



DIESEL GENERATING SETS OPERATING MANUAL




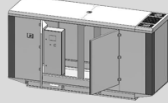


TABLE OF CONTENTS

1.	INTRODUCTION	3
2.	GENERAL SAFETY PRECAUTIONS	3
3.	UNLOADING AND HANDLING	9
4.	INSTALLING PERMANENT GENERATING SETS	11
5.	EXAMPLE OF GENERATING SET INSTALLATION	16
6.	VENTILATION	18
7.	FUEL	19
8.	EXHAUST GAS	20
9.	STARTING	23
10.	ELECTRIC SYSTEM	23
11.	COOLING	25
12.	AMF SYSTEMS	27
13.	GENERAL PRECAUTIONS ABOUT WARRANTY	30

1. INTRODUCTION

This installation recommendations manual is prepared to assist the operator in operation. Observing the advices and rules in this manual will ensure that the generating set operates in maximum performance and efficiency for a long time.

 www.kzpower.com		 
KZ ENERJİ COZUMLARI VE DIŞ TIC LTD STİ MIMAR SINAN MAH. BOSNA CAD. NO:1/6 CEKMEKOY / İSRANBUL / TURKEY TEL:+90 216 641 96 43 FAX: +90 216 641 96 47 Email: info@kzpower.com		
GENERATOR CODE:	GENERATOR SERIAL NUMBER:	
ENGINE:	ALTERNATOR:	
ENGINE SERIAL NUMBER:	ALTERNATOR SERIAL NO:	
STAND-BY kVA:	AMP:	
	RPM:	
MAX TEMP and ALTITUDE:	PRODUCTION DATE:	
	WEIGHT:	
VOLTAGE and FREQUENCY:	VOLTAGE and FREQUENCY:	
* The performance class in accordance ISO8528.1:1993 CLAUSE 7		
ENERGY IS LIFE www.kzpower.com		

1.1. Generator Tag and Serial Number

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

2. GENERAL SAFETY PRECAUTIONS

2.1. General

- 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.
- Operate the unit only for the intended purpose and within its rated limits (pressure, temperature, speeds, etc.).
- Gen-set and equipment shall be kept clean, i.e. as free as possible from oil, dust or other deposits,
- To prevent an increase in working temperature, inspect and clean heat transfer surfaces (cooler fins, intercoolers, water jackets, etc.) regularly.
- Take precautions against fire. Handle fuel, oil and antifreeze 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. Installation, handling and towing

Chapter 3 and 12 of this manual covers procedures for installation, handling and towing of generating sets. That chapter should be read before installing, moving and lifting the generating set or towing a mobile set. 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,
- ! 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.
- ! 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) away 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 anyknown 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,
- ! Wear protective clothing including gloves and hat when 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.



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 ls 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 otherwise 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, turn 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

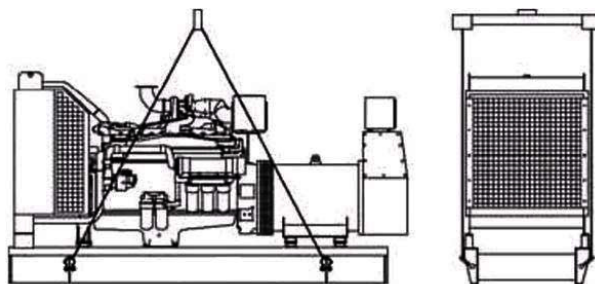
- Turn the victim onto the side.
- Keep the head tilted with the jaw forward to maintain the open airway,
- Make sure the victim cannot roll forwards or backwards.
- Check for breathing and pulse regularly. If either stops, proceed as above.



WARNING

- ! Do not give liquids until victim is conscious.

3. UNLOADING AND HANDLING



3.1 Unloading

3.1.1. Unloading safety

In order to remove the generating sets from their transport with optimum safety and efficiency, you must ensure that :

- The hoisting devices are appropriate for the required tasks.
- The slings are correctly positioned in the lifting lugs provided or the fork lift arms are positioned centrally under the frame.
- The ground is able to withstand the weight of the generating set and its hoisting device (if not, sturdy planks must be laid).
- The set is lowered as close as possible to its service or transport position in an open and easily accessible area.

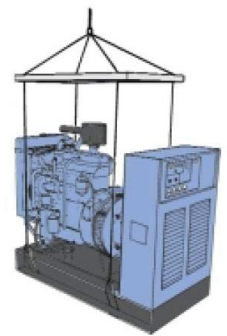
3.1.2. Examples of equipment

- Crane, slings, spreader, lifting hook and shackles.
- Lift truck.

3.1.3. - Unloading instructions

1 . Slinging

- Attach the hoisting device slings to the generating set lifting lugs designed for this operation.
- Slowly tighten the slings.
- Make sure the slings are evenly attached and strong enough.
- Slowly hoist the generating set.
- Move the set to the chosen site and place in position.
- Bring it down slowly while maintaining it in the right position.
- Loosen the slings, unhook and remove the shackles.
- Use at least 2 people.



2 . Lift truck

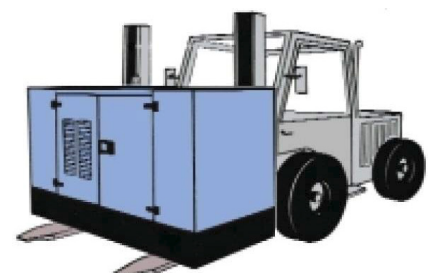
- Position the arms of the lift truck under the frame, making sure only the mainframe is resting on the arms.
- Lift and handle the equipment slowly.
- Set down the generating set in its final position.
- Use at least 2 people, one of whom is the lift truck operator.

3.2. Handling

3.2.1 Handling instructions

Chock the generating set at the alternator end. Slightly lift the generating set at the engine end with two jacks and slide two tubes under the frame.

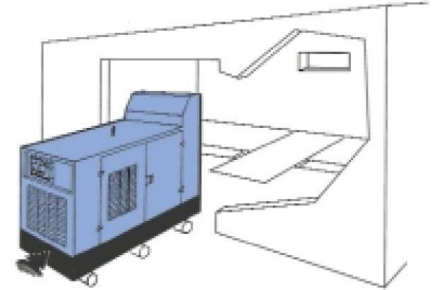
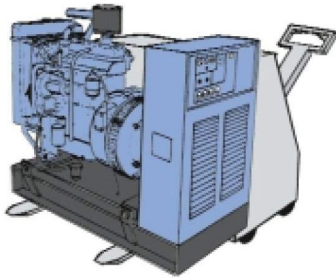
- Let the frame rest on the tubes and move the generating set into the room by pushing it manually or pulling it with a winch or pulley system attached to the bedframe.
- As the generating set moves along, take the free tubes and slip them back under the frame.



- When it gets to its final location, position the generating set, chock and jack it up.
- Remove the tubes and lower the generating set ensuring it remains in the correct position and remove the jacks.

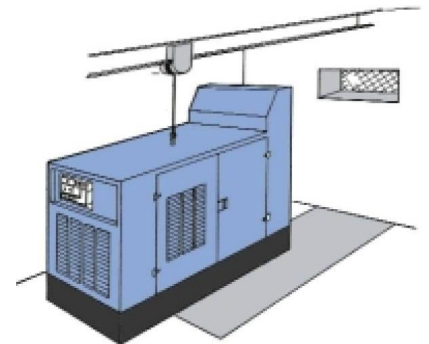
3.2.2 Examples of equipment

- 2 jacks, three 60 mm thick walled tubes, the same width as the frame and 1 winch or pulley system.
- Manpower : at least 2.



- If ground is uneven or the hauling distance too far, use a lift truck with arms longer than the frame width.
- Manpower : at least 2, one of whom is a lift truck operator.

- Once you are in the engine room you have the use of a crane rail and a travelling block, follow the instructions in Section 1-C-1.

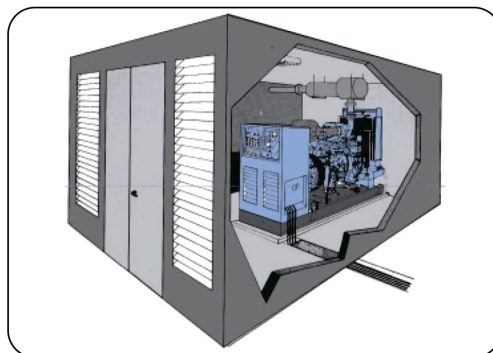
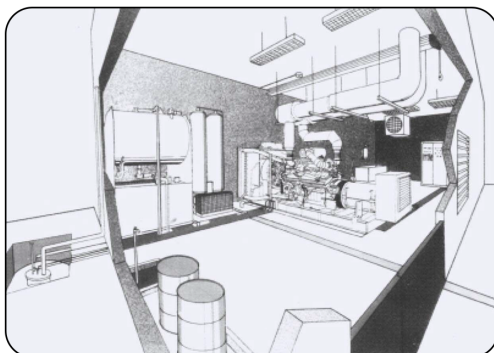


4. INSTALLING PERMANENT GENERATING SETS

PREPARATION

The installation of a generating set must follow certain rules, which must be strictly adhered to in order to get equipment to operate properly.

The whole equipment is liable to sustain damage and abnormal wear if these basic principles are not followed. This manual lists the main installation requirements for a "conventional" generating set built with an I.C. engine, a generator and a control panel. In case of special applications our Technical Department will advise you and study your specific needs. The regulations provisions and laws in effect on the installation premises should also be complied with.



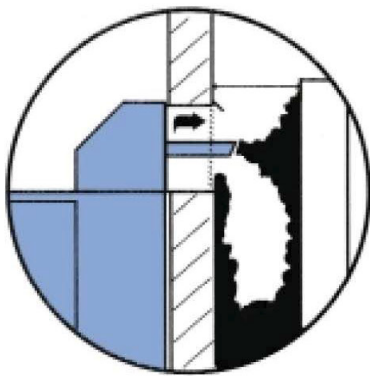
4.1 Site

4.1.1 Location

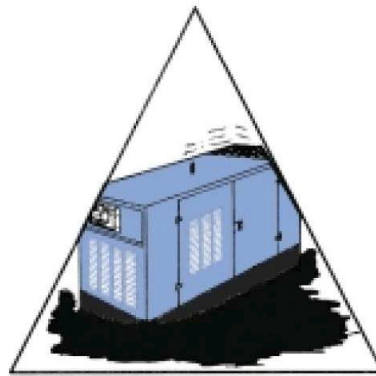
It should be decided by the application. There are no special rules in selecting the location, other than the proximity of the control panel and the noise reduction. Nevertheless, fuel supply, correct ventilation of the site, exhaust gas, direction of radiator hot air and noise must be taken into account.

Do not wait until the last moment to plan the installation of the generating set. It should not be forgotten that a generating set may be the most important piece of machinery designed to back up faulty mains supply and to ensure the continuing operation of the vital functions of a company, factory or hospital.

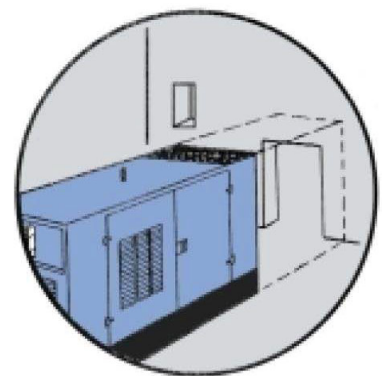
The choice of positioning should be based on a well planned site.



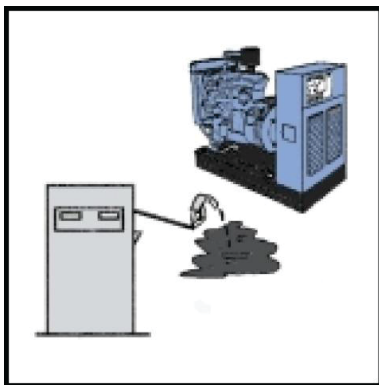
Incorrect exhaust and ventilation access



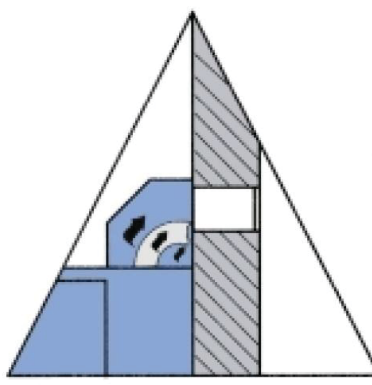
Incorrect base



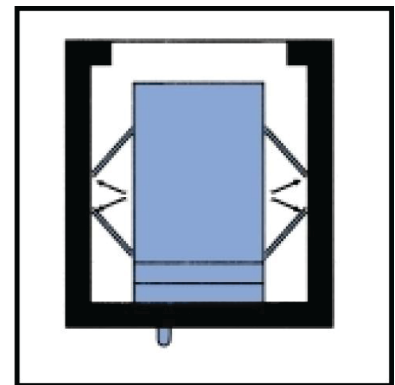
Undersized



Fuel refill impossible



Incorrect ventilation and exhaust openings



Door opening, maintenance and repair are impossible

4.1.2 Dimensions and layout

Depends on two types of requirements :

4.1.2.1 Static

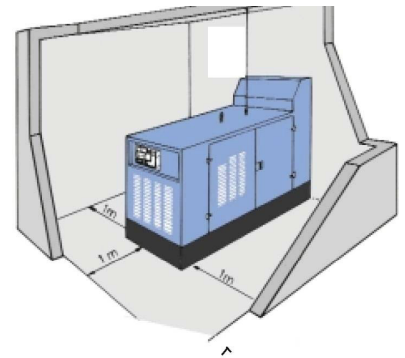
These requirements relate to the size of the equipment installed with its peripherals, namely : daily tank, control panel, exhaust muffler, batteries, etc.

CAUTION : PLEASE CONTACT OUR DESIGN OFFICE FOR CERTIFIED DIMENSIONS.

4.1.2.2 Dynamic

These requirements relate to the space around each set to allow for maintenance and possible removal.

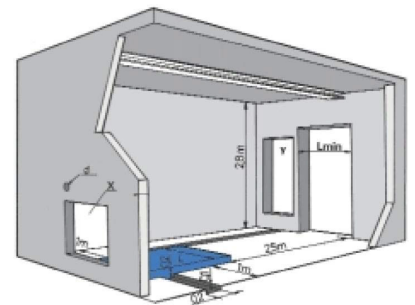
A 1 m clearance around the generating set must be considered as the minimum requirement for problem free maintenance. Make sure the doors of the canopy can be opened completely, the equipment is easily accessible for maintenance and the generating set can be removed from the room.



4.1.2.3 Building

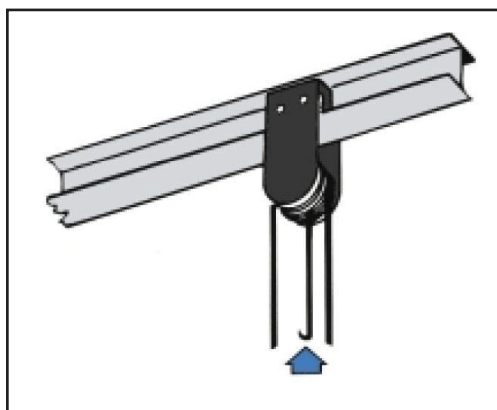
Various room layouts can be considered for housing the generating set.

- If sound level and start up speed are not important the set can be instalied under a simple shelter to protect it from the weather (snow, rain, thunder, etc.).
- If a lower sound lever and a rapid start up is essentiel (e.g. emergency set or noise sensitive area) special care should be taken to build the room with at least 20 cm cast concrete, covered with absorbent fireproof insulating material such as rockwool.



4.1.2.4 Generating set foundation

The slab, door exhaust outlet, air intake and exhaust, must be built according to the dimensions given by our design office.



designed to suit the weight of
the generating set)

A generating set in operation produces a certain amount of vibration which makes its way towards the concrete slab, via the frame. Our generating sets are supported on inbuilt rubber mounts and not normally require a special slab. The slab should be level and smooth after casting and isolated from the building. Sample size of a generating set room for a set without a canopy. The slab, door exhaust outlet, air intake and exhaust, must be built according to the dimensions given by our design office.

4.1.2.5 Openings

A generating set room must have a number of openings essential for its operation.

- A door in line with the generating set plinth to move the generating set and accessories in and out.
- Ventilation openings (fresh air inlet, warm air outlet) sited so that the air blows in the Alternator Engine direction. The size depends on the power of the generating set to be installed, general weather conditions, selected cooling system and possible soundproofing system.
- Exhaust pipe, fuel lines and electric cables.

4.1.2.6 Hoisting

Normally the hoisting equipment should be part of the building and should comprise a moving block on an I beam rail sealed into the walls and ceiling. This will make handling easier and is usually installed above, along the axis of the set, towards the door.

4.1.2.7 Soundproofing

The best quality / price ratio is achieved when soundproofing is part of the initial design of the room. On the other hand if soundproofing is added to an existing room, it will inevitably be more expensive and not as good. Two techniques should be used to soundproof the genset room.

4.1.2.7.1 Insulation

Its purpose is to prevent sound travelling through the walls by providing mass and adequate thickness.

4.1.2.7.2 Absorption

Sound energy is absorbed by specialist materials and reduces reverberation. For a soundproofed room the openings have to be larger and carefully designed to provide adequate ventilation without allowing excessive noise to pass through the openings. A properly designed soundproofed door is also needed.

General

- Building structure: cast concrete or concrete blocks, min. 20 cm thick.
- Anti-vibration mounts under the generating set, when installed close to sensitive areas.
- Walls and ceiling may be lined with absorbent materials such as rockwool.
- Selection of one or more suitable exhaust mufflers.
- When required soundproof doors should be fitted to reach the required sound level.
- Noise attenuators mounted in the air inlet and outlet openings.

EXAMPLES : Measures to be taken.

- Basic noise level of genset : 105 to 11 ODBA 1m.

Non sensitive areas

Generating set soundproofing by means of a canopy bringing the noise down to 85dBA at 1 m (useful for low and medium powered sets), or Room soundproofing : noise attenuator on air inlet, about 1m long, soundproofed access door, 30dB exhaust muffler. Outside noise level : 75dBA about 1m.

Noise sensitive areas (in town, close to houses)

Noise reduction depends on the distance between the noise source and the sensitive areas 6dB on average every time you double the distance : 1m (0); 2m (-3dB); 4m (-12dB); 8m (-18dB).

This calculation done, the following elements must be specified :

From 60 to 70dBA at about 1 m

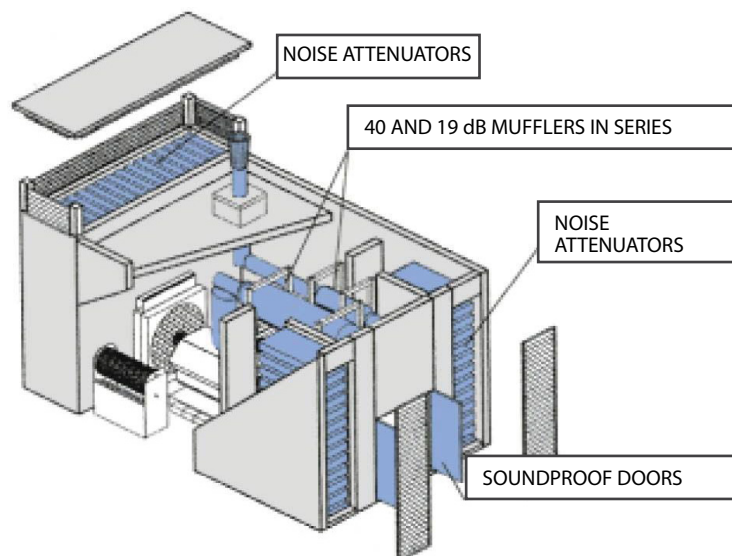
- walls and ceiling made of 20 cm concrete blocks or cast concrete,
- noise attenuators about 1.80 m long,
- high efficiency soundproof door,
- 40 and 19dB mufflers in series

From 40 to 60dBA at about 1 m

Noise attenuators (about 2.50 m) with baffles in ventilation shafts if possible.

- inside walls and ceiling lined with absorbent material.
- soundproof door and airlock.
- floating slab beneath the generating set (vibration).
- 40 and 30dB mufflers in series. Sometimes 40dB and 19dB mufflers are sufficient.

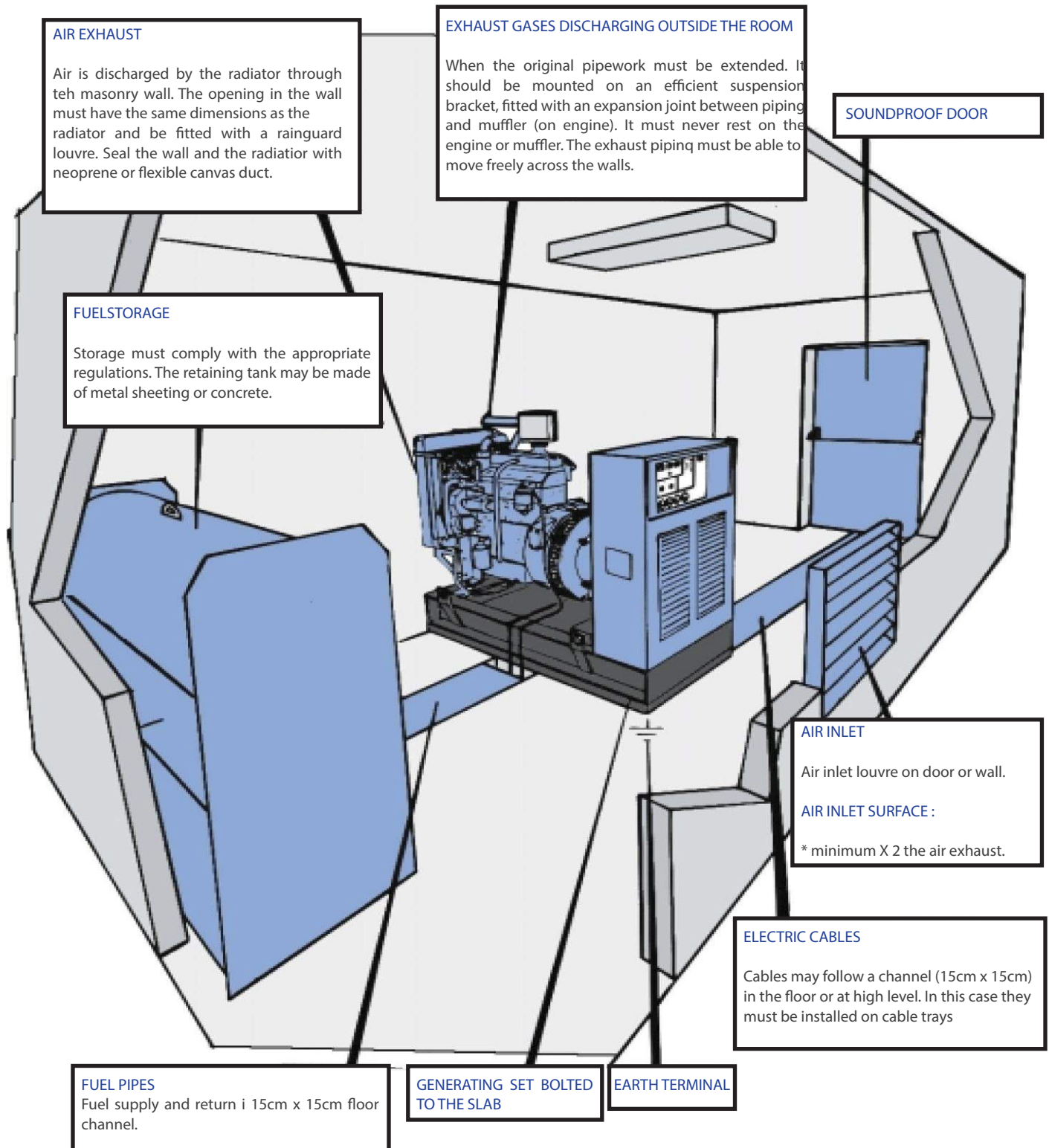
Or generating set soundproofed by means of a canopy, in which case, the sound traps are smaller and the airlock unnecessary. When lower noise levels are required a special study must be carried out.



5. EXAMPLE OF GENERATING SET INSTALLATION

5.1 EXAMPLE OF INSTALLATION

(indoor fuel tank and control panel)



5.2 EXAMPLE OF INSTALLATION

(control panel, muffler and Tank under canopy. Soundproof type room and underground fuel storage tank).

AIR EXHAUST

Hot air from the generating set is discharged from the room through a hot air duct (optional) fitted in an opening in the wall the same size as the duct. The hot air discharge opening is protected from any obstruction, penetration or infiltration of foreign elements by a metal louvre.

Use a neoprene foam to seal the hot air discharge duct in the wall. The exhaust pipe is fitted in the hot air discharge duct. Hot air from the radiator passes through the canopy roof.

SOUNDPROOF DOOR

ELECTRIC CABLES

Cables may follow a channel (15cm x 15 cm) or a high level path in this case they must be installed

AIR INLET

Air inlet louvre on door or Wall.

AIR INLET SURFACE

minimum x 2 the exhaust air area.

GENERATING SET BOLTED TO THE SLAB

EARTH TERMINAL

EXHAUST GASES DISCHARGE OUTSIDE THE ROOM

When the original piping must be extended, should be mounted on an efficient suspension bracket fitted and muffler expansion joint between piping and muffler (or engine). It must never rest on the engine or muffler.

FUEL STORAGE

Storage must comply with the appropriate regulations.

FUEL PIPES

Fuel supply and return in 15cm x 15cm channel.

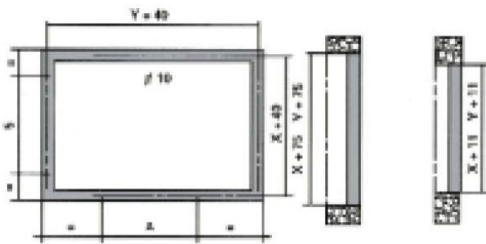
6. VENTILATION

An I.C. engine generates considerable heat which must be discharged from the room to ensure operation. Heat is released from a number of sources :

- radiator cooling,
- engine, exhaust pipework and radiator,
- alternator cooling.

If its necessary to fit the room with air inlets and outlets specifically designed for the cooling system and local operating conditions. Insufficient ventilation will cause an increase in room temperature, which will lead to an engine power loss or the set stopping (in some cases auxiliary fans will be required). The cooling air should sweep the generating set room in the direction Alternator Engine Radiator. This not only allows for the discharge of the heat produced by the generating set, but also supplies the fresh air required for combustion. The openings will have to be large.

The air inlet and outlet should be as direct as possible. The cooling system should be tightly connected to a ventilation shaft or the outlet duct to avoid hot air recirculating. Air inlet and outlet must never be located close to each other.



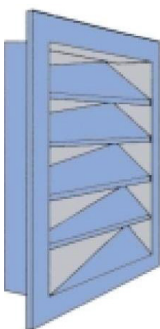
Examples of air inlet and outlet layouts G and R type frames to be sealed.

Air inlet and outlet rainguard Louvre

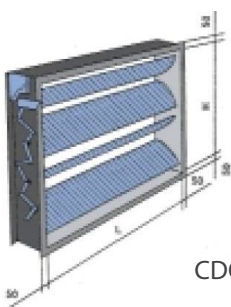
The following table indicates the pressure loss through the Louvre (in dPa).

The air velocity (in m/s) refers to the rated section (H X L).

Pressure losses related to H x L



Air velocity	1	1,5	2	2,5	3	3,5	4	4,5	5
Pressure loss for use air inlet	0,3	0,7	1,2	1,9	2,7	3,7	4,8	6,1	7,5
Pressure loss for use as air	0,35	0,9	1,5	2,3	3,3	4,5	5,8	7,4	9



CDO Dimensions

7. FUEL

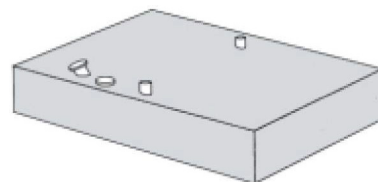
Diesel fuel is classified as a "Dangerous product" and storage and distribution are subject to a number of rules and regulations. Please refer to the local legislation.

On permanent installations it is usual to fit a day tank and a main storage tank. These two tanks can be combined into one if the fuel requirements of the generating set are low.

7.1 Tank with manual filling

This is convenient for a manual start generating set which is visually checked.

Often part of the generating set assembly this tank is fitted either with a dipstick or fuel level gauge, a filler, breather and drainage outlet.



7.2 Tank with automatic filling located inside the room

This is recommended for automatic start generating sets. The tank is refilled automatically by an electric pump from the main storage tank.

This type of equipment is subject to regulations. It must be equipped with a fuel tank bund having the same capacity as the tank for collecting any fuel leakage. A waste pipe returning to the main tank must be installed, with a section of at least twice the fuel supply pipe (supply Ø 20/27 mm, return Ø 33/42 mm typically).

The tank is mounted slightly higher than the diesel engine crankshaft (except in covered parking areas) in order to keep the pump primed.

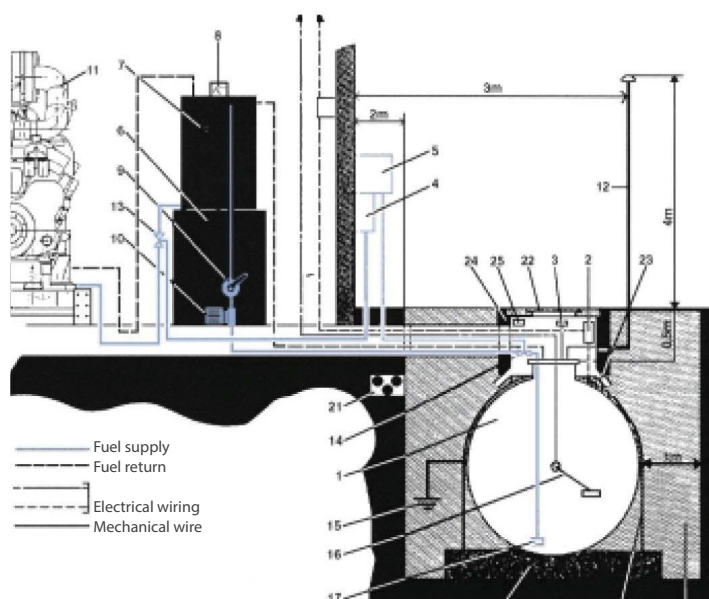
This tank must be fitted with a fire valve controlled from outside the room.

For safety purposes the supply and should run smoothly from the main tank to the daily tank so that no airlocks exist which would slow down supply to the daily tank. If the storage tank is located higher than the daily tank a safety valve and an anti-syphon device must be installed on the pipeline with the daily tank.

The tank should not be at a level higher than 1m above the diesel engine crankshaft. If the tank is located at a lower level than the engine the suction head should not exceed 1 metre.

Main fuel tank, daily service tank and sedimentation tank

1. Double wall main fuel tank
2. Leakage sensor cell
3. Refill opening
4. Police fuel shut off point
5. Fire fighter fuel shut off point
6. 600 litre sedimentation tank
7. 500 litre daily service tank
8. Gauge with level contactor
9. Manual pump
10. Electric pump
11. Generating set
12. Air vent
13. Police fuel valve
14. Fire fighter fuel valve
15. Earth point
16. Electric fuel level gauge sender
17. Foot valve and screen
18. Concrete base
19. Anchoring bolts
20. Excavation
21. Pipe duct
22. Inspection plate
23. Drains
24. Minimum diameter 0,7 x 0,7 metres
25. Type and capacity label



8. EXHAUST GAS

8.1 General

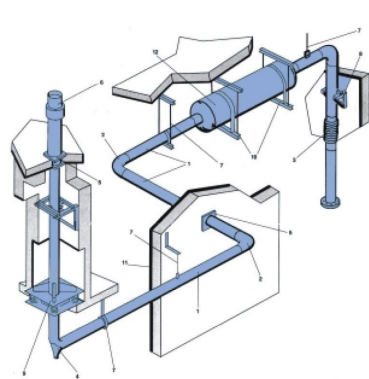
The design of the exhaust pipe from the generating set is a serious matter and should be calculated carefully. If you need assistance please consult us.

A number of constraints must be taken into account such as pressure loss, insulation, suspension, noise level and air pollution.

Please note that the more bends the higher the pressure loss, therefore a larger diameter pipe should be used.

NOTE : Generating sets equipped with built in mufflers must be fitted with an exhaust expansion joint. This expansion joint or flexible exhaust should be mounted on the canopy exhaust outlet.

8.2 Main components



1. Exhaust pipe
2. Elbows
3. Expansion joint
4. Condensation drain
5. Wall and roof seals
6. Exhaust outlet
7. Suspension device
8. Support frame
9. Pipe stand
10. Muffler suspension system
11. Heat insulation
12. Muffler

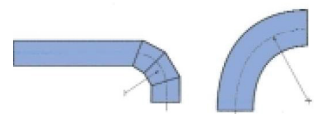
8.3 Piping

Item 1 : Pipe

We recommend using unwelded pipe: for weight reasons, however, rolled sheet piping may be convenient (helical from Vallourec or Cofratol). In any case, welding seams must be avoided inside the conduit (Δp increase).

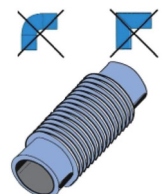
Item 2 : Elbows

Elbows must have a minimum bend radius of $6-8 \times D$, in one element if possible. If the elbow is made of welded sheet, make sure it comprises 2 to 4 sections for a 90° elbow.



Item 3 : Expansion and flexible exhaust

- Flexible exhaust : allows for sideways deflection, but little longitudinal movement.
- Expansion exhaust : absorbs mainly longitudinal movement due to expansion.

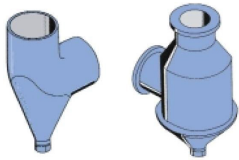


Reminder : the following table gives the expansion in mm per metre of an exhaust when it is heated.

- For stainless steel multiply by 1.5

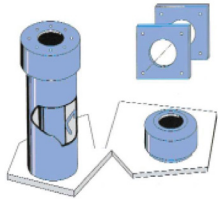
This component must not support exhaust pipe weight; make sure it is in perfect alignment to prevent breakage.

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°
0°	0,00	0,06	0,12	0,18	0,24	0,31	0,37	0,43	0,49	0,55	0,61	0,68	0,74	0,81	0,87	0,93	0,99	1,06	1,12	1,19
100°	1,25	1,32	1,38	1,45	1,52	1,59	1,65	1,72	1,78	1,85	1,92	1,99	2,06	2,13	2,19	2,26	2,33	2,40	2,47	2,54
200°	2,61	2,65	2,75	2,83	2,90	2,97	3,04	3,12	3,19	3,26	3,33	3,41	3,48	3,56	3,63	3,71	3,78	3,86	3,93	4,01
300°	4,08	4,16	4,23	4,31	4,38	4,46	4,54	4,62	4,69	4,77	4,85	4,93	5,01	5,09	5,17	5,25	5,33	5,41	5,49	5,57



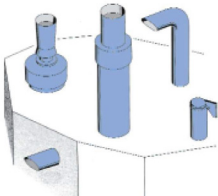
Item 4 : Condensation and rainwater drain.

Must be fitted at the lowest point of the installation and at any horizontal / vertical path change, in order to protect the exhaust muffler and the engine.



Item 5 : Wall seals and roof outlet

To be installed at each wall piercing and on the roof outlet.



Item 6 : Exhaust outlets

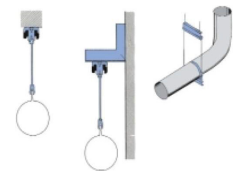
The exhaust outlets are used to discharge into the atmosphere and to protect the inside of the pipes from bad weather.

8.4 PIPES AND MUFFLERS, MOUNTING AND SUSPENSION

The useful life of an installation depends on correct design and appropriate pipe supports

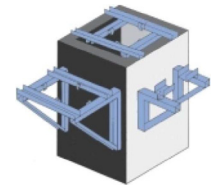
Item 7 : Pipe Support System

Made of a flat iron clamp secured to the ceiling, the suspension system is designed to allow for a free expansion of the pipes.



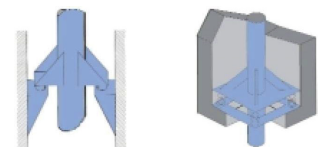
Item 8 : Guide frame

For vertical sections the guide frame is designed to allow the piping to expand while maintaining it laterally.



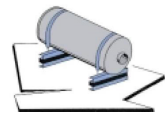
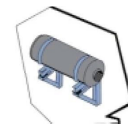
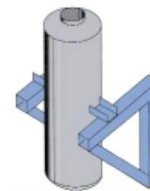
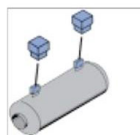
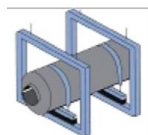
Item 9 : Pipe stand

The pipe stand is designed to support the weight of the vertical piping.



Item 10: Muffler suspension

The muffler suspension is designed to support the weight of the muffler. It may be vertical or horizontal



8.5 HEAT INSULATION (item 11)

Depending on the type of installation it may be necessary to insulate the pipes. The heat emitted by the exhaust pipe(s) inside the room may affect the cooling system, it may also be dangerous for the safety of the maintenance staff.

Once insulation is complete the surface temperature must not exceed 70 °C, the material used for the insulation being rockwool (excluding asbestos). This may be covered with thin aluminium in order to improve the appearance and support the insulating material.

A 50 mm thick glass wool layer should be considered as a minimum requirement.

8.6 MUFFLERS (Item 12) – General

Reduces noise by absorbing the sound wave or reacting with it (refer to manufacturers instructions : BOET, BURGESS, MANNING, LUCHAIRE).

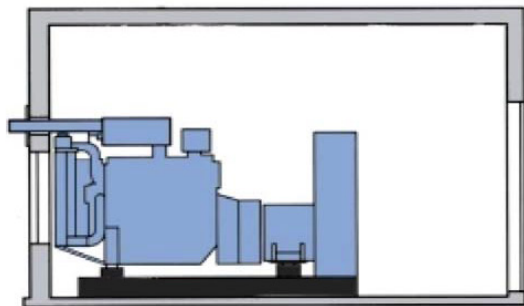
The exhaust pipe should be properly suspended, brackets must not be mounted on the generating set (except for original assemblies). An exhaust expansion coupling should be fitted on the engine outlet. The pipe diameter should never be smaller than the generating set exhaust outlet (please consult us for lengths longer than 6 m).

If the exhaust pipe has to be extended for installation reasons an expansion bellows must be fitted between the generating set and the pipe.

The piping should be installed so that its weight does not press on the flexible bellows, the latter must be perfectly in line (any misalignment will cause the bellows to crack)

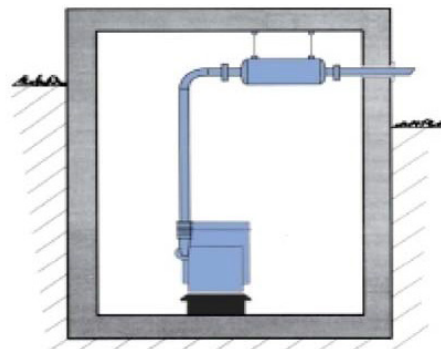
'Mounted' mufflers

A "mounted" muffler is mounted directly on the generating set or the canopy. The brackets are fitted on the generating set and an expansion bellows is fitted between the silencer and the engine.



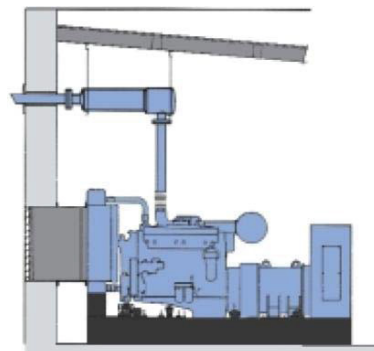
Absorption mufflers

The gases pass through a muffler made of highly efficient sound absorbing material and protected with perforated sheet sometimes called a straight through muffler



Absorptive reactive muffler

Before the gases go through the absorbing sound-proof section they enter into an expansion chamber filled with reactive baffles



9. STARTING

Starting an engine is easy when it succeeds, but may cause untold problems when unsuccessful. The operation of highly complex equipment may depend on the reliability of the genset particularly in applications such as hospitals, factory processes and building protection systems.

That is why there are many starting processes and devices on a generating set to ensure reliable starting every time. We make a distinction between a manual start procedure and an emergency start procedure, which is triggered by the failure of the mains supply (generally in automatic mode three 5 second cranks are provided).

The starting system design depends on the engine temperature. For a start in very cold temperatures it is sometimes necessary to use starting aids, such as heating the intake air, heating the fuel, injecting ether into the air intake. As well as these the engine coolant is heated, and in very cold conditions also the oil is kept warm.

Generating sets can be provided with three types of start systems

Electric starting : This is the most widely used system and consists of a 12V or 24V starter motor supplied by one or more lead acid, or in exceptional cases, alkaline batteries.

The starter motor rotates the ring gear of the engine flywheel moving on receiving the signal from an electric contact. Once the diesel engine has started and the flywheel has run up to its required speed, the starter motor pinion disengages automatically from the ring gear. The batteries are recharged automatically by an alternator or static charger.

Pneumatic starting : Pneumatic starting relies on an air starter that is operated by a flow of compressed air from one or two compressed air bottles and an air compressor. The engine is started in the same way as for electric starting.

The air bottles and air compressor are located as near as possible to the generating set.

Mechanical starting : Several mechanical starting system exist, i.e. spring, crank, inertia etc. All of these are only used with low power generating sets.

The three systems above can be coupled to each other in the following way:

- electric/pneumatic starting
- electric/mechanical starting.

10. ELECTRIC SYSTEM

10.1 CONNECTIONS – General

Just as for low voltage electrical equipment installation and maintenance must comply with the regulations standard or equivalent.

10.2 POWER CABLES

May either be of the single core or multi core type according to the generating set power. Power cables should be type installed in a duct or a cable tray designed for that purpose.

The following table will help you determine the minimum section required for your generating set power.

REMINDER : Current is calculated as follows :

1 phase system:
$$\frac{\text{KVA} \times 1000}{V} = A$$

Where
A = amperes
KVA=genset outputустановки
V = single phase voltage

3 phase system :
$$\frac{\text{KVA} \times 1000}{3V} = A$$

Note : if 3 phase voltage is 400V, then 1 phase voltage is $\frac{400}{\sqrt{3}} = 231V$

Quick calculation for 3 phase (A) = kVA x constant (C)

VOLTAGE	415	415	380	346	220
WHERE C	1,39	1,44	1,52	1,67	2,62

10.3 BATTERY CABLES

Install the battery(ies) near the electric starter. The cables shall be directly connected between the battery terminals and the starter terminals. The first thing to watch is to make sure you match the + and - polarities on the battery and on the starter. The minimum cable section shall be 70 mm². This varies according to the generating set size but also the distance between the batteries and the generating set.

10.4 REMOTE CONTROL CABLES

They usually are multi core cables installed as the power cables in a duct or on a cable tray.

Their minimum sections are given for a maximum length of 4 m between generating set and panel :

- Safety.....1,5 mm²
- Starting control4,0 mm²
- Battery voltage supply.....4,0 mm²
- Fuel solenoid.....4,0 mm²
- Heating2,5 mm²

For longer cables please consult our Technical Department.

10.5 AUTOMATIC START GENERATING SET

In this case do not forget to connect :

- The main voltage sensing or the remote control signal for starting the generating set.
- The power supply for the plant auxiliary equipment (fuel pump, charger) should be taken from the load side of the changeover panel. This power supply should be protected by a fuse or MCB.

Earth connections shall comply with the local standards. Similarly, make sure the generating set neutral rating is identical to the one used in your equipment.

Your equipment should also be protected against lightning.

10.6 CABLE SELECTION TABLE (duct installation)

В случае автоматического запуска генераторной установки не забудьте соединить:

CABLE SECTION H07RNF OU PRC		Acceptalve amperes for ambient temperature of:			
		30°	40°	50°	60°
5x16mm ²	Multi Core	96	86	77	64
5x25mm ²	Multi Core	127	114	101	85
1x25mm ²	Per single core phase	142	128	113	95
1x35mm ²	.....	175	157	140	117
1x50mm ²	.....	212	191	169	142
1x70mm ²	.....	270	243	216	181
1x95mm ²	.....	327	294	281	219
1x120mm ²	.....	379	341	303	254
1x150mm ²	.....	435	391	348	291
1x185mm ²	.....	496	446	397	332
1x240mm ²	.....	584	525	487	391
2(1x35mm ²)	Per single core phase	297	267	238	199
2(1x50mm ²)	.....	360	324	288	241
2(1x70mm ²)	.....	459	413	387	307
2(1x95mm ²)	.....	555	500	444	372
2(1x120mm ²)	.....	644	579	515	431
2(1x150mm ²)	.....	739	665	591	495
2(1x185mm ²)	.....	843	758	674	584
2(1x240mm ²)	.....	992	893	794	665

11. COOLING

Heat needs to be dissipated from three sources:

- the water used to cool the engine
- the air used to ventilate the engine room
- the exhaust gases.

The systems described below enable this heat to be dissipated or ducted away.

ENGINE DRIVEN RADIATOR

The engine cooling system is connected to a tube and fin radiator mounted on the chassis.

- This radiator is cooled by the fan driven directly by the engine. The fan often displaces enough air to ensure adequate ventilation of the engine room on its own.

Air is always blown from the fan to the radiator.

The engine room is cooled by the cold air circulating inside it and air circulation can be controlled in several ways.

ELECTRIC MOTOR DRIVEN RADIATOR

The engine cooling system is connected to a separate electric motor driven radiator located either inside or outside the engine room.

- If the unit is inside the room it works in the same way as the engine driven radiator but the fan is driven by an electric motor.
- When the electric motor driven radiator is located outside the engine room or on a roof top, extra lengths of cooling water pipe are required. These have to be accurately sized and the room ventilation system will be separate from the engine cooling system.

Such systems require great care to ensure proper extraction of gases from the engine room.

WATER HEAT EXCHANGER

This type of cooling system uses a considerable amount of water so extra overheads need to be taken into account. It is suited when local conditions provide a sufficient flow of water and where proper ventilation cannot be ensured by an air cooled radiator or air cooling unit system.

Water cooling systems consist mainly of a tubular heat exchanger connected to the engine cooling system. This exchanger has an expression chamber and one of its circuits vented to the outdoor air. The water is circulated by the engine water pump. The exchanger's second circuit is connected between the building water supply system and the drain. A valve upstream of the exchanger opens or shuts.

ENGINE ROOM VENTILATION

Exhaust fans and/or blowers can be used to cool the engine and draw fresh air into the engine room and over the equipment housed there.

If fans are used, more effective temperature control can be achieved with several fans rather than one large fan. The ventilation of the engine room requires detailed engineering calculations.

IX. SPECIAL PROTECTION

However, the installation of SOULE type 8134 or 8137 variable resistance lightning arresters may be considered, keeping in mind that these devices do not offer full protection.

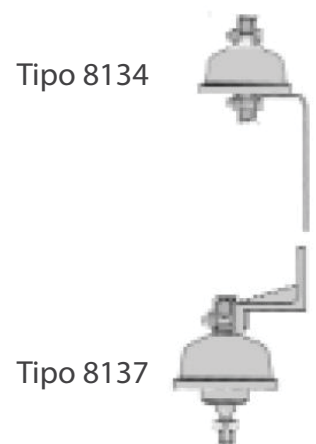
We wish to draw your attention to the fact that this protection concerns the power station itself but not the overhead distribution system that might be connected to it.

This solution may be offered as an option. This type of protection device does not ensure full safety.

A - SOULE LIGHTNING ARRESTER OPERATION

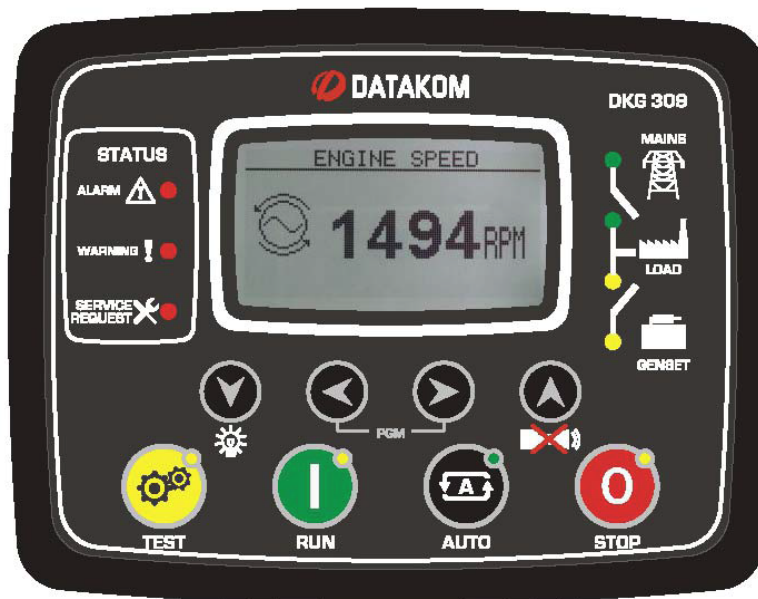
When there is an overvoltage on the lightning arrester, the spark gap is pre-ionized by the formation of a corona at a voltage much lower than the lightning strike. The gap is bridged without any noticeable delay whatever the rise time of the lightning. The discharge current flows to the earth through the Carbosial semi-conductor resistor, the resistivity of which decreases very rapidly with the applied voltage. A very high current of 4 to 5 kA may then flow to earth without the instantaneous voltage on the resistor exceeding 2500V.

When the voltage decreases, after the overvoltage, and gets closer to the normal operating value, the de-ionization stops almost instantly in the carbosial semiconductor resistor and the current becomes so low that the leakage current is close to 0 and the arc is spontaneously de-energised in the spark gap.



OUR GENERATING SETS ARE NOT EQUIPPED WITH PROTECTION DEVICES AGAINST OVERVOLTAGE DUE TO LIGHTNING OR OTHER SIMILAR CONDITIONS.

12. AMF SYSTEMS



12.1. General Purpose

Intended Users

This Operator's Manual is mainly intended for the daily user. On the basis document the operator will be able to carry out simple day-to-day procedures.

Contents /Overall Structure

The document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of new page.

These document is the Operator's Manual for DATAKOM's generator controller DKG-309. The document includes information about push-buttons, LEDs, display readings and icon dist.

The general purpose is to give the operator important information to be used in the daily operation of the unit.

Please make sure to read this manual before working with the DKG-309 controller and the gen-set to be controlled. Failure to do this could result in damage to the equipment or human injury.

12.2. Warnings and legal information

Legal information and responsibility

DATAKOM takes no responsibility for installation or operation of the engine set. If there is any doubt about how to install or operate the engine controlled by the unit, the company responsible for the installation or the operation of the set must be contacted.

This units are not to be opened by unauthorised personel. if opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel, who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

Factory settings

The unit is delivered with certain factory settings. Given the fact that these settings are based on average values, they are not necessarily the correct settings for matching the individual engine. Thus precautions must be taken to check the settings before running the engine.

Definitions

throughout this document a number of notes and warnings will be presented. To ensure that these are noticed, they will be highlighted in order to separate from the general text.

Notes

The notes provide general information, which will be helpful for the reader to bear in mind.

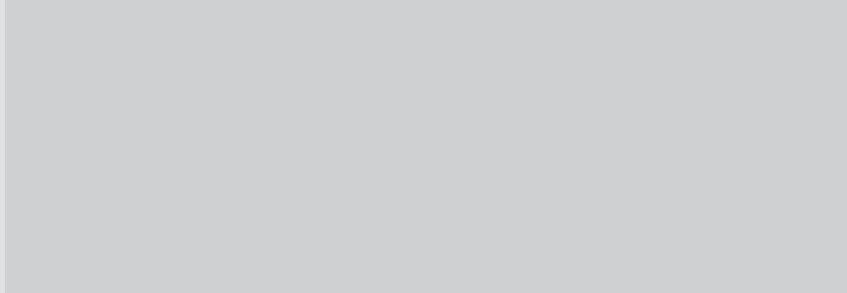


Warnings

The warnings indicate a potentially dangerous situation, which could result in death, personnel injury or damaged equipment, if certain guidelines are not followed.



Distributed By



KZ ENERJİ COZUMLERİ ve DİS TIC. LTD. STİ.

Mimar Sinan Mah. Bosna Caddesi No : 1/6 Cekmekoy / İstanbul / Turkey

T: +90 216 641 96 43 (pbx)

M : +90 532 255 76 77

F : +90 216 641 96 47

www.kzpower.com

info@kzpower.com



TR-QC-EC-3238



TR-SC-3238



TR-QC-EC-3238