

Eco-compatibility and safety: Arneg's choice!

The new environmentally-friendly polyurethane foam (CFC-HCFC-HFC free)



Arneg's attention and sensitivity towards environmental matters ensures that research and development continues with a search to adopt environmentally-friendly products and technologies.

The use of water-based polyurethane foams in all thermal insulation cabinets is a great step forward towards helping the environment, and one that Arneg today is proud to announce to its customers.

Arneg uses a special type of water-based polyurethane foam that is 100% eco-compatible. This is thanks to the use of carbon dioxide (CO₂) as foaming agent, a gas that features extremely low greenhouse effect (Global Warming Potential GWP = 1) and which develops following the chemical reaction between the polyurethane isocyanate and the water.

The mechanical and physical characteristics of this new foam equate to those of the polyurethane in use previously, which, however, contained the high HFC greenhouse gas, R134a, as foaming agent (Global Warming Potential GWP = 1600).

Why use water-based polyurethane foam.

Differences between cyclopentane and CO₂ (water-based) polyurethane foams

One of the main characteristics of a good insulating material, is low thermal conductivity (Lambda).

This value expresses the quantity of heat/energy that 'crosses' the insulating material per unit of thickness, and temperature difference is expressed in W/m²K. The lower this value is, the better its insulating power. The perfect insulation was polyurethane foam with CFC-11. All polyurethane foams coming after this have had increasingly higher Lambda values.

The following table compares the main characteristics of some foaming gases used in polyurethane foams over the years.

		CFC-11	HFC-134a	HFC-152a	CO ₂	CYCLOPENTANE
THERMAL CONDUCTIVITY (W/m ² K)	at 10°C	7,4	12,4	N.A.	15,3	11,4
	at 25°C	7,9	13,8	14,7	16,4	12,8
AIR FLAMMABILITY LIMIT (vol%)		NONE	NONE	3,9-16,9	NONE	1,4-8,0
ODP		1	0	0	0	0
GWP		4600	1600	140	1	0

As seen, regardless of the CFC-11, provided for reference purposes only, the gas featuring the best insulating properties with the least environmental impact (ODP and GWP values null) is cyclopentane.

If, however, we also consider the flammability value (hazard index), we can see that CO₂ is the gas showing the best combination of all characteristics of eco-compatibility and safety.



'BEENVIRONMENT'

synthesises the concepts of active, skillful organisation in the world of commercial refrigeration, striving to support and promote the safeguarding of the environment and the nature in which we live, through the development of low energy consumption products.

There are therefore two main reasons behind Arneg's choice of this gas for its insulating foams:

SAFETY

The flammability of cyclopentane constitutes a significant risk to both internal personal safety and product-related safety (risks in the event of fire), exclusively designed for professional use in public places.

A FEW POINTS ON ENERGY

In an open-type refrigerated cabinet (differently from closed cabinets like the household refrigerator), insulating only affects total thermal load for 9%, and therefore performs a mainly structural function (mechanical bearing capacity and resistance) rather than insulating.

Insulation thickness is therefore defined not on the basis of energy-type factors (consumption), but rather with regards to avoiding reaching dew temperatures in specific thermal hygrometric conditions (preventing formation of condensation).

The reduction of a limited quantity of insulating power does not, therefore, affect the products' quality and energy efficiency, and is an excellent compromise considering the benefits obtained both in terms of safety and the environment.

FURTHER BENEFITS

A critical feature of water-based polyurethane foams is that mould adhesion can be problematic.

To overcome this difficulty, Arneg has worked in collaboration with its suppliers for many years, experimenting various types of water-based PU (polyurethane), in order to reach the quality standards required.

In the end, efforts were rewarded with the development of a specific, high-performance polyurethane system that guarantees not only perfect adhesion to the moulds, but also allows for working at mould temperatures of around 30°C as compared with 40-45°C used previously. This reduction in the mould temperature has granted Arneg significant energy savings in production.

The unique water-based PU system used leads to regular cell dimension and regular foam density distribution, thereby optimising thermal conductivity and resistance to compression.

History

Starting from the late 1950s, the advent of the CFCs has enormously encouraged the development of polyurethane foams using the CFC-11 gas as foaming agent.

This gas has all the characteristics of becoming the foaming agent for insulation par excellence: low molecular weight, boiling temperature close to ambient temperature (23.8°C), low toxicity, non-flammability and low thermal conductivity.

These characteristics have made it possible to develop rigid, closed cell polyurethane foams with excellent mechanical and insulating properties that are simply unobtainable by any other type of plastic foam.

Later, consequent to the infamous problems linked to the destruction of the ozone layer and the Montreal agreements, CFCs were banned as from 2000.

As foaming gases, only gases with lower ODP (Ozone Destruction Potential) values were used, such as HCFC-141b, HCFC-142b and HCFC-22, although values were still not zero (ODP ranging between 0.01 and 0.13), and as such, therefore still damaging to the ozone layer.

Whilst awaiting new ODP=0 gases, the Montreal protocol permitted the use of HCFCs until 2030, whilst European regulations (Regulation no. 2037/2000 EC) established the prohibition of their use as from January 2004.

In Europe, therefore, from this date onwards, most polyurethane foams were developed using gases from the HFC series (HFC-245fa, HFC-134a, HFC-152a) as foaming agents, with values of ODP=0, but high GWP values (140 for 152a up to 1600 for 134a).

The Kyoto regulation (1997) and subsequent European Regulation no. 842/2006 EC on hydrofluorocarbon (HFC) gases have encouraged the development of polyurethane foams using hydrocarbons (HC) as foaming agents, particularly in the sector of household refrigerators and insulating panels for industrial refrigeration cells.

Above all, pentane and cyclopentane marked by values of ODP=0 and GWP=0 proved increasingly popular.

Given the dangers involved in the management and use of these gases, due to their highly flammable nature, at the same time water-based foams with CO₂ were also developed (ODP=0, GWP=1).



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