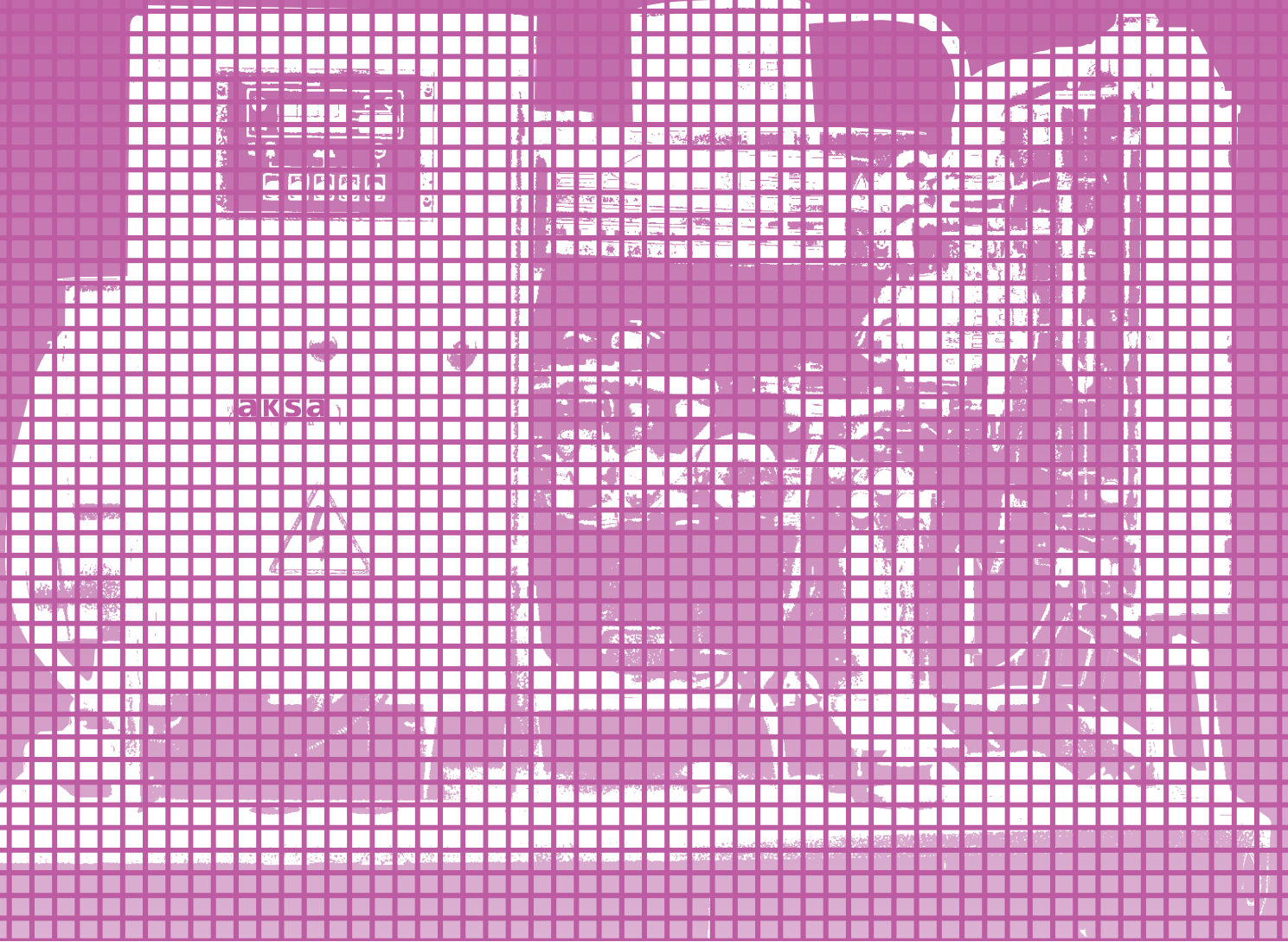


aksa
JENERATÖR

aksa POWER
GENERATION

MITSUBISHI
DİZEL MOTOR JENERATÖR
KULLANIM VE BAKIM
EL KİTABI

MITSUBISHI
DIESEL GENERATING SETS
MAINTENANCE AND USER
MANUAL



DIESEL GENERATING SETS

MAINTENANCE AND USER

MANUAL

mitsubishi DIESEL

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Dear Aksa Generating Set Users;

First of all, we would like to thank you for your choice of Aksa Generating Set. It is solid, safe and reliable machine, built according to the latest technology. This maintenance and user 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.

This manual gives general information about mounting, 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.

Aksa Jeneratör does not assume responsibility for possible errors. Aksa Jeneratör reserves to make changes without prior notice.

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I. INTRODUCTION

Aksa Generating set is designed to be commissioned, when delivered, as soon as the necessary cooling water, antifreeze, fuel, lubrication oil and fully charged battery are provided. With its long years of experience, Aksa manufactures efficient, reliable and quality generating set. This operating and maintenance manual is prepared to assist the operator in operation and maintenance of the generating set. Observing the advices and rules in this manual will ensure that the generating set operates in maximum performance and efficiency for a long time.

- Care should be taken to perform more frequent maintenance in dirty and dusty environments in order to keep the generating set in good working condition.
- Necessary adjustment and repairs should be made only by authorized and qualified persons.
- Each generating set has a model and a serial number indicated on a label on the base frame. This plate also indicates the manufacturing date, voltage, current, power in kVA, frequency, power factor and weight of the generating set. These datas are necessary in spare part orders, for warranty validity and for service calls,

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MODEL	PRODUCT DATE	SERIAL NO	
PRIME KVA		STANDBY KVA	
PRIME A		STANDBY A	
ALTERNATOR MODEL		ALTERNATOR SERIAL NO	
DIMENSIONS L W H	FUEL TANK CAPACITY L		
VOLTS		GROUP WEIGHT kg.	
Hz	Cosφ	CE	
PHASE	R.P.M	SZUTEST ISO 90012000 3 0007 CERTIFICATION NO: 3000 CERTIFICATION NO: 11-06 ETX-025-10	
" Assembled in Türkiye "			

The generating set is designed to be safe when used in correct manner. However responsibility for safety rests with the personnel who install, use and maintain the set. If the following safety precautions are followed, the possibility of accidents will be minimized. Before performing any procedure or operating technique, it is up to the user to ensure that it is safe.

The generating set should only be operated by personnel

who are authorized and trained.

Only people that have the right skills should be allowed to operate, adjust, perform maintenance or repair on Aksa Power Generation equipment. It is the responsibility of management to appoint operators with the appropriate training and skill for each category of job.

Skill level 1 : Operator

An operator is trained in all aspects of operating the unit with the push- buttons, and trained to know the safety aspects.

Skill level 2 : Mechanical technician

A mechanical technician is trained to operate the unit the same as the operator. In addition, the mechanical technician is also trained to perform maintenance and repair, as describe in the instruction manual, and is allowed to change settings of the control and safety system. A mechanical technician does not work on live electrical components.

Skill level 3 : Electrical technician

An electrical technician and has the same qualifications as both the operator and the mechanical technician. In addition, the electrical technician may carry out electrical repairs within the various enclosures of the unit. This includes work on live electrical components.

Skill level 4: Specialist from the manufacturer

This is skilled specialist sent by the manufacturer or its agent to perform complex repairs or modifications to the equipment. In general it is recommended that not more than two people operate the unit, more operators could lead to un safe operating conditions. Take necessary steps to keep unauthorized person away from the unit and eliminate all possible source of danger at the unit.

The manufacturer does not accept any liability for any damage arising from the use of non-original parts and for modifications, additions or conversions made without the manufacturer's approval in writing.

2. GENERAL SAFETY PRECAUTIONS

2.1. General

- 1 The owner is responsible for maintaining the unit in a safe operating condition. Unit parts and accessories must be replaced if missing or unsuitable for safe operation.
- 2 Operate the unit only for the intended purpose and within its rated limits (pressure, temperature, speeds, etc.).
- 3 Gen-set and equipment shall be kept clean, i.e. as free as possible from oil, dust or other deposits.
- 4 To prevent an increase in working temperature, inspect and clean heat transfer surfaces (cooler fins, intercoolers, water jackets, etc.) regularly.
- 5 Take precautions against fire. Handle fuel, oil and anti-freeze with care because they are inflammable substances. Do not smoke or approach with naked flame when handling such substances. Keep a fire-extinguisher in the vicinity.

WARNING

- ! Read and understand all safety precautions and warnings before operating or performing maintenance on the generating set.
- ! Failure to follow the instructions, procedures, and safety precautions in this manual may increase the possibility of accidents and injuries.
- ! Do not attempt to operate the generating set with a known unsafe condition.
- ! If the generating set is unsafe, put danger notices and disconnect the battery negative (-) lead so that it cannot be started until the condition is corrected.
- ! Disconnect the battery negative (-) lead prior to attempting any repairs or cleaning inside the enclosure.
- ! Install and operate this generating set only in full compliance with relevant National, Local or Federal Codes, Standards or other requirements.

2.2. Handling and towing

The following safety precautions should be noted:

WARNING

- ! Make electrical connections in compliance with relevant Electrical Codes, Standards or other requirements. This includes requirements for grounding and ground/earth faults.
- ! For stationary generating sets with remote fuel storage

systems, make sure such systems are installed in compliance with relevant Codes, Standards or other requirements.

! Engine exhaust emissions are hazardous to personnel. The engine exhaust for all indoor generating sets must be piped outdoors via leak-free piping in compliance with relevant Codes, Standards and other requirements. Ensure that hot exhaust silencers and piping are clear of combustible material and are guarded for personnel protection per safety requirements. Ensure that fumes from the exhaust outlet will not be a hazard.

! Never lift the generating set by attaching to the engine or alternator lifting lugs, instead use the lifting points on the base frame or canopy.



! Ensure that the lifting rigging and supporting structure is in good condition and has a capacity suitable for the load.

! Keep all personnel away from the generating set when it is suspended.

2.3. Fire and explosion

Fuel and fumes associated with generating sets can be flammable and potentially explosive. Proper care in handling these materials can dramatically limit the risk of fire or explosion. However, safety dictates that fully charged BC and ABC fire extinguishers are kept on hand.

Personnel must know how to operate them.

WARNING

- ! Ensure that the generating set room is properly ventilated.
- ! Keep the room, the floor and the generating set clean. When spills of fuel, oil, battery electrolyte or coolant occur, they should be cleaned up immediately.
- ! Never store flammable liquids near the engine.
- ! Never store flammable liquids near the engine.

- ! Do not smoke or allow sparks, flames or other sources of ignition around fuel or batteries. Fuel vapors are explosive. Hydrogen gas generated by charging batteries is also explosive.



- ! Turn off or disconnect the power to the battery charger before making or breaking connections with the battery.
- ! To avoiding arcing keep grounded conductive objects (such as tools) a way from exposed live electrical parts (such as terminals). Sparks and arcing might ignite fuel or vapors.
- ! Avoid refilling the fuel tank while the engine is running.

- ! Do not attempt to operate the generating set with any known leaks in the fuel system.



2.4. Mechanical

The generating set is designed with guards for protection from moving parts. Care must still be taken to protect personnel and equipment from other mechanical hazards when working around the generating set.

WARNING

- ! Do not attempt to operate the generating set with the safety guards removed. While the generating set is running do not attempt to reach under or around the guards to do maintenance or for any other reason.

- ! Keep hands, arms, long hair, loose clothing and jewelers away from pulleys, belts and other moving parts.



Attention: Some moving parts cannot be seen clearly when the set is running.

- ! If equipped keep access doors on enclosures closed and locked when not required to be open.



- ! Avoid contact with hot oil, hot coolant, hot exhaust gases, hot surfaces and sharp edges and corners.

working around the generating set.

- ! Do not remove the radiator filler cap until the coolant has cooled. Then loosen the cap slowly to relieve any excess pressure before removing the cap completely.



2.5. Chemical

Fuels, oils, coolants, lubricants and battery electrolyte used in this generating set are typical of the industry. However, they can be hazardous to personnel if not treated properly.

WARNING

- ! Do not swallow or allow skin contact with fuel, oil, coolant, lubricants or battery electrolyte. If swallowed, seek medical treatment immediately. Do not induce vomiting if fuel is swallowed. For skin contact, wash with soap and water.
- ! Do not wear clothing that has been contaminated by fuel or lube oil.

- ! Wear an acid resistant apron and face shield or goggles when servicing the battery. If electrolyte is spilled on skin or clothing, flush immediately with large quantities of water.



2.6. Noise

Generating sets that are not equipped with sound attenuating enclosures can produce noise levels in excess of 105 dB(A). Prolonged exposure to noise levels above 85 dB(A) is hazardous to hearing.



WARNING

Ear protection must be worn when operating or working around an operating generating set.

- ! Wear protective clothing including gloves and hat when

2.7. Electrical

Safe and efficient operation of electrical equipment can be achieved only if the equipments is correctly installed, operated and maintained.

WARNING

! The generating set must be connected to the load only by trained and qualified electricians who are authorized to do so, and in compliance with relevant Electrical Codes, Standards and other regulations.

! Ensure that the generating set, including a mobile set is effectively grounded/earthed in accordance with all relevant regulations priorts operation.

! The generating set should be shutdown with the battery negative (-) terminal disconnected prior to attempting to connect or disconnect load connections.

! Do not attempt to connect or disconnect load connections while standing in water or on wet or soggy ground.

! Do not touch electrically energized parts of the generating set and/or interconnecting cables or conductors with any part of the body or with any non insulated conductive object.



! Replace the generating set terminal box cover as soon as connection or disconnection of the load cables is complete. Do not operate the generating set without the cover securely in place.

! Connect the generating set only to loads and/ or electrical systems that are compatible with its electrical characteristics and that are within its rated capacity.

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

! Insulate all connections and disconnected wires.

! Use only Class BC or Class ABC extinguishers on electrical fires.

2.8 First aid for electric shock

warning

! Do not touch the victim's skin with bare hands until the source of electricity has been turned off.

! Switch off power if possible other wise pull the plug or the cable away from the victim.

! If this is not possible, stand on dry insulating material and pull the victim clear of the conductor; preferably using insulated material such as dry wood.

! If victim is breathing, turn the victim clear of the conductor, preferably using insulated material such as dry wood.

! If victim is breathing, tum the victim into the recovery position described below. If victim is unconscious, perform resuscitation as required;

Open the airway

Tilt the victim's head back and lift the chin upwards. Remove objects from the mouth or throat (including false teeth, tobacco or chewing gum).



Breathing

Check that the victim is breathing by looking, listening and feeling for the breath.



Circulation

Check for pulse in the victim's neck.

If no breathing but pulse is present

- Pinch the victim's nose firmly,
- Take a deep breath and seal your lips around the victim's lips.
- Blow slowly into the mouth watching for the chest to rise.
- Let the chest fall completely.



- Give breaths at a rate of 10 per minute.
- If the victim must be left to get help, give 10 breaths first and then return quickly and continue.
- Check for pulse after every 10 breaths. When breathing restarts, place the victim into the recovery position described later in this section.

If no breathing and no pulse

- Call or telephone for medical help.
- Give two breaths and start chest compression as follows:



- Place heel of hand 2 fingers breadth above ribcage/breastbone junction.
- Place other hand on top and interlock fingers.



- Keeping arms straight, press down 4-5 cm at a rate of 15 times per minute.
- Repeat cycle (2 breaths and 15 compressions) until medical helps takes over.
- If condition improves, confirm pulse and continue with breaths. Check for pulse after every 10 breaths.
- When breathing restarts, place the victim into the recovery position described below.



Recovery position

- Turn the victim onto the side.
- Keep the head tilted with the jaw forward to maintain the open airway.
- Make sure the victim cannot roll forwards or backwards.
- Check for breathing and pulse regularly. If either stops, proceed as above.



WARNING

! Do not give liquids until victim is conscious.

3. GENERAL DESCRIPTION

3.1. Generating Set Description and Identification

Diesel –electric generating sets are independent units for the production of electric power; basically, they comprise a constant voltage synchronous generator driven by an internal –combustion, diesel –cycle engine. The sets are used for two main purposes:

a- Continuous duty sets,

Used to produce electric power for countless requirements (motive power, lighting, heating, etc) in areas where other sources or power are unavailable.

b- Emergency duty sets,

Used during public network failures, when such failures are liable to cause serious trouble to persons or material or financial damage (i.e. in hospitals, industrial plants with non-stop operating cycles, etc) or to meet peak energy demands.

According to their application, the sets are further divided into:

- set for use on land
- set for use at sea

The sets for use on land can be either:

- stationary sets (fixed installation), or
- mobile sets (mobile installation)

These two types of sets are available in a vast range of versions, for every operating requirement, the main ones being:

01. hand control generating sets
02. stand-by generating sets

The standard stationary generating set comprises:

- diesel engine
- synchronous generator
- coupling
- metal sub-base with vibration isolators
- starter batteries
- fuel tank within the bed-plate
- instrument panel
- exhaust gas silencer.

Aksa Generating Set has been designed as a complete package to provide superior performance and reliability. Figure. 3.1. identifies the major components. This figure is of a typical generating set. However, every set will be slightly different due to the size and configuration of the major components. This section briefly describes the parts of the generating set. Further information is provided in later sections of this manual..

Each generating set is provided with a Rating Label (Item 1) generally fixed to the base frame. This label contains the information needed to identify the generating set and its operating characteristics. This information includes the model number, serial number, output characteristics such as voltage and frequency, output rating in kVA and kW, product date and weight.

The model and serial numbers uniquely identify the generating set and are needed when ordering spare parts or obtaining service or warranty work for the set. Aksa generating sets are an Alternating Current generator, built for continuous running at sites where no electricity is available (some models are excepted) or as stand-by in case of interruption of the mains.

The generator operates at 230/220 V, in line-to-neutral mode and 400/440 V in line-to-line mode.

3.2. Generating Set Main Parts

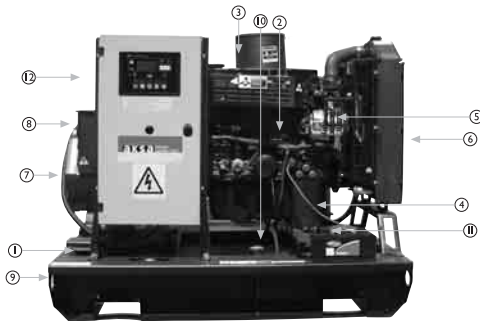


Figure 3.1. Typical generating set configuration

No	Description
1	Aksa generating set rating label
2	Diesel engine
3	Air filter
4	Battery
5	Battery charging alternator
6	Radiator
7	Alternator
8	Terminal box
9	Base frame
10	Fuel tank (inside the base frame)

- 11 Vibration isolators
- 12 Control Panel

3.3. Diesel Engine

The diesel engine powering the generating set (Item 2) has been chosen for its reliability and the fact that it has been specifically designed for powering generating sets. The engine is of the heavy duty industrial type with 4 stroke compression ignition and is fitted with all accessories to provide a reliable power supply. These accessories include, among others, a cartridge type dry air filter (item 3) and a mechanical engine speed governor. The engine cylinder block is cast in one piece cast iron, vertical cylinders inline overhead valves.

The cylinder heat is made of special cast iron. The thermally loaded flame plate is efficiently water cooled. The crankshaft is forged in one piece in a high tensile steel.

Lubrication: forced lubrication via gear pump, special paper cartridge –type filters, lubricant cooling via heat exchanger on most versions.

3.4. Engine Electrical System

The engine electrical system is 12 volt volts DC, negative ground/earth. This system includes an electric engine starter, a battery (item 4) and a battery charging alternator (item 5). For 12 volts electrical system one battery is given. Other types of batteries may be fitted if they were specified.

3.5. Cooling System

The engine cooling system is water cooled. The water cooled system is comprised of a radiator (item 6) a pusher fan and thermostat. The alternator has its own internal fan to cool the alternator components.

3.6. Synchronous Alternator

Horizontal axle alternator (synchronous three phase), on rolling bearings, self-ventilated within the room with low-loss silicon-sheet stator bundle, electrolytic copper winding with class H insulation.

The output electrical power is normally produced by a screen protected and drip-proof, self-exciting, self regulating, brushless alternator. (Item 7) Fine tuned to the output of this generating set. Mounted on top of the alternator is a sheet steel terminal box (item 8)

3.7. Coupling

Engine and alternator are firmly joined by a coupling cone that guarantees the proper assembly coaxiality Mono-support machines are also used a special flexible disk is used in place of a flexible coupling.

3.8. Fuel tank and Base frame

The engine and alternator are coupled together and mounted on a heavy duty steel base-frame (Item 9). This base frame includes a fuel tank (Item 10) 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 set.

3.9. Vibration Isolation

The generating set is fitted with vibration isolators (Item 11) which are designed to reduce engine vibration being transmitted to the foundation on which the generating set is mounted. These isolators are fitted between the engine /alternator feet and the base frame.

3.10. Silencer and Exhaust system

Exhaust gases from the turbocharger are discharged toward atmosphere through a silencer. These should be vented as high as possible, and must be prevented from re-entering the engine via the charge air intake, or polluting the radiator fins.

It is important to note that the turbocharger nozzles must be always free of loads. Stainless steel exhaust compensator(s) is delivered with generator set. Exhaust lines of different engines shall not be mixed in a common stack, but routed separately in individual ducts, enclosed in a chimney.

Suitable material is carbon steel sheet, and recommended calculation temperature is 475°C. Rain and condensate

permanent draining shall be provided to prevent water entering the silencer and the engine.

An exhaust silencer is provided loose for installation with the generating set. The silencer and exhaust system reduce the noise emission from the engine and can direct exhaust system reduce the noise emission from engine and can direct exhaust gases to safe outlets. The exhaust silencer is made of a carbon steel receiver containing sound attenuator and wave de-phasing system made of perforated steel sheet and heavy rock wool. It is asbestos-free. The exhaust silencer is delivered in two configurations with an industrial attenuation and residential attenuation.

3.1.1. Control System

One of several types of control systems and panels (item 12) may be fitted to control the operation and output of the set and to protect the set from possible malfunctions. Section 7 of this manual provides detailed information on these systems and will aid in identification of the control system fitted on the generating set.

4. ELECTRIC STARTING SYSTEMS

Electric starting systems are generally used on all gen-sets.

The power source for electric starting systems is a 12 VDC battery system. Control of starting is via a start solenoid which is controlled by the gen-set control system.

4.1. Battery Systems

Battery type is lead acid. Lead acid batteries are generally used, being the least expensive.

4.2. Maintenance Batteries

Warning

- Do not smoke or allow sparks, flames or other sources of ignition around batteries. Hydrogen gas generated by charging batteries is explosive.
- Wear an acid resistant apron and face shield or goggles when servicing the battery. If electrolyte is spilled on skin or clothing, flush immediately with large quantities of water.
- Take out the metallic things in your wrist and protect

your wrist and hand.

- Disconnect the battery negative (earth) lead first and reconnect last.
- Always ensure that battery charging is carried out in a well ventilated area.

The starting batteries should be located as close as possible to the generating set while still being accessible for servicing. This will prevent electrical losses

4.3. Battery Maintenance

- Keep the top of the battery and its terminals clean.
- Cover the battery terminals and its connections with Vaseline.
- Tighten the terminals but not tighten it hardly.
- Control the electrolyte level periodically. It must be 10 mm above the plates.
- Control the abrasion in the charge alternator belt and check periodically the belt tension according to producer' recommendation.
- Ensure that your battery is not uncharged.

4.4. Maintenance Free Batteries

Ensure that all battery connections are correct and batteries are always charged. After that there is not any procedure for this batteries.

4.5. Control of the Battery

Conduct an inspection every time before testing the battery.

1. A white powdered element causes abrasion to the pole-heads, its connections. Remove the connections and wash them with hot water to purify the oxidation. Reconnect it and coat with vaseline.
2. Check if any un-tightened connections exist.

4.6. Starting Aids

It is customary to maintain coolant temperatures above 40°C min. to promote quick starting on an emergency generating set and to take the load. Thermostatically controlled immersion heaters, deriving their supply from the primary source of power are fitted in the engine cooling system to provide this heating. Heater warms up the jacket water of the engine when the generating

set is not working.

5. HEALTHY and SAFETY

Safety should be the primary concern of the facility design engineer and all personnel engaged on installation and commissioning. Safety involves two aspects:

- 1) Safe operation of the generator itself (and its accessories).
- 2) Reliable operation of the system.

Reliable operation of the system is related to safety because equipment affecting life and health, such as life support equipment in hospitals, emergency aggress lighting, building ventilators, elevators and fire pumps, may depend on the generator set.

5.1. Fire Protection

The design, selection and installation of fire protection systems require the following considerations:

- The fire protection system must comply with the requirements of National Standards.
- Typically, the generator room will be required to have a one hour fire resistance rating. Generator room construction will have to have a two hour fire resistance rating.
- Generator room shall not be used for storage purposes
- The authority may specify the quantity, type and sizes of approved portable fire extinguishers required for the generator room.
- A manual emergency stop station outside the generator room or enclosure or remote from the generator set in an outside enclosure would facilitate shutting down the generator set in the event of a fire or another type of emergency.

General

- Do not fill fuel tanks when the engine is running, unless tanks are located outside the generator room.
- Do not permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generating set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made

with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.

- Be sure all fuel supplies have a positive shut-off.

5.2. Exhaust Gases

- Be sure the exhaust system will properly dispel discharged gases a way from enclosed or sheltered areas and areas where individuals are likely to congregate.
- Never connect the exhaust system of two or more engines.
- Never discharge engine exhaust into a brick, tile or cement block chimney, or a similar structure. Exhaust pulsations could cause severe structural damage.
- Do not use exhaust gases to heat a compartment.
- Be sure that the unit is well ventilated.
- Ensure that there is independent support for the exhaust system. No strain should be imposed on the engine exhaust manifolds. Which is especially important on a turbo-charged engine.

5.3. Moving Parts

- Tighten supports and keep guards in position over fans drive belts etc. Make sure that fasteners on the set are secure.
 - Keep hands, clothing and clothing and jewellery away from moving parts.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc

5.4. Hazardous Voltages

Improper wiring can cause fire or electrocution, resulting in severe personal injury or death and property or equipment damage.

For personal protection, stand on a dry wooden platform or rubber insulating mat, make sure clothing and shoes are dry, remove jewellery from hands and use tools with insulated handles.

- Do not leave cables trailing on the engine room floor.
- Do not use the same trunking for electric cables and fuel water lines.

- Do not run AC and DC cables in the same looms or trunking

• Always ensure that bonding and equipment earthing are correctly done. All metallic parts that could become energised under abnormal conditions must be properly earthed.

- Always disconnect the batteries and battery charger when serving or carrying out maintenance particularly on equipment arranged for automatic mains failure operation. Always disconnect a battery charger from its AC source before disconnecting the battery cable. Accidental starting of the generator set while working on it can cause severe personal injury or death.
- Do not tamper with interlocks.
- Do not connect the generator set directly to any building electrical system.
- Always follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician.

High voltage sets work differently to low voltage ones. Special equipment and training is required to work around high voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures may well result in personal injury or death.

- Do not work on energised equipment. Unauthorised personnel must not be permitted near energised equipment. Due to the nature of high voltage electrical equipment includes voltage remains after the equipment is disconnected from the power source. Equipment should be de-energised and safety earthed.

5.5. Water

Water or moisture inside a generator increases the possibility of “flashing” and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use a generator which is not dry inside and out.

5.6. Coolant and Fuel

The coolant heater must not be operated while the cooling system is empty or when the engine is running

or damage to the heater will occur. Coolant under pressure have a higher boiling point than water.

- Do not open a radiator, heat exchanger or header tank pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.
- Never use galvanised or copper fuel lines, fittings or fuel tanks. Condensation in the tanks and lines combines with the sulphur in the fuel to produce sulphuric acid. The molecular structure of the copper or galvanised lines or tanks reacts with the acid and contaminates the fuel.

6. GENERAL PRECAUTIONS AND CONTROLS WHICH MUST BE DONE BEFORE STARTING UP THE GENERATING SET.

- 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.
- Take out foreign materials such as keys, tools, cleaning wool, papers etc. on the engine and the alternator.
- Check the fuel level in day tank. Refill with fuel if it is low.
- Check the lubrication oil level on the dipstick. Refill with an appropriate oil if it is low. Oil level normally must be close to the maximum level line.
- Look at the water level by opening the radiator tap. If it is inadequate add more water. Look Fig. 6.2 , Fig. 6.3 , Fig. 6.4
- Engine cooling water must include antifreeze according to the coolest weather conditions in the area. A mixture of 50% antifreeze and 50% water provides a good protection in all area.
- Check the air filter gauge. Clean or replace air filter, if necessary.
- Keep the inlet opening open.
- Make sure that the generating set can easily take air from the environment.
- 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.

- Open the battery caps and check the liquid level in the cells for maintenance type battery. Add distilled water, if necessary, so as to be 1 cm higher than the separation. Never fill the cells with tap water, acid water or acid.
- Check if the circuit breaker outlet switch is in OFF position.
- Make sure that the emergency stop button is not pressed

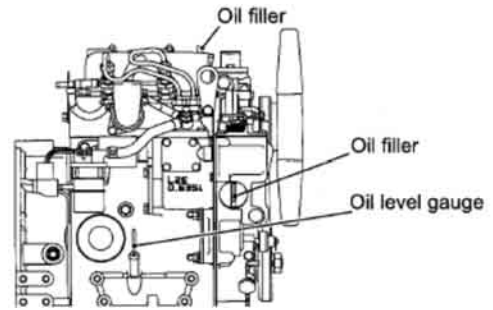


Fig.6.1. Oil filler and oil level gauge

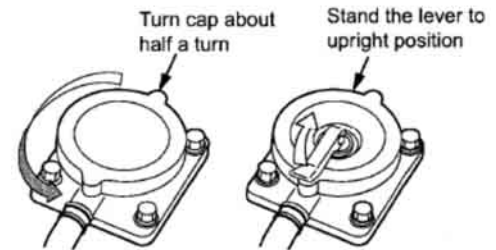


Fig.6.2. Radiator cap

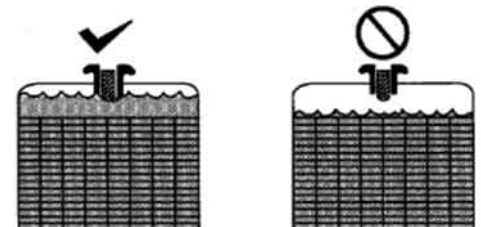


Fig.6.3. Radiator coolant level



Fig.6.4. Reserve tank coolant level

7. GENERATING SET CONTROL SYSTEMS

To control and monitor the generating set, an electronic control system has been used.

P 72 model control system is fitted. 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.

7.1. Control Panels

Control, supervision and protection panels are mounted on the generator base frame.

7.1.1. Control System P 72 Panel Specifications

The control panel is equipped as follows:

Equipments:

- Control with DSE, model 720 module
- Static battery charger
- Emergency stop push button.

DSE 720 Module Features

- To monitoring AC mains supply
- Automatic controls generating set, start and stop
- Provide signal to change over switch
- Scrolling digital LCD display
- Front panel configuration of timers and alarm trip points
- Easy push button control

STOP/RESET - MANUAL – AUTO – TEST – START

Metering via LCD display

- Generator Volt (L – N)
- Generator Ampere (L1, L2, L3)

- Generator Frequency (Hz)
- Mains Volt (L – L / L – N)
- Engine cooling temperature
- Engine oil pressure
- Engine speed
- Engine hours run
- Engine battery volt

Alarms

- Over current
- Over speed
- Under / Over mains volt
- Under / Over mains frequency
- Low oil pressure
- High engine temperature
- Low battery volt
- Charge fail
- Start failure
- Emergency stop

LED indication

- Mains available
- Mains on load
- Generator available
- Generator on load

7.1.2. Static Battery Trickle Charger

This charger is designed to ensure that the starter batteries maintain their charge even if the generating set is not operated for long periods.

As an option, a battery charger ammeter may be fitted to the control panel in order for the operator to monitor the functioning of the battery charger.

7.2. Control System Options

A large variety of options may be fitted to customize the control system to a specific installation.

7.2.1. Heaters

Alternator anti-condensation heaters may be fitted to the alternator stator winding to keep them dry in humid conditions. Panel anti-condensation heaters may be fitted in the control panel to keep moisture levels down.

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

- Check for any abnormal noise or vibration on the generating set.
- Check if the exhaust system has any leakage.
- 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.
- Monitor the generating set outlet voltage and frequency by means of the control module LCD display. Check the voltage, if the voltage between phases is 400 V, and between phase and neutral is 230 V. Check that the frequency is 51 - 52 Hz on generating sets with mechanical governors.
- 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) Apply load to the generating set as follows:
 - Set the alternator outlet circuit breaker on the panel to ON position.
 - Set the load circuit breakers (or fuses) on the distribution panel to ON position one by one. This way, the generating set cannot be suddenly put under full load. Otherwise, the engine stalling or alternator winding insulation of formation or burning can occur.
 - Set the alternator outlet circuit breaker on the circuit to OFF position before stop the generating set.
 - Continue to run the unloaded engine for purpose of cooling period for 5 minutes and then stop.
 - Never operate the generating set before removing any fault, if any.

9. LUBRICATING OIL

Oil system of diesel engine is one of the most important elements of the engine. Correctly made engine overhaul (this subject includes oil change periods, filter change periods, paying attention about selecting the true type of oil) prolongs the life cost of the engine.

9.1. Oil Performance Properties

The American Petroleum Institute (API) the American Society for Testing and Materials (ASTM) and Society of Automotive Engineers (SAE) has developed and preserved a system in order to classify the lubrication oils for their performance categories

9.2. Lubrication Oil Recommendations for Mitsubishi Engines

Many oil standards, which established through special oil depending application of engines and operating conditions. Among those standards, SAE viscosity grades and API service classifications are mostly used to classify engine oils. There are several categories of diesel engine oils. For Mitsubishi diesel engine, CD or CF graded oils are recommended as they are suitable for supercharging and high load application.

Use the following chart to select the appropriate oil viscosity according to the ambient temperature.

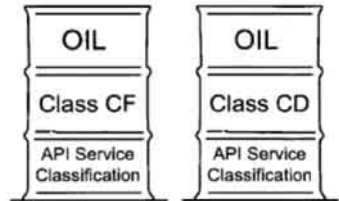


Fig. 9.1. Recommended engine oil

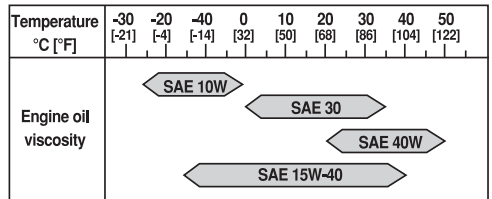


Fig.9.2. Recommended oil viscosity according to air temperature

Generating Set, 50 Hz, 400V			Fuel Consumption at Full Load L/h	Fuel Tank Capacity Liter	Coolant Capacity Liter	Oil Capacity Liter	Oil Specifications Not; Lubricating oil viscosity level will be chosen from Figure 7.1 according to the ambient temperature
Model	Standby Power kVA	Mitsubishi Engine Model					
AMT 11	11	S3L2	2,8	50	6,5	4,2	
AMT 16	16	S4L2	4	50	7,5	6	
AMT 22	22	S4Q2	6	50	10,5	6,5	
AMT 33	33	S4S	8,2	70	12	10	

Table 9.1. Fuel consumption and coolant, fuel and lubricating oil capacities and lubricating oil specifications (50 Hz Gen-sets)

10. GENERATING SET MAINTENANCE

A good maintenance program is the key to long generating set life. Maintenance and service should only be carried out by qualified technicians. The maintenance and service which are done must be recorded to the Maintenance Record Form. In general, the generating set should be kept clean. Do not permit liquids such as fuel or oil film to accumulate on any internal or external surfaces. Wipe down surfaces using an aqueous industrial cleaner.

10.1. Maintenance Schedule for Generator Sets

Using hour meter as a guide, perform all services at the hourly intervals indicated on following. At each maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed.

Important: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

Use correct fuels, Lubricants and coolant.

A. Daily or every 20 hours

Check

- Visually inspect engine, generator, transfer switch and control panel.

- For, Oil, Water and Fuel leaks.
- For, Coolant level, Oil level, Fuel level
- Battery charge level
- Operation of coolant heater
- Drain Fuel/Water separator
- Inspect the engine fan blades
- Inspect the drive belt

B. Weekly

Repeat Daily

Check

Fuel System

- Fuel level in main tank
- Day tank float switch
- Fuel transfer pump operation
- Fuel lines and connections

Cooling System

- Adequate fresh air to engine
- Hose and connections
- Battery charging alternator belts
- Inspect the engine fan blades
- Inspect the fan belt

Lubricating System

- Oil level
- Tighten connections

Exhaust System

- Exhaust leaks
- Tighten connections

Generator

- Vent screens
- Tighten covers
- Output voltage and frequency

Transfer Switch

- Operation under load
- No unusual sounds
- Terminals and connections normal colour
- Doors closed securely

C. First 50 service hours for new or overhauled engine

- Checking and cleaning solenoid fuel pump filter
- Changing engine oil and oil filter (Fig.10.2.)
- Re-tighten bolts and nuts on engine

D. Every 250 service hours

- Changing engine and oil filter (Fig.10.2.)
- Checking and cleaning radiator fins (Fig.10.4.)

E. Every 400 service hours

- Changing fuel filter (Cartridge type)

F. Every 500 service hours or every 1 years

- Cleaning fuel tank

G. Every 500 service hours

- Changing fuel filter element (Change cocktype)
- Replacing solenoid fuel pump filter
- Checking V-belt and adjusting belt tension
- Inspect and adjust fuel injection nozzles
- Checking valve clearance
- Checking glow plug

H. Every 1000 service hours

- Checking starter
- Checking alternator

I. Every 2 years

- Changing coolant

J. As required

- Cleaning, checking, replacing air cleaner element
- Bleeding fuel system (Fig.10.9.)
- Draining water sedimenter

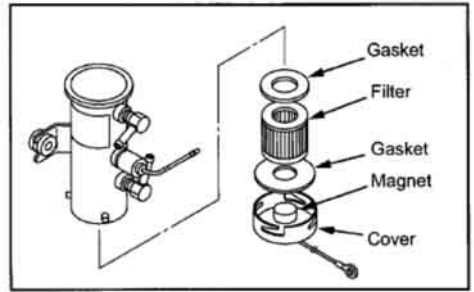


Fig.10.1. Checking and cleaning solenoid fuel pump filter

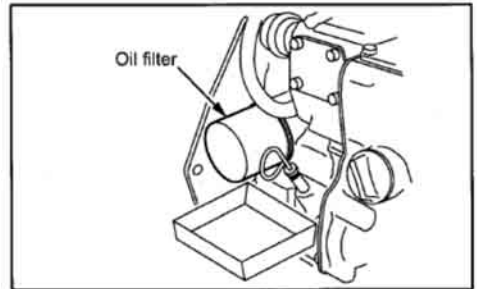


Fig.10.2. Changing oil filter

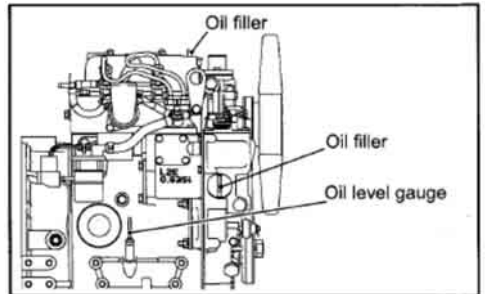


Fig.10.3. Oil filler and oil level gauge

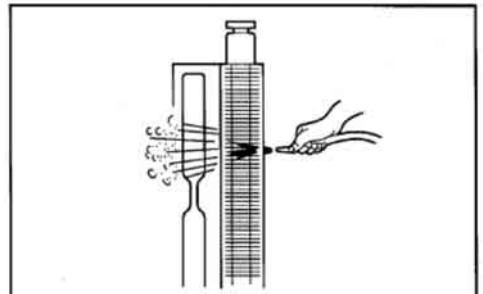


Fig.10.4. Cleaning radiator fins

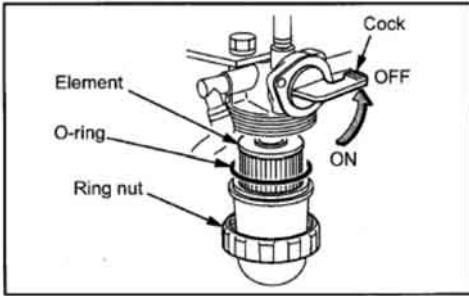


Fig.10.5. Changing fuel filter element

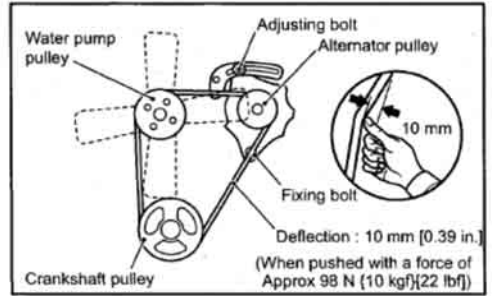


Fig.10.6. Tension adjusting V-belt



Fig.10.7. Cleaning air cleaner element



Fig.10.8. Checking air cleaner element

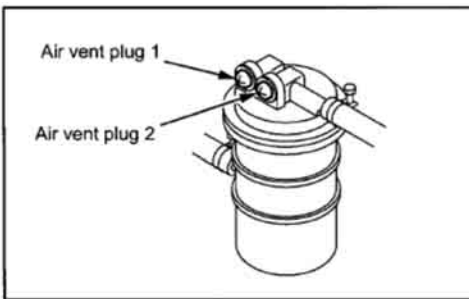


Fig.10.9. Bleeding fuel filter

II. ENGINE TROUBLESHOOTING

The starter motor turns the engine too slowly:

- Battery capacity too low
- Bad electrical connection
- Faulty in starter motor
- Wrong grade of lubricating oil

The engine does not start or difficult to start:

- Starter motor turns engine too slowly
- Fuel tank empty
- Fault in fuel control solenoid
- Restriction in a fuel pipe
- Fault in fuel lift pump
- Dirty fuel filter element
- Air in fuel system
- Fault in atomisers
- Cold start systems used incorrectly
- Fault in cold start system
- Restriction in fuel tank vent
- Wrong type or grade of fuel used
- Restriction in exhaust pipe

Not enough power:

- Restriction in a fuel pipe
- Fault in fuel lift pump
- Dirty fuel filter element
- Air in fuel system
- Restriction air filter/cleaner or induction system
- Restriction in exhaust pipe
- Fault in atomisers or atomisers of an incorrect type
- Restriction in fuel tank vent
- Wrong type or grade of fuel used
- Restricted movement of engine speed control
- Engine temperature is too high or low

Misfire:

- Restriction in a fuel pipe
- Fault in fuel lift pump
- Dirty fuel filter element
- Air in fuel system
- Fault in atomisers or atomisers of an incorrect type
- Fault in cold start system
- Engine temperature is too high
- Incorrect valve tip clearances

The pressure of the lubrication oil is too low:

- Wrong grade of lubrication
- Not enough lubrication oil in sump
- Defective gauge
- Dirty lubrication oil filter element

High fuel consumption:

- Restriction air filter/cleaner or induction system
- Fault in atomisers or atomisers of an incorrect type
- Fault in cold start system
- Wrong type or grade of fuel used
- Restricted movement of engine speed control
- Restriction in exhaust pipe
- Engine temperature is too low
- Incorrect valve tip clearances

Black exhaust smoke:

- Restriction air filter/cleaner or induction system
- Fault in atomisers or atomisers of an incorrect type
- Fault in cold start system
- Wrong type or grade of fuel used
- Restriction in exhaust pipe
- Engine temperature is too low
- In correct valve tip clearances
- Engine over load

Blue or white exhaust smoke:

- Wrong grade of lubrication
- Fault in cold start system
- Engine temperature is too low

The engine knocks:

- Fault in fuel lift pump
- Fault in atomisers or atomisers of an incorrect type
- Wrong type or grade of fuel used
- Fault in cold start system
- Engine temperature is too high
- In correct valve tip clearances

The engine runs erratically:

- Fault in fuel control
- Restriction in a fuel system
- Fault in fuel lift pump
- Dirty fuel filter element
- Restriction air filter/cleaner or induction system
- Air in fuel system
- Fault in atomisers or atomisers of an incorrect type
- Fault in cold start system
- Restriction in fuel tank vent
- Restricted movement of engine speed control
- Engine temperature is too high
- In correct valve tip clearances

Vibration:

- Fault in atomisers or atomisers of an incorrect type
- Restricted movement of engine speed control
- Engine temperature is too high
- Fan damaged
- Faulty in engine mounting or flywheel housing

The engine temperature is too high:

- Restriction air filter/cleaner or induction system
- Fault in atomisers or atomisers of an incorrect type
- Fault in cold start system
- Restriction in exhaust pipe
- Fan damaged
- Too much lubrication oil in sump
- Restriction in air or water passage of radiator
- Insufficient coolant system

Crankcase pressure:

- Restriction in breather pipe
- Vacuum pipe leaks or fault in exhauster

Bad compression:

- Restriction in air filter/cleaner or induction system
- Incorrect valve tip clearances

The engine starts and stops:

- Dirty fuel filter element
- Restriction in air filter/cleaner or induction system
- Air in fuel system

The engine shuts down after approximately 15 seconds:

- Bad connection towards oil pressure switch/coolant temperature switch

12. ALTERNATOR DESCRIPTION

12.1. General

The alternator fitted on the generating set is of the brushless self-excitation type which eliminates the maintenance associated with slip rings and brushes. The control system, consist of an automatic voltage regulator, protective circuits,

12.2. Construction and Components

The stator core is produced from insulated low loss electrical grade sheet steel laminations. These are built and welded under a fixed pressure to give an extremely rigid core to withstand vibration and load impulses. The complete wound stator is, after impregnation, pressed into the frame and pinned into position.

The rotor assembly, which comprises the alternator rotating field systems, the exciter rotating diode system and the cooling fan. The complete rotor assembly is dynamically balanced to ensure vibration-free running. At the drive end of the rotor assembly a cast-aluminum centrifugal fan draws cooling air through screened covers at the non drive end and discharges it through similar side mounted covers at the drive end.

12.3. Operation

The electrical power produced by the generating set is derived from a closed loop system consisting principally of the exciter rotor the man revolving field and the automatic voltage regulator (see Figure 12.1) The process begins when the engine starts to rotate the internal components of the alternator. The residual magnetism in the main rotor produces a small alternating voltage (AC) in the main stator. The automatic voltage regulator rectifies this voltage (converts it to DC) and applies it to the exciter stator.

This DC current to the exciter stator creates a magnetic field which in turn, induces an AC voltage in the exciter rotor. This AC voltage is converted back to DC by the rotating diodes.

When this DC voltage appears at the main rotor, a stronger magnetic field than the original residual field is created which induces a higher voltage in the main stator. This higher voltage circulates through the system inducing an even higher DC voltage back at the main rotor. This cycle continues to build up the voltage until it approaches the proper output level of the generating set. At this point the automatic voltage regulator begins to limit the voltage being passed to the exciter stator which, in turn, limits the overall power output of the alternator.

This build-up process takes place in less than one second.

12.4. Automatic Voltage Regulator

The Automatic Voltage Regulator (AVR) maintains a no load to full load steady state voltage to tight tolerances. The AVR has a volt/hertz characteristic which proportionally reduces the regulated voltage at reduced speeds.

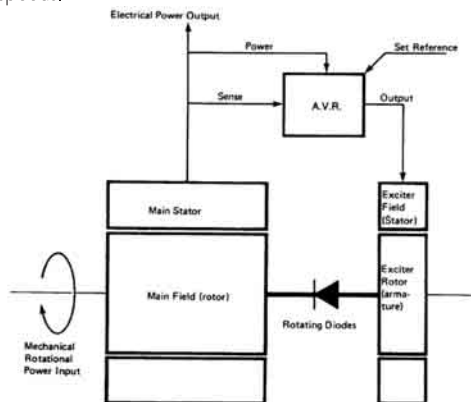


Figure.12.1. Alternator, operating principles block schematic diagram

13. STORAGE

Long term can have detrimental effects on both the engine and alternator. These effects can be minimized by properly preparing and storing the generating set.

13.1. Engine Storage Guidelines:

1.1.1. Preparing Engine for Long Term 3 mounts or more Storage

The following describes how to store the engine in a

non-operable condition for more and in an operable condition for three mounts or more. If the engine has been left unattended for three mounts or more, the internal engine parts can rust that may cause damage to the engine. When storing the engine for an extended period of time, be sure to follow the directions below.

1. Drain engine oil, and pour in rust-prevent oil (NP-10-2) into the engine.
2. Prepare a fuel mixture containing 50% rust-preventive oil (NP-9), and fill the fuel tank with it.
3. Operate the engine at a speed of 800 to 1000 rpm (idling) for 5 to 10 minutes under no load.
4. Immediately before stopping the engine, spray volatile corrosion inhibitor (V.C.I) through the inlet port to prevent rust on the air intake system.
5. With the engine stopped, drain the fuel mixture from the fuel tank.
6. Apply rust preventive oil (NP-3) liberally on the exposed sections of the machining.
7. Seal air inlet, exhaust outlet, breather and other openings with an adhesive cloth tape.
8. Loosen V-belt.
9. Wrap adhesive cloth tape on the terminals of the starters and seal the openings. Cover these sections with polyethylene sheet or processed polyethylene paper, and place desiccants in the polyethylene covers.
10. 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.
11. Cover the entire engine.

Note: (a) Store the engine in a well-ventilated indoor area.

(b) No need to drain coolant since it contains LLC. (Add LLC to increase the concentration between 30 and 60%.)

(c) Post a sign at an easily noticeable place to warn that the rust-preventive oil in the engine must be replaced with engine oil, and the fuel tank must be filled with fuel before operating the engine.

(d) A new engine oil can substitute for rust-preventive oil (NP-10-2)

Recommended rust-preventive oil and corrosion inhibitor

JIS No		Recommended product	Application
K2246	NP-3	Nippon Oil corporation Anti Rust P-1400	Prevention of rust on exposed machine surfaces
	NP-9	Nippon Oil corporation Anti Rust P-2400	Prevention of rust on fuel system
	NP-10-2	Nippon Oil corporation Anti Rust P-230	Prevention of rust on lubricating system
Z1519	...	Ryokou Kagaku V.C.I. Diana volatile corrosion inhibitor	Prevention of rust on intake system

13.1.2. Using engine after storage

1. Remove the cover from the engine.
2. Connect a fully charged battery.
3. Remove the covers from the starters and alternator.
4. Adjust the tension of V-belt.
5. Remove sealing tapes from the openings of the engine.
6. Drain rust-preventive oil, and pour in appropriate engine oil.
7. Fill the fuel tank with fuel, and bleed the fuel system.
8. Inspect the entire engine.
9. Remove the rocker covers, and lubricate the valve mechanisms.
10. 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 starter.

11. Make sure the engine oil pressure rises.
12. Start the engine
13. Conduct a warm-up operation for sufficient duration.
14. Apply load

13.1.3. Storing engine in operable condition for 3 months or more

When the engine is not operated during storage of

three months or more, internal engine parts can rust and lose oil film. As a result, the engine can seize when it is started after storage. To prevent such a risk, the engine must be operated periodically during storage.

13.1.4. Operating engine for maintenance purpose

Operate the engine for maintenance purpose at least once a month as described below.

1. With fuel shut off, operate the starter twice at intervals of about 15 seconds
2. After the engine starts, operate under no load for 5 minutes.

13.2. Alternator Storage:

When an alternator is in storage, moisture tends to condense in the windings. To minimize condensation, store the generating set in a dry storage area. If possible use space heaters to keep the windings dry. After removing the generating set from storage, perform an insulation check.

13.3. Battery Storage:

While the battery is stored, it should receive a refreshing charge every 8 weeks up to a fully charged condition

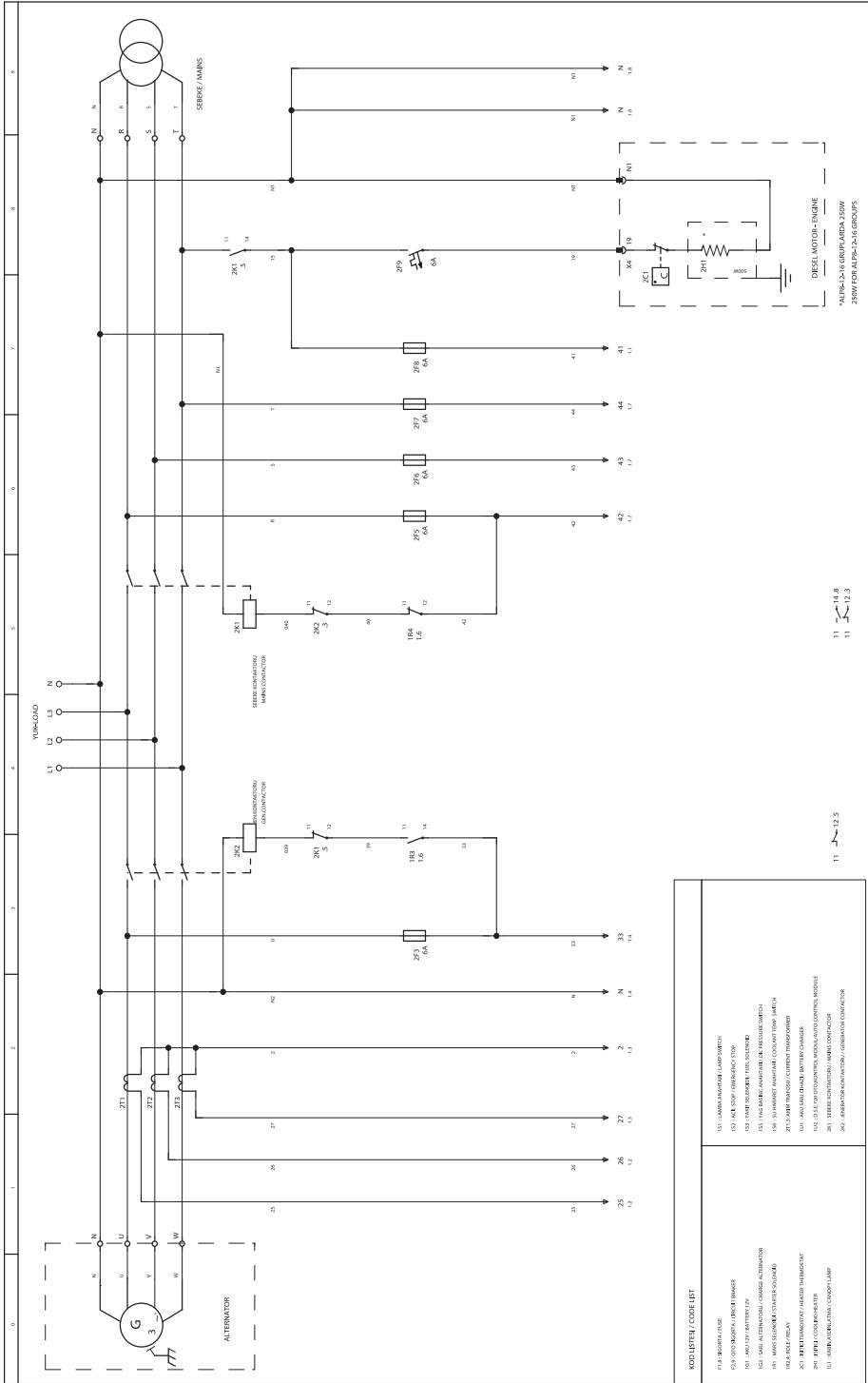
GENERAL PRECAUTIONS ABOUT WARRANTY

DEAR AKSA GENERATING SET OPERATOR, PLEASE TAKE CARE TO THE FOLLOWING ORDER TO PREVENT THE GENERATING SET WARRANTY TO BECOME INVALID BEFORE THE TERMINATION OF THE WARRANTY PERIOD AND TO ENSURE TROUBLE-FREE OPERATION OF THE GENERATING SET WITH A LONG LIFE!

- MAINTENANCE AND REPAIR WORKS WILL NOT BE COVERED BY THE WARRANTY CERTIFICATE, INVOICE OR DELIVERY CERTIFICATE OF THE GENERATING SET IS SUBMITTED.
- THE WARRANTY OF THE GENERATING SET WILL BECOME INVALID IN CASE OF ANY INTERVENTION OF ANY PERSON OTHER THAN AUTHORIZED AKSA SERVICES OR BY PRIOR WRITTEN APPROVAL FROM AKSA POWER GENERATION ON THE GENERATING SET FOR ANY REASON.
- CONTROL AND MAINTENANCE WORKS INDICATED IN THE PERIODICAL MAINTENANCE SCHEDULE AND THE OPERATING MANUAL MUST BE CARRIED OUT COMPLETELY AND TIMELY THE FAILURES DUE TO INCOMPLETE OR UNTIMELY MAINTENANCE ARE NOT COVERED BY THE WARRANTY.
- GENERATING SET SHOULD BE MOUNTED AS INDICATED IN THE OPERATING MANUAL OTHERWISE, THE PROBLEMS WHICH ARE LIKELY TO OCCUR WILL NOT BE COVERED BY THE WARRANTY CUSTOMER IS RESPONSIBLE FOR THE FAILURES WHICH ARE LIKELY TO OCCUR IN CASE THAT THE DIESEL OIL USED CONTAINS DIRT OR WATER.
- THE OIL TYPE INDICATED IN THE OPERATING MANUAL SHOULD BE USED IN THE ENGINE OTHERWISE, THE FAILURES WHICH ARE LIKELY TO OCCUR WILL NOT BE COVERED BY THE WARRANTY.
- BATTERIES WILL NOT BE COVERED BY THE

WARRANTY IF THEY ARE SUBJECTED TO BREAKAGE, EXCESSIVE ACID FILL OR HARDNING BY LEAVING UNCHARGED.

- GENERATING SETS, NEVER START OR STOP THE DIESEL ENGINE WHEN THE GENERATING SET IS UNDER LOAD. ENGINE SHOULD BE STARTED AND STOPPED AFTER LOAD IS DISCONNECTED AND THE GENERATING SET IS AT IDLE CONDITION. OTHERWISE, THE VALVES CAN BE SEIZED, THE VOLTAGE REGULATOR, TRANSFORMER AND DIODES CAN BE BROKEN DOWN. THESE CONDITIONS ARE NOT COVERED WARRANTY.
- OUR COMPANY DOES NOT TAKE THE RESPONSIBILITY OF THE DAMAGES ON THE MAINS SUPPLY CONTACTOR OF THE AUTOMATIC GENERATING SETS DUE TO OVERCURRENT, LOW OR HIGH VOLTAGE.
- NEVER REMOVE THE BATTERY TERMINALS WHILE THE GENERATING SET IS IN USE. EVEN A MOMENT OF DISCONNECTION CAN CAUSE A DAMAGE ON THE ELECTRONIC CLOSING RELAY OF THE CHARGE ALTERNATOR AND ON THE ELECTRONIC ENGINE SPEED CONTROL CIRCUIT THESE CONDITIONS ARE NOT COVERED BY THE WARRANTY.
- FAILURES DUE TO OVERLOAD AND UNBALANCED LOAD IN EXCESS OF THE GENERATING SET POWER (SUCH AS ALTERNATOR AND CONTACTOR FAILURES) ARE NOT COVERED BY THE WARRANTY.
- WHEN THE MANUAL GENERATING SET IS STARTED UP, IT SHOULD BE WARMED BY OPERATING AT IDLE FOR 5 MINUTES . WHEN STOPPING THE DIESEL ENGINE, IT SHOULD BE UNLOADED AND THEN CONTINUED TO BE OPERATED FOR COOLING FOR 10 MINUTES BEFORE STOPPING. OTHERWISE PROBLEMS WHICH ARE LIKELY TO OCCUR WILL NOT BE COVERED BY THE WARRANTY
- WARRANTY PERIOD IS 1 YEAR BEGINNING FROM THE PURCHASE DATE.



KORUPTEK / CODE LIST		DSE 720 KONTROL PANGOSU/KONTROL PANEL 12-33kVA		OTO TRANSFER PANO BAGI LANTIS ATS CONNECTION DIAGRAM	
Scale	1:2=3kVA	Drawing	BURBULI	Rev. No.	
Drawing No.	12-33kVA	Decing	BURBULI	Rev. Date	
Date	04 May 2019	Approved	ACCOSARU	Page	3
				Total Page	2

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