Why should buildings be thermally protected

The thermal protection of buildings is a complex challenge which requires a profound analysis of the following aspects: building physics, economy of execution, use of the building and ecology. Typical for a moderate climatic zone, temperature range and air humidity do not provide conditions that allow comfortable living without a need to be protected against them (e.g. against low temperatures in winter, a considerable amount of rainfall or strong winds).

Buildings which we live and work in need to have a safe and pleasant climate, independent of the actual weather conditions outside. We expect the walls that surround us to ensure the lasting protection against the direct influence of the surrounding conditions such as temperature and moisture and also against the noise. With insulating buildings, one should also bear in mind the principles of sustainable development (e.g. EPD environmental declarations) concerning materials used and their utilisation conditions.

The operating costs of the building depend considerably on its energy performance – the heating effectiveness and hot water supply. The quality of this performance is indicated by the building's annual energy consumption that

is used to provide comfortable conditions indoors. Thanks to introducing the obligatory energy certification for each building, it is possible to determine its annual running costs. These in turn directly influence the market value of the building. High energy consumption in most cases is caused by extensive heat loss through the building walls.

Building walls separate the conditions between the inside and the outside. Therefore the walls become an area subject to processes of heat and moisture transition and transport. Heat always permeates from areas of higher temperature to cooler zones, so in winter, it flows from the heated inside to the cold outside. In summer, it works in reverse – the heat flows to the inside of the building.

It is not only the walls that are responsible for the heat loss. In single-family housing it is 40% of all the losses that 'escape' through the walls. The remaining 15% goes via ventilation, 20% via the roof, 15% via the windows and door frames and 10% via the basement and floors. In multi-family housing the heat loss goes as follows: 37% via the walls, 24% via the windows and door frames, 6% via the roof, 30% via ventilation and 3% via the basement and floors.

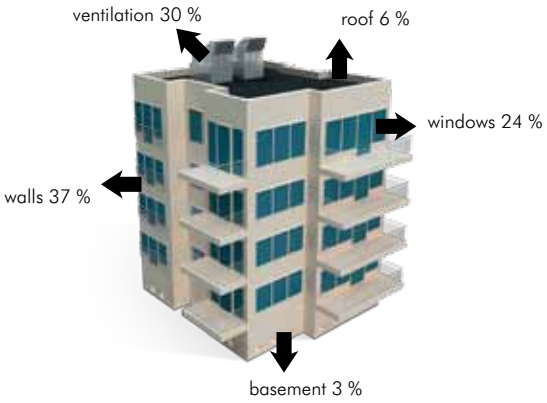
Single-family house

The diagrams clearly show that the building's external walls contribute significantly to its total heat loss, regardless of the type and size of the building. For this reason, efficient thermal insulation of the facade walls is absolutely essential, resulting in the largest reduction of heat loss and in turn reducing the energy demand needed to heat up the rooms. This gives the obvious savings in heating costs.

The bigger the difference between the wall surface temperature and the air temperature in the interior, the less intensive the air convection current. That is why, to obtain optimal warmth, it is recommended that the surface wall temperature differs by no more than 3°C in relation to the air temperature. This way the risk of vapour condensation and mould development is limited.

Multi-family house

(10-floor blocks of flats built of large precast concrete slabs)

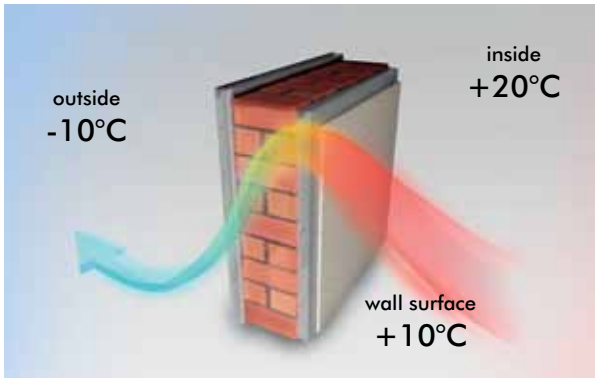


The amount of energy needed to maintain the required temperature inside the building is much higher in the case of standard, not insulated walls. In thermally insulated walls the biggest temperature differences appear inside the insulated material.

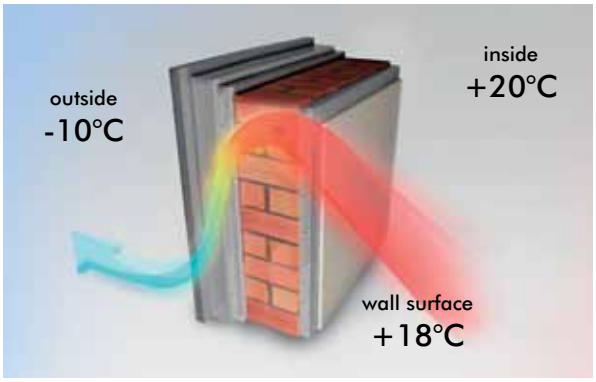
Whether you heat the building or cool it down – both processes are invariably associated with costs. The amount of these costs depends on actual fuel prices and energy sources, the costs of the heating or cooling system installation and its maintenance. By applying complex thermal insulating systems, the building's demand for energy consumption is significantly decreased which directly translates into heating or cooling costs reduction. What is more, the decrease in fuel consumption adds to the positive ecological effects. The consumption of non-renewable energy sources is reduced so the level of CO_2 emissions into the atmosphere, responsible for the progressive greenhouse effect, is also lower.

As seen, the building's external walls contribute significantly to its total heat loss, regardless of the type and size of the building. For this reason, efficient thermal insulation of the facade walls is absolutely essential, especially of projecting parts (such as balconies), by making use of external thermal insulation compound systems. ETICS are able to reduce the intensity of the heat flow through the walls. They can also limit and compensate temperature changes within a building and – of equal importance – within the structural layers of the wall itself.

If the temperature on the wall surfaces is kept as constant as possible, this will result in a higher level of comfort inside – not only by reducing the moisture (no vapour condensation and thus no chance for mould to grow), but also by decreasing the intensity of convection current inside rooms.



The quick escape of heat via a wall with no thermal insulation causes a cooling down of the internal wall surface.



The limited heat flow via a wall with an exterior side thermal insulation causes an increase in temperature of the internal wall surface.

The first of diagrams shows the temperature range for a wall without thermal insulation: inside the building the air temperature is +20°C, whereas the outdoor temperature is a frosty -10°C. As seen, the internal wall surface has a temperature of +10°C, which is much lower than the temperature inside the room. This causes a perceptible, unpleasant air movement and the amount of energy needed to maintain a sufficiently high temperature inside the room is significant.

In the case of a thermally insulated wall (2nd diagram), these problems do not occur. The difference between the air temperature and that of the internal wall surface is much lower. In a thermally insulated wall a rapid drop in temperature takes place in the area where the insulation material has been installed.

Why ETICS

The optimum solution to the aforementioned problems is a seamless thermal insulation system called ETICS, which has been applied and proven for over a dozen years. The name ETICS stands for External Thermal Insulation Composite Systems. Within ETICS a thermal insulation material such as EPS-boards or mineral wool is fixed to the outside wall with a special adhesive mortar, then the surface reinforced with a glass fibre mesh and finally coated with a decorative plaster.

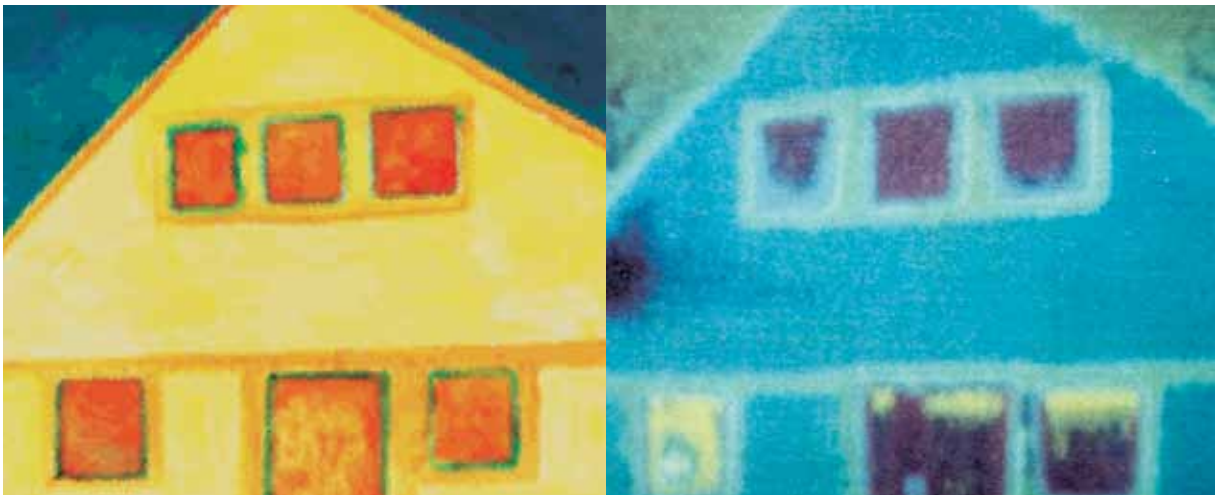
Buildings thermally insulated with ETICS offer the following qualities:
- lower energy demand required for heating the rooms,
- improved thermal comfort of the interiors,
- aesthetic and long-term appearance of the building.

Thermal insulating helps reduce CO_2 emissions, thus protecting the environment.

The insulation efficiency of the building depends on the technology with which the outside walls were built, and it is expressed by the heat flow ratio, U-value. The lower the U value, the lower the heat losses. A low U-value, however, does not always imply successful insulation. But it is not the only factor that reveals the insulation efficiency. The performance of the insulation is negatively influenced by the presence of so called thermal bridges, which come from contact points of construction elements, quoins, balcony and terraces slabs 'cutting' through the walls or the presence of lintel beams. All these 'disturbing' elements disrupt the single-direction flow of the heat and need special attention by choosing adequate insulating technology beforehand and later during the application process.

The easiest and at the same time the most efficient way of insulating the buildings in the above mentioned difficult areas, is with ETIC systems.

Costs incurred for installing an insulation system with the light-wet method (ETICS) pays off after only a few years since the heating bills for the building may go down by as much as 30 %. Together with the ever rising costs of energy fuels, it gives significant savings in every heating season.

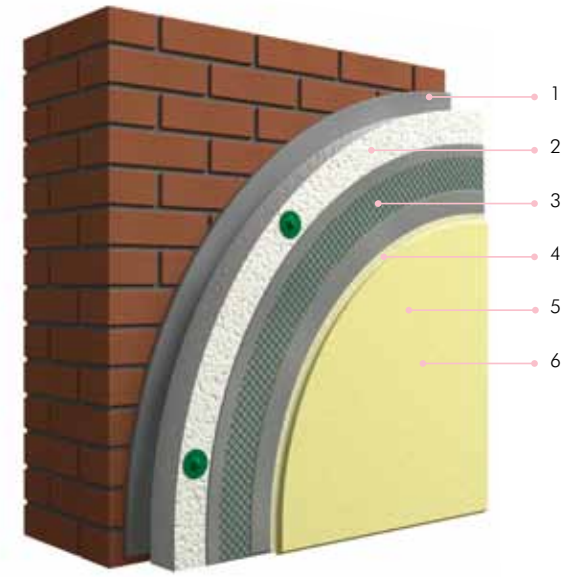


The effect of thermal insulation on a building's external walls is visible in the two thermographic pictures above. In the left picture, the colours yellow and orange mark areas of visible heat loss that can be avoided. Heat flows from the inside of the building, thus raising the temperature of the facade walls. The right picture shows a building whose facade has been thermally insulated. The areas are identical, but they now appear in a blue colour, i.e. they have a much lower temperature due to their thermal insulation. Heat is prevented from flowing from the inside to the outside.

ETIC systems advantages

The key advantages of ETIC systems are:

- effective increase of wall insulation and elimination of thermal bridges,
- complete renovation of the facade and maintaining or changing the building's appearance,
- lightweight system which, as a rule, does not affect the building's structure so that it can be applied on almost every facade (especially important while insulating buildings constructed from pre-fabricated concrete panels),
- the easy workability of the thermal insulation material facilitates the imitation of rustication, the decoration of window frames etc.,
- increase of property value coming from both the attractive appearance and the low energy consumption of the building,
- vast possibilities of surface finish forms and colours



Ceresit Ceretherm System Structure

1. Fixing
2. Insulation material
3. Reinforced layer
4. Priming paint
5. Plaster
6. Paint

Thermography – images of heat loss

Buildings erected in the past, as well as those being built currently, are based on one of a few envelope types. They may be single, double or triple-layered walls with insulation between those layers plus all kinds of modified systems. Each of the possible variants is effective when there are no thermal bridges. As regards non-insulated walls, the differences in the intensity of heat flow are visible even between particular building materials, such as cement mortar and ceramic brick. A thermal imaging camera is a tool that enables us to see the heat flux density and the related temperature distribution on the surface of the partitions.

Henkel's technical department team, equipped with this device, carry out several dozen structure inspections a year, which enables them to assess an envelope's thermal performance. The thermographic pictures below illustrate the condition of same analyzed buildings. On the temperature scale visible on each of the images, lighter areas indicate places with a higher temperature, and darker areas show areas with a lower temperature.

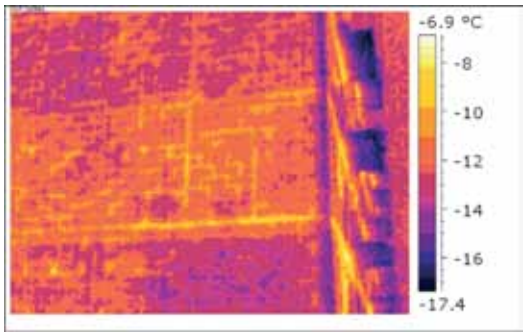
When photographed from the outside, a heated building should ideally have a stable and homogeneous facade temperature. All lighter-coloured areas in a thermogram indicate spot-like and linear thermal bridges. These are the places where excessive amounts of heat are released and thus the potential of vapour condensation occurs.

Three-layer walls perform similarly to the single-layer buildings. The only difference is that with this type of wall construction, increased heat transmission takes place not across joints or tie beams, but across structural nodes. An additional source of thermal transmission are connections between layers, the so called steel anchors.

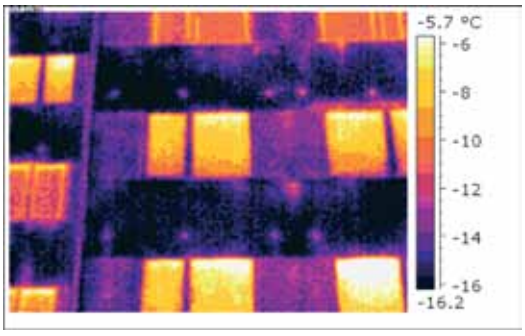
Both one-layer and three-layer walls have one thing in common: a considerable part of the wall mass is exposed to significant changes in temperature and humidity plus thaw cycles that are repeated several times.

Concerning buildings with double-layer wall construction (insulated while a structure is erected or insulated subsequently), you get the optimum possible temperature distribution on the facade. The entire section of the wall has a temperature above zero and there is no risk of water vapour condensation.

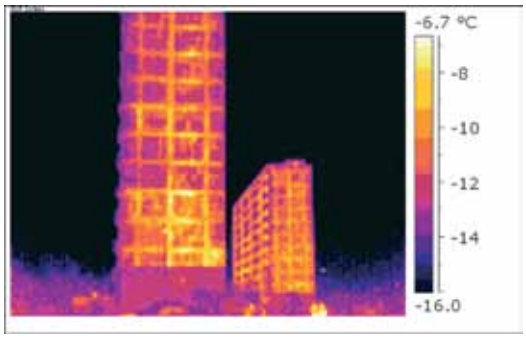
Obviously, the proper method of thermal insulation execution is the main condition in which the wall performs sufficiently in terms of building physics. In practice, there are a lot of mistakes that lead to discontinuities in thermal insulation or thermal bridge occurrence. These thermographic images illustrate some of the common mistakes.



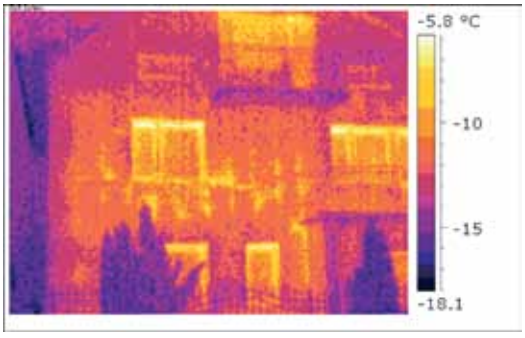
Single-layer wall of cellular concrete blocks with an intense visible heat outflow through the joints.



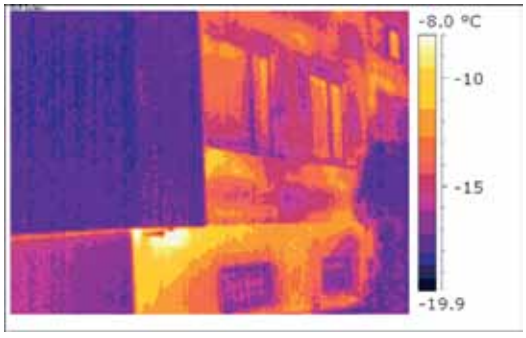
Three-layer wall of a building made of large prefabricated concrete slabs with an intense visible heat outflow through interlayer fasteners.

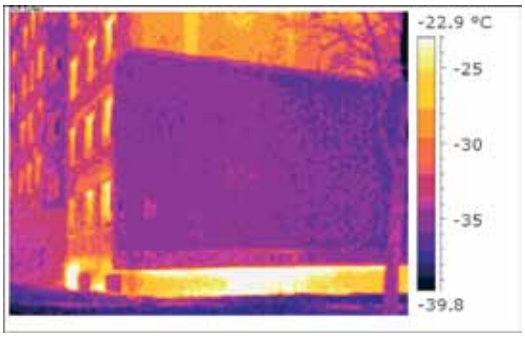


Three-layer wall of a building made of large prefabricated concrete slabs with an intense visible heat outflow through the structural joints.



Two-layer wall with thermal insulation produced by using dry technology, with an intense visible heat outflow caused by air flowing through the insulation layer – ineffective wind insulation.





Gable walls of buildings made of large prefabricated concrete slabs. The picture clearly shows that the installed external thermal insulation system has a strong impact on the heat outflow.

Why to use Ceresit thermal insulation systems

Henkel has 50 years of experience with Ceresit ETIC Systems. Already, a few thousand buildings all over the world have been insulated with the help of our systems. That is an excellent reference for our products, which proves the superb quality of the solutions offered. All this time the Henkel Research and Development team has been working on new solutions and formulas and also on constant improvements to the existing products. We introduce more and more types of adhesive mortars, plasters and paints as well as offer an extensive colour range plus different textures.

Our products and systems are constantly supervised for their compliance with international standards such as ISO 9001, ISO 14001, ISO 18001, AQUAP by the Quality Control Department at our own Central Research Laboratory. The Laboratory has been certified according to ISO/IEC 17025, which means the highest European standards both in terms of functionality and security are met.

European Technical Approvals

European Technical Approvals (ETAs) are granted after proving a thermal insulation system meets the requirements of ETAG 004: 2002 (European Technical Approval Guidelines for External Thermal Insulation Composite Systems with Rendering).
The system must conform to the following six Essential Requirements (specified in accordance with the European Parliament and Council Directive No. 89/106/ EEC, called also the Construction Products Directive):

- mechanical resistance and stability (ER1),
- safety in case of fire (ER2),
- hygiene, health and environment (ER3),
- safety in use (ER4),
- protection against noise (ER5),
- energy, economy and heat retention (ER6).

In this way the high quality, functionality and durability of the thermal insulation system can be proved on the basis of test procedures reflecting 25 years of its performance on a building's facade.

In addition to offering high quality products, Ceresit promotes awareness in the use of the products in the building industry. For this purpose a team of Technical Experts were appointed, whose task is providing advice to designers, contractors and users at every stage of the construction process (starting from design, through execution, to the use and revitalization).

Ceresit cares about the quality of the products, as well as their correct application, therefore the company invests in knowledge transfer and the training of construction companies, and thus constantly increases the level and quality of the work.

High quality products combined with the execution at a high level are the basis for granting warranties for using Ceresit thermal insulation system solutions.

ETICS influence on natural environment

For many years the external environment has been affected by the dynamic development of the world economy and many industries that have been overusing more and more unstable natural resources. Pollution and hazardous waste are generated as a result of civilization growth and get into the environment mankind is fully responsible for this situation.

Excessive exploitation of natural resources and the irresponsible consumption of electric energy has led to the so-called energetic crisis, which has resulted in a significant increase in energy carriers. In order to reduce the negative effects of the energetic crisis (and economic crisis on a global scale) on 19th of May 2011 the European Parliament issued the 2010/3/EU Directive on the energy performance of buildings. This document aims mainly to reduce the energy consumption and to use the energy from renewable sources, which is a part of the implementation of the Kyoto Protocol (EU's commitment to maintain the level of temperature rise below 2°C and to reduce total greenhouse gas emissions by at least 20% by 2020).

ETICS technology should play an extremely important role in this process - as buildings are consuming 40% of the total energy in the EU. The main reasons for this are the growth of this sector as well as the poor technical condition of most of the buildings resulting in a huge amount of energy being lost.

One of the most effective ways (though it may be a compromise between functionality and aesthetics) to save energy consumption is a building's proper insulation, with the use of ETIC system. It allows you to achieve savings of approximately 30% per year. Moreover, it translates directly into natural environment protection through reduced greenhouse gas emissions (including CO_2), which arise during the processes of energy generation and has an extremely devastating influence on ecosystems. Eco trend can be visible also at the process ETICS production viewed as a comprehensive solution. More and more companies attach great significance to ecological production (that generate smaller amounts of waste), and also to recycling, the use of natural components etc.

When properly applied, ETICS has numerous benefits – it is an excellent 'mechanical' protection for a building, as well as improving the microclimate inside a house and the health of its residents by reducing the risk of fungi and mould development, and finally, improving the living comfort of inhabitants - if we are likely to consider these facts, then we obtain the full image of ETICS' comprehensive beneficial influence on the natural environment.