

## Rare gases properties

- Chemically inert
- Non toxic
- Sealants compatible
- Non-sensitive to UV
- Colourless
- Non-flammable
- Air gases, infinitely renewable

## Why use IGAL™ for glass windows:

- Thermal comfort
- Acoustic barrier
- Financial gains
- Environmental friendly
- Longer life for windows

## Why choose Air Liquide as your supplier?

- Expertise of a world leader in industrial gases
- 20 years of experience in glass insulation technology
- Technological support to optimize the filling process
- Specific IGAL™ offer for the IG market
- Reliable and fast supply
- IGAL™ – the mixture manufactured in Air Liquide's production plant in Dąbrowa Górnicza, Poland



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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 78 countries with approximately 64,500 employees and serves more than 3.8 million customers and patients.



# Rare gases for insulated glass

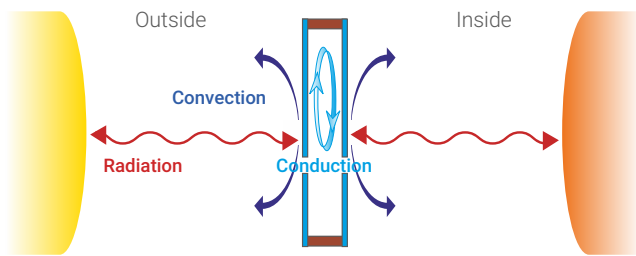


In response to harmful impact on environment and the constant increase on energy prices, European thermal regulations tend to be more and more severe.

### Thermal comfort

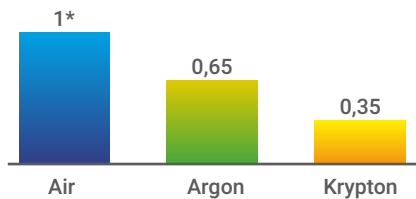
To allow the insulated glass industry to follow regulations and protect the environment, Air Liquide has developed a rare gases solution which increases the window's performance.

#### Heat transfer through IG



#### Rare gases interact on conduction and convection

Thermal Conductivity



Krypton is 3 times less conductive than air and, thanks to its high density, also reduces convection effects, making thermal insulation much more effective.

\* Air normalized at 1

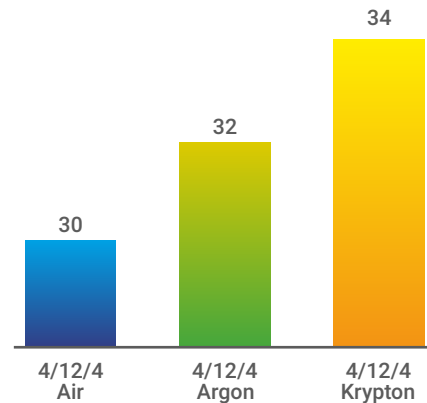
More than 20% of the European population is exposed to acoustic contamination, thus the EU emitted a regulation concerning noise pollution in 2002. In this respect, each country has to establish a "noise map" in cities overcoming 100 000 inhabitants to fight against sensible areas (airports, railways...)

### Acoustic barrier

Air Liquide's rare gases solution allows to obtain a better sound insulation, where IGAL™ mixture shows the best performance.

#### Rare gases reduce sound transmission

Sound resistance coefficient (measured in dB)



For a 3 points increase of the sound resistance coefficient, the noise perceived is reduced by 50%.

IGAL™ is an innovative technology bringing many benefits in glass insulation technology.

### Financial & environmental gains

To compare the benefits of the different gases we will consider a 100 m<sup>2</sup> house, heated using electrical radiators (5000 hrs/year), with 20 m<sup>2</sup> of windows (4/12/4 mm).

Windows can be of 3 types:

- standard double pane windows (clear glass) filled with air
- double pane windows integrating a coated glass filled with Argon
- double pane windows integrating a coated glass filled with Krypton



The table below shows electricity consumption and CO<sub>2</sub> emissions using different gases between panes.

	Air	Argon	Krypton
Electricity	1 unit	0.45 units	0.35 units
CO <sub>2</sub>	460 kg	210 kg	140 kg

#### Longer life for windows

Rare gases allow thinner gap between panes (10 mm for Krypton vs. 16 mm for air), which permits lighter structure (especially at high altitude).