FOCUSED ON GENERATORS ONLY

USER MANUAL

GENERAL MANUAL
FOGO Diesel Engine
Power Generator Sets

TRANSLATION OF GENERAL INSTRUCTION, Ver. 141115

www.fogo.pl

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa

tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

Dear Customer:

Thank you for your trust and for buying a high qualify FOGO® power generator. We are convinced that in cooperation with leading global manufacturers of components and using innovative technological solutions we developed a product that constitutes a benchmark of progress in the area of safety and reliability. We hope that our product will prove to be excellent in daily use.

Agregaty FOGO Sp. z o.o.

Make sure to read this manual before the first startup of the generator!

User safety is a priority to FOGO®. This user manual, as well as the safety principles defined herein, are extremely important to the correct and safe use of the FOGO® power generators. Therefore, make sure to read this manual before the first startup of the generator. The buyer of the generator must make sure that the present manual is stored in an easily accessible and safe place and is always accessible to the persons operating the generator.

FOGO® generators are designed and made in accordance with applicable European directives, with regards to their construction, safety of operation, and environmental protection. In order to confirm that the FOGO® power generators meet the European Union's safety standards, they undergo an additional conformity evaluation procedure conducted by a notified unit.

Compliance with the relevant European Standards is declared in Declaration of EC Conformity accompanying each generator, and confirmed by CE marking on each machine.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

CONTENTS

1. Safety rules.

- Before starting up the power generator, make sure to become familiar with the user instruction and to understand all the guidelines contained herein. Every operator working with the generator must become familiar with the manual.
- The generator may be operated only by qualified and properly trained persons who have valid qualifications for operating the generator in compliance with the applicable laws.
- Do not use the generator without grounding - RISK OF ELECTRIC SHOCK.
- Please note that each device/installation supplied from the power generator must have its own electric shock protection, in accordance with the applicable requirements.
- Do not start the power generator in a closed room without proper ventilation! Combustion gases contain large quantities of scentless poisonous gas (CO - carbon oxide) - RISK OF POISONING AND EVEN DEATH!!!
- Do not leave the generator in closed rooms immediately after they are shut down - RISK OF FIRE!!!
- Do not start the power generator if fuel has been spilled. The generator may be started only after the spilled fuel has been cleaned up - RISK OF EXPLOSION!!!
- Do not start the power generator in an environment where gases and vapors of paints, thinners or other inflammable materials are released - RISK OF EXPLOSION!!!
- Do not start the power generator in forests or similar areas without a spark arrester installed - RISK OF FIRE!!!
- Never start the power generator without the air filter and the exhaust system installed.
- Do not start the power generator if its electrical system has been dampened - RISK OF ELECTRIC SHOCK AND EVEN DEATH!!!
- Before work on the power generator starts, make sure to check the condition of its protections, in particular the protective covers and cable insulation.
- Do not touch rotating elements during operation of the power generator - RISK OF INJURY OR LOSS OF HEALTH!!!
- Do not fill the fuel tank while the motor is in operation (this does not apply to power generators that are factory-equipped with an automatic fuel filling system) - RISK OF FIRE!!!
- Do not smoke and do not use an open fire in the vicinity of fuel tanks - RISK OF EXPLOSION!!!
- During operation of the power generator, pay particular attention to children and animals present in its vicinity.
- Never place any objects on a power generator that is in operation - RISK OF FIRE!!!
- During operation of the generator and long after the generator is shut down, do not touch the generator's exhaust system and its muffler - RISK OF BURNS!!!
- Generator load must be min 30% of the rated power – lower load may cause damage and lead to RISK OF FIRE
- Never use gasoline or other inflammable liquids to clean the generator or its parts.
- When working in contact with oils or electrolytes, always wear proper clothing and protective gloves and glasses. Long or frequent contact with waste engine oil may cause skin diseases. In the event of contact, thoroughly wash your hands immediately.
- Before performing any maintenance and repairs, you must disconnect the battery and the main switch in order to avoid accidental startup of the generator.
- In the case of a generator fixed to a trailer chassis, always pull the manual brake when the generator is not moving and ground the generator prior to the startup.
- Do not control the motor's rotational speed - RISK OF DAMAGE AND LOSS OF WARRANTY!!!

2. Warning signs

	Read the manual		Ground the generator before startup
	Use ear protection		Do not use water to extinguish a fire
	Warning! Danger		Warning! Inflammable materials
	Warning! Risk of electric shock		Warning! Hot surface
	Warning! Risk of explosion		Warning! Rotating components
	Location of lifting lugs.		Location of support points for transport
	Oil		Cooling liquid
	Type of fuel - diesel oil		

3. General characteristics of the machine.

The power generator is an autonomous power device that generates electricity in a process where mechanical energy produced by the internal combustion engine is transformed into electrical energy produced in a generator connected to the motor. It is used in many sectors (industry, construction, agriculture, telecommunication, trade, etc.). It can be used as a power source in the event of a mains power loss or as a substitute power source in locations where mains power supply is difficult or impossible to provide. When used with an automatic startup system, it constitutes an excellent backup power source for private or public buildings in the event of a main power loss.

Power generators are suitable for operation indoor or outdoor, in accordance with their intended use, at temperatures from -25 ℃ to 40 ℃, when installed at altitudes up to 1,000 m above sea level.. If the generator is to be used in other conditions, it is recommended to contact FOGO.

FOGO offers stationary generators as well as generators suitable for mobile applications. Stationary generators are offered in two variants: ones suitable to be built in and ones in a sound-absorbing enclosure that enables installation in outdoor conditions.

WARNING! Stationary generators are ones that are fixed permanently to the ground. Mobile generators are ones that are not permanently fixed to the ground. Stationary generators (not mobile ones) must be used only in stationary conditions. No carrying or installation of stationary generators on trailers and no use of stationary generators in other locations that are not suitable for this purpose is allowed. Generators intended to be used in mobile applications must be factory-modified for such use!

3.1 Design of the generator.

The power generator comprises a synchronous generator and an internal combustion engine, which are connected to each other and fixed in a metal frame using vibration isolators. A fuel tank with a level sensor is also installed in the frame. As a standard, the power generator is equipped with an electrical distribution board with a power supply connection and a control system, a protection system, and a device control system that are necessary for proper operation of the generator.

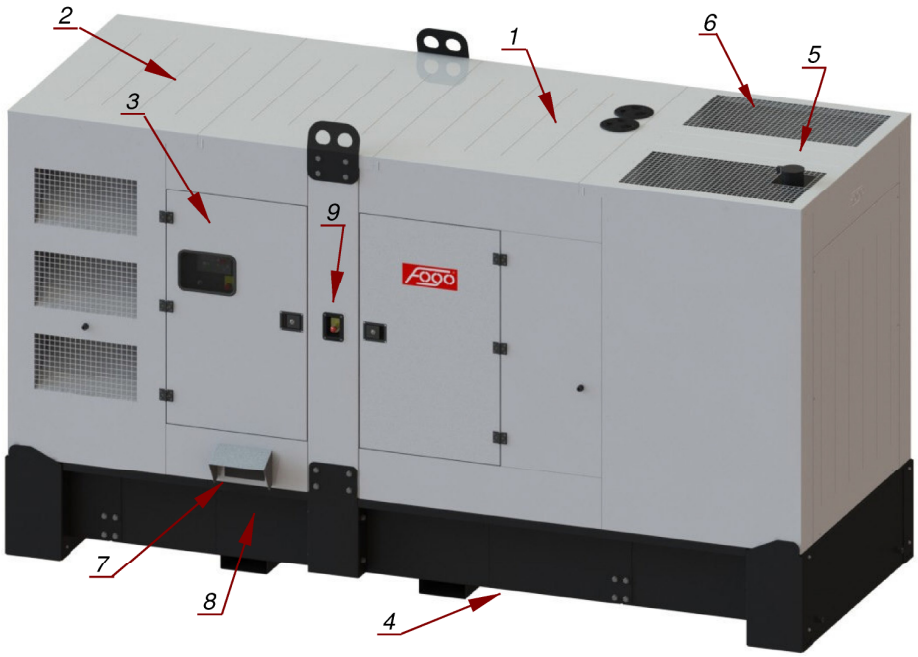
An example of a FOGO generator design is shown in the drawing below. In order to obtain drawings for specific generator models, please contact a representative of FOGO.

3.2 The motor

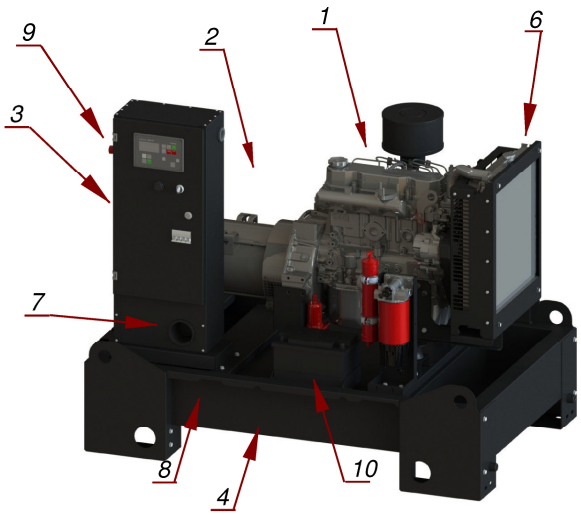
FOGO® power generators use industrial diesel motors from renowned makers, such as Volvo, Perkins, Iveco, Doosan, and Mitsubishi. These motors have fixed rotational speeds equal to 1,500 rpm, which is stabilized using a rotational speed controller. Depending on the controller type, the accuracy of the regulation is from 5% to 0,25%, irrespective of the load on the genset, which guarantees achieving the appropriate output current frequency parameters. The motors are controlled by a dedicated microprocessor controller that ensures optimum operating parameters of the entire genset. A description of and a user manual for the motor are provided in an appendix to the present manual.

FOGO power generators for stand-by application are equipped with a cylinder block heating system, i.e. coolant electrical heater. This component enables quick loading of the unit after start-up and also facilitates the start-up of the motor at low temperatures.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl



Version with a sound-absorbing canopy



Open version on a frame

1. *Motor*
2. *Generator*
3. *Control and power takeoff box*
4. *Frame with the tank (or a tank-frame combination)*
5. *Outlet of the combustion gas exhaust system*
6. *Radiator*
7. *Input of the power takeoff cable*
8. *Grounding connection screw*
9. Safety switch
10. Battery

3.3 Generator.

In FOGO® gensets, electric energy is produced in synchronous alternating current generators made by Sincro, Marelli, Stamford and others. The generators are selected as appropriate for cooperation with the motors used, so as to achieve optimum power parameters and efficiency of the genset. A detailed user and operation manual for the generator is enclosed with this document. The generator is connected to the power connection box with appropriate flexible cables that ensure robustness of the system to the vibrations produced by the genset.

3.4 Power connection.

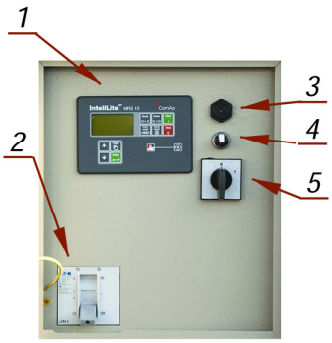
Each FOGO generator is equipped with an electric distribution board with an installed connection and a genset control system. The genset is equipped with an circuit breaker dedicated to generator sets that protects the generator against short circuits and overloads. This enables FOGO to guarantee reliable operation of the machine and, most importantly, high safety to the users.

The power switch is equipped with a release that switches off the switch in emergency situations and, in the case of manually controlled gensets, also after the machine is shut down.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

On request it is possible to install power socket for full power takeoff (up to 125A) and also socket panel with a set of sockets with appropriate electrical protection.

3.5 Control system.



1. *Controller*
2. *Main switch*
3. *Alarm buzzer*
4. *Control switch*
5. *Heater switch (option)*

The control system is installed in the electric distribution box which is an integral part of the genset. In cooperation with reputable manufacturers of genset controllers, FOGO equips its gensets with controllers proven in many various applications worldwide. The flexibility of this solution enables easy product customization. The controllers used in FOGO's gensets, suitably configured at the manufacturing stage, enable the genset to be used in an easy and straightforward manner. The controller executes the start-up procedure, checks the operation, and executes the shutdown sequence of the genset motor according to the operator's commands or external signals. See the control manual for a detailed description of the functions available in the controllers. The controller may be additionally equipped with suitable components to perform communication functions. In this case, contact the FOGO's Technical Department to obtain more information about such special, customized versions.

FOGO's gensets are made in two control system variants: automatic start and manual start.

3.5.1 Gensets with manual start.

Such sets are used mainly as portable devices and power sources in areas where mains power is not available. Less often, they are used as a backup power source. In gensets designed for manual mode, the switch is equipped with an undervoltage release which turns off the main switch in the event of generator power loss. This happens when the genset is turned off manually and also in the event of an emergency shutdown of the engine, e.g. following the "no fuel" signal.

3.5.2 Gensets with automatic start.

Gensets with automatic start are used as standby power sources, designed for electrical power supply in case of the mains power cut-off. The genset control system is connected with an Automatic Transfer Switch system (ATS). In the event of power loss, the genset is started in a few seconds and then the loads are switched to the emergency power supply provided by the genset. The motor preheating systems used by FOGO as a standard enable the genset to be ready for connecting the loads very quickly.

Automatically controlled gensets cooperating with an ATS system feature shunt releases triggered by the genset failure signal.

Units with automatic start should not be used as manual machines, because they are not protected against starting and stopping under load, that may result in genset damage.

3.6 Safety system

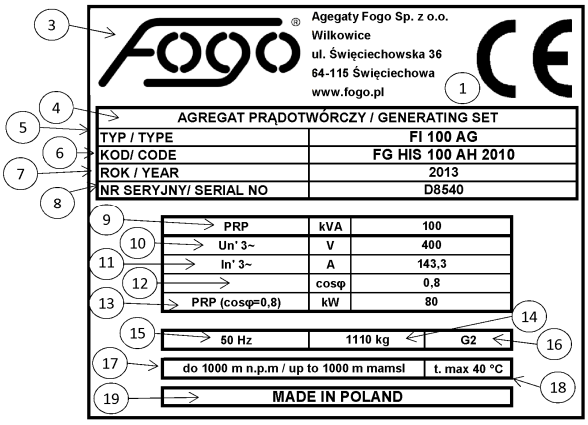
The genset is equipped with an emergency stop button located at the control panel. The user may add additional emergency stop buttons to the emergency stop circuit – see the control system's documentation.

Once the emergency stop button is pressed, the genset is shut down in an emergency mode, i.e. without implementing the engine cooling function after the load is disconnected.

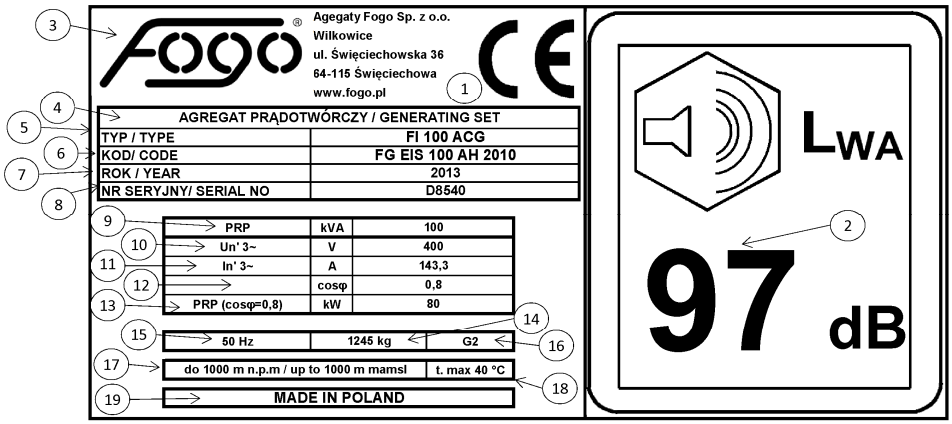
4. Description of the genset rating plate

Each FOGO genset is labeled with a rating plate carrying basic information about the equipment and its rated parameters according to the ISO 8528-5:2013 standard.
For the rated data power output the following standard reference conditions are used (according to ISO 8528-1:2005): barometric pressure 100kPa, ambient temperature 25℃, relative humidity 30%. If the site operating conditions are different, the actual power may deviate from the nominal, depending on the engine manufacturer. Please see technical data for the details or contact FOGO Technical Department.

Rating plate of an open genset – to be built in.



Rating plate of a built-in genset – to be installed outdoor.



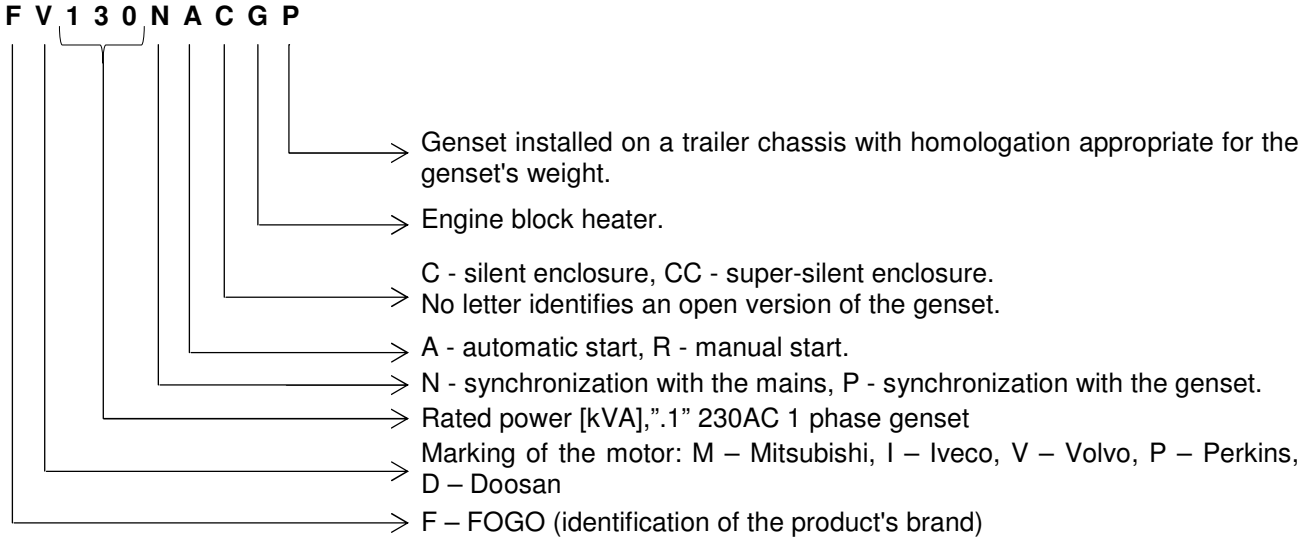
1 – CE marking confirming conformity to the European Directives.
2 – Noise level emitted into the environment according to Directive 2000/14/EC.
3 – Name and address of the manufacturer.
4 – Definition of the device in accordance with the PN-EN 12601 standard.
5 – Genset type.
6 – Genset code.
7 – Year of production.
8 – Factory number.
9 – Rated power [kVA].
10 – Rated voltage [V].
11 – Rated current [A].
12 – Rated power coefficient.
13 – Rated power [kW].
14 – Weight of dry genset [kg].
15 – Rated frequency.

16 – Genset execution class.
17 – Permissible installation altitude to achieve the rated power.
18 – Permissible ambient temperature.
19 – Information on country of origin of the product.

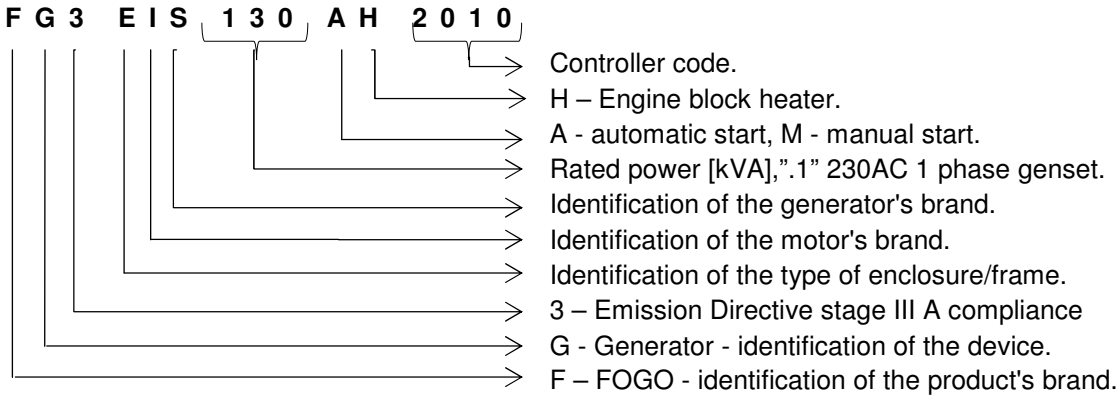
5. FOGO marking.

FOGO uses a dual method of marking of its generator sets. The marking covers all the versions and options present in FOGO gensets. Gensets are marked with the name that identifies the key parameters of the genset and a code that contains supplementary technical information. The marking method and examples are shown below.

5.1 Genset type.



5.2 Genset code.



An example: **FM15RCG** indicates a genset made by FOGO with a Mitsubishi motor whose power is 15 kVA (12 kW), equipped with a manual control system and a sound-absorbing enclosure (suitable for outdoor use),

FG GMS 15 M 2010 indicates the enclosure type (G), Mitsubishi engine, Sincro alternator, 15kVA nominal power and the controller used MRS 10

An example: **FI60AG** indicates a genset made by FOGO with an Iveco motor whose power is 60 kVA (48 kW), made as an open genset on a frame and intended for installation indoors, equipped with engine block heater.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

FG HIS 60 AH 2010 identifies the enclosure type (H frame), Iveco engine, Sincro alternator and the controller used (MRS 10)

6. Environmental impact.

6.1 Combustion gas emission standard.

European Directive 1997/68/EC imposes restrictions on marketed internal combustion engines depending on pollution emissions. Such restrictions do not apply to genset motors that are installed in generators designed to operate at one, fixed location.

The table below shows the manufacturing program of portable FOGO gensets intended to be installed on trailers, in compliance with the provisions of the aforementioned Directive.

Marking of the genset	Range of the genset power in kVa	Applicable combustion gas emission standard	Conformed to combustion gas emission standard	Possibility to install on a trailer	Notes
FM	10-15	NO	STAGE II	YES	
	20-40	STAGE III A	STAGE III A	YES	
FI	30-400	STAGE III A	STAGE II	-	
FD	120-670	STAGE III A	No emission or STAGE I or STAGE II	-	
FP	20-100	STAGE III A	No emission		1)
	750-1000	NO		YES	
FV	80-640	STAGE III A	STAGE II	-	1)

NO - the Stage IIIA standard does not apply
1) - the genset can be ordered with a motor that conforms to the Stage III A standard

6.2 Noise emission standard.

Pursuant to Directive 2000/14/EC, as amended, only equipment operated outdoors that meets the detailed requirements concerning emission of noise into the environment defined in the Directive, as amended, may be marketed in the European Union.

FOGO offers equipment intended to be built in and to be used outdoor. Gensets intended for outdoor use are installed in sound-absorbing enclosures. Each type of genset is tested with respect to noise emission. The detailed data for specific gensets is provided in the specification sheets. Each genset intended for outdoor use is marked on its data plate with information on the rated value of the guaranteed level of emitted acoustic power (see item 4).

WARNING! After the installation of a genset indoor is completed, the noise emission must be measured and the operators must be provided with the necessary noise-protection equipment compliant with the occupational health and safety regulations.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

7. Transport, unloading, and storage.

Make sure that the genset is properly leveled during operation and transport. Any deviation from a level position may cause a spill of the fuel or poor lubrication - RISK OF DAMAGE!!!

7.1 Transport.

As the manufacturer of gensets, FAGO provides transport of its products in Poland. All products sold outside of Poland are delivered in accordance with the EXW terms to a customs warehouse in Wilkowice (postal code 64-115). The customer's duties include unloading and storage of gensets at the sites of their intended use.

During transport, the gensets are protected against the weather conditions. After the gensets are unpacked, remove the elements of the packaging in a way that does not constitute an environmental hazard and is compliant with the applicable laws.

7.2 Unloading.

The buyer of the genset is responsible for unloading it and ensuring its safety. In order to safely unload the genset, one must observe general safety rules and occupational health and safety regulations. In particular, one must pay attention to the following:

- always use dedicated equipment (crane, forklift, etc.) of appropriate loading capacity for unloading; the weight of the genset is specified on the data plate;
- all hooks must be safely placed **only** in dedicated lugs;
- loading must be performed on properly hardened surfaces that enable safe positioning of the genset and the unloading equipment;
- gensets installed on trailers must not be lifted by the genset grip; inset, an appropriate forklift must be used.

7.3 Storage.

If a genset is to be stored for a longer period prior to installation, the following rules must be observed:

- store the genset in a properly prepared room (dry and ventilated);
- properly protect the genset from dust and corrosion;
- clean the genset to eliminate any dirt and perform maintenance of the hinges and the locks;
- close all openings with insulating tape;
- cover the genset with an appropriate tarpaulin, making sure to provide appropriate ventilation;
- in order to provide additional protection against moisture, it is recommended to use moisture-absorbing salt.

Detailed recommendations can be found in the manuals provided by the manufacturers of the motor, the generator, and other important components.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

8. Installation.

The installation of a standard generation set must be performed in accordance with the following guidelines. We recommend that the installation be performed by a company that has appropriate knowledge, experience, qualifications, and licenses. One must keep in mind that gensets intended to be installed indoor are not suitable for installation outdoor and standard gensets in enclosures are not suitable for installation indoor.

It is possible to order gensets in enclosures that are intended for indoor installation - such gensets are custom made**.** Installation of a genset in a sound-absorbing enclosure indoor is possible only if such a genset is made with this specific intended use - this information must be provided at the time of placing the order, as the genset is custom made, which requires consultation with the FOGO Technical Department.

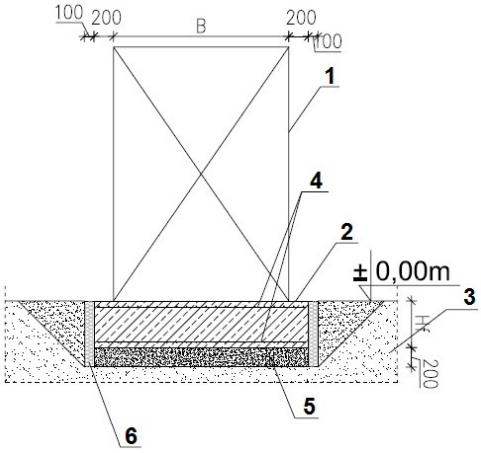
WARNING! When building the foundation for the generator, one must keep in mind that grounding of the genset is mandatory (the required grounding resistance is <5Ω). One must keep in mind that the grounding resistance value is different for different types of soils and, consequently, construction of appropriate grounding requires individual approach. The genset manufacturer offers delivery of grounding sets as required by the customer; however, due to different soil conditions, the manufacturer cannot assume responsibility for achieving the grounding resistance of required value.

8.1 Outdoor installation.

When considering a genset's installation site, one must keep in mind:

- the surface area of the foundation - at least 1.5 m wide band of free space must be ensured around the genset to ensure safety and enable problem-free service of the genset;
- the genset must not be installed beneath trees and canopy roofs or in the vicinity of inflammable materials;
- the genset must be installed at such a distance from buildings that the noise produced by the genset does not cause inconvenience to the buildings' residents, taking into account the permissible values of noise emission defined for a given location;
- the genset must be set on a homogenous leveled foundation slab or on a specially prepared leveled foundation (in the case of a stationary installation);
- the generator must be fixed to the foundation slab/foundation in appropriate locations in the footing of the enclosure;
- one must plan for laying in the excavation (tunnel, etc.) protective cover for the cables routed between the genset and the distribution cabinet.

Foundation slab for outdoor installation.

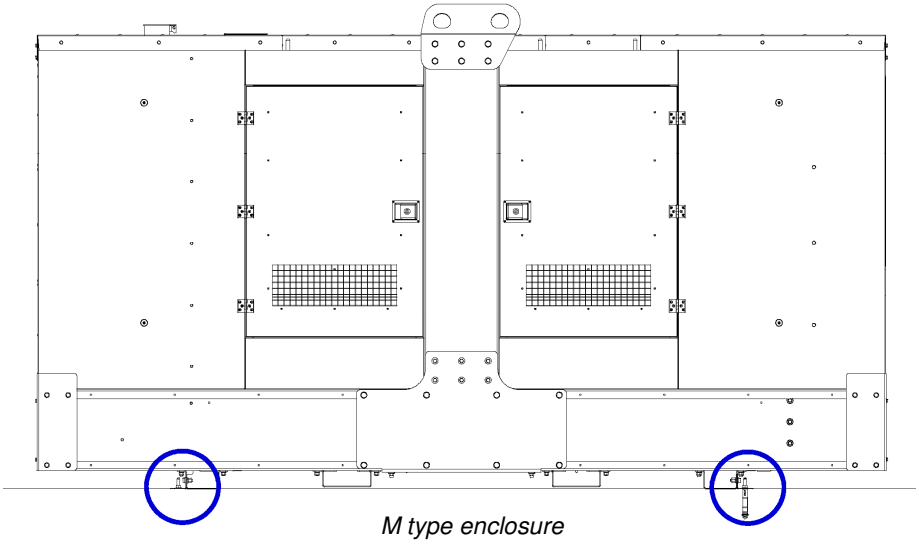


1. *Generating set*
2. *Foundation slab*
3. *Subsoil*
4. *Reinforcing grid fi8,mesh 100mm*
5. *Sand bed h=20cm*
6. *Damping backfill or Styrofoam*

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

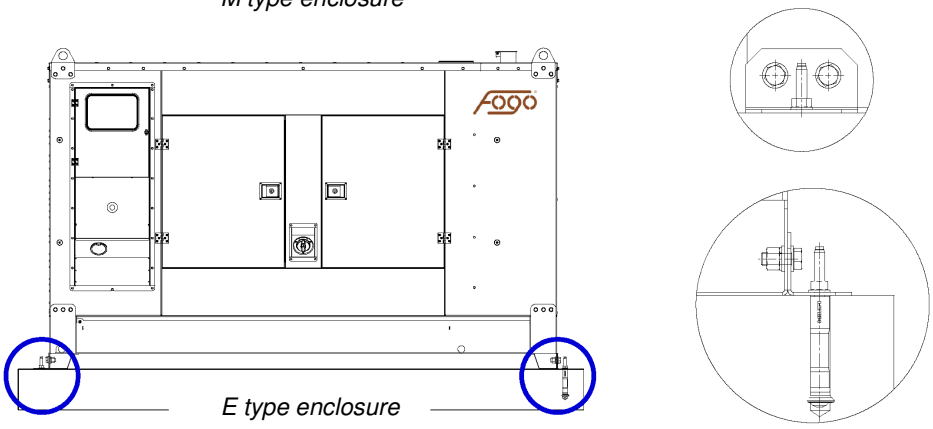
For detailed guidelines - see technical information on page www.fogo.pl or contact FOGO Technical Department.

Anchoring in the case of outdoor installation.



M type enclosure

M10 anchor
Lenght min 80 mm

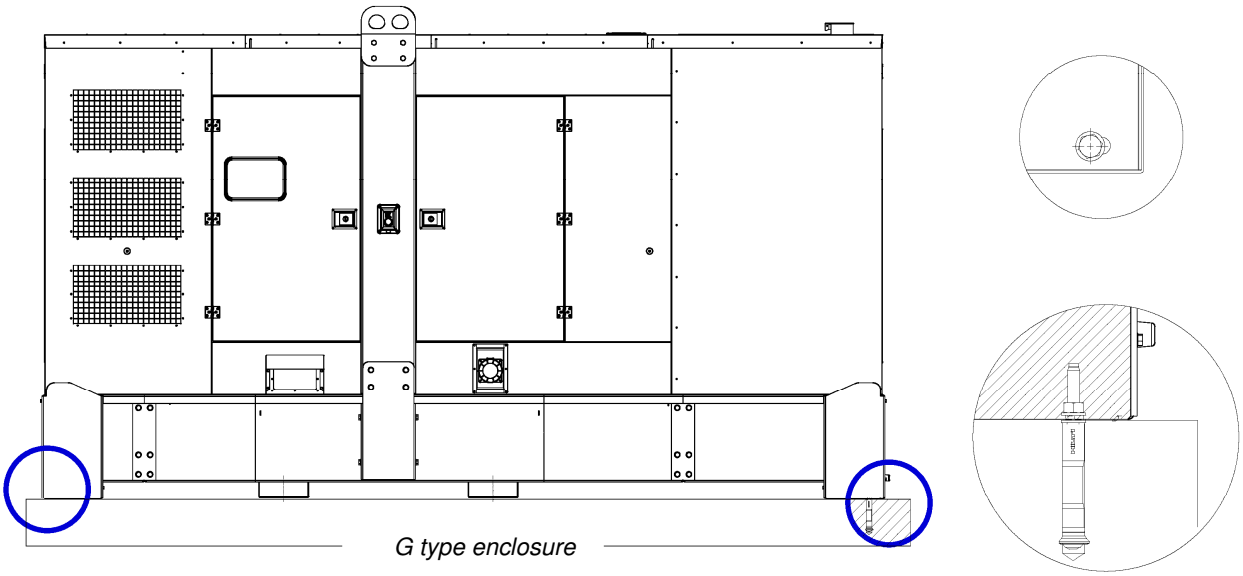


E type enclosure

The genset must be anchored after it is set on the foundation slab/foundation. No fixing elements must be prepared prior to the anchoring. Anchoring is effected using the holes in the genset frame (their location is shown in the figure above) - the holes are prepared for inserting screws. The genset must be anchored using angle bars fixed to the frame with screws and to the foundation with appropriate expansion bolts.

For G type canopy gensets anchoring can be done like for the types presented above. However in order to increase personal safety and also protection of the anchors it is recommended to use holes in the genset frame feet. In this case anchors are hidden within the genset frame and are protected by the frame covers – see the drawing below.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl



G type enclosure

8.2 Indoor installation.

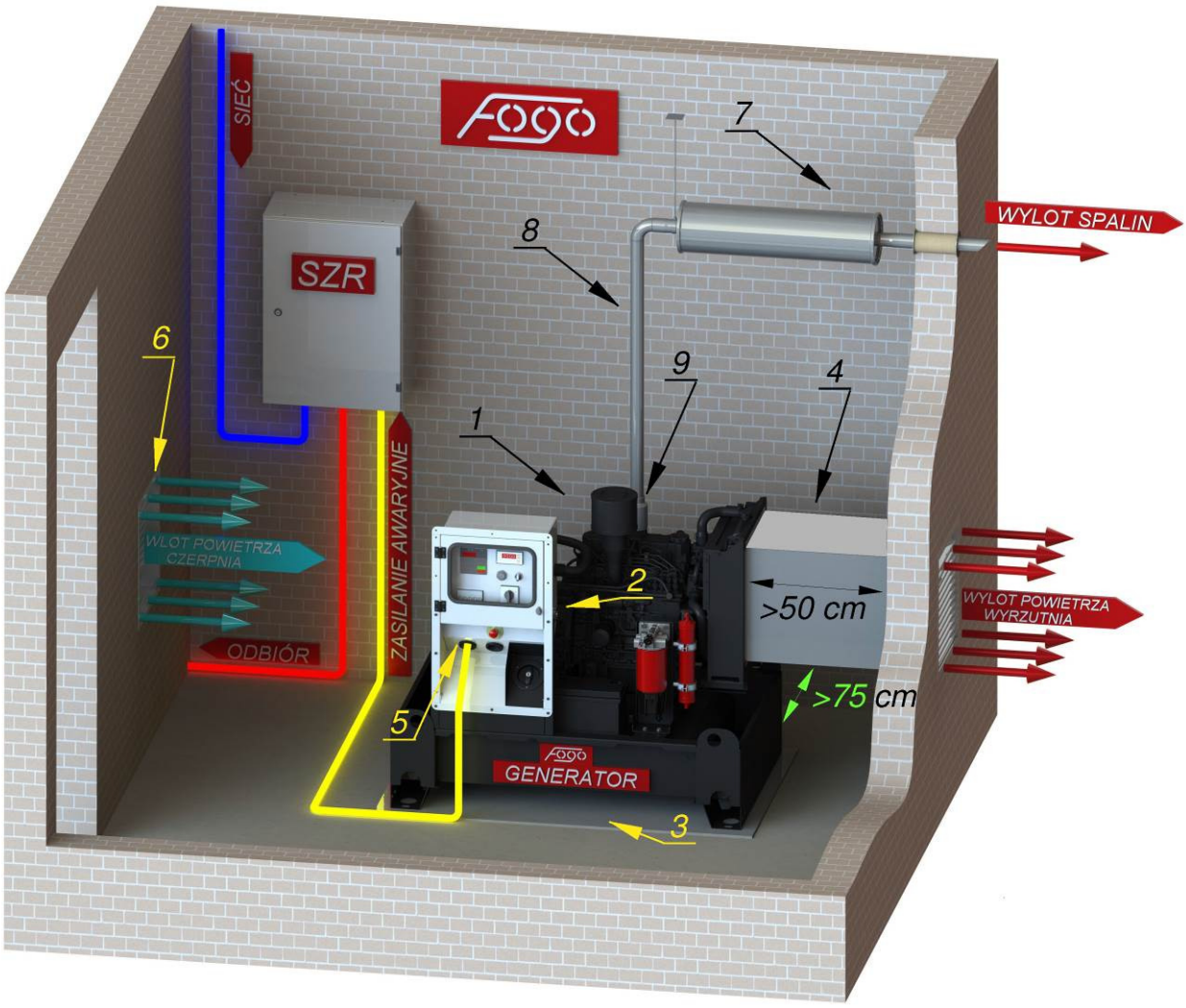
WARNING! The room where the genset is to be operated must be prepared to ensure proper foundation, ventilation, combustion gas extraction, and power supply.

When considering a genset's installation site, one must keep in mind:

- the overall dimensions of the genset and the sizes of the doors/gates to be used for bringing the genset into the room;
- the surface area of the foundation - at least 0,75 m wide band of free space must be ensured around the genset to enable problem-free operation and maintenance - in the case of an open genset or a band of free space on each side of the genset whose width is equal to the width of the genset enclosure's doors - in the case of gensets in enclosures;
- the ventilation system must be made so that noise does not cause inconvenience to other persons in the building and in the vicinity of air inlets and outlets;
- the temperature in the room must be equal to at least +5 ℃;
- the genset must be set on a homogenous foundation slab with an expansion joint around the slab that prevents propagation of vibrations to other parts of the building;
- the foundation must be fixed to the foundation slab in the specified locations in the base of the frame;
- one must plan for the cable route between the genset and the distribution board where the genset will be connected to supply the installations.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

Genset room



1. *Genset,*
2. *Control panel,*
3. *Foundation plate*
4. *Air outlet duct*
5. *Power cable duct*
6. *Air intake*
7. *Muffler*
8. *Exhaust pipe*
9. *Expansion joint (flexible connection)*

Anchoring in the case of indoor installation like for the outdoor installation.
Foundation slab for indoor installation like for outdoor installation – movement joint min 5 mm.
The level of the slab must be flush with the level of the floor.

8.2.1 Guidelines pertaining to the ventilation system.

Room ventilation guidelines – see the genset room drawing above.

WARNING! All elements of the ventilation system can be ordered separately from FOGO. Ventilation systems can be custom made after a local inspection is performed once the genset has been installed in its target location.

WARNING! Ventilation duct dimensions - see the specification of your generator at www.fogo.pl or contact FOGO.

In the case of ventilation duct sections longer than 3 m, the surface areas of their cross-sections must be larger so as to enable free air flow. Also, the surface areas of cross-sections of ventilation ducts must be larger in the event of any turns in the duct lines. Ducts supplying air into the genset room (air intakes) must have cross-section surface areas that are 25% larger than the surface areas of the cross-sections of the hot air exhausts. The standard dimensions of hot air exhausts in the specifications for gensets to be built-in are given for the total length of the air intake and air exhaust ducts that is not longer than 3 m.

WARNING! If a special design of the ventilation system is required (e.g. ventilation system extending to the roof, long ducts, many elbows, etc.), please consult FOGO's technical department to make sure that the ventilation system's design is correct.

In the case of gensets in sound-absorbing enclosures intended for outdoor installation, all elements of the ventilation system and the combustion gas exhaust system are fit inside the enclosure. Do not change the sizes of the ventilation openings (by covering them, changing the direction of air/combustion gas flow, etc.) as this may result in overheating or choking of the genset and, consequently, to its failure or damage.

In the case of a genset in an enclosure installed indoor, observe the same rules as in the case of gensets without enclosures installed indoor. Only custom-made gensets with enclosures, whose design has been agreed with the FOGO's technical department at the time of placing the order, are suitable for indoor installation.

WARNING! After the installation of a genset indoor is completed, the noise emission must be measured and the operators must be provided with the necessary noise-protection equipment compliant with the occupational health and safety regulations.

8.2.2 Guidelines for exhaust systems.

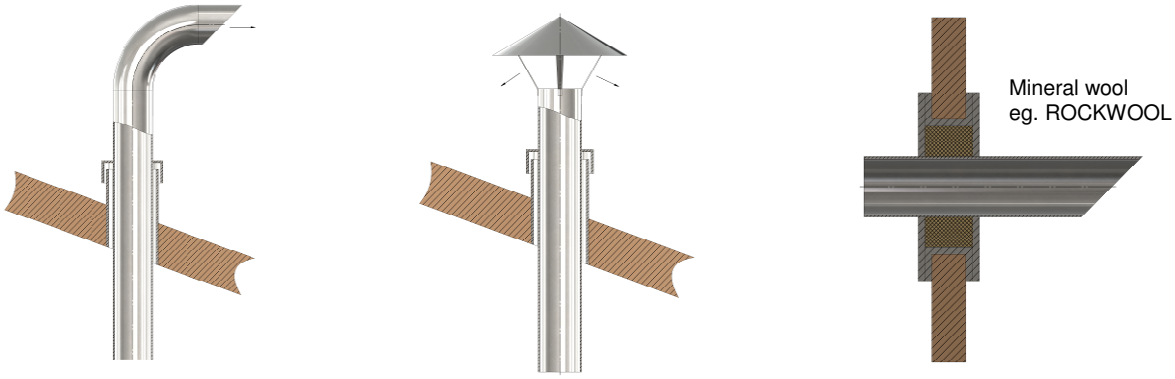
Combustion gas exhaust systems are usually made from smooth, seamless steel pipes or, in exceptional cases, from stainless steel pipes. Pipes should evacuate combustion gas to a location where there will be no risk of losses or difficulties in operation, away from doors, windows, and air inlets, and must be terminated with a permanent system protecting the exhaust system from rainwater. The schematic drawings can be found further in this chapter.

In order to ensure proper operation of the motor of the FOGO genset, ensure that proper cross-sections of the pipes and the mufflers are used in the exhaust system. Please check the data sheet of your gen set for the detailed dimensions.

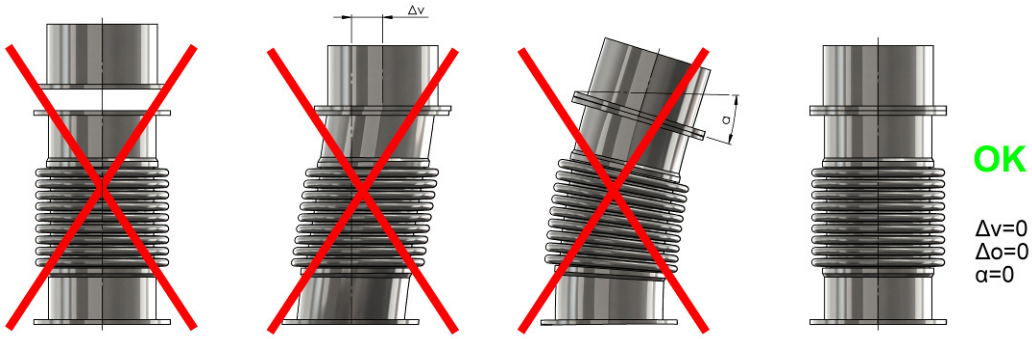
If it is necessary to use an exhaust system that is longer and contains more elbows than stated above, please contact FOGO in order to verify your calculations.

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

Method of termination of the system for combustion gas extraction from rooms.



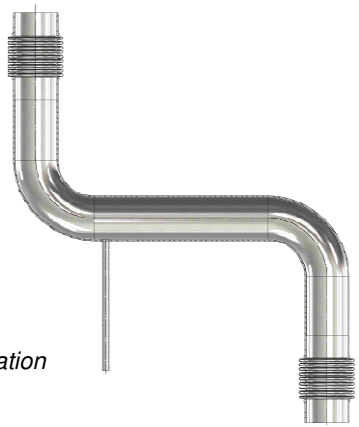
Method of installation of a flexible connector - a vibration compensator.



WARNING! The expansion joint delivered with the genset must be installed with parallel pipes, without initial tightening.

WARNING! The moisture that collects in the exhaust system due to condensation of steam may cause corrosion of the exhaust system or, in the event of larger quantities of moisture, may flow to the motor and cause its damage. In order to prevent this, in systems that are longer than 5 m, a condensation pipe with a cut-off valve must be installed and emptied regularly (the condensate must be disposed of in the same way as waste engine oil).

Valve for discharging condensate from the exhaust system.



Condensation pipe

WARNING! The condensation pipe may be emptied only when the genset motor is not working and is cold. The minimum length of the condensation pipe is 200 mm.

All elements of the combustion gas exhaust system can be ordered separately from FOGO.

8.3 Guidelines for the electrical installation.

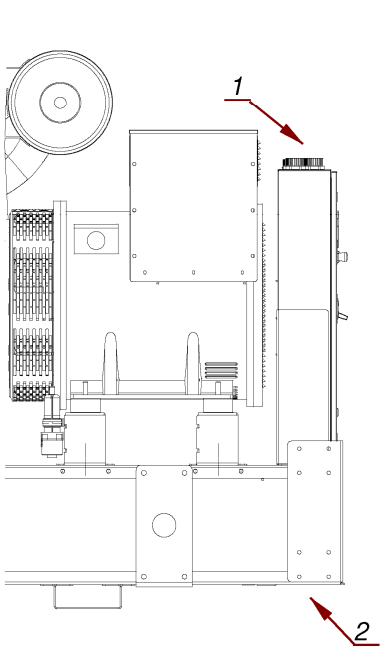
FOGO gensets must be connected by specialized electrical companies that hold current electrical licenses for maintenance and installation of generation sets. The first startup, on pain of loss of the warranty, must be performed by FOGO or its authorized service company, with the exception of generators equipped with manual control systems.

The genset must be grounded before it is started. The grounding cable must comply with the local regulation, providing resistance to the ground <5 Ω

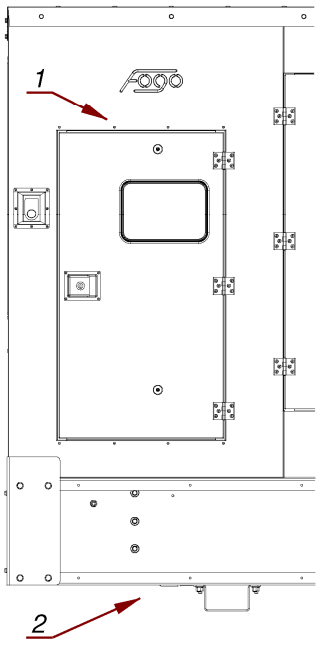
The power takeoff cables, properly laid and routed through dedicated bushings in the genset frame must be connected to the terminals inside the control and power takeoff panel. The terminals can be accessed by opening the doors of the control and power takeoff cabinet. One of the possible ways to route the power takeoff cables and the control cables from FOGO gensets is shown in the figure below.

In standard stationary FOGO gensets the connection is always located in the back of the genset (on the generator side), both in the open version intended to be built-in and in the version in an enclosure.

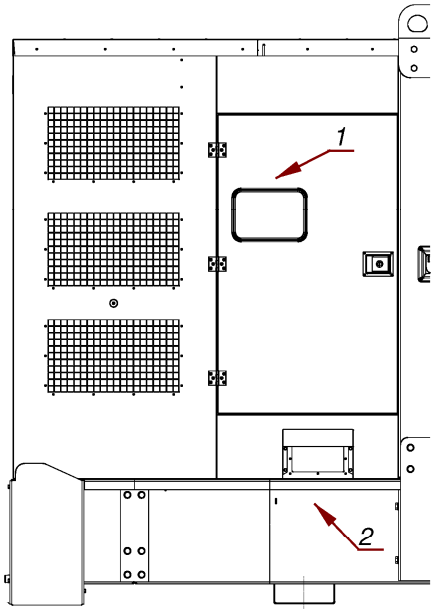
1. *Control cabinet with main switch*
2. *Outlets for power takeoff cables*



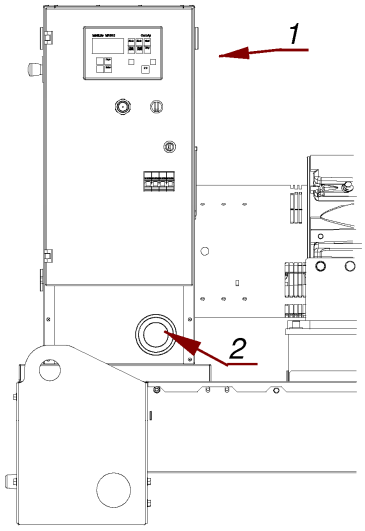
N type frame



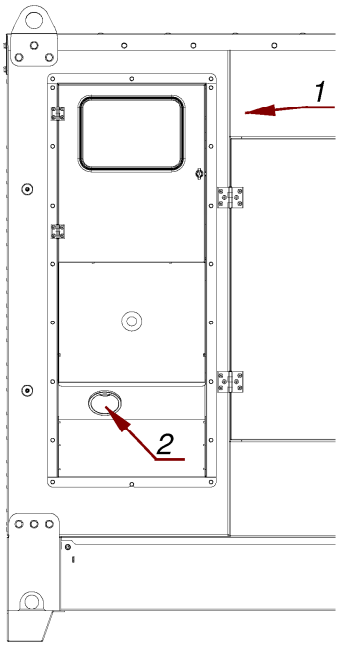
M type canopy



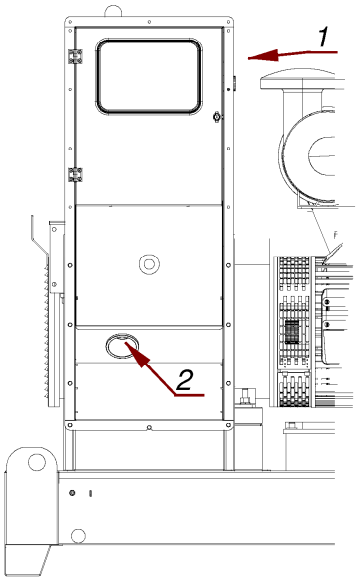
G type canopy



F type frame



E type canopy



H type frame

The cables must be flexible; otherwise, the warranty will be null and void!

Selection of the cable cross-sections and types is the responsibility of the installation designer. Use of improper cable cross-sections may lead to voltage drops and overheating that may cause damage to the cables. Depending on the power and the execution of the genset, the power takeoff cables must be connected to the GCB terminals in the power take-off panel or to the bus bar inside.

In case of automatically-controlled systems, additional connections between the genset and the control panel must be made using flexible cables connected to screw terminals (the cables are not included in the scope of delivery).

All the connecting cables, i.e. the cables between the genset and the installations - in the case of manually-controlled gensets, and the cables between the genset with an automation panel and ATS - in the case of automatically controlled gensets, must be properly laid in a proper duct or trench in the ground (ground cables).

All metal parts that may be touched by people and that, due to poor insulation or for other reasons, may be live, must be grounded. Gensets and control panels are equipped with grounding terminals. The cross-sections of the cable connecting the genset to the grounding and the strength of the connection must comply with the applicable law and regulations.

In the case of operation with automatic startup, the genset must be equipped with a system that facilitates its startup at low ambient temperatures, which enables nearly instantaneous takeover of the load without the need to warm the motor.

WARNING! The electrical circuits that supply installations powered from the genset must be equipped with the required electric-shock protections. It is also possible to additionally provide the genset with a residual current device - to do so, please contact FOGO.

After the installation has been completed, electrical tests must be performed. The system for power takeoff from the generator is made in a TN-S network arrangement (a separate neutral wire and a protective wire connected in one point only). In order to perform electrical tests of the generator (insulation resistance), the connection between the N and the PE wire in the generator must be removed. After the test, the factory setup of

the connections must be restored. The tests must be performed by persons who are properly qualified and hold proper licenses.

WARNING! All stationary FOGO gensets have, as a standard, a connection between the neutral wire N and the protective wire PE.

9. Startup and use.

WARNING! The first startup, on pain of loss of the warranty, must be performed by FOGO or its authorized service company, with the exception of generators equipped with manual control systems. Any possible training on the operation and connection of gensets with manual control systems must be performed in the manufacturer's facilities.

9.1 Preparation for work.

Before the first start, after a routine inspection, and after a long shutdown of the genset, the following checks must be performed:

WARNING! Before the checks, make sure that the genset is locked and cannot start by itself.

9.1.1 Cooling system.

FOGO gensets are always delivered with the cooling liquid and any losses must be replenished with the same coolant that was filled at the factory, i.e. **SHELL AntiFreeze (or VCS in the case of VOLVO motors).** The liquid must be poured slowly and the inlet must be left open for several minutes so that air bubbles may escape from the system.

WARNING! Any and all works on the cooling system must be performed when the motor is shut down and is cold.

9.1.2 Lubrication system.

FOGO gensets are always delivered filled with engine oil. Before the oil is poured for the first time, the oil sump must first be emptied to remove any old oil. Oil must be filled up to the maximum level indicated on the oil level measuring rod, without exceeding the level. A few seconds after the motor is started, with the motor still cold, the oil level must be rechecked and oil must be added as necessary. This action must be repeated several times, if necessary, until the oil level is stabilized. After the motor has warmed up, check the motor thoroughly for leaks. The engine oil that is used in the motor by the manufacturer is a VDS-3/4 oil, Shell Rimula R4 L 15W-40 type..

WARNING! As a standard, the gensets are equipped with sensors that monitor the oil pressure (limit sensors). However, the user is still required to check the oil level before starting the genset.

9.1.3 Fuel system.

For safety reasons, FOGO generators are delivered without fuel, which prevents performing any tests on them. Before the generator is started, fill its tank with diesel oil compliant with the EN-590 standard.

Warning! In order to prevent aeration of the engine, minimum fuel level that enables the engine to work is 10% of the tank capacity.

The tank must be filled with the motor shut down and it is forbidden to fill the tank and connect installation to a working genset at the same time. When filling the tank, leave about 2 cm of free space in the top of the tank so as to provide space for fuel expanding when heated up. Also, a visual inspection of the filters must be performed to ensure that they are clean (in the case of filters equipped with a clarifier) - if the filters are dirty, replace them with new ones and vent the fuel system.

WARNING! The tank must be filled with diesel oil intended for cars (as appropriate for the summer or winter season). DO NOT use biofuels, biocomponents, heating oil, etc. Use of a fuel other than diesel oil may lead to damage to the motor and make the warranty null and void.

WARNING! Be very careful when filling the tank. Use only products that are intended for this purpose, i.e. a fuel dispenser, a funnel of proper length that will prevent spills of the fuel outside of the frame or the enclosure of the genset. DO NOT use substitute products, e.g. a cut bottle instead of a funnel or hoses that are not suitable for use with diesel oil. Use of such substitutes may result in pollution of the genset and, consequently, to ignition and fire in the genset. After the tank has been filled and before the genset is started, any fuel spilled on the enclosure must be cleaned up. It is forbidden to make any changes or modifications to the structural components at the fuel inlet.

9.1.4 Alternator

Check if the ventilation grille of the generator are clean and remove any dirt. After a shutdown longer than 30 days, make sure to perform an inspection of the insulation before starting the genset.

WARNING! During the inspection, the electronic systems of the generator and the controllers must be disconnected so as to avoid their damage during the tests.

9.1.5 Startup batteries.

FOGO gensets are delivered with fully charged batteries. If the batteries are to be replaced, make sure to observe the following sequence: first disconnect the negative terminal and then the positive terminal. Connect the terminals in the reverse order. Before the batteries are connected, check their electrolyte level and replenish it as required.

WARNING! Do not disconnect the batteries when the motor is in operation! Pay particular attention to the polarity of the cables as a failure to observe it may cause damage to the alternator and the electronic components of the control system.

9.1.6 Electrical circuits.

Check the connections of the power takeoff cables, the control cables, and the power supply cables (depending on the genset type) of the mains battery charger and the heater. Check the continuity of the equipotential bonding connections (grounding). Check the phase sequence and their compliance in cooperation with the power mains, the ATS, and equipment that requires the proper phase sequence (e.g. motors, three-phase pumps, etc.). The genset may be started only after a grounding cable of proper resistance has been connected.

9.2 First start.

WARNING! Make sure to ground the genset prior to its first start.

WARNING! During use of the genset, the minimum load must not be lower than 30% of its rated power; otherwise, the warranty will be null and void.

After the preliminary actions defined above have been completed, the following must be done:

- thoroughly clean the genset and its surroundings to remove any spots and dirt, oil, fuel, solvent, and other residues;
- check for any cleaning materials, paper, or other light materials in the direct vicinity of the genset;
- make sure that there are no foreign objects in the vicinity of rotating parts;
- check for any loss of the coolant, low oil level and low fuel level;
- start the genset manually as described in items 9.3 or 9.4, depending on the genset version;
- check proper operation of the sensors by simulating certain conditions on the terminals and proper operation of the protections;
- stop the genset after a short period of operation (2-3 minutes) in the idle gear without load.

After the first operation period, perform the following checks:

- check the oil level and the coolant level and replenish them if necessary;
- check the condition of screw connections and tighten them if necessary.

9.3 Manually controlled gensets.

Gensets must be started only with installed dedicated control systems. In order to start the genset, act in accordance with the control manual. The main switch of the genset is in the off position. Any attempts to set the switch equipped with an overvoltage release in the on position without voltage (with the genset shut down) may cause its damage.

WARNING! The genset's starter must never be operated for more than 15 seconds. After the first attempt, wait for 20 seconds until the starter cools down (long work of the starter may cause its damage).

WARNING! Minimize the number of starts/stops with the main switch under load as this may reduce the service life of the switch.

9.3.1 Genset start:

- Start the genset in accordance with the control manual with the load disconnected.
- After short operation without load (approx. 5 minutes), check if the rated operating parameters have been achieved, i.e. approx. 400 V voltage, approx. 51.5 Hz (class G2 gensets) or 50 Hz (G3 and G4 class gensets - see the data plate) frequency.
- Check if there is any risk of electric shock on the line supplied from the genset and activate the switch by moving the lever from the lower OFF position to the top ON position. If the switch is in the center TRIP position, in order to activate the switch, first move the lever down until it is clamped noticeably and then move it all the way to the top.
- Switch on a partial load (approx. 1/3rd of the rated power).
- After 5-10 minutes (or when the water/coolant temperature exceeds 60 ℃), you can switch on the rated load.

- Use the electrical parameter analyzer or other indicators to check if the load conditions do not exceed the allowed current and power values, as stated on the data plate.

During operation of the genset under a load, periodically check the motor operating conditions and verify if it is working properly; also, check for any loss of operating liquids and the fuel level. When the fuel level drops below the minimum value, a minimum fuel level is generated and the genset stops automatically in order to prevent air lock. In such a case, fuel must be replenished. If the genset is not equipped with an automatic fuel filling device with pipes permanently fixed to the storage tank, the filling must be performed with the genset shut down.

9.3.2 Genset shutdown.

Before the motor is shut down, it must be allowed to work for a few minutes without load; for this purpose, move the switch lever down. This allows the genset to cool down and prevents a serious damage to the turbocompressor. Leave the genset working in the idle gear for at least 2-5 minutes and then stop the motor.

9.4 Automatically controlled gensets.

In gensets with automatic control, the main switch is permanently on with the exception of situations where the main switch is switched off due to overload on the genset or a short circuit in the line supplied from the genset.

In the automatic operation mode, the controller installed in the genset cooperates with the master control system, namely the ATS (automatic transfer switch) system. After the controller of the genset receives the start signal (potential-free contact), the controller performs the start procedure, i.e. it starts the genset. As a standard, the controllers installed in the gensets are programmed to perform up to 5 startup attempts. When the 5 attempts are not successful, the attempts to start the motor can be continued only after the genset controller has been reset. After the genset has been started properly, the genset control system monitors the operation of the motor and other parameters, such as the voltage and frequency of the generated current. After the mains power supply is restored, the ATS system controller switches the installations to the mains power supply and discontinues the remote start signal sent to the genset control system. At that time the controller performs the motor cool-down procedure and then shuts down the genset motor.

9.4.1 Cooperation of FOGO gensets with third-party ATS systems.

In order to cooperate with FOGO gensets, ATS systems must enable remote start of the gensets using a "REMOTE START" signal, with the start performed by closing a potential-free contact. Then the genset controller performs the programmed start sequence. After the genset has been started and the programmed protection thresholds have been checked, the genset works as long as the REMOTE START signal is received at the controller input. If an alarm condition requiring shutdown of the genset is detected, the control system stops the diesel motor despite the continued presence of the REMOTE START signal. Information on detection of possible alarm conditions is provided in the descriptions of the different controllers in the control manual. When the REMOTE START signal is no longer received, the cool-down procedure starts and the genset is shut down by the genset controller.

WARNING! It is forbidden to stop the genset when it is under load! This leads to the risk of damage to the generator. The ATS system must ensure that the load is disconnected before the genset is shut down.

In order to prevent genset shutdown under load, it is recommended to use the "Ready to Load" signal (this applies to ComAp controllers). If a contact ATS system is used, it is recommended to supply the genset contactor coil with the voltage generated by the genset.

If the control system of the genset and the ATS system must perform other non-standard functions, please contact FOGO's technical department to consult this issue.

Fogo generators optionally can be equipped with the controller, that integrates genset control and ATS control. That enables the use of the third party ATS, controlled by the Fogo generator controller.

9.5 Gensets for parallel operation - synchronization.

Parallel operation of gensets is used to supply installations with a high power demand with gensets of lower power. This solution must also be considered when planning a possible expansion of installations and the associated increase in power demand.

The power of a system of gensets connected in parallel is the sum of the power of all the gensets in the system. Up to 31 gensets can be connected in such an arrangement. Each genset has a controller that shows the operating parameter of the motor and the genset on a display. The parallel operation controllers of gensets can be programmed to calculate the electric power demand of an installation and determine the need to switch on another genset or to switch off one or more gensets so as to minimize the cost of generation of 1 kW of power. Please contact FOGO's technical department to obtain detailed information.

9.6 Gensets with trailer chassis.

FOGO also offers gensets equipped with a trailer chassis that enables their transport on public roads (with homologation). Depending on the weight of the genset, the chassis may have the following components:

- overruning or pneumatic brakes;
- one or two axles;
- a ball coupling or an eyelet coupling;
- a suspension of properly selected elasticity;
- a straight tow-bar of a fixed height or a folded tow-bar of regulated height;
- a parking wheel equipped with a lifting crank;
- a spare wheel;
- stabilizing feet;
- lighting.

WARNING! NEVER lift the genset installed on a trailer by pulling on the genset grip. The grip is suitable for lifting only the genset unit. Attempts to lift the entire mobile genset including the trailer by the genset grip may result in damage to the grip and the genset unit's enclosure.

9.6.1 Preparation for work.

Before each startup of a genset installed on a trailer chassis, in addition to the rules defined in item 9.1, make sure to observe the rules and procedures applicable to operation of mobile gensets.

In order to do so, make sure to:

- pull the manual brake of the chassis (if one is provided);
- unhook the steel line of the trailer chassis connected with the chassis brake from the fixed element located on the vehicle;
- unlock the ball coupling or pull out the securing bolt in the case of an eyelet coupling;
- lift the tow-bar using the parking wheel above the tow hitch of the vehicle;
- lower the tow-bar using the parking wheel in order to level the genset;
- lower and block the stabilizing feet (if any are provided);
- ground the genset using a properly prepared and marked grounding screw;
- start the genset.

9.6.2 End of work and preparation for transport.

After each use and prior to each transport of the genset on a trailer chassis, make sure to:

- shut down the genset;
- eliminate the grounding of the genset;
- pull the manual brake of the chassis (if one is provided);
- release and block the stabilizing feet (if any are provided);

- lift the tow-bar using the parking wheel above the tow hitch of the vehicle;
- drive the vehicle back so that the tow hitch is located under the trailer chassis coupling or so that the eyelet is in the vehicle's tow hitch seat;
- lower the trailer chassis using the parking wheel so that the coupling is clamped on the ball coupling (or secure the eyelet coupling with a bolt after the eyelet has been fitted into the seat);
- hook up the steel line of the trailer chassis connected with the chassis brake on the fixed element located on the vehicle;
- release the trailer chassis brake.

10. Maintenance (inspections and tests).

The genset may be operated only by qualified and properly trained persons who have valid qualifications for operating the generator in compliance with the applicable laws.

In order to maintain the genset in a good condition for a long time, the maintenance rules defined by the manufacturer must be strictly adhered to. The customer is required to have and systematically fill out the generator's maintenance log where information on the maintenance operations, the number of work hours of the genset each day, the repairs, the inspections, and the liquid levels must be recorded. **Tests must be conducted at least once a month.**

WARNING! Any and all inspections must be performed with the genset locked: in manually controlled gensets, push in the SAFETY SWITCH button, set the STOP/START switch in the STOP position, disconnect the batteries; in automatically controlled gensets, push in the SAFETY SWITCH button, put the automation in the STOP mode, disconnect the batteries, and disconnect the battery charger.

10.1 Manually controlled gensets.

- Perform the following checks on the genset:
  - check the coolant;
  - check the oil;
  - check the lubrication system and the cooling system for leaks;
  - check the batteries (condition of the electrolyte and the charging level);
  - check the cooler and the generator ventilation for cleanliness;
  - check the air intake, the exhaust, and the supply ducts for cleanliness;
- Start the genset and check its rated parameters (frequency and voltage); check the patency and tightness of the exhaust system.
- If the gen-set is not used for more than 30 days, apply load to the genset (min. 30% of the rated power) and operate the genset under load for approx. 30 min. (checking the genset's parameters).
- After the test, remove the load and then, after approx. 2 minutes of operation in the idle gear, shut down the genset.
- Check the genset again performing the checks specified in the first item above with the exception of the check of the coolant, which must be performed when the motor is cold.

NOTE! Avoid operating the unit at idle or low load. Work with load lower than 30% of rated power leads to increased oil consumption and, consequently, to may lead to oil leak from the exhaust pipe as well as tur damage to the turbocharger.

10.2 Automatically controlled gensets.

- Perform the following checks on the genset:
  - check the coolant;

- check the oil;
- check the lubrication system and the cooling system for leaks;
- check the batteries (condition of the electrolyte and the charging level);
- check the cooler and the generator ventilation for cleanliness;
- check the air intake, the exhaust, and the supply ducts for cleanliness;
- check the controller's display (functionality and legibility);
- check the heater of the cylinder block (before the motor is started, check if the cylinder block is warm: >20°C).

➢ Set the automation in the AUTO operation mode, cause loss of the mains power supply and check if the procedures performed by the automation are correct:

- after the mains power loss, the genset's motor should start automatically after a certain delay;
- after the operation of the genset has been stabilized (voltage and frequency), the load should be automatically switched over to the genset;
- during work under load (min. 30% of rated power), check the electrical parameters (voltage and frequency) and the motor's parameters.

➢ After about 30 minutes of operation of the genset under load, switch on the mains power supply and check if the automation system works properly:

➢ After the automation has checked if the mains voltage is correct, it should switch over the load from the generator to the mains power supply and cool down the genset for about 2 minutes.

➢ After this period, the genset should be shut down and switched to the standby mode (the cool-down time is programmable and may be different than 2 minutes).

➢ Check the exhaust system for tightness.

➢ Check the genset again performing the checks specified in the first item above with the exception of the check of the coolant, which must be performed when the motor is cold.

NOTE! In the case when the generator load during the test is lower than 30% of its nominal load, the test should be limited 5 minutes. To avoid the possible defects related to low engine load, once a year run the unit for 4h with nominal load.

10.3 Other maintenance activities.

- Check the filter on the air inlet regularly. The frequency of the checks depends on the season of the year and the operating conditions; in the event of dusty conditions, the checks must be performed more frequently.
- Regularly check the electrolyte level in the battery and add distilled water if necessary.
- The battery must be kept clean.
- The fuel tank must be almost completely filled with fuel to avoid condensation of steam.
- Regularly remove water and any pollution from the fuel tank.
- Regularly remove water from the preliminary fuel filter (if the motor has one).
- Regularly change the fuel filter if the fuel pressure or the power of the genset has dropped.
- Regularly check the tightness and the condition of the driving belts.
- Once a month, check the connections of the electrical components of the motor to the distribution board.
- Once a year, check the control panel to see if all the terminals are properly fixed. Clean it thoroughly using, for example, a vacuum cleaner. Check the condition and the cleanliness of transmitters.
- In the winter, at least every other day, check the cylinder block heating function operation (if the motor has one).

10.4 Routine inspections.

The first maintenance must be performed after 100 hrs of operation of the genset (or 50 hrs in case of FM gensets), or after a full first year of operation, whichever happens first.

A list of required maintenance activities is given in the enclosed generator and motor maintenance manual. For the stand-by application gen-sets (the genset fixed to the ground, connected with the load by ATS switch or manual genset-Mains switch, working up to 500hr a year, FM and FD up to 200hr a year), maintenance should be performed every 12 months. Inspections should be performed by the manufacturer's service or other FOGO authorized service The scope of the maintenance includes:

- change the oil and the oil filters;
- change the fuel filters;
- change the air filters each two years, or more often in case of excessive dirt
- check the coolant and change it every two years;
- check the rubber components (V-belts, gaskets, pipes);
- check the cooling system, the lubrication system and the fuel system for leaks;
- check the overall condition of the genset;
- check the alternator;
- test the generator insulation resistance;
- check and test the genset's control systems;
- check the electrical systems;
- check the capacity of the battery; replace the batteries with new ones every two years.

For all the other application as well as in case of higher then specified above use of stand-by genset, observe the following periods between maintenance:

- Mitsubishi engines 250 hours of operation
- Doosan engines 200 hours of operation
- Iveco, Volvo and Perkins engines 500 hours of operation

NOTE! In order to preserve the warranty, all maintenance during the warranty period must be performed by the manufacturer's service or another FOGO authorized service agent.

11. Decommissioning and disposal.

WARNING! The generator, the materials used to make it, and the consumable materials may be very harmful to the environment if not disposed of properly. By reusing such materials or using the decommissioned equipment in other ways, you significantly contribute to the condition of our natural environment.

WARNING! Do not dispose of the genset and the consumable materials after the end of their use as regular household waste! All waste is a potential source of danger and contaminates the environment. It is absolutely forbidden to pollute the environment with waste materials or equipment. All materials must be collected, segregated, disposed of, and used in compliance with laws of a given country. Information about the proper waste equipment collection point can be obtained from your local authorities.

After the end of service life of the genset or any of its component, they must be properly disposed of. The following materials must be brought to the official disposal sites as they may be hazardous materials. Hazardous materials are waste objects and solid substances, as well as liquid substances that are not wastewater, that are created in connection with human subsistence or business activities, are not useful in the place or time where or when they were produced, and are harmful to the environment. This applies, in particular, to:

- consumable liquids (engine oil, coolant, etc.);
- filters;
- startup batteries;
- mix of water and freeze-protection agents;
- any and all materials soaked with consumable liquids or diesel oil;
- cleaning materials (e.g. cleaning clothes soiled with grease, soaked with fuel, or soiled with chemicals).

The aforementioned materials must be transferred to appropriate entities that purchase, collect, and utilize such materials. It is forbidden to pollute the environment with such materials or to store them together with regular municipal waste. If the genset is not to be used any more, it must be delivered to an organization that officially utilizes industrial machinery. A decommissioned genset may be returned to the maker of FOGO brand gensets.

12. Documentation.

All the documents required for its operation are delivered with the genset. Such documents are:

- Declaration of CE Conformity;
- the translation of FOGO genset operation manual;
- the genset controller manual
- the homologation document for the trailer - in the case of mobile gensets (the homologation is delivered together with the sales invoice);
- the warranty card and the general warranty terms (ask the local dealer).
- the motor operation manual;
- the generator operation manual;
- electric diagrams;

Agregaty FOGO Sp. z o.o.
ul. Święciechowska 36, Wilkowice
64-115 Święciechowa
tel. +48 65 534 11 80
fax +48 65 534 11 81
generators@fogo.pl

13. Contact data.

If you have any questions concerning the genset you have purchased, please contact our Technical Department. We will also be happy to provide you with advice concerning the installation of the genset.

Phone no.: +48 65 534 11 80 ext. 208 or 405
email: generators@fogo.pl

14. Notes.