Fire Extinguishing Aerosol Generators

type GGA-35St & GGA-11St

Technical and Operating Documentation

1. APPLICATION

Fire extinguishing aerosol generators type GGA-35St and GGA-11St are fixed fire extinguishing devices designed to extinguish the fires of flammable materials, combustible liquids and volatile solids, solids that burn without glowing as well as live electrical power equipment, devices and systems in closed spaces.

In the event of fires involving organic solids that normally burn producing glowing carbons, the aerosol quickly suppresses flames, reduces temperature, considerably slows down and inhibits the process of combustion.

The use of generators to extinguish the fires of materials (*fibrous, loose, porous*) glowing and burning in their whole volume, materials tending to self-ignition (*sawdust, cotton, dried material etc.)* as well as live electric devices with voltage higher than 20kV requires an additional check of the fire area and possible final extinguishment of glowing particles.

The generators can not be used to extinguish alkali metals, rare-earth elements and the substances that does not require oxygen to burn (*e.g. cellulose nitrate*).

The extinguishing concentration of the aerosol in a room with closed openings in screening constructions (casings) and total untightness not exceeding 0,5 %, can be obtained by using the following conversion factor :

50 g of fuel briquette per 1m^3 of protected space.

Considering the above mentioned – one generator is intended for the protection of space with cubic capacity not exceeding 20m^3, and one generator type GGA-35St is intended for the protection of space not exceeding 70m^3.

If the calculated cubic capacity of the protected room exceeds nominal values for the specified generator, then correspondingly more generators should be used to obtain proper protection.

CONSTRUCTION AND TECHNICAL PARAMETERS

The construction of fire extinguishing aerosol generators type GGA-35St and GGA-11St is identical *(they differ in scale only)*and has been presented in Figure 1. These are the main elements of the construction :

1) closed casing made of metal sheet and painted which consists of: external cylinder *(3)*, two covers *(1)* and *(14)* connected with each other by lapping; in the external cylinder *(3)* along its axis there are two bolts intended for fixing the generator in the mount; the cover *(1)* has a hole for installing a primer and the cover *(14)* is equipped with a set of outlets;
2) an assembly of openwork, half-open metal sheet cylinders *(6a)* *(8)* i *(18)* placed centrally and coaxially inside the casing provides maintenance and mechanical security to the coolant *(9)* and fuel briquettes *(10)* and creates appropriate distribution channel for the aerosol;
3) two sieves *(16)* and *(20)* placed centrally on the cylinder *(18)* acting as mechanical filters cleaning aerosol;

The fire extinguishing aerosol generators type GGA-35St and GGA-11St differ from each other in scale only i.e. the size of fuel briquette, coolant quantity, dimensions, operation time and the maximum size of protected space.

General technical data for the generators :

Parameter	***unit***	***GGA11St***	***GGA35St***
diameter	*mm*	161	191
length	*mm*	319	410
weight of generator	*kg*	7,7 ±0,5	14,3±0,5
weight of fuel briquette	*kg*	1,1±5%	3,55±5%
aerosol emmission time	*s*	55÷65	145÷155
maximum protected space	m^3	20	70
maximum temperature of aerosol at the distance of 1m from casing	*°C*	130	80
range of operating temperatures	*°C*	-45 ÷ +55	-45 ÷ +55
life of generator	*years*	5	5

Each generator is supplied with a primer - a pyrotechnical device controlled with an electrical impulse with current strength of at least 0,5A and duration time not shorter than 0,5s, used to initiate the process of aerosol production.

In this option the ZC-95 primer can be used – controlled by external temperature via a thermosensitive fuse - ignition temperature ranges from 170°C to 210°C.

The delivered set includes apart from the generator and the primer a mount for fixing the generator to the constructional elements of the room, consisting of a rack and two - alternatively used - mounts, primer casing, injector and a set of hardware.

PRINCIPLE OF OPERATION

The delivery of an appropriate electric impulse to the contacts of pyrotechnical primer (*ZE-95)* or the increase of temperature in the protected space to approx. 170°C *(ZC-95)* initiates the combustion of fuel briquette *(10)* resulting in the production of aerosol. The aerosol is being cooled while moving inside the generator. The aerosol is released into the room under low pressure via the set of orifices in a casing cover, which provides its quick diffusion. As the room becomes more and more filled with the aerosol, visibility gets worse until its complete lack.

A fire is extinguished by filling up the room with the aerosol. The extinguishing effect of the aerosol consists in the inhibition of combustion radicals and the change in the concentration of oxygen within the direct burning zone.The fire is put out practically already during the operation of the generator.

After initiating the operation, the generator can not be stopped and runs to the end of fuel. As a result of its operation, easy to remove hygroscopic dust remains in the room and the generator becomes a scrap (can not be re-used).

In large rooms all installed generators should start almost simultaneously to provide reaching as soon as possible the extinguishing concentration of the aerosol in the room.

INSTALLATION INSTRUCTIONS

Aerosol fire extinguishing systems should be designed and installed by specialized firms - authorized by the manufacturer to carry out such works.

Generators type GGA-35St and GGA-11St should be installed to a ceiling or walls of the room horizontally with the possibility of slightly directing the aerosol outlet downwards – max. 20°.The generators are fixed to construction elements with a rack and mounts delivered.

The distribution of generators in the space should provide steady and quick filling the protected room with the aerosol. Any existing openings (*windows, doors, vents etc.*) and leaks in the walls and ceiling should be also taken into account. The above mentioned leaks should be minimized.

The number of necessary generators in a fire extinguishing aerosol system should be calculated using the following formula:

$$N = \frac{M}{m}$$

where:

N – number of generators,
M – weight of extinguishing load required to protect the given cubic capacity
m – weight of extinguishing agent icluded in one generator,

When the obtained value N is a fracture, the number of required generators should be rounded upwards to form an integer.

The reserve number of generators to be ordered should be specified as 100% of generators used to protect the largest room of protected area or maximum number of generators intended to be employed in one line.

The wiring for the system of generators release should be made of fireproof wires e.g.: *HDGS 3 x 1,0 EKWS*. The wiring that feeds generator release system including the primer should be laid and shielded in this way so as to protect it against fire. The devices of the generator release system should have certificate allowing to use them in fire protection. The system of generators release should at least enable to:

1. check up the continuity of electric circuits,
   - set up time of delay in generators operation,
   a) start appropriate signalling.
   ▪

While installing the generators special attention should be paid to:

1. **fix them in such a way**, so as to prevent aerosol from being released directly to communication ways, construction elements of the room which are sensitive to high temperature and the elements of its equipment. If it is impossible to meet the requirement, the distance of at least 2 meters should be kept (*measured in the aerosol stream axis*) between the cover with aerosol outlets and the above listed elements, otherwise they should be protected with appropriate screens.
2. **mounting places** – the construction elements of the room the generators are fixed to should be resistant to high temperatures.
3. **operating conditions –** the generators should not be exposed to direct water effect and caustic substances as well as to mechanical external factors that can change their location, cover the set aerosol stream, disconnect the electric control system wiring.

4. provide access to generators during maintenance,

CHECK UP AND QUALITY CONTROL

The quality (technical) control is performed by the manufacturer basing on the standard PN-ISO-2859-1+AC1 in the following order :

Selecting a sample *(for lots up to 280 pcs.and assuming the level of control S-1 and quality level 4 the sample consists of 3pcs)* – 3 pieces of devices are chosen at random after packing and setting the lot.

Packing quality check up, appearance, completness and marking (labelling).

Method – *external visual inspection;*
Criterion of assessment : *AC(qualifying number) – 0; RE (disqualifying number) – 1*

Operation check up

Method – *starting the generator, measuring discharge time, aerosol temperature, visual inspection of used device and the products of combustion;*
Criterion of assessment: *AC(qualifying number) – 0; RE (disqualifying number) – 1*

The quality control is documented in a shape of '*Acceptance act'*. The form for this act is shown in Figure 5.

Each fire extinguishing system using fire extinguishing aerosol generators should be checked up after installation by an authorized by the manufacturer representative of the installer.The check-up should be documented in the form of delivery-acceptance act including the list of all performed actions and their results. The act (report) is delivered to the user of the extinguishing system.

The check-up of correct installation and operation of the generators in the future should consist of :

- visual inspection of the installation with paying special attention to :
  - any mechanical damage to casings of the device.
  - correct primer installation,
  - keeping up required distances,
- electric circuits continuity check-up – a test with current not exceeding the value of 20mA

The installer of the fire extinguishing system should train representalves of the user in the scope of its operation and provide the user with necessary documentation of the extinguishing system along with operation manuals for the devices.

The generator should not be checked up by starting it, because the release of the aerosol can not be stopped and it will be impossible to re-use the unit.

OPERATION AND MAINTENANCE OF THE GENERATORS

During the generators type GGA-35St and GGA-11St operation, an aerosol (extinguishing agent) - a gas mixture consisting of solid particle oxides, alkali metal salts and alkaline earths elements is produced.

The aerosol is non-toxic *(certified by the National Institute of Hygiene)* and may only cause slight irritation of mucous membranes. The effect can be decreased considerably or even eliminated by using smoke-masks or fabric as well as gauze packs.
The protected rooms as a result of generators operation are exposed actually only to dust consisting of the settling aerosol particles and locally elevated temperature.

The aerosol particles settling on horizontal surfaces can be effectively removed by hoovering, dusting with a cloth, cleaning with pure water or water with a slight addition of a detergent.

During the operation of a fire extinguishing system based on fire extinguishing aerosol generators, the following principles should be observed :

In each room and particularly in the places where people may stay, alarm devices with signals distinguishable from other remaining alarm signals and operating immediately after fire detection should be installed.

(PN-93/M-51250/01 item 6)

After detecting a fire and starting alarm devices, all persons staying inside the protected room should leave before generators start working. The aerosol causes complete loss of visibility in the room as early as in about 10 s. from starting generators. It is important to provide obstacle free and properly marked escape routes and to preset the time of delay in operation of the system in such a way so as to enable people to leave the fire hazard area.

If possible, the protected rooms should be equipped with self-closing doors, opened to the outside and that can be opened from the inside in case when they have been closed from the outside.

The procedures of starting the fire extinguishing system should predict the possibility to stop the process on the stage of fire-alarm devices operation and to restart it.

Appropriate instructions should be placed at the entrances to protected rooms.

Call fire fighters in each case of fire whenever the generators are launched and fire fighters are the only persons who are allowed to open the room where the generators operated.

Provide a possibility to air the room after putting out the fire

It is also important to apply in the future all the safety measures found necessary after careful analysis of a specified case.

While operating generators and primers, bear in mind that they include flammable materials.

Any mechanical damage to a generator may cause its malfunction – it won't start despite correct starting impulse or it may cause the change in the aerosol emmision speed resulting in considerable increase of its temperature.

Inspection of the devices should be performed at least once a month by checking their completness, lack of damages and the correctness of connections to controllers.

It is inadmissible to :

Use the generators to extinguish fires by hand.

Perform any welding operations or any other open fire works at the distance not exceeding 2 meters from the generator.

Dismantle generators.

The generators during their operation do not require any special safety measures apart from the ones described in this document.

MAINTENANCE OF THE GENERATORS

The schedule and scope of a fire extinguishing system maintenance worked out by the designer should include the inspection of generators and check-up of the circuits controlling their operation.

An inspection of the generators consists in visual inspection of :

- completeness
- any mechanical damages of the device,
- the primer - if it is present and free from any mechanical damage.

The check-up of the control circuits consists in checking the continuity of primer electric circuit and the status of thermosensitive fuse.

It is also required to check:

- access to generators,
- keeping up required distances,

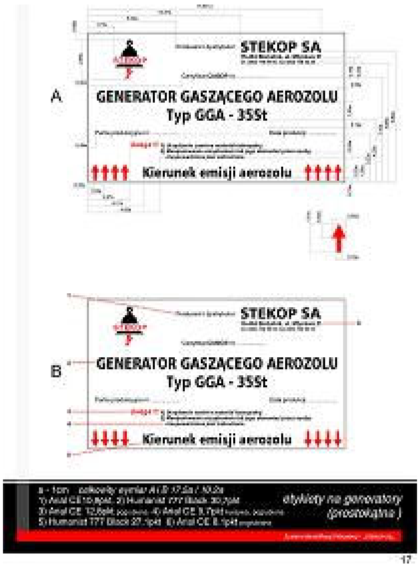
The inspection of generators in full scope should be performed at least once a month and in case when the devices are placed in locations accessible to strangers or increased fire hazard ocurrs in the building – the frequence of inspections is specified by fire protection supervisors.

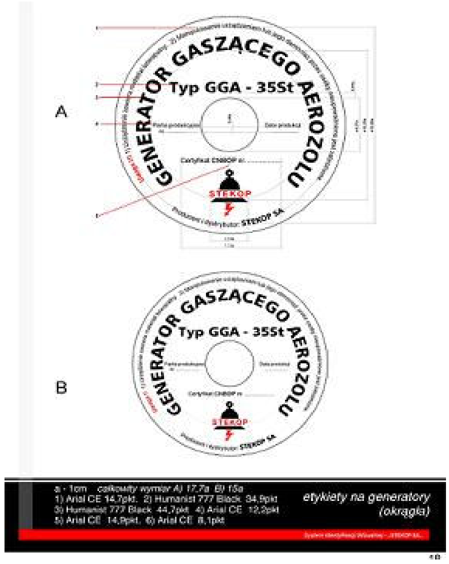
The installer *(maintenance technician)* is obliged to set up a log book for inspections and repairs of fire extinguishing system and the user is obliged to keep it.

LABELLING, PACKING, STORAGE AND TRANSPORT OF THE GENERATORS

The label attached to the casing of the generator and its package includes the following elements:

- abbreviated name of manufacturer and distributor,
- type of generator,
- date of production *(month and year)*,
- production lot symbols ,
- signs showing the direction of aerosol emission.





Generators are packed singly in cardboard boxes, each marked with a label according to the description presented in 8.1. and provided with a label showing the direction of setting the boxes during storage or transport. The box includes:

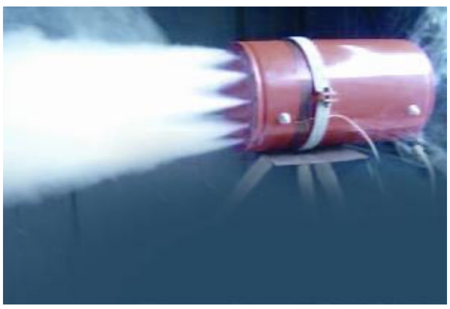
- generator,
- mount *(according to customer's order),*
- primer *(according to customer's order),*

Generators should be stored in their original packages, in non-aggressive evironment, indoors at naturally changing temperatures ranging from +5°C to +40°C and at relative humidity of up to 80%. The generators may be stored in original packages, and not exceeding 3 layers.

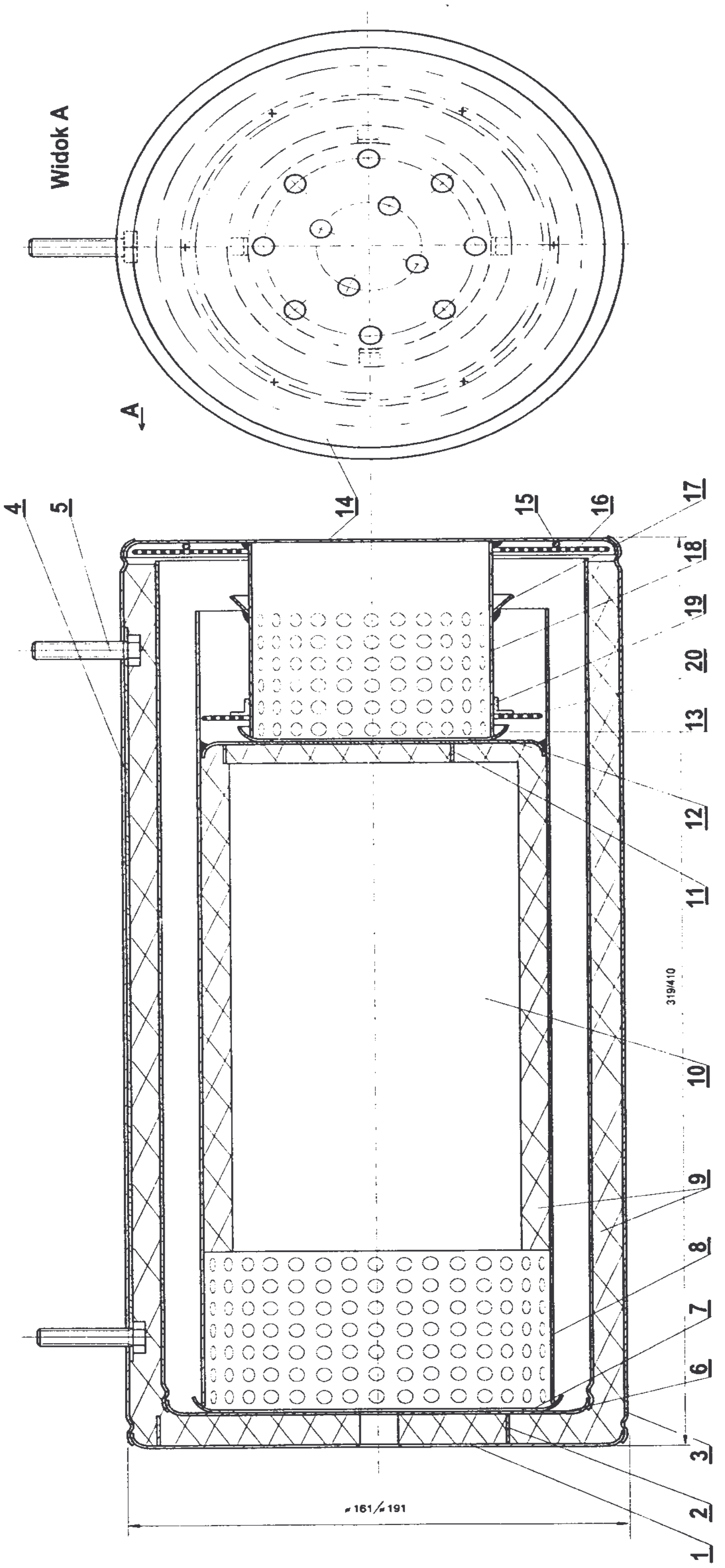
Generators in original packages can be carried by all means of transport according to international regulations (RJD and ADR) concerning loads class 4.1.

Price list

Symbol of generator	*Net price*	*Protected cubic capacity in ideal conditions*
GGA 35 st	1150 €	70 m³
GGA 11 st	550 €	20 m³



Scheme of design generator



Rys. 1. Schemat konstrukcyjny generatora typu GGA - **St