



GENERATOR SET

Installation, Operation and Maintenance Guide



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Enclosed documents

Control unit operating instructions, if included in the scope of supply (Level A) Engine operating and maintenance instructions (Level A)

Operating and maintenance manual and spare **parts** catalogue for the alternator (Level A)

Wiring diagram (supplied with reference materials or with the electric generator) (Level A)

Engine spare **parts** catalogue (Level B)

2. INTRODUCTION

2.1. Introduction

2.1.1 General recommendations

Thank you for choosing an electric generator from our company.

This manual has been produced to help you operate and maintain **your** generator correctly.

Please read the safety instructions carefully to prevent any accidents, incidents or damage. These instructions must always be followed.

To ensure optimum efficiency and the longest possible service life **for** electric **generators**, maintenance work must be carried out at the intervals specified in the enclosed preventive maintenance tables. If an electric generator is used in a dusty environment or under adverse conditions, some of these **intervals** will be shorter.

Ensure that all adjustments and repairs are carried out by staff who have undergone the relevant training. Dealers are suitably qualified and can answer any questions you may have.

They can also supply you with spare parts and provide further services.

The left and right sides can be distinguished from the rear of the electric generator (**the radiator** is at the front).

Our electric generator sets are designed so that damaged or worn parts can be replaced with new or reconditioned parts, **thereby** minimising downtime.

To replace any **parts**, please contact your nearest authorised dealer, who has the necessary equipment and properly trained and knowledgeable staff to carry out maintenance, **part** replacements and even complete overhauls of generator sets.

Please contact your local dealer to obtain the available repair manuals and to arrange the necessary staff training on commissioning and maintenance.

IMPORTANT

Some user manuals and maintenance manuals for engines fitted to electrical **generator** sets contain information on control units and describe in detail the procedures for starting and stopping the engine.

As electrical **generator** sets are equipped with test and control panels specific to each set, only the information in the documentation relating to **the panels** fitted to these sets should be taken into account.

2.1.2. Structure of reference materials

The reference material supplied with the generator sets is divided into three levels:

2.1.2.1 Level A

This basic level contains all user and maintenance procedures for the generator set or power station.

This reference material enables you to familiarise yourself with the equipment – its operation and maintenance – both in day-to-day operation and during scheduled maintenance work.

The reference material for engines and alternators fitted to sets consists of **engine** operating and maintenance **manuals** (from the manufacturer) and **alternator** operating and maintenance **manuals** (from the manufacturer).

Level A reference material comprises:

- an operating and maintenance manual – containing, amongst other things:
 - general recommendations and safety regulations to be observed
 - general recommendations for the installation of generator sets
 - general instructions for preparing generator sets prior to commissioning
 - general reference material for the maintenance of starter batteries
- user and maintenance manual for the engine fitted to the unit
- a maintenance manual for the alternator fitted to the unit
- user manual for the control panel (if supplied)
- wiring diagrams (these diagrams are included in **the reference materials** or are supplied with the generator set)

2.1.2.2 Level B

This reference material supplements the Level A reference material.

In addition, it contains a spare **parts** catalogue for the engine fitted to the set, enabling a qualified user to identify a specific part and order it.

Contents

List (index code – description – part number, etc.) Illustrations
(index code).

These spare **parts** catalogues are available in English only, regardless of the engine manufacturer.

2.2. Pictograms and their meanings



Warning –
danger



Warning: risk of electric
shock
Risk of electric shock



Warning: toxic substances



Warning: pressurised
liquids
liquids



Warning, high
temperature, risk of burns



Warning: rotating or
moving
parts (risk of being caught
in the machinery)



Warning:
corrosive
product



It is essential to follow
the instructions
provided with the
generator set



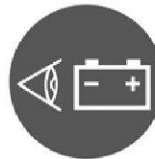
Protective clothing
must be worn



Eye and ear
protection must be
worn



Regular
maintenance must
be carried out



Check the battery condition



A lifting point is required



A stacking point is required



Warning: risk of explosion



Open flames and unprotected lights are prohibited.

No smoking



No entry to persons who are not authorised



Do not use water to extinguish fires



Power supply



If the equipment is on a trailer, starting earth it before ,



Earthing



Emergency shutdown

Application of the EU Machinery Directive 98/37 of 22 June 1998 in relation to generator sets.

- Access is restricted exclusively to authorised persons in accordance with the applicable legislation
- Live equipment: automatic start-up possible.

2.3. Safety instructions and regulations

THESE SAFETY PRECAUTIONS ARE IMPORTANT

If there is anything in this manual that you do not understand or if you have any questions, please contact your dealer, who will explain or demonstrate everything to you. Below is a list of risks and precautionary measures that must be observed. You should also familiarise yourself with the local and national regulations applicable in your jurisdiction.

2.3.1 General advice

- Read and fully understand the manuals supplied with the generator.
- Do not wear loose clothing whilst the generator is in operation, and keep clear of the machinery. Bear in mind that the fans are not clearly visible whilst the engine is running.
- Please ensure that all persons present keep a safe distance whilst the machine is in operation.

- The generator set should always be operated by an experienced operator.
- Always test the generator set from the control panel.
- Follow the maintenance schedule and the instructions set out therein.
- Never allow anyone else to use the generator set **without** first providing them with the necessary instructions.
- Do not start the engine until the protective covers are in place.
- Turbocharged engine: never start the engine without the air filter fitted. The rotating compressor wheel in the turbocharger can cause serious personal injury. Foreign objects in the intake manifold can cause mechanical damage.
- Engine with air preheating (starter components): never use an aerosol or similar products to assist with starting the engine.
Contact with a starter component may cause an explosion in the intake manifold, resulting in injury.
 - Never allow a child to touch the generator – even when it is not in operation.Avoid using the generator in the presence of animals (it may frighten them).
- Never start the engine without an air filter or exhaust.
- Before using the generator, always comply with the applicable local regulations regarding **generators** and the use of fuel (petrol and gas).
- Never use seawater or any other electrolytic or corrosive substances in the cooling circuit.

- Before carrying out any repairs, disconnect the battery and the pneumatic starter (if fitted) to prevent the engine from starting accidentally. Fit the control cover to prevent any attempt to start the engine.
- Do not modify the engine in any way.
- Use only the correct techniques when turning the crankshaft by hand. Do not attempt to turn the crankshaft by pulling or applying force to the fan lever. Doing so may cause serious physical injury or material damage, or may damage the fan blades, **which** could lead to premature fan failure.
- Always use tools that are in good condition. Before starting work, ensure that you understand how to handle them.
- Use only genuine spare parts.
- Use tools that are suitable for the task at hand.
- Wipe away any traces of oil or coolant with a clean cloth.
- Never use petrol or other flammable substances to clean **parts**. Use only approved cleaning solvents.
- Do not use a high-pressure **washer** to clean the engine and accessories. This could damage radiator hoses, electrical components, etc.
- Avoid accidental contact with parts that reach high temperatures (exhaust pipe – exhaust).
- Once the trailer-mounted generator set has been positioned at the site of operation, apply the parking brake.
- When positioning the trailer on a slope, check that there is no one behind it.
- Safety goggles must be worn when carrying out maintenance work.

The operator should remove watches, necklaces, etc.

2.3.2 Risks associated with the gas supply (applies to gas-powered units)

WARNING - DANGER

Gas is explosive. It is forbidden to smoke, approach the generator or create sparks whilst the tank is being filled or in the vicinity of the generator.

- Ask your gas supplier for technical user instructions and safety data sheets for LPG or natural gas.
- Gas appliances must be installed, maintained and repaired by recognised specialists.
- Do not attempt to open, unseal or tamper with **the** gas supply pressure relief **valves** or the gas pipework in general.
- Refuelling must be carried out in the open air (outdoors) in accordance with local regulations
 - in an area sufficiently distant from fire, people and animals.

2.3.3 Risks associated with exhaust gases and fuels

WARNING – DANGER

Generators should not be operated in unventilated areas.

- Before using the generator, always comply with the applicable local regulations regarding **generators** and the use of fuels (petrol, diesel and gas).
- Refuelling should be carried out with the engine switched off (except for units with an automatic refuelling system)
- Engine exhaust fumes are toxic: Do not use the generator in unventilated areas. When installing in a ventilated area, additional fire and explosion protection requirements must be observed.
- If exhaust gases are leaking, the generator set may become noisier. To ensure it is operating efficiently, you should regularly check the exhaust vent.
- Pipes must be replaced as soon as their condition requires it.

2.3.4 Risks associated with toxic products

WARNING - DANGER

The corrosion inhibitor contains alkalis. This substance must not come into contact with the eyes. Avoid any prolonged or repeated contact with the skin. Do not swallow. In the event of contact with the skin, wash thoroughly with soap and water. In the event of contact with the eyes, rinse immediately with plenty of water for at least 15 minutes. SEEK MEDICAL ATTENTION IMMEDIATELY. KEEP THIS PRODUCT OUT OF REACH OF CHILDREN.

This anti-corrosion product is toxic and dangerous if swallowed. Avoid any contact with the skin or eyes. Read the instructions on the packaging.

Glycol is a toxic substance and is dangerous if swallowed. Avoid any contact with the skin or eyes. Read the instructions on the packaging.

- Under no circumstances should you expose the device to splashing liquid or rain, or place it on a wet surface.
- Always use the recommended fuels. Using low-quality fuels can damage the engine and reduce its performance
- Battery electrolyte is harmful to the skin and, in particular, to the eyes. If any splashes get into your eyes, rinse them immediately with running water and/or a 10% boric acid solution.
 - When handling electrolyte, wear safety goggles and gloves resistant to strong alkalis.

2.3.5 Risk of fire, burns and explosion

WARNING - DANGER

The motor must not be operated in areas where explosive substances are present. Where not all electrical and mechanical components are protected, there is a risk of sparks being generated.

- Take care not to create sparks or flames, and do not smoke near batteries, as the gases from the electrolyte are highly flammable (particularly when the battery is being charged). Battery acid is also harmful to the skin and, in particular, to the eyes.
- Never clean, lubricate or adjust the engine **whilst** it is running (unless you are authorised to do so – in which case, take the utmost care to prevent accidents).
- Never carry out any adjustments with **which** you are not familiar.
- Never cover the generator with any material whilst it is running or immediately after it has stopped (wait **until** the engine has cooled down)
- Do not touch hot parts, such as the exhaust pipe, and do not place flammable materials on them.
- Keep all flammable or explosive substances (petrol, oil, rags, etc.) at a safe distance **whilst** the generator is running.

- Good ventilation is essential for the generator to function properly. Without ventilation, the engine will quickly overheat, **which** may lead to accidents or damage to the equipment and surrounding **objects**.
- Do not remove the radiator cap **whilst** the engine is hot and the coolant is under pressure, as there is a risk of scalding.
- Before dismantling or disconnecting any couplings, hoses or connected components, depressurise the air, oil and cooling circuits. When disconnecting the equipment from a pressurised system, be aware of any pressure that may still be present. Do not check for pressure leaks by hand. High-pressure oil can cause injury.
- Some preservative oils are flammable. Some are also hazardous if inhaled. Ensure there is adequate ventilation. Wear a protective mask.
- Hot oil causes burns. Avoid contact with hot oil. Before carrying out any **work**, ensure that the system is no **longer** under pressure. Never start or run the engine **whilst** the oil filler cap is unscrewed, as oil may spray out.
- Never start or leave the engine running whilst the oil filler cap is unscrewed, as oil may spray out.
- Never coat the generator set with a thin layer of oil to protect it from corrosion.
- Never top up the oil or coolant **whilst** the generator set is running or **whilst** the engine is hot.

2.3.6 Risks associated with electrical networks

- The electrical equipment supplied with the generator complies with standard NF C15.100 or the relevant national standards
- Read the manufacturer's rating plate carefully. It specifies the voltage, power, current and frequency ratings. Check that these ratings correspond to the power supply in question.
- Never touch bare **wires** or disconnected **connections**.
- Never handle the generator with wet hands or feet.
- Keep electrical cables and connections in good condition. Using the equipment in a poor condition may result in electric shock and damage to the equipment.
- Any work on the equipment must be carried out whilst the power is off.
- Electrical connections must be made in accordance with the applicable standards and regulations of the country in question.
- Do not use faulty, poorly insulated or makeshift cables.
- When connecting batteries, do not reverse the positive and negative terminals. Doing so may cause serious damage to electrical equipment. Follow the wiring diagram supplied by the manufacturer.

- The generator set should not be connected to any other power sources, such as **the public mains supply**. In specific cases where there is a backup connection to existing electrical networks, this connection must only be carried out by a qualified electrician, who should take into account the operational differences between the equipment depending on whether **the mains supply** or the generator set is being used.
- Protection against electric shock is provided by a set of specific devices. If these devices need to be replaced, components with the same rated values and specifications must be used.
- Due to the strict mechanical specifications, you should only use flexible, durable rubber-sheathed cables in accordance with standard CEI 245-4 or equivalent cables.

2.3.7 Dangers caused by electric current (first

aid) First aid

In the event of an electric shock, immediately disconnect the power supply and activate the machine's emergency stop. If the power has not yet been disconnected, remove the victim from contact with the live conductor as quickly as possible. Avoid direct contact with both the live conductor and the victim's body. Use a dry wooden board, dry clothing or other non-conductive materials to move the victim. **A live conductor** can be cut with an axe. Take the utmost care to avoid the electric arc that is generated during this process.

Initiate emergency procedures – resuscitation

If breathing has stopped, immediately commence artificial respiration at the scene of the accident, provided this does not endanger

the life of the casualty or the person performing CPR.

In the event of cardiac arrest, perform chest **compressions**.

2.3.8 Risks associated with moving the generator set

- Use lifting equipment to lift the generator set. Always ensure that the lifting equipment is in good condition and has sufficient load-bearing capacity.
- To ensure complete safety during operation and to prevent damage to components mounted on the top of the engine, the engine must be lifted using an adjustable jib. All chains and ropes should be parallel to one another and as perpendicular as possible to the top of the unit.
- If other equipment mounted on the generator set alters its centre of gravity, special lifting equipment may be required to maintain the correct balance and ensure work can be carried out in complete safety.
- Never carry out work on a generator set that is suspended solely by lifting equipment.

2.3.9 Recommendations for operators and those in the vicinity

- Operating personnel should be familiar with the safety and operating instructions. These instructions will be updated regularly.
 - Operations should be monitored, either directly or indirectly, by a person designated by the operator who is familiar with the installation and with the risks and issues associated with the products stored and used at that installation.
 - No unauthorised persons should have free access to the equipment unless authorised to do so by the operator.
 - The user should check the operating pressures of the individual pressure stages and ensure that they comply with the prescribed operating requirements. The user is **also** responsible for adjusting the equipment in accordance with **the** manufacturer's **instructions** and should check that the equipment is functioning correctly.
 - The user should draw up or obtain a document describing the modifications and illustrating the changes made to the equipment compared with the original documentation.
-
- The manufacturer's instructions should be made available to on-site technical staff, where possible.
 - A diagram of the internal network should be displayed as close as possible to the access points and should show all individual points. Information on both the internal and external networks may be included in a single distribution diagram.
 - A label on the door identifies the operator and provides details about them, including the telephone number for the gas supplier's emergency service.
 - Staff should be familiar with the layout of the site and should be identifiable on site to simplify procedures. In the event of a problem, this knowledge of the facilities is essential, as insufficient identification of the site could exacerbate the situation.
 - Written operating instructions must be available for activities involving hazardous handling procedures and the operation of equipment. These instructions shall, in particular, specify:
 - Operating modes
 - The frequency of tests on safety equipment and equipment for handling pollutants and other harmful substances generated within the plant
 - Methods of maintenance, inspection and use of adjustment and safety devices.
 - The operator should take the necessary measures to meet aesthetic **requirements** for the workplace. The entire workplace must be kept clean and in good condition.
 - Premises must be kept clean and tidied regularly to prevent the accumulation of hazardous or polluting **materials** or dust which could be liable to ignite or cause an explosion. Cleaning equipment must be adapted to take account of the risks posed by these products and dust.

- The presence of hazardous or flammable **materials** in the premises where combustion plant is located is limited to the quantities necessary for operation.
- The equipment must be operated under the constant supervision of a qualified person. This person should regularly check that the safety devices are functioning correctly and ensure the correct supply of fuel to the combustion equipment.
- Apart from the combustion appliances, open flames of any kind are prohibited. This restriction should be indicated in bold on a sign.
- Residual water, mud and the splashing of waste are prohibited.
- The fuels used should correspond to those specified in the documentation and specifications prescribed by the manufacturer of the combustion plant.
- Fuel is considered to be in the physical state in which it is fed into the combustion chamber.
- Open-air waste incineration is prohibited.
- Unless a special agreement has been concluded – once the main gas supply valve has been closed – it may only be reopened by the gas supplier. However, the user may have conditional access to it. Check this for each location **individually**.
- Always protect your hands when checking for **leaks**. Fluids under pressure can penetrate body tissue and cause serious injury. There is a risk of blood poisoning.
- Drain the engine oil and dispose of it in a designated container (petrol stations may accept **your** used oil).

3. INSTALLATION

WARNING

Chapters 3, 4 and 5 contain only general recommendations.

We recommend that you use the services of a specialist to ensure correct installation and commissioning. The company accepts no liability for faults arising from the installation conditions.

3.1. Unloading

3.1.1 Safety during unloading

To ensure that generator sets can be unloaded from transport **pallets** under optimal conditions in terms of safety and efficiency, please check that the following points are correctly observed.

- Use suitable lifting vehicles or equipment for this work.
- Lifting straps must be positioned in the lifting eyes provided for this purpose, or lifting arms must be placed entirely beneath the frame cross-members.
- A suitable surface capable of **safely** supporting the weight of the unit and the lifting vehicle (if this is not the case, lay down sufficiently strong and stable boards).

Move the unit as close as possible to the point of use or transport – to a clear area with unobstructed access.

3.1.2 Example of suitable material

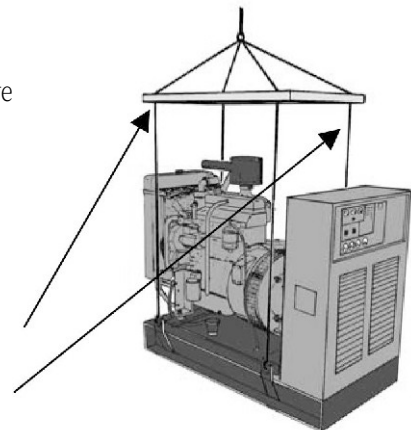
- crane, slings, lifting beam, safety hook, shackles.
- forklift truck.

3.1.3 Unloading instructions

3.1.3.1 Lifting straps

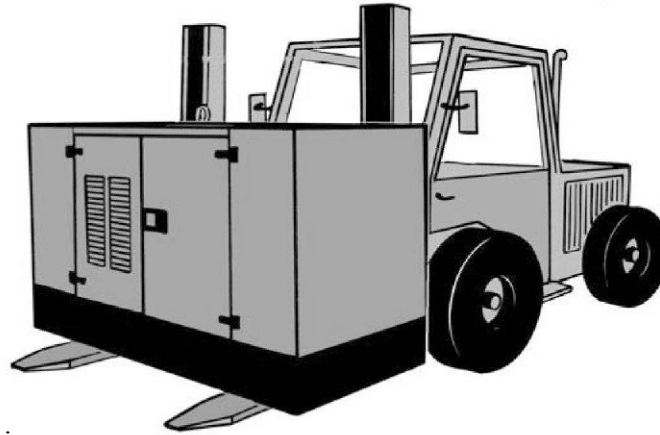
- Attach the lifting straps of the lifting vehicle to the lifting eyes on the generator set designated for this procedure.
- Attach the slings carefully.
- Check that the lifting straps are correctly attached and that the unit is securely fastened.
- Carefully lift the generator.
- Position and stabilise the unit in the chosen position.
- Carefully lower the unit and continue to level it.
- Loosen the suspension ropes and then disconnect and remove the lifting eye

Note: The lifting straps must be perpendicular to the frame to prevent them from rubbing against the unit.



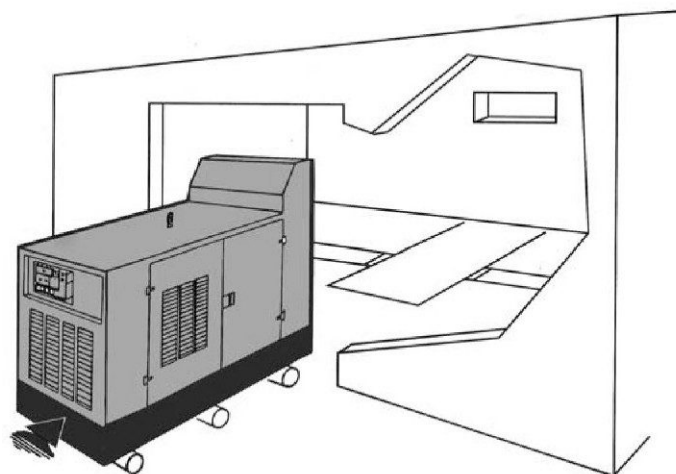
3.1.3.2 Forklift

- Position the forklift's forks under the frame, ensuring that only the crossbars rest on the forks.
- Lift the unit and handle it with care.
- Place the generator set in the unloading position.

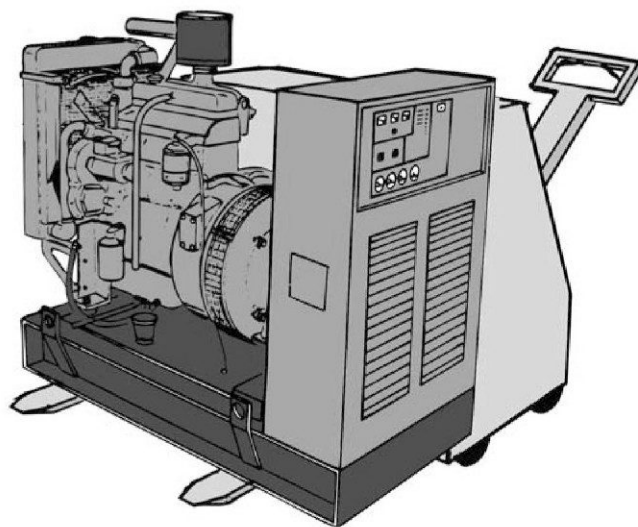


3.2 Handling instructions

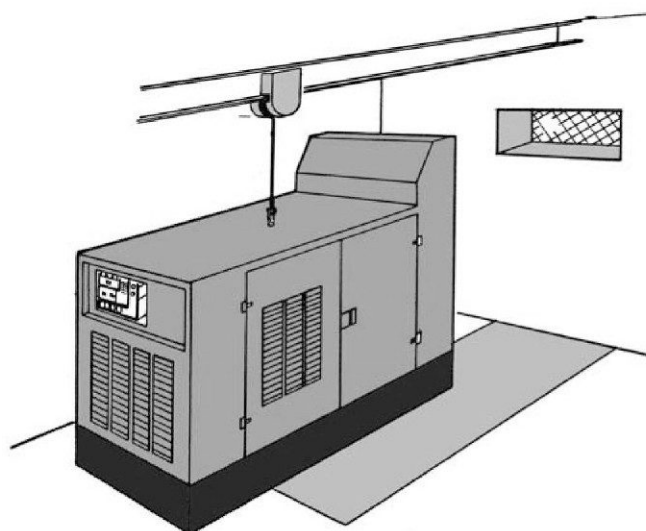
- Carefully lift the edge on the engine side using 2 **jacks**, then slide 3 tubes under the frame.
- Leave the frame under the tubes and then move the unit by hand.
- Whilst moving the unit, make use of the loose pipes by sliding them one by one under the frame.
- Once you have reached the desired location, position the assembly and then lift it using **jacks** to support it.
- Remove the tubes and set the assembly down on the ground, checking that it is in the correct position, then remove the jacks.



It is recommended to use a forklift with forks longer **than** the width of the frame



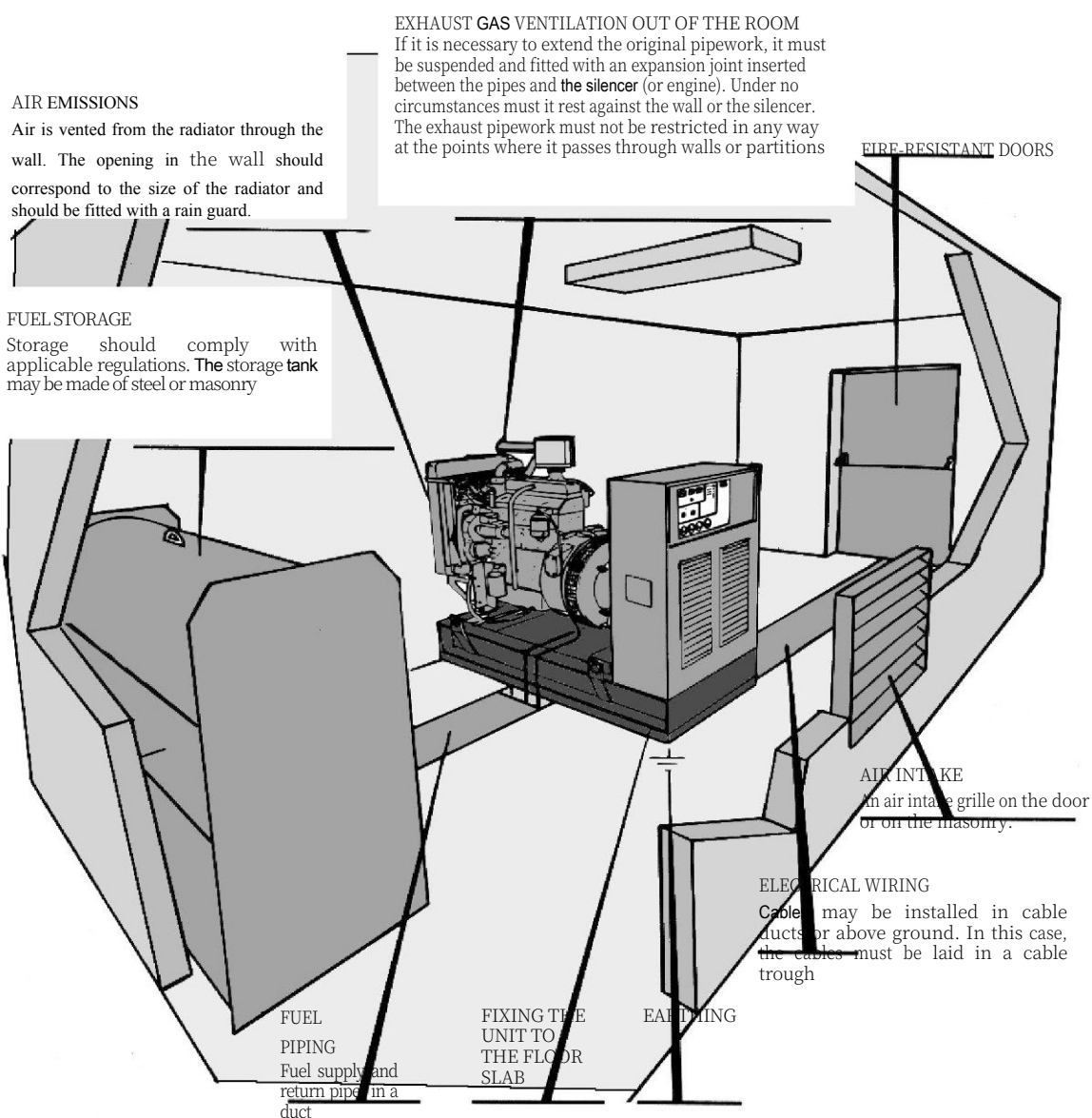
If you are using a rail or a trolley, once the unit is in place, proceed in the same way as described in the section 'Lifting straps'.



3.3 Installation of fixed assemblies

NOTE

Failure to follow the basic principles will result in damage and excessive wear to the assembly. The procedure described sets out the main requirements for the installation of a 'conventional' generator set comprising an internal combustion engine, a generator and an electrical switchboard. These requirements represent general principles that must be followed. For specific applications, or if you have any doubts, our technical department will advise you and assess your specific installation conditions. It is essential to comply with the applicable regulations, directives and laws in force at the installation sites.

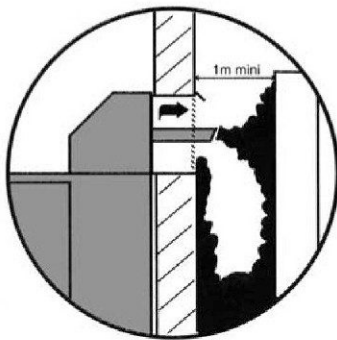


3.3.1 Location

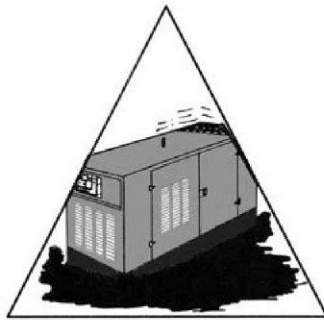
This should be determined based on the intended use. There are no specific rules for selecting the location, apart from proximity to the distribution box and noise interference. However, the fuel supply, flue gas outlet, the direction of flow of these **gases** and the noise emitted must be taken into account.

The choice of location will be based on a carefully considered compromise!

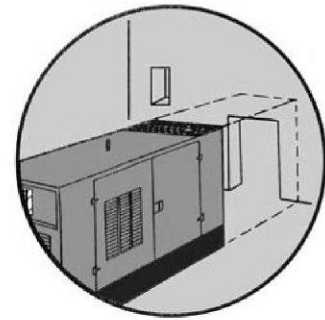
Examples of **problems** that may arise:



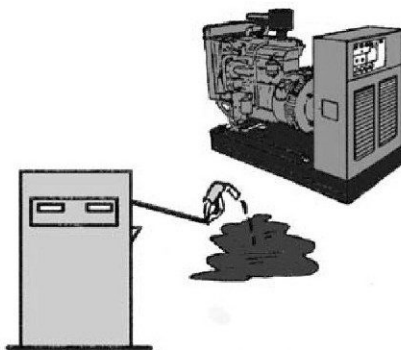
Inadequate ventilation
and
ventilation



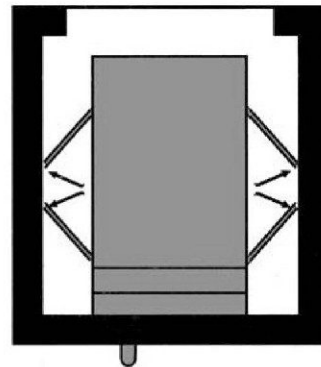
A surface that is **too**
uneven or too soft.
Incorrectly positioned



Restrict
ed access



Cannot refuel



It is not possible to open the cover door

3.3.2 Dimensions and layout

These are subject to two types of **requirements**:

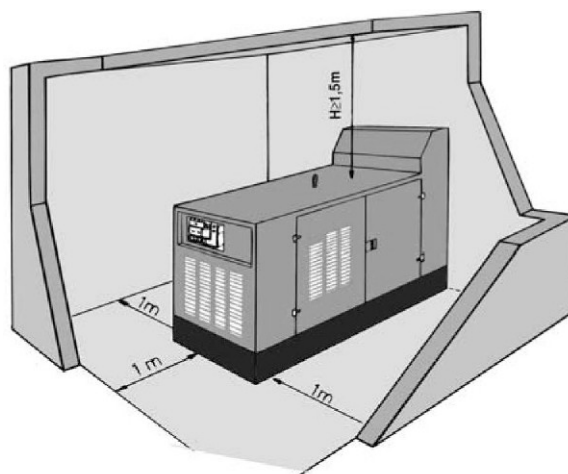
3.3.2.1 Static requirements

These are the dimensions of the installed equipment and its surroundings, specifically: **the fuel tank** for day-to-day operation, the housing, **the exhaust silencer**, the battery, etc.

3.3.2.2 Dynamic requirements

These are the clearances that must be maintained between the individual parts of the equipment to allow for maintenance and any necessary **dismantling**.

To ensure trouble-free maintenance, a minimum clearance of approximately 1 metre around the unit is required. This will provide sufficient space to check that the doors of enclosed units open fully, that the equipment is accessible for maintenance, and that the unit can be completely **dismantled**.



Example of room **dimensions** for the enclosed version of the unit.

3.3.2.3 Design

A wide variety of **shelter** types can be designed to house the generator set.

If noise levels and start-up speed are not the main criteria in your selection, the generator set can be installed under a simple cover to protect it from adverse weather conditions (**rain**, snow, storms, etc.).

If low noise levels and a quick start-up are important criteria (**e.g.** an emergency generator or a noise-sensitive area), special attention will be paid to this, and the enclosure will be constructed from reinforced concrete or solid concrete **blocks** at least 20 cm thick, lined with sound-absorbing, fire-resistant and insulating material.

NOTE

The fire resistance test should comply with the applicable legislation for the type of building.

3.3.2.4 Base of the unit

A generator set in operation emits a certain amount of vibrational energy. This vibrational energy is transmitted via the frame to the floor slab. Our generator sets do not usually require a special floor slab, as they are mounted on flexible bearings. However, the floor slab must be sufficiently strong and separated from the rest of the structure. It must also be levelled, smoothed and laid freely.

If there is a risk of vibration transmission, the unit can be mounted on an anti-vibration floor plate, which is insulated with a flexible material where necessary.

This solution is mainly used for very high-power generator sets.

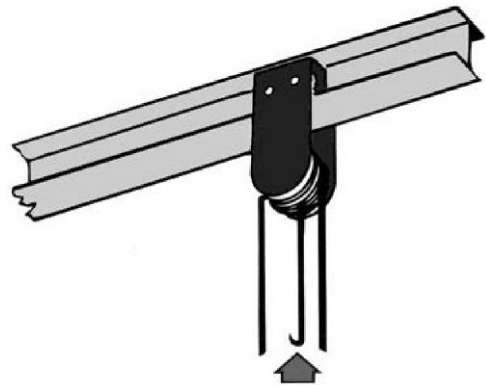
3.3.2.5 Openings

The room should be fitted with a number of **openings** necessary for its operation:

- a door allowing access to the generator set and its accessories, preferably aligned with the generator set's base plate
- ventilation openings (fresh air intake and hot air exhaust) are positioned so that the airflow runs from the alternator towards the engine. Their cross-sections depend on the power output of the installed generator set, general atmospheric conditions, the chosen cooling system and the method of sound insulation.

3.3.2.6 Lifting equipment

The lifting system should normally form an integral part of the structure. It consists of an H- or I-section steel rail – embedded in the walls and ceiling – and a crane trolley. It should be easy to operate and is usually positioned at the top, running along the longitudinal axis of the train and facing the exit.



3.3.2.7 Sound insulation

The room is soundproofed in two ways:

Insulation:

This prevents noise from penetrating the walls – in this case, the weight and thickness of the wall are important.

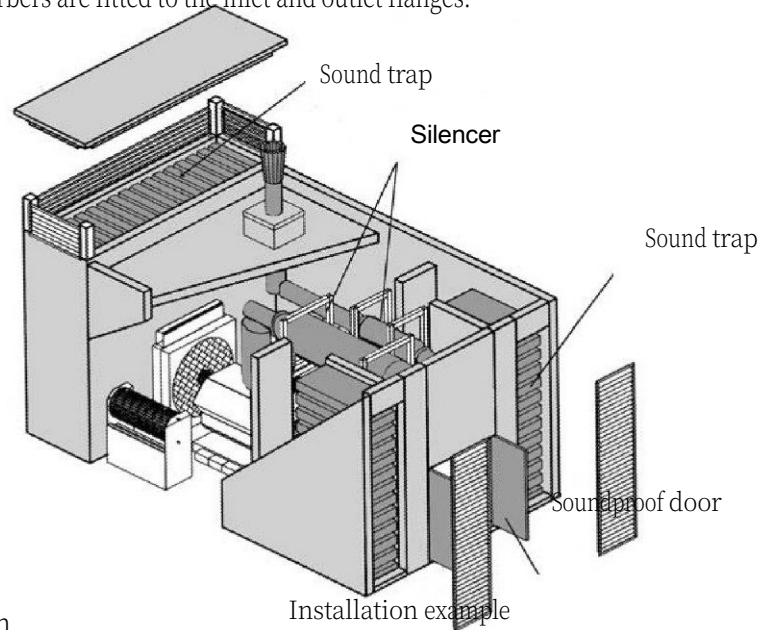
Absorption:

This involves materials that absorb sound energy, and this method is applied to ventilation openings. As a result, the cross-sectional area of the air inlets and outlets is increased.

The interior walls of a room can **also** be lined with sound-absorbing material designed to reduce noise levels within the room – and consequently through the walls, ventilation openings and doors.

General layout

- building structure made of reinforced concrete frames or solid concrete blocks – minimum thickness 20 cm
- an anti-vibration floor slab beneath the generator if it is adjacent to sensitive areas.
- ceiling and walls covered with sound-absorbing materials where necessary
- Selection of a suitable exhaust silencer (or **silencers**).
- Soundproof doors for access to the room and – where necessary – to the pressure chamber, ensuring a very low noise level.
- Sound absorbers are fitted to the inlet and outlet flanges.



3.3.2.8 Ventilation

A heat engine generates a certain amount of heat, which must be dissipated from the room to ensure the equipment functions correctly.

The heat released by this assembly comes from various **sources**:

- **cylinder** cooling
- radiant heat from the engine unit and the exhaust manifold
- alternator cooling.

The room must **also** be fitted with air inlets and outlets suitable for the specific operating conditions and the cooling system. As you know, inadequate ventilation causes the temperature in the space to rise and leads to problems ranging from a loss of engine power to the complete shutdown of the vehicle.

Air must flow through the room where the equipment is located, from the alternator → engine → radiator.

This arrangement also ensures the supply of fresh air required for combustion. The openings should be of sufficient size.

The air intake and exhaust will be as direct as possible. The cooling system will be connected to a sealed exhaust sleeve or cover to prevent the recirculation of hot air. The air intake and exhaust openings should not be located close to one another.

3.3.2.9 Fuel

As fuel is classified as a 'hazardous substance', certain regulations regarding storage and distribution must be observed. When carrying out the installation, it is **also** necessary to familiarise yourself with the applicable legal regulations installation.

Stationary units typically use **a** daily operating **tank** and **a** storage **tank**. These two tanks can be combined into one if the generator's consumption is low.

WARNING

Do not use galvanised containers or containers with a brass coating for storing fuel.

a) Manually filled fuel **tank**

A solution for a manually started generator set that is visually monitored. This **tank** is often integrated into the frame and is fitted with a mechanical level gauge, a filler neck and a drain plug.

b) Automatically filled **tank** located indoors

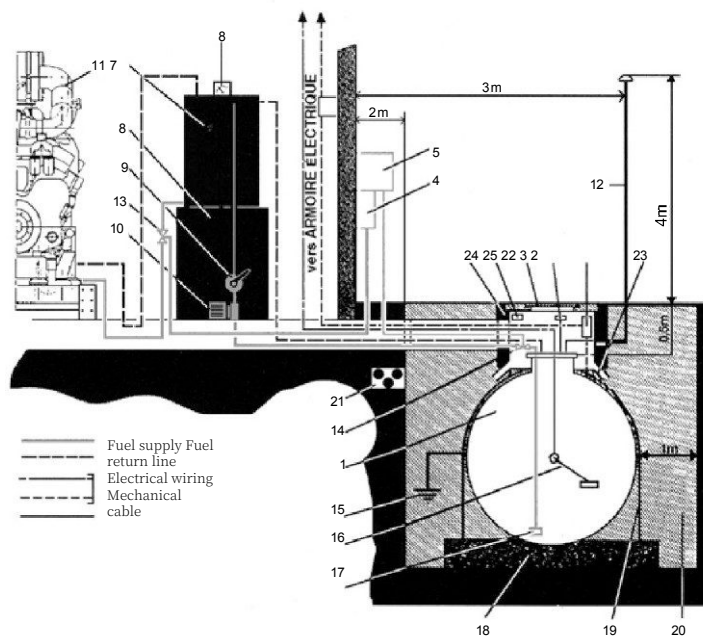
A solution for generators with automatic start-up. The **tank** is automatically filled by an electric pump from the main storage tank.

This type of installation is subject to regulations. Furthermore, it should be fitted with a containment tank capable of collecting any leaks, **with** a capacity at least equal to that of the main tank. An overflow pipe leading back to the main tank must be provided. Its cross-sectional area should be at least twice that of the inlet pipe.

To prevent venting, **the tank** is installed slightly above the level of the diesel engine (except in covered parking areas).

This **tank** must **also** be fitted with a shut-off valve, the control **for which** must be located outside the room.

- 1 - Double-walled storage **tank**
- 2 - Leak test chamber
- 3 - Filling port
- 4 - Shut-off valve control unit
- 5 - Safety valve control unit
- 6 - A 600-litre retention **tank**
- 7 - 500-litre daily service **tank**
- 8 - Gauge with level switch
- 9 - Hand pump
- 10 - Electric pump
- 11 - Generator
- 12 - Venting
- 13 - Safety valve
- 14 - Shut-off valve
- 15 - Earthing
- 16 - Electric fuel level **sensor**
- 17 - Non-return valve with strainer
- 18 - Concrete floor slab
- 19 - Anchor strip (l/m)
- 20 - Pits
- 21 - Pipe penetration
- 22 - Access plug
- 23 - Drains
- 24 - Minimum opening: 0.70 x 0.70
- 25 - Label showing type and capacity



Installation example

3.3.2.10 Flue gas extraction

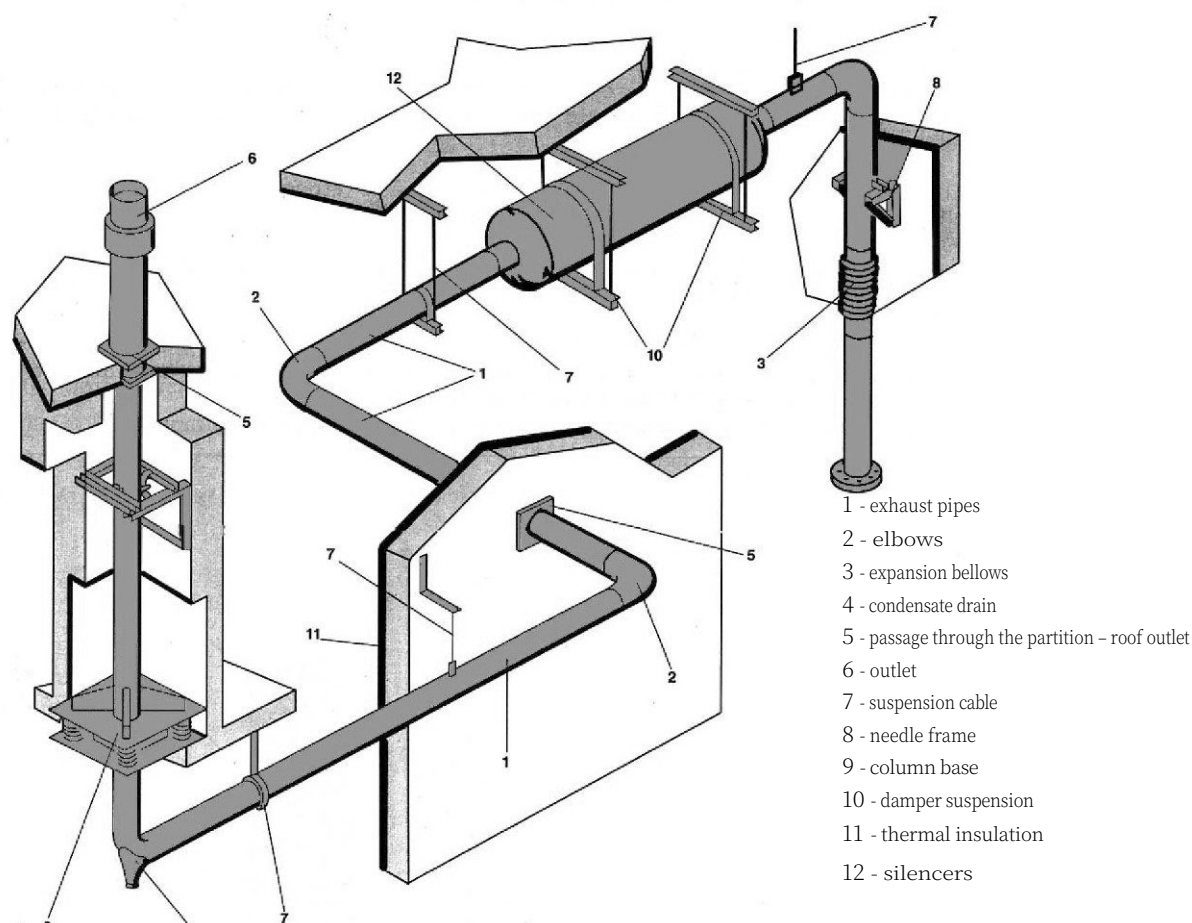
Planning the flue gas outlet from the generator should not be regarded as a minor detail, as the flue can always be installed – even in the most inaccessible places.

In fact, a number of constraints must be taken into account, such as pressure losses caused by flue gas extraction, insulation, suspension, noise levels and air pollution. It should be noted that the more complex the circuit, the greater the pressure losses; consequently, it will have a larger diameter, be heavier, and its supports and dampers will be more expensive.

NOTE

Generator sets with a silencer fitted inside the enclosure must be equipped with an exhaust **gas** compensator. This compensator or hose is connected to **the exhaust** outlet in the enclosure.

Main components



The fitter must check that none of the components fitted to the exhaust pipe cause pressure losses greater than the engine's permissible pressure.

Figure 1: Piping

It is recommended to use seamless pipes. However, for weight **reasons**, rolled steel pipes may also be used. In any case, welded rods **inside** the pipework must be avoided.

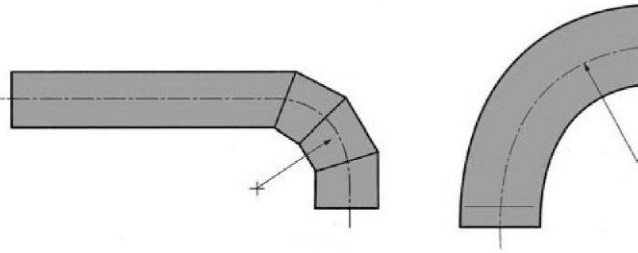


Figure 2: Elbows

Elbows should have a minimum bend radius of $2D$ and, where possible, be made in one piece. If the elbow is made of welded steel, check that 90° elbows contain at least 3 reinforcements.

Figure 3: Expansion joints and hoses

- Compensation bellows: dampen lateral movements caused by thermal expansion (approximately $1 \text{ mm/metre}/100^\circ\text{C}$).
- Hose: allows for considerable lateral movement, but with a small longitudinal amplitude.



Figure 4: Condensate and rainwater drainage

Provided at the lower part of the installation - to protect the silencer and motor or to accommodate any changes in horizontal/vertical displacement.

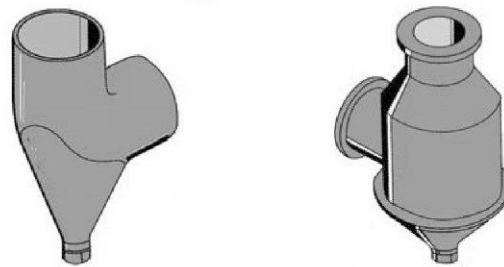


Figure 5: Penetration through a partition - roof outlet For each penetration through a partition and roof outlet.

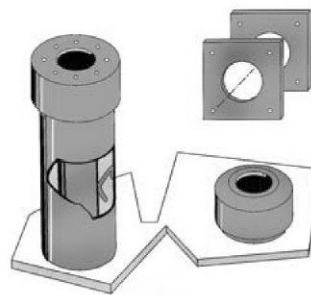


Figure 6: Exhaust **gas** outlet

Exhaust pipe outlets disperse the gases into the atmosphere and protect the internal part of the pipe from adverse weather conditions.

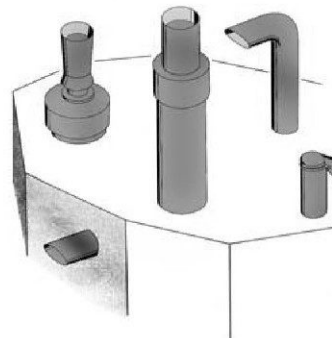


Figure 7: Suspension cable

It usually consists of a flat iron ring attached to the ceiling. The suspension cable allows the pipes to expand freely.

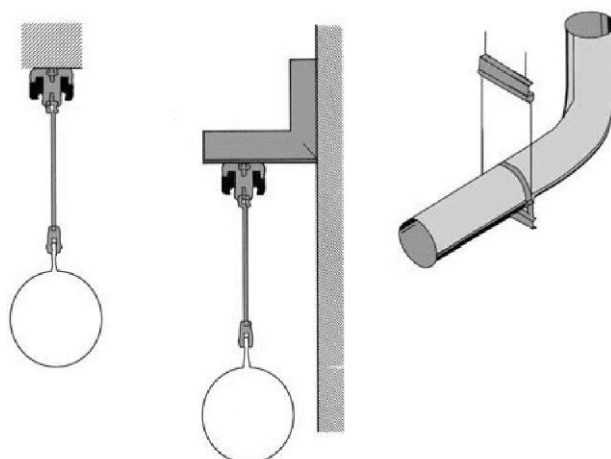


Figure 8: Needle frame

Used for vertical sections – the needle frame allows the pipes to expand whilst holding them in place laterally.

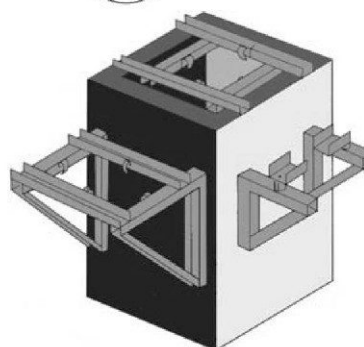


Figure 9: Column base

The column base is designed to support the weight of the vertical pipes.

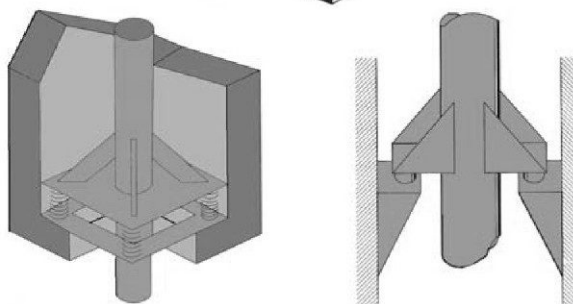


Figure 10: Damper suspension cable

Shock absorber suspension cables are designed to support the weight of the shock absorbers – they can be vertical or horizontal.

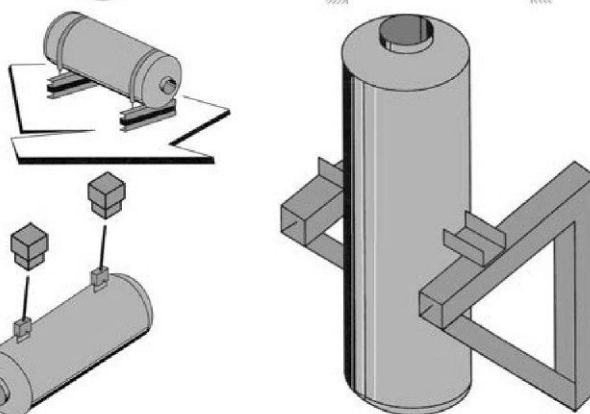
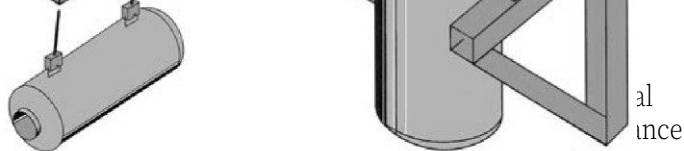


Figure 11: Thermal insulation

Depending on the type of installation, it may be in a room. After insulation, the surface temperature should be maintained. After insulation, the surface temperature should be maintained. After insulation, the surface temperature should be maintained.



Glass wool with a thickness of 50 mm should be regarded as the minimum requirement.

Figure 12: Sound attenuators

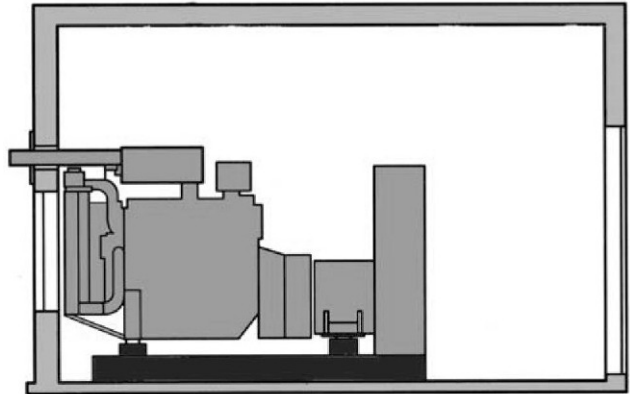
These components reduce noise by absorbing sound waves or inducing phase differences within them. The exhaust system should be effectively suspended – supports should never rest against the equipment (with the exception of original parts). An exhaust compensator will be fitted at the engine outlet. Under no circumstances must the pipes have a diameter smaller **than** that specified (please contact us regarding **Škoda vehicles**), and they must be routed in such a way that exhaust gases cannot seep back into the room.

The pipework should be secured in such a way that its weight is not borne by the expansion joint. It must be perfectly straight (any misalignment could lead to a rupture).

Modified **silencer**

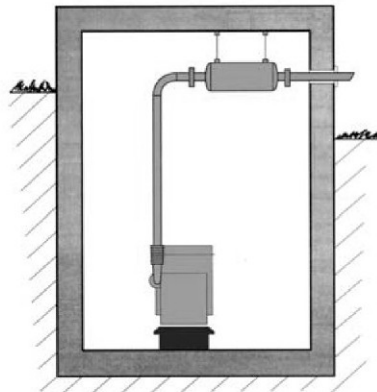
The modified **silencer** is fitted directly to the equipment or housing. It is an absorption-type **silencer**.

In the enclosed version, an expansion joint is fitted between the engine and the exhaust.



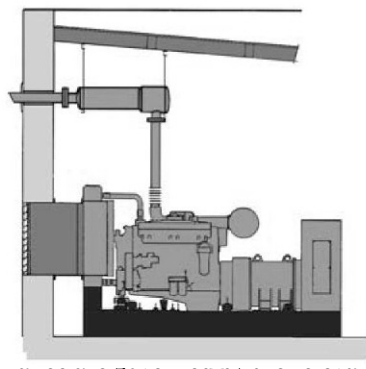
Absorptive **silencer**

The gas passes through a soundproof duct made of highly effective acoustic absorption material protected by a perforated metal sheet.



Absorptive reactive **silencer**

The gas enters an expansion chamber lined with absorption material, supported by perforated metal sheets, and then into an absorption sound-insulated duct.



3.3.2.11 Electricity

a) Connection – general information

As with low-voltage electrical installations, operation ... standards.

b) Power supply cables

Depending on the generator's output, they may be single-pole or multi-pole. Where possible, power cables should be routed through cable ducts or on cable trays for this purpose.

c) Battery cables

Install the battery or batteries immediately adjacent to the electric starter motor. The cables are connected directly from **the** battery **terminals** to the starter motor terminals.

The first step is to check that the polarity of the battery and the starter motor match. The minimum **conductor** cross-section is 70 mm²

. This varies depending on the starter's power rating, but also on the distance between the batteries and the unit (voltage drops in the wiring).

3.3.2.12 Cooling

Three types of heat must be dissipated:

- heat from the engine's cooling circuit(s)
- heat radiated **by** the engine and exhaust
- ventilation air from the passenger compartment
- exhaust gases

The systems described below dissipate and transfer the heat generated in the engine cooling circuit.

a) **Radiator** with fan

For this purpose, the engine cooling circuit is connected to a finned tube radiator at the end of the frame.

This **radiator** is cooled by a fan driven directly by the engine.

In all cases, air is blown from the fan towards the radiator. Cooling is provided by the circulation of air in the room.

An expansion tank can compensate for temperature-related changes in the volume of the coolant.

b) Air **cooler**

The engine's cooling circuit is connected for this purpose to an air cooler located either **inside** or outside the room.

If located indoors, it operates in the same way as **a** ventilated **radiator**. The fan is **either** connected to the diesel engine or driven by an electric motor. If **the** air **cooler** is moved outside – onto the roof or into another room – the coolant pipes are extended and cooling ventilation is provided from another room. With these installations, even greater attention must be paid to degassing conditions **than** with the cooler itself.

In all cases, **the** air **cooler** is cooled by a fan.

When cooling with a radiator or an air cooler in a room, the temperature rise caused by thermal radiation must be taken into account when sizing the equipment.

c) Lost heat exchanger

This type of cooling consumes a significant amount of water, and operating costs must therefore be taken into account. It is a solution for situations where local conditions ensure a water supply but do not allow for the installation of a ventilation system for cooling using a ventilated cooler or an air cooler.

These open-loop installations essentially consist of a heat exchanger, one circuit **of which** is fitted with an expansion tank and connected to the engine's cooling circuit. Circulation is provided by the water pump in this circuit. The second circuit of the heat exchanger, known as the raw water circuit, is connected between the building's water supply and the drain. A valve located upstream of the heat exchanger allows the circulation to be switched on and off. In automatic systems, this valve should also be fitted with an electric control (a solenoid valve).

Heat exchange in this system ensures the engine is cooled. The room requires a ventilation system, and this type of installation will necessitate a detailed study.

d) Room ventilation

Extract fans and/or blowers can remove heat radiation from the engine and supply fresh air to the room and to the equipment in the case of external air **coolers** or water **heat exchangers**.

If fans are used – preferably several **fans rather than** one large one – this can be used to regulate the temperature. Ventilation of the premises requires a detailed analysis and should take particular account of the ambient air temperature and the pressure losses caused by **components** located in the air supply and exhaust ducts (grilles, noise barriers, etc.)

3.3.2.13 Special measures

Generator sets are not equipped with protection against overvoltage caused by drops in atmospheric pressure or manoeuvring.

The company accepts no liability for damage caused by these phenomena. It is, however, possible to install lightning conductors, although it should be noted that these do not provide complete protection.

4. INSTALLATION OF MOBILE STATIONS

4.1 General information

In addition to the recommendations and rules set out for fixed installations, certain measures must be taken for 'mobile' installations.

4.2 Specific measures

An area must be set aside for the installation of the generator set. This should be level and sufficiently sturdy to prevent the generator from sinking into it. It may be made of concrete or even large planks joined together.

It is important to bear in mind that a generator set which is not correctly supported on its base (frame or trailer) will be subjected to vibrations that could cause damage to the entire unit.

The location of the unit should be chosen to ensure easy fuel supply and power distribution to users.

For safety and maintenance **reasons**, access to the generator doors should be ensured at all times. Ventilation of the generator should not be obstructed by the presence of foreign **objects** in its vicinity. This could cause excessive heating and a reduction in output.

The flue gas must be vented in such a way as to prevent it from being drawn back into the air filter or the cooling system.

To ensure personal safety, the generator must be operated at idle speed. Earthing is carried out using a metal post deeply embedded in the ground.

These units must be covered or protected from adverse weather conditions by means of a suitable structure (see previous sections).

5. ROAD TRAILER

5.1 Trailer coupling device

Before coupling the trailer, check the tow hook on the towing vehicle; it should fit perfectly into the trailer's tow eye.

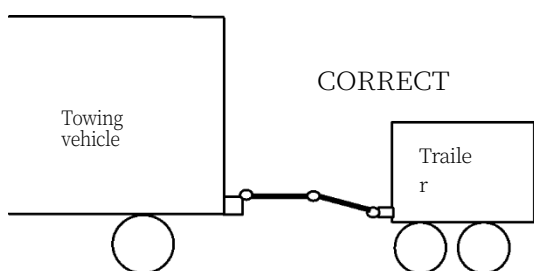
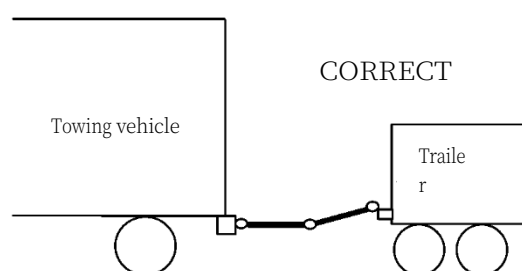
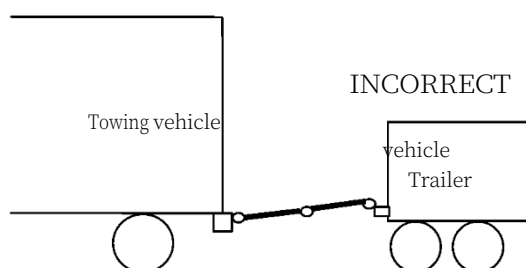
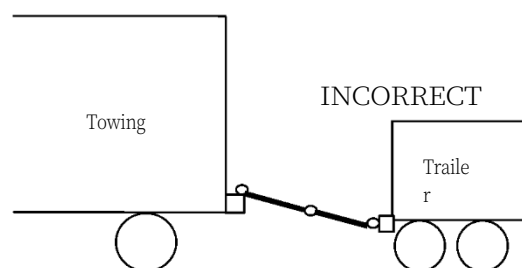
Attempting to tow a trailer using unsuitable equipment (a pole, wires, ropes, etc.) may lead to serious accidents.

Also check:

- whether there are any incipient cracks or excessive wear on the tow bar.
- Check that the locking system is working correctly

When coupling the trailer, proceed as follows:

- chock the wheels so that the trailer cannot move
- raise the trailer's rear supports and secure them
- Release the parking brake
- Release the locking levers on the tow bar arms and adjust the ring to the same height as the vehicle's tow hook
- Connect the trailer – release the locks on both sides of the wheels and then use the handle to lift the front wheel completely
- Connect the trailer's electrical circuit to that of the towing vehicle
- Hook the handbrake safety cable onto the hook on the towing vehicle.



5.2 Pre-towing checks

Before towing, carry out the following checks:

- wheel tightness
- secure the tow bar
- tyre pressure
- **that the lights** are working
- cover doors are closed
- parking brake released
- front wheels and rear supports raised
- Tightening and securing the locking levers on the drawbar arms
- Brake testing on ‘road’ type **trailers**
- Fitting the safety brake cable.

5.3 Driving

- ‘On-site’ type trailer

These trailers are not fitted with a service brake and therefore cannot be braked whilst in use; the tyres are rated for a speed of 17 mph (27 km/h). It is therefore strictly forbidden to exceed this speed.

- ‘Road’ type trailer

The driving speed should be adapted to road conditions and the manoeuvrability of the trailer.

Driving at a constant speed causes the tyres to heat up; it is therefore important to stop from time to time and check them. Excessive heat build-up can lead to a tyre blow-out and, consequently, a serious accident. When reversing, do not forget to apply the handbrake.

NOTE

Particular attention must be paid to wheel tightening on new vehicles. In particular during the first few miles, **the wheel hubs** and brake **drums** overheat, leading to a reduction in wheel tightening torque. It is therefore essential to check the tightening torque every 6 miles (10 **kilometres**) until no further loosening is detected.

However, a torque test must be carried out before towing.

5.4 Uncoupling the trailer

This operation must be carried out on a level, flat and stable surface.

- Chock the wheels
- lower the front wheel
- disconnect the indicator cable
- Refit the tow bar and use the wheel to release the tow hook from the towing vehicle
- Release the towing vehicle
- Apply the handbrake.

5.5 Installation procedure

Steps to be followed:

- check that the ground is firm enough to prevent the assembly from sinking into it
- Use the front wheel to adjust the unit to as level a position as possible
- Apply the handbrake.
- Lower the trailer's rear supports and secure them

6. INSTALLATION OF ELECTRIC GENERATOR SYSTEMS IN CONTAINERS

NOTICE

If the generator set is operating in automatic start-up mode, the ventilation door must be open.

WARNING

If the generator set is operating in manual start-up mode, the vent flaps must be opened before start-up.

WARNING DANGER

Once the generator has been started and the doors remain closed, opening them is strictly prohibited (very high risk of injury due to the doors opening suddenly).

WARNING

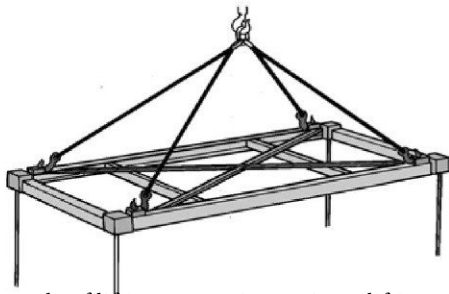
Before commencing any handling operations, you must ensure that the operator is suitably qualified. All handling must be carried out exclusively under the supervision of a single coordinator.
To handle the container correctly, it is essential to use suitable lifting equipment (taking into account load capacity, reach, etc.) fitted with a lifting beam.

6.1 Handling, transport and placement of containers

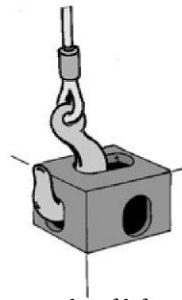
6.1.1 Handling instructions

- Attach the lifting straps of the lifting equipment to the lifting eyes on the container.
- Carefully tension the straps **without** lifting the container.
- Check that the **sling** hooks are correctly attached and that the equipment is secure.
- Lift the container carefully and smoothly.
- Position and stabilise the container in its final position.
- Position the container – whilst it is still suspended – into its final position.
- Lower the container carefully and smoothly, **whilst** continuing to level it.
- Once the container is on the ground and in the correct position, release the lifting straps, check that the container is stable, and adjust its position if necessary
- Unclip the straps and remove them from the lifting eyes.
- The procedure is complete once the container is in place.

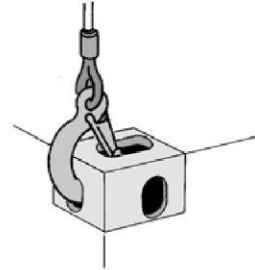
Examples of equipment and handling



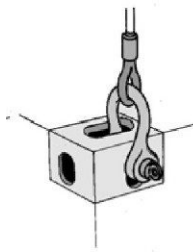
Example of lifting a container using a lifting beam fitted with hooks, connecting eyes or a manually operated safety catch



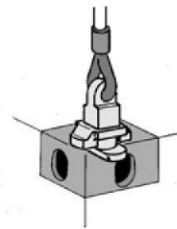
Example of lifting using a standard hook or a safety hook



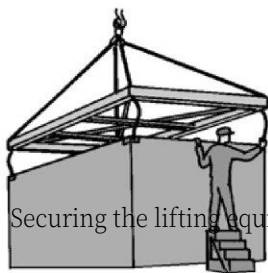
Example of lifting using a safety hook



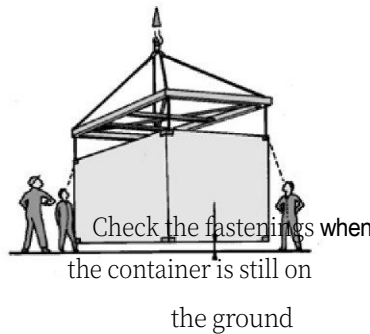
Example of lifting using a connecting chain



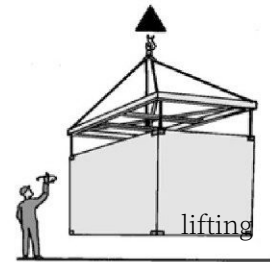
Example of gripping using a manually operated latch



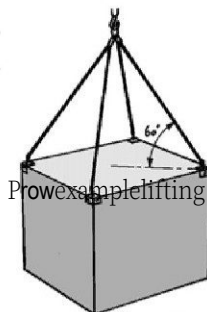
Securing the lifting equipment



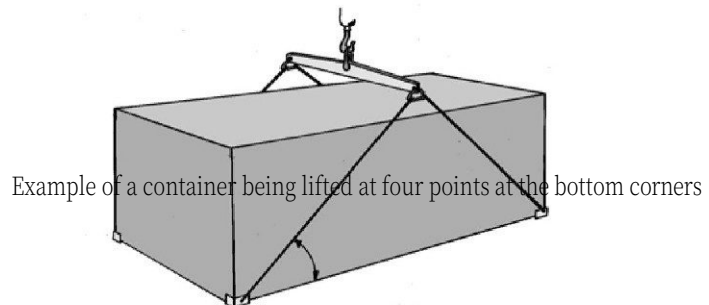
Check the fastenings when the container is still on the ground



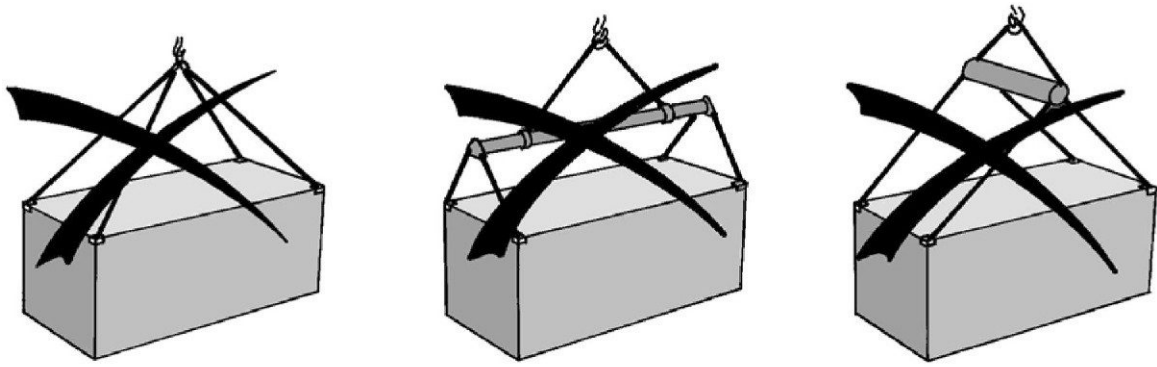
lifting



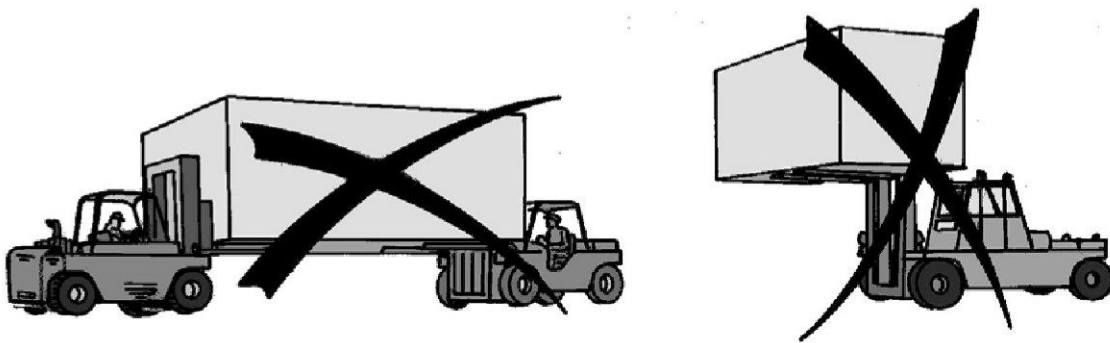
Pro example lifting



Example of a container being lifted at four points at the bottom corners



Example of a lifting method that must not be used



Example of incorrect handling

6.1.2 Transport

The transport of **containers** should comply with the rules of the road (as applicable in the relevant countries). The transport equipment (trailer, semi-trailer, **container carrier**, etc.) should be suitable for this purpose and provide all necessary safety guarantees in terms of its load-bearing capacity and securing devices. The journey should take place on roads of sufficient quality to prevent damage to the equipment stored **inside** the container.

WARNING

Although our containers closely resemble ISO shipping containers, they do not meet the various certification tests that these containers have undergone.

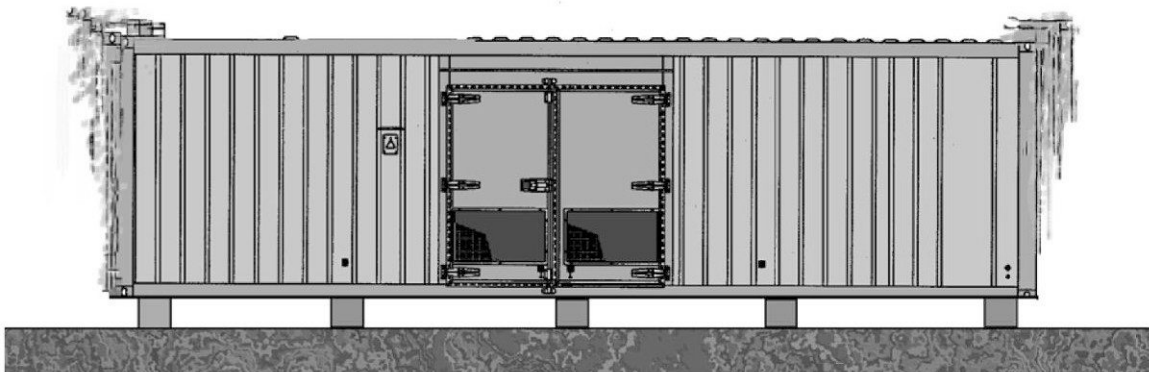
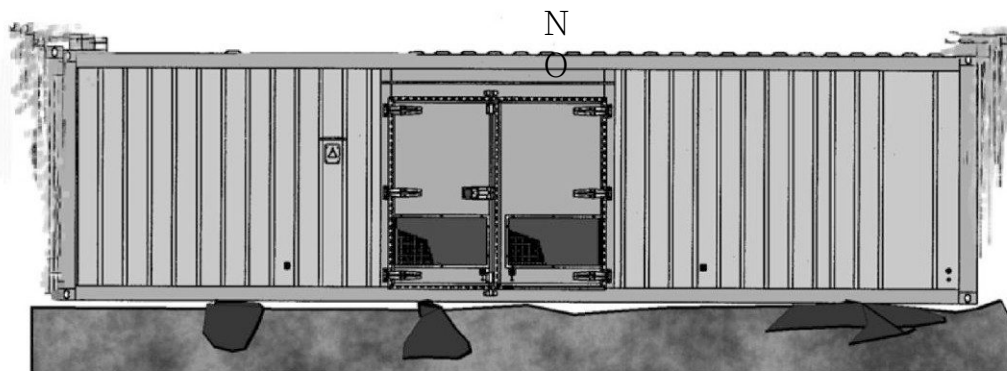
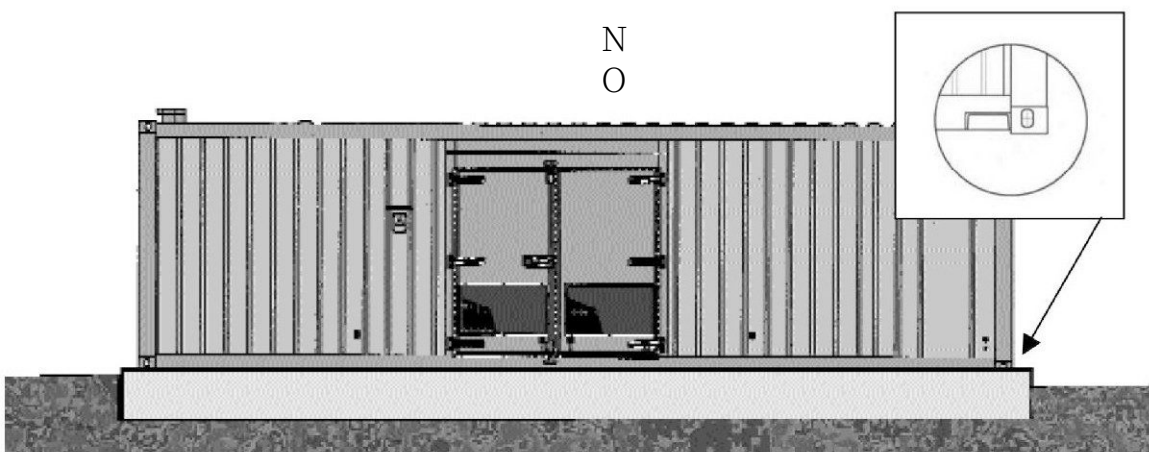
Our containers are therefore not designed to carry additional loads (they cannot be stacked).

6.1.3 Installation – location

Before the equipment can be installed, its location must first be considered, taking into account the electrical substation, the fuel storage facility, the surrounding area as a whole and the type of soil

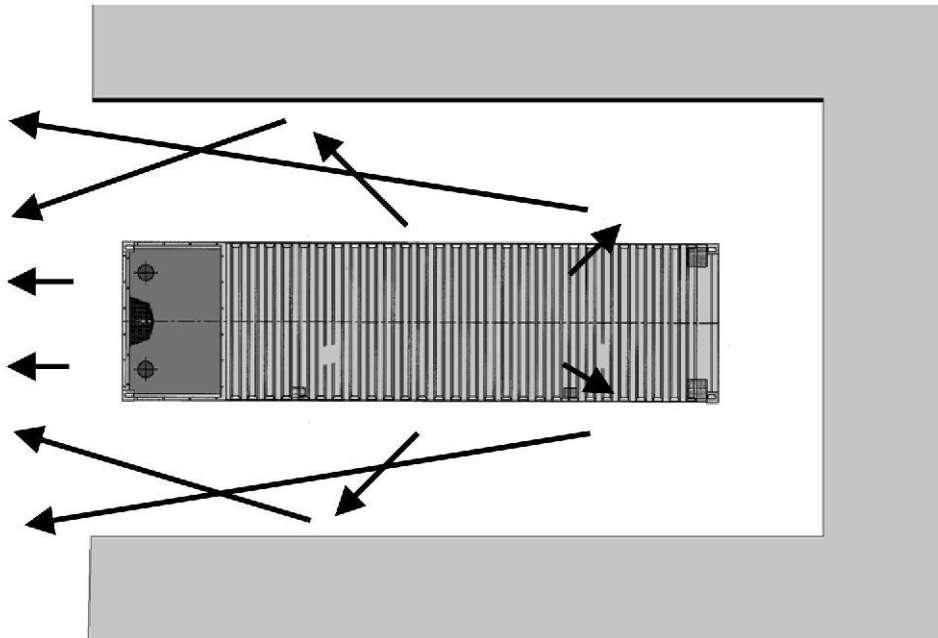
The installation site should be sufficiently level to ensure the frame stands horizontally, and sufficiently firm to prevent the container from sinking.

If the container(s) are to be installed permanently, a concrete foundation must be constructed; the calculations and execution of this must be carried out by a specialist.

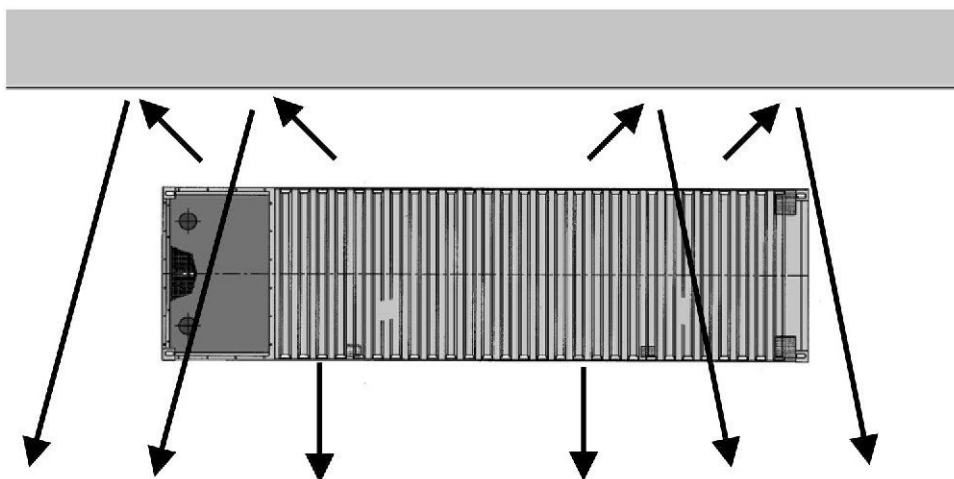


YES

An environmental impact assessment must **also** be carried out to ensure that the noise generated by the equipment does not adversely affect people living in the vicinity. It is therefore essential to be familiar with the applicable regulations in order to avoid the risk of future legal **action**. In this context, the noise level of the equipment and the effect of reverberation on buildings must be taken into account.



Examples of increased noise levels due to reverberation and location.



Regulations regulating noise arising from

6.2 Maintenance

- Lubricate the hinges and locks regularly
- Lubricate the rubber seals with silicone grease
- Wash and clean the bodywork using **products** designed for car bodywork
- Check the condition of the bodywork and repair any scratches immediately (to prevent rust).

7. PREPARATION BEFORE USING THE KIT

WARNING – DANGER

The checks listed in this section enable the electric generator to be operated. Specific skills are required to carry out these **tasks**.

They must only be carried out by suitably qualified personnel.

Any failure to follow these **instructions** may result in accidents or very serious accidents.

7.1 Installation checks

- check that the general recommendations in the section on installation have been followed (ventilation, flue gas extraction, fluids, etc.)
- Check the fluid levels (oil, water, diesel, battery).

7.2. Connection checks

- Check the remote controls according to the relevant sections and numbers (sector, accessories, low-voltage central control panels, etc.)
- Connect the power supply to the accessories and check the following components (this list is not exhaustive)
 - fuel pump (flow rate and direction of rotation) ➤ water preheater (current and voltage) ➤ battery charger
 - etc.

7.3 Starting the generator set

- Carry out mechanical checks (oil pressure, water temperature, absence of noise, etc.)
- Carry out electrical checks (voltage and frequency)
- Carry out safety checks (emergency stop, oil pressure, water temperature, etc.)

7.4 Load test at the installation site

- Check the rotating field
- Check the voltage, frequency and current
- Check normal/emergency switching or connection.

8. BATTERY MAINTENANCE

WARNING - DANGER

- Install the battery so that proper ventilation is ensured
- Never place the battery near an open fire or flame
- Use only insulated tools
- Never use sulphuric acid or acid water to top up the electrolyte level.

PROCEDURE FOR TESTING STARTER BATTERIES

