Heating today

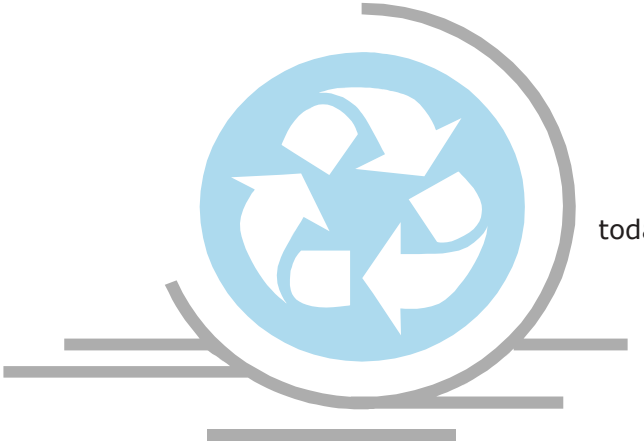
Nowadays, heating is a more demanding market than ever before, made up of professionals in the sector who insist on products of the highest quality capable of guaranteeing comfort, energy savings, and respect for the environment, as well as being esthetically pleasing. This means designing and installing systems that suit every lifestyle.

A number of factors have to be taken into consideration: an overall evaluation of the installation, selection of the material and layout of the terminals. In this connection, we would like to highlight the technical advantages of a heating system with radiators, focusing particular attention on aluminum heating elements.

Why choose an aluminum radiator

These are the main reasons that influence our choices:

1) Environmental concerns
2) Modern material
3) Light weight
4) Resistance to corrosion
5) Modularity
6) Finishing
7) Reduced size
8) High power
9) Excellent heat conductivity
10) Reduced water content
11) Low thermal inertia
12) Low temperature
13) Radiators, condensing boilers and heat pumps
14) A rapid, effective system
15) Energy savings
16) Quality of the heat



1 Environmental concerns

The secondary aluminum alloy EN AB-46100 is used today because of its excellent metallurgical and mechanical properties and for its resistance to corrosion.

It is 100% recyclable.

2 Modern raw material

Aluminum has been used for a little over a hundred years, so compared with iron or steel, metals that have marked the fundamental stages of progress in our history, it can be considered a relatively “recent” metal.

In a short time, aluminum succeeded in imposing itself on modern industrial society, with its excellent technical features and low weight, replacing traditional metals to a large extent.

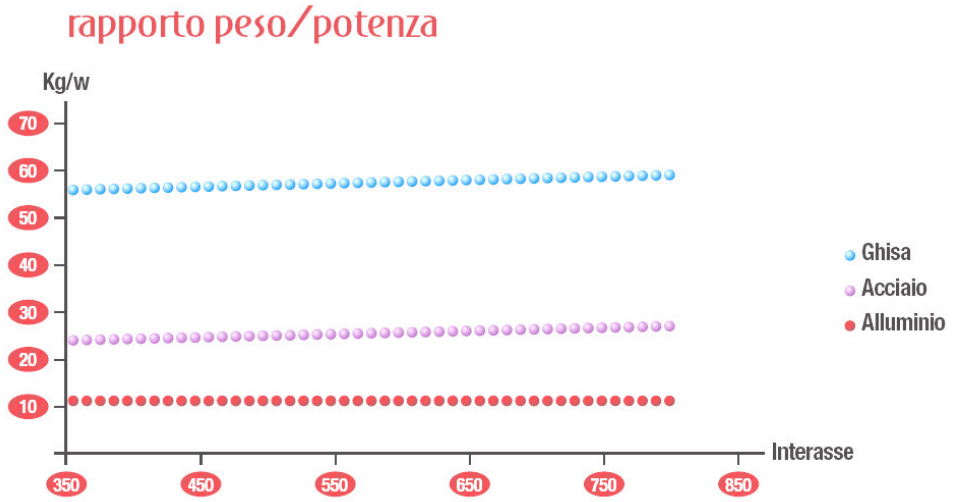
Aluminum is now used by many companies in the manufacture of the widest variety of products for medium and mass consumption, such as auto parts. It is also an excellent conductor of heat and electricity. It has a thermal conductivity of 209.3 W/mK, and extraordinary characteristics of resistance to pressure, making it ideal for the production of heating elements.

3 Light weight

In terms of lightness, aluminum has no rivals among the types of metal used for the production of radiators.

The evaluation is confirmed by the values of the specific weight of each:
The aluminum alloy has specific weight of 2.7 kg/dm^3, while for ferrous metals (steel/cast iron) it is 7.8 kg/dm^3. This is certainly an advantage for the installer during shipment and handling, as well as assembly, reducing the time for installation and above all eliminating the effort of carrying the radiators into the house.

In the same power range, aluminum radiators are much lighter than steel or cast iron radiators.

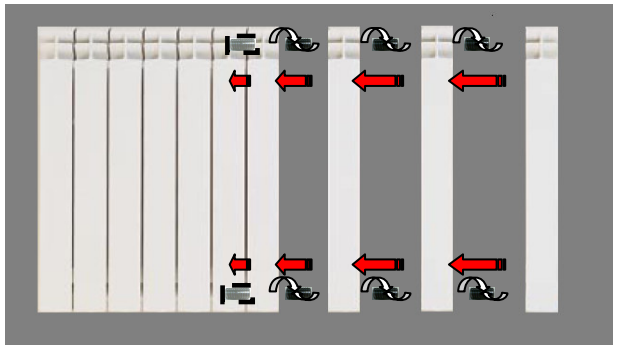


4 Resistance to corrosion

Aluminum has the characteristic of self-passivation: it is its own protection against corrosion through its chemical/physical composition. Diecast aluminum oxidizes in contact with air. The by-product that forms is aluminum oxide (Al2O3, a very hard substance). In the water passage chamber, the protection provided by aluminum oxide reaches a thickness of 3µ (microns), which enables it to resist attack from sludge, sand, etc. The painting operation is preceded by specific multi-layer treatments that give the inner surface excellent resistance to corrosion caused by water in the system and in the environment in which the radiator is installed.

5 Modularity

Aluminum radiators are supplied in pre-assembled batteries with a practical nipple system. It is also possible to add or reduce the number of required elements in a battery. This system makes aluminum radiators extremely versatile, as the number of elements can always be adjusted, both in case of possible corrections during the installation of new systems, or when altering existing installations.



6 Finishing

The painting procedure used for radiators is the most reliable and satisfactory available today; the pretreatment stage ensures that the radiators are clean on the inside and outside and this is fundamental for best operation, as well as protecting them from corrosion at the site where the radiator is installed. The actual painting process is a highly advanced procedure using zirconium fluoride.

The two painting stages are both performed by electrostatic means: the first by anaphoresis and the second by the application of a layer of epoxy-polyester powder (120 µ) for an ecological, flame retardant finish. Both coats of paint are baked in furnaces at a temperature of 180°C, guaranteeing a permanent finish, resistant to impact and abrasion. The process simplifies routine maintenance and cleaning, without requiring any additional costly operations after installation.

ANAPHORESIS

The first coat of paint by anaphoresis is of fundamental importance for the protection of the radiator under normal conditions of use, ensuring longer lasting performance in terms of protection from corrosion and invariability of the color with respect to radiators that, for economic reasons, do not apply this treatment.

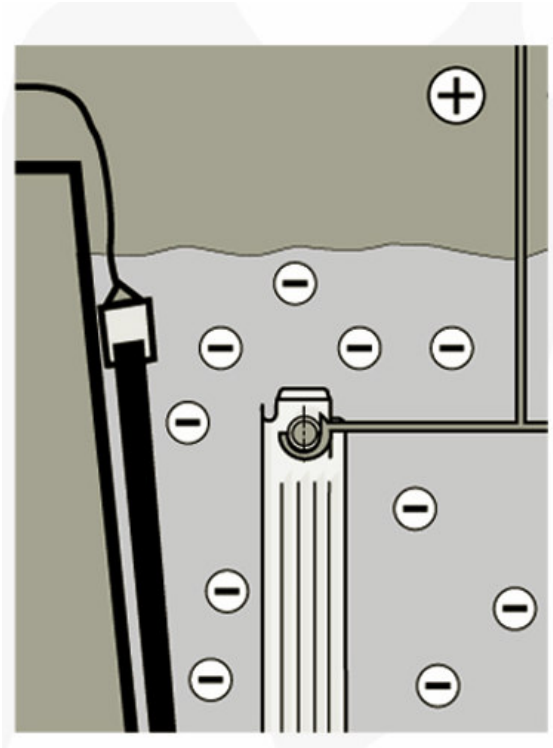
Anaphoresis is a system of painting by immersion in which the paint particles are applied by an electrical effect. The radiator, charged positively, acts as an anode and attracts the paint, which has a negative charge. It is the system that ensures total and uniform protection of the painted part.

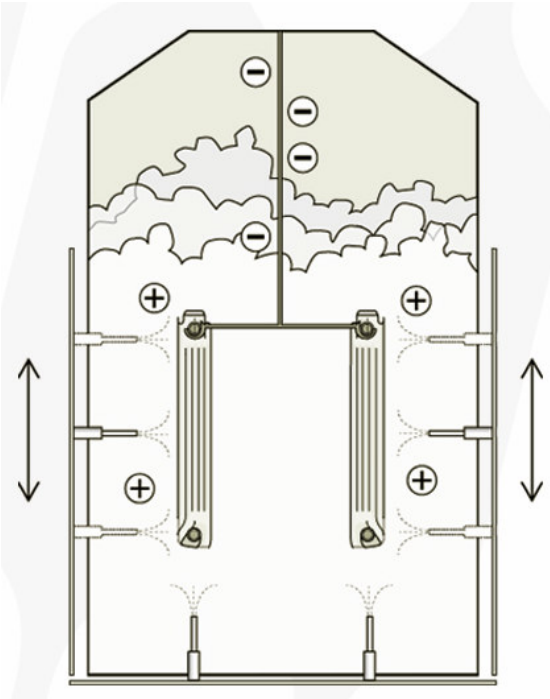
This process permits total painting of the radiator, even between the elements that are assembled to compose it, with the advantage that when the battery has to be disassembled to change its size and thermal power, the end elements are perfectly and uniformly covered with paint. On the contrary, if we remove an element from a radiator painted with **powder alone,** an

unwelcome surprise awaits us: **the inner portions of the elements are not completely painted!**

POWDER

The second coat of paint is applied electrostatically, sprayed directly on the radiator. This gives the radiator its final aspect, with a bright, glossy finish that permits its coordinated, efficient inclusion in any context of interior design.

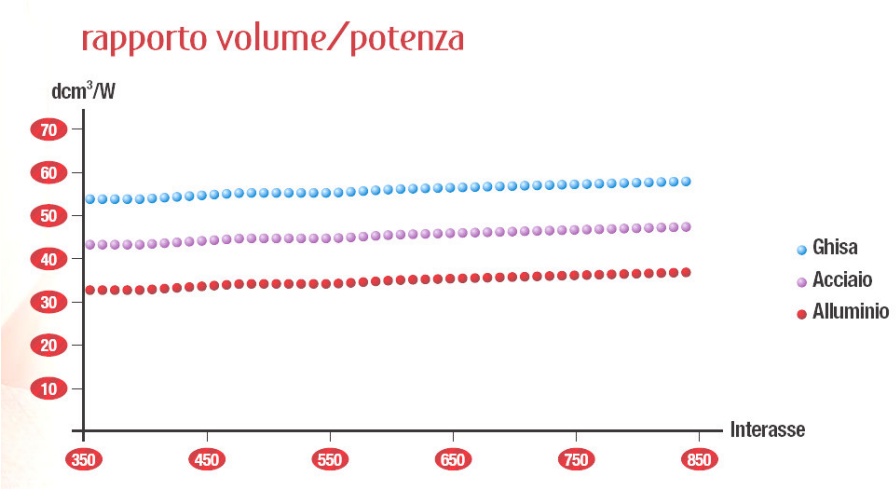




7 Reduced size

Aluminum radiators are more compact, with the same thermal output, in perfect harmony with the needs of residential users, in apartments where space is always at a premium. This makes it possible to reduce the space occupied by the radiators. Suppliers, too, acquire valuable storage space through the smaller size of the elements, in a ratio of 1 to 4 with respect to steel and cast iron radiators.

For radiators of the same size, the output of aluminum radiators is higher than that of steel and cast iron radiators, due to the more efficient development of the fins and higher thermal conductivity of the material.



8 High power

Aluminum radiators, all things being equal, unquestionably ensure the best thermal output.
As a guarantee of the truth of the thermal, hydraulic and construction data indicated on the technical and commercial documentation, all producers of aluminum radiators are required to supply certification in accordance with standards EN 442/1 and EN 442/2 and the EEC certification in accordance with the reference directive 89/106/EEC.
Respect of these standards is a first priority for the companies that belong to the CIRA consortium.

9 Excellent heat conductor

Heat transmission in aluminum radiators is achieved by convection and by radiation.

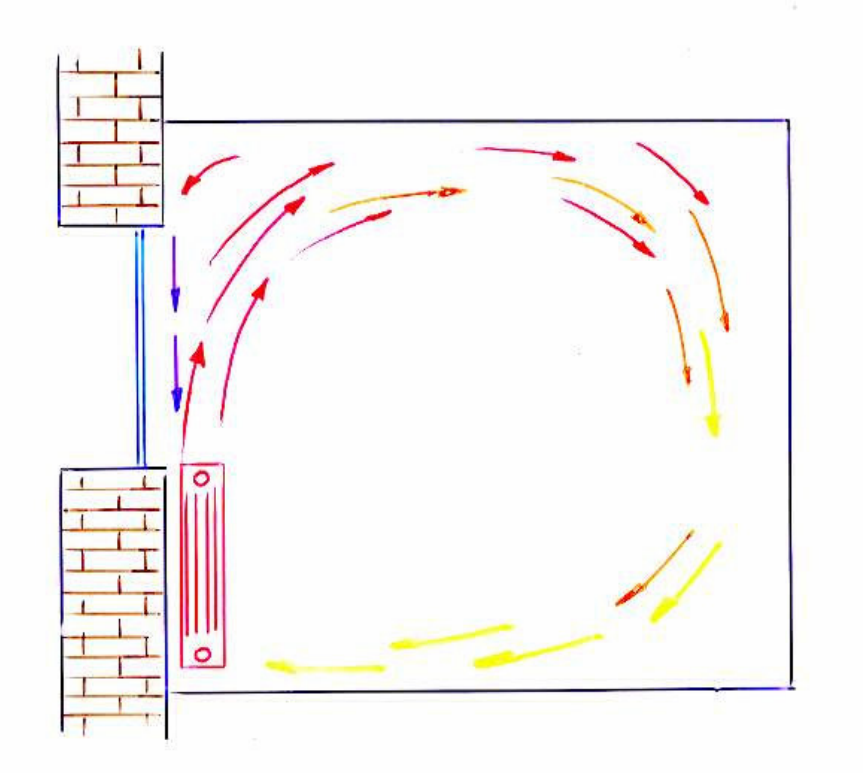
CONVECTION

Convection is the movement generated when air is heated in contact with the walls of the heating element, becomes lighter and starts to rise, causing a convective movement that distributes heat in the room.

RADIATION

Heat exchange by radiation occurs by means of the emission of electromagnetic radiation from the heating element, which is warmer, towards the room, which is colder.

Heating systems that operate mainly by radiation achieve a radiant exchange that, to be appreciable, must occur over a large area.

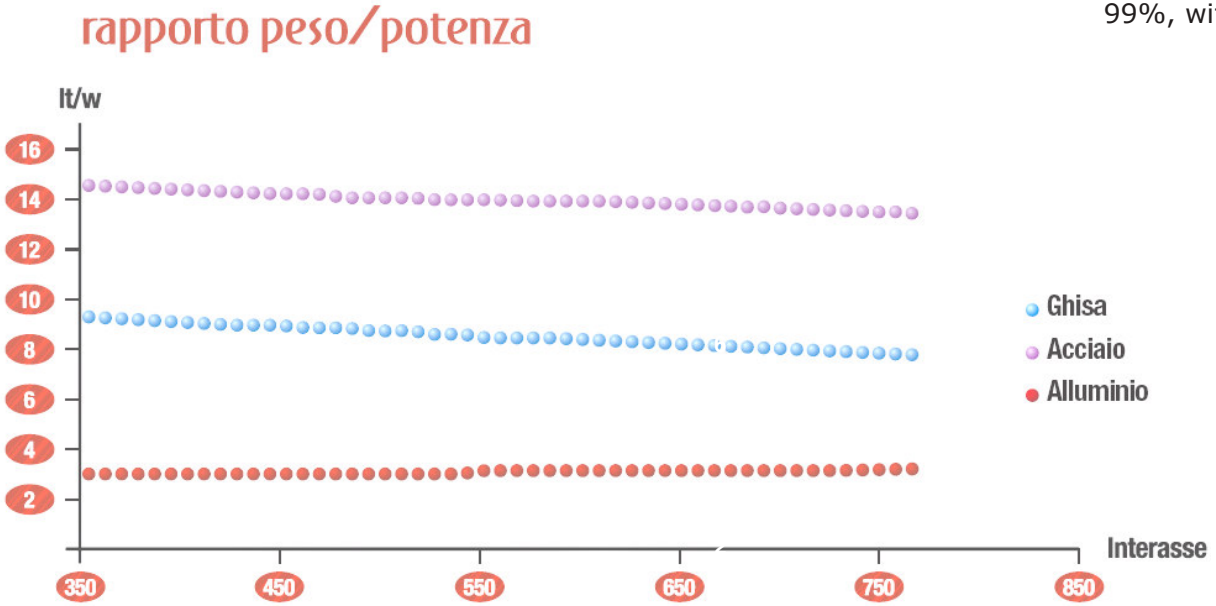


10 Reduced water content

The water content in the system, and thus in the radiators, is a factor that is often overlooked, but one that has important consequences. Over the years, radiators have developed in the direction of reducing the water content.

What is the advantage of less water in the system?

- To improve the thermal inertia of the system.
- Low thermal inertia means high output and ease of regulation: with aluminum radiators it is 99%, with steel or cast iron radiators it can go as low as 75%.
- Reduced size of expansion chambers.
- Reduced wear and consumption of the boiler.



11 Low thermal inertia

The thermal inertia of an installation can be defined as the speed with which the installation responds to changes in room temperature.
A heating system is supposed to maintain the temperature at a set value, reacting rapidly to climatic changes.

There are a number of variables that can affect the temperature in a room:

There can be an increase of the external temperature during hours of sunlight, or an increase of the temperature in the room itself due to the use of electrical devices and appliances that generate heat (light bulbs, ovens, computers, printer, home appliances in general)

These changes make it necessary to reduce the output of the radiators to prevent the temperature to increase too much, with consequent reduction of the comfort and a needless waste of power and money.

Under these circumstances, considering that changes can occur very rapidly, it is important to have systems with low thermal inertia, capable of adapting rapidly to changing conditions, unlike systems in the floor, characterized by very high thermal inertia.

Systems using aluminum radiators have the lowest thermal inertia and lowest water content, and are thus able to quickly adjust the room temperature, adapting promptly to demands for heat and working in perfect harmony with other climate control instruments (thermostatic valves, outside probes, climate control units, etc.) to ensure total comfort while saving money.

12 Low temperature

The aluminum radiator characterized by a large heat exchange area, low thermal inertia and low water content, is the heating element that works best with low temperature systems (from ΔT 35/40 K).

The main objection, regarding low temperature thermal systems equipped with aluminum radiators that we can observe, is the inevitable increase in the area of the heating element, but in this connection a number of evaluations of the practical installation have to be made, where one of the following three situations may be found:

1. In the past, lacking specific design and adequate thermal insulation, oversized heating elements were installed, with much more power than necessary to function at high temperature.
   Later, attempts were made to reduce the thermal dispersion in the rooms, or replace the heating elements with more modern, more efficient ones that, if they were the same size, led to systems that were definitely oversized.

2. In traditional radiator systems, even if the design temperature is relatively high, the furnace may often have to function at low temperature, due to the fact that the size of the system, and thus of the heating elements, has been made considering borderline climatic conditions (for example -5°) that would not occur very often over the season. Actually, during the day, even in the heart of winter,

and in the spring and fall, the heating elements are "oversized", and this means that the system is working most of the time at low temperatures, which exalt the performance of condensing furnaces used with aluminum radiators.

3. Recently, and even more in the future, the improvement of the energy performance of buildings will permit, if operated at high temperature, the installation of much smaller heating elements, while operation at low temperature will permit installation of normal sized radiators

Let us see how, in all three above cases, operation at low temperature can be combined with the aluminum heating elements already installed, or with new correctly designed systems, without using oversized radiators.

13 Radiators, condensing boilers and heat pumps

When we talk about low temperature it is important to consider a few points about the use of condensing boilers and heat pumps with aluminum radiator systems.

As indicated above in section 12, the use of aluminum radiators with a condensing boiler or a heat pump is perfectly feasible, bearing in mind, however, that as the average temperature of the water circulating in the battery drops, the thermal power supplied also decreases, and therefore the size of the heating elements will depend exclusively on their performance under these conditions of use, as indicated in the producers' technical catalogues.

It is also useful to know that, in a condensing heat generator, the fumes are cooled to below the dew point (about 55-56°C with normal natural gas combustion) to recover even the latent heat from evaporation (the energy necessary to take the water to the gaseous state). To lower the temperature of the fumes below this threshold, however, it is necessary for the return temperature of the installation to be as low as possible: for this reason we are hearing more and more about condensing boilers being used with "low temperature" systems.

The best use of the condensing boiler is obtained with the lowest possible return temperatures, but the delivery temperatures need not also be low. We think it is important to stress how heating elements in aluminum offer a high technological content and make it possible to use low temperature installations with condensing type heat generators, in line with the demands of professionals in the heating sector, to design and install systems that are adequate for every home.

14 A rapid,effective system

An installation made with aluminum radiators, in case of abrupt climate changes or particularly cold winters, can fulfill the extra demand without difficulty and also adapt equally quickly to temperature changes caused by heat from other sources (sunlight, lamps, appliances, printers, etc.).

This flexibility is not found in cast iron or steel heating elements and in panel systems, that do not have the elasticity in management of the working temperatures typical of aluminum radiators.

In particular, floor systems are characterized by high thermal inertia, that causes a lag between the need of more heat in the room and the response time of the system, with resulting lesser comfort as the temperature can fall too low beyond the ideal, or can climb too high and cause a needless waste of costly energy. Under equal conditions, the time necessary to take a room to the ideal temperature will differ depending on the type of system: aluminum radiators respond more rapidly than steel and cast iron, while radiating panels take much longer.

15 Energy savings

Installation of a system with aluminum radiators facilitates a reduction of consumption and prevents needless waste of energy and money.
The savings derive from the particular features of aluminum heating elements such as their ability to respond rapidly to changes in room temperature, adapting quickly to the needs of the user and permitting easy and immediate regulation of the temperature in every room.

It is clear that it is unnecessary and costly to heat the home and office twenty-four hours a day for six months a year, when we only spend a few hours there every day. The energy consumed to heat the house in the morning or when we come home in the evening is less that would be necessary to maintain a constant temperature all day. If with radiating panels the interruption of heating is not advisable due to the high thermal inertia, with aluminum radiators the energy savings during the nighttime hours is real and easily explained, while with cast iron and steel radiators it takes longer to reach the required temperature.
An article published in "Il Giorno" reports that by lowering the temperature from 20 to 16 degrees between 10 pm and 6 am we obtain savings of 13%
If there is no one at home during the day and we maintain a temperature of 16 degrees from 10 am to 6 pm, the savings go up to 24%.

Care should be taken in setting the temperature: the ideal temperature is 20 degrees; a study published in "Altro consumo" shows that every additional degree means raising the heating bill by 8%.

This explains the importance of having a system that will enable us to maintain the room temperature in line with the setting and that can bring the room to the proper temperature quickly and is flexible in its response to climatic changes.
It is important not to drop below the setting, but it is equally important not to exceed it,

considering the resulting discomfort and useless waste of money.

Heating elements in cast iron and steel offer little reactivity, and floor systems are not flexible in management of the working temperature due to the congenital limits of the system, while aluminum radiators are the ideal solution for a heating system that functions in perfect harmony with the needs described above.

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16 Quality of heat

Like radiating panels, the degree of comfort offered by a room heated with aluminum radiators is the sum of these factors:

- Temperature of the air in the room.
- Thermal gradient (difference between temperatures at different heights between the floor and the ceiling).
- Working temperature (average of the room air temperature and that radiated by walls and windows).

It is important to choose the best system management, recommended as ΔT 40/35K and the ideal position for the radiators. As a general rule they should be placed along the walls where there is the greatest heat loss.

Radiators have always been placed underneath windows, for example, just because they can screen the cold radiation from outside, a function that no other heating system can perform as effectively.

To improve the thermal gradient and the working temperature in rooms, the recent regulations on building insulation have provided a valid contribution, and are perfectly suited to heating systems that use aluminum radiators.

Conclusion

As already indicated, the market for heating systems, made up of professionals in the sector, has become more demanding in recent years.

There are a number of factors involved and that can influence choices: from installation assessments to selection of materials, as well as the choice of the installation terminals.

In this connection, we decided to prepare this brochure to give potential clients something to think about,

and a little more information on the technical value of heating elements in aluminum and their application.

The aluminum radiator is a product in line with current heating needs, quick and easy to adapt to different climatic conditions, reducing energy waste and working in harmony with the latest heat generators and climate control systems.

It offers flexibility in designing installations at both high and low temperature, without placing limitations on designers and installers in the choice of the system to use