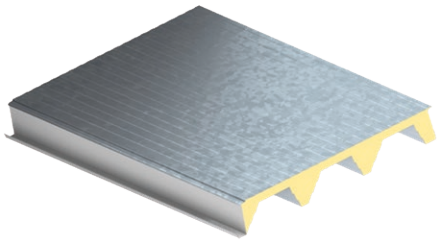
Design Guide
For Kingspan Flat Roof Products

Why flat roofs?

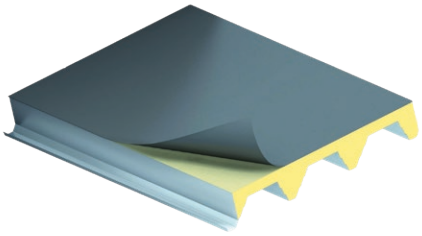
A flat roof offers clear structural and operational advantages for sandwich panel buildings. It streamlines load distribution, supports efficient installation of mechanical and photovoltaic systems, and enables precise control of thermal performance. The straightforward geometry reduces detailing complexity, improves airtightness, and lowers long term maintenance needs.

KS X-Dek™ XD Roof Panel



The KS X-Dek™ XD Roof Panel combines a support structure, high-quality thermal insulation core, and external metal cladding in a single product. Its design allows for a variety of optional retrofit waterproofing and fastening methods.

KS X-Dek™ XM Roof Panel

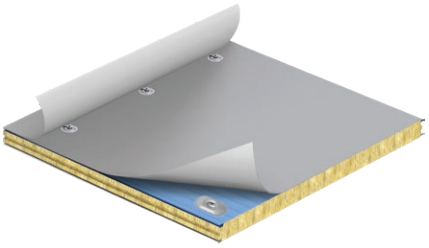


The KS X-Dek™ XM flat roof sandwich panel system combines load-bearing trapezoidal sheet metal, high-quality thermal insulation core, and an external waterproof PVC waterproofing surface integrated during manufacture in a single product.

KS X-Dek™ XG Roof Panel

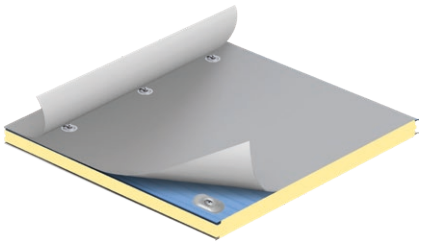
The KS X-dek™ XG panel variant is available with an external glass fiber cladding to be covered with a waterproof membrane on site, not factory-applied.

KS FP/RP K-Roc® Roof Panel



The main advantage of these panels is their high fire resistance, allowing them to be used in fire barriers and DP1 structures. The roof system is complete only with a waterproofing PVC foil applied on site, which is not part of the panel from the factory.

KS NR Roof Panel



It offers very good properties, especially in the area of thermal insulation. The advantage is the low overall height of the roof cladding. The roof system is complete only with a waterproofing PVC foil applied on site.

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1. Application

General

The installation of our flat roof panel systems can be carried out faster than traditional mounted roof structures, as there is no need of installation of separate components, like a trapezoidal sheet or a vapour barrier foil.

The panels are fixed mechanically to a supporting system with load bearing function. The type of screws depends on material type of supports (steel, concrete, wood).

Our flat roof panels are suitable for all types of buildings with an internal design temperature higher than +5°C.

The installation of the panel is recommended above a roof pitch of 1° (i.e. 2%). Please check your local regulations for minimum slope requirements. Maximum recommended slope is 15° (27%) which depends on fire performance requirements as well.

The suitability and possibility of using the panels must be assessed individually with regard to the specific conditions of the project.

KS X-Dek™ XD

KS X-Dek™ XD flat roof sandwich panel is a combination of load-bearing trapezoidal sheet, a high-quality IPN or QuadCore® insulation core, and external metal sheet reinforcement in one product. Its design allows for a variety of subsequent waterproofing and fixing methods that can be chosen as desired.

It can also be used as a base for the construction of so-called „green roofs".

The inner surface of the panels is covered with a white plastic coating, which creates a pleasant and clean impression from the inside.

The panel has a minimum factory panel end cut-back of 50mm, so it can be extended longitudinally with other X-Dek™ panels, providing a minimum gap avoiding thermal bridges and moisture penetrations.

Mechanical fixing of panel to the supporting construction is possible by long & short screws, as it is described in Fixing Section later in this Guide.

The panel is produced in Újhartyán, Hungary and in Lipsko, Poland.

KS X-Dek™ XM

The KS X-DEK™ XM flat roof sandwich panel system is a combination of load-bearing trapezoidal sheet, a high-quality thermal insulation core and a factory applied external watertight PVC waterproofing surface in one product.

The inner surface of the panels is covered with a white plastic coating, which creates a pleasant and clean impression from the inside.

The panel has a 80mm overlap of PVC membrane along the long side of panel which can be adhered to a neighbouring panel by a hot melt welding procedure.

The panel has a minimum factory panel end cut-back of 50mm, so it can be extended longitudinally with other X-Dek™ panels, providing a minimum gap avoiding thermal bridges and moisture penetrations.

Mechanical fixing of panel to the supporting construction is possible by short screws, as it is described in Fixing Section later in this Guide.

The panel is produced in Újhartyán, Hungary and in Lipsko, Poland.

KS X-Dek™ XG

The KS X-DEK™ XG flat roof sandwich panel system is a combination of load-bearing trapezoidal sheet, a high-quality thermal insulation core and a factory applied external glass-fibre tissue in one product, prepared for a watertight waterproofing surface, applied on site. The external veil layer is suitable for various additional waterproof coverings, such as a PVC, TPO, EPDM or bituminous membrane using an adhered or mechanical fixing method. It can also be used as a base for the construction of so-called „green roofs".

The inner surface of the panels is covered with a white plastic coating, which creates a pleasant and clean impression from the inside.

The panel has a minimum factory panel end cut-back of 50mm, so it can be extended longitudinally with other X-Dek™ panels, providing a minimum gap avoiding thermal bridges and moisture penetrations.

Mechanical fixing of panel to the supporting construction is possible by short screws, as it is described in Fixing Section later in this Guide.

The panel is produced in Lipsko, Poland.

KS NR

KS NR roof panel is a sandwich panel with an insulating core made of IPN high quality closed cell PIR insulation, supplied from the production plant in Hradec Králové, Czech Republic.

The panel has a thin 0,6mm external and 0,4mm internal steel surface with plastic coating and a slightly profiled surface.

Mechanical fixing of panel to the supporting construction is possible by longs screws using big diameter washers, as it is described in Fixing Section later in this Guide.

The system is only complete with a waterproofing membrane applied on site. The waterproofing membrane is supplied as extra accessory with the panel on special request.

To fasten the waterproofing membrane to the upper sheet of the panel, it is necessary to use a system type of fasteners with a washer.

KS FP K-Roc®

KS FP K-Roc® roof panel is a sandwich panel with an insulating core made of K-Roc® mineral wool, supplied from the production plant in Hradec Králové, Czech Republic.

The panel can be applied in areas with high fire performance requirements, up to EI90 fire resistance. The panel with K-Roc® insulation is an A2 class (reaction-to-fire) product.

The panel has a thin 0,6mm external and 0,5mm internal steel surface with plastic coating and a slightly profiled surface.

Mechanical fixing of panel to the supporting construction is possible by longs screws using big diameter washers, as it is described in Fixing Section later in this Guide.

The system is only complete with a waterproofing membrane applied on site. The waterproofing membrane is supplied as extra accessory with the panel on special request.

To fasten the waterproofing membrane to the upper sheet of the panel, it is necessary to use a system type of fasteners with a washer.

KS RP K-Roc®

KS RP K-Roc® roof panel is a sandwich panel with an insulating core made of K-Roc® mineral wool, supplied from the production plant in Lipsko, Poland.

The panel can be applied in areas with high fire performance requirements, up to EI90 fire resistance. The panel with K-Roc® insulation is an A2 class (reaction-to-fire) product.

The panel has a thin 0,6mm external and 0,5mm internal steel surface with plastic coating and a slightly profiled surface.

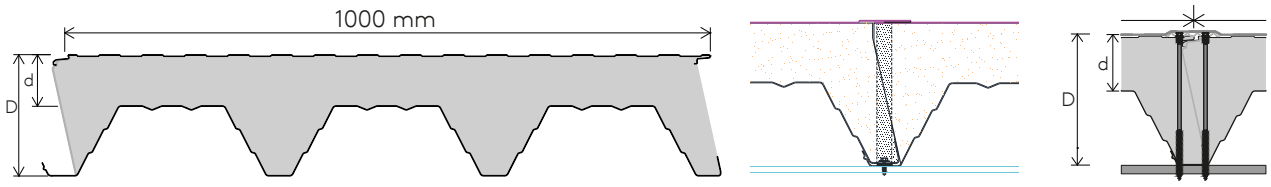
Mechanical fixing of panel to the supporting construction is possible by longs screws using big diameter washers, as it is described in Fixing Section later in this Guide.

The system is only complete with a waterproofing membrane applied on site. The waterproofing membrane is supplied as extra accessory with the panel on special request.

To fasten the waterproofing membrane to the upper sheet of the panel, it is necessary to use a system type of fasteners with a washer.

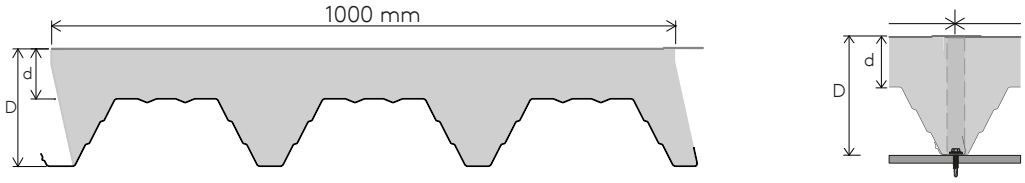
2. Product overview

KS X-Dek™ XD



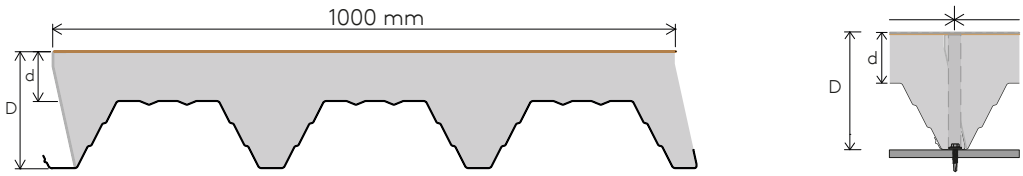
Key parameters	
Production	Hungary (HU) & Poland (PL)
Fixing method	visible – by long screws
	hidden – by short screws
Module width	1000mm
Insulation thickness (d)	80mm(HU) /100mm(HU, PL) /140mm(PL) (D=d+208mm)
Insulation core	IPN or QuadCore® (QC1) (high quality closed cell PIR)
Steel thickness external	0,7mm
Steel thickness internal	0,9mm(standard) or 1,1mm
Profile of external face	Q(minibox) – HU / D(deep) - PL
Profile of internal face	Trapez (V)
Coating inside	PEI15
Factory applied sealants	PE foam side tape

KS X-Dek™ XM



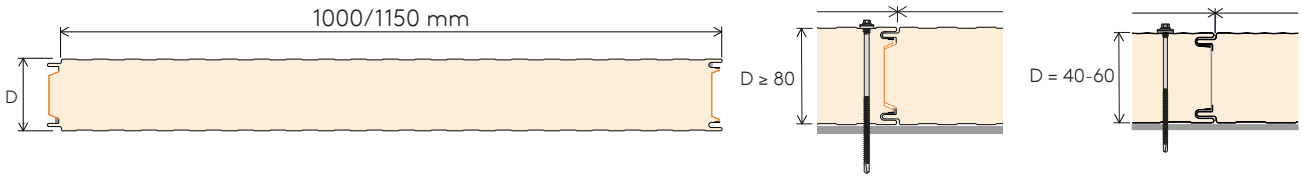
Key parameters	
Production	Hungary (HU) & Poland (PL)
Fixing method	hidden – by short screws. See joint detail above
Module width	1000mm
Insulation thickness (d)	80mm(HU) /100mm(HU, PL) /140mm(PL) (D=d+208mm)
Insulation core	IPN or QuadCore® (QC1) (high quality closed cell PIR)
Type & thickness of external membrane	PVC 1,2mm or PVC 1,5mm
Steel thickness internal	0,9mm(standard) or 1,1mm
Profile of internal face	Trapez (V)
Coating inside	PEI15
Factory applied sealants	PE foam side tape

KS X-Dek™ XG



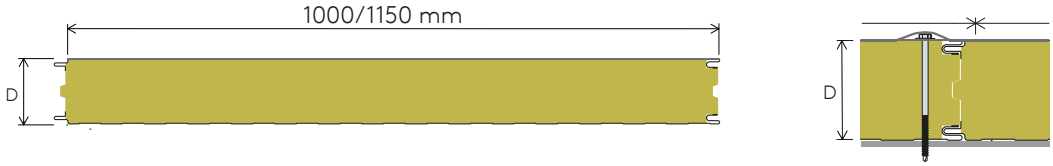
Key parameters	
Production	Poland (PL)
Fixing method	hidden – by short screws. See joint detail above
Module width	1000mm
Insulation thickness (d)	100mm /140mm (D=d+208mm)
Insulation core	IPN or QuadCore® (QC1) (high quality closed cell PIR)
Type & thickness of external face	glass fibre veil
Steel thickness internal	0,9mm(standard) or 1,1mm
Profile of internal face	Trapez (V)
Coating inside	PEI15
Factory applied sealants	PE foam side tape

KS NR



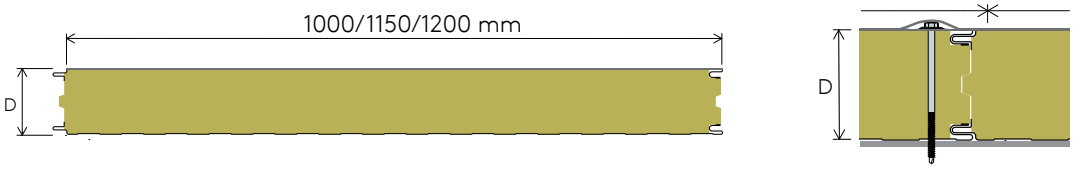
Key parameters	
Production	Czech Republic (CZ)
Fixing method	visible – by long screws. See joint detail above.
Module width	1000mm /1150mm
Insulation thickness (d)	40-200mm
Insulation core	IPN (high quality closed cell PIR)
Steel thickness external	0,6mm (standard)
Steel thickness internal	0,4mm (standard) /0,5mm /0,6mm
Profile of external face	M(micro)
Profile of internal face	Q(minibox)
Coating external	Polyester SP25 (Kingspan PES25)
Coating inside	Polyester SP25 (Kingspan PES25)
Factory applied sealants	PU sealants in both external and internal side of joint

KS FP K-Roc®



Key parameters	
Production	Czech Republic (CZ)
Fixing method	visible – by long screws. See joint detail above.
Module width	1000mm /1150mm
Insulation thickness (d)	60-150mm
Insulation core	K-Roc® (MLA)
Steel thickness external	0,6mm (standard)
Steel thickness internal	0,5mm (standard) /0,6mm
Profile of external face	B(box) /M(micro) /Q(minibox) /E(eurobox)
Profile of internal face	Q(minibox) /B(box)
Coating external	Polyester SP25 (Kingspan PES25)
Coating inside	Polyester SP25 (Kingspan PES25)
Factory applied sealants	PU sealant in external side of joint

KS RP K-Roc®



Key parameters	
Production	Poland (PL)
Fixing method	visible – by long screws. See joint detail above.
Module width	1000mm /1150mm /1200mm
Insulation thickness (d)	175-240mm
Insulation core	K-Roc® (MPF)
Steel thickness external	0,6mm (standard) /0,7mm /0,75mm
Steel thickness internal	0,5mm (standard) /0,6mm /0,75mm
Profile of external face	B(box) /M(micro) /Q(minibox) /E(eurobox)
Profile of internal face	Q(minibox) /B(box)
Coating external	Polyester SP25 (Kingspan PES25)
Coating inside	Polyester SP25 (Kingspan PES25)
Factory applied sealants	PU sealant in internal side of joint

More info about products, you can find in specific datasheets, connected indiviually to each manufacturing site and in product DoP.

3. Thermal design

The thermal transmittance value for the panel (**U-value**), incorporating the declared thermal conductivity for the core material ($\lambda_{declared}$) and the joints and any profiled facings, shall be determined in accordance with **A.10. annex of EN14509** product standard.

Both U-value and lambda must be delcared in DoP of product.

3.1. Thermal conductivity [W/mK]

The design thermal conductivity (λ_{design}) shall be determined according to **EN ISO 10456**, except in the case where the declared value is the aged value, when it is not necessary to use the ageing calculations in EN ISO 10456.

Both **Kingspan IPN & QuadCore®** foam and **K-Roc®** mineral fibre insulations have an aged value of thermal conductivity declared in DOP which means that that $\lambda_{declared} = \lambda_{design}$.

If necessary, you can apply the formula below, specifying λ_{design}, based on EN10456:

$$\lambda_2 = \lambda_1 F_T F_m F_a$$

where

$\lambda_1 = \lambda_{declared}$ It is declared in DoP on +**15°C** operational temperature.

$\lambda_2 = \lambda_{design}$

F_t - is a factor considering temperature conditions different than +15°C, (ie cold rooms or freezers). In this case the declared U-value in DoP can be recalculated. (Temperature below +15°C means lower lambda/U-value)

F_m - is a factor in different moisture conditions. **IPN and QuadCore®** insulation is moisture resistant, so this factor can be set to 1. **K-Roc®** mineral fiber insulation is hydrophobic material which prevents water absorption. Temporary increase of moisture content inside is possible. In case of extreme conditions, like constant water ingress, or high humidity environment lambda has to be recalculated using this factor.

F_a - is a factor used for the aging effect of core. Kingspan declares for all cores an aged value in DoP. This value can be set to 1.

3.2. Thermal transmittance (U-value) [W/m²K]

Based on EN14509 product standard, U-value for panels can be calculated using two methods:

Simplified method based on A.10.4 section of EN14509 using the following formula:

$$U_{d,S} = \frac{1}{R_{si} + \frac{d_c}{\lambda_c} + R_{se}} \cdot \left(1 + f_{joint} \cdot \frac{1{,}0}{B}\right)$$

Where f_{joint} parameter is the linear thermal transmittance contribution factor of the joints calculated for a joint distance of 1,0 m.

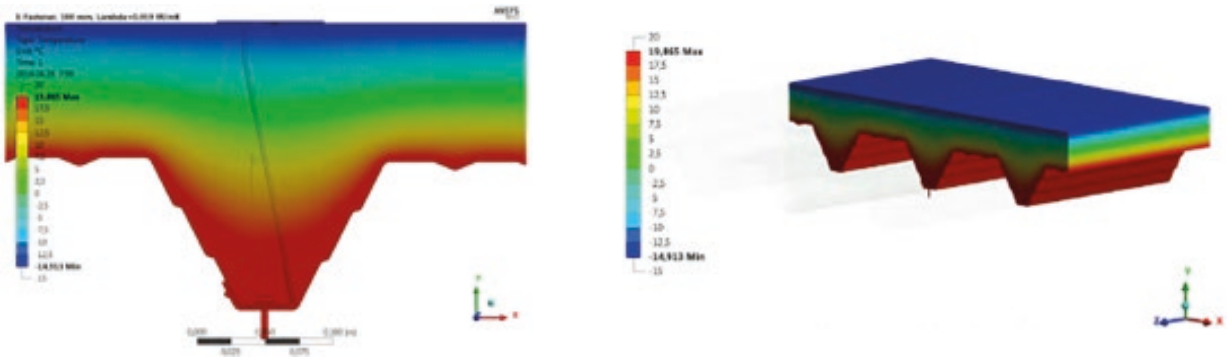
Finite element method by **A.10.3** section in EN14509, using **EN ISO 10211** defining a linear transmittance of joints (**Ψj**) for following formula:

$$U_{d,S} = U_{n,S} + \Delta U_j$$

where

$$U_{n,S} = \frac{1}{R_{si} + \frac{t_{ni}}{\lambda_{fi}} + \frac{d_c + \Delta e}{\lambda_c} + \frac{t_{ne}}{\lambda_{fe}} + R_{se}}$$

$$\Delta U_j = \frac{\Psi_j}{B}$$



Simulation sample: Temperature field & heat flux density for X-Dek XM panel joint with fixing using EN ISO10211 (source: ÉFL-2016/1 report made by Budapest University of Technolgy)

In case you need more information or details then please contact your direct sales support or Kingspan Technical Team.

4. Static design

Static performance of panels can be checked in 2 ways:

- **Comparing requirements with load tables (faster, easier but less complex)**
- **Making a detailed calculation using a calculator (time consuming but detailed)**

Kingspan can provide both solutions. Load tables for products you can find on your local website, or you need to contact our Technical Support Team. Detailed calculations we can do on a special agreement with our customer.

4.1. Load parameters, design conditions

A load table refers to usual, variable climatic loads, typically wind loads in accordance with EN 1991-1-4 and snow loads in accordance with EN 1991-1-3 for roof panels.

The values given in the load table refer to loads in excess of the dead weight of the panels, which don't need to be considered for the comparison.

The tables refer to thermally insulated sandwich panels of a given type and specification, considering the harmonized product standard EN 14509. The panel's load-bearing capacity is calculated in accordance with this standard. (Except X-Dek™ XM & XG products)

The tables show the load ranges for the surface profiles and standard external/internal sheet thickness combinations as indicated.

For other types of profiles (especially flat surface!), other sheet thicknesses, or other load requirements (e.g., unevenly distributed, concentrated, or long-term loads, special temperatures in cold rooms, etc.), please contact Kingspan Technical Customer Service.

It is possible to perform detailed static calculations, considering building-specific load situations and deformations not included in a load table.

Multi-span solutions with non-equal span values and cantilevers can be calculated only using a detailed computer calculation.

Unless otherwise specified, use the characteristic values of the loads comparing with values in the tables.

When dimensioning panels, always consider both load directions (pressure/suction) and any other conditions that may affect the load-bearing capacity of the panel (snow load accumulation, solar panel load, internal pressure, etc).

4.2. Deflection limits for roof panels

EN 14509 product standard for thermally insulated sandwich panels specifies the following permissible deformation values in terms of serviceability limit state (SLS), as specified in Annex E, point E.5.4:

Roofs and ceilings – short term loads	L/200
Roofs and ceilings – long term loads (ie. creeping)	L/100

Not specified in EN14509:

Cantilevers (not in EN14059) – short term	L/100
Cantilevers (not in EN14059) – short term	L/50

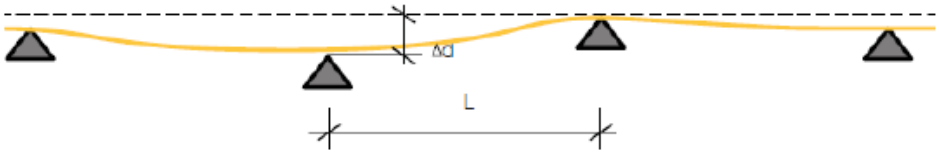
where L – the distance between adjacent supports (span)

4.3. Verification of tolerances of the supporting construcion

The tolerances for framework can neither be adjusted nor can they be compensated for by a roof covering sandwich panel lined on the structure. Indeed, the differences in the actual dimensions of the load-bearing structure are necessarily to be seen in the final aspect of the roof cover. Therefore, the structure shall comply with the tolerances stated in Table below.

Alignment of the purlins or rafter of the portal frames

Panel core type	maximum deviance (Δd)
IPN/QuadCore® insulation foam	L/600
K-Roc® mineral fibre core	L/1000



Failure of the expected planar accuracy may lead to increased loading of the panel, its failure and unacceptable fixing method of the fixing elements

4.4. Span (distance of supports)

Span is the straight-line distance between adjacent fixing or supporting points on the supporting structure. In load tables always choose a span that is at least equal to the value in the table.

The maximum permissible values of the span should be judged considering followings:

- **design load**
- **type and thickness of the panel,**
- **fixing system,**
- **width of the supports on the structure,**
- **colour groups,**
- **fixing methods**
- **other limitations of the given application.**

In some cases, a theoretical span can also be calculated. Please consult our Technical Customer Service in this regard.

4.5. Maximum cantilever overhang

In case of cantilevers EN 14519 does not contain rules for calculation. In Code of Practice there are some basic rules specifying size without detailed calculation:

The maximum longitudinal cantilever overhang of sandwich panels depends on their thickness „e", the applicable loads, the spans „L" between purlins, and the fasteners.

In the absence of calculations or verifying testing, the cantilever overhang must be smaller than the smallest one of the following values:

- **6 times the thickness „e"**
- **1/10 of span length „L"**
- **0.60 m.**

Above a 900 m altitude, the cantilever overhang shall not exceed 200 mm.

Transverse cantilever overhangs are not permissible for flat roofs.

4.6. Temperature loads

Examples of RAL colour shades and their classification group are given according to EN14509 Annex E, point E.3.3. If necessary, please ask our Technical Support team to provide more information about specific colours.

In load tables, the temperature of the external surface of the panel is given according to the following classification:

For summer period: +55 °C, +65 °C, +80 °C, and for the winter period: -20 °C

Colour Group	H [%]	$T_{ext.}$ [°C]
I – very light colours	75–90	+55
II – light colours	40–75	+65
III – dark colours	8–39	+80

H – the degree of light reflection compared to magnesium oxide (100%)

T_{ext} – temperature of external panel sheet

The load capacity tables assume a temperature of +25 °C on the internal side of the panel in summer and +20 °C in winter. In case of temperature-controlled applications like cold stores, freezers, bakeries or other rooms with special temperature conditions, where a greater temperature difference between the inner and outer surfaces of the panel than assumed above is expected, individual static calculations must be performed. For further information, please contact Technical Customer Service.

5. Openings on roof

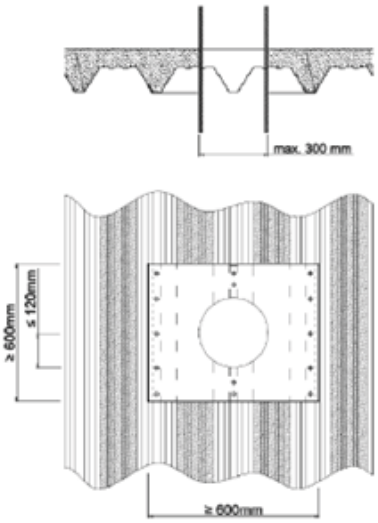
Flat roof panels are designed to bear loads specified in section 4 of this document. Especially, X-dek™ panels due to the static performance of bottom trapezoidal steel deck, provide high load bearing capacity as a roof member.

Any roof penetrations or openings designed on roof panels must be first considered as a weakening of structural capacity. Therefore, the structural assessment must be carried on defining the influence of opening/penetration to overall capacity of these panels. As a next step the appropriate design procedure must be provided to secure required load-span capability of panels with openings/penetrations.

The opening considerations relate to two ranges of sizes:

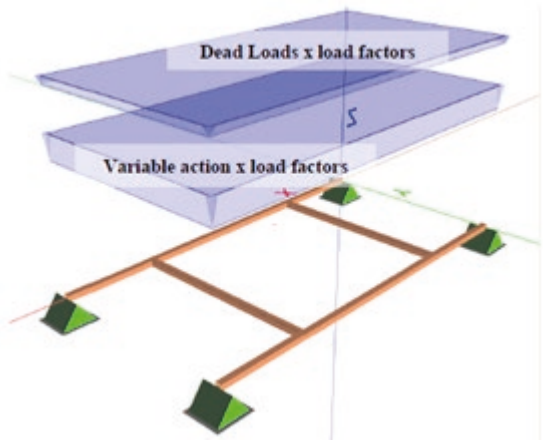
- **Openings with maximum diameter (side dimension) below 300mm;**
- **Openings with sizes (diameter/side dimension) above 300mm**

It is recommended the openings with the maximum dimensions of 300x300mm should be secured with reinforcing collar plate installed to the bottom ribs of the internal trapezoidal skin. As on the drawings below. The smaller diameters, i.e. <200mm diameter do not require additional collar plates.



All openings with dimensions higher than a x b = 300x300mm (or Ø > 300mm) – typically a skydome - must supported locally, with separately designed steel frame system, to sustain the required rigidity of the panels with opening.

The supporting frame must be designed taking into consideration all loads. Dead loads, snow loads and wind loads must be considered according to general rules, including required combinations of all actions. The typical scheme of supporting frame with loads is shown on picture below:



If you need more detailed solutions than please contact our Technical Support Team.

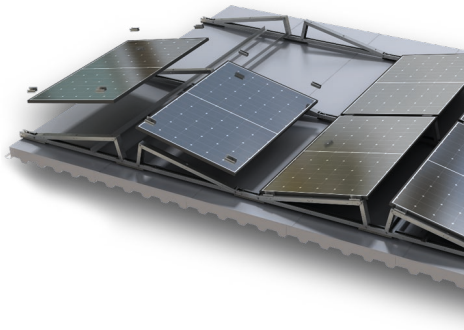
6. PV system on flat roofs

During the last few years PV elements became more popular because of increasing demand for on-site generated renewable solutions. Such solutions are usually tilt-mounted which needs a supporting frame set-up to an optimized angle/orientation to provide the best performance.

Kingspan **Powerail FR** provides a system solution in 2 orientations, East-West and South:

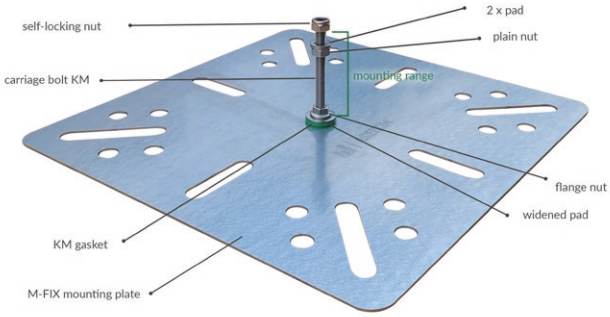
South modul

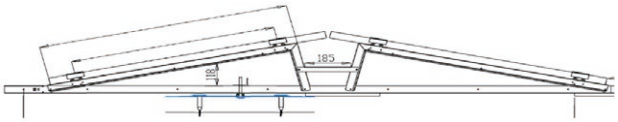
East-West modul



This system provides a basic fixing solution using a ballast system. In this case you must consider a relatively high (up to 60-80kg/m²) extra load on panel.

In case of **X-Dek™ XM** or **XG** panels we can extend **Powerail FR** with a supporting element which is suitable a water membrane solution, using maximum four screws fixed to the bottom trapezoidal sheet of panel:





If you need a detailed support in design of a PV system than please contact our Technical Support Team. We can help you in each project case separately. For the full design and quotation of our system we may need a project specific building documentation.

7. Fixing design

7.1. Types of primary fixings

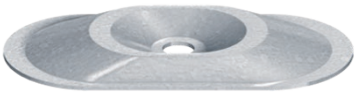
The types of screws that can be used to fasten the roof panels listed in section 2. in this guide are included in the list below. The list contains only EJOT products, but equivalent products can also be used. It is the designer's responsibility to verify the suitability of the fasteners and in the case of other screw manufacturers their equivalence with EJOT products.

X-Dek™, XM, XG panel	
Steel supporting construction with **short** screws	
2-5mm steel thickness	EJOT JT2-6-5.5x35
4-10mm steel thickness (self drilling)	**Opticore JT2-12-5,5x38 HS** (recommended)
	EJOT JT2-12-5.5x35
4-16mm steel thickness (self drilling)	EJOT JT2-18-5.5x40
>10mm steel thickness (self tapping screws with pre-drilling)	EJOT JZ5-6.3x30

X-Dek™, XM, XG panel
Concrete supporting construction with **short** screws
EJOT BS-R-6,3 x L (with pre-drilling in core and in concrete)

X-Dek™ XD, NR, FP, RP panel	
Steel supporting construction with **long** screws	
2-5mm steel thickness	EJOT JT2-D-6H-5.5xL
4-10mm steel thickness (self drilling)	EJOT JT2-D-12H-5.5xL
4-16mm steel thickness (self drilling)	EJOT JT3-18-5.5xL
>10mm steel thickness (self tapping screws with pre-drilling)	EJOT JZ5-6.3xL
Big diameter washer types	
HTV 82/40 with 7mm hole	
HTV 82/40 F with 7,5m hole (needs a 20mm pre-drilled hole in external steel face of XD, RO, NR, FP)	
HTV40 RU with a 6,5m hole	

HTV 80/40



HTV 80/40 F

HTV 40 RU

The exact number of fasteners must be determined based on detailed static calculations.

The length (L) of the fasteners is determined by the type of sandwich panel and the type of supporting structure.

Below you can find a simplified method for the calculation of screws. If required, we provide separate technical support for the calculation based on the project data.

Additional technical parameters of the fasteners are included in the product-specific technical approval (ETA, NTA, Zulassung) and the DoP issued by the screw manufacturer.

7.2. Simplified calculation sample of fixings:

Product	KS XM 100 panel
Internal steel thickness	$t_{N,I}$ = 0,9mm (trapez profile)
Span	L=6,00m (2x6,00m double span - 12m long panel)
Wind suction load	w_k=-1,0kPa
Supporting structure	Steel, $t_{N,II}$ = 10mm
Applied screw type	Opticore JT2-12-5,5x38 HS

Support reactions can be identified in a following way	
End support	$N_{sd} = ½ * \gamma_f * w_k * L$ [kN/lm],
Intermediate support	$N_{sd} = \gamma_f * w_k * L$ [kN/lm], where

N_{sd} – force transferred from the panel to the load-bearing element on a 1,00m length.

γ_f = 1.5 – partial factor for wind effect

w_k [kN/m^2] – characteristic value of wind suction load according to EC (varies depending on the geometry of the building facade)

L [m] – center distance between the fixing points (span)

N_{sd} for end support: 0,5*1,5*1,0*6 = 4,5kN/lm

N_{sd} for middle support: 1,5*1,0*6= 9,0kN/lm

N_{Rd} – Pull-out capacity of Opticore screw (ETA-13-0177, Annex.19): 3,90kN/1,33=2,93kN/pc

Recommended minimum Nr. of screws:

End support: 4,50/2,93 = 1,54pcs → 2pcs → 3pcs (min. 1screw in each rib of XM)

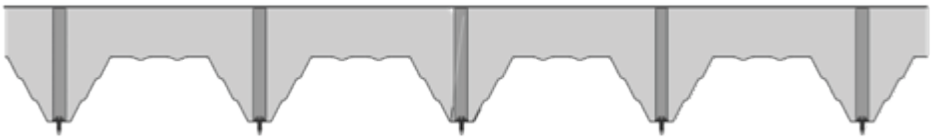
Middle support: 9,00/2,93 = 3,07pcs → 4pcs

More screws in one rib can be distributed along the width of supporting element

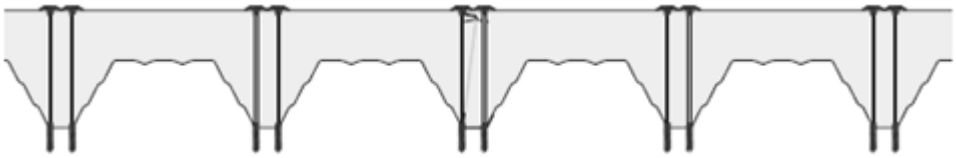
7.3. Fixings flat roof panels over supports

Fixing of XM/XD panel

Using short 1 or 2 screws on each trapez rib, according to calculation:
(Panel must be fixed on each rib, with minimum 1 screw)



Fixing of XM panel, using long screws on each trapez rib, according to calculation:
(Panel must be fixed on each rib, with minimum 2 screws)

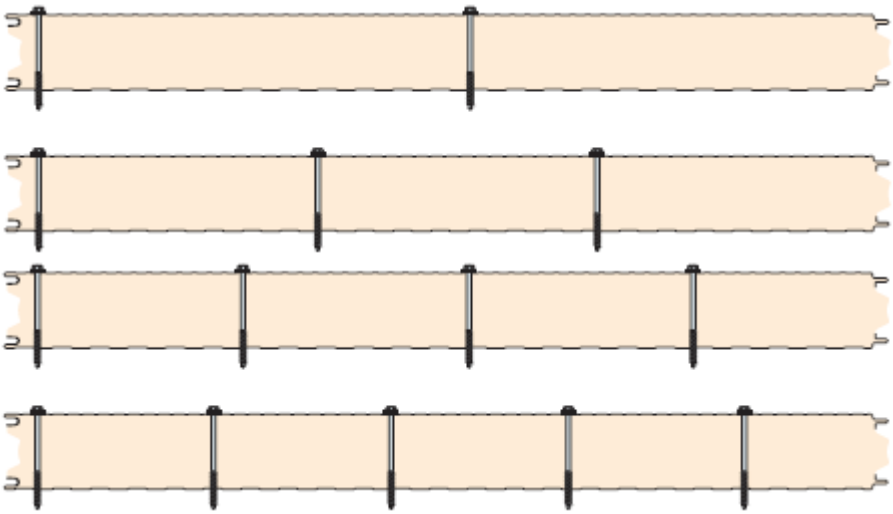


Fixing of NR panel

Maximum 5 pcs of screw for one support, according to k=(11-n)/6 formula where

n – number of screws for a 1000mm width of panel

if k ≤ 1,0 than mechanical performance of panel must be reduced and checked if capacity is still valid.

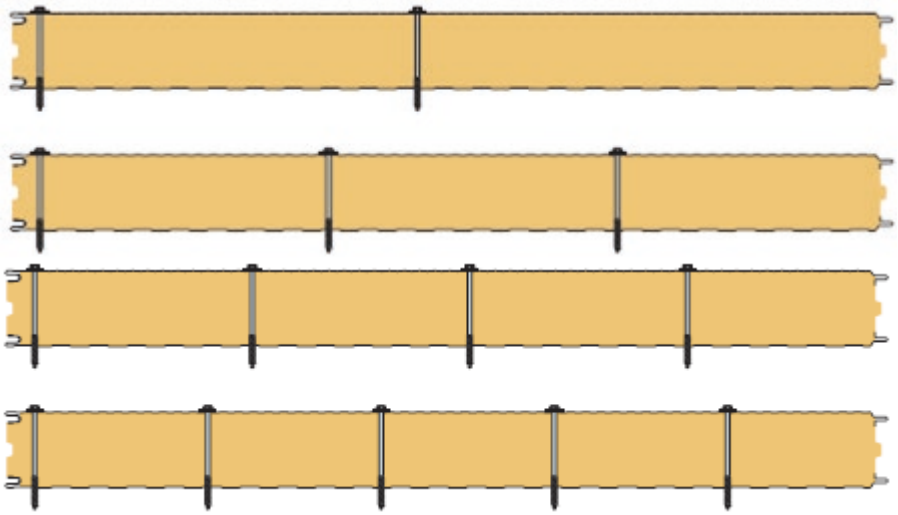


Fixing of FP, RP panel

Maximum 5 pcs of screw for one support, according to k=(11-n)/6 formula where

n – number of screws for a 1000mm width of panel

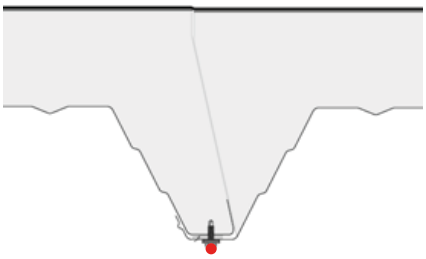
if k ≤ 1,0 than mechanical performance of panel must be reduced and checked if capacity is still valid.



7.4. Stitching of X-Dek™ panels (secondary fixing)

Secondary fasteners are used to tighten the lower trapezoidal overlap of the X-Dek™ roof panels to each other, between the supports. These fixing elements must conform with following application conditions:

- **Providing the necessary air- and vapour tightness of panel joint from inside (including vapour sealant).**
- **Reaction-to-fire: distance of screws up to maximum 400mm distance**
- **Fire resistance: Distance of fixings is based on fire test conditions which can be between 300-1000mm, depending on fire resistance requirement. Please check value in relevant fire classification reports or contact our Technical Support for more details.**



8. Suspension systems on roof

Suspension systems can be applied on X-Dek™ products. NR, FP & RP flat roof panels ar not suitable for this option. A typical fixing solution you can see on photo below:

During design you need to consider following conditions:

- **Weight of system (ceiling or pipes/ducting): This load must be considered both for standard static design and fire design of building. For a water drainage system, you need to calculate the weight of pipes fully loaded with water.**
- **In case of linear suspension system, you need to consider followings:**
  - **Orientation: parallel or perpendicular to panels**
  - **Position: distance of pipeline from supports.**

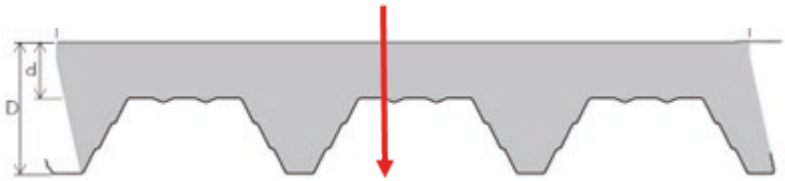
Load tables of panels are prepared for comparison of evenly distributed loads in [kN/m^2]. If you want to match suspended system loads in [kN] or [kN/lm] with load values, then you must recalculate them to evenly distributed loads.

In case of fire resistance, the maximum loading is specified as distributed load [kN/m^2] or as maximum bending moment [kNm/m]. You can find more info about static design in case of fire in section 9.4 of this document.

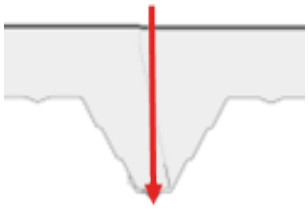
9. Fire design of flat roof panels

According to 305/2011EU regulation the manufacturer is responsible for the performance of the product as it is classified according to a specific harmonized standard, which is EN14509 for panels. The fire performance of panel is classified and tested for the product's „body" and for the factory connections (joint), specifying some conditions for application.

Fire performance through the "body" of product



Fire performance through the factory joint of product



The task of designer is to design the appropriate building structure solutions (joint details) combining different products from different manufacturers, connecting them to each other, according to project specifications. Designer must verify and approve the joint details of the building, considering the conditions of application. Each feature is described in more details below:

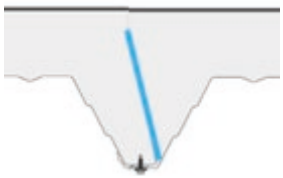
9.1. Fire sealants

The relevant fire protection/fire resistance reports for the flat roof products in this document are valid without using special fire sealants or fire mastic in factory joint.

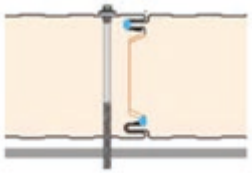
There is a factory applied PE foam side tape or PU gasket in panel joints, as it is specified in section 2. of this document. This foam sealants have no fire protection function, but it has an important role as it is specified in fire classification documents:

In case of reaction-to-fire or fire resistance: the classification is valid only for the types of joint seals and gaskets tested and for those of equal or lower PCS value.

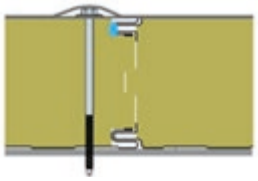
X-Dek™ - PE side tape



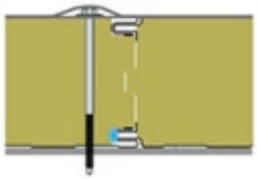
KS NR - PU sealants



KS FP - PU sealants



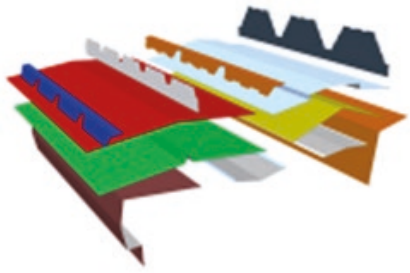
KS RP - PU sealants



9.2. Steel flashings

Panel connections to other building elements (cill, roof-wall, window, etc) or to another panel with cut-end (corner, top-hat, etc.) need steel covers. Regarding fire protection characteristics, the following application conditions are valid, based on fire classification of products:

Reaction-to-fire: All end use flashings of same material as that tested and of at least the same width and thickness. Usually, the standard flashing is steel with **0,6mm** thickness.



9.3. Reaction-to-fire

Based on EN13501-1 fire classification standard the flat roof panels specified in section 2. of this document have following reaction-to-fire classification:

Product	Core	Thickness	Production site	Classification
KS X-Dek™ XD	IPN	80-100mm	Hungary	C-s2, d0
KS X-Dek™ XD	IP6	100-140mm	Poland	B-s2, d0
KS X-Dek™ XD	QuadCore®	80-140mm	Hungary / Poland	B-s2, d0
KS X-Dek™ XM*	IPN	80-100mm	Hungary	B-s2,d0
KS X-Dek™ XM*	IP6	100-140mm	Poland	B-s2,d0
KS X-Dek™ XM*	QuadCore®	80-140mm	Hungary / Poland	B-s2,d0
KS X-Dek™ XG*	IP6	100-140mm	Poland	B-s2, d0
KS X-Dek™ XG*	QuadCore®	100-140mm	Poland	B-s2, d0
KS NR	IP3	40mm	Czech Republic	B-s2, d0
KS NR	IP3	60-200mm	Czech Republic	B-s1, d0
KS FP	K-Roc® MLA	60-150mm	Czech Republic	A2-s1, d0
KS RP	K-Roc® MPC	175-240mm	Poland	A2-s1, d0

*This product has a national certification which is valid only in selected EU countries.

If you need help or more detailed information about this classification than please turn to our Technical Support Team.

General application conditions:

- Valid for **roof, roof cladding or ceiling** applications,
- Valid for fixing metal flashings up to spacing **400 mm** or less
- Valid only for the types of joint seals and **gaskets tested** and for those of equal or lower PCS value (see section 9.1)
- Valid for edges unprotected with flashings, or **all end use applications** of edges and corners protection are permitted.

9.4. Fire resistance

The classification of R E I values must be carried out in accordance with the provisions of standard EN13501-2. Fire resistance must be tested in accordance with testing standard EN 1365-2. This involves testing of a threshold in minutes, when this threshold is reached on the unexposed side of sample panel during fire, simulating by a standard fire curve: This threshold can be a load-bearing limit (R), an integrity failure (E) or a specific temperature (I).

The fire resistance of flat roof panels is classified on specific reports created by an independent fire laboratory. The content of these reports follows the structure below.

- Section 1: Specification of reference standard and for previous report version.
- Section 2: Description of product testing specimen, focusing on core, panel's facings, gaskets and stitching of product's factory joint.
- Section 3: reference to test reports, testing conditions and test results.
- Section 4:
  - 4.1 reference of classification, which is EN13501-2, Clause 7.3.3 for loadbearing roofs
  - 4.2 REI classification of product
  - 4.3 Field of application conditions:
    - Maximum bending moments, and shear forces specified by load-span conditions used during fire tests (see in section 3.1, test result description or in section 2.3)
    - Limit of roof slope (in general as 0-15° for flat roofs)

- 4.1 reference of classification, which is EN13501-2, Clause 7.3.3 for loadbearing roofs
- 4.2 REI classification of product
- 4.3 Field of application conditions:
  - Maximum bending moments, and shear forces specified by load-span conditions used during fire tests (see in section 3.1, test result description or in section 2.3)
  - Limit of roof slope (in general as 0-15° for flat roofs)
- 5.0 Limitations showing validity conditions of classification as a date or reference to relevant product or classification standards (like EN14509 or EN13501), regulations (like CPR) or product specification changes. (material, location of manufacturing site, etc)

This table below contains some results and application conditions for each product:

Product	Core	Thickness	Production site	Classification	Load-Span	Stitching	Slope
KS X-Dek™ XD	IPN	80-100mm	Hungary	REI15	M=1,38kNm/m	500mm	0-15°
KS X-Dek™ XD	IP6	100mm	Poland	REI20	M=1,02kNm/m	300mm	0-15°
KS X-Dek™ XD	IP6	140mm	Poland	REI30	M=1,02kNm/m	300mm	0-15°
KS X-Dek™ XD	QuadCore®	80mm	Hungary	NPD	-	-	-
KS X-Dek™ XD	QuadCore®	100mm	Hungary	REI15	M=1,32kNm/m; V=1,25kN/m	500mm	0-15°
KS X-Dek™ XD	QuadCore®	100mm	Poland	REI15	M=1,32kNm/m; V=1,25kN/m	333mm	0-15°
KS X-Dek™ XD	QuadCore®	140mm	Poland	REI20	M=3,61kNm/m	333mm	0-15°
KS X-Dek™ XM*	IPN	80-100mm	Hungary	REI15	M=1,38kNm	333mm	0-15°
KS X-Dek™ XM*	IPN	100-140mm	Poland	REI20	Check report	333mm	0-15°
KS X-Dek™ XM*	QuadCore®	80mm	Hungary	NPD	-	-	-
KS X-Dek™ XM*	QuadCore®	100mm	Hungary	REI15	M_{max+}=1,41kNm M_{max-}=-1,69kNm V_{2max}=-2,31kN	333mm	0-15°
KS X-Dek™ XM*	QuadCore®	80-100mm	Poland	REI20	Check report	333mm	0-15°
KS X-Dek™ XG*	IP6	100mm	Poland	REI20	Check report	300mm	0-15°
KS X-Dek™ XG*	IP6	140mm	Poland	REI30	Check report	300mm	0-15°
KS X-Dek™ XG*	QuadCore®	100mm	Poland	REI20	Check report	333mm	0-15°
KS X-Dek™ XG*	QuadCore®	140mm	Poland	REI30	Check report	333mm	0-15°
KS NR	IP3	40-80mm	Czech Republic	NPD	-	-	-
KS NR	IP3	100-200mm	Czech Republic	REI20	2,90+1,1m /0,1kN/m²	300mm	0-15°
KS FP	K-Roc® MLA	60-80mm	Czech Republic	NPD	-	-	-
KS FP	K-Roc® MLA	100-150mm	Czech Republic	REI90	2+2m /0,32kN/m²	300mm	0-15°
KS RP	K-Roc® MPC	175mm	Poland	NPD	-	-	-
KS RP	K-Roc® MPC	200-240mm	Poland	REI90	0,25kN/m² /2,70+1,9m	300mm	0-15°

*This product has a national certification which is valid only in selected EU countries.

If you need help or more detailed information about this classification than please turn to our Technical Support Team.

9.5. Load bearing of panel in fire (design sample)

Fire is not a load caused by a force effect, but the high temperature increase may decrease the structural strength of product and weaken some parameters of geometry or material performance. It is an exceptional load situation, so an exceptional load classification must be applied. Nevertheless, a lower load must be considered in the structural analysis, than in a normal case. This reflects the fact that it is unlikely that heavy snow or a windstorm would occur simultaneously with a fire. Thus, when a fire occurs, it is not the actual load present that changes, but rather the value to be considered.

According to the Eurocode standard, the classification of exceptional loads must be performed in the same way as for the ultimate limit state, except that the exceptional load is the primary load. In this case, the snow load must be considered simultaneously with the fire load, using a combination factor of Ψ_{1snow}=0.2. Other permanent loads like the weight of panel, a PV system or a hanging load must be considered with a Ψ_1=1.0

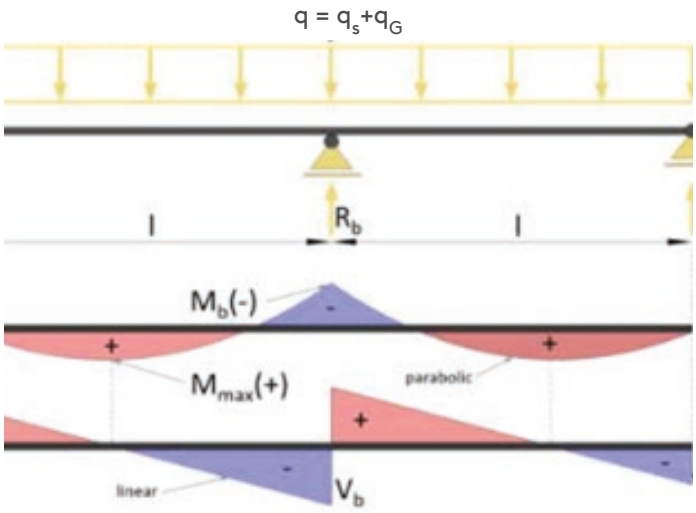
The roof products are tested with a given support distance and certain simulated extra loads. These parameters must be considered as the extra utilization to achieve the required REI performance of product:

- **Span: single / double or multi-support. Given in [m] or [mm] in report.**
- **Applied load: weight of product / simulated load as distributed load [kN/m²]on panel surface or hanging load [kN] on bottom rib of panel (X-Dek)**
- **Utilization: in Field of Application section of classification report you can find the maximum values calculated by a span-load calculation of test parameters, which a panel must not exceed during fire: bending moment M_{max+}/M_{max-} [kNm] / Shear force V_{max} [kN]**

Below you can see a diagram for a double span (l) system, showing the maximum load (q) for the panel, in case of fire, where q_s is the snow load as exceptional load and q_G, represents as the extra permanent weight like a PV system on roof.

Please consider that some loads on roof can be concentrated load os linear loads, which must be recalculated to evenly distributed load or to a bending moment for a correct comparison.

These loads need only be considered for the fire resistance of the panel if they are attached directly to the panel—and not through the panel—to an independent supporting structure.



Please be aware that, in addition to the load-bearing capacity under fire conditions, the panel's normal load-bearing capacity must also be verified; this guide does not include the calculation for the normal load-bearing capacity. Of the two load-bearing capacity limits, the less favourable one must always be applied.

9.6. Fire spread on roof surface of panel (B_{roof})

The flat roof panels in this document have been tested and classified as **B_{roof}(t1) - B_{roof}(t3)**, according to **EN13501-5:2016** standard.

The table below shows the product B_{roof} classification levels and the maximum slope limit for each product. The product B_{roof} classification must comply with the national regulation.

Product type	Core	Thickness	Production	Classification	Slope
KS X-Dek™ XD	IPN	80-100mm	Hungary	B_{roof}(t1)	0-20°
KS X-Dek™ XD	IP6	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t3)	0-10°
KS X-Dek™ XD	QuadCore®	80-100mm	Hungary	B_{roof}(t1)	0-20°
KS X-Dek™ XD	QuadCore®	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t3)	0-10°
KS X-Dek™ XM*	IPN	80-100mm	Hungary	B_{roof}(t1)	0-20°
KS X-Dek™ XM*	IP6	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t2)/B_{roof}(t3)	0-10°
KS X-Dek™ XM*	QuadCore®	80-100mm	Hungary	B_{roof}(t1)	0-20°
KS X-Dek™ XM*	QuadCore®	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t2)/B_{roof}(t3)	0-10°
KS X-Dek™ XG*	IP6	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t3)	0-10°
KS X-Dek™ XG*	QuadCore®	100-140mm	Poland	B_{roof}(t1)/B_{roof}(t3)	0-10°
KS NR	IP3	40-200mm	Czech Republic	B_{roof}(t3)	0-10°
KS FP	K-Roc® MLA	60-150mm	Czech Republic	B_{roof}(t3)	0-10°
KS RP	K-Roc® MPC	175-240mm	Poland	B_{roof}(t1)/B_{roof}(t3)	0-20°

10. Other notes

If the technical information in this document is unclear to you or you are unsure about the solution, please contact our Technical Department. To provide you with the appropriate assistance, we typically need the following information about the building, as well as as many of these documents as possible:

- **Floor plan/roof plan**
- **Cross-sections (preferably in both directions)**
- **Architectural description**
- **Fire safety description**
- **If solar panels are planned for the roof, their specifications and layout**

Contact Details

Kingspan Kereskedelmi Kft. Újhartyán site

Central contact information

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Újhartyán

2367

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Issue: 2026/03

Version: v1.0en

For the latest information, please visit: www.kingspan.com/hu/hu/

For the most up to date and comprehensive product details, always refer to the latest version of this guide by scanning the QR code below.