EVERYTHING TO WARM YOU UP

DIE-CAST RADIATORS

EXTRUDED RADIATORS

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GB

The production SITES

1 FONDITAL - Carpeneda 1
Via Provinciale, 49
25079 Carpeneda di Vobarno (Brescia)
Italy
Total surface area m² 131,000
Covered surface area m² 32,500

2 FONDITAL - Vestone 1
Via Mocenigo, 123
25078 Vestone (Brescia) Italy
Total surface area m² 43,100
Covered surface area m² 16,250

3 FONDITAL - Vestone 2
Via Mocenigo, 125
25078 Vestone (Brescia) Italy
Total surface area m² 9,500
Covered surface area m² 7,710

4 FONDITAL - Sabbio Chiese
Via XX Settembre, 39
25070 Sabbio Chiese (Brescia) Italy
Total surface area m² 3,600
Covered surface area m² 3,470

5 FONDITAL - Carpeneda 2
Via Cerreto, 40
25079 Vobarno (Brescia) Italy
Total surface area m² 75.695
Covered surface area m² 21,445
Covered production area m² 45,500

The Fondital Group is still evolving and has recently invested heavily in setting up a new production and logistics site in Carpeneda (see photo) for the production of boilers and new electric radiators.

FONDITAL is known all over the world for the excellence of its products and constant innovation in terms of product quality and efficiency in service.

A 750-strong workforce, world leadership in the production of heating systems and a new 45,000m^2 boiler production site and warehouses are facts and figures referring to a continually expanding company that is always ready to take up market challenges and anticipate global scenarios.

Fondital is the world's leading producer of aluminium radiators, but also makes, at its production sites in Italy, a full range of wall-hung and floor-standing boilers plus extruded aluminium designer radiators, gas-fired convection radiators and stoves, electric radiators, solar panels and photo-voltaic modules.

Each product undergoes rigorous internal tests and inspections to guarantee the highest possible standard of quality without affecting the time to market.

A well-structured sales network and high production capacity have earned Fondital a top-ranking position in the world of heating since 1970 and a reputation for achieving total customer satisfaction.

Thanks to a high production capacity and extensive sales network, Fondital is now a global benchmark in plumbing and heating systems.

RADIATORS

HOME-FURNISHING RADIATORS: INNOVATION, TRADITION, WARMTH AND DESIGN

Thanks to their pure, harmonious shapes, radiators become a furnishing accessory that provides added comfort and style. The result of Fondital's lengthy experience and cutting-edge technology, decorative radiators are superior quality, high-tech products, just what you would expect.

They can be used in any interior design layout, regardless of the amount of space available. Their special design means they can be combined at will to suit different settings. Made of aluminium alloy, Fondital radiators are tested at 9 bar and come with a 10-year guarantee.


50°
40°

RADIATORS

DIE-CAST RADIATORS
IN LOW-TEMPERATURE PLANTS

Fondital aluminium radiators are particularly indicated for low-temperature use, using water at around 50°C, which makes best use of modern condensing boilers.

Low-temperature heating using aluminium radiators combines the known advantages of rapid response and enhanced overall use of the system with higher efficiency and optimised comfort. This method is comparable to under-floor radiant panel systems, but with lower installation costs and more versatile use.

LOW TEMPERATURE MEANS:

- lower heating costs
- lower installation costs
- enhanced comfort
- reduced dust circulation
- uniform temperature in the room

RADIATORS

DIE-CAST ALUMINIUM RADIATORS

Many years of **research**, a team of more than 25 engineers and a high-tech R&D lab allowed Fondital to become a pioneer in technological innovation.

Die-cast aluminium radiators, that have always been the company's core business, today present themselves as the **future of the heating technology**.

Lightness, high performance, refined design and durability are the distinctive features of the new series of aluminium radiators by **Fondital**. The intellectual property right on these groundbreaking research projects is protected by **international patents**, and the most prestigious European universities have certified the high quality standards of our work.

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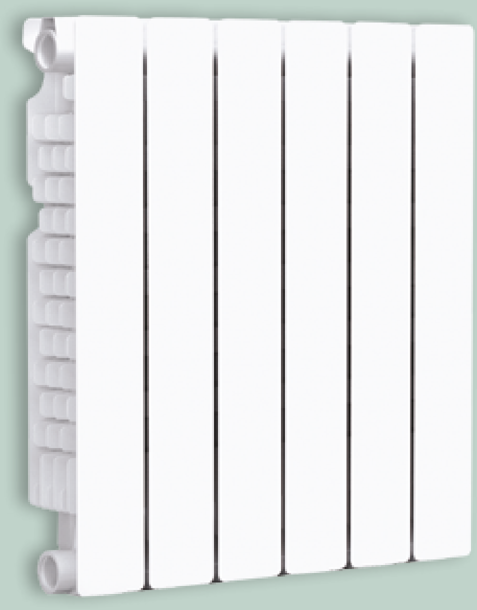
BLITZ SUPER

Blitz
Super

DIE CAST ALUMINIUM RADIATORS
FOR HIGH PRESSURE HEATING SYSTEMS



BLITZ SUPER

Model	Depth (C) mm	Height (B) mm	Centre distance (A) mm	Length (D) mm	Connection diameters inches	Water capacity litres/sect.	Heat output ΔT 30K W/sect.	**Heat output ΔT 50K W/sect.**	Exponent n	Coefficient K_m
350/100	97	407	350	80	G1	0.24	48.1	**93.4**	1.3001	0.5776
500/100	97	557	500	80	G1	0.30	63.5	**124.3**	1.3158	0.7225
600/100	97	657	600	80	G1	0.35	72.3	**142.5**	1.3286	0.7881
700/100	97	757	700	80	G1	0.38	79.9	**158.0**	1.3337	0.8566
800/100	97	857	800	80	G1	0.42	88.4	**175.1**	1.3372	0.9364

Maximum working pressure: 1600 kPa (16 bar)

Characteristic equation of the model $\Phi = Km\ \Delta T^n$ (reference EN 442-1). The thermal efficiency values, expressed at ΔT 50K, comply with EN 442-2 and are certified by the MRT Lab of the Milan Polytechnic, notified body no. 1695.

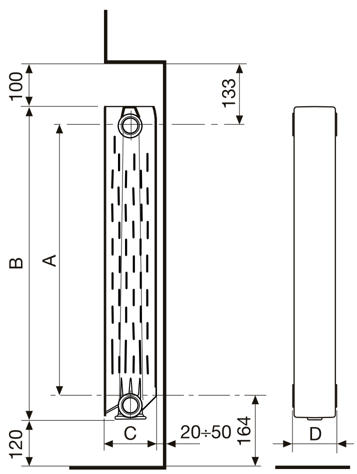
COLOUR: Ral 9010 white

STANDARD SUPPLY:

350/100-500/100-600/100: blocks of 3,4,5,6,7,8,9,10,11,12,13,14 sections

700/100: blocks of 3,4,5,6,7,8,9,10,11,12 sections

800/100: blocks of 3,4,5,6,7,8,9,10 sections



GARANZIA 10 YEARS WARRANTY

CE 13

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RADIATORS

EXTRUDED RADIATORS

The know-how acquired in the development of die-cast radiators has been applied and refined for the new range of home furnishing models by Fondital.

Traditional models have been updated with our patented anti-corrosion Aleternum treatment; moreover our range of extruded radiators has been significantly extended with modern tubular towel rails, available both in the traditional and in the electric version.

Design meets the lightness and high performance of aluminium. Wide range of finishes and heights.

GARDA S/90

Garda S/90

EXTRUDED RADIATORS

Model	Depth mm	Height (B) mm	Centre distance (A) mm	Width mm	Diameter inches	Water content litres/sect.	Heat output ΔT 30K W/sect.	**Heat output ΔT 50K** W/sect.	Exponent n	Coefficient K_m
900	90	966	900	80	G1	0,43	182	90,9	1,3605	0,8886
1000	90	1066	1000	80	G1	0,47	195	97,2	1,3630	0,9426
1200	90	1266	1200	80	G1	0,55	223	111,3	1,3610	1,0864
1400	90	1466	1400	80	G1	0,62	250	124,8	1,3600	1,2227
1600	90	1666	1600	80	G1	0,70	275	135,9	1,3843	1,2260
1800	90	1866	1800	80	G1	0,78	300	150,0	1,3570	1,4846
2000	90	2066	2000	80	G1	0,86	324	159,5	1,3905	1,4083

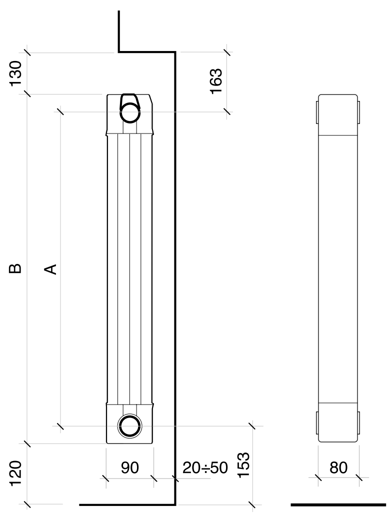
Maximum working pressure: 600 kPa (6 bar)

Characteristic equation of the model $\Phi = Km\ \Delta T^n$ (reference EN 442-1). The heat output values published, calculated with a ΔT 50 K, are in compliance with the European Standard EN 442-2.

COLOUR: Ral 9010 white

STANDARD SUPPLY: Blocks of 3, 4, 5, 6 sections

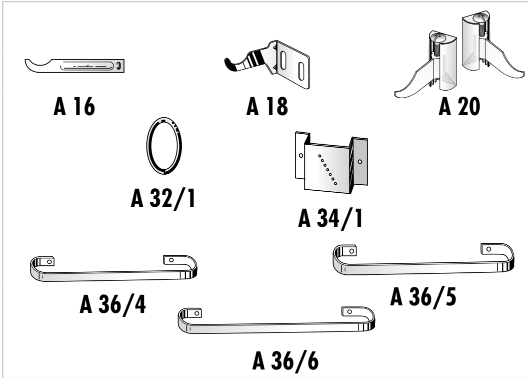
INCLUDED: Water diaphragm



Special accessories for:

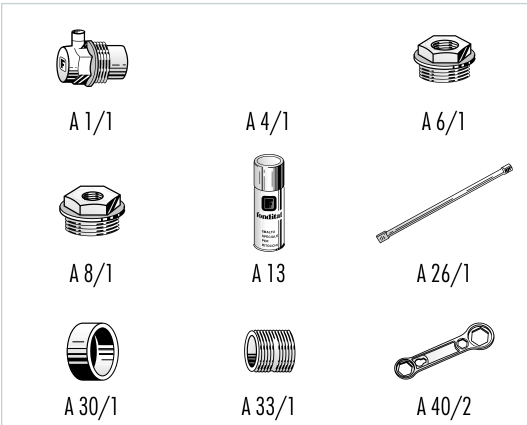
Garda S/90

A 16	Bracket to wall mm 175
A 18	Bracket to screw on to the wall, Rh or Lh
A 20	Installation kit with two adjustable, coated brackets
A 32/1	O-ring gasket for nipples, plugs and adapters for Garda radiators
A 34/1	Lower spacer support
A 36/4	Towel rack for Garda S/90 radiators, 4 sections, white 9010
A 36/5	Towel rack for Garda S/90 radiators, 5 sections, white 9010
A 36/6	Towel rack for Garda S/90 radiators, 6 sections, white 9010



Accessories common to all radiators

A 1/1	1”G automatic air valve, chromed, Rh or Lh
A 4/1	1"G zinc plated and paint-coated plug, Rh or Lh
A 6/1	Adapter, Rh or Lh, G1” to G 3/8” - G 1/2” - G 3/4”
A 8/1	Valve plug, Rh or Lh, G1” to G 1/4” - G 1/8”
A 13	Touch-up spray (White RAL 9010) cc 400
A 26/1	Nipple wrench 1"G
A 30/1	Rubber plug (water diaphragm)
A 33/1	1"G special nipple for extruded radiators
A 40/2	Plastic wrench for plugs and adapters



RADIATOR SIZING and INSTALLATION

RADIATOR SIZING

To correctly determine the heat output of the radiators to be installed, you must comply with the rules in force.

To determine the number of sections required for each radiator, you must remember that their nominal heat output is associated with a ΔT (difference between the average water temperature and ambient temperature) of 50 K.

It is therefore advisable to ensure a ΔT of less than 50 K by decreasing the water outlet temperature (for example, a ΔT of 40 to 30 K). This will ensure energy savings as well as increase the degree of comfort.

The radiator heat output for different ΔT values is calculated using the formula:

$\Phi = K_m \times \Delta T^n$

For example: calculate the heat output of a Garda S/90, model 1800 radiator with water temperature: of 65°C at inlet, 55°C at outlet and ambient temperature at 20°C.

ΔT = [(inlet water temperature + outlet water temperature) / 2] - ambient temperature =

[(65 + 55) / 2] - 20 = 40 K

$\Phi (40K) = K_m \times \Delta T^n = 1.4846 \times (40)^{1.357}$
= 221.6 W

Heat output for different ΔT values can also be approximated by referring to the table of corrective coefficients calculated for an average value of n = 1.3: in this case the margin for error in determining the heat output is in the range of ± 4%.

Using the corrective coefficients, the required heat output is obtained by multiplying the power value at ΔT = 50 K by the coefficient of the required ΔT:

Φ (40 K) = 300 W x 0.748 = 224.4 W

When determining the number of sections, remember that in the case of installations with water inlet and outlet at the base or installations with one-way or two-way valve, heat output may decrease by up to 10÷12% and 20% respectively, due to the particular water distribution in the radiators. If the radiator is installed under shelves, in niches or - worse - in the event of radiator covers, heat output may decrease by around 10-12 %.

RADIATOR INSTALLATION, USE AND MAINTENANCE

The heating systems must be designed, installed, operated and maintained according to the rules in force.

In particular, remember the following during installation:

- The radiators may be used with water and steam systems (max temperature of 120°C);
- The max operating pressure is 6 bar (600 kPa);
- The radiators must be installed according to the minimum permitted distances:
  - 12 cm above the floor
  - 2÷5 cm from the wall behind
  - 10 cm from any niches or shelves;
- If the wall at the back is not sufficiently insulated, fit any additional insulation to minimize dispersion of heat out through the wall;
- Each radiator must be fitted with a vent valve, preferably an automatic one (especially if the radiator has to be isolated from the system);
- The water must have a pH of 7 or 8 and must not have any properties that can corrode metal in general;
- As regards treating water in domestic heating systems, it is advisable to use specific products that are suitable for multi-metal plants, in order to optimize performance and safety, preserve these conditions over time, ensure regular operation of auxiliary equipment as well, and minimize energy consumption, in compliance with the applicable laws and standards.

  Compliance with this standard is a legal requirement.

  Use specific products suitable for multi-metal systems such as, for example, CILLIT HS 23 Combi, SENTINEL X 100 or FERNOX F1.

  When using the radiator, remember:
- Never use abrasive products to clean the surfaces;
- Do not use humidifiers in porous materials such as terracotta;
- Avoid fully closing the valve and thereby isolating the radiator from the system;
- If the radiator requires excessive purging, this means there is a fault with the heating system. Contact a qualified technician or call the manufacturer's technical office directly.

Corrective coefficient values for ΔT other than 50 K calculated for n = 1.3

ΔT	0°C	1°C	2°C	3°C	4°C	5°C	6°C	7°C	8°C	9°C
30	0.515	0.537	0.560	0.583	0.606	0.629	0.652	0.676	0.700	0.724
40	0.748	0.773	0.797	0.822	0.847	0.872	0.897	0.923	0.948	0.974
50	1.000	1.026	1.052	1.079	1.105	1.132	1.159	1.186	1.213	1.240
60	1.267	1.267	1.323	1.350	1.378	1.406	1.435	1.463	1.491	1.520
70	1.549	1.578	1.606	1.636	1.665	1.649	1.723	1.753	1.783	1.812

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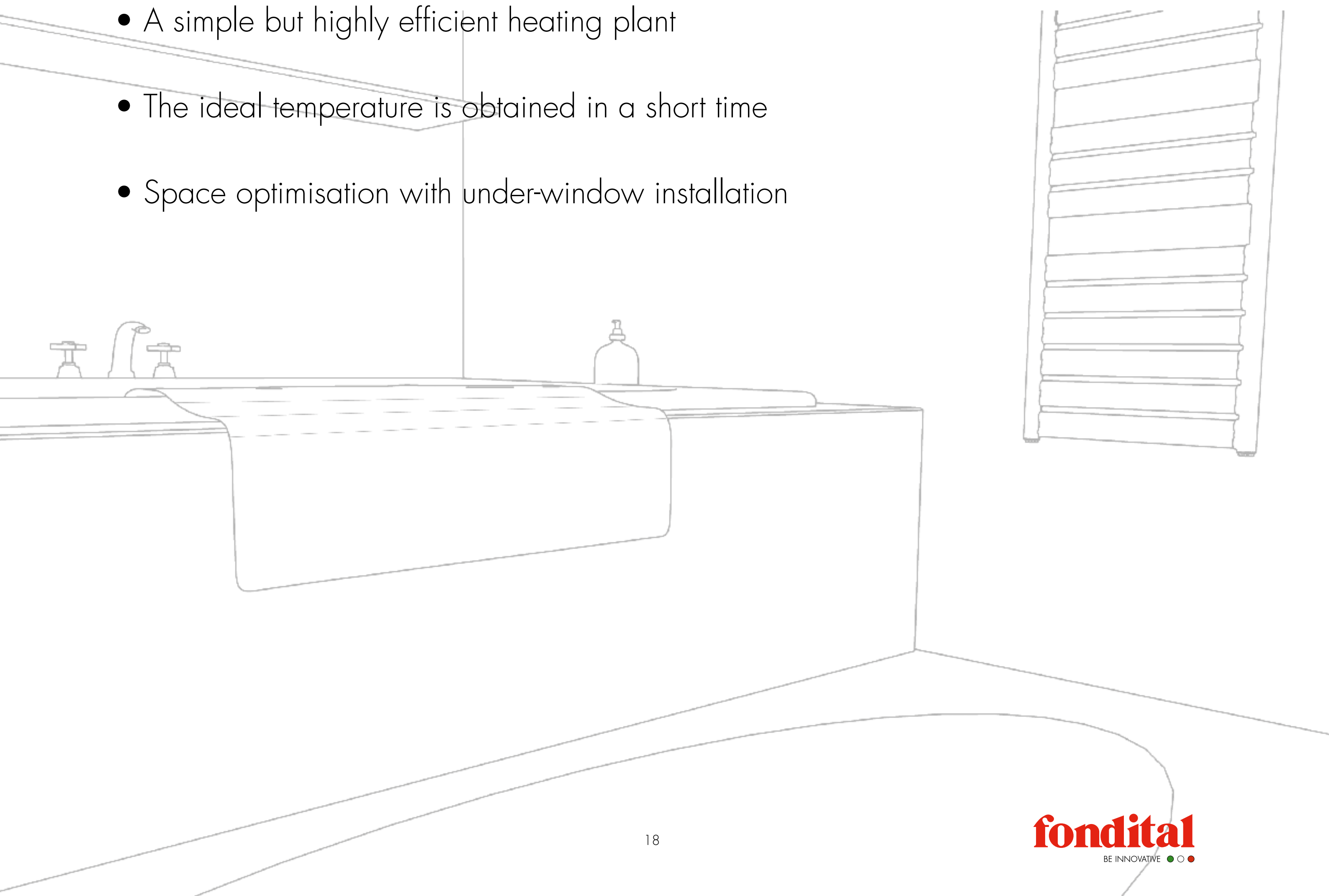
- Climatic comfort
- Saving on heating plant costs
- Reduced installation costs
- Ideal coupling with condensing boilers and plants running on renewable energies
- Every room at the right temperature
- A simple but highly efficient heating plant
- The ideal temperature is obtained in a short time
- Space optimisation with under-window installation



Low temperature radiators: a modern, efficient, economical and convenient way of heating

FROM TRADITIONAL TO LOW-TEMPERATURE HEATING SYSTEMS

In the early 1990s, in an attempt to increase efficiency and reduce energy consumption, western Europe started to change the temperatures used in heating systems. Design temperatures were lowered, to comply with the regulations and as a practical application, from an average water temperature of 80°C, (90°C flow and 70°C return) to 70°C (75°C flow and 65°C return).

• Trends in heating system design

The tendency to reduce water temperature in heating systems has continued as a result of the spread of low-temperature heat generation systems, with the introduction of condensation boilers, heat pumps and solar panels, all of which aim to save energy and reduce polluting emissions. The use of average heating water temperatures of 50°C or less is becoming increasingly common.
A vast amount of information is available on low-temperature water production systems, but limited and often misleading information is available on systems that emit heat under these conditions. It is a common conviction, for instance, that ordinary radiators are not suitable for low-temperature operation. This is not the case at all, as we will see later on.

The amount of heat required to keep a room warm depends solely on its constructional features, i.e. the degree of insulation from outside or adjacent rooms. This amount of heat is exactly the same, regardless of the emission system used.
The job of the emission system is to transmit to the room the amount of heat needed, as and when required. The only difference between one emission system and another is when and how the heat is supplied: the most suitable system is one that reduces wastage as far as possible and in which the environmental conditions are kept at the values set by the user.

Once the type of heat generation system has been chosen and the design temperatures have been established for optimal operation, the choice of the emission system must be supported by valid technical reasons that are documented in terms of overall efficiency, installation costs and running costs, in order to provide the buyer with adequate information to make a choice that comes up to his expectations.

Like other heat emission systems, radiators are the end point for emitting heat into the room; the heat is usually generated by a boiler and conveyed through pipes. The entire system is controlled by regulation devices such as ambient thermostats, thermostatic valves and temperature probes inside and outside the boiler.

That being stated and presuming that a low-temperature system has been adopted, using a condensation boiler for instance, let us see why and how a radiator system is perfectly compatible with this choice, and is actually one of the best applications possible.

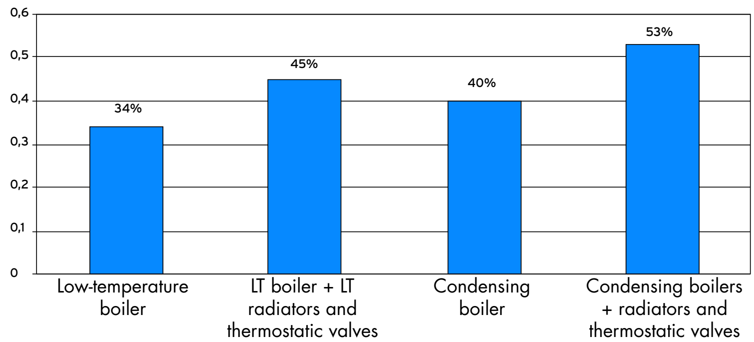
First we need to make a distinction between existing systems and new systems.
Virtually all existing systems use radiators and conversion to low-temperature operation requires them to be adapted. This involves increasing the size to make up for the drop in heat output due to the use of cooler water. In such cases it is advisable to check whether and to what extent the existing radiators are already oversized compared to the true requirements to prevent an excessive increase in size. Many existing radiators are the modular type, which are very easy to increase in size.

• Installation with condensing boilers

If the building is properly insulated, which allows a 55% tax deduction under the Budget Law, it will not even be necessary to increase the size of the radiators.

Condensation boilers can even be used without having to alter the size of the radiators. This can be done, for instance, by reducing the flow rate and allowing a higher thermal head

Saving (%) with respect to a system based on a high temperature boiler pic. | **1**



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inside the heating units, giving return temperatures low enough to guarantee condensation (below 50°C). It should be remembered that the return temperature is fundamental for condensation, whereas the flow temperature can be high. The use of modulating pumps in some cases may facilitate this type of application.

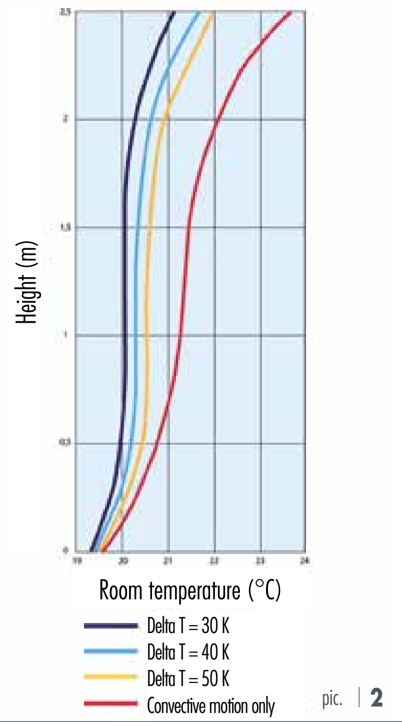
The chart in pic. 1 shows the advantages of switching from a low-temperature to a high-temperature system in a 135m^2 home built in 1970[1]:
It can be seen that the use of low-temperature radiators with a condensation boiler and thermostatic valves gives a 53% saving in consumption compared to a high-temperature system using a traditional boiler.

- Choosing a heating system

In existing buildings the choice is restricted, but in new buildings it is – or should be – the designer who advises the occupant to help him choose from among the alternatives the market has to offer. There is no single system that always provides the best solution. Likewise, there are various reasons leading to the adoption of a particular system, including technical features, appearance or simply the latest fashion.

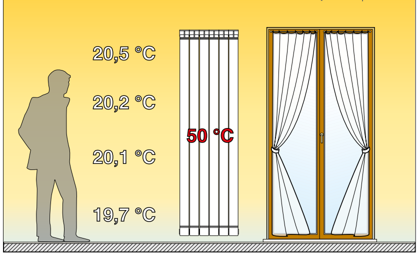
Now let us analyse the behaviour of low-temperature radiators, leaving aside the mistaken preconception that low temperature is a prerogative of a few systems only, such as under-floor heating systems, the best known example.

The aspects to analyze are the spatial distribution of temperatures in the heated room, comfort, running costs, installation costs, environmental impact and flexibility of use.



pic. 2

When we talk about low temperature we refer to an average water temperature of around 50°C. With condensation boilers it can be higher as long as the return temperature is low enough to allow condensation. This means that the radiators operate at ΔT=40 K or ΔT=30 K, where ΔT is the difference between the average temperature of the radiator and the room temperature, which is normally taken as 20°C.

pic. 3


As the temperature of the water inside the radiators decreases, the temperature distribution in the room changes, with a net drop in stratification, the temperature gradient reduces and the temperature at occupant height is virtually constant.
Pic. 2 graph[2] shows how the temperature in a heated room changes with different average water temperatures when the room temperature is set at 20°C. The graph also shows the temperature distribution for a convection system, which acts very differently from radiators, whose convective percentage is at most 70-75%, considering that heat emission by radiation is 25-30%.
In low-temperature radiators the thermal gradient is very limited, varying little from the typical distribution of other emission systems, in contrast with what is frequently reported. When the average water temperature is set from 70°C (ΔT=50 K) to 50°C (ΔT=30 K), the thermal gradient is reduced by 0.5°C. This means a reduction in the average temperature in a room with the same temperature perceived by the occupant, leading to a reduction in consumption. The temperature remains very close to the value required by the user. The slight increase in temperature in the upper part of the room will give a less than optimal situation but well below the loss suffered by under-floor heating systems due to downward dispersion.

To make the temperature in the room as even as possible, it is advisable to install radiators below the window. This saves about 5% and also intercepts the flows of cold air down from the window, which is impossible with other systems (pic. 3).
Reduced thermal gradient and low-temperature water lead to a reduction in convective motion; the movement of dust grains in the atmosphere is just

Low temperature radiators: a modern, efficient, economical and convenient way of heating

the same as with under-floor systems, and no black marks form on the walls, the direct result of carbonisation of dust coming into contact with high-temperature bodies. All this gives what is commonly known as "comfort", which – we repeat – is not linked to the type of system used to transmit heat. When designed and used properly, various systems allow the same degree of comfort.

• A rapid and flexible sollution

As well as being able to function perfectly at low temperatures, radiators are much more flexible to use than other systems. In particular, radiators can be regulated, and switched on and off very quickly to adapt to climatic changes, including sudden changes in outdoor temperature, which are typical of spring and autumn, or linked to changing conditions during the day, when the amount of sun varies considerably, or to heat from internal sources such as household appliances, lights and cookers.
This phenomenon is referred to by the technical term "thermal inertia". Low thermal inertia, with radiators for example, allows quick adaptation to heat demand, but without wasting fuel and avoiding unpleasant variations in the temperature of the room.
Imagine common situations such as switching on the oven in the kitchen, the heat of the sunlight entering the room or the simultaneous presence of several people in the room. If the heating system cannot adapt quickly to the changing conditions, the temperature will rise above the desired set value, the feeling of comfort will be lost and money will be wasted heating unnecessarily.

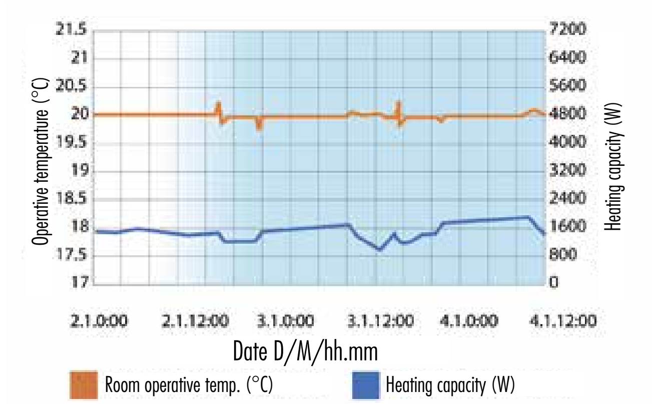
This situation will always be more critical in new homes, which, for legal or energy saving reasons, have a high degree of insulation and take much less to heat than before. It only takes a few hundred watts to heat an average size room, so the presence of free sources will have a significant effect on heat exchange economy. Switching on a light, or the simultaneous presence of two or three people will supply most of the need, so the heating system must be able to react immediately and reduce its contribution to what is strictly necessary. All this can only be guaranteed by systems with low thermal inertia, such as those using radiators.

Pic. 4 graph[3] shows the radiator system's ability to respond to changes in indoor and outdoor temperatures over three days in winter: the temperature in the room does not undergo any appreciable change.

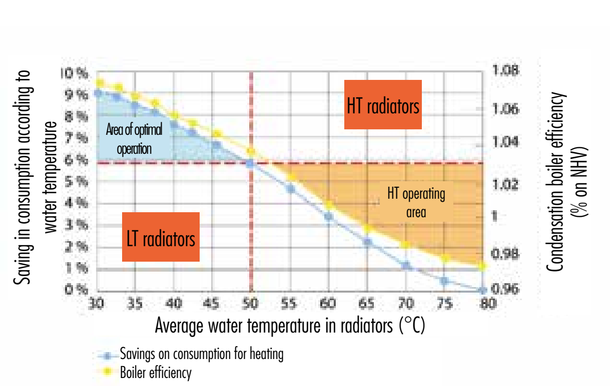
• The economic factor

Another aspect to be considered when using low thermal inertia systems is non-continuous use of the home. A building whose occupants are only present at certain times does not require a constant temperature round the clock. The result would be an increase in heating costs if the system does not react promptly to changes in the user's requirements.
This is where the economic aspect comes into play, probably the most widespread misconception in the world of radiators. The conviction that radiators consume more than other systems is extremely common, arising from marketing data, backed up by vague and non-existent reasoning and often based on elaborate theoretical studies that are completed detached from applied practice.

The real situation is quite the opposite in fact.



pic. | 4



pic. | 5

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Let us start from the assumption that the heating system must cover heat requirement, and the requirement is the same for any system as it is determined solely by the thermal insulation of the room to be heated.
The differences in consumption, which must be measured over an entire season, can only originate from system's inadequacy in maintaining the user settings, its inability to exploit free heat contributions or drifts in the temperature settings.
It is evident that a low thermal inertia system adapts better to this; if such a system is operated at low temperature it can, as illustrated above, ensure temperature conditions very close to the set ones, which all helps reduce consumption. Studies conducted in Scandinavian countries, where high-inertia heating systems are common since they are theoretically more suitable for use in climates where the cold season lasts for a long time, show that fuel consumption in such systems is 15% higher than in systems using radiators.[4)]

The cost-to-benefit ratio can clearly not ignore the initial installation costs, which are much lower in radiator systems, the difference ranging from 20% to 40%, which is unjustifiable from a performance viewpoint.
Pic. 5 graph[5)] shows the main differences in terms of consumption between high-temperature and low-temperature radiators that use a condensation boiler.

• Radiator sizing

Correct sizing of radiators is of fundamental importance in a good heating system. Once the building's energy requirements, the design temperature, the installation layout and the type of radiator have been determined, it is extremely easy to calculate the size of radiator to install – it is merely a question of establishing which radiator provides the closest to the required output.
It must be remembered that heat output is measured accurately in accordance with European regulation EN 442-2, so there is no risk of misunderstandings or false statements, to the advantage of both designers and end users.

The dimensions of a radiator are therefore strictly linked with the energy requirement and the average water temperature. If the energy requirement is low, even very low temperature water temperature can be used and the radiators need not be overly large.

• A few recommendations

In radiator management, a few simple rules can lead to considerable saving in operating costs.
For example, installing thermostatic valves on radiators allows independent temperature regulation for each room, saving up to 15%. Whenever feasible, it is advisable to install the radiator below a window, the width being as similar as possible to that of the window span. It is also advisable to install a reflecting panel behind each radiator, keeping to the distances from the wall recommended by the manufacturer.
Connect the flow pipe at the top and the return pipe at the bottom. Low-low connections entail a slight reduction in output.

• Normative references

The stated heat output of radiators available on the market is determined by means of measurements made by approved independent test laboratories, in accordance with UNI EN 442-2, which specifies the laboratory instrumentation and test methods to be used, the admissible tolerances, and the criteria for selecting test specimens and verifying conformity of series production with the initially tested samples.

• Conclusions

Radiators are particularly suitable for low-temperature operation. A high standard of comfort and energy saving combine with flexible use, which other systems cannot offer, while keeping plant engineering costs reasonably low. Low-temperature operation exploits the features of the radiators, which are suitable for use with condensation boilers, heat pumps and all sources of renewable energy.

• References

1) Source: Pouget Consultant – CETIAT
2) Source: CETIAT
3) Source: Passiv Haus Institut
4) Peter Roots, Carl Eric Hagentoft Floor heating, heating demand Building Physics 2002
5) Source: CETIAT

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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV
= ISO 9001 =

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