

# COMMERCIAL BUILDINGS

## CONTEXT AND ISSUES



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### CONTEXT

#### 1. Definition :

Every since the 50's, the commercial sector has been expanding at the expenses of agriculture and industry sectors. Nowadays, France is ranked second in terms of services exportations. The commercial sector includes offices, hotels, public rooms, public buildings, shops and professional kitchens. In 2010, in France, 78% of people were employed in the commercial sector or 20.5 million people and that represents 70% of the national GDP.

The energetic efficiency and the costs of a commercial building are central issues during their construction. Those practices are regulated by the RT 2012 that recommends an ever higher degree of airtightness in this type of buildings in order to reduce energy losses.

To renew the air in these airtight buildings, a control over the ventilation is compulsory and a standard fresh air blowing rate has been set up (18m<sup>3</sup>/h per person).

These different commercial applications present similar issues that will be reviewed before presenting each of their specific constraints.

#### 2. Issues and comon constraints

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##### a. Smoke exhaust and compartmentalization constraints

##### Smoke exhaust constaint:

In a commercial building, one of the main issues is the evacuation of users and a direct access for firemen in the event of fire. Smoke exhaust systems are set up to prevent the main dangers:

- Visibility loss, preventing auto-evacuation,
- Asphyxia due to the inhalation of harmful smokes

##### Compartmentalization constraint:

In order to lessen the risk of fire propagation through the ventilation duct, it has to be equipped with fire dampers. When a ventilation duct goes through a fire resistant wall, the fire damper must have the same level of resistance as the wall.



### b. Energy efficiency and high environmental quality

Energy performance is evaluated with the criteria of RT 2012. It also sets the energetic threshold of low consumption buildings, limiting the heating, cooling, ventilation, lighting consumption at 50 kW/h/m<sup>2</sup> and 80 kW/h/m<sup>2</sup> for renovated buildings (depending on the location and regulation).

There are other labels such as Effinergie, or HQE (High Environmental Quality). These labels enable to benefit from subventions or just to improve the image of the building. In the long term, these labels are meant to create BEPAS (passive energy buildings) and BEPOS (positive energy buildings).

### c. Comfort and sanitary quality (air quality, CO<sub>2</sub> and O<sub>2</sub> quantities)

One of the main issues of ventilating a commercial building is the comfortable and efficient diffusion of air. The comfort criteria to obtain in an occupied area are:

- Absence of stratification: when the air is no longer in movement, and it hasn't been blown enough, differences in temperature emerge on the height of the premises inducing a sensation of discomfort and trouble breathing.
- Absence of air draught: if the residual velocity of air is too high in an occupied area (over 0.20 m/s) the thermal exchange with the occupant increases and induces cold sensations.

However, blowing the air in the premises contributes to a better air quality. The more important the mixing rate is in a premise, the better the air quality is, for it lessens pollutants concentration. It is also necessary to reach a compromise between hygiene and comfort in order to respect the minimum air renewal rate without disturbing the occupants with air draught.

Most of commercial buildings are equipped with filters of variable efficiency. In some applications, in particular in polluted environments (ex: Shanghai, Tokyo, Mexico), extremely tight filters are installed behind the ventilation units so as to filter the outside air before its distribution in the building.



*Photography of Shanghai during a pollution spike*



### d. Acoustic

In order to ensure good working conditions to the people that are in the same premise all day long, it is important that the overall noise level does not bother them when neighboring machines are working. The main noise emergences (difference between the ambient noise level with and without the noise generated by the functioning of ventilation equipments) come from the functioning of heating and cooling equipments.

An acoustic study is often needed to set the most adapted treatment enabling to reach the requirements set by the acoustic engineering office that generally relies on the existing regulation.

### e. Recap of comon constraint in commercial buildings :

It is important to note that an efficient ventilation reduces the air relative humidity, hereby reducing condensation and increasing the buildings lifespan.

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Constraint /Sectors	Offices	Shops	Public rooms
Fire resistance	++	+++	+++
Performance and High Environmental Quality	++	+	+++
Comfort/ Sanitary quality	++	++	+
Acoustic	++	+	++



### MANY AREAS OF APPLICATION

#### 1. Offices

Ventilation in an office answers the following issues :

- hygiene,
- comfort,
- energy costs.

The main technical constraint is to ventilate the entire office, in order not to create dead zones where the polluted air would concentrate, while keeping in mind that offices are flexible spaces that adapt to different possible modifications.

In order to reach an efficient solution, offices can be equipped with variable air flow ventilation equipments. The hygiene ventilation air flow of 18 m<sup>3</sup>/h per person is respected in rooms where the number of people is set and in rooms with variable occupants, like meeting rooms, the air flow is variable (see III.1)

Acoustic noise pressure levels are set according to the work regulation (indoors) and neighboring noise regulation (outdoors).

#### 2. Shops, Supermarkets, commercial agencies

In the case of shops and other businesses, the notion of thermal comfort is part of the selling process.

The air treatment equipments' integration must be set in an overall architectural logic. Depending on the architect and the required aesthetic, the ventilation equipments will be hidden or on the contrary exposed in a perspective of industrial decoration.

Air treatment equipments must adapt to the issues of the client's flow, depending on the time of influx and on the frequency of doors and windows opening.

#### 3. Public rooms : Schools, Public buildings, university, Airports, Pools, Train stations

Public rooms are buildings with a specific regulation. Fire safety is the main issue of this kind of application in order to ensure public and workers safety. These structures are also confronted to high acoustic constraints, related to the noise on the workplace regulation and neighborhood regulation.



### 4. Kitchen

The main issue with professional kitchen mostly is about hygiene, hygrothermal comfort and noise emergencies.

Because of the smokes and elevated humidity induced by the cooking of food, the air renewal rate must be efficient. In average a renewal rate of 40 to 50 Vol/h is advised.

The extraction of smokes in kitchen is considered as smoke exhaust and the regulation of fire safety therefore apply to this kind of ventilation.

To ease the process of washing the splitters that have received cooking oil, reachable and easily washed solutions are necessary.



### SOLUTIONS

#### 1. Sanitary ventilaton methods

There are several ventilation sanitary strategies depending on the size of the premises, their exposure to pollutants and the number of people working in it. We can distinguish 3 types of ventilation:

- Natural or static ventilation: it relies on two elements, wind and the temperature difference between inside and outside air. The wind enables to make the fresh air go inside the building and through a convection phenomenon, the outside air blown in the upper parts, usually through opening on top of windows, is gradually warmed, rises and is extracted through the ceiling.
- Double flow ventilation is the most used in commercial premises. It consists in bringing fresh hair in the premises through good induction, enabling fresh and exhaust air to mix and therefore to reduce the pollutant levels. The intake and exhaust are mechanically handled.
- Variable flow ventilation is used in premises where the circulation rate is variable, like in meeting rooms or dining halls. They are three types depending on the sensor in the room:
  - Motion sensors: it detects whether there is someone in the room or not. When a person is detected, the maximum extraction rate is engaged whatever the number of occupants. This operating mode is called on/off.
  - CO2 sensor: it detects the level of CO2 in the room and engages the ventilation according to the needed extraction air flow. This system enables to have thresholds and therefore adapts to the occupants' need for fresh air. This operating mode is called modulating.
  - Temperature sensor: the air flow is set according to the temperature in the room.

#### 2. Smoke exhaust

Smoke exhaust strategies follow the same set up in the different buildings composing the commercial sector.

During a fire, smoke exhaust lies on two major steps:

- Air intakes louvres are implanted in the lower parts bringing in fresh air and creating a layer of non polluted air, enabling the users to evacuate the premises in relative safety.
- This fresh air intake is coupled with an exhaust air in the higher parts and a smoke exhaust duct that blows the smokes outside.

The objective is to avoid the stratification of smokes in circulating areas. The height of rooms and hallways is often low and a stratified smoke without a proper exhaust system invades the hallways in very little time.





### 3. Reduce energetic costs

The RT 2012 brought with it innovations in the field of energy consumption reduction. This regulation results in technological innovation for ventilation equipments:

- Heat exchanger: it enables the recovery of outdoor or indoor heat for a structure, depending on the season, by making the air flow pass on two separated height. That process enables their temperature to harmonize.
- Reduced pressure drop: by reducing the pressure drop, the power needed to cool down a building is lessened.
- Network's airtightness: by improving the ventilation elements' airtightness, the efficiency when heating and cooling gets better. A better efficiency leads to a reduction in energy costs.

### 4. Acoustic

Acoustic solutions for the treatment of commercial building's noise emergencies are divided in three great types:

- Environmental: relative to the layout of office equipment, flooring, insulation, materials of the walls, the presence or not of acoustic panels between the different offices and to the ambient noise caused by people and office equipments (computer, printers).
- Dimensional: An under-sized or over-sized network will increase the noise regeneration and increase the ventilation equipments' noise emergencies. One solution to this problem is the correct sizing of these low speed ventilation networks in order to lessen regeneration.

Volume control dampers must also be properly sized, whether they are at constant or variable airflow, fire backdraught dampers and diffusers. The latter can be a great cause of disturbances in the room, if it is too small for the air flow.

- Linked to equipments: in order to limit the functioning fan or cooling unit's noise silencers are placed on the air exhaust. The silencers are sized depending on the requirements of each application. The insulating material of the silencer will absorb part of the air vibrations and lessen the overall noise pressure.





### REGULATIONS

#### Acoustic

Neighboring noise, 2006-1099 decree of 31 august 2006

This decree describes the regulations to which commercial buildings 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 work place:

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

Level of application	Daily noise exposure		Peak point	
	European	French	European	French
Standards	2003/10/CE Directive	2006-892 decree of 19 July 2006	2003/10/CE Directive	2006-892 decree of 19 July 2006
Exposure limit values	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 measures	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/jopdf.jsp?numJO=0&dateJO=20060720&numTexte=14&pageDebut=10905&pageFin=10908>



**Acoustic regulation in schools imposed by the NRA** (concerning construction license dated after 1st January 1996).

Acoustic pressure levels generated by the building's equipments that cannot be exceeded in premises:

Premises	Équipements fonctionnant	
	en continu	par intermit-tence
Libraries, information and documentation ceters, medical premises, rest rooms	33 dB (A)	38 dB (A)
Teaching premises, musical classrooms, calm workshops, adminis-tration, dining room, general purpose room.	38 dB (A)	43 dB (A)

<http://www.bruit.fr/tout-sur-les-bruits/logement-mal-isole/logement-neuf/la-reglementation-acoustique-applica-ble-aux-logements-construits-apres-le-1er-janvier-1996.html?format=pdf>

Insulation to equipments' noises

For equipments' noises, the required performances correspond to the maximum noise level that must not be exceeded in a reception premises (standardized acoustic pressure level):

- Ventilation equipments (Set up at minimum airflow ) : 30 dB(A)
- Sound proofing to outside noises: the front walls must attenuate outdoor noises by at least 30 db(A)

### Thermal regulation

RT 2012

It describes the French objectives regarding the environment, by establishing energetic efficiency standards for buildings, through the integration of new ventilation systems, a valuation of the certification, an assessment of the energy consumption and a control of the quality of the installations.

<http://www.rt-batiment.fr/batiments-neufs/reglementation-thermique-2012/textes-de-references.html>

### Air flow regulation

NF EN 13779 July 2007

This standard applies to the making of ventilation and air conditioning systems for non residential buildings subject



to human occupation, except for applications such as industrial process. It also describes the minimum airflow in sanitary ventilation set at 18m<sup>3</sup>/h.

### Fire safety

14th February 2000 decree Article 28

It specifies the setting places for different types of ventilation (comfort or air exhaust) as well as the location of the fresh air intakes.

<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000205424&dateTexte=>

### Fire safety

#### European regulation:

Technical instruction 246, modified by the 22 March 2004 decree concerning smoke exhaust processes in public rooms

It states that in a public room, stairways and common circulation areas must be cleared of smoke.

<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000436811>

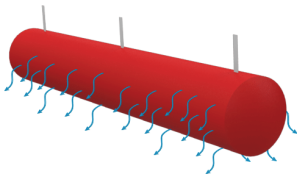


### F2A SOLUTIONS

#### Textile duct

##### Texi-Soft

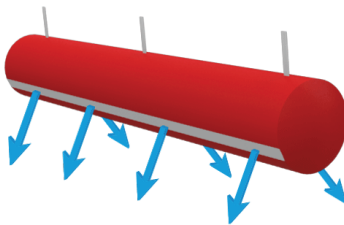
Designed for low speed diffusion.



- Very low velocity diffusion
- Minimal air movement (filling effect)
- Low pressure needed
- Low sound level
- Design: Perfect fitting (tailor-made shapes and colors)

##### Texi-Pulse

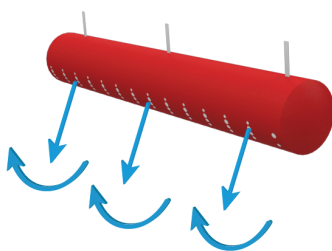
Designed for average speed diffusion through diffusing slots



- Controlled residual speed
- Important air flow by diffusing linear meter
- No dust clogging
- Design : perfect fitting (tailor made shapes and color)

##### Texi-Jet

Designed for high air velocity diffusion through rows of perforation



- Airflow distributed on request
- Guaranteed efficiency in heating and cooling
- Air velocity control: no draught
- Available in public building version : M0 Certified
- No risk of clogging
- Design: perfect fitting (tailor-made shapes and colors)



### Rectangular dampers



#### **Volume control damper, large sizes PLO**

Designed to adjust the volume of air flow in large sized ventilation networks in commercial buildings

- Good handling, aerofoil blade
- Large sizes : 2 000x 1 950 mm
- Available with manual or motorized control

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#### **Volume control NW0**

Designed to adjust the volume of air flow in the ventilation networks in commercial buildings.

- Easy to handle: aerofoil blade
- Settings accuracy
- Delivery time: 48h exworks
- Available with manual or motorized control
- Kit version : quick assembly



### Smoke exhaust and shut-off damper MOD

Highly efficient for smoke exhaust.

- Withstands pressure up to 3 000Pa
- Leaking rate class 3 (according to EN 1751)
- Certified 400°/2h and 600°C/1h

**400°C/2h**

### Circular dampers :



### Iris damper RCI

RCI damper is designed to adjust and measure the air flow in ventilation networks.

- Position indicator
- Pressure plugs: air flow measurement
- Delivery time: 8 days
- Accurate and easy settings



### Constant air volume damper - RCC



The RCC damper is an airflow self regulating system without any external power supply. This adjustable device enables to maintain a constant air flow in the ventilation network despite pressure variations.

- Accurate and easy settings of the air flow
- Quick to assemble
- No maintenance
- No power needed
- Available in insulated version: mineral wool of 50mm

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### Variable air volume damper - RCV



The RCV damper is a self-regulated system with adjustable air flow. It enables to control the air flow in a building's zone according to specific instructions.

- Factory setting of the airflow rate
- Pressure plug for control and maintenance
- Possible use in constant air volume
- Regenerations tested in a laboratory (EN 7235)
- Supplied with a circular duct silencer in option





### Circular volume control damper RCO

Circular damper RCO is designed to adjust the volume of air flow in ventilation networks for commercial HVAC applications.



- Connection with gasket: good network's airtightness
- Easy settings
- Frame's airtightness: class C (EN 1751)
- Available with manual or motorized control

### Circular airtight damper RCE

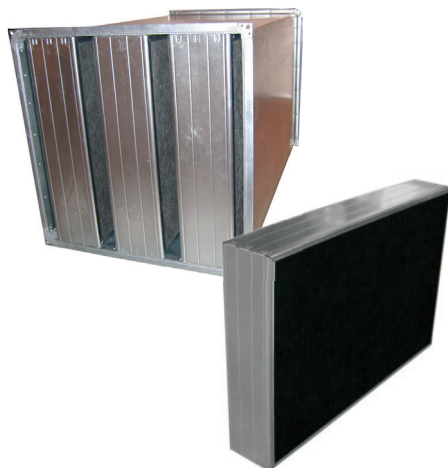


Circular damper RCE is designed to shut off circular ventilation networks. It is suitable for clean room HVAC applications (laboratories, hospitals...)

- High airtightness: class 4C (EN 1751)
- Connection with gasket: network's airtightness
- Easy settings
- Available with manual or motorized control



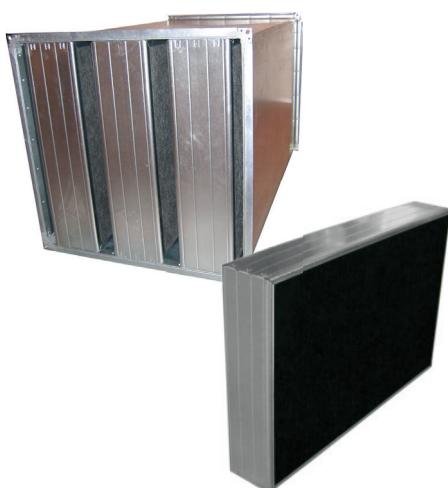
### Acoustic splitters SONIE BS



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

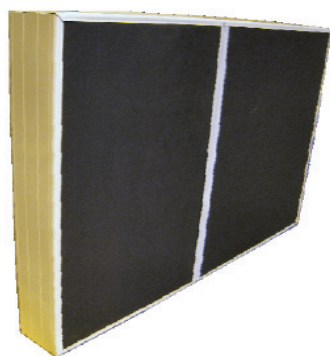
- Performances tested in laboratory (EN 7235)
- Aerodynamic frame: optimized pressure loss
- Anti-erosion protection
- Fire class A1
- Delivery time: 48h exworks (express version)

### Acoustic splitters SONIE BS +



SONIE BS+ acoustic splitters are designed to be installed in aeraulic networks and enable to attenuate the noise generated by the ventilation system. SONIE BS+ splitters offer a better sound treatment for low frequencies: +10% attenuation between 250 & 500 Hz compared to standard splitters

- Performances tested in laboratory (EN 7235)
- Better attenuations in low frequencies
- Easy to handle and install: 35% lighter
- Fire class A2-S1-D0

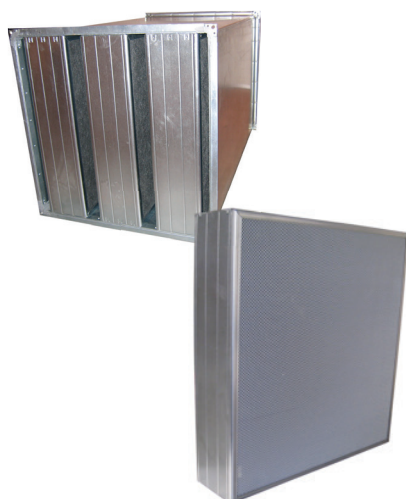


### Acoustic splitter anti-erosion Sonie BL

SONIE BL acoustic splitters are designed to be installed in aeraulic networks and enable to attenuate the noise generated by the ventilation system. It is particularly adapted to clean rooms (laboratories, operating rooms...).

- Performances tested in laboratory (EN 7235)
- Anti-defibration coating: fiberglass fabric
- Aerodynamic frame: optimized pressure loss
- Fire class A1

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### Acoustic splitter Sonie BD+

Les baffles acoustiques SONIE BD+ s'installent dans les réseaux aérauliques et permettent d'atténuer les nuisances sonores générées par le système de ventilation. Elles sont particulièrement efficaces dans les applications de désenfumage.

- 400°C / 2h certified
- Tests in independent laboratory (EN 7235)
- Easy to install: lighter
- Anti-erosion protection with spread metal sheet
- Fire class A2-S1-D0



### Circular silencers Confort range



CONFORT circular silencers are of direct type and enable to reduce the noise generated by the ventilation system.

They are usually installed in secondary networks and enable an additional acoustic attenuation.

- Performances tested in laboratories (EN 7235)
- Negligible pressure loss
- Delivery time: 1 week exworks (depending on diameter)
- Classement Euroclasse A1

### Circular silencers Optimum range



OPTIMUM circular duct silencers enable to reduce the noise generated by the ventilation system. They are equipped with a central sound-absorbing splitter providing excellent acoustic performances

- Performances tested in laboratory (EN 7235)
- V-shaped profiles: optimized pressure loss
- High performance attenuations
- Delivery time: 1 week exworks (depending on diameter)



### Acoustic louvre SONIE GNB

The GNB acoustic louvre enables to reduce the ventilation noise on frontage buildings. It can be placed either for air intake or air discharge. The GNB acoustic louvre is particularly adapted to commercial applications

- Good acoustic attenuation
- Performances tested in laboratory (EN 7235)
- Weather louvre

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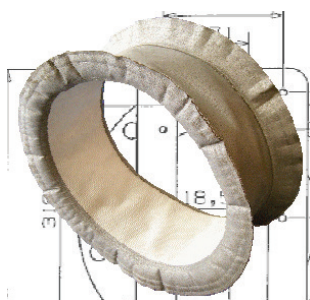
### Flexible connectors



### Airtight framed sleeve Elyt +

The airtight duct connector ELYT+ has been designed to connect ventilation equipments to rectangular ductworks.

- Reducing energy consumption
- Airtightness: up to class D (EN 15727)
- Turnkey flexible sleeve
- Easy and fast to instal



### Custom-made flexible sleeve Elyform

- Custom-made shapes : conical, rectangular...
- Every type of connection
- Tailor-made designing and manufacturing
- Heat resistance : 400°C/2h

### Weather louvres



#### Small format weather louvre GB

The GB weather louvre can be used for air intake or air exhaust. It is suitable for external wall mounting and is dedicated to commercial applications

- Low pressure loss
- Weather louvre
- Delivery time: 48h exworks (express version)



### External weather louvre GN/GH

Large size louvre used for air intake or air exhaust.

- Large dimensions
- Weather louvre
- Possible assembly with a sound attenuator or volume control damper
- Materials: Galvanized steel, painted steel: RAL colour on request, Aluminum, Stainless steel

### Backdraught dampers



#### Overpressure and depression backdraught damper **BS/BD**

Permet de maintenir une surpression ou dépression dans un local ou dans le réseau de ventilation

- Low pressure drop
- Assembly on front
- Frame : galvanized or stainless steel, aluminum





### Low pressure backdraught damper AS

Backdraught damper AS is designed to allow airflow in one-way direction.

- Large sizes
- ALuminum blades
- Duct installation