

Sustainable roof refurbishment

Economical - durable - safe

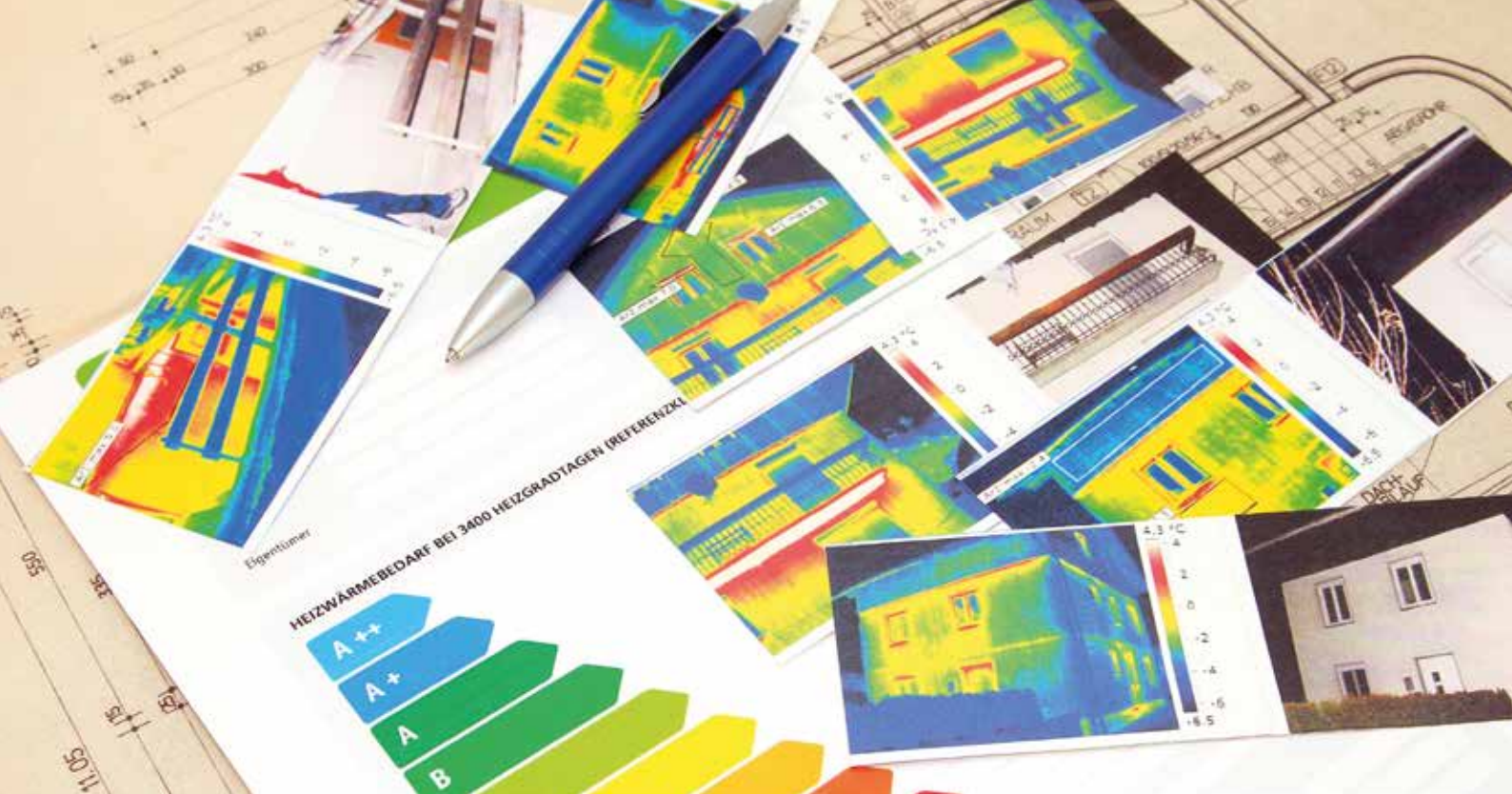


Miele & Cie. KG, Warendorf
Architect: Bauabteilung Miele & Cie. KG



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Energetic and affordable restoration - sustainable investment for the future

About 40 percent of the final energy in Germany is consumed by the building use. The largest part is caused by the room heat. The rest is consumed by the provision of hot water as well as cooling and lighting in non-residential buildings.

The energy and political climate objectives of the Federal Government intends to design the existing buildings in such a way that they are climate-neutral. A variety of different measures are implemented for this purpose. They are targeted to cut the energy consumption in half and to increase the share of renewable energies to about 60 percent. Energy saving

potentials exist especially in the non-residential area, based on the number of buildings or the energy demand of the high number of existing buildings with a bad energy balance.

An energetic restoration of the existing buildings makes a significant contribution to reach the established objectives. However, the modernisation of buildings is only attractive for the cities, communes, communities, real estate owners and the Federal Government if the economic feasibility of the measures is supported by subsidies and affordable system solutions.

REFURBISHMENT SERVICE OVERVIEW

The basis for an economic and safe restoration concept is a detailed appraisal and analysis of the building condition, the carrying capacity and the planned restoration scope. Updated plans, static proofs and documentation as well as the specifications for the materials used at the time are missing for buildings of the 1970s and 1980s. The Kalzip restoration options therefore provide a holistic solution, from the planning and RFP phase to the provision of all required materials for the substructure, roof covering and drainage:

- Non-binding, project related on-site consultation by Kalzip refurbishment experts
- Appraisal by qualified roof experts (e.g. check of the insulation and sealing constructions)*
- Recommendation by independent engineering consultants for the status check
- Rechnerische Erfassung und Bewertung der tragenden Deckenkonstruktion sowie Aufnahme von Bindern und Stützen*
- Calculation based acquisition and assessment of the carrying roof structure as well as the inclusion of bonders and supports*
- Cost determination
- Provision of principles for the request for proposal
- Cost comparison: conventional refurbishment vs. Kalzip
- Monitoring the implementation work with extended warranty
- Removal calculations for anchors, fasteners and dowels*
- Heat and moisture protection proofs*
- Lightning protection
- Parts lists and installation plans

*These services will be charged





The correct refurbishment solution instead of kludge - for highest construction-physical and architectural requirements

Old roof structures are often not in accordance with the current EnEV requirements. The adaptation to the current heat protection standards by the installation of an additional, EnEV-conforming insulation layer can be realised easily and economically as part of a roof restoration with aluminium standing seam profile panels by Kalzip.

The simplified process of verifying the U-value $W/(m^2 \times K)$ at outside components is possible to fulfil the strict requirements of the energy saving regulation for roof restorations, without the need that the expensive and difficult proof for the entire building must be provided. In addition to the fulfilment of the heat protection requirements, the Kalzip roof systems also achieve outstanding sound protection values up to $R'w = 43 \text{ dB (A)}$, depending on the roof structure. Based on their generally low weight, they are also predestined for large spans and the restoration of old roofs.

The flexibility and versatility of the Kalzip restoration options offer architects, planners and builders creative design options while providing contemporary new definitions of roof landscapes for existing buildings as well as associated significant optical improvement.

The advantages

- Highest corrosion resistance through seawater resistant basic aluminium materials
- Permanent, functional and almost maintenance-free building protection
- High design freedom through individual roof forms
- Economic, fast installation
- Unrestricted object uses during refurbishment in most cases
- In most cases disposal cost savings for the old roof skin and insulation layer
- Conforming adaptation to the current EnEV

Sports hall Vallendar
Architect: Guido Fries Architekten



Refurbishment of flat roof sealings (starting at 1.5°) using the roof refurbishment system Vario LB

Kalzip offers a variety of systems, which have proven itself in practical use, for the sustainable restoration of flat roofs. By using these solutions, ailing flat roofs can be converted especially cost-effective into a safe sloped roof (cold roof structure).

The possibly existing gravel fill will initially be removed during the constructional implementation. The weight reduction provides load reserves that are suitable to safely absorb the additional superstructures. Afterwards, the thorough review of the sealings is performed (cutting of existing perforation, blisters, etc.). A flexible light weight substructure will be permanently connected to the building for the formation as a cold roof construction. Special slope-flexible tubs are used as the anchoring base, which are used to install, and screw-connect variable supports. A T-shaped component with a round pipe will be installed and fastened in these supports vertically for the installation of the slope-flexible purlins. The flex-purlin is designed in such a way that it determines the roof slope placed on the round pipe and that it can accept the newly developed rail clips.

To adjust to different roof slopes or unevennesses, an optional 360° ball-and-socket joint is available for the variable alignment of the total substructure.

The systems are stiffened by compression struts, which are installed after the clip installation from the eaves to the ridge. Longitudinal and traverse bracings will be installed additionally to stabilise the structure. Afterwards, the new roof skin made of aluminium standing seam panels will be installed and connected force-fit with each other. The system includes all connection and termination details.

The existing bearing structure can normally be used without the need for additional measures. The new substructure can easily and safely be adapted to the building geometry and the building structure.

Kalzip restorations offer the opportunity to permanently increase the value of objects through a contemporary roof architecture. In accordance with the architectural concept, the profile panels will be pre-fabricated accurate to dimension. This means that drums, arches and rounded eaves solutions can be implemented cost effective and exactly. This restoration variant is preferably being qualified for all flat roof structures made of bitumen and foils.

The advantages

- Low additional structure weight - suitable for statically critical roof superstructures
- Activation of carrying load and safety reserved by removing the gravel filling
- High stiffness and stability
- Easy determination of the new roof geometry
- Economic, fast installation
- Depending on the condition, all insulation materials can be reused, and new installation materials provide additional heat protection



Refurbishment of flat roof sealings (under 1,5°) with the roof refurb

Before



After

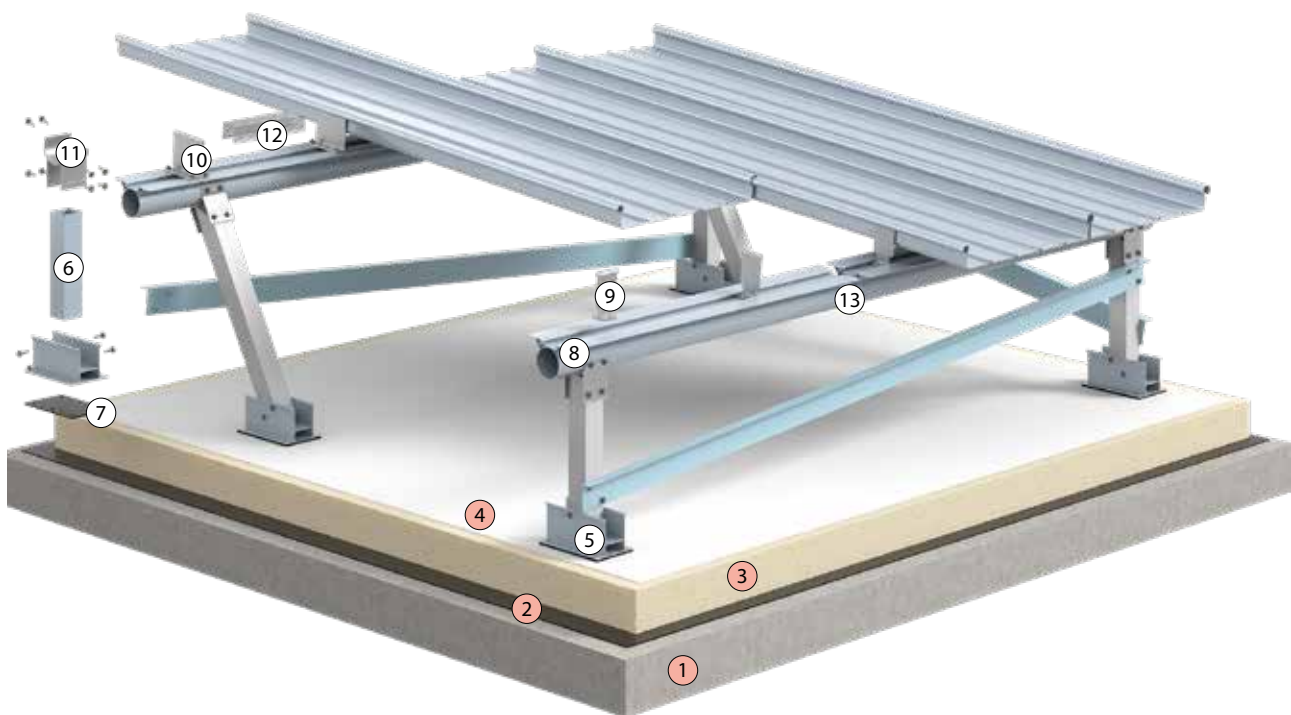


Berufsbildende Schulen, Meppen
Planer: Stefan Hölscher, Geeste

Refurbishment system Vario LB

Refurbishment solution:

Kalzip Vario LB refurbishment system for flat roofs (under 1,5°)



Kalzip Vario RT system design

Existing buildings

- 1) Top floor ceiling (weight bearing substructure), e.g. concrete or trapeze profiles
- 2) Vapour barrier
- 3) Flat roof insulation
- 4) Existing bitumen or membrane sealing

Kalzip refurbishment solution

- 5) Vario LB basic profile
- 6) Vario LB support profile
- 7) Vario LB support head 145/200
- 8) Kalzip LB pipe purlin 80
- 9) Vario LB rotatable clip
- 10) Fixed point clip
- 11) Vario LB fork profile
- 12) Vario LB support sheet
- 13) Vario LB joint profile 80
- 14) Vario LB eave angle



Refurbishment of flat sloped sealings ...

on concrete ceilings
on hollow chamber
ceilings on ribbed ceilings
on wood substructure
(formed surfaces)

Kalzip offers different construction variants for refurbishment of flat-slope roofs with upper sealings e.g. on a concrete substructure: the energy-saving Kalzip DuoPlus or a simple and light weight substructure directly on the existing roof structure.

Kalzip DuoPlus – The energy saving wonder

The outer roof cover and the inner shell structure for Kalzip DuoPlus are thermally separated. The existing roof structure often qualifies as shell structure. A sloped vapour barrier will be installed on the concrete surface after removing the old roof structure. As a continuous thermal separation, this is the basis for a layer of step-resistant or compression resistant mineral wool as per DIN EN 13162 or PIR/PUR insulation panels as per DIN EN 13165 with thickness of 100 mm or 140 mm.

The especially developed DuoPlus rotational clip rail type E will be installed on this heat insulation and it will be fastened at the substructure using approved connections elements.

The rotatable clip rail is used to transfer the outside load from the clip to the heat insulation and the substructure underneath. Based on its special design, it is used as an economic and safe fastening surface for the rotational clip adapter with E-Klipp. It will subsequently be screwed in manually. Depending of the profile dimensions and/or the tolerance, it can be adapted during the installation to the respective condition. The second mineral fibre insulation felt layer is determined by the height of the E-Klipps, and the total insulation thicknesses of maximal 330 mm with a root face of 65 mm or 345 mm with a root face of 50 mm of the aluminium profile can be realised.



“For us, the Kalzip roof system is the most economic and also the most sustainable solution. Based on the low weight of the new roof structure, we were able to install an efficient heat insulation on the existing substructure without the need for additional static measures and therefore we have fulfilled the required insulation values also with respect to the future usage options of the hall. An outstanding installation quality was achieved due to the optimised installation characteristics and the flexibility of the restoration system. The new hard roofing is durable, flying sparks resistant and maintenance-free. During the next few years, we will save maintenance and operating costs. In addition, we can cover the roof surface with the company colours and place the name of our company on it and this contributes to our image building programme.”

Klaus Hillmer, Head of Global Contract logistics, company group Lexzau, Scharbau GmbH & Co. KG, Bremen

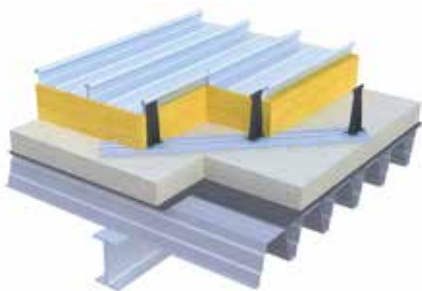
More efficiency at low costs

The Kalzip standing seam roof system is the sustainable and economic alternative for the permanent restoration of flat sloped roofs for industry and commerce buildings. It is especially qualified for buildings for which builders, planners and architects request low maintenance, a long service life and the safety of a “hard” roofing. In combination with the Kalzip vapour barrier FR, this roof concept is in accordance with the fire protection as per industry construction directive [Industriebau-richtlinie].

In general, the existing building construction of the old roof structure will be checked first for the restoration. If the heat insulation for the building is still functional and dry, then an additional vapour barrier may possibly be installed. Sealing and insulation must be removed and replaced in parts or completely in case of an ailing roof structure. The installation of the Kalzip standing seam roof can be started on the newly installed vapour barrier. For this purpose, the Kalzip E-Klipps may, for example, be fixed using approved connection materials on an intermediate

structure, e.g. as a rotational clip rail, which was fastened in advance as per installation plan, for example, on the concrete ceiling. Depending on the structure, clip height and U-value specification, a condensed heat insulation can subsequently be installed. The Kalzip aluminium panels, which are beaded force-fit to each other, are installed last.

A later installation of additional roof structures, for example, photovoltaics, without the need for penetration is possible at any time depending on the static condition.



Kalzip DuoPlus E roof structure

Combination of insulation materials with different thermal transfer coefficients

Variant	Basic insulation	Insulation felt	Insulation thicknesses condensed (mm)	U-value (undisturbed)	U-value* (rated value)
1	WLS 024	WLS 032	100 + 100	0,135	0,141
			140 + 180	0,086	0,092
2	WLS 037	WLS 035	100 + 100	0,173	0,186
			140 + 190	0,106	0,118
3	WLS 040	WLS 040	100 + 100	0,195	0,205
			140 + 180	0,123	0,131

*U-values in W/(m² x K) for the combination of heat insulation materials with different thermal transfer coefficients and insulation material thicknesses for a clip quantity of 2 Klipps/m².

Refurbishment of flat sloped roofs

Before



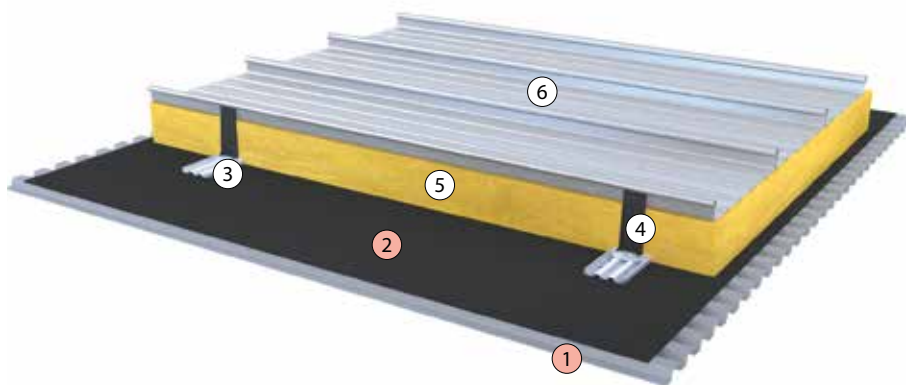
After



Trützscher GmbH & Co KG Textilmaschinenfabrik

Refurbishment solution:

Kalzip DuoPlus rotatable clip rail E for flat sloped roof structures

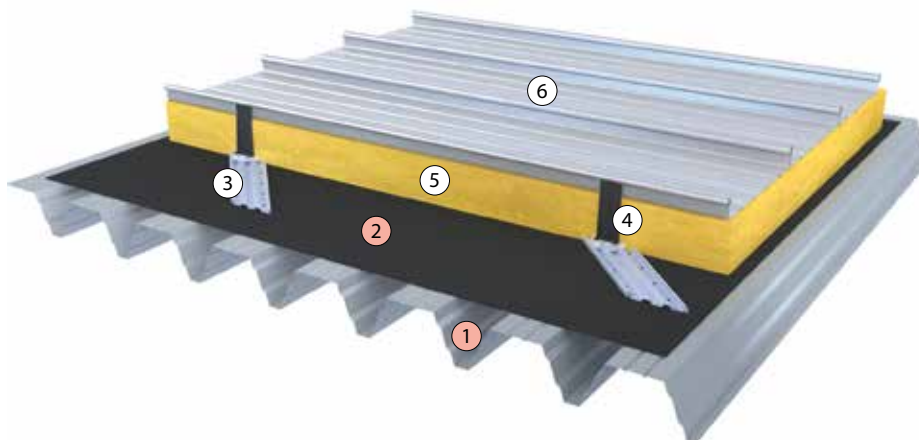


Existing buildings

- 1) Steel trapeze shell structure in purlin position
- 2) Vapour barrier

Kalzip refurbishment solution

- 3) DuoPlus rotatable clip rail E
- 4) Rotatable clip adapter with E-Klipp
- 5) Insulation felt that can be condensed
- 6) Kalzip Profiled sheets

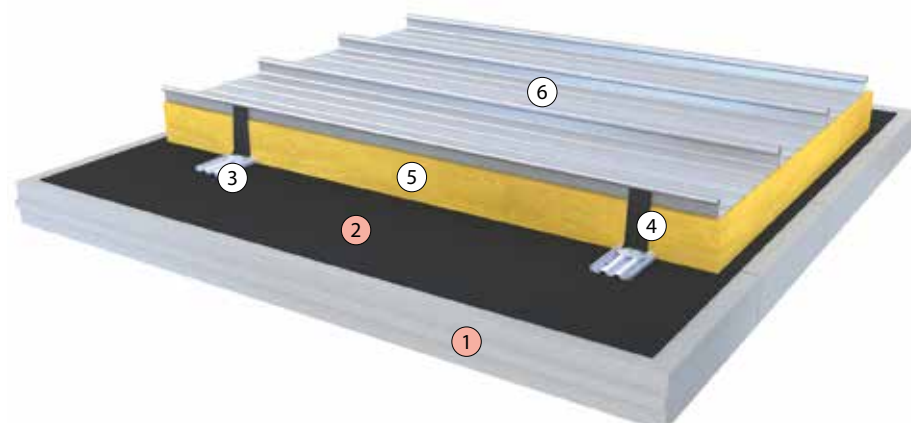


Existing buildings

- 1) Steel trapeze shell structure in bonder position
- 2) Vapour barrier

Kalzip refurbishment solution

- 3) DuoPlus rotatable clip rail E installed diagonally
- 4) Rotatable clip adapter with E-Klipp
- 7) Insulation felt that can be condensed
- 8) Profiled sheets



Existing buildings

- 1) Concrete ceilings with hollow chamber ceiling
- 2) Vapour barrier and emergency sealing

Kalzip Sanierungslösung

- 3) DuoPlus rotatable clip rail E
- 4) Rotatable clip adapter with E-Klipp
- 5) Insulation felt that can be condensed
- 6) Profiled sheets



Refurbishment of sawtooth roofs

For the sustainable refurbishment of industry halls, the preservation and modernisation of traditional sawtooth roofs are increasingly more important for builders and architects. Their aesthetic forms provide a distinctive city and landscape character for the old factory buildings. Their high usage value is appreciated in those areas where they are preserved. Sawtooth roofs provide more light for the rooms underneath. They provide conditions free of shades and glares. They increase the feel-good factor for the people who work here, which in turn increases their productivity. And finally, the sawtooth roofs create normally support-free spaces, which means that the production surface can be used more flexible.

Sawtooth roofs exist either in a sloped or an arched form as a thin shell structure made of concrete. The sawtooth roofs also consist often as wood or steel structures with different roof covers. Large spans with very thin concrete shells can be produced based on the cleverly devised geometry of roof shell and gutter. Their sustainable energy-related modernisation plays a large role now since many roofs built in the 1930s to 1950s have not been insulated.

As a matter of principle, a detailed appraisal of the existing roof structure must be performed for each refurbishment of sawtooth roofs. The carrying capacity of a concrete shell and the permissible resilience of the planned fastening materials can be tested through extraction tests. Wind suction loads must be calculated in accordance with DIN 1055. A new vapour barrier is used after the existing roof structure has been removed and while installing the new

roof structure. Depending on the substructure, an intermediate structure for the assumption of the E-Klipps will be installed. The roof structure with a soft heat insulation follows and the Kalzip profile panels are finally installed. One advantage of this light roof structure is the fact the static proof in accordance with the new standards is easy and without the need for additional measures. The Kalzip aluminium profile panels can be used ideally as welded joints for the connection to the window bands.

Power plant on the roof

As part of the energy-related restoration, usages that were previously not possible are now available for old industry halls. The Kalzip standing seam system based on light-weight aluminium profile panels permits the installation of photovoltaics on the existing roof structure also for structures that are stressed to a large extend. The standing seams are ideal for the installation of carrier systems for solar modules without the need for penetration.



Refurbishment of sawtooth roofs

Before



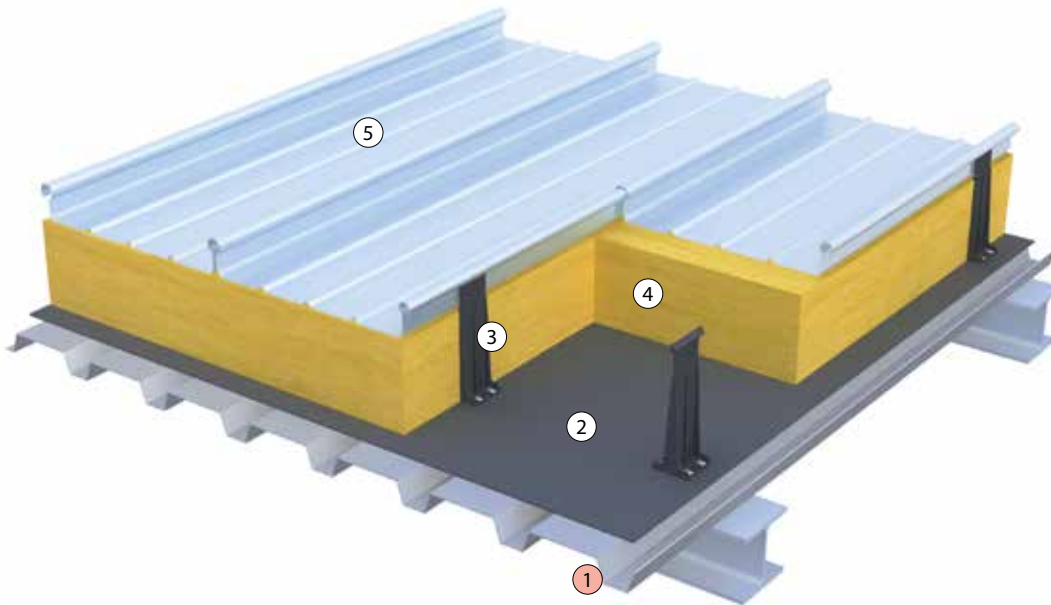
After



Truniger AG, Langendorf (CH), vorher/nachher
Architect: InduBau AG

Refurbishment solution:

Kalzip refurbishment solution for flat sloped roof structures

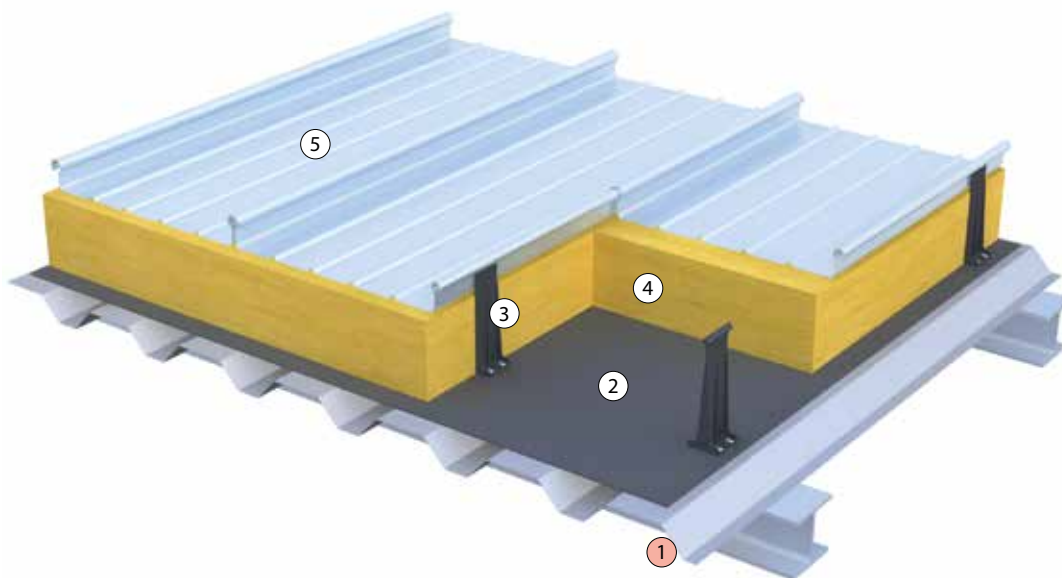


Existing buildings

- 1) Steel trapeze carrier TR 35/250

Kalzip refurbishment solution

- 2) Vapour barrier
- 3) E-Klipp
- 4) Insulation felt that can be condensed
- 5) Kalzip profiled sheets 65/400



Existing buildings

- 1) Steel trapeze carrier TR 35/250

Kalzip refurbishment solution

- 2) Vapour barrier
- 3) E-Klipp
- 4) Insulation felt that can be condensed
- 5) Kalzip profiled sheets 65/500

Note:

The Kalzip restoration solution for flat sloped roof structures is also qualified for asbestos roof structures (page 27).



Refurbishment of sandwich roofs

Sandwich elements consists of a weather-proof an outer and an inner cover layer with an insulation material core made of rigid foam or mineral wool. State-of-the-art sandwich panels include U-values between 0.22 and 0.44 W/(m² x K). Fillings made of mineral wool are used for increased fire protection requirements.

Based on weather influences, penetrating rainfall water through leaking traverse and longitudinal joints is often experienced for older roofs with sandwich elements made of steel. In addition, corrosion damages are experienced again and again with time at the cutting edge and the outer fastenings. A repair or exchange of individual panels is often not acceptable.

The Kalzip refurbishment professionals provide sustainable and innovative solutions for cases like these. A feasibility study will be presented to the builder after a detailed appraisal at the onsite situation and the assessment of the static conditions. The direct installation of a Kalzip non-insulated roof on to the sandwich element is a proven solution, which will basically be installed as an “umbrella” over the existing roof.

An intermediate structure for the placement of the Kalzip E-Klipps using the DuoPlus rail E is used additionally. Depending on the U-value requirement, the roof can also be enhanced energy-related by installing a heat insulation. The refurbishment is performed without restricting the use of the building and without any operational interruptions.

The advantages

- Corrosion-resistant, weather-resistant aluminium alloy as the basic material
- The restoration work is in most cases performed while the building is in use
- Disposal costs are not generated
- The constructional heat protection is increased due to the additional heat insulation
- A high-quality sound protection can be achieved through constructional measures
- High stability and low dead-weight load
- Fast and largely weather independent installation
- Age resistant and durable
- Immune against UV rays
- Resistant against micro organisms

Sanierung von Sandwichdächern

Before



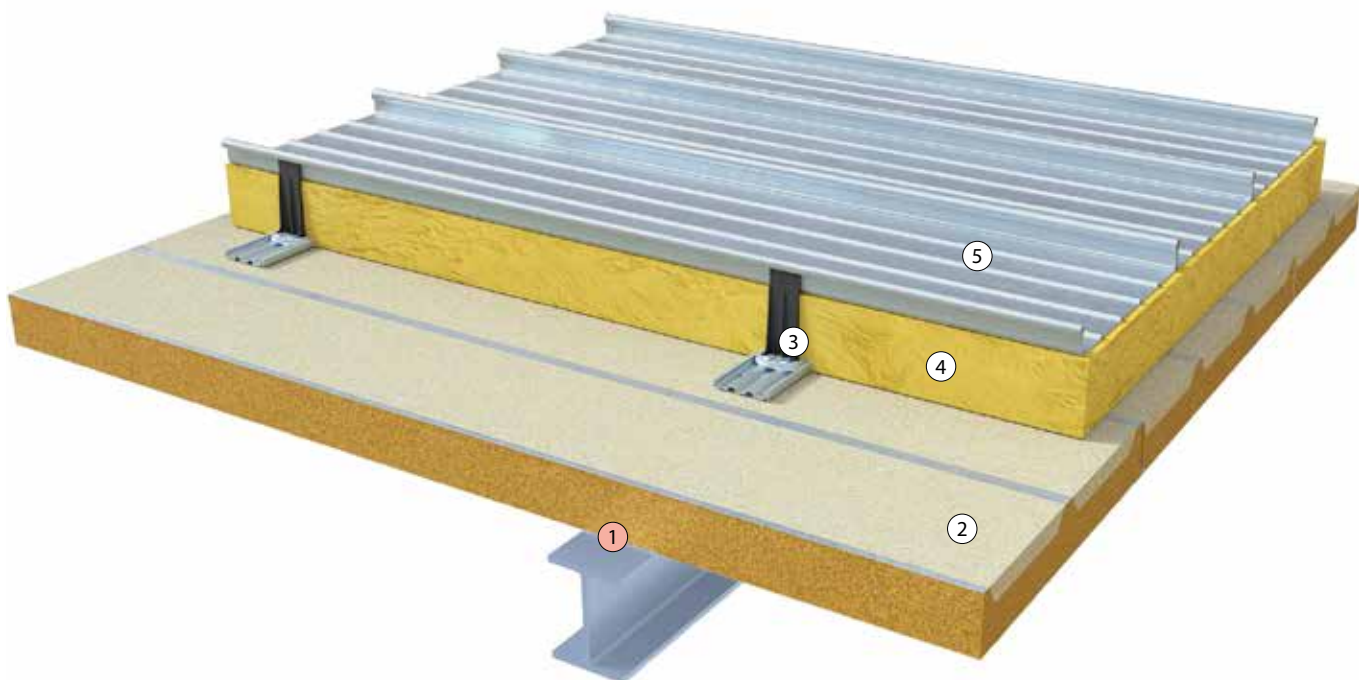
After



Westfalz-Werkstätten, Betriebsstätte Kaiserslautern-Siegelbach

Refurbishment solution:

Kalzip DuoPlus rotatable clip rail E with step-resistant insulation on the entire surface for steel sandwich roof structures



Existing buildings

- 1) Steel sandwich element

Kalzip refurbishment solution

- 2) Step-resistant insulation as a shim to establish a bearing area
- 3) DuoPlus rotatable clip rail E with E-Klipp
- 4) Insulation felt that can be condensed
- 5) Kalzip profiled sheet



Refurbishment of corrugated asbestos roof covers

Based on its versatile characteristics (non-flammable, resistant against heat, corrosion, acids, high insulation characteristic, low heat conductivity), asbestos was used in many building areas. Until the early 1980, many roofs were roofed with the then practical and cost effective corrugated panels made of asbestos cement. Therefore, it must be assumed that most buildings that were erected before this time also included asbestos containing products. Serious measures are currently taken to remove and dispose this harmful construction material from the public space. In Holland, for example, all buildings with asbestos containing materials must be restored before 2024.

Kalzip refurbishment experts can offer sustainable and cost-effective solutions especially for roofs that are covered by corrugated asbestos panels. Kalzip develops the optimal restoration for the existing roof after a detailed appraisal of the on-site situation.

After the old roofing has been removed, the new roof structure is placed on the existing substructure, either

- as a cold roof with restoration purlin, i.e., the carrying purlin will be placed on the existing building and anchored. The clips with the Kalzip profile panel will be installed on this basis as the ventilated cold roof.
- as a warm roof - a steel trapeze profile, e.g. TR 50/250, in the tensioning direction ridge/eaves, will be placed on the existing purlins, this is followed by the vapour barrier; the E-Klipps will be fastened on the upper belt in accordance with installation plan. The insulation will be placed afterwards and the Kalzip 65/500 profile will finally be installed in the grid of the trapeze profiles. A 35/200 trapeze profile with a corresponding Kalzip profile 65/400 can also be installed as an alternative.

The advantages

- Corrosion-resistant, weather-resistant aluminium alloy as the basic material
- The disposal will be performed in accordance with the hazardous materials regulations TRGS 519
- Flexible, adaptable to any layout and size
- High stability and low dead-weight load
- Fast and largely weather independent installation
- Age resistant and durable
- Immune against UV rays
- Resistant against micro organisms

Sanierung von Wellasbestdachdeckungen

Before

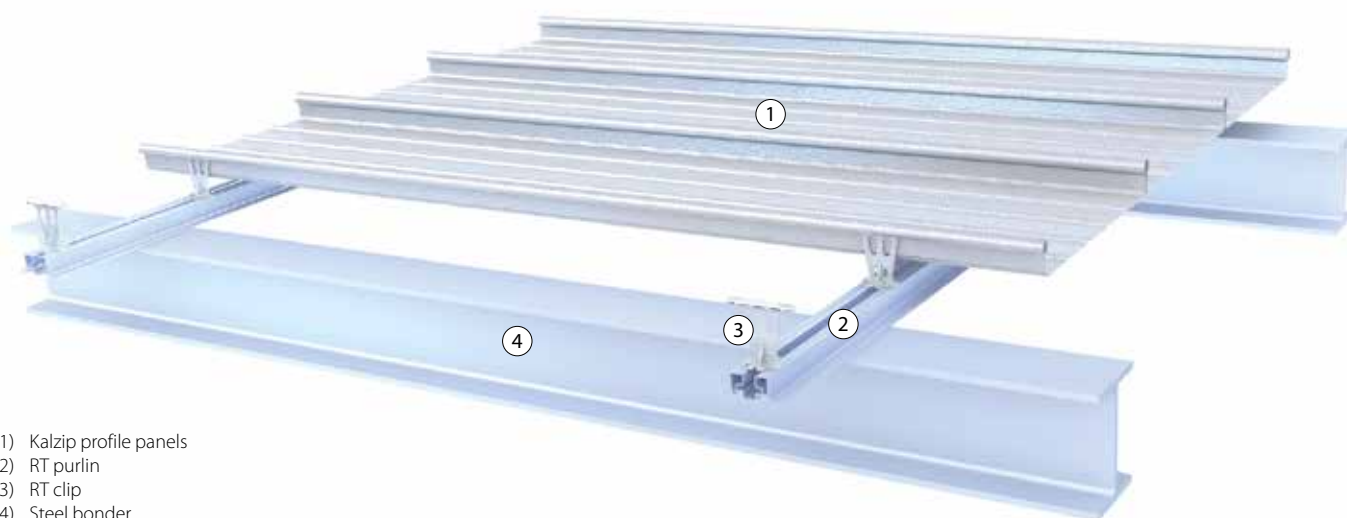


After

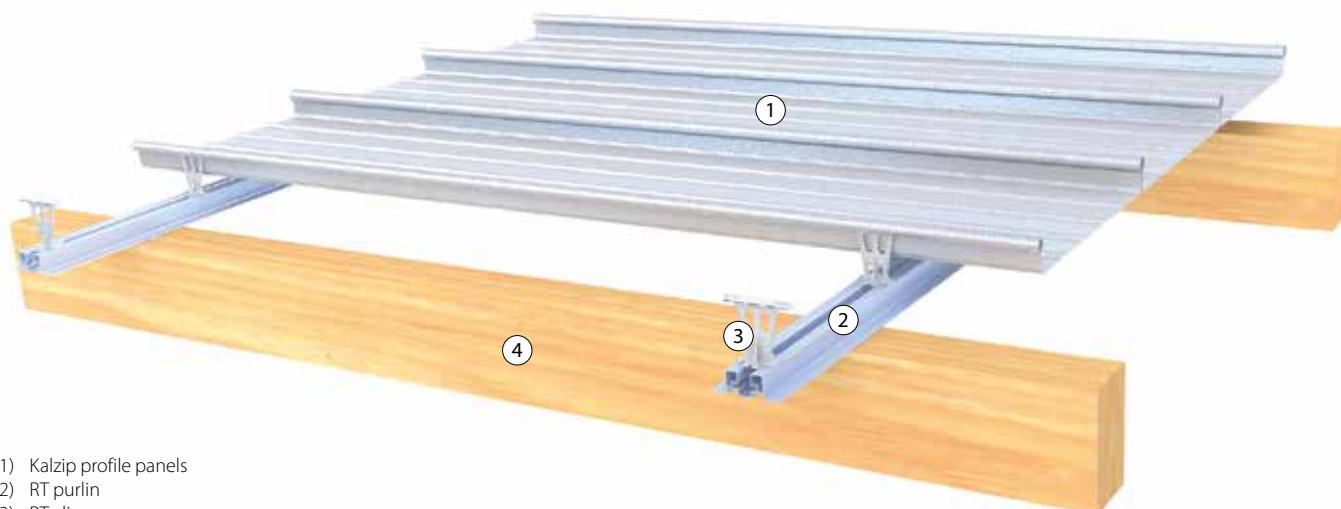


MDR-Zentrale Leipzig (D)
Architekten: Harms & Partner

Refurbishment solution:
for a cold roof with a Kalzip RT 40 purlin



- 1) Kalzip profile panels
- 2) RT purlin
- 3) RT clip
- 4) Steel bondar



- 1) Kalzip profile panels
- 2) RT purlin
- 3) RT clip
- 4) Wood bondar

Refurbishment solution
for a warm roof can be found on page 21



General information

(Disposal of HBCD containing insulation materials, asbestos containing materials, fastening materials)

Handling of HBCD containing materials

HBCD is the abbreviation for hexabromocyclododecane, a hazardous poisonous fire protection agent, which was used in Styrofoam. Therefore, the disposal of old Styrofoam is often impossible, additionally it is very expensive and requires a high administrative effort. The disposal problem is based on technical reasons: The Styrofoam, polluted with poisonous material, must be burned. However, only a few incinerators exist in Germany. Alternative processes are still in their trial phase.

The Kalzip restoration concept eliminated the disposal problem for Styrofoam, foils and membranes: The old roof insulation and the ailing sealing remain where they are.

The new roof skin made of aluminium and the new insulation layer made of non-flammable mineral fibre will be installed completely independent of the existing roof structure. This reduces the work time and the costs for dismantling and it uses the old insulation layer for the optimisation of the thermal protection.

Handling of asbestos containing material

Depending on the asbestos type, invisible, frayed and split asbestos fibres are health hazards. They get unnoticed into the organism through the inhaled air and can cause incurable illnesses. The fibres of so-called non-friable asbestos will be released through decomposition or during dismantling measures. Therefore, the use of asbestos products is prohibited since 1993.

In general, installed asbestos element parts must not be removed or replaced. However, strict regulations apply if restoration work is required for ailing or damaged corrugated asbestos roofs. This also applies to the cover of asbestos containing construction materials or the installation of solar systems and photovoltaics. The detailed prerequisites can be found in the technical rules for hazardous materials [Technische Regeln für Gefahrstoffe (TRGS 519)]. Reporting and verification obligations to the respective industrial inspectorate authorities is required for the industrial company in accordance with the hazardous materials regulation. As a matter of principle, asbestos containing materials must only be disposed by specialised companies or persons with appropriate professional know-how and in accordance with appropriate protective measures.

SUSTAINABLE BUILDING WITH POSITIVE ECOLOGICAL BALANCE

Kalzip is constantly developing new solutions with sustainability in mind. Reliability, safety, consistency and innovation are the guiding principles in every phase of product development. As a result, buildings are no longer designed as energy consumers, but as certified „green buildings“; should make an active contribution to achieving climate targets.

The demand for environmentally friendly buildings with sustainability certificates and quality seals is constantly increasing. This seal of approval evaluates the ecological, economic and socio-cultural aspects of building. In addition, technology, processes, site quality and life cycle costs are also included in the evaluation criteria.

With the BRE, ECO* and FDES Environmental Declarations, Kalzip offers the relevant European programmes which support certification of the construction project. You make a Type III

environmental product declaration in accordance with ISO 14025 and are recognized and verified by independent auditors.

The trend in international construction is moving even further in the direction of intelligent buildings. The further development of the „green building“; aims to create high-tech buildings with the greatest possible claim to sustainability - the use of building materials such as Kalzip is more than obvious.

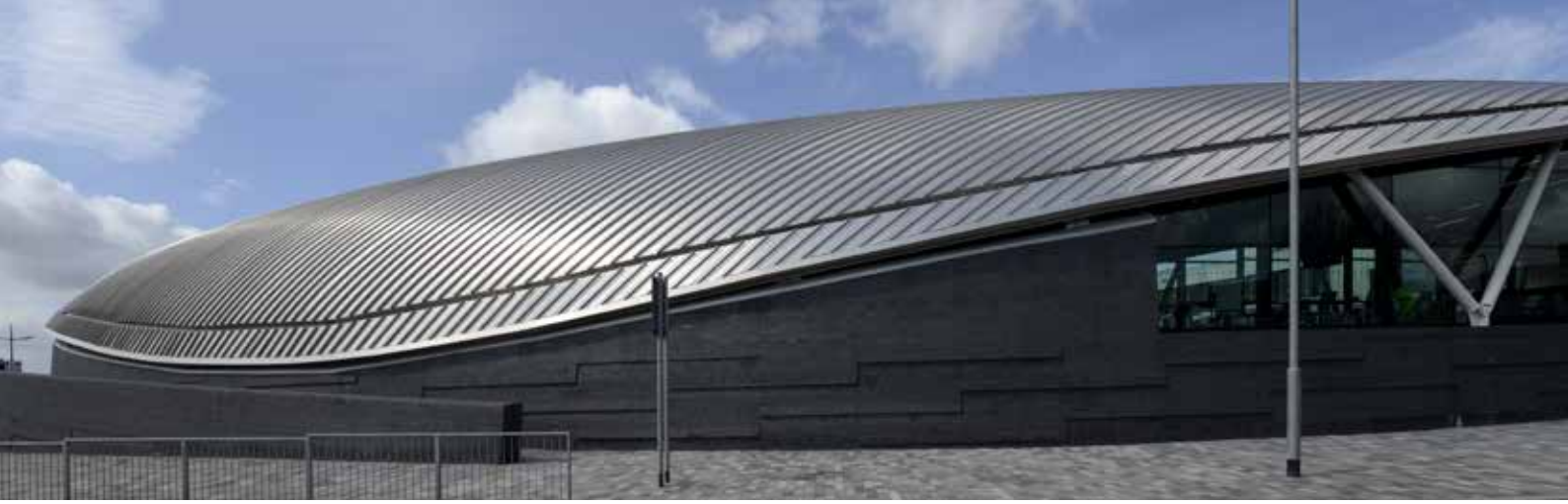
So the future belongs to the „blue technologies“. Together with all involved companies in the construction process, Kalzip buildings is striving to develop new international building technologies. Not only meet national sustainability standards, but also set global standards themselves. The Kalzip material is the perfect choice to achieve this goal.



**Institut Bauen
und Umwelt e.V.**



* European EPD, carried out by the Institute for Building and Environment (IBU e.V.) in accordance with prEN 15804.



Stoke Bus Station (UK), Profiltyp : 65/400, stucco-dessiniert
Architekt: Grimshaw Architects

Aluminium - functional and durable

Kalzip sustainability focuses on aluminium itself - a material that can be recycled as often as required and which can be recycled over a long period of time has abundant deposits. It contributes significantly to protecting buildings effectively and for decades against external influences and to maintaining their value.

Due to its enormous durability and excellent recycling properties, three-quarters of the aluminium produced worldwide to date is still in use.

One of the outstanding properties of the material is its resistance to weathering and the associated durability. This creates security, especially when there are high demands on the use of buildings, e. g. B. at airports, or in aggressive Environment, as near the coast.

The material used for Kalzip has been subjected to critical tests time and again over the years. Among other things, the Federal Institute for Material Testing and -research - after almost 40 years of exposure - the improved weather resistance of plated Kalzip profiled sheets.

Why aluminium?

- Third most common element of the earth's crust - in combination with other elements it is present everywhere in nature
- Aluminium, once produced, delivers products for generations through recycling
- It can be dismantled without restriction
- Up to 95 % of the energy used for production required energy are generated during the Recycling saved
- Roof and façade products are durable, maintenance-free, deconstructable and therefore sustainable
- Very corrosion resistant and causes a very low load potential through worn metal parts.

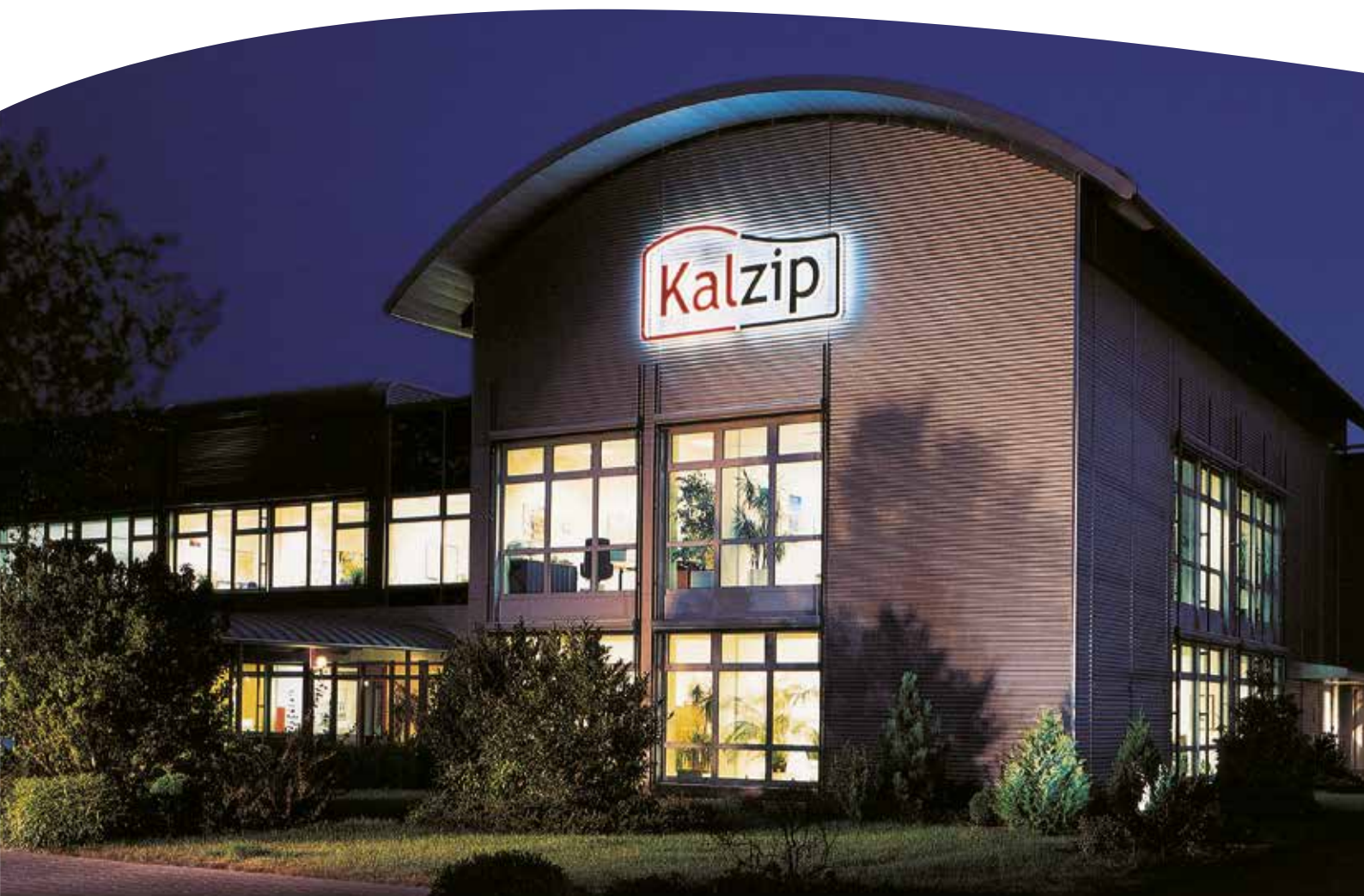


Spazio Zoetermeer (NL), Profiltyp 65/... konisch, stucco-dessiniert
Architekt: De Architekten Cie, Amsterdam

SUBSIDY PROGRAMME THROUGH KFW

The KfW energy efficiency programme “Energy efficient construction and restoration” regulates the subsidies for the financing of the erection, the first purchase and the restoration of industrially used buildings including the implementation of individual measures to improve the energy efficiency as part of the “CO2 building restoration programme” of the Federal Government

The subsidy programme is used for the low interest, long-term financing of measures for significant energy savings and the reduction of CO2 emissions in existing, industrial buildings in Germany. In addition, the erection of KfW energy efficiency houses with a low energy consumption and CO2 emission will be subsidized. Using federal financing, the interest rate will be reduced during the first 10 years of the loan. The projects will in most cases also be subsidized with amortisation grants provided by the Federal Government.



www.kalzip.com

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