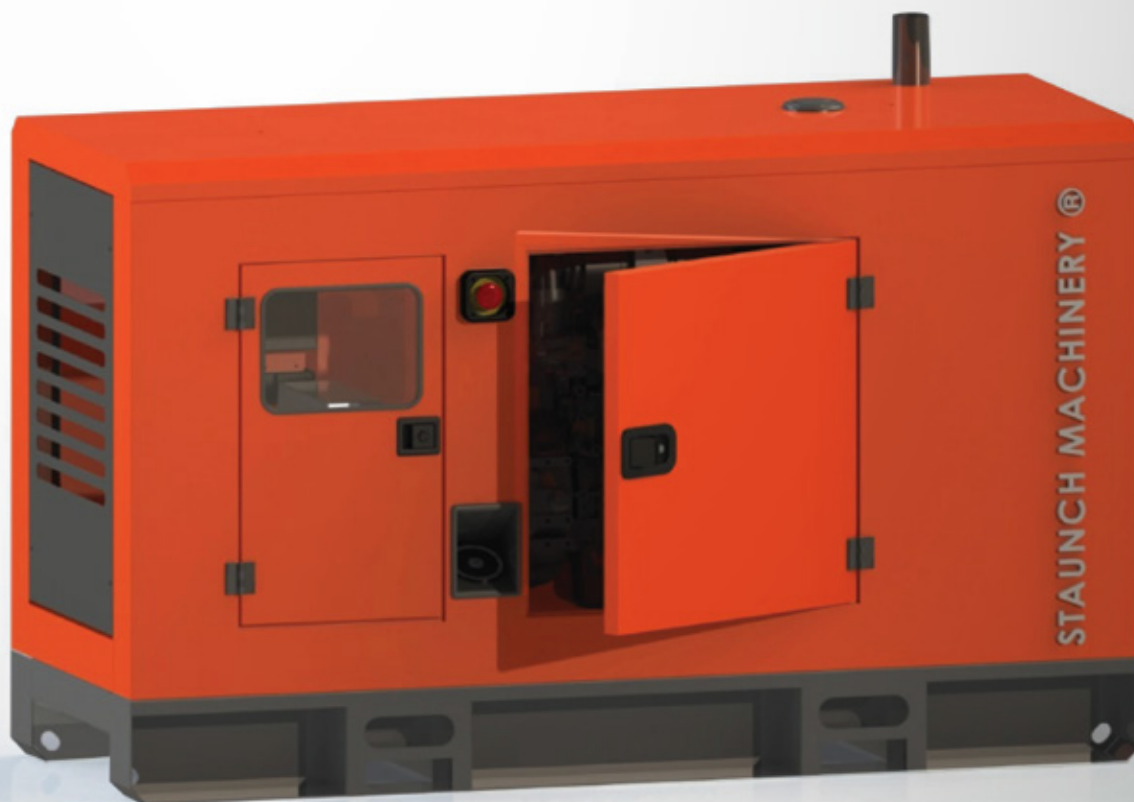




STAUNCH
MACHINERY
— SINCE 1979

DIESEL GENERATING SETS INSTALLATION RECOMMENDATIONS AND OPERATIONS MANUAL



www.staunchpower.com

DEAR STAUNCH MACHINERY GENERATING SET USERS.

We would like to thank you for your choice of STAUNCH Generating Set. It is solid, safe and reliable machine, built according to the latest technology. This operating and maintenance manual is designed and developed to make you familiar with the generating system. Please read the following instructions carefully before starting to use your machine. Observing the advices and rules in this manual will ensure that the generating set operates in maximum performance and efficiency for a long time. This manual gives general information about mounting, operation and maintenance of the generating set. Tables and diagrams are also available outlining your generating set. Never operate, maintain or repair your generating set without taking general safety precautions.

TABLE OF CONTENTS

1. General Introduction.....	1-2
1.1 Brief Introduction.....	1
1.2 Identifying sets.....	2
2. GENERAL SAFETY PRECAUTIONS.....	3-5
2.1 Safety and Warning.....	3-4
2.2 Pictograms and their meanings.....	5
3. GENERAL DESCRIPTION.....	6-7
3.1 Diesel Engine.....	6
3.2 Engine Electrical System.....	6
3.3 Cooling System.....	6
3.4 Pre-heater for generator set (Optional Spare Part).....	6
3.5 Fuel tank and Base frame.....	6
3.6 Bulk Storage Tanks.....	7
3.7 Fuel delivery and return.....	7
3.8 Vibration Isolation.....	7
4. Ergonomic improvement.....	7-8
4.1 Improved design for easy transportation.....	7
4.2 Lubricant discharge hole which directly connect to outside.....	8
4.3 Powder Coating.....	8
4.4 External antifreeze adding hole (Optional).....	8
4.5 External Diesel filling hole.(Optional).....	8
5. INSTALLATION, HANDLING AND STORAGE.....	8-10
5.1 General Outline.....	8
5.2 Transportation.....	9
5.3 Design for Foundation.....	9
5.4 Design for Generator Set Working Room.....	9-10
5.5 Long term storage.....	10
5.6 Placing the generator set.....	10
5.7 Automatic Transfer Switch (ATS).....	10



6. OPERATION.....	11-18
6.1 Inspect Before Operation.....	11-12
6.2 Generating set control systems.....	12-15
6.2.1 Push Buttons, key features, key benefits, emergency stop.....	13
6.2.2 Manual Mode of Operation.....	14
6.2.3 Automatic Mode of operation.....	14
6.2.4 Test Mode of Operation.....	15
6.3 INFORMATION THAT CAN BE DISPLAYED.....	15
6.3.1 ALARMS.....	15
6.3.2 Shutdown alarms.....	16
6.3.3 ENGINE.....	16
6.3.4 GENERATOR.....	17
6.3.5 SHUTDOWN ALARM ICONS AND THEIR MEANING.....	17-18
 7. GENERAL PRECAUTIONS AND CONTROLS WHICH MUST BE DONE AFTE	
STARTING UP THE GENERATING SET.....	18-19
7.1 Warning about putting the gen-set under load.....	19
 8. MAINTENANCE.....	19-22
8.1 Engine maintenance chart	19-20
8.2 Storing gen-set in non-operable condition for 3 months or more.....	21
8.2.1 Preparation for storage.....	21
8.2.2 Maintenance during storage.....	21
8.2.3 Using gen-set after storage.....	21
8.3 Engine Oil Recommendation.....	21
8.4 Oil Change Procedure.....	22
8.4.1 Drain the oil.....	22
8.4.2 Replace the oil filter.....	22
8.4.3 Fill with oil.....	22
8.4.4 Check for leaks.....	22
 9. ENGINE TROUBLESHOOTING CHART.....	23-24
 10. GENERATOR SET 3D RENDERED IMAGES FOR ILLUSTRATION.....	24-25

1. GENERAL INTRODUCTION

1.1 Brief Introduction

STAUNCH series diesel engine generator sets is the core products of STAUNCH Power Equipment Manufacturing. Thanks to their good performance, the generator sets are widely used in the fields of construction, communication, banking business, mining, leasing industry and other special sites. As what you are expecting, STAUNCH generator sets endeavor to meet your needs for the concept of individual design through the excellent features of more safe, more reliable and cleaner. The generator sets provided by STAUNCH Power is reliable and professional. The advantage of low noise level, energy conservation, and stable performance has made a credible assurance for many enterprises. Our generator sets supply the following power service.

Continuous service

Used as main power supply to generate electricity for several purposes: motion force, heating etc. The generator sets can continue running.

Standby service

Used as standby power supply to provide continue electric power for non-invariable loads. The generator set is suitable for the area where must ensure continue power supply, such as hospitals, industrial facilities, airports etc. Keep the generator set standby state at any time and start to run when the mains supply is abnormal.

Emergency service

Used as auxiliary power supply to solve energy interruptions that may cause serious problems to people, physical and /or financial damage or to face consumption peaks. The generator set can start in short order to provide steady electric power for the loads when the mains supply happen abnormality, and switch to stop after the mains supply becomes normal.



Each generating set has a model and a serial number indicated on a label. This label is located on the canopy. These data are necessary in order to determine the rating of the generating sets, to help in spare parts orders, and also for warranty applications.

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STAUNCH
MACHINERY

CE



Work order:XXXXX



Model : STG15

Engine Serial no. :XXXXX

Alternator Serial no:XXXXX

Production Year : 2018

Rated KVA :13.3 KVA

Rated Kilowatt:10.64KW -3PH

Rated Current :15.2A @ P.F:1

Rated Current :19A @ P.F:0.8

PRP :12.96

ESP :13.3

Rated Frequency :50 HZ

Rated voltage output :220/380V

Weight : Dry:720KG
Wet :1238KG

Performance Class : H According to ISO 8528-1:2005

Generating Set S/N : 000XXXX



000044999





Made in Lebanon

Saida-Al Ghazieh Main Street

Tel : +961 7 724013

Fax : +961 7 724062

Email : info@staunchmachinery.net

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1. Work order
2. Generating Set Serial Number
3. Generating Set Model
4. Engine Serial Number
5. Alternator Serial Number
6. Production Year
7. Rated KVA
8. Rated Kilowatt
9. Rated current at Power Factor 1
10. Rated current at Power Factor 0.8

11. Prime Rated Power (PRP)
12. Emergency Standby Power
13. Rated Frequency
14. Rated Voltage Output (V)
15. Weight dry and Wet
16. Governing Class H According to ISO 8528-1:2005
17. Manufacturer Country
18. Manufacturer Address, Phone and Email

2. GENERAL SAFETY PRECAUTIONS

2.1 Safety and Warning

Before operation and maintenance for the generator sets, please read carefully about this manual and make sure a good understanding of this operation manual and other documents which attached with the engine.

Correct installation of the generator set is the precondition of normal operation.

Qualified spare parts shall be used for maintenance to ensure good running condition and long life expectancy of the generator sets.

The generator set shall be operated only by the staffs who have received training on the operation and the repair shall be made by the authorized staffs. Operator and maintenance staff shall be clear about safety and preventive actions and operation maintenance procedure.

The generator sets can only be started under safety conditions. Please do not start the generator sets when any abnormal condition has been found so that to avoid accidents. Maintain and repair the generator sets, please shut down the generator set and cut off the connection of negative polar of the battery or dismantle battery connecting cable, and place warning label at the relative place so that to avoid accident. The exhaust air discharged from engine is harmful for people's health. All of the generator sets installed indoors shall discharge the exhaust gas to outside doors. During the period of generator set running, the exhaust pipe and silencer will generate high temperature. Therefore when the generator set is installed, these parts need to be covered with insulation materials and be kept far away from inflammable materials.

Please ensure good ventilation and organized environment for the generator set's installation room. Please do not place inflammable materials and explosives (liquid) near the engine. Smoking, spark over, and other fire lighting behaviors are not allowed in the area which is close to the battery and fuel because the mixture of volatilization from fuel and hydrogen generated by battery charging process will cause explosion when it meets sparkle or naked flame.

The generator set installation room shall be facilitated with BC and ABC fire extinguisher, and operators shall be familiar with the knowledge on how to use it. When fan protection cover or other protection cover has been detached, please do not try to start the generator set, and when the generator set has to be started, please don't put your hand in the area where the protection cover is missing or make repair around these areas.

Please keep your palm, arm, long hair, jewelry and loose clothes far away from belt pulley, belt and other power transmission parts. When working in the generator set installation room, please wear working clothes, gloves and hat.

After the generator set being started, please don't try to open the cover of the radiator before the anti-freeze fully cooled down, so that to avoid steam (hot water) burst forth to hurt people. Please don't swallow or let your skin contact with the harmful materials such as fuel, anti-freeze, lubricant and electrolyte. When your skin is spattered with these kinds of liquids, please use plenty of water to rinse.

Long time stay in high noise level environment will cause harm to your hearing. If you have to work around the generator set frequently, you'd better wear the device to protect your ear.

When the generator set needs to make cable connections to output power, the operation shall conform to the condition, specification, standard related to power distribution. Qualified cable shall be used to make power distribution.

When the installation of generator set involves with welding, please do not connect to the ground circuit or make grounding through generator set (engine) so that to avoid the big current generated from welding operation hurt the electric appliance, inside of the generator set.

Please ensure the safety of generator set and reliable grounding.

2.2 Pictograms and their meanings

Safety notices are clearly mounted on the equipment to draw the operator's or maintenance technician's attention to the potential dangers and explain the action to be taken in the interest of safety. These notices are reproduced in this publication for ease of identification by the operator. Replace any notice that is missing or illegible.



Read manual before starting the generating set. Do not perform any maintenance works before reading the related manual. It is recommended that maintenance be done by a qualified technician.



There are hot areas around the exhaust pipe/radiator cap. Do not touch the surface before cooling off the generating set.



Exhaust emissions are hazardous to the personnel. The exhausts of all in-door generating sets should be piped outdoor through a leak-free piping. Ensure that flammable fluids are never stored near the generating set.



Ensure that the generating set (including mobile generating set) is effectively grounded/earthed.



The day fuel tank contains fuel. Be sure to avoid flame proximity or smoking nearby.



Keep hands, long hair and jewelry away from the pulleys, belt and over moving objects. Do not attempt to operate the generating set with the safety guard removed.



Stop the engine when performing preventive maintenance. Do not perform any change or repair work when the engine is running.



Lift here: lift the generating set/canop from the bottom
Do not lift: do not lift the canopy/generating set from the top hooks



Wear protective gloves when:

- 1- using inhibitors
- 2- using anti-freeze
- 3- removing the cap pressure from the cooling system
- 4- when changing the lubricating oil/filter



Prolonged exposure to generating sets that are not equipped with sound attenuating enclosures is hazardous to hearing. Wear ear protection in generating set proximity.



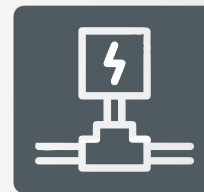
Please check (retighten) the screws of terminals before the first operation and then periodically every 6 months.



Do not wear clothing that has been contaminated by fuel or lubricating oil. Wear foot protection when working with heavy machines.



Electrical shock hazard. The generating set should be connected to the load only by trained and qualified electricians.



Keep all the electrical equipment clean and dry. Replace any wiring where the insulation is cracked, cut abraded or degraded. Replace any terminals that are worn, discolored or corroded.

2.3 Safety precautions against fire, burns and explosions

1. The design or installation of pipes or rubber hoses shall prevent any flammable or explosive liquid dripping or spraying leakage
2. The area around the generator must be clean and free of clutter and any combustible material that can be hazardous.
3. The unit should not be opened or dismantled while it is functioning. Moving of hot parts should not be tampered with. Battery cables should be disconnected before proceeding to work on the generator to eliminate any possible of an accidental start-up
4. Refill the engine with fuel when the engine has stopped
5. Use appropriate ventilation to allow the equipment to cool correctly
6. Depressurize the air, oil and cooling circuits before removing or disconnecting all the fittings, pipes or connected components.
7. A fire extinguisher should be readily available. Use of extinguishers that operate on carbon tetra-chloride is strictly prohibited since the fumes are toxic and can deteriorate the insulation on the wiring of generators.
8. Fuel shut off valve operated by fusible link is one of most common methods to stop the engine in case of fire.
9. If the medium around the generating set has any flammable or explosive gases, as in oil and gas rigs applications, chemical factories and others, you should inform the factory to do the needed adjustments.

2.4 Safety precautions against toxic products - exhaust gas

1. Suitable personal protective equipment must be worn
2. The employer must ensure that written work procedures providing instructions for the safe handling of the toxic process gas (diesel,gas) are prepared for all hazardous tasks in accordance with the risk assessment results, critical technical information and operations manuals.
3. ensure that ventilation systems are designed to exhaust toxic process gases directly to the outdoors in a safe manner
4. The employer must ensure that piping systems are equipped with isolation, pressure venting or bleed valves designed to purge the lines safely of residual gases before maintenance or servicing procedures.

LIQUID COLLECTION TRAYS

- Never empty the liquid collection vessels onto the ground; do so into a suitable vessel.

EXHAUST CIRCUIT

- Visually check the exhaust circuit, if any gas leakage is detected, conduct repairs immediately, because inhalation is very harmful to health, as well as being a potential source of fire.
 - Warning: very hot surfaces. Installation parts which are preassembled at the factory are protected from accidental impacts.
- The installer must insulate and/or protect accessory parts, the gas evacuation piping at the premises, the silencer supplied separately, etc.
- Drain the exhaust piping through the condensate discharge points, in the event they are incorporated.

ENVIRONMENTAL SAFETY

- Do not start the genset in confined areas without installing an exhaust pipe which vents fumes outside. Exhaust gases are harmful and can be lethal.
- Observe the rules and regulations concerning acoustic installations.
- Never run the engine without an air filter or without an exhaust.
- Replace the engine's exhaust and/or silencer if the noise level emitted is higher than that permitted by corresponding legislation.
- Maintenance (oil changes, cleaning the fuel tank, cleaning the radiator, washes, battery changes, etc.), storage and waste disposal must be carried out according to the regulations in the country of use.

3. GENERAL DESCRIPTION

3.1 Diesel Engine

The diesel engine powering the generator set has been chosen for its reliability and the fact that it has been specifically designed for powering generator sets. The engine is of the heavy duty industrial type and is fitted with all accessories to provide a reliable power supply. These accessories include, among others, a cartridge type dry air filter, a turbocharger fitted on some engines and a mechanical or electronic controlled engine speed governor. STAUNCH pay special attention to the User technical advantage of engines in the aspects of reducing exhaust gas, decrease fuel consumption rate and good noise level control.

3.2 Engine Electrical System

The engine electrical system is 12 volt or 24 volts DC, negative ground/earth. This system includes an electric engine starter, a battery and a battery charging alternator. For 12 volts electrical system one battery is given. For 24 volt system two batteries are given.

3.3 Cooling System

The engine cooling system comprises of a radiator, a high capacity pusher fan (air is 'blown' through the radiator). The alternator has its own internal fan to cool the alternator components. Note that the air is "pushed" through the radiator so that the cooling air is drawn past the alternator, then past the engine and finally through the radiator.

3.4 Pre-heater for generator set (Optional Spare Part)

Our generator set has been facilitated with heater for water jacket. The purpose to install the pre-heater is to ensure that the generator set can be started under low temperature and some emergency cases, and also it can prevent the generator sets from being damaged by cold winter weather.

3.5 Fuel tank and Base frame

The engine and alternator are coupled together and mounted on a heavy duty steel base-frame. This base frame includes a fuel tank with capacity of approximately 8 hours operation under variable loads. The tank is complete with filling cap and fuel level gauge and is connected by flexible joints to the intake piping and to the overflow piping containing fuel from the injector drain. High power gen-set's fuel tank is separate from gen-set.

3.6 Bulk Storage Tanks

For extended operation, a separate bulk fuel storage tank is required. Especially for standby generator sets it is not advisable to depend on regular delivery of fuel. The emergency that requires use of the standby set may also interrupt the delivery of fuel. The bulk tank should generally be located outside the building where it will be convenient for refilling, cleaning and inspection. It should not, however, be exposed to freezing weather because fuel flow will be restricted as viscosity increases with cold temperatures. The tank may be located either above or below ground. A vent must be installed on the bulk tank to relieve the air pressure created by filling the tank or created by evaporation and expansion. It will also prevent a vacuum as the fuel is consumed. The tank should be placed on a 2° tilt to assure a concentrated settling of water and sediment. A sludge drain valve should be installed at the low point to allow removal of water and sediment on a regular basis. Underground tanks should have this water and sediment pumped out regularly. All bulk tanks should be fitted with an external filter and be part of the maintenance program of the generator set.

3.7 Fuel delivery and return

Do not use galvanized pipe or fittings for the fuel system. Fuel delivery and return lines should be at least as large as the fitting sizes on the engine and overflow piping should be one size larger. For longer runs of piping or low ambient temperatures the size of these lines should be increased to ensure adequate flow. Flexible piping should be used to connect to the engine to avoid damage or leaks caused by engine vibration. The fuel delivery line should pick up fuel from a point no lower than 50 mm (2") from the bottom at the high end of the tank (away from the drain plug). Avoid refilling the fuel tank while the engine is running.

3.8 Vibration Isolation

The generator set is fitted with vibration isolators which are designed to reduce engine vibration being transmitted to the foundation on which the generator set is mounted. These isolators are fitted between the engine/alternator feet and the base frame. Alternately, on larger models the engine/alternator is rigidly mounted on the base frame and the vibration isolators are supplied loose to be fitted between the base frame and the foundation.

4. ERGONOMIC IMPROVEMENT

4.1 Improved design for easy transportation

Our canopy generator sets have been designed for easy hoisting and transportation. Standard canopy generator set is facilitated with lifting hole. For the small power generator sets, we have designed hoisting lug on the canopy roof and forklift opening in the base frame, which better serves the needs of customers who have stationary power supplier but need to move the generator set frequently. (See figure:1)

4.2 Lubricant discharge hole which directly connect to outside

Our generator sets have been facilitated with lubricant discharge valve which connect directly to outside. This lubricant discharge valve is another humanized design feature of STAUNCH MACHINERY gen-set. It offers more convenient operation for the users. When you want to discharge surplus lubricant or change it, you can easily make it by opening the lubricant discharge ball valve.

4.3 Powder Coating

Powder Coatings are a blend of resins, curing agents and pigments, which are melt-mixed (extruded) and pulverized into finely divided particles. They are totally solvent free. Typically applied to metal products by electrostatic spray, the coated item is then heated and the powder melts into a smooth, continuous and encapsulating film. When thermosetting resins are used, the coating changes chemically (crosslinking) during cure, resulting in a decorative / functional finish with superior performance characteristics.

4.4 External antifreeze adding hole (Optional)

For canopy generator set has been facilitated with external antifreeze filling hole. When user intends to add antifreeze, He only needs to open the antifreeze filling hole on the roof of canopy and the radiator's pressure valve cap to directly add antifreeze to the hole, and easily watch the anti-freeze level. (see figure:2)

4.5 External Diesel filling hole. (Optional)

Canopy generator set has been designed with external diesel filling hole in order to refill the built-in diesel tank and taking into consideration safety and access ease. (see figure:3)

5. INSTALLATION, HANDLING AND STORAGE

5.1 General Outline

Correct installation of generator set is the precondition which ensures the normal working status of the generator set. The working room for generator set shall be designed specifically to meet the expected functions and maintenance operations, and at the same time the design of generator set working room shall conform to local government's laws and regulations on architecture, fire protection laws and other applicable regulations. This section discusses factors important in effective and safe installation of the generating set.

5.2 Transportation

During the period of shipment, protection shall be made for the generator set. In addition, the generator set shall be tightly secured in the loading truck so that to avoid any vibration during shipment which will cause the generator set's components loosen and even damaged. During the process of shipment of generator set, no people or other material is allowed to place above the generator set so that to avoid damage to generator set caused by weight. When loading or unloading the generator set to the truck, forklift or hoisting device shall be used to avoid the generator set become tilted or fell to the ground, which causes damage. Lifting holes have been designed on the common base frame of our generator sets.

Some of the specifically designed generator sets has been facilitated with lifting holes on the roof and forklift openings on the base frame etc. Users can transport the generator set according to the guidance specified on the specific labels stacked on the generator set.

Please do not use the lifting lugs on the engine or on the alternator to hoist the whole generator set.

5.3 Design for Foundation

The foundation which used to install and fix the diesel generator set is very important, it must conform to the following requirement:

Have enough hardness and stability, so that to avoid deformation, which will affect the concentricity of diesel engine and alternator and other accessory parts.

Generator set's foundation is not allowed to connect to other architecture's foundation. The width and depth of foundation shall meet requirement. Normally, concrete foundation is reliable, simple and preferable. When pouring the concrete foundation, please make sure the surface of concrete is flat, and no scratch is allowed

The design of foundation can refer to following calculation formula (see figure:8)

$$t = k / (d * w * l)$$

t = thickness of foundation in m

k = net weight of set in kg

d = density of concrete (take 2403 kg/m²)

w = width of foundation in (m)

l = length of foundation in (m)

5.4 Design for Generator Set Working Room

The installation of generator set shall be designed, so that to meet the demand of planned operation and maintenance. The complete installation shall conform to local architecture laws, fire protection laws and other applicable regulations. The following considerations must be still given when temporarily installing the generator set.

1. Ensure diesel engine generator set working room has good ventilation and good exhaust system, and the area for ventilation is sufficient
2. Locate the generator set where it will be protected from damage and away from the exhaust fumes of other engines or other airborne contaminants such as dust, lint, smoke, oil mist or vapors
3. Ensure the generator set is not positioned in such a way that it will obstruct the entrance or exit to the area where it is situated
4. Ensuring that fumes from the exhaust outlet will not be a hazard, especially when wind is taken into account.
5. Ensure there is enough area around the generator set for access and serviceability
6. Ensure adequate access to refill the fuel tank when required.
7. If Protecting electrical cables are laid on the ground ensure they are boxed in or covered to prevent damage or injury to personnel
8. No combustible and explosive materials are allowed to be placed in the generator set working room

5.5 Long term storage

For storage or long periods of inactivity, STAUNCH Generators recommend the following:

Generators should be stored with oil filled to the correct capacity; Storage periods of 18 months and over may require special lubricants and treatments. If so please seek further advice from the engine manufacturer.

Before the generator is used after long term storage, all fuels and oils should be replaced. Generator mounts, pipes and hoses should be checked to ensure that they are un-perished following extended periods of storage. The generator should be stored in a clean dry area, ideally having a reasonable constant ambient temperature, and ideally not below freezing.

The battery isolator switch should be switched off.

5.6 Placing the generator set

After preparing the right Foundation for the generator set to be placed on it, insure that there is a minimum distance of 3 meters space between the inlet and any obstacle and between the outlet and the any obstacle.(see figure:8)

5.7 Automatic Transfer Switch (ATS)

An Automatic Transfer Switch (ATS) is an electrical switch that switches a load between two sources, when they sense one of the sources has lost or gained power. An Automatic Transfer Switch (ATS) is often installed where a backup generator is located, so that the generator may provide temporary electrical power if the utility source fails providing the highest protection for continuous power.

In order to control the generator set remotely, connect the (RS) and the (5) cables to the remote switch(see figure:9).

6. OPERATION

6.1 Inspect Before Operation

Operate the generator set without load once each week for 20 minutes. If the generator set is not connected to an automatic transfer switch (ATS) with an exercise option, exercise the unit in the presence of an operator.

The operator should perform all of the prestart checks before starting the exercise procedure. Start the generator set according to the starting procedure in the controller section of this manual. While the generator set is operating, listen for a smooth-running engine and visually inspect the generator set for fluid or exhaust leaks. Check the air inlets and outlets and remove any items restricting the air flow.

After finished installation, our diesel engine generator set can be put into use. Each time before starting the generator set, following items shall be checked without fail.

1. Make a general visual inspection on the engine and alternator. Check if there is any breakage, crack, indentation, leakage or looseness. Never operate the generating set before removing any fault, if any.
2. Take out foreign materials such as keys, tools, cleaning wool, papers etc. on the engine and the alternator.
3. Check the fuel level in the tank, refill with fuel if it is low.
4. Control the abrasion in the charge alternator belt and check periodically the belt tension according to producer' recommendation.
5. Check the oil level on the dipstick. Refill with an appropriate oil if it is low. Maintain the oil level at or near, not over, the full mark on the dipstick. (see figure:4)
6. Look at the water level by opening the radiator tap. If it is inadequate add more water. Water level must be 30 mm lower than the water filling neck. Engine cooling water must include antifreeze according to the coolest weather conditions in the area. (See figure:2)
Note (Fluid may abruptly exit the cooling circuit and cause serious burns. Only remove the filler cap once the engine and cap have cooled sufficiently to enable them to be handled with bare hands. Firstly, loosen the cap slightly by one notch to eliminate any pressure, then remove it.)
7. A mixture of antifreeze and water provides a good protection in all area. For antifreeze and water percentage refer to manufacturer requirements.
8. Inspect the radiator air outlet hood, open if clogged and clear away all obstructions in front of the air outlet

9. Check the air filter. If the air filter is fitted with a dust control valve, press the tip of the valve to evacuate any accumulated dust particles. Check the air filter clogging indicator, if the indicator is red, clean the air filter.(see figure:6)
- 10.Keep the inlet opening open. Make sure that the generating set can easily take air from the environment (see figure:8)
- 11.Check the battery connection cables. Take care to tighten the loosened battery terminals with spanner and, cover with special substance and keep clean in order to avoid oxidation.
- 12.Check if the circuit breaker outlet switch is in OFF position.
- 13.Make sure that the emergency stop button is not pressed. (see figure:5)

6.2 GENERATING SET CONTROL SYSTEMS

To control and monitor the generating set, an (DEEP SEA ELECTRONICS PLC) has been used. Control panel provides a means of starting and stopping the generating set, monitoring its operation and output and automatically shutting down the set in the event of critical condition arising such as low oil pressure or high engine temperature.










CAUTION: The module may instruct an engine start event due to external influences. Therefore, it is possible for the engine to start at any time without warning. Prior to performing any maintenance on the system, it is recommended that steps are taken to remove the battery and isolate supplies.

The following descriptions detail the sequences followed by a module containing the standard 'factory configuration'. Always refer to your configuration source for the exact sequences and timers observed by any particular module in the field.

Control of the module is via push buttons mounted on the front of the module:



6.2.1 Push Buttons

Display	Description	Display	Description	Display	Description
	Stop/Reset		Test mode		Atuo mode
	Scroll				Start (when in manual or test mode)
	Close Generator (Manual Mode Only)		Manual mode		
			Alarm mute/lamp test		Common alarm indicator




KEY FEATURES
• Back-lit text LCD display
• Front panel editing
• LED and LCD alarm indication
• Power Save mode
• CAN and Magnetic Pick-up/Alt. versions available (specify on ordering)
• PC and front panel configuration
• 6 Digital inputs
• 3 Analogue inputs
• 6 Outputs (4 configurable on Magnetic Pick-up/Alt.,6 configurable on CAN version)
• Configurable timers and alarms
• Alternative configuration
• Event Log (10)
• Remote Start input
• 3 Phase generator monitoring
• Current Monitoring and protection
• 3 Phase Mains (Utility) monitoring (DSE6120 only)
• Test button (DSE6120 only)
• Battery voltage monitoring
• Engine pre-heat
• Hours counter
• Comprehensive shutdown or warning on fault condition


• Automatically transfers between mains (utility) and generator (DSE6120 MKII only)
• Increased input and output expansion capability via DSENet®
• Hours counter provides accurate information for monitoring and maintenance periods
• User-friendly set-up and button layout for ease of use
• Multiple parameters are monitored simultaneously which are clearly displayed on a large back-lit text display via multiple languages
• The module can be configured to suit a wide range of applications
• Compatible with a wide range of CAN engines including Tier 4
• Uses DSE Configuration Suite PC Software for simplified configuration
• License -free PC software
• IP65 rating (with optional gasket) offers increased resistance to water ingress

Emergency stop

The generator is equipped with an emergency stop button which should only be used in an emergency and not for general stopping.

6.2.2 Manual Mode of Operation

This mode activated by pressing the  pushbutton. A LED indicator beside the button confirms this action. Press the button  to begin the start sequence (There is no Start Delay in this mode of operation). After the fuel solenoid is energized, then the starter motor is engaged. The engine is cranked for 10 sec. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for 10 sec. This sequence should continue beyond the 3 cranking attempts, the start sequence will be terminated and Fail to Start  fault will be displayed. When the engine fires, the starter motor is disengaged and locked out. Delayed alarms (under speed, low oil pressure etc) will be monitored after the end of the Safety On delay.


The generator will continue to run on load regardless of the state of the mains supply. If Auto mode is selected, and the mains supply is healthy then the Remote Stop Delay Timer begins, after which the load is transferred to the mains. The generator will then run off load allowing the engine a cooling down period. Selecting stop  de-energizes the fuel solenoid, bringing the generator to a stop.

6.2.3 Automatic Mode of operation

This mode is activated by pressing the  push button. A LED indicator beside the button confirms this action.


Should the mains (utility) supply fail outside the configurable limits for longer than the period of the delay start timer, the mains healthy indicator will extinguish .

Additionally, while in AUTO mode, the remote start input is monitored. Whether the start sequence is initiated by mains failure or by remote start input, the following sequence is followed: To allow for short term mains supply transient conditions or false remote start signals, the start delay timer is initiated. After the Fuel Solenoid is energized, then 1 /2 second later, the starter motor is engaged.




The engine is cranked for 10 second. If the engine fails to fire during this cranking attempt than the starter motor is disengaged for 10 second. Should this sequence continue beyond the 3 cranking attempts, the start sequence will be terminated and Fail to Start  fault will be displayed. When the engine fires, the starter motor is disengaged and locked out. Delayed alarms (under speed, low oil pressure etc) will be monitored after the end of the Safety On Delay.

If the remote start is being used and has been configured to Remote Start is on load, or the mains failed, the load will be transferred to the generator.


On the return of the mains supply, the Stop delay timer is initiated, once it has timed out, the load is transferred back to the mains (utility). The cooling timer is than initiated, allowing the engine a cooling down period (180 sec) off load before shutting down.

Once the cooling timer expires the fuel solenoid is de-energized, bringing the generator to a stop. Selecting Stop  de-energizes the fuel solenoid, bringing the generator to a stop.

6.2.4 Test Mode of Operation

This mode is activated by pressing the  push button. A LED indicator beside the button confirms this action. Press the  button to begin the test sequence. After the Fuel Solenoid is energized, then 1/2 second later, the Starter Motor is engaged. The engine is cranked for 10 second. If the engine fails to fire during this cranking attempt then the starter motor is disengaged for 10 second. Should this sequence continue beyond the 3 cranking attempts, the start sequence will be terminated and Fail to Start  fault will be displayed.

When the engine fires, the starter motor is disengaged and locked out. Delayed alarms (under speed, low oil pressure etc) will be monitored after the end of the Safety On delay. The load will be transferred to the generator and the set will run on load until Auto mode is selected or Stop is pressed.


Selecting Stop  de-energizes the fuel solenoid, bringing the fuel solenoid, bringing the generator to a stop.

6.3 INFORMATION THAT CAN BE DISPLAYED

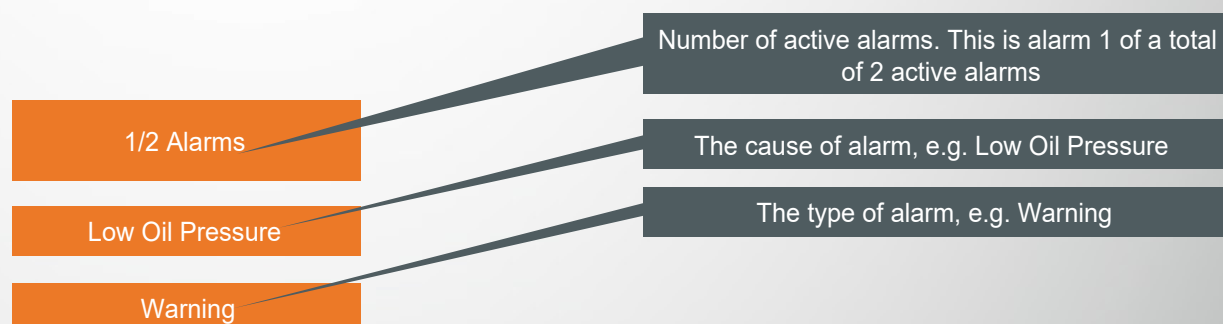
6.3.1 ALARMS

Warnings are non-critical alarm conditions and do not affect the operation of the generator system, they serve to draw the operators attention to an undesirable condition. By default, warning alarms are self-resetting when the fault condition is removed.

When an alarm is active, the Common Alarm LED, illuminates and a message appears on the module's display. If configured, the external audible alarm also sounds.

The external audible alarm is silenced by pressing the *Alarm Reset / Lamp Test*  button.

The LCD display jumps from the 'Information page' to display the Alarm Page



6.4 Induction and Exhaust systems

1. Exhaust system design is of prime importance to the installation of generating set. The purpose of the exhaust system is to convey the exhaust gases safely outside the building, and to disperse the exhaust fumes and the noise away from the building.
2. It is prohibited to run the generating set without filters
3. Flexible connections are required to isolate engine vibration and noise from the ducting system
4. Exhaust pipes are to be strapped to the roof to minimize the weight pressure exerted in the generating set
5. Proper selection of elbows and ducts is needed to minimize the inlet air restriction
6. Use of rain cap or exhaust trap may be needed in case of vertical exhaust system to prevent the rain from entering the exhaust system
7. The positions of the exhaust pipe and air inlet pipes should be studied carefully to prevent hot air circulation
8. The breather gases should be routed in a way that prevents its entrance to radiator
9. Proper measurement of elbows and ducts is needed to minimize the back pressure of the exhaust system. To minimize the backpressure, the curve radius should be 1.5times the radius of the pipe
10. Exhaust backpressure must not exceed the allowable backpressure specified by the engine manufacturer

6.5 Cooling system and Ventilation

1. When a generating set with an integrally mounted radiator is installed in an engine room, the basic principal is to extract hot air from the room and induce air at the ambient temperature outside the engine room with minimum re-circulation
2. The object is to get cool air in at the lowest possible point, push it through the radiator matrix and then out of the building
3. The outlet opening in the wall should have a FREE FLOW AREA about 25% larger than the frontal area of the radiator matrix and be of the same rectangular shape
4. A sheet metal or plastic duct is fixed to the opening frame using a flexible connection to the radiator duct flange. The flexible section is particularly necessary when the set is mounted on a floating concrete block or anti-vibration mountings, so that vibration shouldn't be transmitted from the generating set to the wall

5. The inlet air opening should also have a FREE FLOW AREA at least 25%/ larger than the radiator matrix
6. The inlet and outlet openings will usually be fitted with a mesh grille, louvers, noise attenuating panels or inside and outside ducting. Whatever is fitted will promote resistance to air flow and it may be necessary to further increase the opening area
7. As shown in Fig 5 the cool incoming air is drawn over the alternator which takes its own cooling air from this flow, across the engine air intake filter and the engine. The radiator fan then pushes air through the radiator matrix to outside. There must be no obstruction to air flow immediately in front of the radiator outlet and to deflectors, etc
8. This is the possible ventilation system but in practice, the best is not always possible Fig. shows the air inlet position high in the wall. This is acceptable if ducting directs the air to the end of the alternator and has the advantage of preventing heated air from collecting near the ceiling

The LCD displays multiple alarms such as “Coolant Temperature High”, “Emergency Stop” and “Low Coolant Warning”. These automatically scroll in the order that they occurred. In the event of an alarm, the LCD displays the appropriate text. If an additional alarm then occurs, the module displays the appropriate text.

Example:

1/2	Alarms	2/2	Alarms
Low Oil Pressure		Coolant Temperature High	
Warning		Shutdown	


6.3.2 SHUTDOWN ALARMS

NOTE: The alarm condition must be rectified before a reset takes place. If the alarm condition remains, it is not possible to reset the unit (The exception to this is the Low Oil Pressure alarm and similar active from safety on alarms, as the oil pressure is low with the engine at rest).

Shutdown alarms are latching and immediately stop the Generator. On initiation of the shutdown condition the module de-energizes all the Delayed Load Output and the Close Gen Output outputs to remove the load from the generator. Once this has occurred, the module shuts the generator set down immediately to prevent further damage. The alarm must be accepted and cleared, and the fault removed to reset the module.

Example

1/2	Alarms
Low Oil Pressure	
Shutdown	

Shutdowns are latching alarms and to remove the fault, press the Stop/Reset  Mode button on the module.

6.3.3 ENGINE

These pages contain instrumentation gathered about the engine measured or derived from the module’s inputs, some of which may be obtained from the engine ECU.












- Engine Speed
 - Oil Pressure
 - Coolant Temperature
 - Engine Battery Volts
 - Engine Run Time
 - Engine Fuel Level
 - Oil Temperature
 - Coolant Pressure
- Inlet Temperature
 - Exhaust Temperature
 - Fuel Temperature
 - Turbo Pressure
 - Fuel Pressure
 - Fuel Consumption
 - Fuel Used
 - Fuel Level
- Flexible Sensors
 - Engine Maintenance Alarm 1
 - Engine Maintenance Alarm 2
 - Engine Maintenance Alarm 3
 - Engine ECU Link
 - Tier 4 Engine Information













6.3.4 GENERATOR

These pages contain electrical values of the generator, measured or derived from the module’s voltage inputs.

- Generator Voltage (ph-N)
 - Generator Voltage (ph-ph)
 - Generator Frequency
 - Generator Current (A)
 - Generator Load ph-N (kW)
 - Generator Total Load (kW)
 - Generator Load ph-N (kVA)
 - Generator Total Load (kVA)
 - Generator Power Factor Average
 - Generator Load ph-N (kVAr)
 - Generator Total Load (kVAr)
 - Generator Accumulated Load (kWh, kVAh, kVArh)
 - Generator Phase Sequence
 - Active Configuration

6.3.5 SHUTDOWN ALARM ICONS AND THEIR MEANING

Icon	Fault	Description
	Auxiliary Inputs	The module detects that an auxiliary input which has been user configured to create a fault condition has become active.
	Analogue Input Configured as Digital	The analogue inputs can be configured to digital inputs. The module detects that an input configured to create a fault condition has become active.
	Fail to Start	The engine has failed to start after the configured number of start attempts
	Low Oil Pressure	The module detects that the engine oil pressure has fallen below the low oil pressure pre-alarm setting level after the Safety On timer has expired.
	Engine High Temperature	The module detects that the engine coolant temperature has exceeded the high engine temperature pre-alarm setting level after the Safety On timer has expired.
	Under Speed	The engine speed has fallen below the under speed pre alarm setting
	Over Speed	The engine speed has risen above the over speed pre alarm setting
	Charge Failure	The auxiliary charge alternator voltage is low as measured from the W/L terminal.
	Low Fuel Level	The level detected by the fuel level sensor is below the low fuel level pre-set alarm setting.
	High Fuel Level	The level detected by the fuel level sensor is above the high fuel level pre-set alarm setting.
	Generator Under Voltage	The generator output voltage has fallen below the pre-set alarm setting. after the Safety On timer has expired.
	Generator Over Voltage	The generator output voltage has risen above the pre-set alarm setting.

Icon	Fault	Description
	Generator Under Frequency	The generator output frequency has fallen below the pre-set alarm setting after the Safety On timer has expired.
	Generator Over Frequency	The generator output frequency has risen above the pre-set alarm setting.
	Delayed Over Current	The measured current has risen above the configured trip level for a configured duration.
	kW Overload	The measured kW has risen above the configured trip level for a configured duration.
	CAN ECU Fault	The engine ECU has detected an alarm – CHECK ENGINE LIGHT Contact Engine Manufacturer for support.
	CAN Data Fail	The module is configured for CAN operation and does not detect data on the engine Can data link.
	Emergency Stop	The emergency stop button has been depressed. This failsafe (normally closed to emergency stop) input and immediately stops the set should the signal be removed.
	Oil Sender Open Circuit	The oil pressure sensor has been detected as being open circuit.
	Coolant Temperature Sender Open Circuit	The coolant temperature sensor has been detected as being open circuit.
	Oil Filter Maintenance Alarm	Maintenance due for oil filter.
	Air Filter Maintenance Alarm	Maintenance due for air filter
	Fuel Filter Maintenance Alarm	Maintenance due for fuel filter.

7. GENERAL PRECAUTIONS AND CONTROLS WHICH MUST BE DONE AFTER STARTING UP THE GENERATING SET.

1. Check for any abnormal noise or vibration on the generating set.
2. Check if the exhaust system has any leakage.
3. Monitor the generating set operation by means of the control module LCD display. Check the engine temperature and oil pressure. Oil pressure must reach the normal value 10 seconds after the generating set operation.
4. If an engine block water heater is not available, run the generating set at no-load for 8 minutes and when the engine warm than apply on load (for manual models).

7.1 Warning about putting the gen-set under load.

Our gen-set cannot run under less than 25% load for a long time. Because inside engine, some parts use pressure for seal, such as between cylinder liner and piston and piston ring, between supercharger and supercharger rotor axle. For this kind of seal, when engine has about 1/3 load, which will fully come into play. And under this load, there will be followed failures:

1. Seal between piston and cylinder liner is poor, oil will go up and into combustor, and exhaust will emit blue smoke.
2. As for supercharged diesel gen-sets, because of under low load, no load, low supercharging pressure, it will easily cause the sealing effect(using pressure to seal) of supercharger oil seal(non contact) to decrease, then oil will go into supercharging chamber and then goes into cylinder together with inlet air.
3. A part of oil which goes into cylinder will take part in combustion, another part of oil cannot combust fully and will form carbon deposit at air valve, air inlet passage, piston top, piston ring and other places. And other part of oil will go out with exhaust air and form carbon deposit at exhaust pipe. When accumulated oil and carbon deposit are to some extent, they will drip from connector of exhaust manifold.
4. When oil in supercharging chamber of supercharger is accumulated to some extent, it will leak form junction of supercharger.
5. If gen-set runs under load for a long time, it will cause its moving parts to have serious abrading and engine combustion environment will worsen, finally it will cause overhaul ahead of time. So overseas diesel gen-set manufacturers always emphasize to make gen-set not to run under low load or no load as less time as possible. And it is ruled that the smallest load cannot be less than gen-set rated power 25% - 30%.

8. MAINTENANCE

8.1 Engine maintenance chart



○ :Check ♦ :Replace ● :Contact STAUNCH MACHINERY									
System	Check Item	Daily	Periodic Maintenance Interval						
			Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours	Every 3000 hours
Cooling System	Check and Refill Engine Coolant	○							
	Check and Clean Radiator Fins		○						
	Check and Adjust Cooling Fan V-belt		○ 1 st time	○ 2 nd & after					
	Drain, Flush and Refill Cooling System With New Coolant					♦ or every 1 year which ever comes first			
Cylinder Head	Adjust Intake/Exhaust Valve Clearance					●			
	Lap Intake/Exhaust Valve Seats (if required)							●	
Electrical Equipment	Check Indicators	○							
	Check Battery		○						
Engine Oil	Check Engine Oil Level	○							
	Drain and Fill Engine Oil		♦ 1 st time	♦ 2 nd & after					
	Replace Engine Oil Filter								
Engine Speed Control	Check and Adjust Governor Lever and Engine Speed Control	○		○					
Emission Control Warranty	Inspect, Clean And Test Fuel Injectors, if necessary						●		
	Inspect Turbocharger (Blower Wash as Necessary)								●
	Inspect, Clean And Test EGR Valve								●
	Clean EGR Lead Valve								●
	Clean EGR Cooler						●		
	Inspect Crankcase Breather System						●		
Fuel	Check and Refill Fuel Tank Level	○							
	Drain Fuel Tank			○					
	Drain Fuel Filter / Water Separator	○							
	Check Fuel Filter / Water Separator	○							
	Clean Fuel Filter / Water Separator				○				
	Replace Fuel Filter				♦				
Hoses	Replace Fuel System And Cooling System Hoses							♦ or every 2 yrs.	
Intake And Exhaust	Clean Or Replace Air Cleaner Element			○	♦				
Complete Engine	Overall Visual Check Daily	○							

8.2 Storing gen-set in non-operable condition for 3 months or more.

8.2.1 Preparation for storage.

1. Drain engine oil, and pour in rust-preventive oil into the engine.
2. Prepare a fuel mixture containing 50% rust-preventive oil, and fill the fuel tank with it.
3. Operate the gen-set at rated speed for 5 to 10 minutes under no load.
4. Immediately before stopping the engine, spray volatile.
5. With the gen-set stopped, drain the fuel mixture from the fuel tank.
6. Apply rust-preventive oil liberally on the exposed sections of the gen-set.
7. Seal air inlet, exhaust outlet, breather and other openings with an adhesive cloth tape.
8. Loosen V-belt of engine.
9. Disconnect cables from the battery terminals, and charge the battery. Clean the terminals, apply a thin coat of grease to the terminals, and store the battery in a cool and dry room.
10. Cover the entire gen-set.

8.2.2 Maintenance during storage

Charge the battery once a month.

First, check the battery electrolyte for correct level and then charge the battery.

8.2.3 Using gen-set after storage

1. Remove the cover from the gen-set.
2. Connect a fully charged battery.
3. Adjust the tension of V-belt.
4. Remove sealing tapes from the openings of the engine.
5. Drain rust-preventive oil, and pour in appropriate engine oil.
6. Fill the fuel tank with fuel, and bleed the fuel system.
7. Inspect the entire gen-set.
8. Remove the rocker covers, and lubricate the valve mechanisms.
9. Shut off the fuel supply and crank the engine for about 10 seconds, and repeat this cranking 3 times at intervals of about 1 minute.
caution; to crank the engine, shut off the fuel supply to the engine and operate the starters.
10. Make sure the engine oil pressure rises.
11. Start the engine.
12. Apply load and increase the engine speed to the rated speed.

8.3 Engine Oil Recommendation

Due to differences in the engine size and engine description, and taking into consideration the environment by which the engine will operate, please contact staunch machinery in order to provide the correct grade and type of oil that will best serve your engine.

8.4 Oil Change Procedure

Note: Dispose of all waste materials (engine oil, fuel, filter, etc.) in an environmentally safe manner.

For best result please drain the oil while it is still warm.

8.4.1 Drain the oil

1. Place the generator set master switch in the OFF position.
2. Disconnect the power to the battery charger.
3. Disconnect the generator set engine starting battery, negative (--) lead first.
4. Clean the area around the dipstick and oil fill cap.
5. Open the oil drain ball valve on the engine.
6. Remove the dipstick and oil fill cap. Allow time for the engine oil to drain completely.
7. Close the oil drain valve.
8. Replace the dipstick.

8.4.2 Replace the oil filter

1. Clean the area around the oil filter. Remove the oil filter by rotating it counterclockwise with an oil filter wrench.
2. Clean the gasket sealing surface of the oil filter adapter.
3. Apply a light coat of clean oil to the rubber seal of the new oil filter.
4. Install the new oil filter following the instructions provided with the filter.

8.4.3 Fill with oil

1. Fill the engine to the F mark on the dipstick. See The engine data sheet for the oil capacity
2. Reinstall the dipstick and the oil fill cap.
3. Check that the generator set master switch is in the OFF position.
4. Reconnect the generator set engine starting battery, negative (--) lead last. Reconnect the power to the battery charger.
5. Start and run the generator set for a minute to allow the oil pressure to reach operating range.
6. Stop the generator set, wait 1 minute, and then recheck the oil level. Add oil to bring the level up to the F mark on the dipstick.

8.4.4 Check for leaks

1. Check for oil leaks.
2. Fix leaks and recheck the oil level.

8.5 Batteries description and maintenance

- Batteries are very important component of the generating set, if they fail, the generating set will fail to work.
- Batteries are selected according to the recommendations of engine manufacturers as its size is mainly dependent on the engine characteristics. Also the viscosity grade of lube oil used and ambient temperature are also important factors in selecting a battery.
- Batteries are only needed during cranking of engine, after then, the DC alternator will take it over. That is why we need always to keep the battery ready or “charged”.
- Two kinds of batteries are employed in our generating sets: sealed lead acid batteries and wet lead acid.
- Wet lead acid batteries are traditional batteries that can be used for all kinds of applications.
- Sealed lead acid batteries are mainly intended for internal combustion engines.
- They are minimum maintenance batteries as they do not need to be serviced as frequently.

8.6 Checking specific gravity

- A tool called hydrometer is be used to measure the battery state.
- Hydrometer measures the specific gravity or SG of battery liquid, which is an indication for the state of charge of battery.
- Below table describes the relation between battery SG and state of charge

Specific gravity (@ 27C)	State-of-Charge in %
1.28	100%
1.25	75%
1.22	50%
1.19	25%
1.13 and less	Discharged

- In sealed lead acid batteries, there is no access to battery fluid to check.
- A built-in hydrometer is found on the battery. This hydrometer gives rough indication of battery status:
 GREEN: fully charged
 WHILE: need replacement
- This indication is not always credible as it sense the status of one cell of the six cells of battery.
- The open OCV or Open Circuit Voltage of battery can be another indication for battery state of charge as shown in fig.20.

8.7 Checking electrolyte level (Wet Type Batteries)

For wet lead acid batteries, check the level of the electrolyte in the batteries at least every 200 hours of operation. If low, fill the battery cells to the bottom of the filler neck with distilled water.

8.8 Battery Maintenance

Weak or undercharged batteries are mainly the widespread cause of prime power system failures. Even when kept fully charged and maintained, lead-acid starting batteries are subject to deterioration over time and must be periodically replaced when they no longer hold a proper charge. Only a regular schedule of inspection and testing under load can prevent generator starting problems.

8.9 Cleaning batteries

Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive. If corrosion is present around the terminals, remove the battery cables and wash the terminals with a solution of baking soda and water (1/4-pound baking soda to one quart of water). Be careful to prevent the solution from entering the battery cells, and flush the batteries with clean water when done. After replacing the connections, coat the terminals with a light application of petroleum jelly.

Testing batteries

Merely checking the output voltage of the batteries is not indicative of their ability to deliver adequate starting power. As batteries age, their internal resistance to current flow goes up, and the only accurate measure of terminal voltage must be done under load. This test is performed automatically every time the generator is started on generator sets.

9. ENGINE TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	ACTION
Engine oil pressure indicator	Low level of engine oil	Check and adjust oil level as necessary
	Too high an oil level	
	Clogged engine oil filter	Replace engine oil filter
Engine coolant indicator	Low engine coolant level	Add engine coolant
	Dirty radiator fins	Clean the radiator fins
	Engine coolant leaking	Contact Staunch machinery maintenance department
	V -belt loose or damaged	Adjust V -belt or replace
	Contaminated engine coolant	Contact Staunch machinery maintenance department
	Faulty engine coolant pump	
Battery Indicator	V -belt loose or damaged	Adjust V-belt or replace
	Battery failure	Check battery condition
	Faulty alternator	Contact Staunch machinery maintenance department
Battery indicator stays ON	Faulty alternator	Contact Staunch machinery maintenance department
Engine oil pressure indicator stays ON	Faulty engine oil pressure switch	
	No or low level of engine oil	Check and adjust oil level as necessary
	Clogged engine oil filter	Replace engine oil filter
Starter motor operates but engine does not start	No diesel fuel	Refuel and prime fuel system
	Air in fuel system	Prime fuel system
	Improper diesel fuel	Replace with recommended diesel fuel
	Clogged fuel filter	Replace fuel filter
	Poor fuel injection	Contact Staunch machinery maintenance department
	Compressed air leakage from intake /exhaust valves	
	Faulty engine stop solenoid	
Starter motor does not operate or rotates too slowly (engine can be turned manually)	Battery needs charging	Check electrolyte, recharge
	Faulty cable connection at battery terminals	Clean terminals, retighten
	Faulty starter switch	Contact Staunch machinery maintenance department
	Faulty starter motor	
Engine cannot be manually turned	Inner parts seized or damaged	

SYMPTOM	PROBABLE CAUSE	ACTION
Black exhaust smoke	Engine overloaded	Reduce load
	Clogged air cleaner element	Clean element or replace
	Improper diesel fuel	Replace with recommended diesel fuel
	Faulty spraying of fuel injection	Contact Staunch machinery maintenance department
	Excessive intake / exhaust valve clearance	
	Faulty EGR valve	
White exhaust smoke	Improper diesel fuel	Replace with recommended diesel fuel
	Faulty spray pattern of fuel injection	Contact Staunch machinery maintenance department
	Engine burning oil	
	Fuel injection timing delay	

10. GENERATOR SET 3D RENDERED IMAGES FOR ILLUSTRATION



Figure 1: Forklift opening in the base frame



Figure 2: External antifreeze filling hole



Figure 3: External diesel filling hole

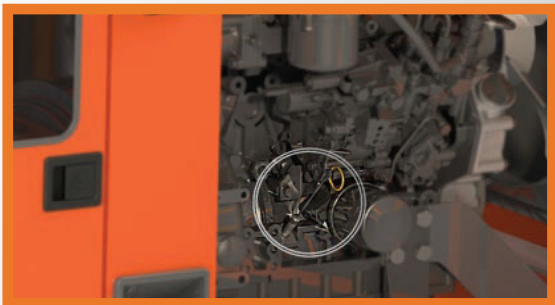


Figure 4: Oil level dipstick



Figure 5: Emergency stop button

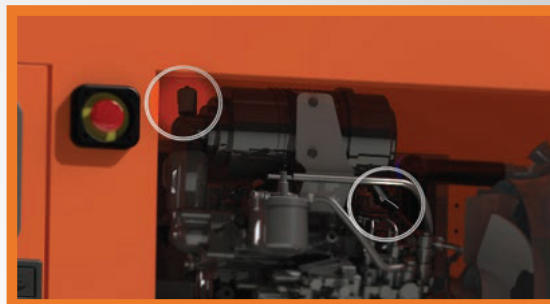


Figure 6: Air filter equipped with dust control valve to the right and clogging indicator to the left



Figure 7: Caution: Hot Surface Inside contact may cause burn

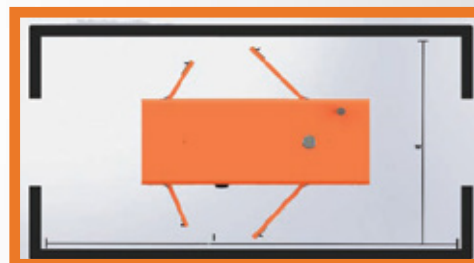
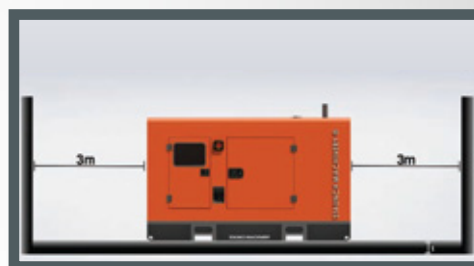


Figure 8: Design of foundation and distance requirements for placing the gen-set

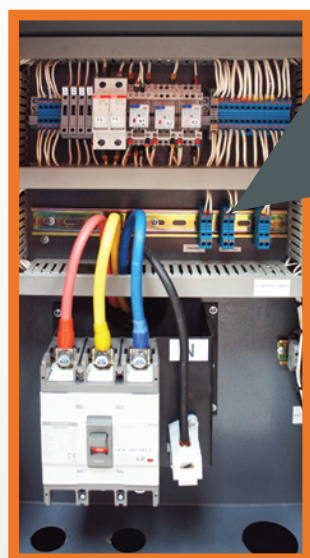
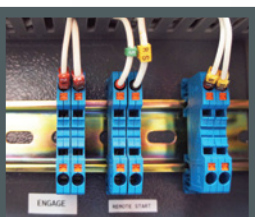


Figure 9: Remote Start



STAUNCH - LEBANON - Head Office:

Lebanon, Saida, Ghazieh, Maarouf Saad Blvd. - Tel/Fax: 00961 7 724013
info@staunchmachinery.net - www.staunchmachinery.com