Kalzip® NatureRoof

The sustainable green roof

KALZIP NATUREROOF – A PIECE OF NATURE FOR URBAN ARCHITECTURE

SUCCESSFULLY ESTABLISHED IN THE MARKET SINCE **1999**

The flood catastrophe that struck North Rhine-Westphalia, Rhineland-Palatinate and Belgium in July 2021 can be regarded as a clear wake-up call to take climate change seriously and to react decisively to its consequences. Such extreme events pose considerable problems for almost the entire drainage infrastructure.

Why install a Kalzip NatureRoof?

More and more natural roofs are being installed as the cornerstone of sustainable urban development. The Kalzip NatureRoof has many advantages with regard to sustainability as well as environmental and experiential values. It's not without reason that the NatureRoof solution has been established in the market since 1999. Kalzip realised at an early stage the importance of a sustainable green roof construction for more environmentally friendly roofs. The sedum plants used by Kalzip convert carbon dioxide into oxygen and absorb particles from the air. In particular in cities, natural roofs can considerably improve the air quality. Also, the NatureRoof contributes to urban redensification.

Natural roofs as an energy-saving solution

Natural roofs significantly reduce the need for air conditioning systems, because they contribute to thermal protection, especially in summer. In winter, the NatureRoof structure forms a special additional insulating layer that contributes to a reduction in heating costs. Not only that, natural roofs make a big contribution to optimal noise protection.

The Kalzip NatureRoof is based on the advantages of an aluminium roof, which is practically maintenance-free and has a minimum lifetime of 50 years. Unlike conventional green or natural roofs, this makes the Kalzip NatureRoof a sustainable, long-life roof. In addition, the roof has a water transport function, as it stores excess water from storms and delays its discharge into the sewer system. This prevents flooding and lowers the ambient temperature through evaporation. Not only that, natural roofs create space for the development of biodiversity. They are nature reserves and breeding grounds for birds, bees, butterflies and other insects.

Kalzip NatureRoof

Ecologically valuable and permanently safe roof greening

High ecological, structural and design requirements are fulfilled by the Kalzip NatureRoof. The thermally insulating and resource-saving lightweight construction of the Kalzip building system is both the benchmark and the prerequisite for sustainable, intelligent construction. Environmentally friendly and aesthetic needs are equally fulfilled and the technical planning security is guaranteed.

The Kalzip NatureRoof enables safe, extensive roof greening with a low maintenance requirement – low-growing, self-regenerating and dryness-resistant sedum plants convert grey roof landscapes into natural habitats for the smallest of creatures. The sedum plants are undemanding, they withstand smoke and exhaust fumes and are resistant to frost and wind.

The benefits

- Construction without additional sealing measures directly on the Kalzip profiled sheets
- Complete package with a modular building method
- Permanently resistant to root and moisture penetration
- High cost-effectiveness with easy and fast installation
- Slip protection enables greening even with inclined and curved roof shapes
- The function as an arrester device for lightning protection is retained
- All components are environmentally friendly and removable
- The planning is homogenous, even if only partial areas are greened
- With an appropriate static design, Kalzip is easy to retrofit to make a NatureRoof (Kalzip 65/400 & alternatively 65/333)
- The Kalzip aluminium profiled sheets offer high protection against mechanical damage to the roof seal when installing the NatureRoof components
- Kalzip remains a full-value roof covering after removal of the greening
- Kalzip is resistant to flying sparks and radiant heat. This property is retained if the corresponding requirements of the FLL guidelines and the state building regulations are followed

Transformer substation in Wustermark (D)
Profile type: 65/400, stucco embossed

Compensating green areas with the Kalzip NatureRoof

The water retention effect is particularly large on flatly inclined roofs. The sustainable gain for plants, animals and people lies in the sum of the roof greening measures. The Kalzip NatureRoof makes a valuable contribution to rainwater management and to the improvement of air quality.

With a Kalzip NatureRoof with a run-off coefficient Ψ of 0.5 (gradient up to 5 %), 50 % of the precipitation quantity is retained due to the storage capacity of the NatureRoof construction. According to experiments conducted at the School of Technology and Architecture in Bonn, around 33% of the precipitation quantity is returned to the natural rainwater circulation through evaporation.

Renaturation as compensation for urbanisation makes a significant contribution to the preservation of our living space and to the improvement of our living conditions. Roof greening can effectively counteract low humidity, high dust formation, pollution and overheating. Material pollutants from the air in undissolved and particulate form, e.g. "acid rain" and soot, are degraded to a large degree as they seep through the root area of the NatureRoof construction.

reduction in pollutants with extensive roof greening:

Cd	Zn	Cu	Pb	N
96 %	16 %	99 %	99 %	97 %

Kalzip NatureRoof also convinces through

- considerable relief of the sewer system and time-delayed discharge of the excess rainwater into the local and communal drainage facilities
- improvement of the oxygen content, microclimate and humidity in the area surrounding the building
- binding of dust and air pollutants, e.g. CO_2
- thermal and mechanical protection against the influences of temperature, radiation and weather
- all-year-round improvement of thermal protection and room climate
- an increase in the value of the building
- creation of ecological compensation areas to counteract advancing surface sealing

THE NATURAL ROOF IN DETAIL

Improved thermal performance

The natural roof improves the thermal performance of a building by protecting it against heat loss in winter and heat gain in summer. Due to more constant temperatures and a better air quality, the interior climate is improved in comparison with buildings that depend strongly on mechanical heating and cooling systems. The thermal performance is improved by the combined effect of the insulation within the underlying Kalzip system together and the insulating effect of the plant substrate and the greening layer.

However, since the natural roof is a "living" structure, the actual U-values vary depending on the current state of the roof, i.e. density/ maturity of the plants and whether the roof is "wet" or "dry".

The recorded building temperatures under greened roofs are consistently cooler than the air temperature in the surrounding area during warm weather periods. This "cooling" effect will be important for the climate warming in the coming years. A lesser dependence on energy-intensive air conditioning units will lead to considerable cost savings and have a positive effect on the carbon dioxide balance.

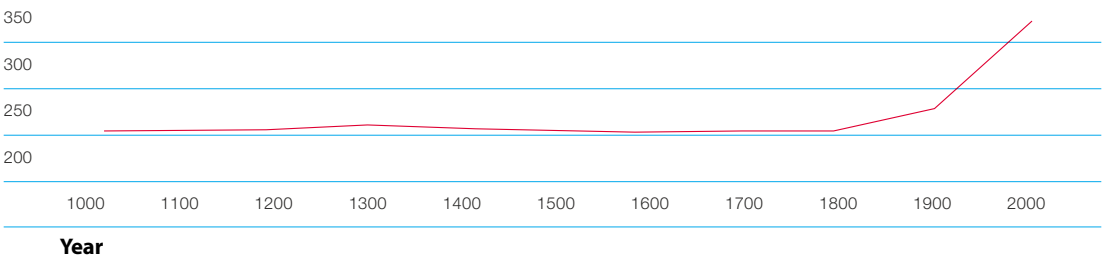
Improved air quality

Plants take up carbon dioxide and give off oxygen to the atmosphere through the process of photosynthesis. At the same time, the leaves of the plants absorb airborne pollutants such as particles from traffic exhaust gases and dust and lock them inside.

In this way, the natural roof can lead to a drastic improvement in the air quality in the area surrounding the building and – in the case of large-scale roof greening – the air quality of entire conurbations.

On the basis of the net balance of the natural processes of respiration and photosynthesis, and assuming a maximum of twelve hours of daylight, it was calculated that each square metre of single leaf surface on an established natural roof absorbs 14.15 g of carbon dioxide and releases 9.68 g of oxygen per day. This calculation is very conservative, as mature plants will have larger leaf surfaces.

Atmospheric CO_2 concentrations in the last 1000 years



Office and business complex on the Mariendorfer Damm, Berlin (D)
Product: Kalzip NatureRoof 65/400
Architect: Pechtold Gesellschaft von Architekten mbH

Reduced rainwater run-off

The management of rainwater is a big problem in urban areas. The impermeable property of most surfaces (both roof and ground) means that the drainage systems have to deal with sudden large changes in the run-off quantity.

Initial studies in the United Kingdom show that greened roofs retain up to 100% of the precipitation if up to 3 mm fall and up to 80% if between 3 mm and
23 mm fall, while 73% of the water was retained in a period in which 41 mm of rain fell in 47 hours. A similar drastic reduction in the rainwater run-off was found in the tests with the Kalzip NatureRoof.

The effect of the roof inclination on the retention was also investigated in these studies. (Kalzip can be installed up to a minimum roof inclination of 1.5 degrees to optimise the retention rates). Further factors that influence the retention rates are the temperature, the maturity of the planted systems and the type of plant.

Minimisation of the temperature fluctuations

The roof greening contributes to the reduction in temperature differences by covering the heat sources and dissipating the solar energy through the evaporation of water from the plant and substrate layers. In Europe it has been shown that roof surfaces can reach a temperature of up to 100 °C. This temperature range can be reduced to 20 - 25 °C by greening the roof area.

Greening by decree

The natural roof offers lifelong environmental and performance advantages for the structure on which it is installed – with measurable improvements in the surrounding "microclimate". So that roof greening has a significant and long-term effect on the climatic conditions in wider geographical regions, however, it must also be applied internationally. This has already been recognised in several European countries and there are legal and tax incentives to drive roof greening programmes forward.

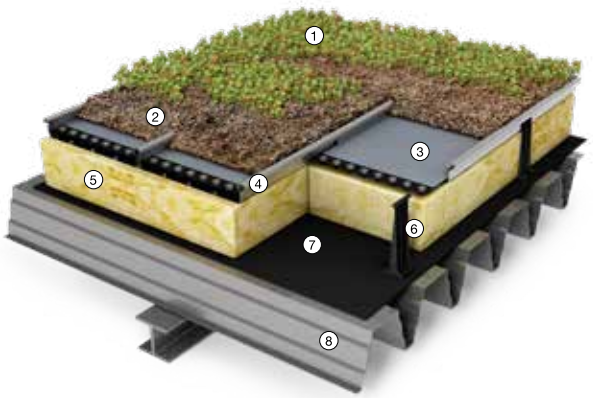
Administration building, Kalzip GmbH, Koblenz (D)
Profile type: 65/333, stucco embossed
Architect: Architektengruppe Voss Naujack von Canal, Koblenz

The Kalzip NatureRoof is unique in its make-up and technical design

The components of the Kalzip NatureRoof structure are delivered to the construction site as a separate unit. The functional layers are coordinated in their mode of operation and form a unit in terms of execution. DIN 4095 "Planning, design and installation of drainage systems protecting structures against water in the ground" as well as the roof greening guidelines of the FLL [Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. - research society for landscape development and landscaping] are complied with.

The Kalzip drainage mat is delivered on a roll with a nonwoven filter cladding. The width matches the Kalzip 65/400 aluminium profiled sheets used (65/333 is alternatively possible) in a length of 10 m or 30 m. This is a linear drainage system according to DIN 4095 with drain holes and water storage troughs – a recycling product, biologically neutral, weather-resistant and once again recyclable. The water storage troughs retain up to 6 l/m² of the precipitation quantity. This serves the plants as a nutrient and the natural circulation as a valuable evaporation reservoir. The nonwoven filter prevents finer soil and substrate parts from the vegetation layer being washed into the drainage layer.
The Kalzip plant substrate is a quality-assured natural product with a test certificate. Consisting of lava and pumice gravel, the Kalzip plant substrate's pH-value is well-matched to the aluminium base material. It is placed on top of the drainage mat and has a layer thickness of 6 cm in the settled state (approx. 15 to 20% settling should be allowed for).

Roof structure Kalzip NatureRoof



① **Kalzip sedum plants,** low-growing, self-regenerating, resistant to dryness and frost

② **Kalzip plant substrate,** natural product with test certificate

③ **Kalzip drainage mat** delivered on a roll with a nonwoven filter sheath

④ **Kalzip aluminium profiled sheets,** the basis for the NatureRoof structure, which is resistant to root and moisture penetration

⑤ **Thermal insulation layer,** precisely adaptable to suit the building requirements

⑥ **Kalzip composite clip**

⑦ **Vapour and air barrier,** protects permanently against diffusion moisture from above and below

⑧ **Trapezoidal profile,** the resistant, lightweight support shell for beam and purlin roof construction; timber boarding is also possible

Extensive roof greening with minimum creation and maintenance effort

Kalzip aluminium profiled sheets 65/400 or 65/333
Thickness: 1.0 mm
Weight per unit area: 65/400 approx. 3.9 kg/m²
65/333 approx. 4.3 kg/m²

Kalzip NatureRoof construction
Kalzip 65/400/1.0 mm
KD 400 drainage mat
Substrate height: 6 - 8 cm (NDS 60 – Vulkaplus Extensiv)
Roof inclination: 1.5 degrees
Determined run-off coefficient C = approx. 0.6 – 0.7

Kalzip KD 400 linear drainage system
Perforated dimpled membrane with integrated geotexile
Cover width: 400 mm
Thickness: approx. 20 mm
Water storage: approx. 6.0 l/m²
Compressive strength: approx. 150 kN/m² = 15 t/m²
Water permeability EN ISO 11058: approx. 100 · 10-3 m/s

Kalzip KD 333 linear drainage system
Perforated dimpled membrane with integrated geotexile
Cover width: 333 mm
Thickness: approx. 28 mm
Water storage: approx. 6.0 l/m²
Compressive strength: approx. 150 kN/m² = 15 t/m2
Water permeability EN ISO 11058: approx. 100 · 10-3 m/s

Kalzip NDS -VE
NatureRoof substrate, pH = 5 – 7
Lava and pumice gravel
Layer thickness: 6 cm (more is possible on request)
Area load: approx. 75 kg/m²

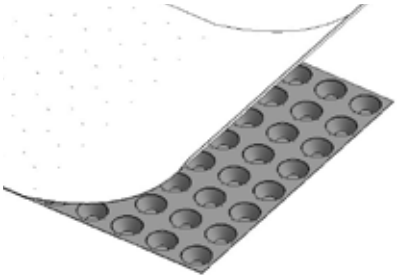
Loose goods, deliverable by truck or
in a silo vehicle for approx. 380 m²,
or in a big-bag (contents 1000 l) for approx. 14 m²

Kalzip sedum sprouts
5 – 7 common plant species/sorts
depending on the season,
in sacks containing 2 - 10 kg

Kalzip Nerotec 60 erosion-protection adhesive
(when using sprouts or only necessary in case of high wind loads)
delivered in 60-litre sacks
1 sack suffices for 25 m² (requirement 0.4 kg/m²)

Kalzip shallow-rooted sedum plants
9 common plant species/sorts
depending on the season,
50 pieces in slabs

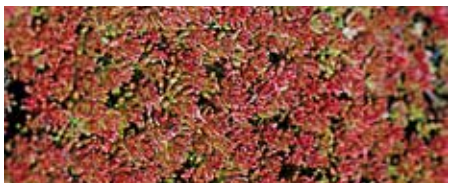
The construction details and the NatureRoof installation guideline can be found at www.kalzip.com



Kalzip KD 400 linear drainage system

Kalzip NDS 60 NatureRoof substrate

Sedum acre, wallpepper
Height: 5 cm, bloom: June to August



Sedum album "Coral Carpet", white stonecrop
Height: 5 cm, bloom: June to August

Sedum floriferum "Weihenstephaner Gold", gold sedum
Height: 15 cm, bloom: July to August

Sedum hybridum, "evergreen"
Height: 10 cm, bloom: June to August

Sedum reflexum, blue stonecrop
Height: 15 cm, bloom: June to August

Sedum reflexum ssp. rupestre, cliff stonecrop
Height: 10 cm, bloom: June to August

Sedum spurium "Album Superbum", Caucasian stonecrop
Height: 10 cm, bloom: July to August

Sedum spurium, "Fuldaglut"
Height: 10 cm, bloom: July to August

Sedum sexangulare, six-sided stonecrop
Height: 5 cm, bloom: June to August

The sedum sprouts for the Kalzip NatureRoof

Composition:
Mix of 5 - 7 sorts/species of sedum plants according to the table below; composition varies according to the weather and the season-dependent condition of the cultures.

Packaging units:
Sedum sprouts are sold by the kilogram and filled into air-permeable sacks of various sizes. The maximum quantity that the largest sack can hold is 10 kg. Larger quantities are therefore divided into several 10 kg sacks plus any additionally required smaller sacks.

Required sowing quantity:
Variable; not less than 60 g/m^2 and 150 g/m^2 for fast greening.

Sowing:
Sedum sprouts are scattered over the area to be greened, lightly raked and in the ideal case rolled and copiously watered, penetrating the substrate. It takes 2 – 4 weeks for the roots to form, during which time the area has to be kept moist. The time taken for successful greening to become visible depends among other things on the time of sowing, the quantity of sprouts sown per m^2, as well as the weather with external influences such as temperature, sunshine duration, precipitation and dew moisture etc.

Storage possibility
Since sprouts are easily perishable, they should not be stored, but used immediately! If storage should nevertheless be necessary, the sedum sprouts should be scattered from the sacks and distributed over a wide area in a cool, dry shady place, protected against wind. In this way they can be stored for 2 – 3 days at the most. Do not water the sedum sprouts during storage, as this will lead to rotting.

Product availability
The sprout harvest usually begins at the end of April and ends in late October to mid-November, depending on availability.

Shipment methods
Depending on the size of the order, sedum sprouts are dispatched by parcel service in cardboard boxes, while larger quantities are sent via general cargo carriers in disposable plastic or wooden crates stacked on pallets. Express dispatch is strongly recommended here in order to keep the transport duration as short as possible.

Islington Waste & Recycling Centre (UK)
Profile type: 65/333, stucco embossed

www.kalzip.com

Kalzip is a Donges Group company

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