mode , the set will stop running in following cases:

Press the Stop/Reset button – the delay load output will be invalid, and the set will stop running immediately.

Press the AUTO mode button, The set can monitor all start orders in the AUTO mode and stop the timer before the stopping sequence in the AUTO mode starts.

3. Auto mode

The return delay timer runs to ensure that the start request is completely cancelled instead of being cancelled for a short time. If there is a start request at the cooling down and stop stage, the set will be reloaded.

If no start request is sent any more at the end of the return delay stage, the circuit breaker will be disconnected after the generator set is unloaded, and the generator set will initially cool down and stop.

With the cooling timer, it is allowed that the alternator removes its load and fully cools down before shutdown. This is especially important when the engine is equipped with a turbocharger.

The set will stop running after the delay of cooling timer.

Caution! Before shutting down the set, you must turn off the switch for unloading. It is strictly forbidden to shut

down the machine with load. Generally, after unloading, the set needs to run at no load for 3~5 min before shutdown.
Caution! When connecting or removing the load cable, you must shut down the set and remove the negative connection of the battery.

Emergency shutdown
Press the emergency stop button for emergency shutdown.
When fire, electricity leakage or other natural disasters that may endanger the safety of set and operators occur.

At this time, if the emergency stop button is pressed, the set will quickly cut off the load and immediately turn off the throttle, and the red "emergency stop" indicator is on. To release the emergency stop signal, the button needs to be pressed again and to pop up.

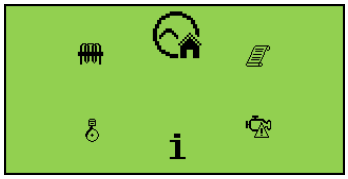
When the set is running normally or supplying power to the equipment, the user is advised not to perform emergency shutdown at will under non-emergency conditions.

Menu display and button

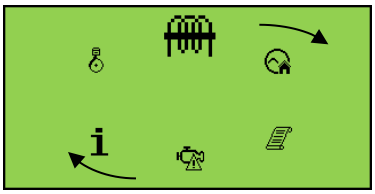
6020MKII
Check of meter parameters page

Navigation menu

Press  and  buttons simultaneously to enter the navigation menu.



Select the corresponding icon, and press  button to turn to the right or press  button to turn to the left until the required meter section is visible.



When the required icon is at the top, you press the AUTO mode button  to enter the meter option.

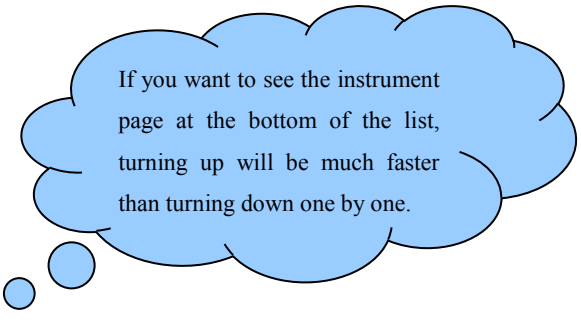
If the AUTO mode button  is not pressed, the display will automatically return to the home page ( / ) after the time read by LCD rolling timer is up.

Navigation menu icon

Icon	Description
	Parameters of alternator and mains supply voltage meters (only applicable to DSE6020 MKII)
	Alternator meter
	Mains supply meter (only applicable to DSE6020 MKII)
	Current and load meters
	Engine meter
	Controller information
	Engine DTC
	Event record

General navigation

Different page information can be viewed by pressing or navigation button continuously.



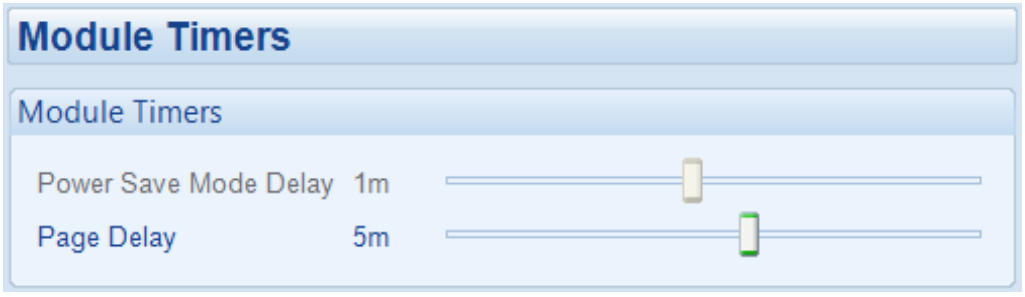
such as:

Home → Press → Alternator → Press → Mains supply → Until the last page.

Press the button again to return to the homepage (/).

Once selected, the current page will stay on the screen until the user selects another page, or if the page display duration is exceeded, the controller will return to the homepage.

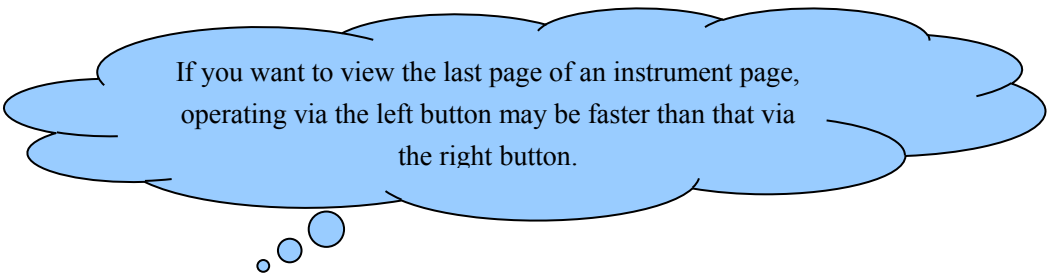
Page display duration can be set with DSE setting software or front panel editor.



7320MKII

Check of display interface

Information on different pages can scroll by repeatedly operating the next page & previous page button.



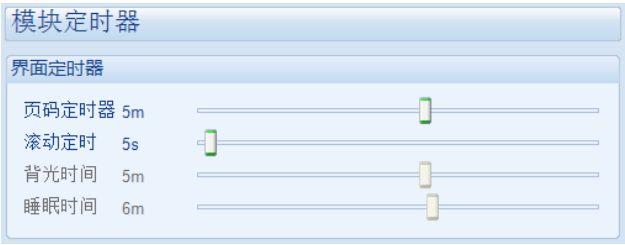
For example

State  Alternator  Mains supply

Until the desired page is displayed. For details,

press the next page button  to return to the status page.

The display order and contents of each page are given in the following section.
Once a page is selected, this page will still be displayed till the user selects another page, or the controller will return to the status display after the external delay timer stops timing (LCD page turning time).
If the button is not pressed for entering a page, the page will automatically scroll according to the LCD scrolling time.
LCD page turning time and scrolling timing can be set by DSE setting software or front panel button.



The left figure shows the time set by factory default, screenshot from the DSE setting software.

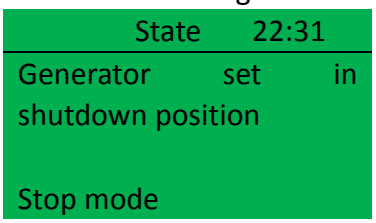
Alternatively, to check all parameters on the current page by turning pages manually, press the auto scroll button  . The auto scroll will be invalid.

To re-enable the auto scroll button  , please switch to the page under the 'title' (e.g., mains supply). After delay for a short time (LCD scrolling time), the page will automatically get into the auto scroll operation.
In the manual scroll mode, if the button is not pressed in the LCD page turning time, the display interface will automatically return to the status page.
When there is an alarm on the status page, the controller screen will automatically switch to the alarm interface to remind the operator of this alarm.

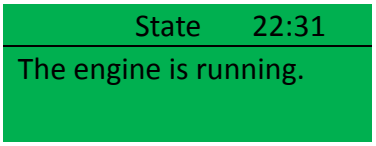
State

If set, press the scroll button on the status page to view other parameters configured on that page.
This is the 'homepage', which is displayed when no other page is configured. After LCD page turning time and no navigation button on the panel is operated, the controller will automatically switch to this page for display.

This page automatically changes the display according to the status of the controller, such as when the generator set is running:

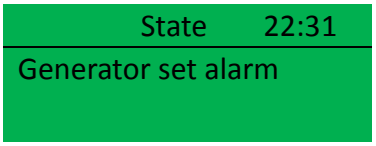


The factory is set in the *status interface* by default, showing that the generator set is in the stop position...



The engine is running.

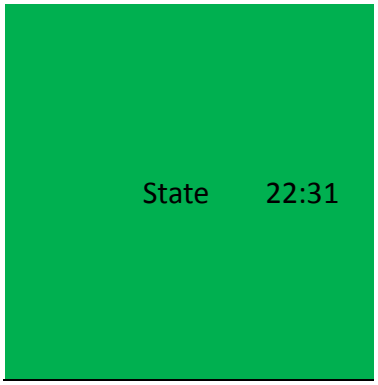
Generator set alarm



The generator set has an alarm indicating that the alternator cannot be started due to a shutdown or trip alarm. Press Page Up or Page Down  to turn to the alarm page to view the specific alarm information.

Press the *shutdown/reset button*  to clear the alarm. The fault remains valid if the alarm is not cleared.

Waiting for command from generator set



Waiting for command from generator set indicates that the alternator has been started but does not reach the on-load voltage and/or frequency set in the software.

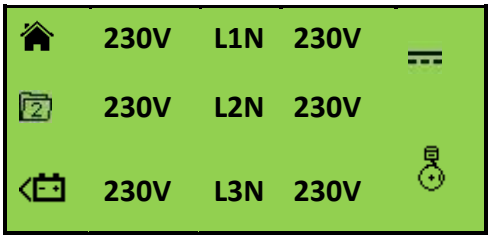
Press Page Up or Page Down  *to turn to the alternator interface to see if the alternator voltage and frequency exceed the set on-load voltage and frequency.*

Main menu

6020MKII

The controller display contains the following parts

DSE6020MKII homepage



Commissioning

6020MKII

Before the system is started, the following inspections/check points are recommended:

 The set is fully cooled, and all controller wiring is standard and compatible with the system. Check whether all mechanical parts are properly installed and all electrical connections (including ground wires) are connected properly.

 The battery provides DC power to the controller and has correct polarity.

 The emergency stop input is connected with the external, normally closed contact connected to the positive pole of the DC power supply.

 To check the operation of the start cycle, appropriate measures are taken to prevent the engine from starting (do not let the fuel valve work). Perform peripheral inspection to ensure safe operation, and connect the battery for power supply. Select the manual mode and press the start button to start the program of the set.

 During the preset turning cycle, the motor is started for turning. If several turnings fail, the LCD will display "start fails". Press the Stop/Reset button to reset the controller.

 The engine is restored to working condition (reconnect the fuel valve). Select manual mode and press the start button. This time, the engine shall be started and the starter shall be disengaged automatically. If not, check whether both the starter and the fuel valve are working. The engine shall reach the normal operating speed. If not, an alarm will be given and the alarm condition and input wiring will be checked. The engine will continue to operate, and the engine and alternator parameters can be checked at this time.

 When the auto mode is selected, the remote start input signal is invalid, and the engine enters the preset cooling cycle and then stops. The set will remain in standby mode.

 A remote start signal is provided to activate the automatic start program (if set). After the program is started, the engine reaches the rated speed. Once the set is available and the delay load takes effect, the set will start working with load. If not, check whether the wiring and warm-up time of the delay load output has been exceeded.

 After the remote start signal is removed, the set will cool down and shut down. The alternator will be unloaded after pre-set time. The alternator will run the pre-set cooling time and then shut down to standby mode.

 The internal clock/calendar of the controller is set to ensure normal call maintenance and event recording functions.

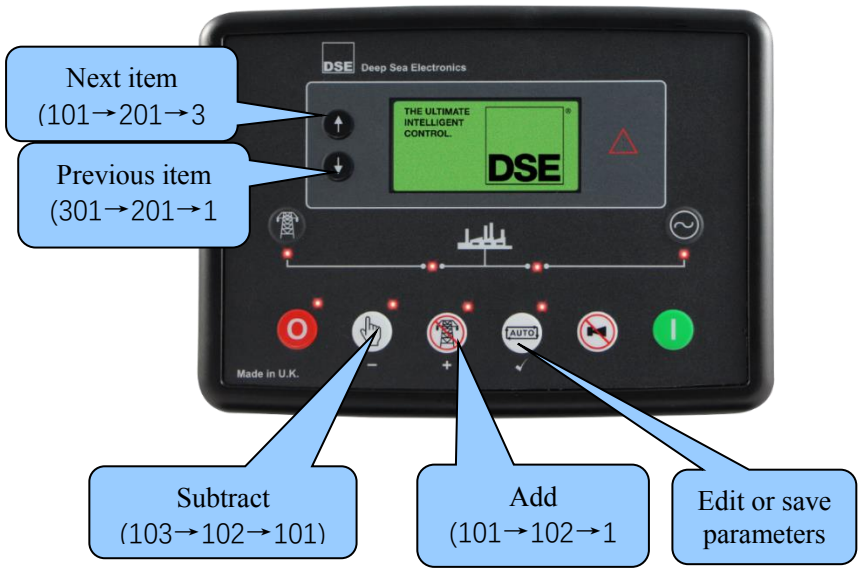
Controller configuration menu

6020MKII

Setting of front panel

The user can also fully set the parameters of the controller without using the DSE setting software.

View the menu and modify the parameters through the buttons on the controller:



Enter the front panel parameter editor

Pressing and holding the Up and Down navigation buttons will repeat the operation automatically. Pressing the navigation button for a long enough time can quickly modify the parameter value.

The editor will exit automatically if no operation is performed within 5 min.

- Press Stop/Reset and Auto Mode buttons at the same time to enter the editor mode🛠.
- Press Up and Down navigation buttons to add or subtract the number based on 100 in the front panel editor.
- Press (+) and (-) buttons to add or subtract the number within 1.
- When viewing the parameters to be edited, press the Auto Mode button, then the parameter value will start to flash.
- Press (+) and (-) buttons to adjust the parameters to the desired values.
- Press the Auto Mode button to save the current value, then the parameter value will stop flashing.
- Press the Auto Mode button to save and exit the editor, then the setting icon 🛠 will disappear.

Adjust parameters

Controller settings

Parameter settings - Controller (Page 1)		
101	Screen contrast	0 (%)
102	Fast on-load	ON (1), OFF (0)
103	Locking all alarms	ON (1), OFF (0)
104	Lamp test when power-on	ON (1), OFF (0)
105	Power saving mode	ON (1), OFF (0)
106	Reserved	
107	Reserved	
108	Event record display format	ON (1), OFF (0)
109	Selection of startup mode	0 (Selection of startup mode)
110	DTC character display	ON (1), OFF (0)
111	Reserved	
112	Password protection when resetting maintenance alarm	ON (1), OFF (0)
113	Pressing Shutdown to enter the cooling stage	ON (1), OFF (0)
114	Use of the oil pressure detection port of the controller	ON (1), OFF (0)
115	Use of the water temperature detection port of the controller	ON (1), OFF (0)
116	Use of the controller for engine timing	ON (1), OFF (0)
117	Use of the speed port of the controller	ON (1), OFF (0)
118	Use of the charging alternator port of the controller	ON (1), OFF (0)
119	Cancellation of CAN speed control	ON (1), OFF (0)
120	CT position of alternator	Alternator (0), load (1)
121	Display of alternator voltage	ON (1), OFF (0)
122	Display of mains voltage	ON (1), OFF (0)
123	Display of alternator frequency	ON (1), OFF (0)
124	Display of frequency of mains supply	ON (1), OFF (0)
125	Current display	ON (1), OFF (0)
126	kW display	ON (1), OFF (0)
127	kVAr display	ON (1), OFF (0)
128	kVA display	ON (1), OFF (0)
129	pf display	ON (1), OFF (0)
130	kWh display	ON (1), OFF (0)
131	kVArh display	ON (1), OFF (0)
132	kVAh display	ON (1), OFF (0)
133	Long press Start until the start is successful	ON (1), OFF (0)

7320MKII

The user can also fully set the parameters of the module without using the DSE setting software.
View the menu and modify the parameters through the buttons on the module:

Main configuration parameter settings:

Enter main configuration parameter settings

- Ensure that the generator set is in the shutdown position and operate the *stop/reset mode button* of the controller.
- At the same time, press the *stop/reset mode button* and tick button  to enter the edit interface.

Edit parameter

- Press and hold the menu navigation button  for repeated operation. Press and hold the navigation button to change the parameters quickly.
- Press the right or left button  to repeatedly view/modify the parameters.
- Press the up or down button  to select the parameters you want to view or change in the currently selected part.
- To edit parameters, press the *tick button*  to enter edit mode. The parameter starts to flash, indicating that you can edit it at present.
- Press the up or down button  to change the parameters you need.
- Press the tick button  to save the modified parameters. The parameter no longer flashes, indicating that it has been saved.

Exit main configuration parameter settings

Failure to operate any button on the panel within 5min will automatically exit the edit interface to ensure safety.

- Press and hold the *stop/reset mode button*  to exit the edit interface, which cannot save the set parameters.
- Press and hold the tick button  to exit the edit interface, which can save the set parameters.

"Running" parameter settings

Enter "Running" parameter setting

- The generator set can enter the "running edit interface" during running. All protections are still valid when the set is in this interface.
- Press and hold the "*tick button*"  to enter the running edit interface.

Edit parameter

- Press and hold the menu navigation button  for repeated operation. Press and hold the navigation button to change the parameters quickly.
- Press the right or left button to repeatedly view/modify the parameters. 
- Press the up or down button  to select the parameters you want to view or change in the currently selected part.
- To edit parameters, press the tick button to enter edit mode.  The parameter starts to flash, indicating that you can edit it at present.
- Press the up or down button to change the parameters you need. 
- Press the tick button to save the modified parameters.  The parameter no longer flashes, indicating that it has been saved.

Exit "Running" parameter setting

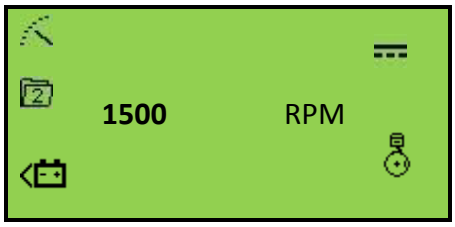
Failure to operate any button on the panel within 5min will automatically exit the edit interface to ensure safety.

- Press and hold the tick button  to exit the edit interface and save the modified parameters.

Engine menu

6020MKII
Engine

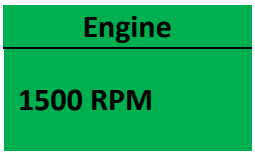
The interface contains the engine instrument parameters detected by the controller input, part of which are obtained from the engine ECU.



- Engine speed
- Engine running time
- Engine battery voltage
- Engine cooling temperature
- Engine oil pressure
- Engine fuel level
- Flexible sensor
- Engine maintenance expiration date - Oil
- Engine maintenance expiration date - Air
- Engine maintenance expiration date - Fuel

7320MKII
Engine

The interface contains engine measurement parameters or parameters I driven from the input end of the controller, some of which may be obtained from the engine ECU.



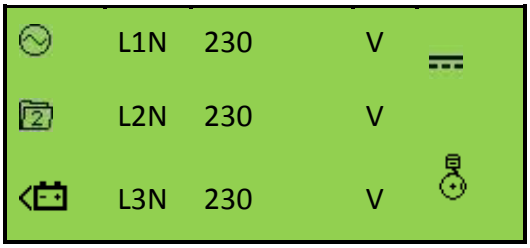
Engine speed
Oil pressure
Coolant temperature
Engine battery voltage
Engine running time
Engine fuel level
Flexible sensor
Engine maintenance alarm
Engine ECU connection;

Alternator menu

6020MKII

Alternator

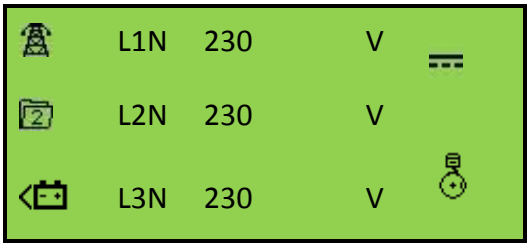
The interface contains the values of the alternator detected by the controller voltage input.



- Alternator voltage (ph - N)
- Alternator voltage (ph - ph)
- Alternator frequency

Mains supply (only applicable to DSE6020 MKII)

The interface contains the values of the mains supply detected by the controller voltage input.



- Mains voltage (ph-N)
- Mains voltage (ph-ph)
- Frequency of mains supply

7320MKII

Including major electrical values, measurements or inputs of voltage and current from the controller.

Press the *up or down button*  to view different parameters of the alternator.

Alternator phase voltage (ph-N)
Alternator wire voltage (ph-ph)
Alternator frequency
Alternator current (A)
Alternator phase load (kW)
Total alternator load (kW)
Total alternator phase load (kVA)
Total alternator load (kVA)
Single-phase power factor of alternator
Average power factor of alternator
Alternator phase load (kvar)
Total alternator power (kvar)
Cumulative alternator load (kWh, kVAh, kvarh)
On-load sequence of alternator
Alternator phase sequence
Normal value of alternator Nominal
Effective configuration parameters of alternator

Mains supply (only applicable to DSE7320 MKII)

Mains current and functional monitoring are only valid when the CT has been set in the software and installed on the load sideIncluding major electrical values, measurements or inputs of voltage and current from the controller.

Press the *up or down button*  to view different parameters of the mains supply.

Mains
50.0 Hz

Mains supply phase voltage (ph-N)
Mains supply wire voltage (ph-ph)
Frequency of mains supply
Mains supply phase sequence
Effective configuration parameters of mains supply

Fault code menu

6020MKII

Meter icon

When you check the meter parameter page, a valid icon will pop up to indicate contents displayed currently.

Icon	Description
	Voltages of set and mains supply that will be displayed on the home page by default (only applicable to DSE6020MKII)
	Voltage and frequency of set
	Voltage and frequency of mains supply (DSE6020 MKII only)
	Current of set
	Current of mains supply (only applicable to DSE6020 MKII, when the current transformer is on the load side)
	Load power
	Engine speed
	Operating hours
	Battery voltage
	Oil pressure
	Coolant temperature
	Flexible sensor
	It will pop up when you check event records.
	Current time
	Running hours set
	ECU DTC
	Oil filter maintenance timer
	Air filter maintenance timer
	Fuel filter maintenance timer

Mode icon

An icon will pop up in the mode icon area to indicate the mode currently used by the controller.

Icon	Notes:
	The engine is in standby state and the controller is in the Stop/Reset mode
	The engine is in standby state and the controller is in the manual mode
	The engine is in standby state and the controller is in the test mode
	The engine is in standby state and the controller is in the AUTO mode
	When the timer starts working, the icon for the preset turning time, waiting time for turning, etc. will pop up
	It pops up when the engine is running with/without load and all timers have finished timing When the engine is idling, the speed for the icon to pop up will become slow
	It pops up when FPE is started
	It pops up when the controller is connected to the USB equipment
	It pops up when the configuration file or engine file is damaged

Common alarm icon

Giving a common alarm generally indicates that the condition is not very serious, and will also not affect the operation of the alternator system. It is just to remind the user that there is a poor condition.

By default, the common alarm will automatically disappear after the fault is removed. If all the common alarms are set to be locked and saved, these alarms can be released only after manual reset. The controller can be connected to the computer and be set through DSE settings.

Icon	Fault	Description
	User-defined input	The controller detects that the user-defined input preset by the user as a fault condition has been activated
	Analog input	The controller detects that the input preset by the user as a fault condition has been activated
	Failure in stop	⚠Note: Failure in shutdown may mean that the oil pressure sensor gets faulted. If the engine is in standby state, check the oil pressure sensor for wiring and setting. The controller detects that the engine has been instructed to stop but the set is still running
	Charging fault	The auxiliary charging motor voltage is lower than the measured voltage of W/L terminal
	Low oil level	The oil level sensor detects a low oil level value lower than the preset
	High oil level	The oil level sensor detects a high oil level value higher than the preset
	Insufficient battery voltage	The voltage of DC power supply is lower or higher than the preset LV pre-alarm value
	Battery overvoltage	The voltage of DC power supply rises above the preset HV pre-alarm value
	Battery undervoltage	After the safety delay, the alternator voltage drops below the preset alarm value
	Alternator overvoltage	The alternator output voltage rises above the preset alarm value
	Alternator underfrequency	After the safety delay, the alternator output frequency drops below the preset alarm value
	Alternator overfrequency	The alternator output frequency rises above the preset alarm value
	CAN ECU fault	The engine ECU detects an alarm
	Invalid CAN data	The controller is set to be operated through CAN but fails to detect CAN data connection of the engine
	Valid immediate overcurrent	The detected current is higher than the set trip value
	Delay overcurrent	The detected current is higher than the set trip value after a certain time.

	Oil filter maintenance alarm	Oil filter maintenance expiration
	Air filter maintenance alarm	Air filter maintenance expiration
	Fuel filter maintenance alarm	Fuel filter maintenance expiration

Electrical trip fault icon

The controller can be reset only after an alarm is released. When an alarm is given, the controller cannot be reset (except for low oil pressure alarm and similar safety alarm, because the oil pressure is very low when the engine is in standby state).

Electrical trip is a controllable way to lock and stop the alternator. When the electrical trip becomes valid, the controller will cut off all delay load outputs and turn off the alternator output to complete the unloading. At the same time, the controller will start the cooling timer and let the engine cool down with the engine unloaded. The controller can be restarted only after reception and release of the alarm and removal of the fault.

As the alarm will be locked by electrical trip, to remove the fault, please press the Stop/Reset button.

Icon	Fault	Description
	User-defined input	The controller detects that the user-defined input set by the user as a fault has become valid.
	Analog input	The controller detects that the input set as a fault has become valid.
	Low oil level	The oil level sensor detects that the oil level value has already been lower than the preset low level alarm value.
	High oil level	The oil level sensor detects that the oil level value has already been higher than the preset high level alarm value.
	Overcurrent delay	In the set time, it is detected that the current is higher than the set trip value
	Power overload	In the set time, it is detected that the power is higher than the set trip value

Shutdown alarm icon

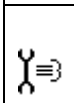
The fault must be removed before restart. If the alarm condition is present, the controller will not restart (except for low oil pressure alarm and similar safety alarm, because the oil pressure is very low when the engine is in standby state).

The alternator will be locked and stopped immediately after the shutdown alarm is given. When the shutdown becomes valid, the controller will cut off all delay load outputs and turn off the alternator output to remove the load. Once this condition happens, the controller will immediately stop all sets from operating, to prevent this condition from worsening. The controller can only be restarted after the reception and release of the alarm and removal of the fault.

As the alarm will be locked by shutdown, to remove the fault, please press the Stop/Reset button.

Icon	Fault	Description
	User-defined input	The controller detects that the user-defined input set by the user as a fault has become valid.
	Analog input	The controller detects that the input set by the user as a fault has become valid.
	Start failure	The engine fails to start.
	Low oil pressure	The controller detects that the engine oil pressure is lower than the preset alarm value
	The engine overheats.	The controller detects that the engine coolant temperature is higher than the preset high temperature alarm value
	Underspeed	The engine speed is lower than the preset minimum value
	Excessively high speed	The engine speed is higher than the preset high alarm value
	Charging failure	At the W/L terminal, it is detected that the voltage of auxiliary charging motor is low
	Low oil level	The oil level sensor detects that the oil level value is lower than the preset low level alarm value
	High oil level	The oil level sensor detects that the oil level value is higher than the preset high level alarm value
	Alternator undervoltage	The alternator output voltage is lower than the preset alarm value
	Alternator over-voltage	The alternator output voltage is higher than the preset alarm value

See next page for other shutdown alarm icons

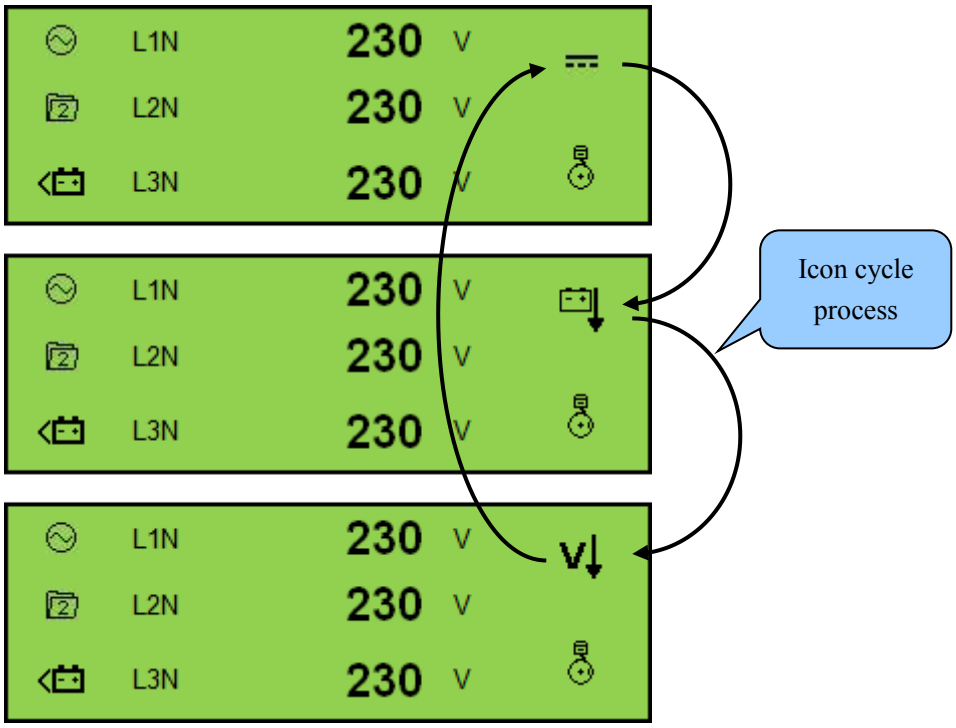
Icon	Fault	Description
	Alternator underfrequency	After the safety delay, the alternator output frequency is lower than the preset alarm value
	Alternator overfrequency	The alternator output frequency is higher than the preset alarm value
	Overcurrent delay	In a certain period of time, it is detected that the current is higher than the preset trip value
	Too high power	In a certain period of time, it is detected that the power is higher than the preset trip value
	CAN ECU fault	The engine ECU detects an alarm for "detecting engine light" Please contact the technical support personnel of the engine manufacturer
	Invalid CAN data	The controller is set to be operated through CAN but fails to detect CAN data connection of the engine
	Emergency shutdown	The emergency stop button cannot be used. Once the fail-safe (usually closed as emergency stop) signal is inputted, the set is stopped immediately until the signal disappears.
	Oil pressure sensor open circuit	Oil pressure sensor open circuit
	Coolant sensor open circuit	It is detected that the coolant sensor is open circuited
	Oil filter maintenance alarm	Oil filter maintenance expiration
	Air filter maintenance alarm	Air filter maintenance expiration
	Fuel filter maintenance alarm	Fuel filter maintenance expiration

Alarm icon (protection)

An icon will be displayed in the alarm icon area to indicate that an alarm is given out by the controller.

In case a common alarm is given, LCD will display an alarm icon. In case of electrical trip or shutdown fault, the controller will not only display the alarm icon, but also the LED indicator on the Stop/Reset button will flash.

If many alarms are given simultaneously, the alarm icon will automatically and circularly give indications among icons.
such as:
If the DSE controller detects a charger fault alarm and delays an overcurrent alarm and an AC undervoltage alarm, the alarm icon will circulate in each icon area.



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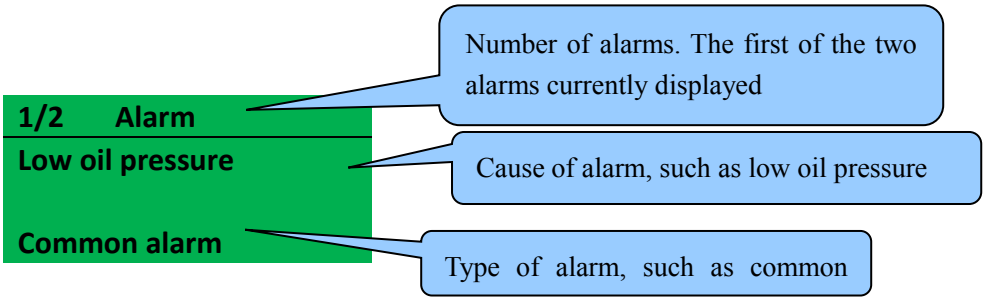
Alarm

When an alarm is valid, the internal audible alarm will blow, and if defined, the LED indicator on the right side of the screen will be on mute: This alarm can be activated by pressing the **mute/lamp test button** .

The LCD display skips from the "current page" to the alarm page.



LCD can display multiple alarms, such as "high coolant temperature", "emergency shutdown" and "low cooling temperature alarm". These will be displayed automatically in the order in which the alarm occurs, or manually turned by pressing the **up or down button** .

If an alarm occurs, the LCD screen displays the specific text information. If an external alarm occurs later, the controller will display text information.

such as:

1/2 Alarm
Low oil pressure
Common alarm

2/2 Alarm
High coolant temperature
Shutdown alarms

ECU alarm (EFI engine fault code/DTC)

When connected to a matching engine, the controller reads and displays the alarm status information from the ECU.

1/1 Alarm
ECU yellow alarm
Common alarm

Alarm type has been triggered and displayed on the

Press the **next page** button  to view the current engine DTCs (diagnostic trouble code) from the DM1 information of the ECU.

1/2 Current DTCs of ECU
Low water level
SPN=131166 , FMI=8, OC=127

The DM1 DTC is parsed by the controller and displayed in the controller in a text message. In addition, the engine manufacturer's DTC information is displayed below.

Press the **next page button**  to view the previous DTCs (diagnostic trouble code) of ECU from the DM2 information of the ECU.

1/1 Previous DTCs of 0 ECU
Low water level
SPN=131166 , FMI=8, OC=127

The DM2 DTC is parsed by the controller and displayed in the controller in a text message. In addition, the engine manufacturer's DTC information is displayed below.

Historical information menu

6020MKII

Event record

Event records of the controller contain 50 events and engine running hours. Event records can be customized by DSE setting software.

Once event records are full, new records will be used to overwrite old ones. Therefore, the latest event records are always kept. The controller will record all alarms and engine running hours.

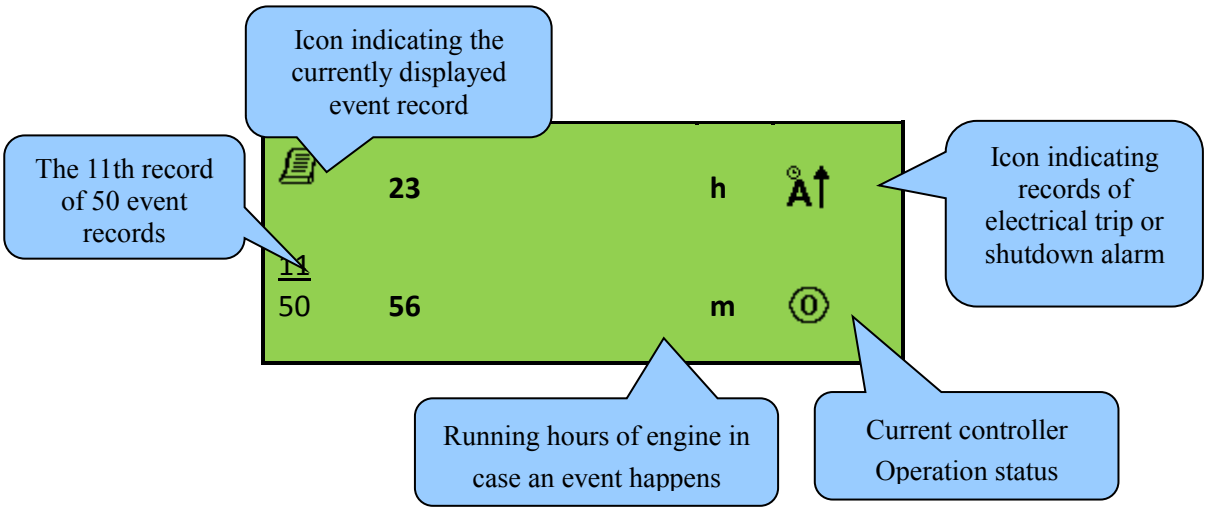
Event records check

To check event records, please press Up and Down buttons simultaneously to enter the navigation menu, and then scroll to the event records ( ) section.

To check event records, please press Up and Down buttons continuously until the desired records are displayed on LCD.

After reading through the latest alarm records, continue to press Up and Down buttons to check the previous alarm records.

To exit from the event records, please press Up and Down buttons simultaneously to enter the navigation menu, and then scroll to the desired meter parameter section.



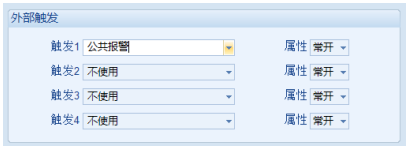
7320MKII

The controller displays the recorded total time/total memory, not the remaining time/remaining memory.

The total time is the actual clock, and the total time calculated at different intervals will vary.

Up to 10 items can be recorded, which is triggered when a specific event exceeds the recorded range

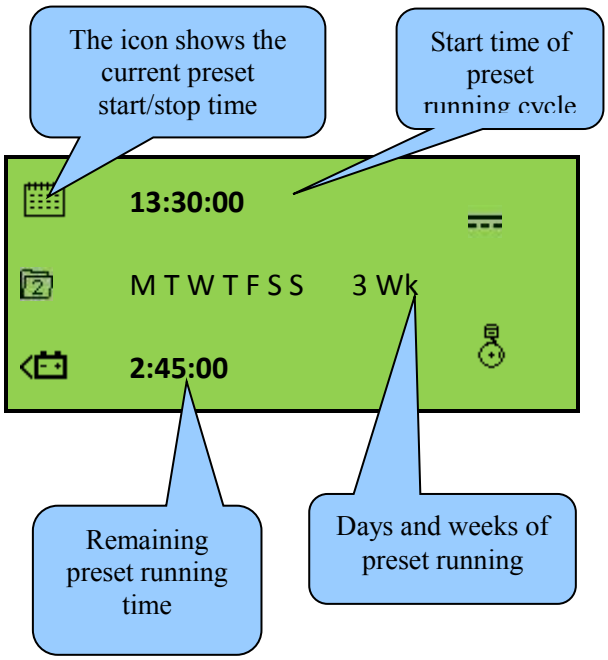
Data records are stored in memory



Menu (software version, etc.)

6020MKII
Controller information

The interface contains the information of the controller.

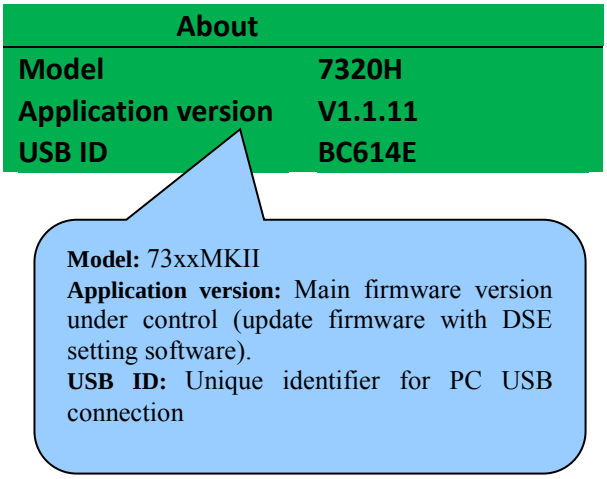


Date and time of controller
Cycle Setting
Product information and USB identification code
Application and engine version

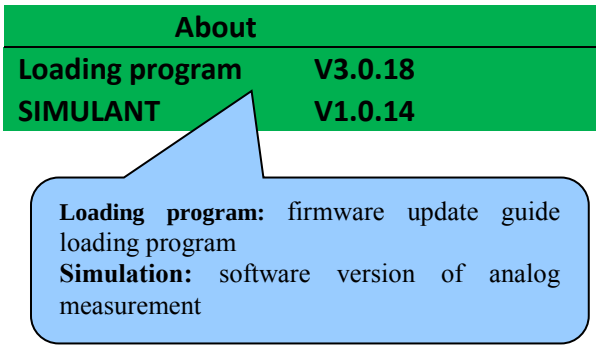
7320MKII
Controller information

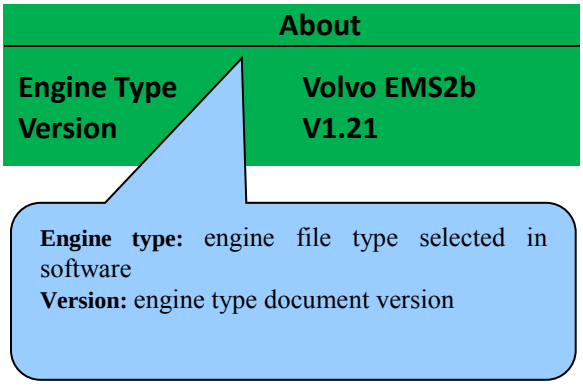
Important information is included between the controller and the firmware.

The information may be consulted or contacted with DSE's technical support department.



Press the **down button**  to view more information about the controller.





Parallel operation of the set and precautions

Parallel operation of the set can improve the reliability and stability of power supply. In addition, when the load changes greatly, the number of sets connected in parallel can be determined according to the load size, thus realizing economic operation.

Preparations before paralleling

1. Check whether the diesel, oil and water levels of the engine and check battery as well;
2. Check whether the controller and peripheral wiring are correct and avoid short circuit according to the electrical drawings;
3. Check the grounding system: check whether the grounding of controller (connected to engine housing), engine grounding system and grounding of current transformer are good;
4. Set up the program according to the drawings;
5. Check whether the single set startup operation and opening and closing of circuit breaker are normal;
6. Perform phase sequence detection to ensure that the phase sequence of all sets to be connected in parallel is consistent.

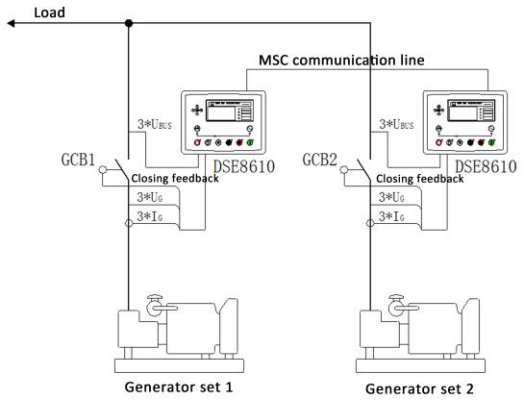
Four elements for parallel connection

1. The phase sequence is the same;
2. The frequency must be the same (minimal error is allowed);
3. The voltage must be the same (minimal error allowed);
4. Voltage phase angle must be the same (minimal error is allowed).

Note: When the parallel switch is closed, if the above conditions are not met, excessive mechanical and current impact will be caused to the alternator and equipment may get damaged.

Two generator sets in parallel

The two generator sets are manually/automatically connected in parallel to the common busbar, and the controller automatically equalizes the load and automatically starts/stops the set according to the load size. The deep-sea parallel controller supports parallel connection of 32 sets.



Primary system diagram

Description of two generator sets in parallel:

■ Two DSE8610 controllers are selected.

■ The generator set starts automatically when the "remote on-load start" input is activated.

■ The set circuit breaker is automatically controlled.

■ The start and end of the MSC communication line must be connected in parallel with a 120Ω resistance.

■ Necessary detection signals such as generation voltage, generation

current, busbar voltage and generation circuit breaker closing are fed back.

■ Required settings:

Input: remote on-load start.

Output: set closing output.

Multiple sets: priority and ID number cannot be repeated

Load requirements: Initially start all the sets or start sets according to load requirements.

Manual startup and shutdown steps:

Place the switch knob on the switchgear in the automatic position, operate the DSE861MKII controller of the control panel beside the set, press the manual button to put the set in the manual mode, then press the start button to start the generator set, and after the generator set rises to the rated state after idle running for some time, check whether the set voltage and frequency are correct, oil pressure and water temperature on the control panel are normal and the set is abnormal. If the set is in normal condition, press the closing button on the DSE861MKII controller: if there are no sets connected in parallel on the busbar at this time, the set directly issues the closing command to control the closing of the circuit breaker; if there are sets connected in parallel on the busbar at this time (other sets have been closed), the DSE861MKII module will automatically issue a synchronization command to control the set to carry out speed adjustment and voltage adjustment. When the alternator voltage and busbar voltage frequencies are detected to be the same, the voltage is the same, and the phase angle is consistent, the DSE8610MKII module will automatically issue a closing command to control the circuit breaker to close. At this time, the set will complete the synchronization process and realize parallel operation. After parallel operation,

in manual mode, it is necessary to confirm before shutdown that the power generation of the remaining sets connected in parallel can meet the load requirements after shutdown of the set. Press the opening button on the DSE861MKII controller directly and wait for the load transfer to be completed. After the opening is completed, press the stop button on the DSE861MKII controller to ensure that the diesel engine will stop after the cooling delay.

Note: Manual operation of the circuit breaker at the switchgear is prohibited when multiple generator sets are manually connected in parallel.

Automatic startup steps:

Place the switch knob on the switchgear in the automatic position.

Place the DSE861MKII controller of the control panel beside the set in auto mode. After the DSE861MKII controller of the control panel beside the set receives the remote start signal, multiple diesel alternators start at the same time, and then any set first automatically closes after the rated voltage is met (the priority of multiple sets is the same level) to transmit power to the busbar section, and then the DSE8610MKII parallel modules of other sets perform simultaneous detection. After it is detected that the frequency, voltage and phase angle of the alternator and busbar are the same, the alternate automatically closes to the busbar section to realize parallel connection of

multiple sets.

When the synchronization process starts, the controller will automatically switch from the status page to the synchronization window page. When parallel connection occurs, the ramp adjustment process will also be displayed in the synchronization window page.

Automatic load distribution:

After multiple sets are connected in parallel, the set can run with load, and the power distribution control unit inside the DSE8610MKII control module will act on the speed regulating system and the voltage regulating system to distribute the load according to the proportion set by the program in advance.

When the models of multiple sets connected in parallel are consistent, the average power distribution is default; when the models of multiple sets connected in parallel are inconsistent, the average power distribution by capacity proportion is default.

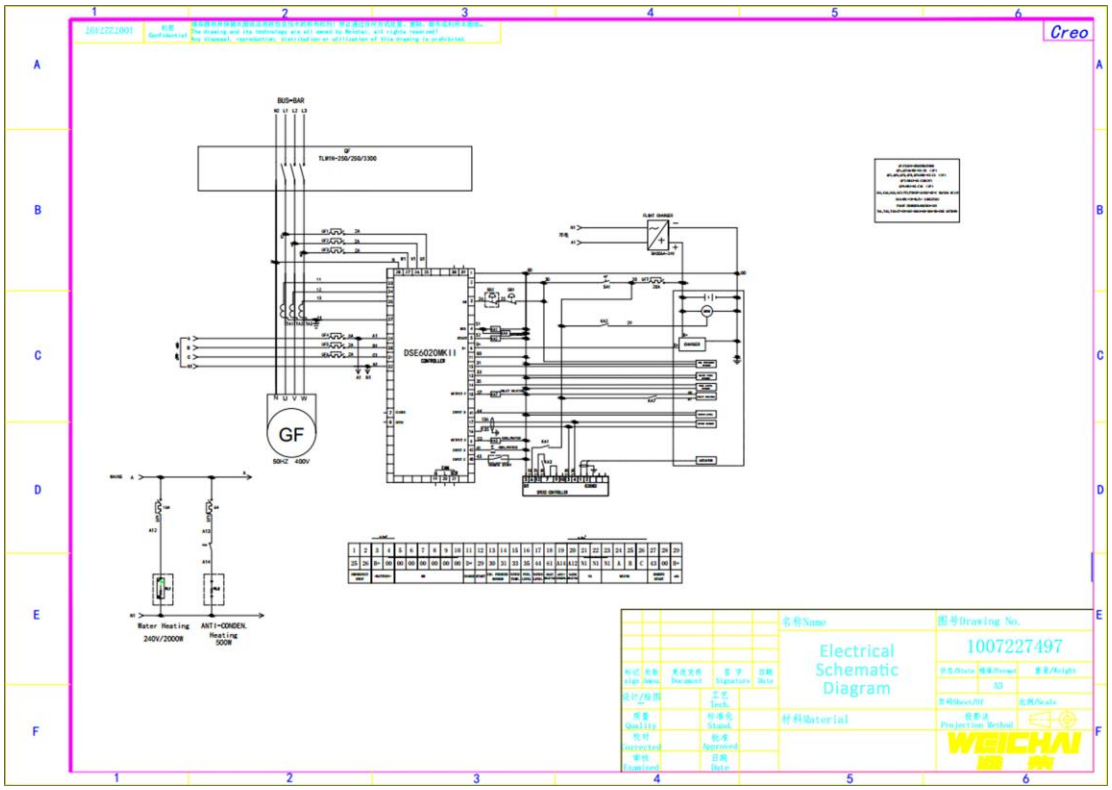
Automatic control of sets connected in parallel

When multiple sets run in parallel and the load changes, the number of running generator sets can be increased and decreased according to the total load. The set starts and stops automatically according to the load size, making the set work in the most economical state.

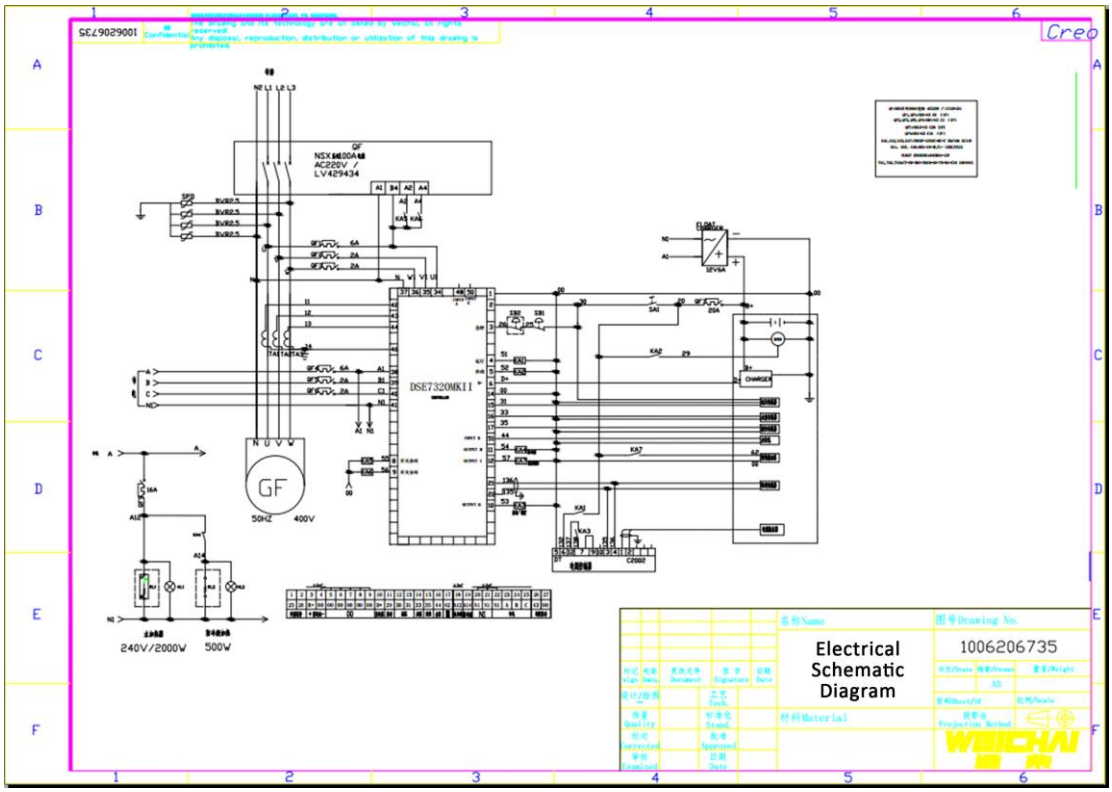
After multiple sets are in normal parallel operation, the parallel control system DSE8610MKII detects the load size change. If the load exceeds 80% (adjustable) of the total capacity of the existing sets connected in parallel, the parallel control system DSE8610MKII controls to start the next set, and automatically synchronizes and closes for parallel operation after startup. At this time, the built-in load distributor DSE8610MKII will be put into operation, and automatically detect the load condition of each set, and automatically distribute the load to the set according to the load condition to balance the load of the set.

When multiple sets are in parallel operation, the parallel control system DSE8610MKII detects the load size change. If the load is less than 50% (adjustable) of the total capacity of (N-1) sets connected in parallel, the built-in load distributor of the parallel control system DSE8610MKII will automatically transfer all loads out of the Nth set, and after this process is completed, disconnection signal is given to the Nth set. The Nth set is released from parallel operation. After disconnection, the unloaded set is cooled regularly and then shuts down and enters the standby state.

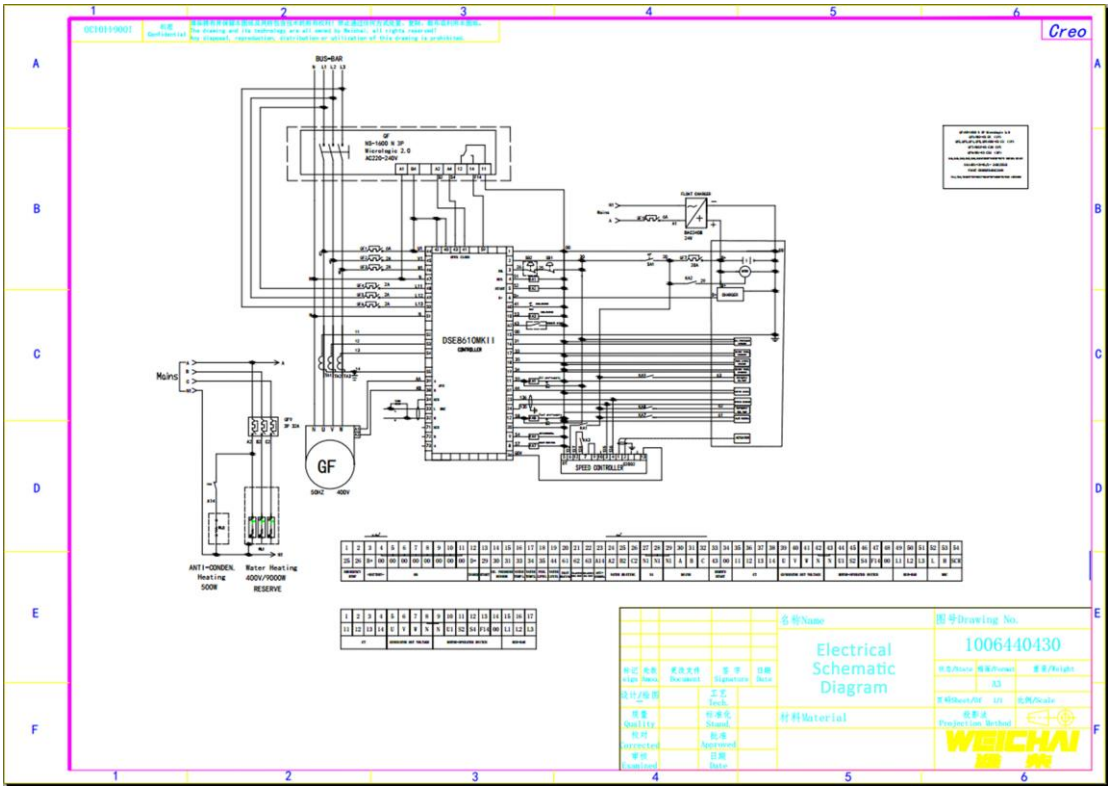
Electrical schematic diagram of set



Common function



Automation function



Parallel function

4 Troubleshooting

Overall introduction

GENERAL

The genset control continuously monitors engine sensors for abnormal conditions, such as low oil pressure and high coolant temperature. If any of these conditions occur, the control will light a yellow Warning lamp or a red Shutdown lamp and display a message on the digital display.

Safety tips

SAFETY CONSIDERATIONS

Contacting high voltage components may result in severe personal injury or death. Keep the output box covers in place during troubleshooting.

High voltages are present when the set is running. Do not open the generator output box while the set is running.

Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery—Wear goggles—Stop genset and disconnect charger before disconnecting battery cables—Disconnect negative (−) cable first and reconnect last.

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the generator set.

Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (−) cable from the battery terminal.

When troubleshooting a set that is shut down, ensure that the generator set cannot be accidentally re- started as follows:

1. Move the O/Manual/Auto switch on the control panel to the O (off) position.

2. Turn off or remove AC power from the battery charger.

3. Remove the negative (−) battery cable from the generator set starting battery.

Faults and Troubleshooting Methods of Diesel Engine

1. Start failure or start difficulty of diesel engine

Cause analysis: The following problems—starting system fault, fuel supply system fault, and intake system fault may contribute to failure in starting of the diesel engine. If the start failure is not caused by the above reasons, check whether the speed sensor and wiring are correct.

Tab. 4-1 Faults of starting system

S/N	Fault	Treatment method
1	The control system is not powered ON	Close the power switch of control box system
2	The battery is low or is damaged	Check the battery voltage. In case of under-voltage, charge it by floating charging device. In case of damage, maintain and replace the battery if necessary
3	The fuse in control box is blown	Replace the fuse
4	Fault of starter relay	Replace the starter relay
5	Circuit fault	Eliminate any open circuit and poor contact; check the connection for oxidation and clean it if necessary
6	Fault of starter motor	Contact after-sales service personnel for repair or replacement

Tab. 4-2 Faults of fuel supply system

S/N	Fault	Treatment method
1	There is no fuel in the fuel tank	Filling of fuel
2	Fault of shutdown solenoid valve	Check the shutdown solenoid valve and replace it if necessary
3	The fuel filter or the intake pipe is blocked	Replace the fuel filter and check the fuel hose for blockage
4	The suction pipe joint of fuel supply pump is loose	Tighten all filter pipe joints from the fuel tank to the fuel pump
5	Fault of fuel supply pump	Contact after-sales service personnel for repair or replacement
6	Fault of fuel injection pump	Contact after-sales service personnel for repair or replacement

7	Fault of fuel injector	Contact after-sales service personnel for repair or replacement
8	Diesel contains water	Check the fuel tank, unscrew the bolts at the lower part of the diesel filter to drain water, and install an oil-water separator.

Tab. 4-3 Faults of governor (actuator does not act)

S/N	Fault	Treatment method
1	The governor is not powered ON	The polarity of the power supply is reversed; reconnect the power supply.
2	The maximum fuel quantity of the controller is set to the zero position	Adjust the maximum fuel quantity of the controller
3	The actuator drive rod is stuck	Repair
4	The connection cable is broken	Replace the cable
5	Controller fault	Replace the controller

Tab. 4-4 Faults of intake system

S/N	Fault	Treatment method
1	Leakage of air intake system	Find out the fault point, and conduct repair or replacement
2	The intake manifold is blocked	Clean the intake manifold and replace it if necessary
3	Fault of air filter	Clean the air filter and replace it if necessary
4	Air leakage at intake and exhaust valves	Contact after-sales service personnel for repair or replacement
5	Air leakage at cylinder	Contact after-sales service personnel for repair or replacement
6	Gas leakage of piston ring	Replace the piston ring

2. The diesel engine runs but emits smoke

Cause analysis: In normal operation, the smoke emitted by the diesel engine is colorless. Black smoke, blue smoke and white smoke emitted from the exhaust pipe of the diesel engine are caused by the following reasons.

(1) Black smoke from the exhaust pipe of diesel engine is often caused by insufficient mixing of diesel and air (large amount of diesel and small amount of air in cylinder) and incomplete combustion of diesel. A large amount of diesel is discharged in the form of free carbon particles, resulting in black smoke.

Tab. 4-5 Causes of black smoke from diesel engine

S/N	Fault	Treatment method
1	Leakage of air intake system	Find out the fault point, and conduct repair or replacement
2	The intake manifold is blocked	Clean the intake manifold and replace it if necessary
3	Fault of air filter	Clean the air filter and replace it if necessary
4	Wear of piston ring causes insufficient compression pressure of cylinder	Replace the piston ring
5	Incorrect valve clearance	Contact after-sales service personnel for repair or replacement
6	High temperature or altitude results in thin air	Consult the sales staff to correct the set power
7	The fault of fuel injection pump causes insufficient injection pressure	Contact after-sales service personnel for repair or replacement
8	The supply amount of fuel injection pump is excessive	Contact with after-sales service personnel for adjustment
9	Fault of electronic governor of fuel injection pump	Contact after-sales service personnel for repair or replacement
10	The fuel supply timing is incorrect	Contact the after-sales service personnel to adjust the injection advance angle
11	Fuel injector fault, poor diesel atomization	Contact after-sales service personnel for repair or replacement
12	Turbocharger fault	Repair or replace the turbocharger

(2) Blue smoke from the diesel engine is usually caused by long-time running of diesel engine and gradual burning of oil. With the blue smoke becoming dense, the oil burning situation is worsened, so maintenance of the diesel engine shall be considered. Sometimes water is mixed in the fuel, or water permeates into the combustion chamber, causing combustion change, and the diesel engine will emit light blue smoke.

Tab. 4-6 Causes of blue smoke from diesel engine

S/N	Fault	Treatment method
1	Leakage of air intake system	Find out the fault point, and conduct repair or replacement
2	The intake manifold is blocked	Clean the intake manifold and replace it if necessary

3	Fault of air filter	Clean the air filter and replace it if necessary
4	Too much oil is added in the oil pan, and the oil flows into the combustion chamber when the diesel engine is running	Drain excess oil
5	Long-term low-load (40%) operation increases the clearance between piston and cylinder liner and causes oil inflow in the combustion chamber	Increase the load appropriately, or select a generator set with appropriate power
6	The piston ring is stuck or excessively worn. Thus, its elasticity is insufficient, resulting in oil inflow in the combustion chamber	Replace the piston ring

(3) White smoke is different from colorless smoke, and it indicates that the smoke contains moisture or unburned fuel. The white smoke of diesel engine is mixture of unburned hydrocarbon (including fuel oil and lubricating oil), water vapor and intermediate products of incomplete combustion (such as oxygenated hydrocarbon). White smoke is emitted from the exhaust pipe when the diesel engine is just started or in the cold state is formed by the fuel vapor at low temperature in the cylinder of the diesel engine. Such situation is more apparent in winter. When the diesel engine runs in cold weather, the temperature of the diesel engine remains low, so is the temperature of the exhaust pipe. It is normal that the exhaust vapor condenses into the steam and forms white exhaust smoke. If white smoke is still emitted when the temperature of diesel engine and exhaust pipe is normal, it means that the diesel engine does not function properly and may considered as faulty.

Tab. 4-7 Causes of white smoke from diesel engine

S/N	Fault	Treatment method
1	When the diesel engine is just started (especially in winter or when the ambient temperature is low), the unburned fuel mixture will discharged with the exhaust gas	Normal
2	The cracks of cylinder liner or the damage of cylinder head gasket causes inflow of cooling water in the cylinder	Contact after-sales service personnel for repair or replacement
3	The poor atomization of fuel injector and low fuel injection pressure lead to oil dripping	Contact after-sales service personnel for repair or replacement

4	The oil supply advance angle is too small	Contact with after-sales service personnel for adjustment
5	There is moisture and air in the fuel	Replace the fuel, and install an oil-water separator. Loosen the bleed screw on the diesel filter, pump fuel with a manual fuel pump to the bleed screw, exhaust the air in the fuel system, and then tighten the bleed screw.
6	The piston ring is stuck or excessively worn. Thus, its elasticity is inadequate, resulting in oil inflow in the combustion chamber	Replace the piston ring

3. Diesel engine cannot reach rated speed

S/N	Fault	Treatment method
1	Speed display problem	Check with a hand-held tachometer or digital tachometer
2	Speed sensor malfunction	Contact after-sales service personnel for repair or replacement
3	The fuel supply system is blocked	Check the suction pipe and fuel filter for blockage, and replace them if necessary
4	There is water in diesel	Replace the fuel, and install an oil-water separator
5	Improper adjustment of throttle control lever	Check the throttle stroke
6	Governor fault	Check and adjust the governor
7	The maximum speed limit of governor is set too low	Check and adjust the governor

4. Shutdown failure of set

S/N	Fault	Treatment method
1	A fuse in the junction box is disconnected	Press the button on the fuse to reset it
2	Poor contact, disconnected circuit	Eliminate any open circuit/poor contact fault, check the connection for oxidation and clean it if necessary
3	Stop button fault	Replace the stop button

4	Fault of shutdown solenoid valve	Check and replace the shutdown solenoid valve
5	The oil return pipe is blocked	Check the oil return pipe for blockage, twisting or sinking, and replace it if necessary

5. Insufficient output power of diesel engine

S/N	Fault	Treatment method
1	The engine load is excessive compare to its rated power	Reduce the load or select a diesel engine with higher rated power
2	High temperature or altitude results in low air flow	Consult the sales staff to correct the set power
3	Leakage of air intake system	Find out the fault point, and conduct repair or replacement
4	The intake manifold is blocked	Clean the intake manifold and replace it if necessary
5	Fault of air filter	Clean the air filter and replace it if necessary
6	The exhaust pipe is blocked	Remove the carbon deposit in the exhaust manifold, and replace the manifold if necessary
7	The silencer is blocked	Remove the carbon deposit in the silencer, and replace the silencer if necessary
8	The exhaust turbocharger is blocked or the impeller is damaged	Clean the exhaust turbocharger and replace it if necessary
9	Wear of piston ring causes insufficient compression pressure of cylinder	Replace the piston ring
10	The intake and exhaust valves are not tightly sealed, causing leakage during compression	Contact after-sales service personnel for repair or replacement
11	The valve spring is damaged, making valve return difficult	Contact after-sales service personnel for repair or replacement
12	The valve clearance is incorrect causing air leakage	Contact after-sales service personnel for repair or replacement
13	The damage of cylinder head gasket causes air leakage at the joint surface between the cylinder head and the engine block	Replace the cylinder head gasket
14	The oil supply advance angle is	Contact with after-sales service

	inaccurate	personnel for adjustment
15	The diesel filter is blocked	Check and clean the diesel filter element frequently, and replace it if necessary
16	The fuel supply line is blocked	Check and replace
17	There is air in the fuel circuit, causing large fluctuation of the injection pressure	Loosen the bleed screw on the diesel filter, pump fuel with a manual fuel pump to the bleed screw, exhaust the air in the fuel system, and then tighten the bleed screw.
18	There is water in the fuel	Replace the fuel, and install an oil-water separator
19	The fuel injector coupling is damaged or the fuel atomization is poor.	Contact after-sales service personnel for repair or replacement
20	The fuel supply of fuel injection pump is insufficient or uneven	Contact after-sales service personnel for repair or replacement
21	Improper adjustment of the maximum fuel supply limit screw of the fuel injection pump	Adjust the high speed limit screw
22	Governor fault	Contact after-sales service personnel for repair or replacement
23	Insufficient supply from fuel supply pump	Contact after-sales service personnel for repair or replacement
24	The piston ring, piston and cylinder liner are worn	Replace the cylinder liner, piston and piston ring.
25	The cold state of diesel engine is not conducive to the combustion of combustible mixture	It is normal, and the diesel engine can only run with load in the hot state
26	Excessive diesel engine temperature and reduced cylinder charge causes incomplete combustion	Check the working condition of cooling system and repair it
27	Excessive oil viscosity increases the running resistance and power consumption of diesel engine	Clean the lubrication system and replace the oil of appropriate grade
28	Excess oil in the oil pan, and the crankshaft runs in the oil with great resistance	Drain excess oil

6. Excessively low pressure of lubricating oil

S/N	Fault	Treatment method
1	Defective oil pressure gauge and oil pressure sensor	Correct the oil pressure gauge and oil pressure sensor, and replace them if necessary
2	Insufficient oil	Add oil
3	High oil temperature causes low oil viscosity, resulting in decrease in oil pressure	Check the cooling system and oil cooler
4	Oil leakage at internal and external lubricating oil passages of diesel engine	Replace the parts with leakage
5	The oil filter is blocked	Replace the engine oil filter.
6	The oil suction pan is blocked	Clean the oil suction pan
7	Oil deterioration or mixture of other liquids in oil causing decrease of the viscosity, resulting decrease of oil pressure	Replace oil
8	Insufficient oil pump capacity	Replace the oil pump
9	Excessive fit clearance between crankshaft and bearing is due to wear	Replace the main and connecting rod bearings

7. Excessively high fluid coolant temperature

S/N	Fault	Treatment method
1	There is no or little oil in the oil pan	Add oil
2	Insufficient coolant	Add coolant
3	Water pump fault	Contact after-sales service personnel for repair or replacement
4	Thermostat fault	Contact after-sales service personnel for repair or replacement
5	Hose damage	Replace the connecting hose
6	Belt looseness	Adjust the tension of the belt and replace it if necessary
7	The radiator is blocked	Clean the radiator

8. Excessive fuel consumption

S/N	Fault	Treatment method
1	Fault of fuel injector	Contact after-sales service

		personnel for repair or replacement
2	Poor quality of diesel	Use fuel of appropriate grade
3	The air intake system is unobstructed	Clean the intake manifold and air filter, and replace them if necessary
4	The exhaust back pressure is too high	Clean carbon deposit in exhaust manifold and silencer
5	The turbocharger is dirty	Clean the turbocharger
6	The fuel supply system is blocked	Check and replace the fuel filter, sealing gasket and oil supply pipeline
7	Fuel supply system leakage	Replace in time
8	Faulty fuel injection pump	Contact after-sales service personnel for recalibration or replacement
9	Excess oil in oil pan	Drain excess oil

9. Excessive consumption of lubricating oil

Main cause: engine oil burnt

S/N	Fault	Treatment method
1	The lubricating oil grade is incorrect	Use lubricating oil of correct grade.
2	The piston ring, piston and cylinder liner are seriously worn, causing oil inflow in the combustion chamber	Replace the piston ring, piston and cylinder liner
3	The valve stem and valve guide are seriously worn, causing oil inflow in the combustion chamber	Replace the valve stem and valve guide
4	Excessive oil in the oil pan leads to oil inflow in the combustion chamber	Drain excess oil

10. Abnormal noise or vibration from diesel engine during operation

S/N	Fault	Treatment method
1	Early oil injection or uneven oil supply in each cylinder causes crisp and rhythmic metal knocking sound in the cylinder, and the sound is obviously louder at start-up or low speed	Adjust the oil supply advance angle or adjust the oil quantity uniformity
2	The clearance between the intake and exhaust valves is too large,	Adjust valve clearance

	causing rhythmic slight tapping sound	
3	If the diesel engine load is increased when the engine is not warmed up, knocking sound will be generated because the clearance between the piston and the cylinder liner is relatively large	Unload and idle to warm up
4	Excessive wear of piston, piston ring and cylinder liner causing knocking sound	Replace corresponding parts
5	Knocking sound across engine because of heavy wear of journal and bearing bush of crankshaft.	Check or replace the bearing
6	Excessive compression ratio, rough running and intensive vibration	Adjust the compression ratio
7	The clearance between the intake and exhaust valves is too small or the intake and exhaust timing is incorrect, causing the valves hitting the top of the piston	Adjust the valve clearance or valve timing
8	Individual cylinders are not working resulting heavy vibrations in engine	Check the fuel system and eliminate the fault
9	Valve breakage (or sudden and violent impact sound made due to the damage of the valve collet, the valve falling or the piston breaking)	Stop immediately for inspection
10	Air leakage howling at the cylinder head gasket	Check the tightness of the cylinder head nut, and replace the cylinder head gasket if necessary
11	Knocking sound due to excessive wear of gears	Check and replace it.
12	The engine vibrations are intensified because of fixing bolts of engine are loose or damaged.	Tighten or replace the bolts
13	The diesel engine and the alternator are eccentric, so the vibration is intensified	Check and adjust.

11. Unstable operation of engine

S/N	Fault	Treatment method
1	Fault of electronic governor	Adjust the differential and gain of

		the electronic governor controller
2	Actuator fault	Remove, check (whether the rack of high-pressure fuel pump is flexible and whether the connection of transmission mechanism is loose) and repair
3	The electronic governor is installed in an environment with high voltage and strong interference	Strong shielding measures shall be taken, or the installation location shall be changed
4	Engine dual system governor not functioning automatically at low or medium diesel engine speed	Increase to the calibrated speed
5	Diesel engine load change frequency	Check the load output
6	Individual cylinders are intermittently ignited, causing knocking sound in the cylinder because of the excessive explosion of accumulated oil	Check the fuel system
7	The fuel quantity and fuel injection time of each fuel injection pump are inconsistent	Check and adjust it.
8	Air trapped in the fuel system.	Loosen the bleed screw on the diesel filter, pump fuel with a manual fuel pump to the bleed screw, exhaust the air in the fuel system, and then tighten the bleed screw.
9	The fuel system contains moisture	Check fuel and drain water
10	The timing gear moves back and forth	Check the fastening of gears

12. Engine speed losing control

The "speed losing control" of diesel engine is also called "surging", and is a manifestation of unstable speed of diesel engine. Phenomenon: When the diesel engine is running at idle speed or medium speed, it presents periodic and regular changes of speed. At the same time, the engine sound level rises and falls rhythmically; the rotating speed fluctuates greatly; and the sound can be clearly distinguished.
Periodic "speed losing control" of diesel engine will reduce the economic performance of diesel engine, cause unstable operation of the diesel engine, and aggravate the wear and fatigue of parts, thus affecting the service reliability of the diesel engine. In

severe cases, the diesel engine will not function properly.

S/N	Fault	Treatment method
1	The governor linkage is jammed; the lubricating oil is dirty or the lubrication effect is poor; foreign matter enters the surface of the fitting pair, making the governor linkage not move smoothly or increasing the resistance, thus reducing the sensitivity of the governor.	Check and adjust it.
2	The internal parts or working face of the governor are seriously worn, resulting in excessive resistance and reduced sensitivity of the governor	Check and adjust it.
3	The governor parts are too tightly matched and the motion resistance is too high; thus, the oil supply rod does not move flexibly	Check and adjust it.
4	There is too much oil filled in the governor. Because of the damping effect of oil, the expansion and contraction of the centrifugal block is hindered, thus reducing the sensitivity.	Check and adjust it.
5	All connection points of the governor are worn out of limit, resulting in loose matching and clearance increase. When the engine speed changes, the centrifugal thrust of the flying ball must eliminate the clearance, so that the oil supply adjustment rack (or shift fork) can be pulled to increase or decrease the oil supply quantity, making the governor function lag.	Check and adjust it.
6	The inflexible movement of the fuel supply control rod of the fuel injection pump hinders the normal function of the regulator, resulting in unstable fuel pumping quantity	Check and adjust it.

	and affecting the smooth operation of the engine.	
7	Incorrect injection timing, poor atomization and uneven injection pressure of nozzle	Check and adjust it.

13. Engine overspeed

Under normal operation, the engine speed suddenly rises and exceeds the rated speed, and cannot be controlled; the engine generates loud roar and emits a lot of black smoke or blue smoke from the exhaust pipe.

The fundamental cause of diesel engine overspeed is the loss or changes in the speed regulation characteristics. Faults of fuel injection pump and governor, such as sticking or loosening of related parts, will cause excessive supply and make them lose normal speed regulation characteristics. However, the extra diesel or oil in the combustion chamber will change the speed regulation characteristics of diesel engine.

S/N	Fault	Treatment method
1	During maintenance and assembling, the fuel injection pump plunger may not rotate smoothly or be stuck at the maximum supply position in case of the damage of fuel injection pump plunger and outlet valve seat, deformation of plunger sleeve due to excessive tightening torque, entry of foreign matters into the clearance of plunger pair, excessively thin spacer on the positioning bolt of plunger sleeve or long bolt jacking the plunger sleeve.	Check and adjust it.
2	The fixing screw for the fuel quantity adjusting gear ring of the fuel injection pump plunger is loose, making the plunger out of control.	Check and adjust it.
3	The plunger regulating arm of fuel injection pump or the ball head of rack adjusting arm does not enter into the groove of adjusting fork, so that the plunger is in the maximum supply position.	Check and adjust it.
4	The oil supply adjusting rack and the moving part of the governor are	Check and adjust it.

	stuck, and the oil quantity adjusting rack is disconnected from the linkage of the governor.	
5	Due to excessive lubricating oil, high viscosity or dirty oil in the governor, the ball of the governor cannot be thrown out in time when the speed rises, causing loss of control on the governor by the linkage or rack.	Check and adjust it.
6	Because of the skew of the flying ball seat or the wear of the inclined chute of the thrust plate force transmission plate, the flying ball of full speed governor cannot be thrown due to increased sliding resistance.	Check and adjust it.
7	Because the elastic force of the injector spring is too weak or the spring is broken, the injection pressure is low and the fuel in the cylinder is excessive.	Check and adjust it.
8	The pin shaft of governor flying ball breaks and falls off, and the flying ball is thrown off.	Check and adjust it.

Faults and troubleshooting methods of alternator

Important! Check whether all connections are disconnected or loose before any troubleshooting step.

AVR-troubleshooting

1. No voltage output when the set is running

1) Check whether the AVR wiring is correct and reliable;

2) Check the rotating speed of diesel generator set;

3) Check the residual magnetic voltage of the alternator and magnetize the alternator if necessary;

4) Check the alternator and AVR according to the steps of excitation separation test method.

5) The rotating diode is damaged.

2. Unstable output voltage of set

1) Check whether the rotating speed of the set is stable;

2) Check whether the stability setting is correct.

3. Output voltage too high

1) Check whether the rotating speed of the set is too high;

2) Check whether the load carried by the set is capacitive load (power factor lead).

4. Too low voltage at no load

1) Check whether the rotating speed of the set is too low;

2) Check whether the K1-K2 wire of AVR or the external manual fine adjustment device is in good condition.

5. Excessively low voltage under load

1) Check whether the rotating speed of the set is normal;

2) Check whether the alternator AVR is normal according to the steps of excitation separation test method;

3) The rotating diode is damaged.

Note:

See Operation Manual of Three-phase Synchronous Alternator for details of the faults and troubleshooting methods of synchronous alternators.

See the Operation Manual of Control Panel of Diesel Generator Set for troubleshooting methods of control panel of set.

See the Operation Manual of Electronic Governor for faults and troubleshooting methods of electronic governor.

For more detailed contents about fault analysis and troubleshooting of the control module, please also see the random data of control box.

5 Maintenance

Overall introduction

GENERAL

Establish and adhere to a definite schedule for maintenance and service based on the application and severity of the environment. If the set will be subjected to extreme operating conditions, the service intervals should be reduced accordingly. Some of the factors that can affect the maintenance schedule are the following:

- Use for continuous duty (prime power)
- Extreme ambient temperature
- Exposure to weather
- Exposure to salt water
- Exposure to dust, sand or other airborne contaminates.

Consult with your local Weichai Generation distributor if the generator set will be subjected to any extreme operating conditions and determine a suitable schedule of maintenance. Use the running time meter to keep an accurate log of all service per- formed for warranty support. Perform all service at the time period indicated or after the number of operating hours indicated, whichever comes first.

Daily technical maintenance

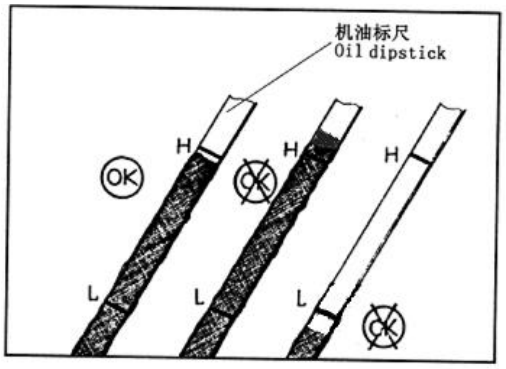
1) Check the control panel and generator set for dust accumulation, and clean them if necessary to prevent the dust or pollutants from causing electric shock or affecting the cooling effect of the generator set.

2) Check the fuel, oil and coolant levels

Fuel level: Do not start the set when the fuel level is lower than the low scale. Add proper amount of diesel into the chassis fuel tank.

Oil level: As shown in Fig. 5-1, when the oil level is lower than L (low level) scale or higher than H (high level) scale, do not start the set. When the liquid level is lower than L (low level) scale, add the oil of same grade to H scale. When the liquid level is higher than the H scale, discharge a proper amount of oil to the H scale.

Fig. 5-1 Oil level



Coolant level: When the coolant level is low, add a proper amount of coolant into the water tank.

Caution! Do not open the radiator cover before the coolant is cooled sufficiently; otherwise, scalds will be caused easily.

Caution! Do not add a large amount of coolant when the engine is hot; otherwise, severe damage will be caused to the set.

Caution! Coolant shall be added slowly, so that the residual air in the engine cooling system can be exhausted.

Caution! Check the coolant level, and it is preferably within 5 cm below the filler cap.

3) Check the reliability of fasteners and throttle adjusting system, confirm that each operating mechanism is flexible, light and reliable, and check the pre-tightening condition of water pump belt, charger belt and fan belt.

4) Check all electrical circuits to see if there is any potential electric leakage in the wire harness due to broken insulation layer and aging, and replace the wires when necessary. Check whether the joint is loose or damaged, and tighten or replace it when necessary.

5) Check the blockage indicator of the air filter, and replace the filter if it indicates blockage.

6) Check the pipelines of and joints between oil supply, lubrication and cooling systems of the diesel engine for oil or water leakage.

Technical maintenance after working for 250 h

In addition to the work items of "Daily technical maintenance", the following work shall be performed:

1) Replacement of lubricating oil and filter

Operate as described in "Lubrication system" of this chapter.

2) Replace the fuel filter

Operate as described in "Fuel system" of this chapter.

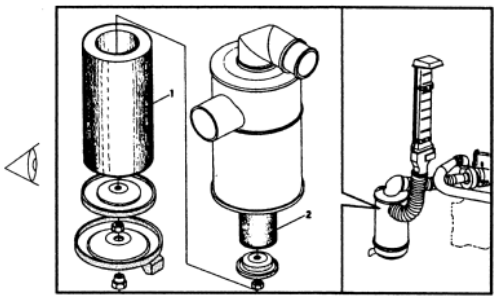
3) Check the belt tension

4) Clean the air filter element

The maximum allowable intake resistance of diesel engine is 3.5 kPa, and the maximum intake resistance of diesel engine must be inspected with the engine running at rated speed and under full load. When the intake resistance reaches the maximum allowable value, the filter element shall be cleaned or replaced in accordance with the provisions of the manufacturer.

Caution! It is prohibited to operate the engine without air filter; otherwise entrance of dust or foreign matters into diesel engine will result in premature wear of engine.

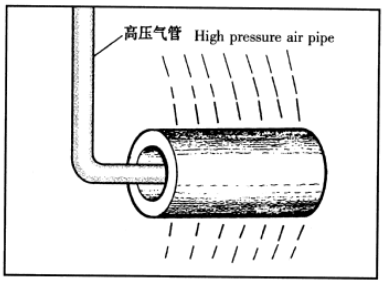
Fig. 5-2 Air filter structure



1.纸质主滤芯 Paper filtering element
2.毛毡安全滤芯 Blanketry safety filtering element

Remove the air filter element from the air filter. Pat the end face to make dust fall, or blow back with compressed air (blow from inside to outside) as shown in Fig. 5-3.

Fig. 5-3 Cleaning air filter



Caution! Do not blow through the filter paper, clean the filter paper with water or oil, or slap or knock the filter element hard.

5) Check/clean the crankcase breather pipe

Check and clean the crankcase breather pipe, check the pipe for any blockage, and clean it thoroughly.

6) Check the status of cooling fan

Check for cracks, loose rivets, bent or loose blades, etc. Tighten the fastening nuts, and replace them when necessary.

Technical maintenance after working for 500 h

In addition to the work items of "Technical maintenance after working for 250 h", the following work shall be performed:

1) Clean the diesel engine with steam

Before cleaning, cover all openings and electrical equipment on the diesel engine to prevent damage caused by water ingress. Steam cleaning is the most effective method to clean dirty diesel engine. If steam is not available, the diesel engine can be cleaned with solution.

2) Adjust and check valves and injectors

In most cases, after the diesel engine is calibrated for the first time after running for 500 h, the wear of its intake and exhaust valves and fuel injectors is very slight. Therefore, after this calibration, the valves and fuel injectors will not be calibrated until the engine runs for 1000 h.

3) Check and replace the hose

Check hoses and hose joints of oil filter, fuel filter and cooling system for leakage or corrosion, and replace them when necessary.

4) Tighten the mounting bolts

Check the torque of connecting bolts, tighten loose bolts, check rubber parts for corrosion, aging and damage, and supplement the lost bolts and replace the damaged rubber parts.

5) Check the heat exchanger zinc plug, and replace it if it is badly corroded.

6) Clean the carbon deposit in the silencer of exhaust pipe.

Technical maintenance after working for 1000 h

In addition to the work items of "Technical maintenance after working for 500 h", the following work shall be performed:

1) Replace the air filter element.

2) Remove the limescale from cooling system.

3) Clean the fuel tank and fuel pipings.

4) According to the technical status of the engine, decide whether it can be used continuously without maintenance. Remove the relevant parts of diesel engine when necessary. Check for and measure the wear of piston ring, cylinder liner, connecting rod bearing bush and main bearing bush. Remove carbon deposits in cylinder head, piston, piston ring and cylinder liner.

Lubrication system

Quality grade of lubricating oil

Lubricating oil is classified according to its quality and characteristics usually by API (American Petroleum Institute) or GB (Chinese National Standard) (Oil Standard GB/T7631).

Oil allowed for this set:

API grade: CF CG;

GB grade: CF CG.

The diesel engine can be provided with CF grade of oil, allowing high-quality oil to replace low-quality oil.

Lubricating oil viscosity

Since the viscosity of the oil depends largely on the temperature, the viscosity of the lubricating oil decreases sharply with the temperature rise. Refer to Fig. 5-4 to select the most appropriate oil according to the ambient temperature.

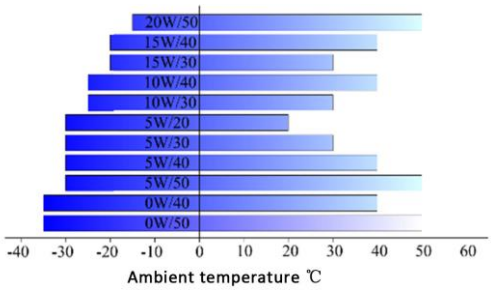


Fig. 5-4 Selection of lubricating oil grade

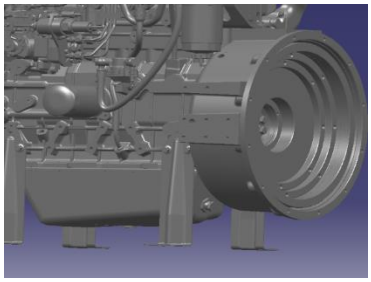
In order to ensure safe and reliable operation of diesel engine, please select Grade 10W/40CF-4 or 20W/40CF-4 lubricating oil. Grade 10W/40CF-4 can be used when the temperature is between -15°C and +30°C, while Grade 20W/40CF-4 can be used when the temperature is between -10°C and +30°C (Weichai special engine oil as recommended). When the temperature is below -15°C, Grade 5W/20CF-4 lubricating oil should be used.

The engine lubrication system is essential to ensure the reliable operation of engine and prolong its service life and also a significant part of regular engine maintenance.

The recommended lubricating oil replacement cycle must be observed, and the lubricating oil filter must be replaced at the same time.

1) Start the set so that the water temperature reaches 60 ℃. After shutdown, prepare a vessel to collect the discharged oil, and immediately open the oil drain valve of the oil pan (the position of the oil drain valve is shown in Fig. 5-5) to drain the oil and impurities, and take care to prevent burns.

Fig. 5-5 Oil drain valve of diesel engine



2) Remove the oil filter with a tool, clean the surrounding part of the filter cover, wipe the seal ring surface clean (replace it if necessary), and remove the O-ring because it may adhere to the cover.

3) Use the filter properly and fill the new filter with clean lubricating oil. Otherwise, the engine will be damaged due to short-time oil shortage.

4) Apply a thin layer of lubricating oil to the seal ring surface before installing a new filter.

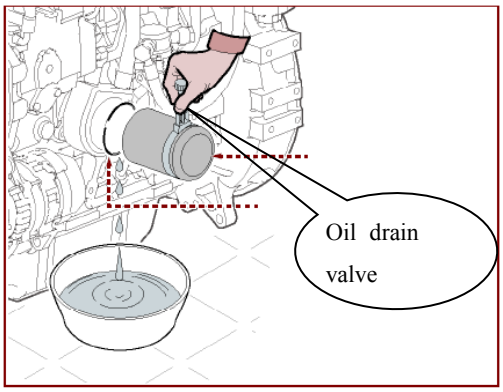
5) Install the filter on the filter cover, tighten the filter until the washer fits with the filter cover surface, and then tighten 3/4-1 turns to seal it (tightening torque is 12.7 N·m).

6) Check and clean the drain plug and washer, and then tighten them.

7) Add new lubricating oil between the upper and lower scale lines of the oil dipstick.

8) After replacing the oil, start the set and run at idle speed. Check the drain plug and filter for leakage.

Fig. 5-6 Replacement of oil filter



9) Shut down and wait for about 5 min before checking the oil level. If the oil level drops below the lower scale line, add lubricating oil between the upper and lower scale lines of the oil dipstick.

Caution! The lubricating oil shall be filled between the upper and lower scale lines of the oil dipstick, because too much lubricating oil will flow into the combustion chamber from the clearance between the cylinder and the piston to form carbon deposit. These carbon deposits will increase the compression ratio of the engine and increase the tendency to generate knocks; carbon deposits in the cylinder are red and hot, and can easily cause premature combustion, such as falling into the cylinder will aggravate the wear of the cylinder and piston and accelerate the contamination of lubricating oil. Besides, excessive lubricating oil will increase the mixing resistance of the crankshaft connecting rod and the fuel consumption.

Fuel system

Fuel quality grade

Light diesel is used as fuel for diesel engine. Fuel of the specified grade shall be used, and its sulfur content shall not exceed 0.5%.

Selection of fuel grade (according to GB252-2000)

GB252 10# light diesel: suitable for diesel engines with preheating equipment;

GB252 5# light diesel: suitable for use in areas with a minimum temperature above 8℃;

GB252 0# light diesel: suitable for use in areas with a minimum temperature above 4℃;

GB252 -10# light diesel: suitable for use in areas with a minimum temperature above -5℃;

GB252 -20# light diesel: suitable for use in areas with a minimum temperature above -14℃;

GB252 -35# light diesel: suitable for use in areas with a minimum temperature above -29℃;

GB252 -50# light diesel: suitable for use in areas with a minimum temperature above -44℃;

For diesel engines, the use of low-

quality fuel can cause the control lever to stick and the engine to rotate over speed, causing set damage or even serious personal injury. Poor-quality fuel will also shorten the maintenance period, increase the maintenance cost and reduce the normal service life of the set. Replace the fuel filter regularly

1) Shut down the engine;

2) Cool the engine sufficiently to avoid burns;

3) Prepare a vessel to collect leaked fuel;

4) Remove the filter with special tools;

5) Fill the new fuel filter with fuel;

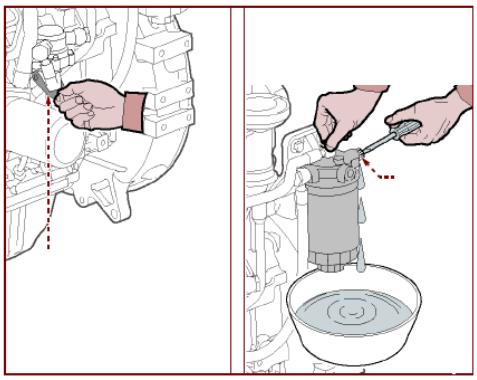
6) Apply lubricating oil to the surface of the filter seal ring before installation;

7) Install the filter with a special tool. After the seal ring contacts the base, tighten 3/4-1 turns to seal it;

8) Exhaust air;

a) Vent the air in the low-pressure circuit, mainly the air in the filter, as shown in Fig. 5-7.

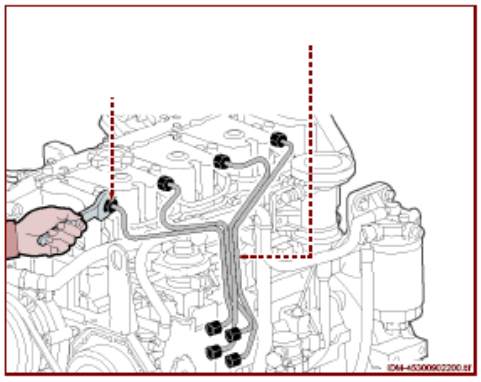
Fig. 5-7 Air vent from low-pressure circuit



Loosen the bolt and manually press the fuel supply pump to remove air from the fuel circuit until all air is removed. Interrupt this operation and tighten the bolt.

b) Vent the air from the high-pressure circuit and fuel pump. The operation is shown in Fig. 5-8.

Fig. 5-8 Air vent from high-pressure circuit

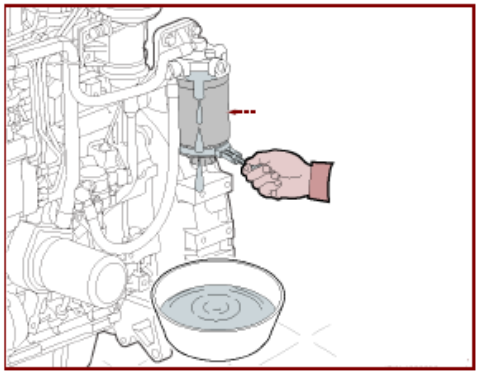


Loosen the nut, drive the diesel engine to run with the starter, drain the air from the fuel pump and the high-pressure fuel pipe until the high-pressure fuel pipe continues to drain oil, interrupt this operation, and tighten the nut.

Caution! To avoid problems, it is necessary to ensure that the battery is in a good and appropriate working environment when performing the above operations.

c) Start the engine after venting air, and remove all residual fuel first before starting; if the engine can be started, end the above process.

Fig. 5-9 Installation of fuel filter



9) Start the engine to check whether there is oil leakage.

Cooling system

The design and structure of radiator equipped with the set can ensure trouble-free operation all year round in industrial environment. Various maintenance rules can ensure trouble-free operation.

The original cause of radiator failure is the corrosion of radiator. This is caused by air mixed in the water. It shall be ensured that there is no air leakage at the pipe connection all the time, so that the air can be discharged from the top of the radiator, ensuring that there is generally no air in the system. The radiator shall not be half filled with coolant. If half a tank of coolant is injected into the radiator, it will be corroded quickly. When the set is not in use, the coolant in the radiator can be completely discharged or the radiator can be fully filled with antifreeze coolant.

1. External cleaning of radiator

In a dusty environment, dust and debris will block the radiator blades and affect the performance of the radiator. The general method to remove these tiny foreign matters is to spray low-pressure steam flow in the radiator.

Stubborn foreign matters can be removed by using low-pressure hot water added with detergent. If some deposits cannot be removed by the method above, it is necessary to remove the radiator, immerse it in hot alkali de-oiling solution for about 20 min, and then use a hose to rinse it with hot water.

2. Internal cleaning of radiator

If hard water is mixed in the added water due to leakage or other reasons, or the set runs without anti-rust agent, the whole system will be blocked by rust scale.

De-rusting steps of radiator are as follows:

1) Drain the accumulated water in the system, remove and close the connection between the pipeline and the diesel engine;

2) Prepare 4% anti-acid solvent and fresh water. Pour acid agent into water, and do not reverse the order;

3) After a few minutes upon mixing, heat the solvent to a temperature not higher than 49℃;

4) Pour the solvent slowly into the radiator through the filler or bypass pipe, and then foam will appear. After the foam disappears, fill the radiator with hot solvent;

5) Keep the radiator upright for a few minutes, and then drain the solvent back to the original container through

the bottom branch pipe or drain port;

6) Check the inside of the water tank. If there is rust scale, increase the solvent concentration to 8%, and repeat the steps above;

7) After de-rusting, the acid solvent can be neutralized by the following methods: filling fresh water into the mixing container, heating the mixture to boiling point, and adding ordinary soda as per the ratio: 0.5 kg soda with 20 l of water. Fill the solvent into the radiator tank and then drain it back into the container.

8) Flush the radiator tank several times in this way, and finally let the radiator tank be full of solvent for at least one hour, then drain the internal solvent and flush the radiator tank with fresh hot water.

9) When the radiator is used again, fill water into the tank, and test the pressure in twice the working hydraulic pressure. Carefully check for any leakage caused by rust layer.

10) Before re-commissioning, the coolant must be mixed with necessary anti-rust and anti-corrosion agents or antifreeze of proper proportion.

Air filter

The air filter is a device for removing particulate impurities in the air. When the diesel engine is working, if dust and other impurities are contained in the suction air, the wear of the parts will be aggravated, so the air filter must be installed. The air filter consists of filter element and housing. The main requirements for air filters are high filtering efficiency, low flow resistance, and long-term continuous use without maintenance.

The air filter is equipped with a resistance indicator to indicate the blockage of the filter element. Before each startup and operation of the set, the resistance indicator shall be checked, and the air filter shall be replaced immediately when all red signs can be seen from the window. The replaced air filter shall be scrapped and cannot be reused.

Caution! The filter element must be replaced in time if it is damaged or the intake resistance reaches the specified pressure drop. No part that may be loose is allowed in the intake duct in front of the turbocharger; otherwise, it will enter the turbocharger to damage the impeller.

Battery

1. Precautions for correct use and maintenance of battery

1) Check whether the bolts fixing the battery on the bracket are tightened. If the bolts are not tightened reliably, the case will be damaged due to running vibration. In addition, do not put any metal object on the battery to prevent short circuit.

2) Always check whether the poles and connection terminals are reliably connected. To prevent oxidation of the terminals, protective agent such as Vaseline can be applied.

3) Do not check the battery SOC with

the direct sparking (short circuit test) method because this will damage the battery.

4) Always add distilled water regularly for ordinary lead-acid batteries. It is preferred to properly charge dry-charged batteries before use. For maintenance-free batteries for which water can be added, proper maintenance by adding necessary distilled water at due time helps to extend their service life.

5) Make sure that the air vent in the battery cover is unblocked. When a battery is charged, many air bubbles will be produced. If the air vent is blocked, the air cannot escape; when the internal pressure increases to a certain extent, the battery case will burst.

6) Yellow-white paste will be found around the battery poles and cap occasionally; this is the result of the root column, line clamp and/or fixed frame corroded by sulfuric acid. These substances have high resistance and must be removed in time.

7) When it is necessary to use two batteries connected in series, their capacities should be the same preferably. Otherwise, the battery service life will be affected.

2. Precautions for maintenance-free battery

1) Storage: The maintenance-free battery can be stored for 10 months from delivery to use, and its voltage and capacitance will remain unchanged.

2) Supplementary charging of maintenance-free batteries: The charging method is basically the same as that for ordinary batteries. The voltage of each cell shall be limited to 2.3-2.4V during charging. The conventional charging method will consume more water, and the charging current should be slightly lower (below 5A) for charging. If possible, the maintenance-free battery can be charged with charging equipment with current-voltage characteristics. The equipment can not only ensure full charge, but also avoid overcharging and consuming more water.

3) Scrapping indication: When the hydrometer of maintenance-free battery indicates light yellow or red, it means that the battery is nearly scrapped, and even if it is recharged, it will discharge very quickly. Charging at this time is only an emergency expedient.

Lubrication of alternator bearing

The alternator bearings are of completely closed type and do not need grease.

For general applications, if, the vibration does not exceed the specified value of BS5000-3 or ISO8528-9, and the ambient temperature does not exceed 50℃, the following estimated values can be used as reference for planning bearing replacement.

Definition in BS5000-3:

The alternator shall be able to withstand linear vibration with amplitude of 0.25 mm between 5 Hz and 8 Hz and vibration with speed of

9.0 mm/s between 8 Hz and 200 Hz continuously. The amplitude or speed can be measured on any shell or base of the alternator, and this limit is the highest frequency amplitude of multiple complex vibration waveforms.

Definition in ISO8528-9

ISO8528-9 specifies a broadband frequency band from 2 Hz to 300 Hz. The following table is taken from ISO8528-9. Tab. 7-1 lists the vibration limits of sets with different capacities and speeds.

Motor speed	Set output capacitance, KVA	Vibration amplitude, mm	Vibration speed, mm/	Vibration acceleration, m/s2
4-pole 1500r/min 50Hz	⩽ 50KVA	0.8	50	31
	〉50 KVA	0.64	40	25
Frequency band of 2 Hz~300 Hz				

Important! The service life of bearings is directly related to working conditions and environment.

Important! Excessive vibration of the engine or poor alignment of the set causes lateral force to the bearing, thus reducing its service life. If the vibration exceeds the specified value in BS5000-3 or ISO8528-9, The service life of bearing will be reduced.

Important! Long-term storage in a vibrating environment leads to forced vibration of the alternator, and thus Brinell ball indentation, making the steel ball deform and dent on the raceway, resulting in premature damage.

Important! Grease may be softened in a very humid climate or environment, thereby causing corrosion and premature bearing damage.

6 Operation Advice

NO-LOAD OPERATION

Periods of no load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a load bank of at least 30 per- cent of nameplate rating.

EXERCISE PERIOD

Generator sets on continuous standby must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe bur- den on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts and in general helps provide reliable engine starting.

Exercise the generator set at least once a month for a minimum of 30 minutes, under not less than 30 percent of the nameplate rating.

LOW OPERATING TEMPERATURE

Use a coolant heater if a separate source of power is available. The optional heater will help provide re- liable starting under adverse weather conditions. Be sure the voltage of the separate power source is correct for the heater element rating.

HIGH OPERATING TEMPERATURE

Refer to the genset nameplate for the maximum ambient operating temperature, if applicable.