# GENERATORS EXPERTISE

## CONTEXT AND ISSUES

## TABLE OF CONTENTS



ISO 9001 14001 Certified


F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr


F2A Equipementier en traitement de l'air

## CONTEXT

Ever since the discovery of electromagnetic forces in 1733 up to the invention of power grids, technologies have evolved around the idea of building more and more complex machines and using the electric power source.

Now that this energy has become one of the most important factors of economical and industrial growth, ensuring its production has turned up to be essential.

Public networks aren't always able to supply the electrical intensities necessary to the functioning of the several companies which rely on this energy to ensure the sustainability of their business.

To mitigate the possibility of power outage and power failure of public networks, generators (mobile sources of energy) have been developed and perfected. Today they have become an essential answer to several stakes depending on their usage:

- Human stakes: In the medical field, lives are at stake, the least failure of public power grid has to be immediately counterbalanced by backup generators.

- Security stakes : in the banking sector or in a DataCenter, ensuring that no Data is lost during a power outage is mandatory

- Financial stakes: the costs of a power failure in a bank, DataCenter or construction site are colossal.



### 1.Use

According to the generator's location and the issues it is facing, its use, yield and importance vary greatly.

a.Spike production

The generator is used to cover up the spikes in the public electric network. When the network is working properly, the generator is in standby and will become active again only to mitigate the spikes of electric consumption. This technique is mainly used in developing countries when the electrical main grid is no longer enough to provide electricity to all the facilities of the region.

On the same principle, EJP pricing (Spike day mitigation) are special fares on 22 days in a year when the electricity provided by the public network is overpriced.

To avoid this additional cost, some companies chose to resort to generators for their daily needs in energy during these days.



F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

b. Electric energy production

A generator is used to produce electrical energy. This type of installation can usually be found in places where the public network is non-existent or where it is technically or financially impossible to set up, in places such as mountains, working sites or mines. The working time per year when these generators are used is usually high.

c. Back up production

Backup generators are meant to provide a structure with electrical current in case of failure of the public service. They automatically start when a breakdown is detected. They are set up in buildings where power outage leads to a danger for humans (hospitals or retirement home) or productivity losses (banks or DataCenters).

d. Reversed back up production

In some places where the electrical production is critical, like the launch of Ariane's shuttle (Kourou) or the lightening of a football stadium, a generator is in charge of the main power production. If there were to be any failures, the main grid would take over.





F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

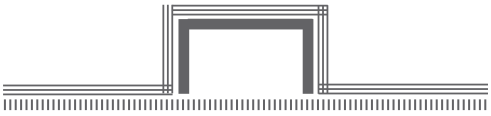
Recap:

The chart below simplifies the different uses of a generator for the production of energy:

**Public network :** provides electricity via a wired network

**Energy supply need**: real energy needs of a structure

**Generator**: provides energy via a generator

| Type of energy production | Functioning | Applications |
|---|---|---|
| Spike |  | Malls, mines |
| Back up |  | Hospitals, Data-centers, banks |
| Reversed back up |  | Stadium, lightening, shuttle, launchpad |
| Energy production |  | Construction sites, isolated structures |

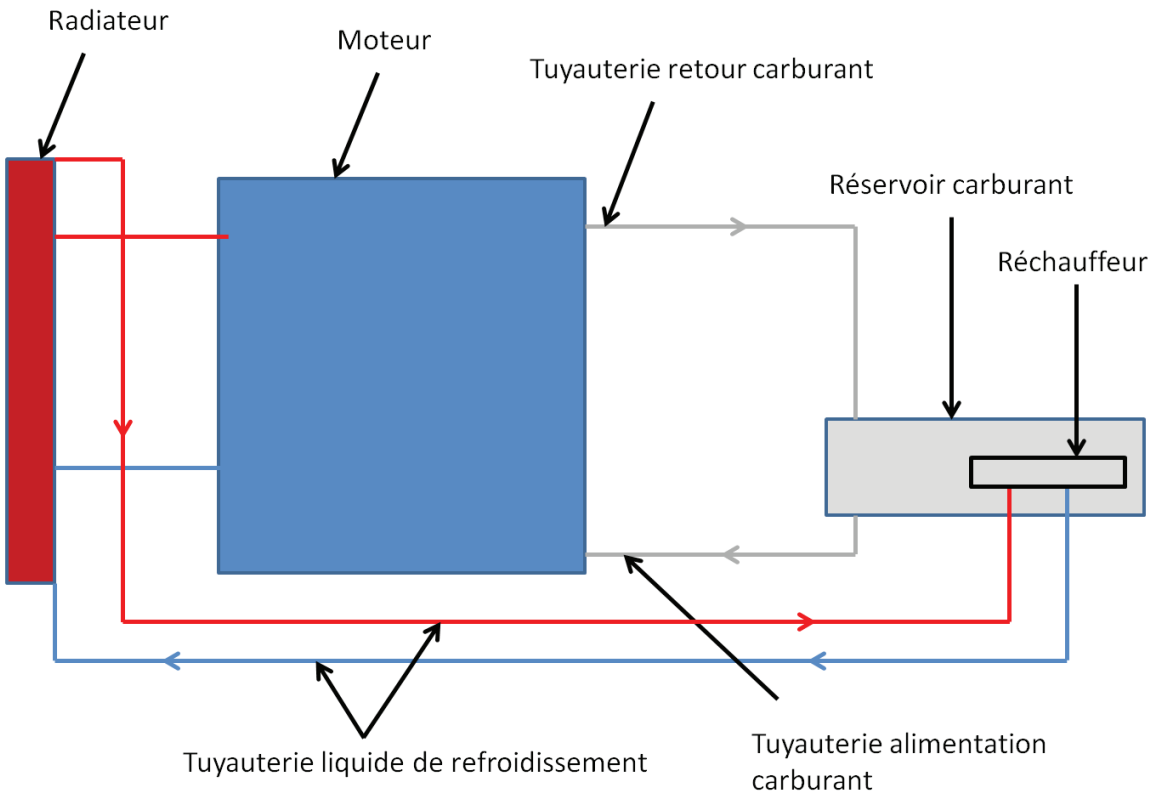




F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

## 2. Definition and functioning

Every fuel can power a generator. The most frequent are gas, diesel oil, natural gas, bio fuel and heavy fuel for the most powerful.




Sketch of the composition of a generator

For an easier starting, a generator must first reach a set temperature. When it is shut down, the pre-heater starts functioning and maintains the generator's temperature at the set level.

Once the generator is working, fuel is injected in the engine, which in return produces electric energy and heat.

In order to dissipate the emitted heat, a radiator composed a multitude of small strips disperses the heat through a hydraulic cooling system. It is one of the main equipment of a generator, for it prevents it from overheating.





F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

## AERAULIC ISSUES

### 1. Ventilation

When it is working, the generator uses fuel and produces energy. Generators nowadays are only 50% less efficient compared to the calorific value of the fuel. Meaning that during the combustion, half the fuel is converted into energy while the other half is converted into heat.

During its transformation, the fuel heats the generator. This rise in the temperature can lead to:

- An overconsumption of fuel by the generator
- A reduction of its efficiency
- Sometimes even the breakdown of the engine

The ventilation of a generator is therefore necessary to prevent the system from overheating.

### 2. Preheating

Generators delivering a high power are usually larger and need the permanent maintaining of their temperature to optimize their start.

In order for the engine to already be warm when it is started, a preheating circuit has to maintain the temperature of the generator from the moment it is shut down up to the moment it is started again.

Therefore, for generators located outdoor or when the premises are stocked in an open air intake, preheating can be very expensive in energy because the heat emitted dissipates outside.

### 3. Acoustic issue

A generator generates noise and the noise levels near it can reach very high values (up to 120-130 dB(A)).

Emergence is defined as being the difference between the noise levels assessed when the installation is working and when it is not.

The regulation applying to generators inside a public room is supervised by the neighborhood regulation and the noise on the workplace regulation (see page regulation). It sets the maximum noise levels, values we refer to as noise emergences. It applies to the production following modes:

- Backup
- Reverse backup
- Spike

Furthermore, the law forbids to use noisy engines out of these times:





F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

- On working days from 8.30 to 12 and 14 to 19.30
- On Saturday from 9 to 12 and 15 to 19
- On Sunday from 10 until midday.



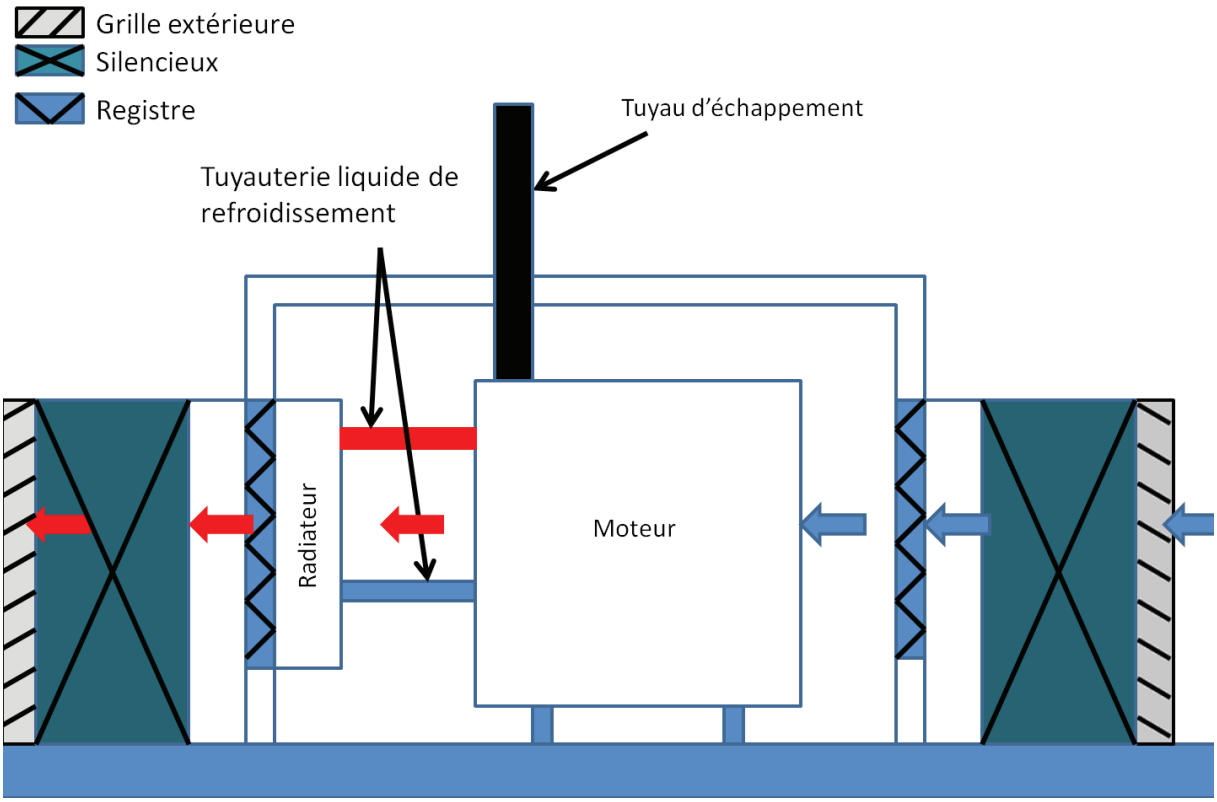


F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

## SOLUTION

### 1. Ventilation

The ventilation system is operated through air intake dampers and an extraction of exhaust air. They are several strategies depending on the location of the fan: before the damper on the air intake, after it or behind the radiator.




When a powerful generator is located in a small premise, the radiator can be placed outside.

### 2. Preheating

In order to avoid any dispersion of heat and to reduce energy consumption, shut off dampers are placed on the air intake and air exhaust, and closed when the generator is shut down.





F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

This layout enables to preserve the heat in the premises, reducing the costs linked to the maintaining of engine's temperature when it is shut down.

## 3. Acoustic

### a. Radiated noise

It is essential to lessen the noise emitted by a generator through the use of devices such as:

- Acoustic protection of the engine itself when there are no premises dedicated only to the generator. It is covered with insulating panels in mineral wool that lessens the noise emergences.
- Processing of the walls: when a generator is in a dedicated premise, the walls are equipped with acoustic splitters absorbing the noise emergences.
- Closing by sound-proofing doors.



### b. Propagated noise

Solutions are also deployed to treat the premises acoustically:

- Splitters placed on the air intake and air exhaust enable, through the use of mineral wool membranes, to lessen the vibrations of the airflow going in and out, lessening the overall acoustic level.
- Silencers enable to lessen the noise propagated through to exhaust pipe.
- Anti vibration rubber pads are fastened under the engine and enable the absorption of part of the vibrations created when the generator is working.



F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

## REGULATIONS

### Acoustic

Neighboring noise, 2006-1099 decree of 31 august 2006

This decree describes the regulations to which tunnel's equipments are subject when they are near an inhabited area. The maximum values for emerging sounds are 5 dBA per day and 3dBA per night to which is added a corrective in db(A) that depends on the cumulated span of apparition. In the case of a generator, the ventilation operates continuously and no corrective is added.

http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000459023&dateText

Noise on the working place:

These decrees set the minimum security and health prescription regarding workers exposures to loud noises.

| | Daily exposure to noise | | Peak point | |
|---|---|---|---|---|
| **Level of application** | **European** | **French** | **European** | **French** |
| **Standard** | 2003/10/CE Directive | 2006-892 decree of 19 july 2006 | 2003/10/CE Directive | 2006-892 decree of 19 july 2006 |
| **Exposure limit value** | 87 dB(A) | 87 dB(A) | 200 Pa | 140 dB(C) |
| **Superior exposure values inducing measures** | 85 dB(A) | 85 dB(A) | 140 Pa | 137 dB(C) |
| **Inferior exposure values inducing measure** | 80 dB(A) | 80 dB(A) | 112 Pa | 135 dB(C) |

Europe:

2003/10/CE Directive

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0010:FR:HTML

France:

2006-892 decree of 19 July 2006

http://www.legifrance.gouv.fr/jopdf/common/jo_pdf.jsp?numJO=0&dateJO=20060720&numTexte=14&pageDebut=10905&pageFin=10908



ISO 9001 14001 Certified

F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

F2A Equipementier en traitement de l'air

Article 4 of 23rd January 1997 decree, concerning noise emergences of structures classified for the environment protection

Transport vehicles, construction materials and construction vehicles used inside the premises must comply with the legal dispositions regarding their noise emergences.

http://www.ineris.fr/aida/consultation_document/5737

Public rooms' regulation

This document describes the obligation for public rooms to have a smoke exhaust system for firemen's use, using a generator as backup.

http://groupe-electrogene.comprendrechoisir.com/comprendre/reglementation-groupe-electrogene

**Generators' regulation**

2004/8/CE directive of European Parliament of 11th February 2004 concerning Cogeneration

This directive tends to reinforce the use of cogeneration in Europe, especially by praising the energetic efficiency it enables to reach. In the long term the directive will aim at creating a framework for high efficiency cogeneration to reduce carbon dioxide emissions and limit the discharge of other substances during the energetic production.

http://europa.eu/legislation_summaries/energy/energy_efficiency/l27021_fr.htm



19th November 2001 decree

Article EL 7

Premises where the generators are installed, whatever their power, must be largely ventilated on the outside.

Section IV, Article EL 18

Generators must be subject to regular maintenance:

- Oil level verification, water and fuel, heating device and the heating device of the power source used for the starting of the engine.
- Test every month of the automatic start with a charge of at least 50% for 30 minutes.

http://www.syndicat-eclairage.com/upload/documentation/21%20Arr%C3%AAte%20du%2019%20-11-2001%20S%C3%A9curit%C3%A9.pdf

HSOE/E4/2005-256 decree of 30 may 2005 concerning the technical conditions of hospitals' power supply.

Normal and backup installations must be tested at regular periods. Back up generators must at any time be able to take over the public power supply of all priority services.

http://www.sante.gouv.fr/fichiers/bo/2006/06-10/a0100027.htm

## F2A SOLUTIONS

### Acoustic louvre SONIE GNB

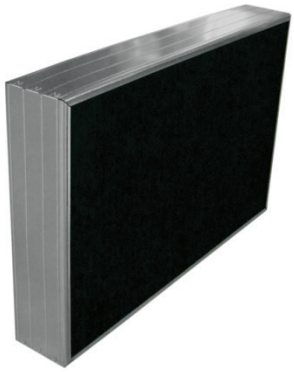
Good acoustic attenuation.

- Anti-sand device
- Sound proofing : rot-proof and water repellent mineral wool insede the blades
- ANti-bird wire mesh
- Double louvre (series assembly) for better attenuations
- Acoustic performances tested in laboratory



### Acoustic splitter SONIE BS+ (and silencers) :

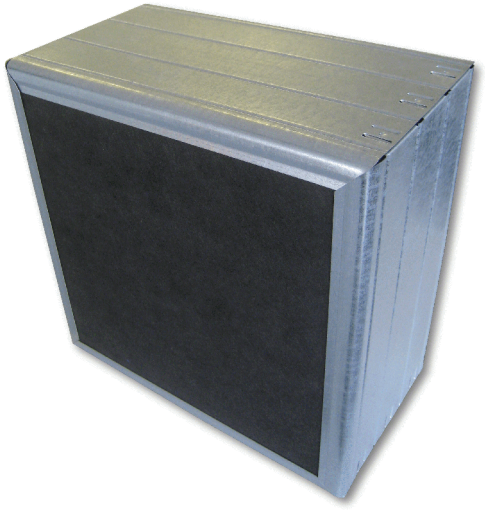
SONIE BS + acoustic splitters are designed to be installed in aeraulic networks and enable to attenuate the noise generated by the ventilation system.



- Performances tested in laboratory (EN 7235)
- Easy to handle and install : 35% lighter
- Better attenuation in low frequencies
- Anti-errosion protection : glass silk
- Fire class A2

### Acoustic splitter Sonie BMI

- 1/2 internal resonator



- Anti-errosion protection : glass silk
- Pressure drop reduced by 30%
- Fire Class A2



## PLO/PLS Damper

- Large size commercial damper

- Withstands up to 2 000 Pa
- As an option, damper can be motorized

PLS :

- Airtightness upstream/ downstream class 3 according to EN 1751
- Can be coupled with : anti-bird wire mesh, weather louvres, filtering plans.



F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr

## External louvre GN/GH :

- Optimized pressure drop
- Weather louvre
- Anti bird wire mesh
- Large sizes without intermediate backing
- Possible assembly with a sound attenuator or volume control damper
- Frame and blades in galavnized steel





F2A - 70 Impasse des Barmettes - Parc d'activités des 2B - F 01360 BELIGNEUX
Tel. +33 (0) 4 78 06 54 72 - Fax +33 (0) 4 78 06 53 45 - E-mail : f2a.info@f2a.fr