SUSTAINABLE CONSTRUCTION

CALOSTAT® for the LEED certification
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Let us build a better world, together.

FROM THE ROOF TO THE FOUNDATION, AND FROM PROTECTING ANCIENT NATIONAL TREASURES TO BUILDING THE CITIES OF THE FUTURE, EVONIK HAS PRODUCTS AND SOLUTIONS FOR USE IN ALMOST ALL ASPECTS OF CONSTRUCTION.

As one of the world’s most innovative specialty chemicals companies, we are defined by our creativity, energy, and passion for our products and for our customers.

With CALOSTAT®, a newly developed high-performance heat insulating panel based on silicon dioxide, we provide the construction industry with an attractive alternative to conventional insulation materials, which is ecologically and economically sustainable.

CALOSTAT® contributes towards sustainable construction. The LEED certification system objectively describes and evaluates the sustainability of buildings. In this brochure, we investigate the assessment criteria that are relevant for CALOSTAT® and describe the relevant properties of the high-performance insulation. This gives you a direct overview and specific details about how CALOSTAT® has a positive effect on a building’s environmental impact.
The construction sector is one of the most resource-intensive industries. If you look at the complete life cycle of a building, from raw material extraction, production of construction materials, the construction process itself, through to the use and maintenance of the building, in the United States the construction sector is responsible for:

- 23% of Air pollution
- 50% of carbon emissions
- 40% of drinking water pollution
- 50% of landfill waste.

(Source: Gocontractor)

This is why energy efficiency is just as important as the durability and recyclability of products and systems. The use of high-performance insulation such as CALOSTAT® materials is recommended for meeting local energy efficiency codes and regulations such as the California Energy Code or local applications of EU energy efficiency directive 2012/27/EU.

CALOSTAT® is a pure mineral insulation material, consisting mainly of silicon dioxide. It contains no fungicides, algicides, binders, or flame retardants. The high-performance insulation material is vapor diffusion permeable but does not absorb liquid water.

Because of the material properties and the ecological and economic benefits, CALOSTAT® is recommended for a broad range of applications inside and outside the building envelope, such as interior insulation, cavity insulation for load-bearing walls (veneered, prefabricated composites) and even for the thermal insulation of various facade systems for residential, industrial, office, and administrative buildings.

\[ \lambda = 0.019 \text{ W/(m·K)} \]

A2-s1, d0

Recyclable

All documents in this brochure can be downloaded from the website www.calostat.com.
LEED BUILDING DESIGN AND CONSTRUCTION

LEED BD+C v4

CALOSTAT® HAS POSITIVE INFLUENCE ON UP TO A THIRD OF AVAILABLE CREDIT POINTS

LEED is the most prevalent sustainability rating system for the built environment. Initially developed in the US it has since been applied worldwide in over 167 countries and territories and over 80,000 projects. LEED provides schemes for assessing new constructions, refurbishments, in-use and infrastructure projects. A building’s performance is assessed in 9 categories to collect up to 110 points. Ratings are awarded based on how many points are achieved.
# IN SUMMARY: LEED-RELEVANT ISSUES

<table>
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<th>Category</th>
<th>Credits</th>
<th>Intention</th>
<th>Requirements and Evidence</th>
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<tr>
<td>EA</td>
<td>Minimum Energy Performance: Prerequisite</td>
<td>Evaluation of the energetic performance of the building compared to a baseline building constructed acc. to ASHRAE standard. The energetic performance is assessed based on a comparison of the yearly energy costs.</td>
<td>The energetic performance is calculated with a whole building simulation, that has to be performed either by the LEED AP or the HVAC design team.</td>
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<tr>
<td>EA</td>
<td>Optimize Energy Performance: 18 Points</td>
<td>Further increased energetic performance, for example through an improved building envelope or efficient plant engineering.</td>
<td>Performing a LCA based on as-built data. Environmental product declarations (EPDs) supply additional information for individual building products. CALOSTAT® provides an EPD.</td>
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<tr>
<td>MR</td>
<td>Building Life Cycle Impact Reduction: 3 Points</td>
<td>By performing a life cycle assessment (LCA) a wholistic, lifecycle-oriented design approach is followed. The goal is to reduce both the environmental impact and the consumption of finite resources during the entire lifecycle of the building.</td>
<td>Providing the characteristic values of CALOSTAT® are displayed in its EPD.</td>
</tr>
<tr>
<td>MR</td>
<td>Building Product Disclosure and Optimisation – Environmental Product Declarations: 2 Points</td>
<td>The utilization of building products with environmental product declarations (EPDs) creates a transparency of the environmental impacts. Furthermore, the EPDs can be used as a basis of the LCA calculation</td>
<td>The necessary documentation is the corporate sustainability report (CSR) of the company. Evonik publishes a yearly CSR, that sets sustainability targets and documents the target performance of the previous years, among others.</td>
</tr>
<tr>
<td>MR</td>
<td>Building Product Disclosure and Optimisation – Sourcing of Raw Materials: 2 Points</td>
<td>This credit promotes the usage of responsibly sourced building products. Overexploitation and inefficient usage account for major environmental damage and waste of resources.</td>
<td>Evidence for this credit is material ingredient reporting according to a certified standard. CALOSTAT® is Cradle to Cradle Certified™ and fulfills the requirements.</td>
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<tr>
<td>MR</td>
<td>Building Product Disclosure and Optimisation – Material Ingredients: 2 Points</td>
<td>Analyzing and judging the chemical components of the building products aims to reduce potential harmful impacts for the buildings occupants.</td>
<td>Pure products such as CALOSTAT® contribute towards good recycling rates of demolition waste.</td>
</tr>
<tr>
<td>MR</td>
<td>Construction and Demolition Waste Management: 2 Points</td>
<td>The construction sector accounts for the majority of the waste produced worldwide. By focusing on the recycling of construction waste, resource consumption and landfill growth can be limited.</td>
<td>CAŁOSTAT® has a very low pollutant content and contributes towards a healthy indoor environment.</td>
</tr>
<tr>
<td>EQ</td>
<td>Low-Emitting Materials: 3 Points</td>
<td>Requirements for the VOC-content of building products are specified, to ensure a healthy environment for all users.</td>
<td>Veriﬁcation of the thermal comfort happens via a thermal simulation, that can be performed by either the LEED AP or the HVAC design team.</td>
</tr>
<tr>
<td>EQ</td>
<td>Indoor Air Quality Assessment: 1 Point</td>
<td>Verifying the quality of indoor air by performing testing of VOC- and formaldehyde content, among others.</td>
<td>Veriﬁcation of the daylight levels happens either by a daylighting simulation or by measurements.</td>
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<tr>
<td>EQ</td>
<td>Thermal Comfort: 1 Point</td>
<td>A comfortable working environment requires certain temperature and humidity levels during usage. This credit evaluates the the thermal comfort as designed.</td>
<td></td>
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<tr>
<td>EQ</td>
<td>Daylight: 3 Points</td>
<td>Assuring adequate daylighting at the working place to improve user comfort and health.</td>
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</table>
BUILDINGS ARE RESPONSIBLE FOR NEARLY HALF THE CO₂-EMISSIONS OF THE US. WITH THIS LARGE FOOTPRINT, IMPROVING THE ENERGETIC EFFICIENCY IN THE BUILDING SECTOR HAS THE NECESSARY LEVERAGE TO GREATLY DECREASE THE OVERALL ENVIRONMENTAL IMPACT.

Reducing the CO₂ footprint of a building can happen in a few different ways: increasing component efficiency, decreasing consumption by changes of habit, incorporating renewable energy sources into the building design or improving the buildings shell.

LEED judges the energetic performance by comparing the real (“proposed”) building against a baseline building constructed in accordance with ASHRAE 90.1-2010. This comparison is done via a dynamic energy simulation covering one full year.

The temperature amplitude ratio (TAR), the result of complex interaction between specific heat-storage capacity, the density of the insulating material and its thermal conductivity.

EVIDENCE

The necessary information for this credit can be found in the technical data sheet.
PRODUCT CHARACTERISTICS

CALOSTAT® excels in this credit due to its low thermal conduction of only 0.019 W/(m·K). As a very high performing insulation material, CALOSTAT® reduces heat transmission losses by up to 40 % at the same thickness of the insulating layer compared to a regular insulating material. These reduced transmission losses are directly translated into energy savings and a potentially great energetic performance of the proposed building.

Besides the high performance in a winter case, CALOSTAT® further improves energy savings during the summer case. Due to its low temperature amplitude ratio, temperature fluctuations of the outside air are reduced on the interior of the building.

Overall, CALOSTAT® as a high performance insulation material is a great choice for improving the overall energetic performance of a building, for example in the frame of a LEED certification.
A LIFE CYCLE ASSESSMENT (LCA) ANALYZES THE ENVIRONMENTAL IMPACT OF CONSTRUCTION PRODUCTS OVER ITS ENTIRE LIFE CYCLE, CONSIDERING PERFORMANCE INDICATORS SUCH AS CARBON DIOXIDE EMISSIONS, WATER USAGE AND PRODUCED WASTE.

A LCA should be carried out in the design stages to inform building owner and design team on potential measures that may reduce the buildings environmental footprint. LEED encourages conducting a LCA of the project’s structure and enclosure. By requiring one of the impact categories to be reduced by at least 10% compared to a baseline building, building owners are forced to consciously deal with the environmental footprint of their construction project and are encouraged to find measures minimizing it.

PRODUCT CHARACTERISTICS

Due to its low environmental impact, CALOSTAT® has the premise of decreasing the overall LCA impacts. Based on its low conduction coefficient of only 0.019 W/(m·K), up to 50% of layer strength can be saved while achieving the same U-value. This reduction in product volume correlates with a decrease in the overall environmental impact associated with material extraction, product manufacture and transport. CALOSTAT® is covered by an EPD with a Gate-to-Gate scope with recycling option. The environmental impact largely stems from the energy for the manufacturing process – a dedicated recycling effort allows savings of 48% to 91% of the baseline emissions.

EVIDENCE

The necessary inputs for the LCA calculations and the overall evidence for this issue can be found in the EPD.
WHILE THE NECESSITY FOR SUSTAINABLE PRACTICES IN THE CONSTRUCTION INDUSTRY HAS BECOME LARGELY ACCEPTED IN THE PAST FEW YEARS, A LACK OF INFORMATION CREATES DIFFICULTIES IN THE DECISION-MAKING PROCESS.

Only if the environmental impact of building products is presented in a transparent, understandable manner, informed decisions regarding the overall environmental impact can be made. LEED recognizes this gap by rewarding the installation of products fitted with environmental product declarations (EPDs). These quantify the environmental impact of a product, including information on energy use intensity during manufacturing and distribution, material contents, pollutant emissions and waste generation. To achieve this credit it is required for at least 20 permanently installed products to be equipped with an EPD.

PRODUCT CHARACTERISTICS

CALOSTAT® is covered by an EPD with a recycling option. The EPD covers environmental impacts and health effects; overall, CALOSTAT® has low environmental impacts with a chance to further decrease them by 48 % to 91 % by implementing a comprehensive recycling scheme. CALOSTAT® also doesn’t negatively affect health and wellbeing of construction workers or building users. Therefore CALOSTAT® can be counted as one product against the 20 products requirement of LEED.

EVIDENCE

Evidential requirement is a copy of the EPD, which was created in accordance with EN 15804.
Evonik releases a yearly corporate sustainability report (CSR), which covers various topics related to corporate sustainability. Evonik has defined six sustainability areas of action: Strategy and growth, Governance and compliance, Employees, Value chain and products, the environment and safety. Progress in all areas can be controlled by various key performance indicators to ensure a high level of transparency. Furthermore, yearly sustainability targets are set whose attainment is controlled in the following year’s CSR. Overall, the CSR of Evonik features a high level of transparency and commitment and fully accomplishes the requirements of the LEED credit. CALOSTAT® does not feature any recycled content and is not eligible for the related credit points.

**LEED CATEGORY MATERIALS AND RESOURCES**

**Building Product Disclosure and Optimization, Sourcing of Raw Materials**

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**THE DEPLETION OF THE PLANET’S ECOSYSTEMS HAPPENS TO A LARGE DEGREE BECAUSE OF RAW MATERIAL EXTRACTION.**

A product manufactured from primary raw materials causes CO₂ emissions for extraction and transport, further depletes earth’s dwindling resources and might result in potentially recyclable products and materials to be treated as waste. LEED recognizes this issue by promoting products made from recycled materials. Additional points can be earned if a company publicly released a report that states their raw material suppliers as well as supplier locations.

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**EVIDENCE**

Evidence for this credit can be provided by the most recent version of Evonik’s Sustainability report.

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**PRODUCT CHARACTERISTICS**

Evonik releases a yearly corporate sustainability report (CSR), which covers various topics related to corporate sustainability. Evonik has defined six sustainability areas of action: Strategy and growth, Governance and compliance, Employees, Value chain and products, the environment and safety. Progress in all areas can be controlled by various key performance indicators to ensure a high level of transparency. Furthermore, yearly sustainability targets are set whose attainment is controlled in the following year’s CSR. Overall, the CSR of Evonik features a high level of transparency and commitment and fully accomplishes the requirements of the LEED credit. CALOSTAT® does not feature any recycled content and is not eligible for the related credit points.
EVEN THOUGH THE MATERIAL INGREDIENTS OF CONSTRUCTION MATERIALS AND PRODUCTS HAVE A DIRECT EFFECT ON THE HEALTH AND WELLBEING OF THE BUILDING USERS, THE VAST MAJORITY OF CHEMICALS HAVE NEVER BEEN SCREENED FOR POSSIBLE HEALTH EFFECTS.

Some of these chemicals pose a substantial health risk, toxic and bio accumulative chemicals can cause harm even in very small doses. The intent of this credit is to encourage the use of products and materials, for which lifecycle information is available; LEED rewards the selection of products for which the chemical ingredients in the product are inventoried and where the use and generation of harmful substances has been minimized.

EVIDENCE

The necessary evidence is found in the CALOSTAT® Material Health certificate.

PRODUCT CHARACTERISTICS

One approach of demonstrating the harmlessness of the materials used is using products that are Cradle to Cradle Certified™. CALOSTAT® has been assessed against the requirements of the Material Health category of the Cradle to Cradle Certified™ product standard and been awarded Platinum. The product is fully optimized and contains no forbidden chemical substances; furthermore, contact with the product doesn’t expose the building users or construction workers on site to any sort of carcinogens, mutagens or reproductive toxicants.
THE INCREASE IN GLOBAL CONSTRUCTION ACTIVITY IS LEADING TO AN INCREASING SCARCITY OF RESOURCES IN THIS SECTOR.

A sustainable approach to resource management calls for increased usage of recycling opportunities. One such opportunity is diverting construction waste from landfills; in 2014 construction activities accounted for 34% of the total generated waste in the EU. To reduce the amount of waste diverted to landfills, construction waste has to be reused or recycled and be returned to the material circulation as secondary resources. To achieve the points for this credit, at least 50% of construction waste by either weight or volume has to be diverted from landfills.

PRODUCT CHARACTERISTICS

If CALOSTAT® insulation boards are available in a pure and unmixed form, they can be fully reused to create new insulation boards. With these qualities, CALOSTAT® can be considered fully recyclable. When installing the insulation boards it has to be ensured, that the insulation boards can be disassembled without major mingling with other construction products, otherwise it cannot be ensured that the product can be recycled to the extent it may otherwise be.

CALOSTAT® boards are supplied on wooden pallets by the manufacturer. These pallets may be handed in to the supplier of construction materials to be returned to the manufacturer and put back into usage, hence no construction waste is created by the transport of the insulation boards.

EVIDENCE

The evidence needs to document the amount of construction waste that has been diverted from landfill. Usually this consists of weighting receipts of the waste handler showing the amount of waste removed as well as the share being diverted to recycling, heat generation and landfill applications.
THE AVERAGE PERSON SPENDS APPROXIMATELY 90% OF THEIR TIME INDOORS; HENCE A GOOD AIR QUALITY IS CRITICAL TO ACHIEVE A GOOD LEVEL OF HEALTHINESS.

Pollutants to be avoided in an indoor environment include biological agents such as mold, pesticides, various volatile organic compounds and combustion byproducts such as carbon monoxide and particulate matter. The people most perceptible to the effects of bad air quality are those with cardiovascular and respiratory disease. The best course of minimizing air pollutants is avoiding them altogether by installing products with very low emission levels. LEED rewards this approach by allocating up to three points.

EVIDENCE

Reports from the emission testing documenting the VOC content and emissions.

PRODUCT CHARACTERISTICS

CALOSTAT® has been assessed against the requirements of the Material Health category of the Cradle to Cradle Certified™ product standard and been awarded Platinum. This encompasses low pollutant emission levels. Emission testing has shown VOC-levels of 0.04 mg/m³ after three days and 0.018 mg/m³ after 28 days – CALOSTAT® consequently fulfills all requirements of this LEED credit and contributes to creating a healthy working and living environment. Due to their very low emissions, the insulation boards will not affect the indoor air quality testing.
DESPITE THE BEST PREPARED SPECIFICATIONS, CONSTRUCTION PRACTICES CAN GO WRONG. AIR TESTING IS REQUIRED TO ENSURE THAT THE REQUIRED QUALITY IS ACHIEVED DURING THE ENTIRE PROCESS.

Experience shows, that even on the best managed construction sites mishaps happen: Contractors may bring materials on site which may not have been checked against the requirements or which may not adhere to the emissions specifications. To ensure, that the products used reflect the quality required, LEED requires extensive air testing to be performed to evaluate the newly built environment. This way it is ensured, that the working spaces to adhere to the strict emissions standards set by LEED and ensures that counter measures can be enacted if necessary.

PRODUCT CHARACTERISTICS

CALOSTAT® does not emit any of the pollutants tested for in LEED testing protocol. CALOSTAT® has been assessed against the requirements of the Material Health category of the Cradle to Cradle Certified™ product standard and been awarded Platinum. This encompasses low pollutant emission levels that fulfill all requirements from LEED.

EVIDENCE

No evidence specific to CALOSTAT® required; the evidential requirements are fulfilled by the air testing.
THERMAL CONDITIONS INSIDE A BUILDING DIRECTLY AFFECT PEOPLE’S SATISFACTION AND PERFORMANCE. A WORKING ENVIRONMENT THAT CAN BE CONSIDERED EITHER TOO COLD OR TOO HOT WILL LEAD TO DECREASED PRODUCTIVITY AND POTENTIALLY AN INCREASE IN SICK DAYS.

A comfortable working temperature is dependent on clothing level of the building users and the physical effort associated with the activity. An occupant that has to perform physically intense labor is more likely to accept low indoor temperatures compared to one that performs a sitting activity. LEED demands the requirements of either ISO 7730:2005 or ASHREA Standard 55-2010 to be upheld.

EVIDENCE

The necessary information for this evidence can be found in the technical data sheet.

PRODUCT CHARACTERISTICS

Due to its excellent conduction properties, CALOSTAT® is predestined to provide a very good thermal comfort. With a conductivity coefficient of $\lambda = 0.019 \text{ W/(m·K)}$, CALOSTAT® ensures minimal heat transfers through the building’s shell. A further cause for discomfort is a large difference in temperature between the room air and the radiant temperature of walls and ceilings. The low thermal conductivity of CALOSTAT® effectively counteracts this by aligning wall temperatures with the room air temperature.

Another advantageous characteristic of CALOSTAT® is its consistent thermal conductivity, largely independent of the temperature. While many conventional insulation materials face a rapid degradation of insulation capabilities when heated in summer, the thermal insulation of CALOSTAT® is nearly consistent. A temperature rise of 100 K from 10 °C to 110 °C is only accompanied with an increase in conductivity of 0.0045 W/(m·K).
THE INTENT OF THIS ISSUE IS TO ENSURE, THAT ALL WORKSPACES ARE SUPPLIED WITH ADEQUATE AMOUNTS OF DAYLIGHT. SUFFICIENT DAYLIGHTING INCREASES EMPLOYEE PRODUCTIVITY AND DECREASES SICK DAYS WHILE SAVING ENERGY OTHERWISE USED ON ARTIFICIAL LIGHTING.

To ensure compliance with the requirements of this issue, a computer-based daylighting simulation is carried out that accounts for room geometry, wall thickness, reflectivity of the materials as well as local shading to ensure an accurate portrayal of the room as it will be built.

PRODUCT CHARACTERISTICS

CALOSTAT® has an exceedingly low thermal conductivity of 0.019 W/(m·K). This allows for much thinner constructions compared to regular insulations. The reduced wall thickness increases daylight availability in the building, since a wider angle of light can enter the room. Thick constructions can lead to a heavily decreased daylight availability similar to the effect embrasures create in historic buildings.

EVIDENCE

No direct evidential requirements in this credit.
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