KÖSTER

Waterproofing Systems

Technical Manual
KÖSTER Roofing Membranes

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KÖSTER BAUCHEMIE AG – Manufacturer of thermoplastic roofing and waterproofing membranes

The KÖSTER BAUCHEMIE AG has been developing and manufacturing products for the waterproofing of buildings since 1982.

Due to our many years of experience in production and processing, along with the high quality of our products, KÖSTER roofing membranes can be found on roofs all over the world.

Products

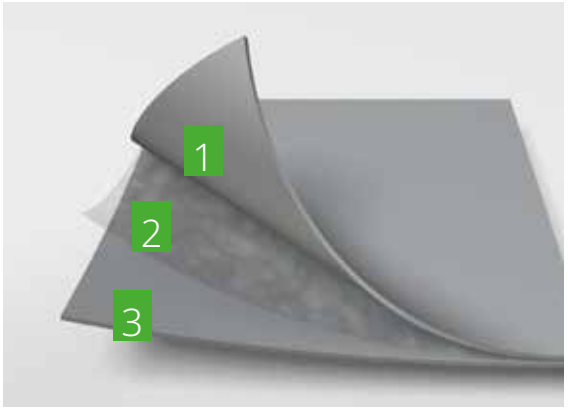
At the plant in Aurich, Germany, three extruder lines produce high-quality roofing membranes in accordance with EN 13956 CE and building waterproofing in accordance with DIN EN 13967 made of TPO / FPO (thermoplastic or flexible polyolefin) and ECB (ethylene copolymer bitumen).

The main component of KÖSTER waterproofing membranes is polyethylene, one of the oldest and most commonly used polymers. KÖSTER roofing and waterproofing membranes are free of volatile plasticisers and remain flexible throughout their entire service life.

The structure of both product lines is identical: they are made of the same material on the top and bottom surfaces and contain a centrally embedded glass mesh reinforcement.

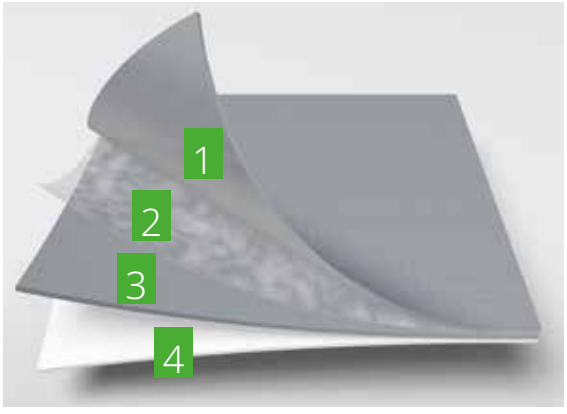
KÖSTER F (fleece-backed) membranes are laminated with an additional layer of polyester fleece on the underside.

KÖSTER SK (self-adhesive) is provided with a special self-adhesive polyester fleece layer, providing a strong adhesion to the substate.



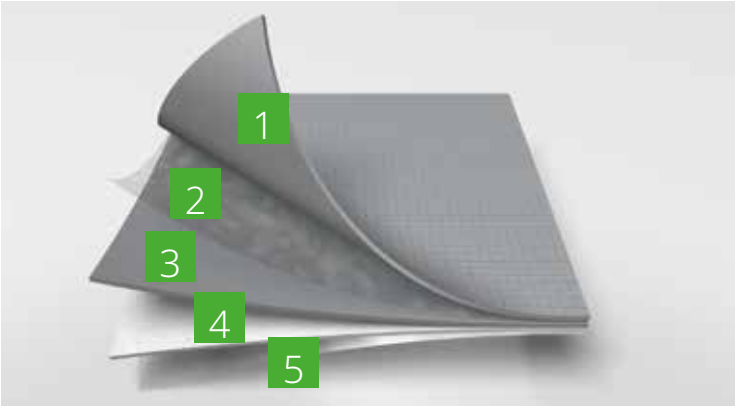
KÖSTER TPO / TPO Pro / ECB:

1) TPO / TPO Pro / ECB
2) Glass Fiber Reinforcement
3) TPO / TPO Pro / ECB



KÖSTER TPO F:

1) TPO / ECB
2) Glass Fiber Reinforcement
3) TPO / ECB
4) Polyester fleece



KÖSTER TPO SK:

1) and 3) TPO

2) Glass Fiber Reinforcement

4) Special polyester fleece with self-adhesive layer

5) Release film

KÖSTER TPO					
	KÖSTER TPO 1.5	**KÖSTER TPO 1.8**	**KÖSTER TPO 2.0**	**KÖSTER TPO Pro 1.5**	**KÖSTER TPO Pro 1.8**
Thickness	1.5 mm	1.8 mm	2.0 mm	1.5 mm	1.8 mm
Width	2.10 m* / 1.50 m / 1.05 m / 0.75 m/ 0.525 m / 0.35 m / 0.25 m			1.50 m	
Roll length	20 m				
Color	Light grey, white, slate grey; special colors on request			Light grey, White	

* not available in 1.5 mm thickness

KÖSTER TPO F	
	KÖSTER TPO 2.0 F
	With polyester fleece lamination on the underside
Effective thickness	1.5 mm / 2.0 mm
Width	1.50 m / 1.05 m
Roll length	20 m
Color	Light grey, white, slate grey

KÖSTER TPO SK (FR)		
	KÖSTER TPO 1.5 SK (FR)	**KÖSTER TPO 2.0 SK (FR)**
	With special fleece lamination on the underside, with self-adhesive layer and increased fire protection	
Effective thickness	1.5 mm	2.0 mm
Width	1.05 m	
Roll length	20 m	
Color	Light grey, slate grey	

KÖSTER ECB	
	KÖSTER ECB 2.0
Thickness	2.0 mm
Width	2.10 m / 1.50 m / 1.05 m / 0.75 m / 0.525 m / 0.35 m / 0.25 m
Roll length	20 m
Color	Black

Product features

KÖSTER roofing and waterproofing membranes have the following charcteristics:

- Same material quality on the top and bottom layers
- Can be welded homogeneously with hot air
- Temperature and weather resistant
- Ageing resistant and rot-proof
- High low-temperature flexibility (≤ -50 °C)
- UV-resistant
- Resistant to root penetration (FLL certificate)
- Bitumen compatible
- Polystyrene compatible
- Insulation neutral
- Resistant to normal mechanical stresses
- Resistant to microorganisms and old adhered coatings
- Environmentally friendly (EPD declarations, DGNB/German Sustainable Building Council and LEED classification)
- Harmless to health, water, soil, animals and plants
- Free of volatile plasticisers
- Chlorine-free
- Recyclable

Common roof build-ups using KÖSTER roofing membranes are classified in accordance with EN 13501-5 (external fire exposure to roofs).

Quality control

Structural Waterproofing is an area in which high-quality materials and processing make a real difference. By using the best available materials, optimal performance is achieved which ultimately results in saving both time and money. The KÖSTER BAUCHEMIE AG supplies materials of the highest quality, durability, and longevity. KÖSTER does not compromise on quality and firmly believes in a long-term and strong relationship with our customers. This philosophy applies to all of the company's divisions, from research and development through to production and sales. This is confirmed by a quality management (QM) system that is certified in accordance with DIN EN ISO 9001:2015.

KÖSTER roofing membranes are CE labelled in accordance with EN 13956 System 2+ and EN 13967. The quality of the products is regularly checked in-house and verified with regular production monitoring and quality assurance by an external testing institute.

Environmental protection and ecology

The KÖSTER BAUCHEMIE AG is committed to the protection and preservation of the environment, combining the use of state-of-the-art raw materials and production technologies in conjunction with continuous research and development. Today, this means that most materials are not only solvent-free, but also designed for minimal environmental impact and maximum protection for applicators. As a member of the German Chemical Industry Association, the KÖSTER BAUCHEMIE AG is also part of the "Responsible Care Worldwide" initiative, which is committed to responsible and sustainable action within the industry in the areas of health and environmental protection. In addition, the KÖSTER BAUCHEMIE AG is a member of the Institute for Construction and the Environment, whose members are committed to sustainable construction. The basis for this is transparent disclosure of all relevant product information, including life cycle assessment data.

KÖSTER roofing and waterproofing Membranes have product declarations in accordance with the DGNB and LEED system and Environmental Product Declarations in accordance with ISO 14025 and EN 15804 (EPD).

All manufacturer-relevant criteria for materials and production are evaluated in order for our products to qualify as sustainable and low-emission building materials.

With the development of KÖSTER TPO Pro we have taken another step toward our sustainability goals by creating the first roofing membrane made of a recycled base material. Then, to close the loop, after decades of reliable service, KÖSTER TPO Pro can once again be completely recycled.

KÖSTER, your reliable partner in construction

The KÖSTER BAUCHEMIE AG has built a reputation as a reliable partner in the construction industry over many years thanks to its expertise in high-quality and durable waterproofing. Solving waterproofing problems requires knowledge and experience. This is why KÖSTER supports our customers and partners with highly trained technical experts who provide help in mastering on-site challenges and finding safe, economical solutions. In addition, The KÖSTER BAUCHEMIE AG offers numerous training courses and seminars for architects and contractors to help guarantee the successful specification and use of our products.

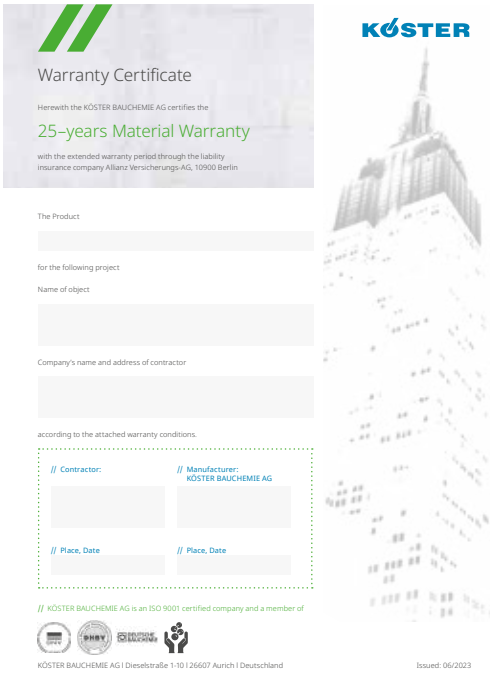
Warranties

At KÖSTER we stand behind our products and customers. That's why the KÖSTER BAUCHEMIE AG offers an extensive warranty program for TPO membranes: Premium and Premium Plus. With the Premium warranty level, the roof is insured for a period of 10 to 20 years depending on the membrane thickness.

There is coverage for both material and wage reimbursement for the installation of the membrane and for the costs of replacing other damaged components from the roof assembly (for example, drenched insulation). With the Premium Plus warranty level, the coverage goes one step further: reimbursement for consequential damage to general assets is covered by the extended product liability insurance from the Allianz AG. With these two warranty options, the client can choose the appropriate level of cover for each roof.

Advantages of warranty insurance with KÖSTER:

- The KÖSTER warranty can cover all KÖSTER roofing membrane products on the official price list (current at the time of taking out the warranty).
- The proven quality of KÖSTER TPO roofing and waterproofing membranes is the reason for the unusual commitment to extend the product liability up to 25 years.
- After completing a construction project with KÖSTER products, the KÖSTER BAUCHEMIE AG can provide the installer with a project specific warranty certificate.
- With this warranty, KÖSTER offers much more than the legal minimum for a product warranty.


Warranty Certificate

Herewith the KÖSTER BAUCHEMIE AG certifies the

25–years Material Warranty

with the extended warranty period through the liability insurance company Allianz Versicherungs-AG, 10900 Berlin

The Product

for the following project

Name of object

Company's name and address of contractor

according to the attached warranty conditions.

// Contractor: // Manufacturer: KÖSTER BAUCHEMIE AG

// Place, Date // Place, Date

// KÖSTER BAUCHEMIE AG is an ISO 9001 certified company and a member of

KÖSTER BAUCHEMIE AG | Dieselstraße 1-10 | 26607 Aurich | Deutschland

Issued: 06/2023


Warranty Certificate

Extended Manufacturer's Warranty from KÖSTER BAUCHEMIE AG for KÖSTER TPO Roofing Membranes

years Material Warranty

// Client

Name:

Address:

// Contractor

Name:

Address:

// Object's Address

Address:

Date of Delivery: Area (in m²):

Invoice Number:

The KÖSTER BAUCHEMIE AG hereby assumes responsibility for the repair of roof waterproofing in case of water permeability (hereinafter "leakage") for a period of years after delivery of KÖSTER BAUCHEMIE AG TPO Waterproofing Membranes (hereafter "Roofing Membranes") for the above-mentioned client under the following conditions:

// Die KÖSTER BAUCHEMIE AG ist ein ISO-9001 zertifiziertes Unternehmen und Mitglied von

KÖSTER BAUCHEMIE AG | Dieselstraße 1-10 | 26607 Aurich | Deutschland

Issued: 9/2022

The flat roof

Flat and sloping roofs pre-date recorded history. Modern architecture, functional industrial buildings and a variety of new materials have significantly increased the proportion of flat roofs in recent decades.

Cold, heat, rain, hail and snow, extreme wind loads, UV and infrared rays and many different chemicals will affect a roof. There are all also movements or tensions stemming from the building itself. A roof must be capable of durably withstanding many loads. At the same time, residents or users place a wide variety of demands on their roofs. They should be architecturally sophisticated; roof terraces should offer space for comfort and

relaxation, solar panels producing energy must be securely fastened to the roof. Many other installations and structures such as ventilation shafts, transmission masts or chimneys can also be found on roofs. The following requirements are all important considerations for selection of the roof design:

- Safety
- Durability and ease of installation
- Cost effectiveness
- Lowest possible environmental impact
- Low weight
- Low maintenance requirements

If the roof waterproofing is carefully planned and executed, the building will be well protected for decades.

High quality materials in conjunction with correct specifications and the exclusive use of approved and standard-compliant installers guarantees a long service life for flat roofs.

This manual is intended to support the planning of professional flat roof waterproofing.

Standards and guidelines

In order to guarantee a durable and safe implementation of roof waterproofing work, standards and guidelines have been established and continuously developed over time. Among the most important are:

- EN 13956 Waterproofing Membranes – Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics — For materials
- EN 13967 Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet. Definitions and characteristics
- SPEC 20.000–201 Application of construction products in structures - Part 201: Application standard for flexible sheets for waterproofing according to European product standards for the use as waterproofing of roofs
- SPEC 20.000–202 Application of construction products in structures - Adaption standard for flexible sheets for waterproofing according to European standards for the use as waterproofing of elements in contact with soil, of indoor applications and of tanks and pools
- EN 13501 Fire classification of construction products and building elements

Other Guidelines

Construction standards vary widely depending on your location and local regulations should always be checked. The following list includes German and European standards:

- Installation Instructions of the KÖSTER BAUCHEMIE AG
- DIN 18531 Roof waterproofing
- DIN 18195 + DIN 18531 ff. Building waterproofing
- Flat roof guideline of the German roofing trade
- Specialist regulations for metal work in the roofing trade
- Energy saving regulations - ENEV
- EN 1991-1-4 Wind loads
- EN 13165 Thermal insulation materials for buildings - Factory-made products made from rigid polyurethane foam
- ETAG 006 Mechanically attached roof systems
- FLL Guideline Root resistance of waterproofing
- VOB Contract award regulations in the construction trade
- CEN/TS 1187 Test procedures for external fire exposure
- Construction regulation list A, part 3, number 2.8
- EN 1253 Gullies for buildings
- EN 12056 Part 3 - Gravity drainage systems inside buildings
- DIN 1986-100 Drainage systems for buildings and land plots
- EN 13162 Thermal insulation building materials made from mineral wool
- EN 13163 Thermal insulation building materials made from expanded polystyrene EPS
- Industrial construction guidelines
- DIN 18234 Structural fire protection of large-area roofs
- KTW- German Federal Environment Agency Guidelines
- DVGW/German Technical and Scientific Association for Gas and Water rules and regulations

Definition of a flat roof

A flat roof is a roof with a low roof pitch, between 2° and 10°. Due to the low roof pitch, the water flows off slowly and puddles can form due to unevenness. Therefore, a flat roof must always be waterproofed against standing water.

Roofs with a slope between 10° and 20° are referred to as low-pitched roofs.

Roofs with a slope of more than a 20° are called pitched roofs.

Stresses

Environmental influences such as weathering, emissions, humidity, wind and snow loads, dirt and dust deposits, changing temperatures, atmospheric precipitation, UV radiation, oxygen, ozone, and mechanical stresses due to traffic can have a negative effect on the service life of the building materials and the longevity of the roof.

Flat roofs according to usage

Un-trafficked flat roofs

Un-trafficked flat roofs are not intended for regular pedestrian use. They may only be walked on for maintenance or repair purposes. This also includes extensively greened roof areas.

Foot-trafficable flat roofs

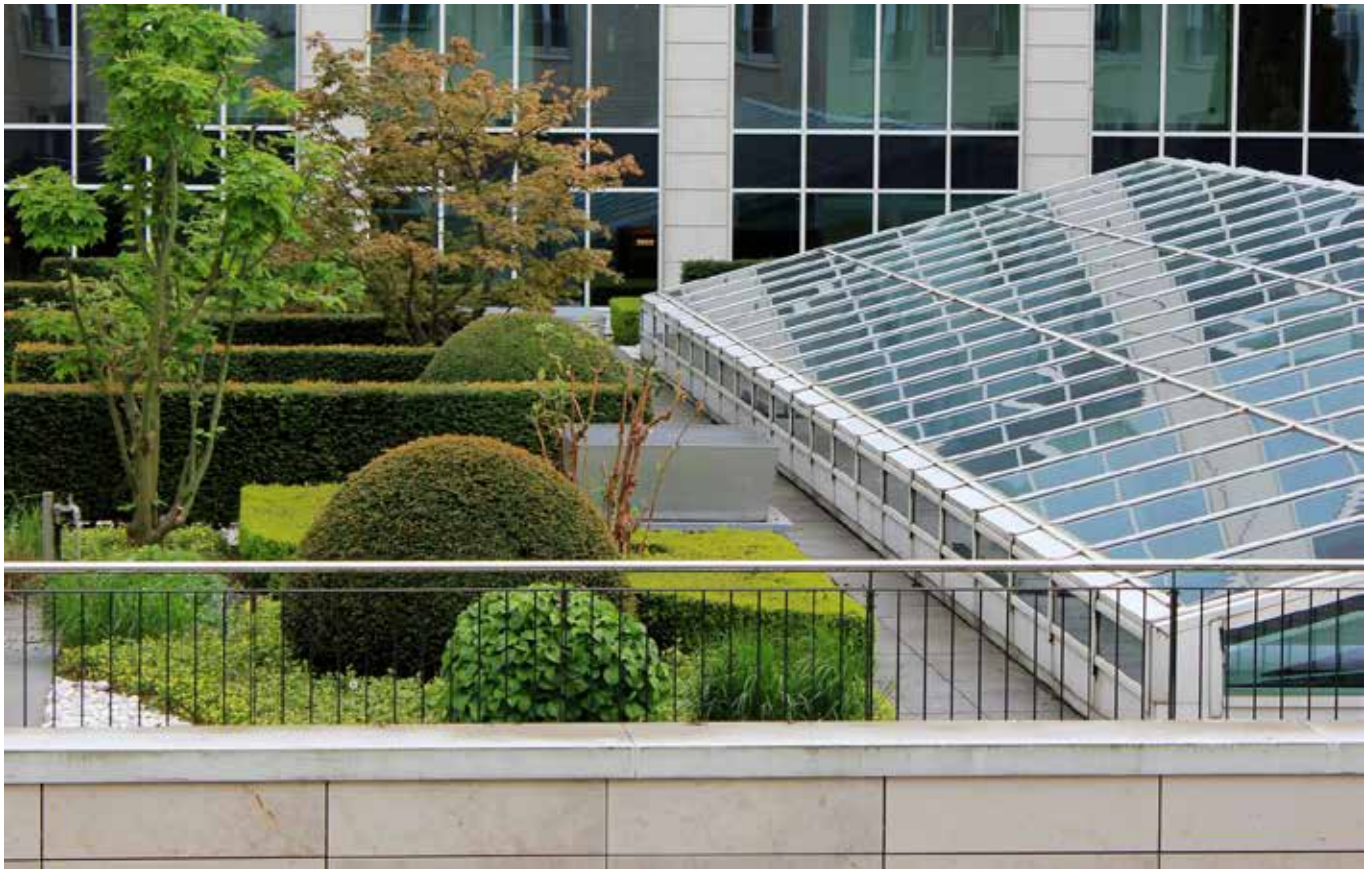
Foot-trafficable flat roofs are used as, for example, terraces, balconies, recessed balconies, access balconies, roofs with intensively greened roofs, and roofs with solar systems. These could also include earth-covered basement roofs.

Flat roofs subject to vehicular traffic

Flat Roofs subject to vehicular access. Due to the weight of the vehicles that are allowed to drive on the roof, special requirements are placed on the substrate and the thermal insulation. On parking decks, for example, only extremely pressure-resistant thermal insulation can be used. Protection of the waterproofing under the wearing course must be ensured via suitable measures, such as by using geotextiles or other protection and separating layers.

Green roofs

A green roof is alive. The roots of the trees and shrubs planted in the humus layer can penetrate some waterproofing membranes, causing leakage. This makes special root protection a necessary consideration. Fortunately, KÖSTER TPO membranes are root-resistant and tested according to the FLL method. This eliminates the need for an additional root protection layer in the green roof structure.

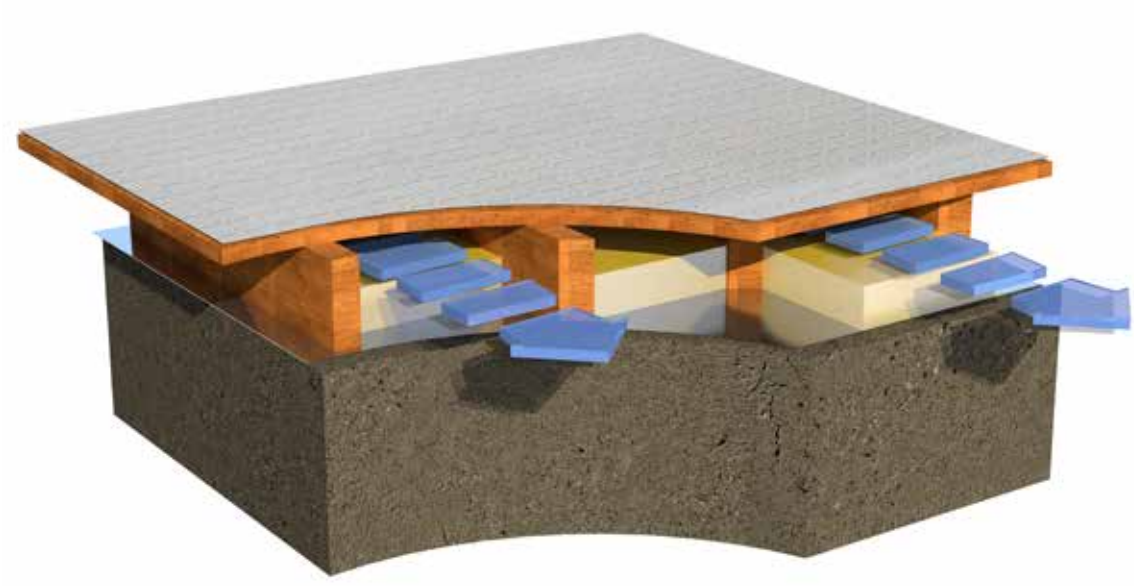


Design types: Cold roof (ventilated roof)

A cold roof consists of a two-layer flat roof structure, (upper and lower shell). The height of the ventilation void between the top of the insulation and the underside of the top shell will be defined by local building regulations, which will control the minimum spacing required for both longitudinal and transverse aeration. Usually the cold roof structure is created using wooden joists and furling strips to create the void between the lower and upper shells. The upper shell should always have a slope toward drainage. Fiber insulation materials are normally used on the lower shell for thermal insulation, this does not have to be rigid as it is fitted within the structural wooden framework and will not be compressed by any loading of the roof.

A cold roof construction method is convenient (particularly for smaller roofs) and is structurally and thermally safe, provided that the ventilation void is correctly connected to the outside. This is achieved through air-vents positioned at the eaves, at the wall-head and sometimes through the upper roof deck. The vent openings must be orientated to provide protection from driving rain and prevent the ingress of birds, vermin, etc. with mesh or grills. It is also vital that water vapor from the room below cannot penetrate the insulation layer. To prevent this a vapor barrier should be installed under the thermal insulation. This ensures that the full insulation performance is maintained, preventing the inner shell (ceiling) from becoming cold and causing issues with condensation.

If the upper shell is inclined relatively to the lower shell, an additional chimney effect is created which ensures improved aeration of the double-shell flat roof structure. If necessary, the required aeration cross-section can be reduced in this regard.



Cold roof (ventilated roof)

Warm roof (non-ventilated): Normal roof

In the case of a normal, non-ventilated roof, the waterproofing is installed directly above the insulation. A vapor barrier must be applied to the supporting deck under the insulation. The design of the vapor barrier and determination of the fastening details for the structure's functional layers must be carried out by the roof designer.

Warm roof (non-ventilated): Normal roof

Inverted roof

The waterproofing is applied directly to the roof deck and is then covered with a weatherproof and environmentally resistant insulation, which is secured by a suitable ballast. The waterproofing membrane also functions as a vapor barrier and therefore no additional vapor control layer is required.

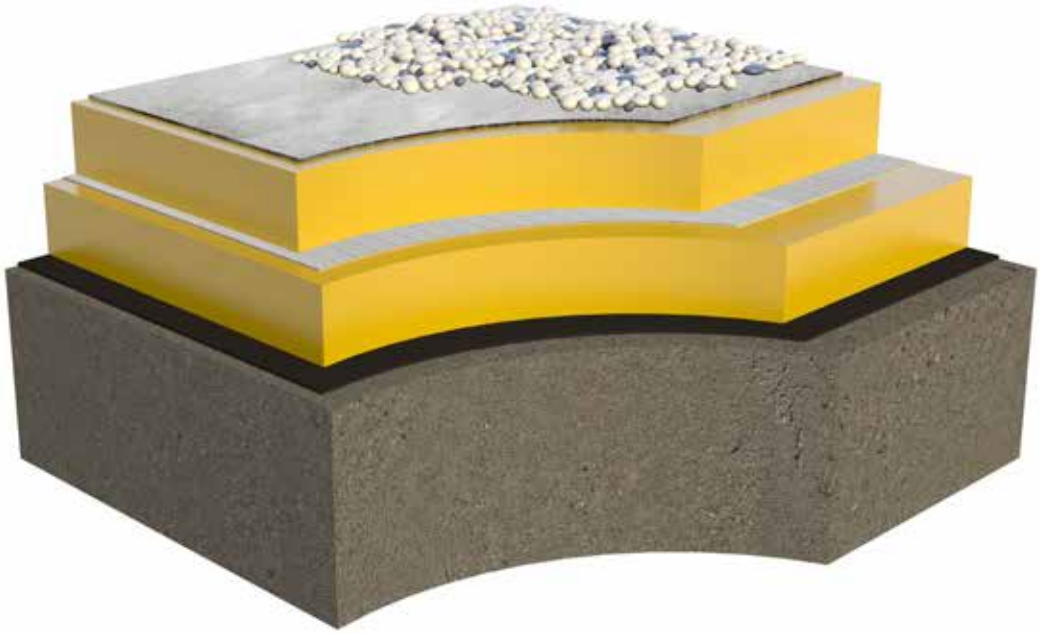
Warm roof (non-ventilated): Inverted roof

Double / built-up flat roof or combination roof

The double or built-up flat roof is a flat roof construction whereby the waterproofing is placed between two thermal insulation layers. The upper insulation layer must be weatherproof and environmentally resistant. As with the inverted roof, it must be protected from wind uplift with sufficient ballast. The insulation layer is normally covered prior to installing ballast with a geotextile fleece, preventing small dust and dirt particles from seeping in.

This roof construction serves in particular to improve the insulating capacity of normal, single-shell flat roofs. For this reason, it is sometimes referred to as a “combined inverted roof“. The roof represents a combination of normal and inverted roofs.

Since the roof waterproofing is sandwiched between two insulation layers, it is subject to less thermal stress. When renovating an existing roof in this way, it must always be ensured beforehand that the “old“ roof has its full structural integrity and that there is no pre-existing damage.



Double / built-up flat roof or combination roof

Planning and design of a flat roof

Gradient

A gradient of at least 2 % (approx. 1.2°) should be planned for diverting surface water. The gradient can be created via the substructure, e.g. sloping screed, tapered wooden framework, or insulation materials in wedge form. The drainage elements must be installed at the lowest points of the gradient.

Puddles can also form on roof pitches of up to 5 % due to permissible tolerances, deflections, thicknesses of the materials, and overlaps.

In exceptional cases, a gradient-free design is permissible, e.g. for renovations with pre-existing drainage, for low connection heights to doors, legal building requirements that do not permit a gradient, or intensive greening and earth-covered areas with mat irrigation.

Due to the homogeneous weld seam it is easy to waterproof non-sloped roofs with KÖSTER roofing membranes made of TPO and ECB.

Substrate

The substrate is the surface to which the roofing build-up is applied. It should be continuous, clean, and even. It can consist of concrete, precast concrete elements, wood materials, trapezoidal sheets, or other suitable materials.

If possible, it is recommended to implement a gradient already at the structural substrate, however it is also possible to create the gradient with the insulation layer.

Concrete

The surfaces of concrete roof decks or any sloping screed must be brushed, clean, free of gravel pockets and gaping cracks, sufficiently hardened and surface dry.

Joints between precast concrete parts must be closed or covered in a dimensionally stable manner.

Wooden materials

Roof decks made of wooden sheathing are defined as light-weight structures.

All wood used must conform to local building regulations both dimensionally and qualitatively. The wood is normally treated by impregnation to protect against rot, decay, insect, and fungal attack. It must be ensured that any wood protection methods used will have no detrimental effect on any other elements of the roof structure.

Suitable wood-based materials are e.g.: OSB boards according to EN 300, plywood according to EN 636, rigid fiberboard in accordance with EN 622-2; resin-bonded chipboard in accordance with EN 312, cement-bonded chipboard in accordance with EN 634-1, and solid wood panels in accordance with EN 13353.

Trapezoidal steel profiles

Trapezoidal steel profiles are also defined as light-weight structures. The thickness, quality, and maximum deflection will be defined by local building regulations. The sheet thickness is normally at least 0.88 mm. The upper chords should be on one level. When installing glued roof structures the heights of adjacent upper chords should not differ by more than 2 mm.

Vapor barrier

For metal roofs with insulation below the waterproofing, a vapor barrier would normally be installed between the deck and the insulation layer. This is an essential component of the building's moisture and heat protection.

Suitable materials are bitumen membranes, polymer membranes and composite films, e.g. the KÖSTER Vapor Barrier FR.

Vapor barriers can be loose-laid or glued either by strip adhesion, by spot-bonding, or over the full surface.

Vapor barriers must be raised up and connected to the top edge of the insulation at junctions and transitions. They must also be sealed at all penetrations.

When installing on trapezoidal sheets, the vapor barrier (e.g. KÖSTER Vapor Barrier FR) must be installed in the same direction as the upper chords. The longitudinal seam must lie on an upper chord. An auxiliary support (e.g. a metal strip) must be installed under cross seams.

If the vapor barrier is also required to act as a temporary waterproofing then only suitable products, i.e. adhered bitumen membranes, should be used.

Minimum compressive strength		
Insulation	**Compressive strength in kPa**	
	Non-trafficked roofs	Trafficked roofs
EPS Hard foam	100	150
XPS Hard foam	200	300
PU Hard foam	100	100
Foam glass	500	500
Mineral wool	60 at 10% compression	70 at 10% compression

Insulation

Suitable materials for thermal insulation include: mineral wool insulation in accordance with EN 13162; rigid polystyrene foam (EPS) in accordance with EN 13163; extruded polystyrene foam (XPS) in accordance with EN 13164; rigid polyurethane foam in accordance with EN 13165, and foam glass in accordance with EN 13167.

Insulation materials that serve as a base for a waterproofing must comply with minimum pressure load values.

When using mineral wool, a load-distributing layer should be placed above or below the waterproofing if the roof is likely to be trafficked and in the area of maintenance routes to avoid point loading.

Thermal insulation materials should be laid butt-jointed, with the joint offset. More than one layer of insulation panels can be used in a shiplap arrangement to avoid thermal bridges.

For insulation requirements thicker than 160 mm, the panels should be installed in two layers. Insulation panels can be installed loose (ballasted), with adhesive, or by mechanically fixing.

The insulation panels must be protected against wind suction forces in accordance with EN 1991-1-4.

Mechanical fastening of the insulation can be implemented together with the mechanical fastening of the waterproofing or carried out as a separate work step prior to the membrane installation. Insulated tube washers are available to ensure that mechanical fixings do not compromise the thermal performance of the insulation.

Tapered insulation can be a useful option for creating a slope to drainage or spouts prior to membrane installation, it is custom produced for each roof and is supplied along with an installation plan.

In the case of inverted roofs, the insulating materials are installed above the waterproofing. Suitable materials such as XPS insulation with a shiplap layout must be used. A filter (trickle protection) fleece must be installed above the insulation layer and must be sufficiently ballasted to avoid the possibility of wind uplift. All layers above the insulation must be water permeable.

Separating layers / protective layers

KÖSTER Roofing Membranes are free of volatile plasticisers, are bitumen compatible, and can be installed over all common thermal insulation materials without a separating layer.

For the direct installation of KÖSTER roofing membranes over concrete, wooden sheets and old bitumen or PVC roofs an additional protection and separation layer is recommended. This can be provided by using a KÖSTER TPO F membrane which includes a fleece lamination on the underside. Alternatively a separate polyester fleece of approx. 300 g/m^2 or glass fleece ≥ 120 g / m^2 can be used.

For roofs with ballast, KÖSTER recommends a protective layer of rot-proof fleece (trickle protection) or other suitable materials providing a high level of protection whilst being water permeable. The protection layer will protect the membrane during installation of the gravel and will prevent small particles from washing into the insulation layer.

Waterproofing

KÖSTER TPO and ECB membranes are used for both roofing and waterproofing applications.

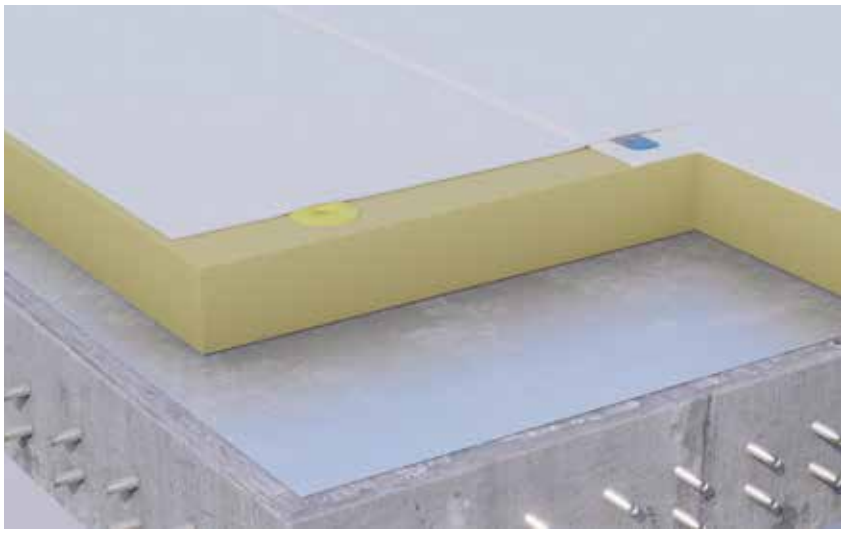
The TPO and ECB membranes can be implemented in various designs. These depend on how the buildings are used and on their roof surfaces, the planning requirements, and the local building regulations.

Application / Installation method

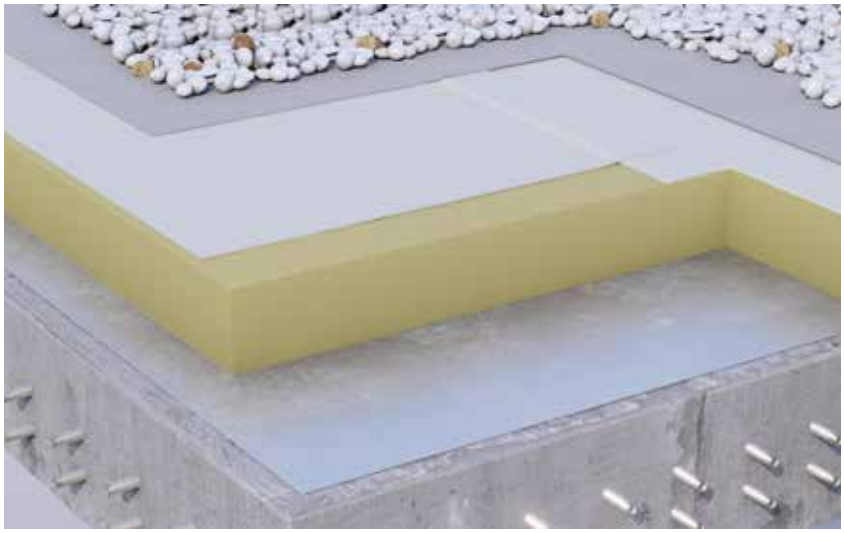
The application method of KÖSTER roofing and waterproofing membranes depends on the field of application and the type of installation.

Application / installation method					
	KÖSTER TPO / ECB	**KÖSTER TPO F**	**KÖSTER TPO SK (FR)**	**KÖSTER TPO ECB U**	**KÖSTER TPO Pro**
Loosely installed under ballast / green roof	x	x			
Exposed to the weather, mechanically fastened	x	x			x
Exposed to weather, strip and full-surface adhesion		x			
Exposed to weather, fully self-adhesive			x		
Exposed to the weather – direct installation on EPS Glued or mechanically fastened			x		
Connection strips for wall connections, drainage outlets, skylight domes etc., glued with KÖSTER contact adhesive or self-adhesive (SK)	x				
For the production of connection pieces or flanges, pipe penetrations and corner protections where greater malleability is required.				x	

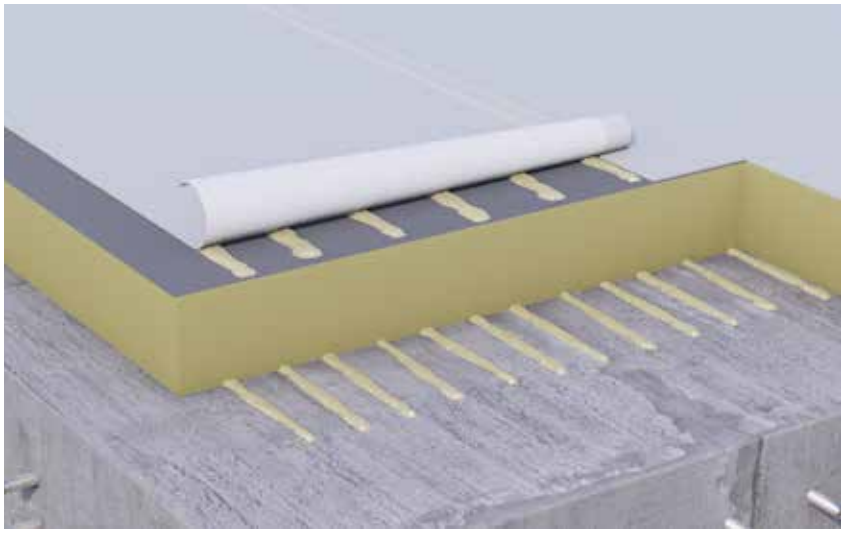
Installation types



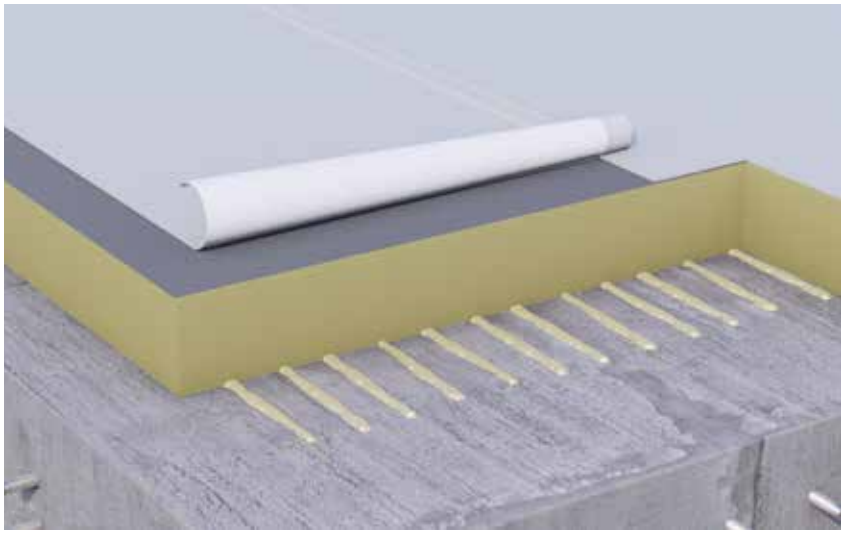
Mechanically fastened installation



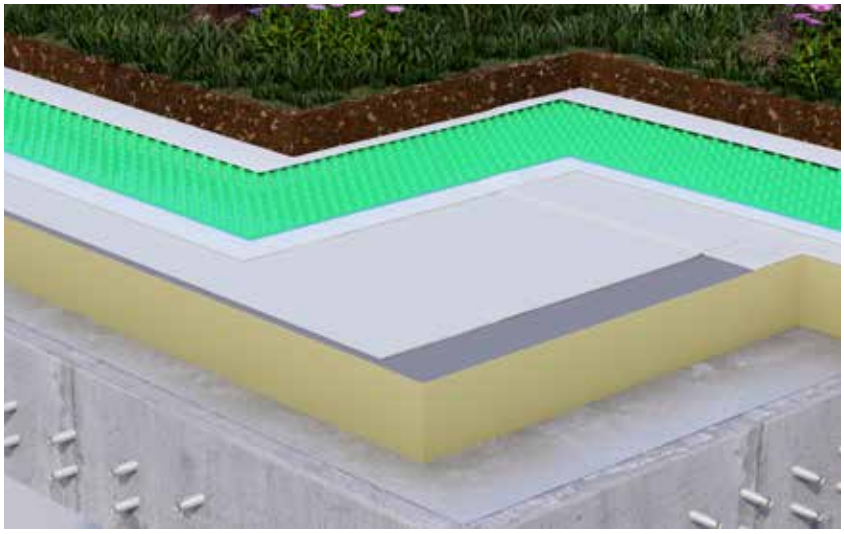
Loose laid with ballast



Adhered installation with adhesives



Self-adhesive installation



Green roofs

Overlap

The side overlap of the KÖSTER roofing and waterproofing membranes is generally a minimum of 5 cm. Depending on the fastening method and type of insulation, the seam overlap can increase.

Seam overlaps against the watercourse are generally permitted at connections and ends. In exceptional cases, opposing seams are also possible in the roof area.

Seam overlap according to the application				
Substrate	**Loosely installed with ballast**	**Strip-gluing / Self-adhesive**	**Full-surface adhesion**	**Mechanically fastened**
Concrete	50 mm	50 mm	80 mm	110 mm
Wood	50 mm	not permitted		110 mm
Insulation (not EPS)	50 mm	50 mm	80 mm	110 mm
EPS insulation	80 mm	80 mm	80 mm	110 mm

Side joints / end joints

The side overlap of KÖSTER roofing and waterproofing membranes is generally a minimum of 5 cm. Depending on the fastening method and type of insulation material, the overlap may be increased. Seam overlaps against the water flow are only permitted for junctions and transitions and at upstands.

In the case of standard non-fleece backed KÖSTER TPO roofing membranes, the end joints are produced with a 5 cm minimum overlap. For EPS insulation or mechanical fastening, the overlap must be increased accordingly (see table above).

Fleece-laminated KÖSTER TPO roofing membranes are installed with the same type of side joints as for the non-fleece backed material. The fleece doesn't cover the full width of the membrane, leaving a strip at the side for welding the overlap. At the roll ends or other transverse joints the material is butted together then over-banded with a non-laminated TPO strip cut to 25 cm wide. This is welded at both sides of the joint.

Self-adhesive KÖSTER TPO roofing membranes (SK) are overlapped at the end joint by approx. 5 cm and pre-welded. Then proceed as with the fleece-backed membranes with an over-banding strip.

The overlap strip must project at least 5 cm beyond the edge of the membrane. All corners (e.g. at the end of the membrane) are rounded to ensure faultless welding. This step applies to both the lower and upper layers.

Cross joints are a weak point (as they produce multiple layers of overlapping material) and should be avoided at all costs. It is better to offset overlaps from one sheet to the next. Alternatively butt joints with over-banding (as with the fleece backed material) can be used.

Weld seam width

The width of the homogeneous joint weld must be at least 20 mm for KÖSTER TPO and KÖSTER ECB roofing membranes.

Additional precautions

Securing against horizontal forces

Horizontal forces occurring in the waterproofing layer must be absorbed to avoid adverse effects on the roof structure. To this end, all single-ply roof waterproofing, regardless of the installation method, substrate and building height, must be mechanically fastened at all junctions and transitions in the roof. This includes all roof edges as well as all upstands.

KÖSTER TPO Metal Composite Sheet, roofing membrane fasteners, or rigid fixing bars are suitable for fastening. These must be fixed with at least 4 fasteners per meter. The fasteners should be installed either horizontally, through the main waterproofing or into the vertical or inclined surface as close to the transition point as possible. All mechanical fasteners are covered with an additional layer of membrane or a capping detail at parapet heads. For large insulation thicknesses, it is recommended that the fasteners are fixed to the vertical surface where possible.

If the roof surface gradient changes direction > 7 % (approx. 4°) the waterproofing membrane must be mechanically fastened at the low point in the same way as for edge fastening.

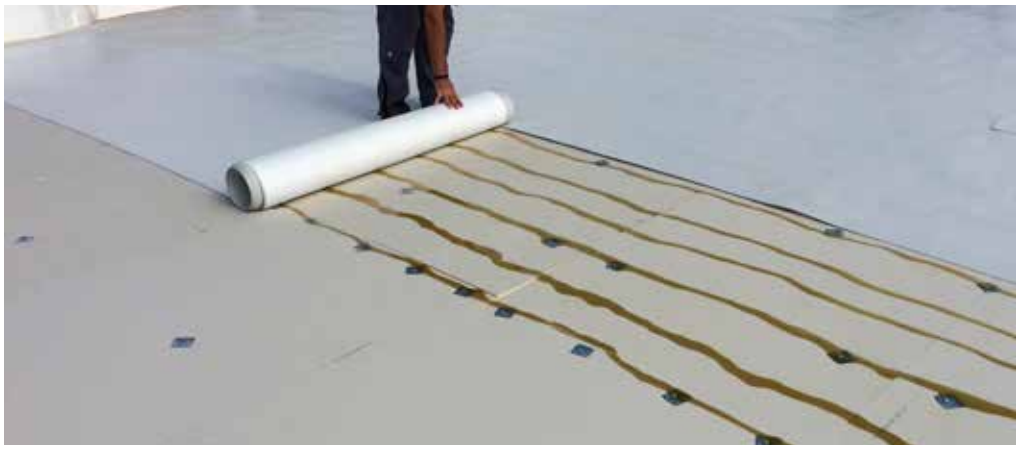
Protection against wind uplift

Roofing membranes must be secured against wind uplift. KÖSTER TPO and ECB roofing membranes are mechanically fastened, adhered, or secured via ballast.

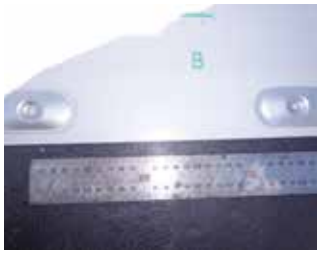
The number of fasteners, the quantities of adhesive, or the necessary ballast must be determined by a wind load calculation in accordance with EN 1991-1-4 or by the simplified specifications in the flat roof guidelines.

Wind loads acting on the building depend on the building's location, height, roof form, and roof pitch.

As a free service, the KÖSTER BAUCHEMIE AG prepares fastening plans for our customers in accordance with "EN 1991-1-4 - Wind loads on buildings".



Mechanical fastening



The roofing membranes are mechanically fastened in the overlapped area. In accordance with the wind load calculations, fasteners may also be required in the center of a width of roofing membrane, typically in the zones close to the edge of the building. These additional fasteners must be covered with a 250 mm wide patch of KÖSTER TPO.

The membranes must be anchored to the substructure with approved roofing membrane fasteners in accordance with the fastening plan. The length and type of fastener depends on the substructure and the thickness of the insulation being used. Fasteners of different lengths must be used for tapered insulation. In one work step, the entire roof layer package can be fastened in a windproof manner. For certain insulating materials, additional fasteners may be necessary in accordance with the manufacturer's installation guidelines. Plastic tube washers can be used when fixing through insulation to prevent thermal bridges.

For trapezoidal sheet steel constructions, the roof layer package is fastened to the upper chords of the trapezoidal sheeting. The KÖSTER roof membranes are laid transversely to the direction of the trapezoidal sheeting.

On wooden roofs the waterproofing membranes are laid transversely to the direction of the wooden sheets when possible.

The fasteners are installed 10 mm in from the edges of the membrane. Plate anchor fasteners with a larger head must be used on mineral fiber insulation to prevent pull-through. We always recommend that corrosion resistant fasteners are used, of a type recommended specifically for roofing applications.

Adhered Application

Only KÖSTER TPO F roofing membranes with fleece lamination or KÖSTER TPO SK (FR) roofing membranes should be used. The roofing membranes should be stored in a dry place and the fleece must be dry during application.

During application make sure that the weld area remains free of adhesives and soiling. If necessary, adhesive residues must be mechanically removed.

Adhered installation can only be undertaken for renovation if the old roof membrane is still securely adhered in place or if it has been mechanically re-fastened in accordance with EN 1991-1-4.

Full-surface adhesion

The entire surface is adhered with KÖSTER PUR Membrane Adhesive.

The consumption of the KÖSTER PUR Membrane Adhesive for full-surface adhesive is approx. 400 to 450 g/m^2. Apply the adhesive evenly over the entire surface of the prepared substrate using suitable tools such as a rubber lip squeegee or adhesive trowel. Insulation

panels should be fleece faced for use with KÖSTER PUR Membrane Adhesive. For foil faced insulation we recommend the use of KÖSTER TPO SK, (see the "Self-adhesive installation" section below.

KÖSTER TPO F roofing membranes are bitumen compatible and can also be adhered to hot-melt bitumen.

Adhesion to bitumen must always be undertaken over the full area. Light-colored KÖSTER TPO roofing membranes may discolor when adhered with bitumen adhesives. This however has no influence on the quality and durability of the roofing membrane.

Strip adhesion

Only PUR roofing membrane adhesives are to be used for strip adhesion. The adhesive is applied in parallel lines.

The roof area is divided as per a wind uplift calculation in accordance with EN 1991-1-4 or the specifications in the flat roof guidelines.

Consumption according to roof area division			
Roof area	**Nr. of strips per meter**	**KÖSTER PUR Membrane Adhesive consumption**	**KÖSTER 2C PUR Membrane Adhesive**
Inner zone	4	approx. 160 g / m²	0.08 Cartridge/m²
Intermediate Zone	5	approx. 200 g / m²	0.1 Cartridge/m²
Perimeter zone	6	approx. 240 g / m²	0.12 Cartridge/m²
Corner Areas	8	approx. 320 g / m²	0.16 Cartridge/m²

The strips width should be approx. 2 cm (consumption 25-40 g / m²)

Self-adhesive installation

KÖSTER TPO SK (FR) roofing membranes have a special self-adhesive polyester fleece laminated to the underside. The substrate must be solid, clean, dry, and free of grease and oil. Depending on the substrate, the application of KÖSTER TPO SK primer may be necessary.

The primer is applied over the entire surface in a single operation using a roller or brush. It is absolutely necessary to check for thorough drying before installing KÖSTER TPO SK (FR) roofing and waterproofing membranes. The consumption of SK Primer is approx. 200 ml/m².

The manufacturer's instructions must be observed for aluminium-laminated PUR / PIR insulation.

Note: At high working temperatures, if the release film snags, it may be necessary to partially roll the membrane back up, free the release film, then gradually pull-off while the material is unwound again.

Non-laminated PUR / PIR insulation materials, tongue and groove cladding, and gravel roofs are not suitable. For other substrates please contact the KÖSTER BAUCHEMIE AG.

KÖSTER TPO SK (FR) membranes are rolled out and aligned. The protective release film is then pulled out laterally from under the laid membrane. Make sure that the membrane does not slip.

Finally, the membrane must be thoroughly pressed down over its entire surface using a roller. The seams are sealed via hot-air welding.

Substrate	Direct installation	KÖSTER TPO SK Primer
EPS insulation, non-laminated	X	
XPS insulation, non-laminated	X	
PUR / PIR insulation, fleece-laminated*	X	
PUR / PIR insulation, aluminium-laminated*	X	
Mineral fiber insulation, fleece-laminated*		X
Concrete		X

* Must be approved by the adhesive manufacturer

Securing with ballast

If a ballast is provided, the membrane can be laid loosely on the roof surface without further fastening.

The required surface weight of the ballast can be determined by a wind uplift calculation in accordance with EN 1991-1-4. The material used must be applied in such a way that it is stable and wind-resistant. In edge and corner areas, it is recommended to use paving slabs. Suitable ballasts are:

- Round gravel 16/32, at least 5 cm
- Slabs, shaped stones, frost-resistant concrete slabs
- Greening, KÖSTER TPO is tested in accordance with the FLL method
- Layers of earth
- Using a protective layer is recommended when utilising ballast (see section separating layers / protective layers)

As a form of building greening, green roofs form an important part of ecological construction.

A distinction is made between extensive and intensive green roofs.

The standard structure of a green roof is independent of the type of greening. In any case, the green roof guidelines must be observed.

Standard layer construction for green roofs:

- Plant level
- Filter layer
- Protection layer
- Vegetation layer
- Drainage layer
- Roof construction with KÖSTER TPO

KÖSTER TPO and ECB roofing membranes are root-resistant and do not require additional root penetration protection.

Due to the expected loads, it is absolutely necessary to check the load-bearing capacity of the roof structure.

Extensive green roof

Extensive green roofs can usually be produced and maintained with little effort. Additional watering is not necessary. They are placed close to nature and are intended to be self-maintaining and developing. Various types of sedum are used alongside grasses, mosses and herbs.

Installation thickness

Extensive greening has an installation thickness of approx. 6 to 15 cm and a surface weight of between approx. 0.5 and 1.5 kN/m².

Intensive green roof

Roofs with intensive roof greening are usually multifunctional and accessible. They resemble the construction of a roof garden. Intensive greening has a significantly higher weight and a thicker system structure. Depending on the layer thickness, almost all plants are an option, such as grass, perennials, shrubs, and trees along with landscaping elements such as ponds, pergolas and terraces. Maintenance must be carried out regularly and depends on the design and the plants selected.

Installation height

An intensive greening has an installation height of approx. 15 to 200 cm and a surface weight between approx. 2 and 30 kN/m².

Detailing: General planning principles

At the planning stage, the prerequisites of the roof design must be agreed on and the basic details prepared. The height of waterproofing at junctions and transitions, distances between drainage points, and the details of upstands and roof edges should all be determined in advance of the membrane application. If additional roof elements such as roof lights or railings form part of the project then the exact details of these should be provided by the designer in order for the best waterproofing detail to be agreed upon.

Junctions and transitions

Junctions to upstands

Junctions and transitions at upstands, eave connections and the like are always installed with two layers. Use strips of KÖSTER TPO cut to size. The transition point has the horizontal membrane turned up onto the vertical then the overlapping upstand membrane turned down on to the horizontal. The overlapping pieces are easiest made from the standard reinforced TPO without fleece or self-adhesive layers.

The material thickness of the reinforcing strips should be the same as the thickness of the main membrane. The strips can be loosely installed at upstand heights up to 50 cm but always mechanically secured at the upper edge, e.g. by using clamping profiles or fixing bars. At least 4 fasteners per running meter should be used.

Termination heights

Terminations should be at the following minimum heights

- a roof pitch of ≤ 5° at least 15 cm
- a roof pitch > 5° at least 10 cm

above the upper edge of the roof covering.

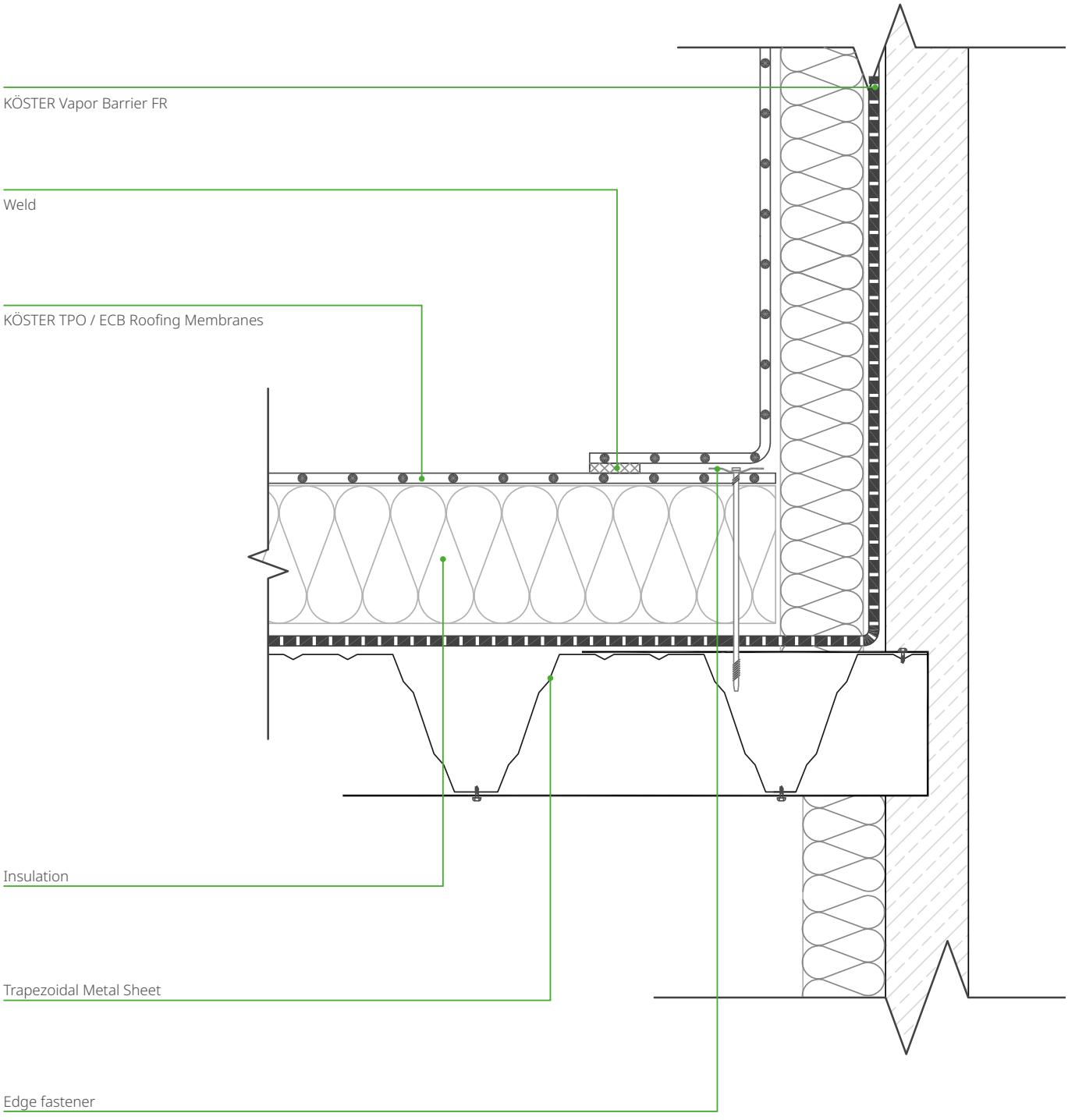
Junctions at heights higher than 50 cm must either be installed with Intermediate mechanical fasteners or be fastened by gluing or self-adhesion over their full surface.

Mechanical fastening can be achieved by using individual fasteners, fixing bars, or a TPO Metal Composite Sheet. At least 4 fasteners per meter are required. With the exception of end terminations, fasteners are installed in the overlap area or else must be overbanded with a strip of KÖSTER TPO welded at all edges.

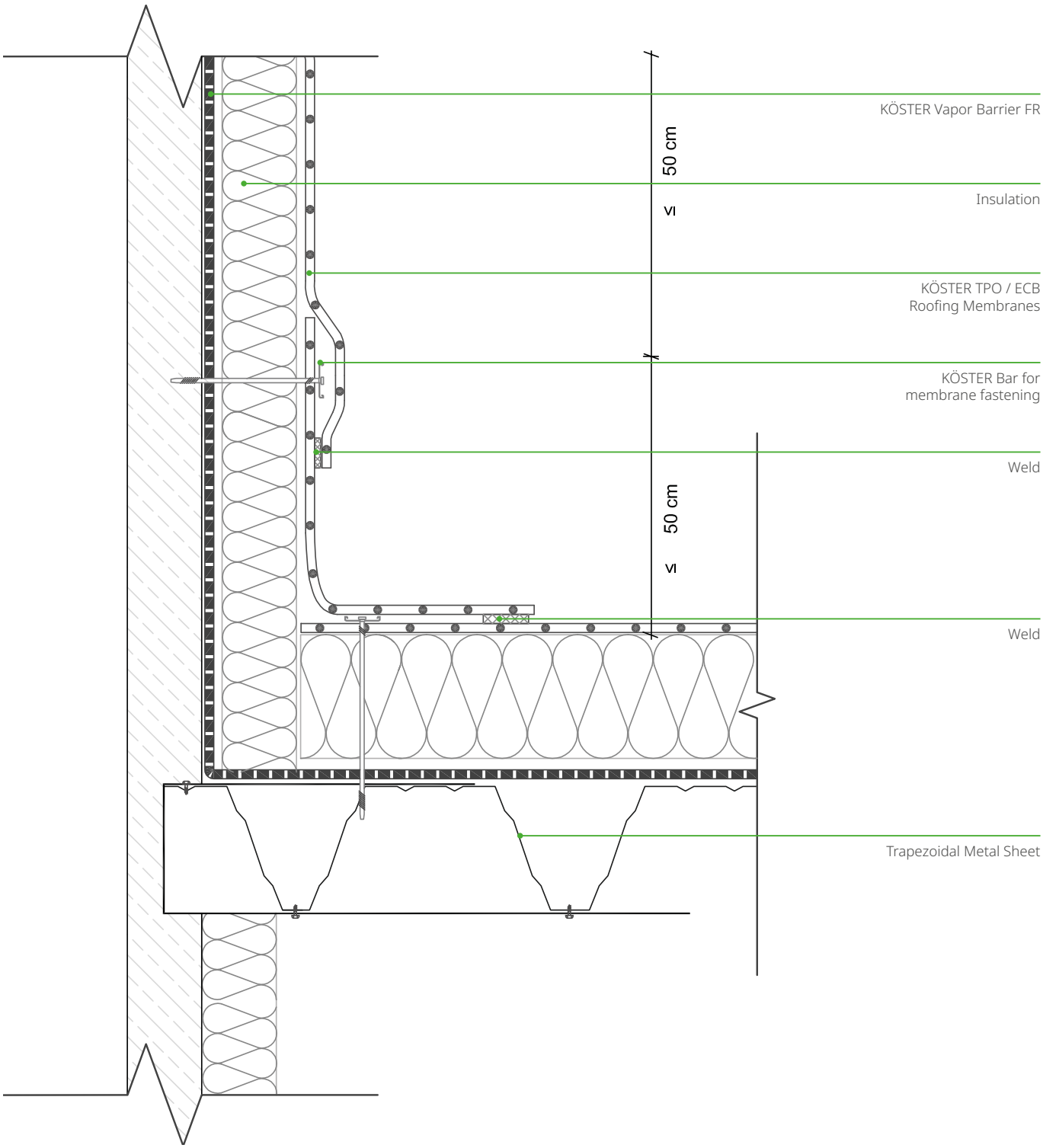
The end termination should always be overlapped by a flashing, sealing strip, or metal profile to prevent water flowing directly against the membrane edge.

KÖSTER Contact Adhesive is used for full area adhesion of the KÖSTER TPO Roofing Membranes at upstands. The consumption is approx. 400 g/m².

Example wall upstand up to 50 cm height

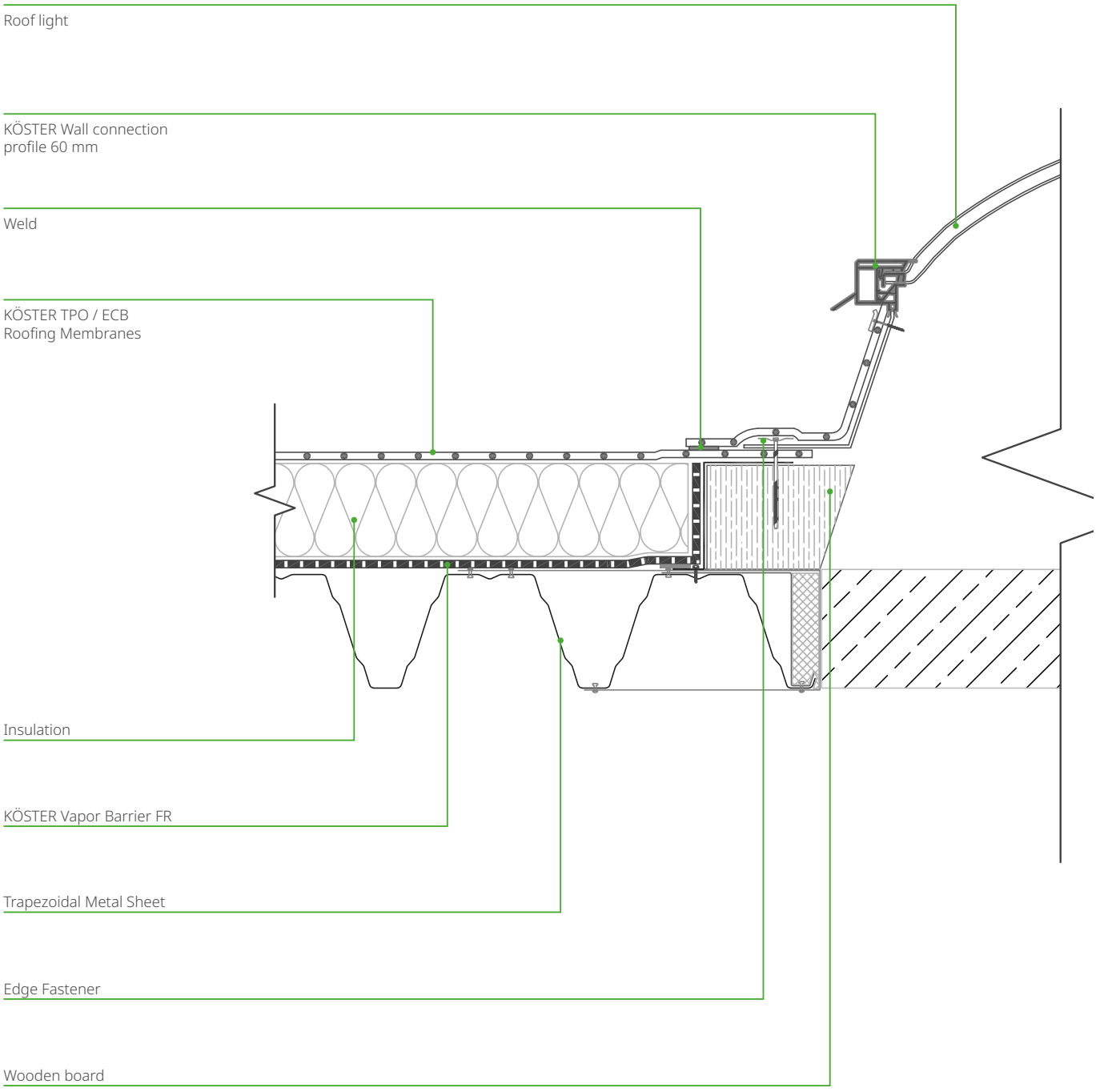


Example wall upstand over 50 cm height



Junction to horizontal glazing and skylight domes

Junctions to roof lights and skylights are treated in the same manner as other upstands. The vertical strips of membrane can be applied without intermediate fastening up to a height of 50 cm. Gluing with KÖSTER Contact Adhesive or using the TPO SK (FR) membrane is also possible. The top edges must always be mechanically fastened using a fixing strip or other clamping mechanism. The top termination should always be overlapped by a flashing, sealing strip, or metal profile to prevent water coming to bear directly against the membrane edge.

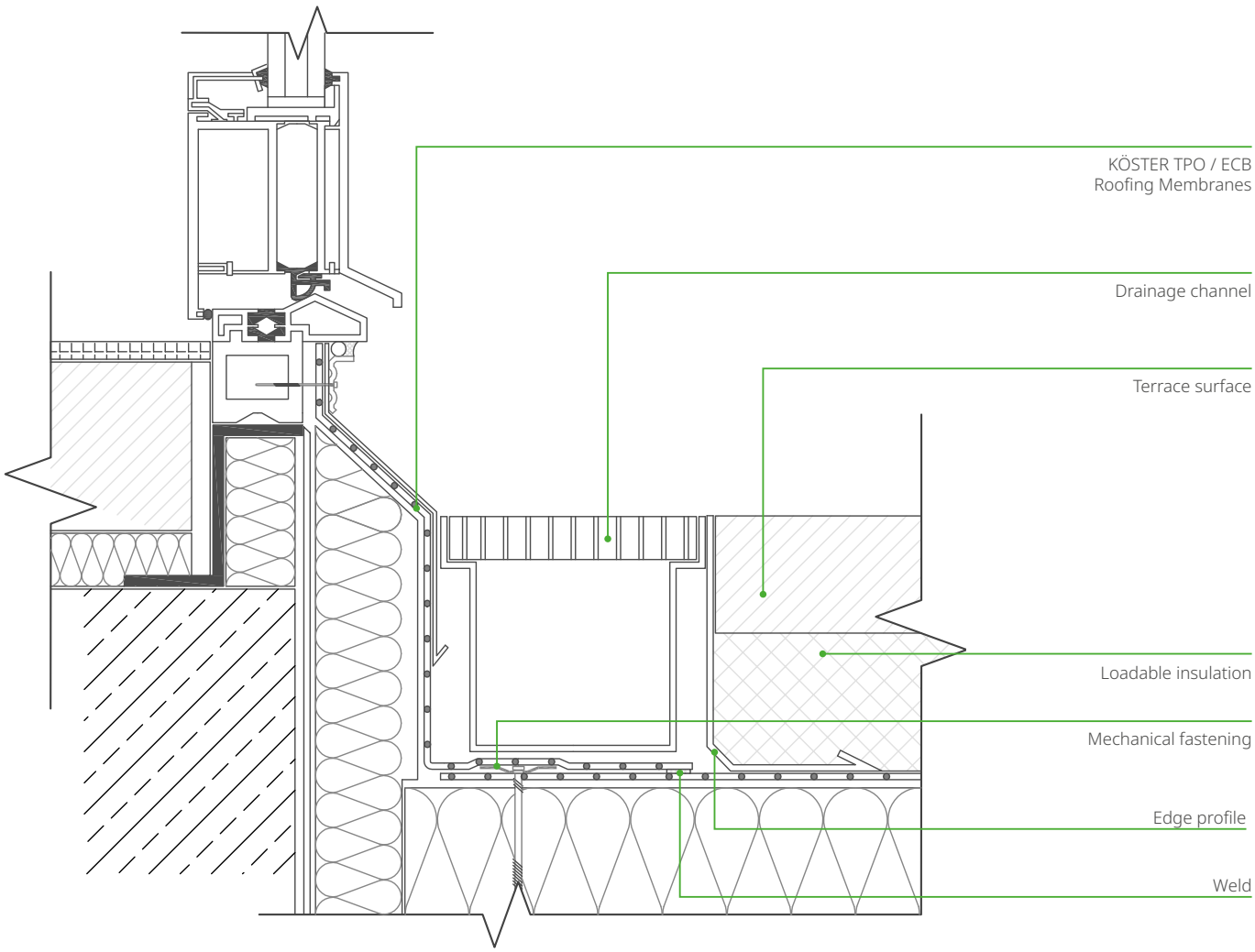


Junction to doors

Junctions to thresholds can be treated in the same way as for wall junctions. The junction height for doors should also be at least 15 cm above the roof covering surface. This is to prevent rainwater from penetrating over the threshold via slush, driving rain, build-ups in the case of partially blocked drains, or ice formation.

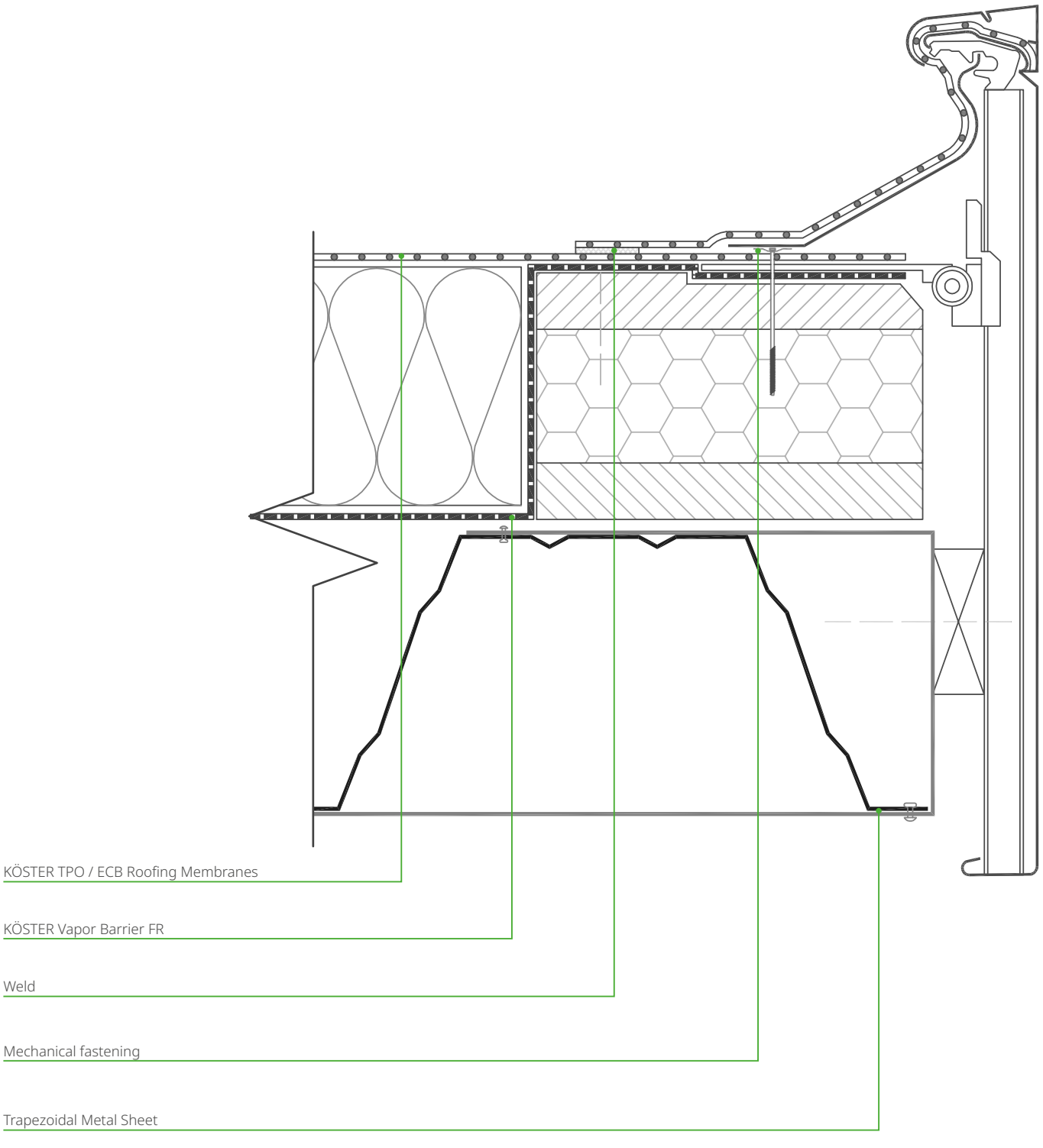
If the junction height is low, it must be ensured that perfect water drainage is guaranteed in the area of the door element. This can be achieved using a drainage channel with a direct connection to a downpipe. The width of the grate should be at least 15 cm and the threshold height for this design should be at least 5 cm. It is recommended to further protect the junction with a portico above the door area.

Additional measures are required for barrier-free door junctions. These include, for example: protection against driving rain and splashing water using door canopies, door frames with flange connections, or specialized door systems with built-in waterproofing features.



Roof edge transitions

A transition detail is required at all flat roof edges. For non-draining edges a drip edge should be installed. This could be formed with a fascia board, with KÖSTER Composite Metal Sheet, or with a commercially available upstand or roof edge profile.

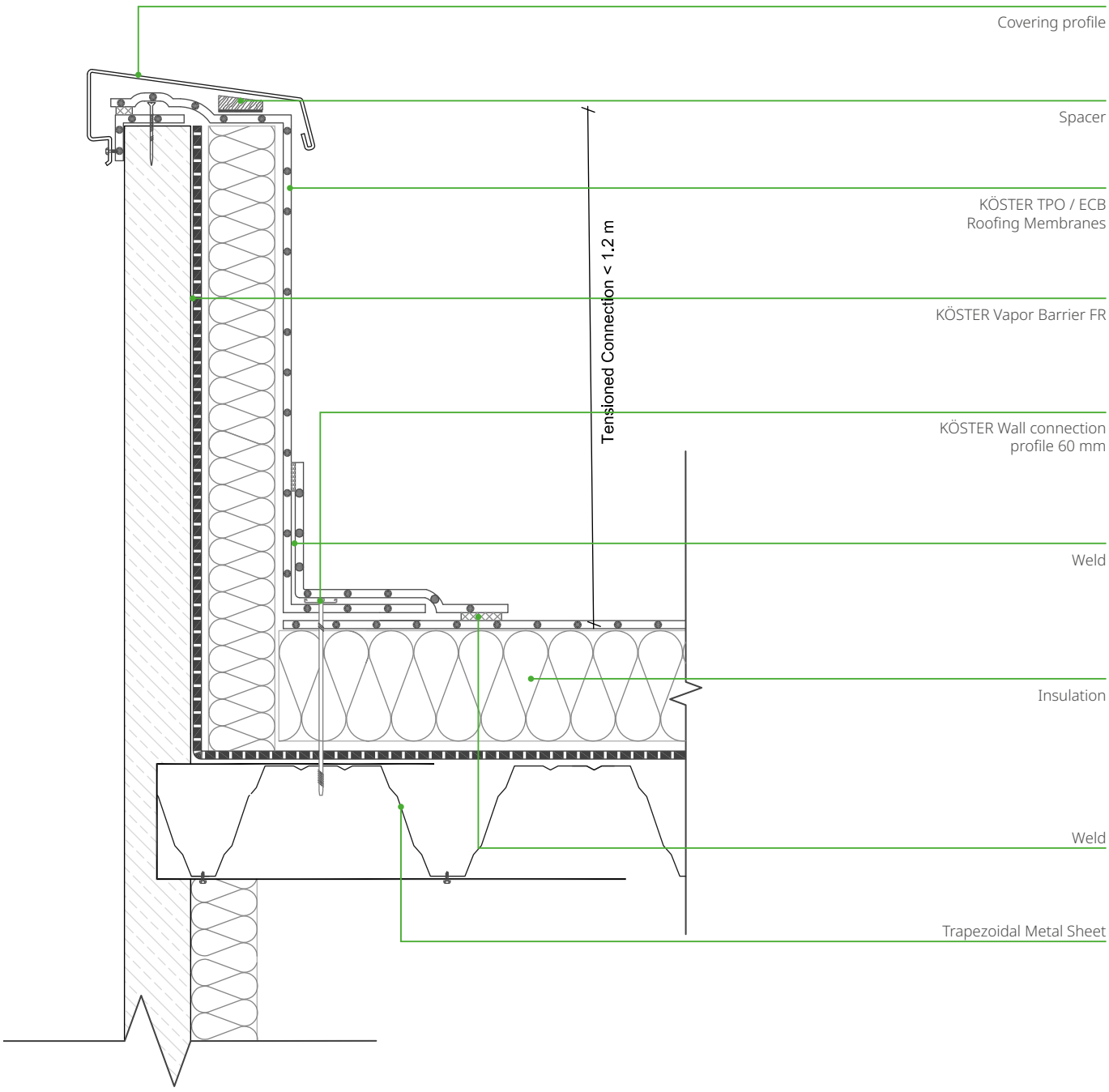


Parapet wall junctions

In the case of parapet walls it is common practice to bring the membrane up and over onto the outside edge of the wall and mechanically fix and cover it, using a combination of fixing bars, KÖSTER TPO Composite Metal Sheet, or special capping profiles and seals.

If the termination is required to be on the inside face of the parapet, a minimum turn-up of 150 mm is required between the final roof height and the top edge of the fixing point. The termination should always be overlapped by a flashing, sealing strip, or metal profile to prevent water coming to bear directly against the membrane edge.

Tensioned parapet connection

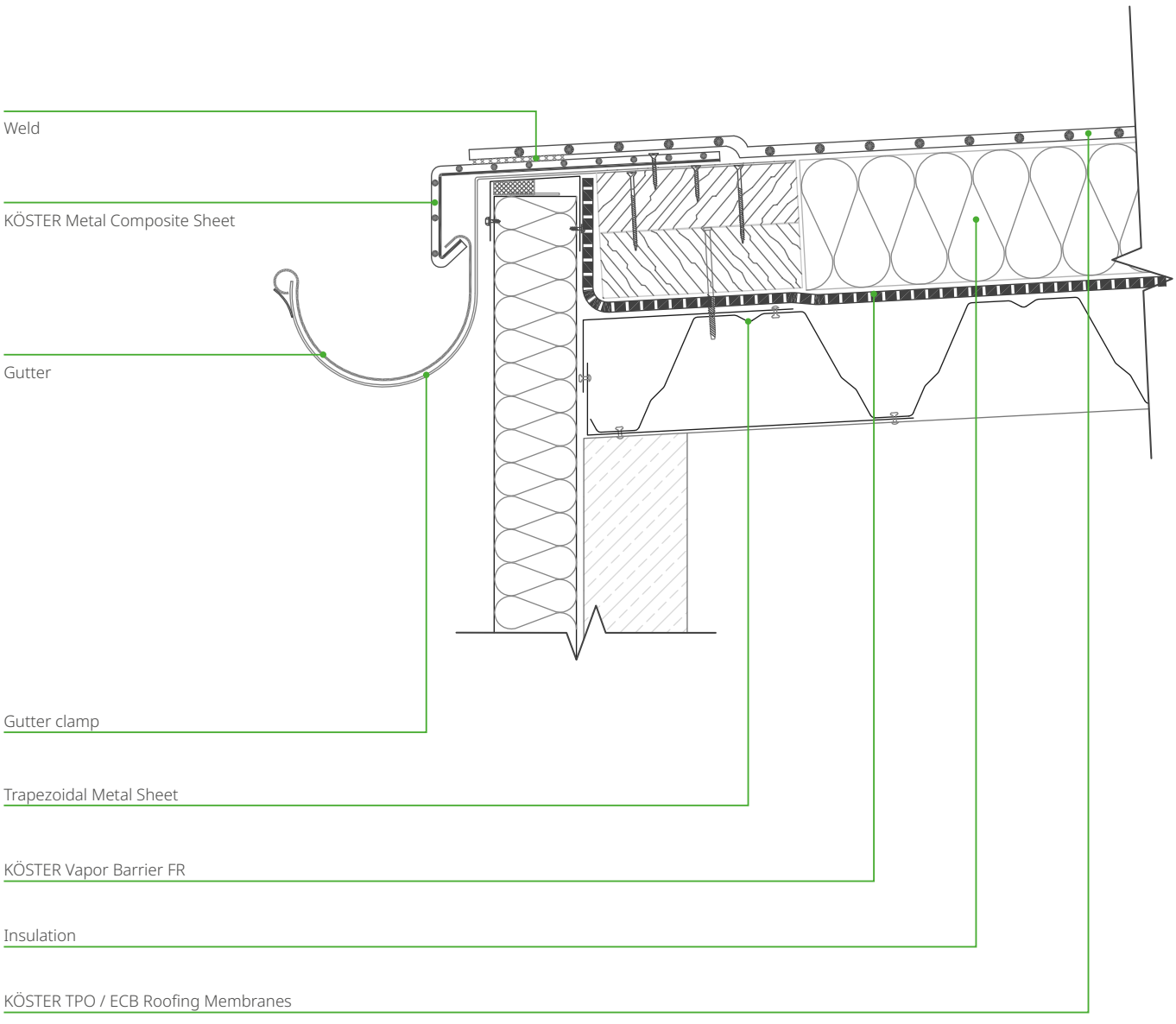


Junction to eaves

Junctions to open roof edges which serve to drain the roof surface are prepared with custom profiles, produced using KÖSTER TPO Metal Composite Sheets. These are cut to size, folded, and fastened in accordance with the specification and recognised practice. KÖSTER TPO Roofing Membranes can be welded directly onto the KÖSTER Metal Composite Sheet.

When using KÖSTER TPO F or KÖSTER TPO SK as the area waterproofing membrane, the waterproofing is positioned under the KÖSTER Metal Composite Sheet, with the fastenings going through the metal sheet and the membrane. A 250 mm wide strip of KÖSTER TPO is used to make the connection between the metal sheet and the roofing membrane, covering all fasteners. This jointing strip is welded to the sheet metal and the membrane.

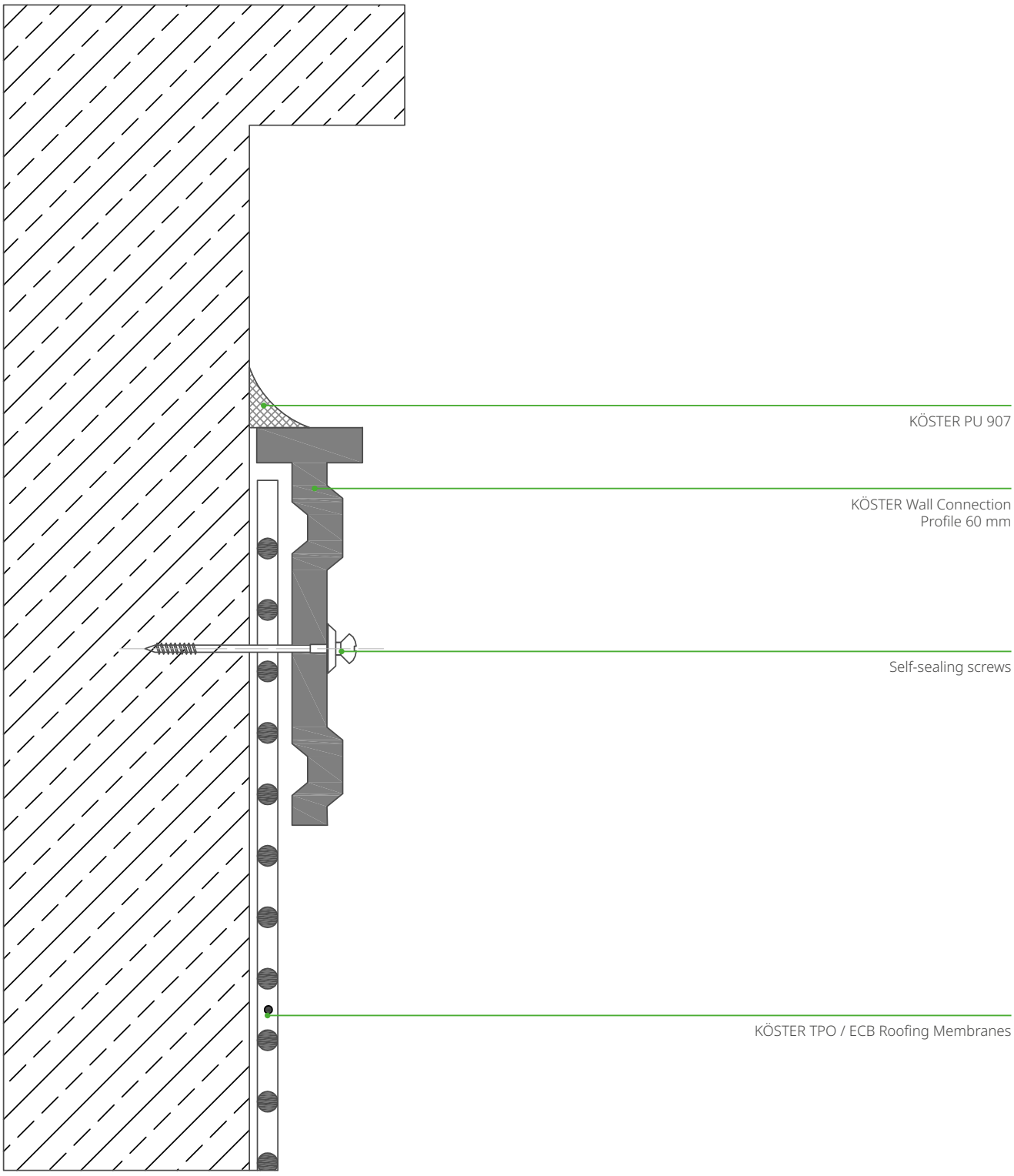
The Metal Composite Sheet profile strips must be installed with a gap of approx. 5 mm between each piece. A 120 mm wide strip of KÖSTER TPO U is then welded oven the joint. This is wielded directly to the KÖSTER Metal Composite Sheet. It should be welded 40mm at each edge, leaving a 40 mm un-welded section immediately over the joint.



Clamping Details

Clamping profiles are used to securely fix the membrane at its top edge. Generally they must be fastened at intervals of 20 cm. The upper part of the profile should turn back to the wall, capping the membrane and should be caulked with a high-performance mastic sealant such as KÖSTER PU 907. Any sealant used for this purpose should be subject to regular maintenance.

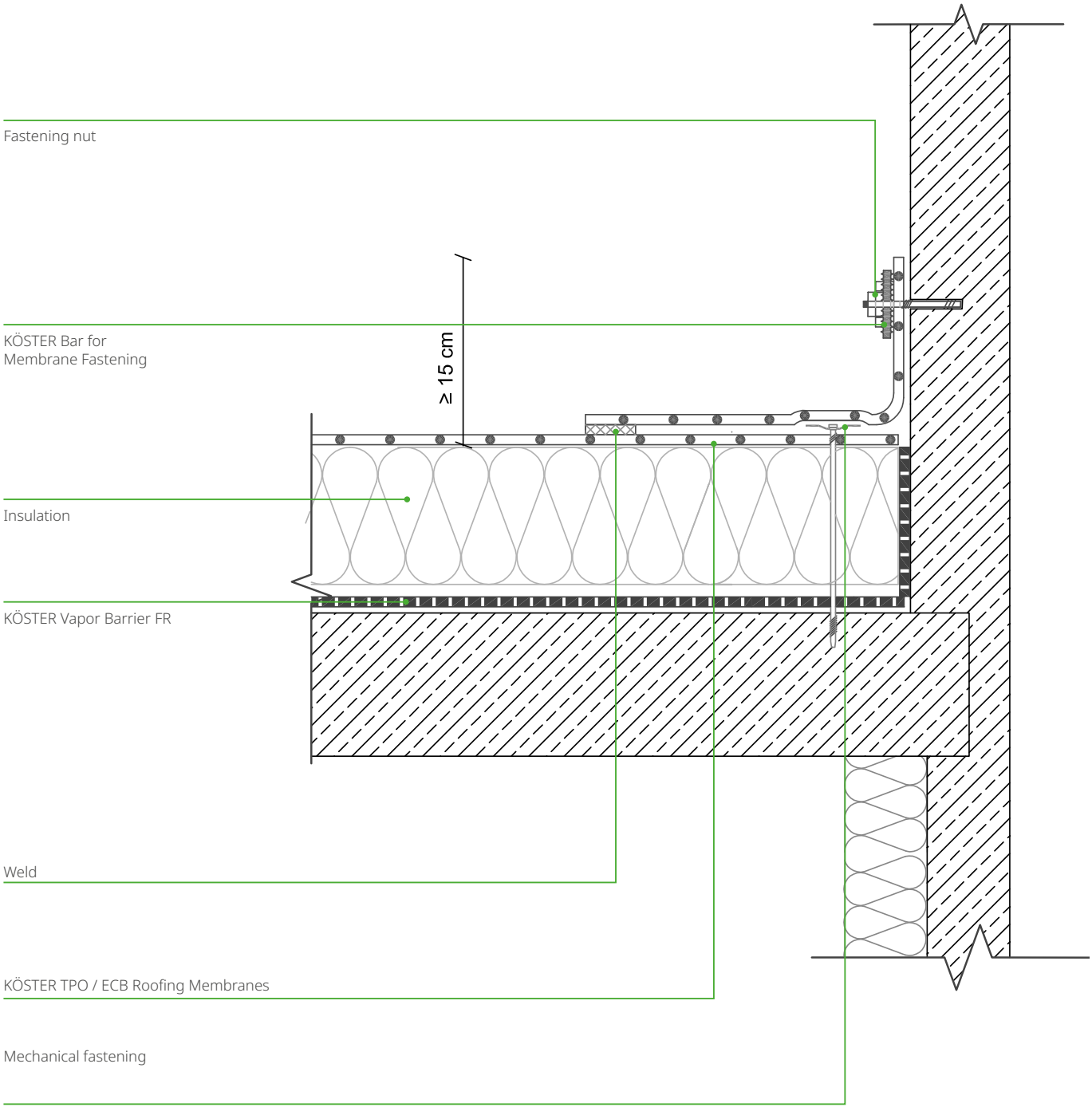
Clamping profiles



Termination bars

On suitable substrates (such as concrete), termination bars can be used to fix the top edge of the membrane.

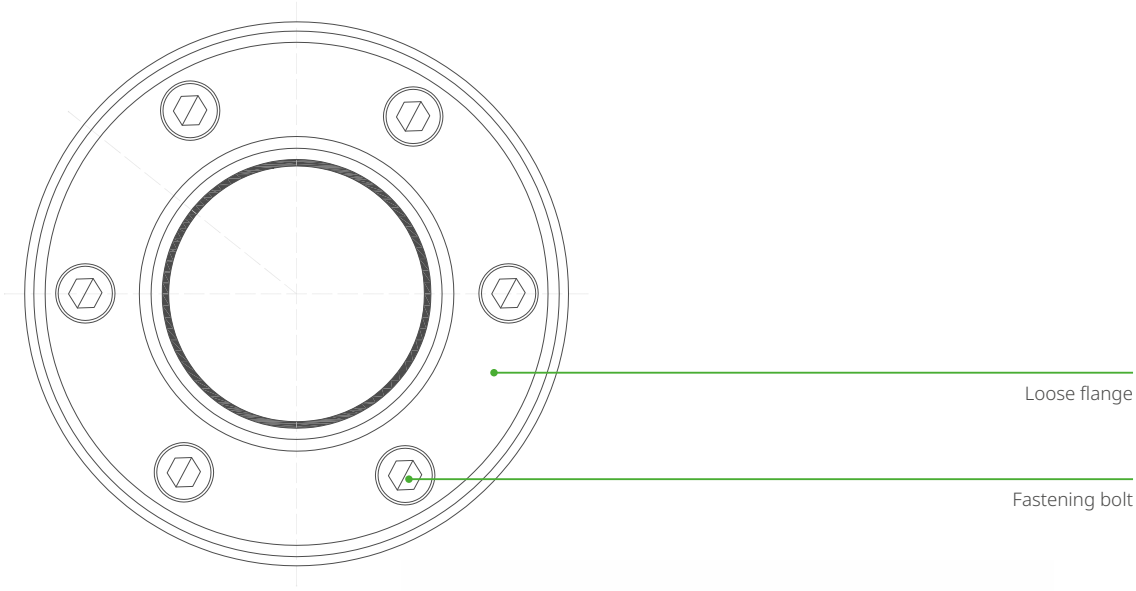
Termination bars must be at least 45 mm wide and 5 to 7 mm thick and should not be longer than 2.50 m. The waterproofing edge must be clamped between the termination bar and the substrate surface. We strongly recommend that a flashing detail is used to further protect the leading edge of the membrane from water ingress.



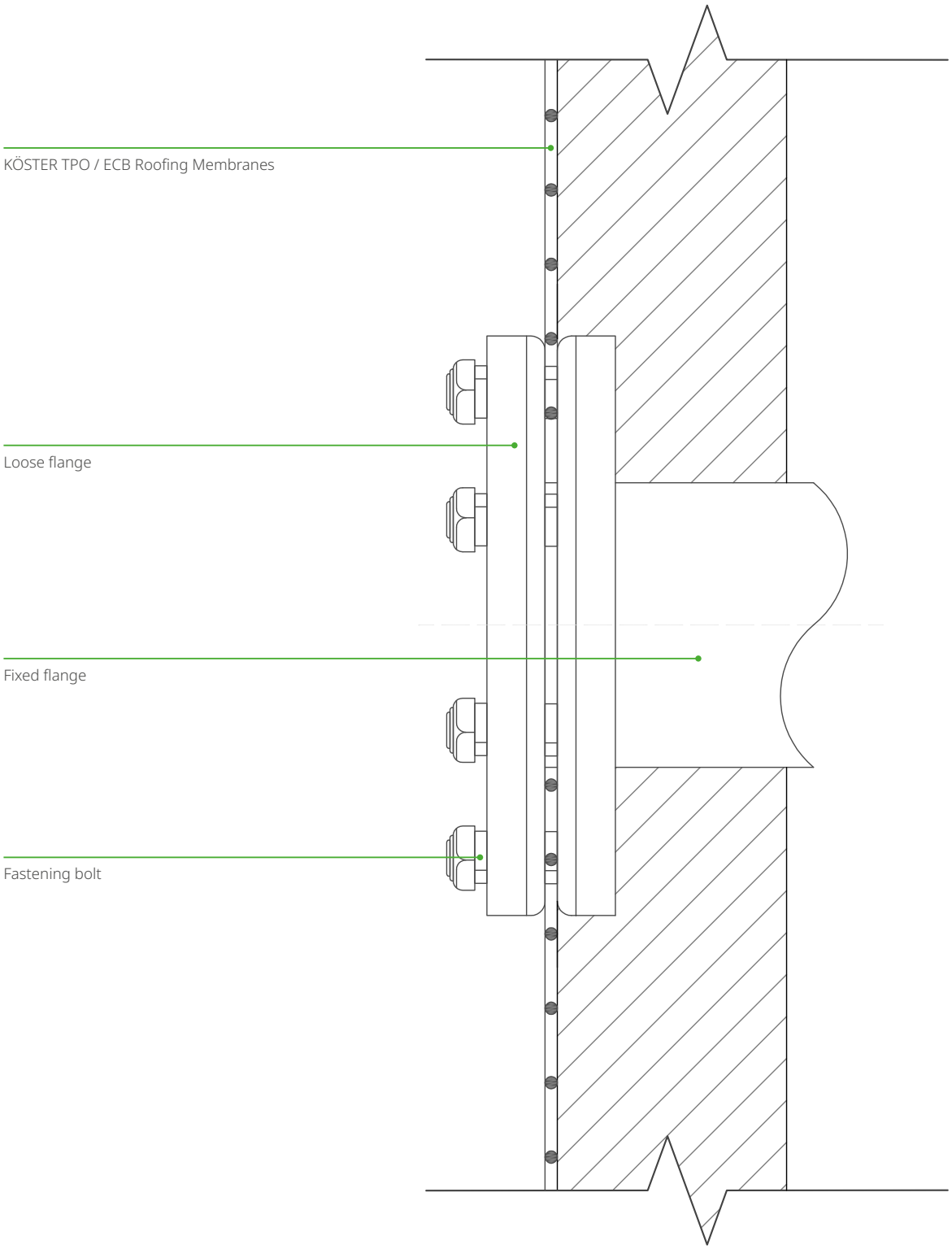
Fixed flanges can be used for forming a watertight connection between KÖSTER Roofing Membranes and various penetrations.

The base of the flange must be securely fixed and sealed into or onto the concrete surface, (never to the screed only). The waterproofing is installed between the base flange (fixed to the concrete) and the clamping flange (loose flange) ensuring that all sealing gaskets are included in the correct order.

When installing the waterproofing, the holes required for the threaded flange bolts must be punched out in advance, also no weld seams may be pressed into the flange.



Example of mechanically fixed flange detail



Connection to penetrations

If creating a custom detail at penetrations the membrane upstand should be at least 15 cm above the final roof height and secured at the top edge against water ingress. This can be done by creating a flange and collar pieces of KÖSTER TPO 2.0 U. Heat the flange and force over the penetration creating a weld edge of 20 mm. Weld the flange to the area membrane which will be securely fixed to the substrate. Tightly wrap the collar piece around the penetration and weld to the 20mm upstand as you progress, before welding the side overlap to the full 150mm height. Secure the upper end of the collar with a stainless steel clamping band or by other suitable means. For professional waterproofing, the distance between penetrations should be at least 30 cm. This clearance should also be observed between the penetration and any other fittings.

Round penetrations

A wide variety of KÖSTER pre-formed collars are available for waterproofing around roof penetrations. These make the task of waterproofing penetrations much easier and more secure. The pre-formed collars are fitted over the penetration, welded to the area membrane and clamped at the top edge. If possible it is always recommended to use these factory produced pre-molded parts.

Professional and safe aeration and ventilation in the roof area can also be achieved with KÖSTER prefabricated Roof Vents.

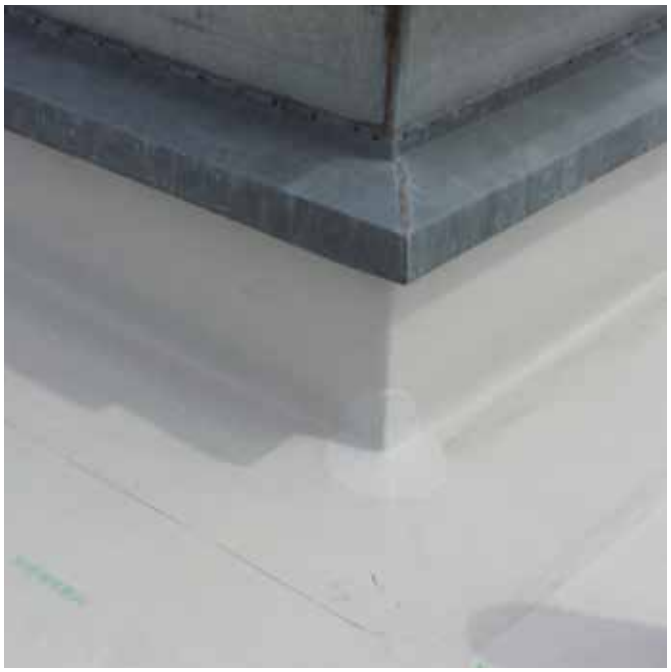
Attachment points, supports, etc.

Attachment points for guardrails, masts, supports, and anchors must be fastened directly to the roof structure. They should be waterproofed with KÖSTER pre-formed accessories where possible or by custom detailing on-site using KÖSTER membranes in accordance with our technical guidelines.

	KÖSTER Cold Roof Vent DN 70/100	**KÖSTER Sanitary Vent top DN 100/125/150**
		
Nominal diameter	70/100	100/125/150
Connection Flange	Hard PE Flange	TPO 1.8 - Flange
Connection to KÖSTER TPO / ECB Roofing Membrane	Using a flange made of KÖSTER TPO 2.0 U / ECB 2.0 U, welded directly to a PE flange	TPO flange to weld the surface
Implementation	Ventilated Roof (cold roof)	Sanitary lines

Square or rectangular penetrations

Square or rectangular penetrations such as chimneys or vents are generally treated in the same way as wall junctions. The corner points should be reinforced with KÖSTER pre-made corners (for right angle corners). If it is not possible to use pre-made corners, then it is possible to use round corner patches made from KÖSTER TPO U and molded into shape using a hot-air gun. The clearance at such penetrations should be min. 150 mm and the top edge should be mechanically fixed or steel banded depending on the type of penetration.



Junctions to right-angled penetrations

Junctions to angled penetrations

Drainage

Internal drains or external gutters can be used for drainage. Drainage must always be positioned at the lowest point of the gradient.

Drainage planning must be carried out well in advance of the commencement of roofing works, in compliance with all local building regulation. The drainage outlets will generally be positioned in such a way that the precipitation is drained off over as short a distance as possible.

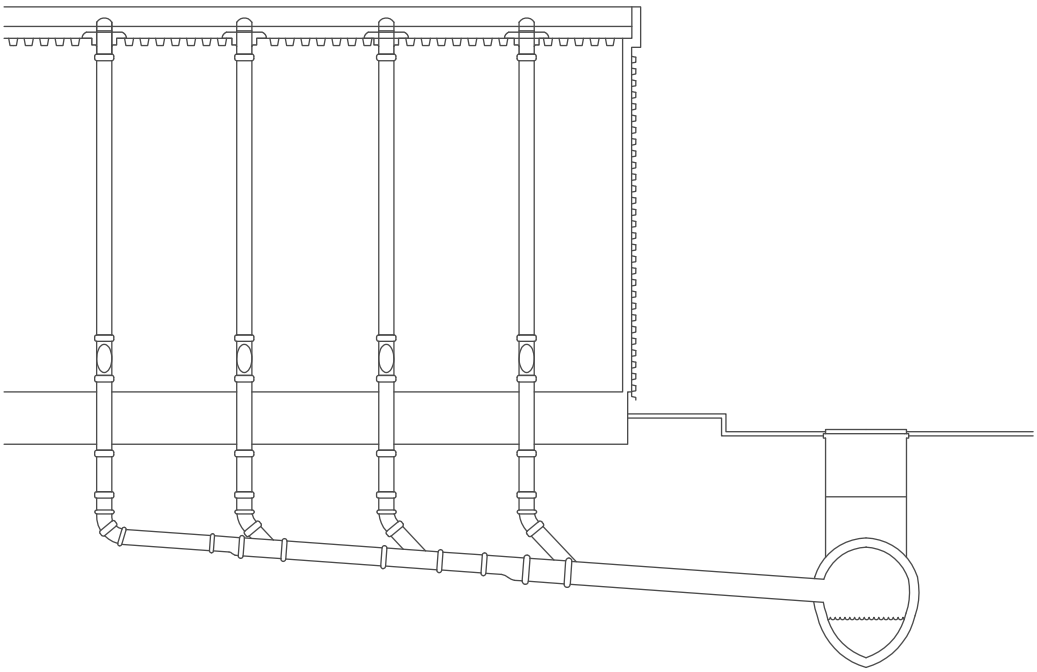
Drainage types

For roof surfaces with internal drainage, there should be at least one primary roof drain. An emergency spillway should also be provided, irrespective of the size of the roof. Flat roof inlets should be at least 30 cm from upstands.

A distinction is made between siphonic and gravity drainage.

Gravity roof drainage is traditionally used in both new-build and renovation projects, providing a reliable and cost-effective drainage solution. It is possible to install gravity drainage systems using KÖSTER Roof Drains. The KÖSTER range includes a simple TPO Roof Drain with trap (in a variety of diameters) for refurbishment projects as well as the more advanced “T Drain” system. Our “T Drain” products consist of a base piece which can be connected to the roof structure and the vapor control layer under the insulation, and an extension piece which is cut to size to suit the insulation thickness. The extension piece includes a flange of KÖSTER TPO which can be welded directly to the roof membrane. There is also an optional emergency drainage fitting that can be connected to the other parts of the system.

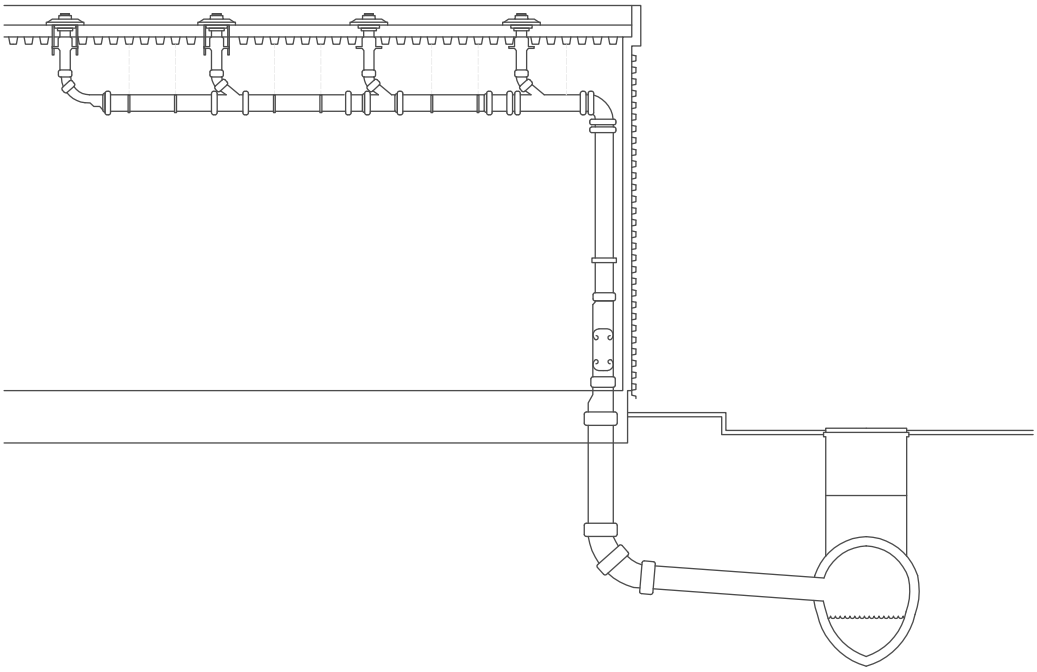
A siphonic roof drainage is a more technical solution. It is similar to gravity roof drainage, however a vacuum is created in the pipe system which generates a discharge volume that



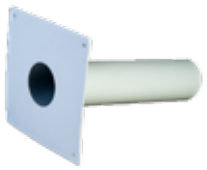
Gravity Roof Drain

is increased several times over. This means that fewer roof outlets can be used in conjunction with only one pipe run with a smaller diameter than with gravity flow. The drainage outlets are supplied as part of the siphonic system and should include either a membrane clamping mechanism or a flange piece (PE based TPO / FPO) to which the KÖSTER TPO can be welded.

When using any drainage outlet with a clamping ring, always make a flange using KÖSTER TPO U, never clamp the main area membrane directly.



Siphonic roof drainage

	KÖSTER Vertical Roof Drain DN 100 with TPO	KÖSTER Roof Drain Angled TPO DN 75	KÖSTER Water Spout DN75/100	KÖSTER Emergency Overflow DN 100
				
Nominal diameter	100/125/160	75/100	75/100	100
Connection Flange	TPO 1.8 - Flange	TPO 1.8 - Flange	Hard PE	Hard PE
Connection to KÖSTER TPO / ECB Roofing Membrane	Weld the TPO flange onto the surface	Weld the TPO flange onto the surface	To be welded directly onto the hard PE using a flange made of TPO 2.0 U	To be welded directly onto the hard PE using a flange made of TPO 2.0 U
Implementation	vertical roof drain	horizontal roof drain	horizontal roof drain	horizontal roof drain

Emergency drains/spillways

Emergency drains must always be planned and installed for roofs with internal drainage. The number and location of emergency drainage outlets depends on the size and layout of the roof area. This must be determined by a drainage assessment. Due consideration should be given to the drainage route to provide an alternative routing for the emergency overflows.

Roof gutters

Gutters can be made of a wide variety of materials such as copper, zinc, stainless steel, or PVC. Their dimensions and those of the corresponding downpipes are determined by a drainage assessment. No additional emergency drainage is required for gutters.

The connection of the KÖSTER roofing membrane to the gutter is created using a drip edge made with KÖSTER Metal Composite Sheet. Alternatively, where there is a perimeter parapet water can be drained through this using a KÖSTER Water Spout or KÖSTER Attika Spout feeding into a hopper or downpipe.

Emergency overflow

Emergency overflow

Attica drainage

Gutter

Movement joints

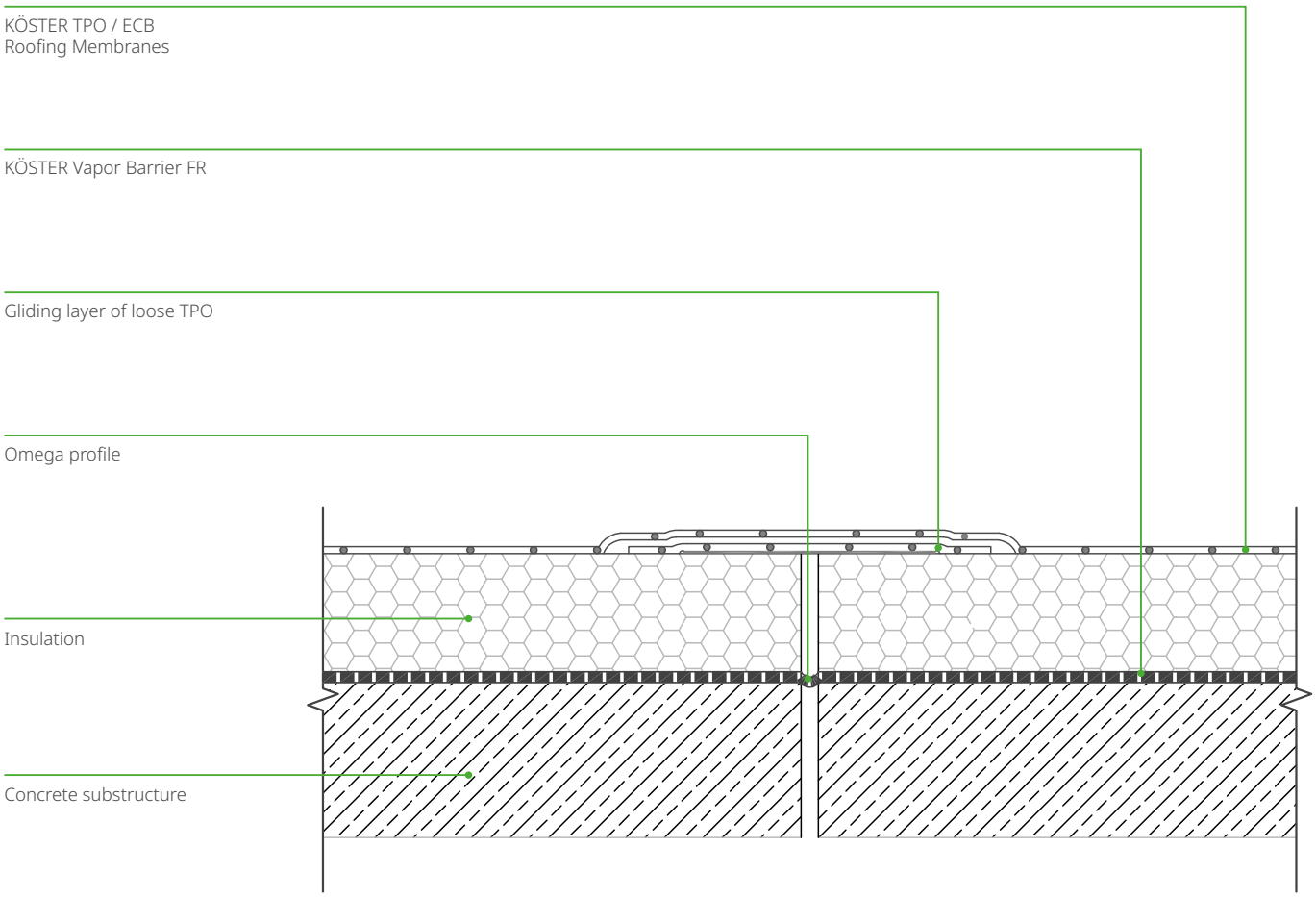
There can be various reasons for movement between different roof elements. This can be caused by daily or seasonal temperature fluctuations or many other factors. Movement can occur slowly or quickly, once, rarely or repeatedly, and can vary in its extent. Relative movement between roofing elements could be transverse or deflection and could run vertically, parallel, or at an angle to the waterproofing layer. In order to be able to absorb the different forces without damage the most diverse factors must be taken into account when planning and positioning the movement joints.

Movement joints must be implemented in all layers of the roof structure.

Joint type I

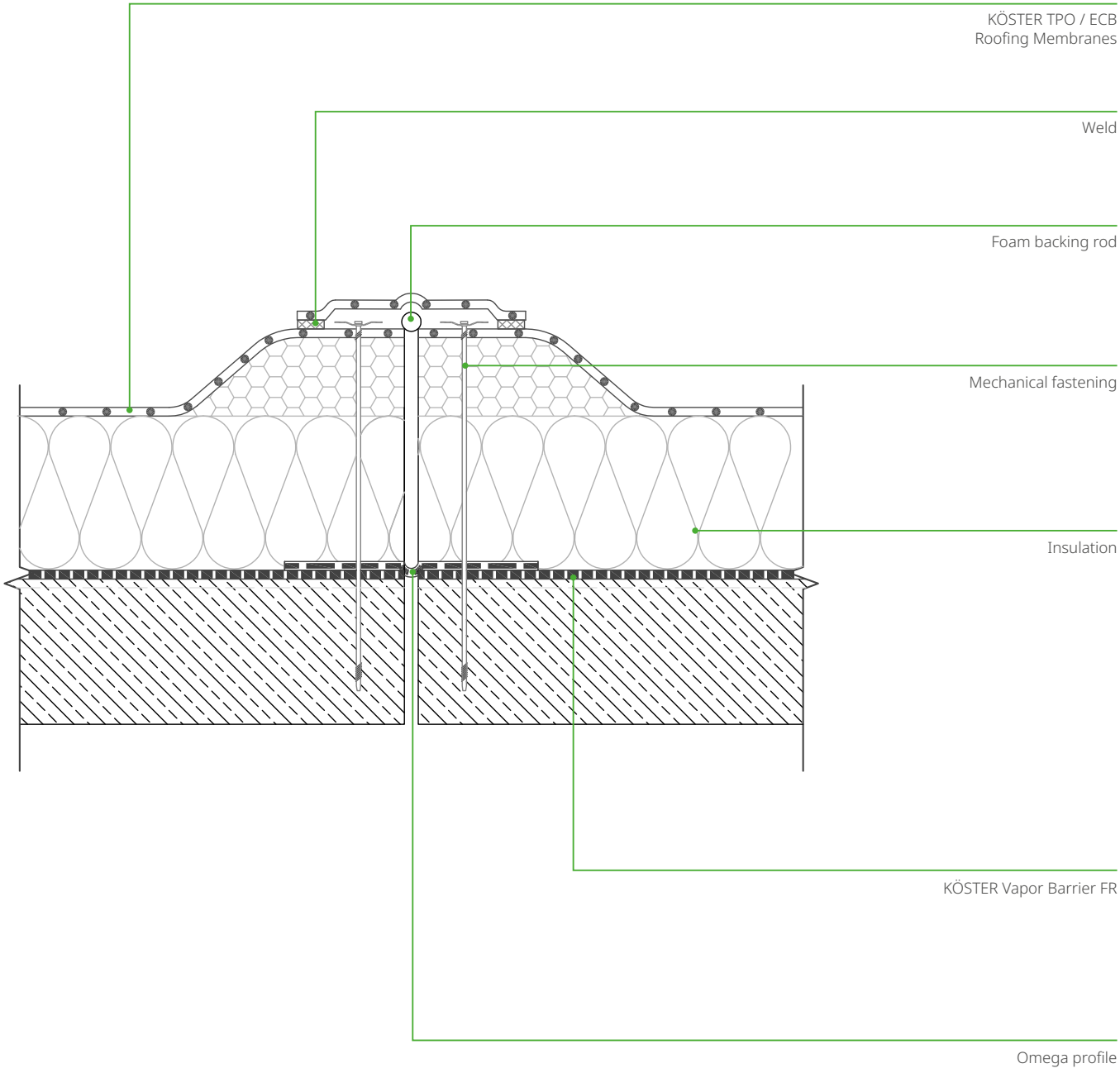
Joints of type I are usually used on flat roofs. This allows for slow, one-off or rare movements of a maximum of 10 mm in such cases as settlement cracks or changes in length due to seasonal temperature fluctuations.

With Joint Type I, KÖSTER TPO membranes can be installed directly over the joint. It is recommended to install an extra piece of membrane as a gliding layer between the joint and the main membrane. This prevents the main waterproofing from sinking into the joint gap and spreads the joint movement over a wider area. The vapor barrier must also be installed in the joint area in an omega profile.



Joints of type II are required for rapid or frequently repeated movements as in cases of movements due to changing traffic loads or changes in length due to temperature fluctuations during the day and for movements of more than 10 mm. Type II Joints should be raised above of the waterproofing layer, e.g. by positioning insulation wedges or upstands. This will require independent drainage solutions on each side of the joint.

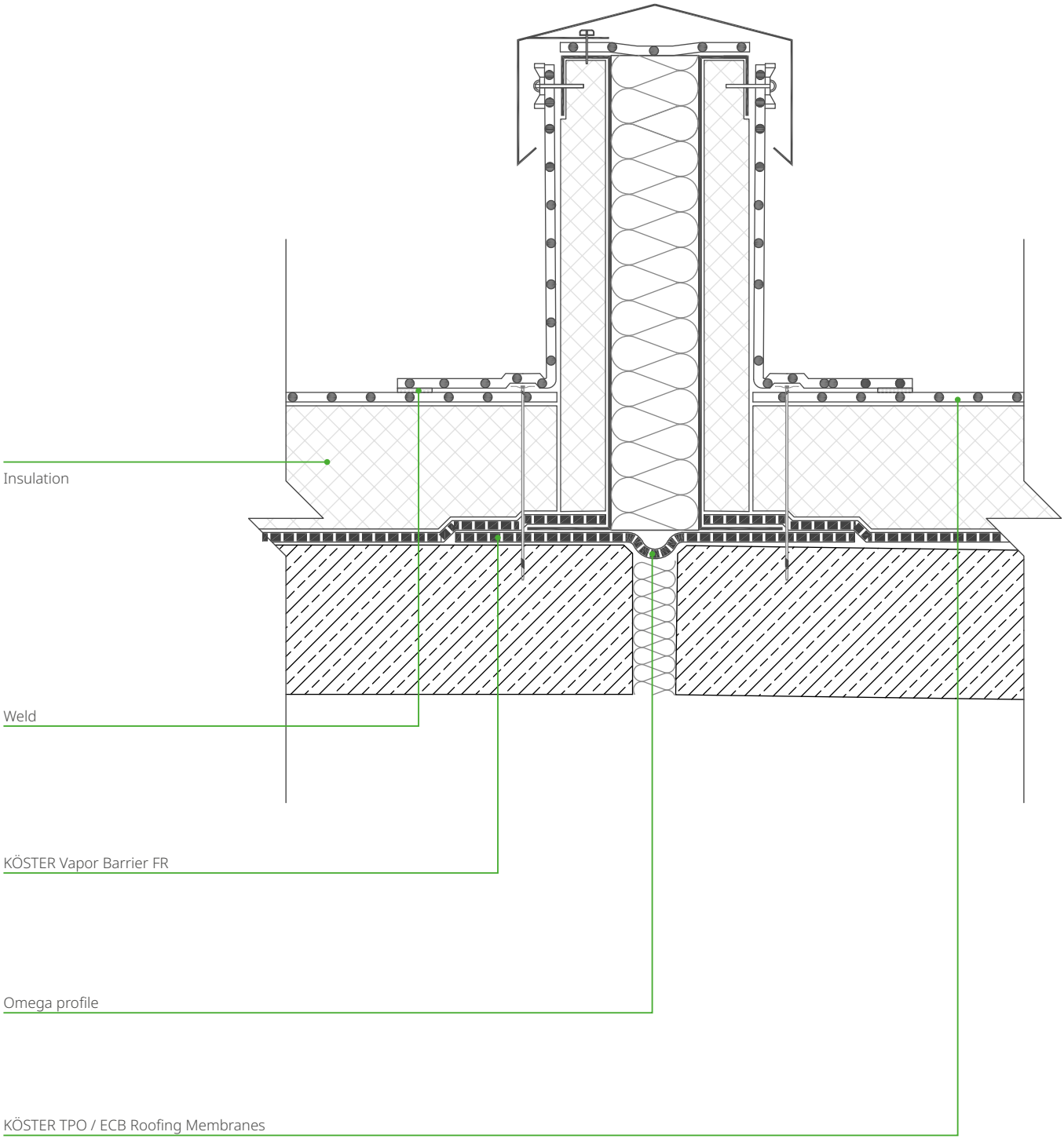
Joint type II



For joint type II, the waterproofing membrane is separated at the joint and mechanically fastened. In the area of the joint, a foam backer rod or other suitable spacer is inserted and covered with a loop-shaped strip of KÖSTER TPO .

The vapor barrier must also be installed in the area of the joint in the form of a loop or omega profile.

Another way to implement a type II joint is to create an auxiliary construction with upstands and capping that effectively separates the two roof areas.



Other

Waterproofing work with KÖSTER roofing and waterproofing membranes should not be carried out during weather conditions that could have a negative impact on performance. These include for example temperatures below +5 °C, rain, snow, ice, or strong wind.

The flat surfaces between upstands such as channels lined with KÖSTER TPO / ECB membranes or surfaces between glazing units should be at least 50 cm wide.

Air-conditioning units and other equipment installed over the waterproofing should be placed so that it is easily accessible for care and maintenance, has sufficient space between units, and if possible has sufficient clearance to the surface of the roofing to allow for maintenance / repair.

Installed units must not introduce excessive horizontal or vertical forces, (compression loads, shear, and stress forces) onto the roof surface as these could cause damage to the roofing membranes or other components of the roof structure.

Anchor point details and maintenance routes must be planned with care. KÖSTER Maintenance Walkway Mats can be used for the construction and marking of maintenance routes.

When planning and constructing any roof local building regulations must be followed. These should cover the roof structure, insulation, drainage, the waterproofing layer, and fire regulations.

Terraces and balconies

Terrace and balcony waterproofing is performed in the same way as for the main roof, but there should always be a separate trafficable surface such as pavers, decking, or tiles. The finished surface should not be directly fixed to the waterproofing layer. In the case of pavers or wooden decking, paver supports can be used.In the case of tiling a de-coupling membrane should be used. All screeds should be self-supporting and be installed over a separating layer of PE foil. Membrane Upstands at wall connections should be protected.

Earth-covered structures

KÖSTER TPO and ECB roofing membranes can be used for the waterproofing of earth-covered structures such as basements that extend beyond the original building footprint. The build-up can generally be approached in accordance with the previous section “Securing with Ballast”. Edge Transitions of covered decks must turn down the side of the structure by at least 20 cm beyond the joint between the deck and the wall and be connected to the wall waterproofing. The KÖSTER technical team can provide further guidance on this.

Care and Maintenance

Flat roofs with KÖSTER Waterproofing Membranes should be subject to regular maintenance. The frequency of maintenance depends on the roof pitch, exposure, and the general stresses on the roof waterproofing.

A roof inspection is recommended once or twice a year, ideally in Spring and Autumn.

The following work must be carried out:

Maintenance of a flat roof

- Visual inspection of the waterproofing membranes
- Checking junctions and transitions
- Removal of dirt, leaves and unwanted plant growth
- Cleaning of roof drains / emergency drains
- Cleaning of gutters
- Cleaning of aeration and ventilation openings
- Levelling of possible gravel drifts (for roofs with ballast)
- Checking maintenance joints, such as sealant beads, grouting, and the like

KÖSTER recommends that the applicator enters into a maintenance contract with the owner/client in order to guarantee a continuously functioning waterproofing made of KÖSTER TPO / ECB roofing membranes.

Inspection of a flat roof

- should be carried out every three to four years
- Determining the condition of the waterproofing with a visual inspection
- Checking junctions and transitions
- Checking roof penetrations
- Preparing a written log
- Determining any necessary measures

Sun reflection damages

Highly reflective surfaces such as ductwork and HVAC installations, and materials for example aluminum, zinc coated metals, stainless steel, copper, and reflective glazing can heat surrounding areas above the melting point of certain insulation material types and cause damage to the membrane and roof structure. This phenomenon has been acknowledged and the German Flat Roof Guidelines suggest areas in danger of this phenomenon are to be:

a) coated with a matt finish paint that prevent light reflection
b) installed at least in 50cm high / distant from the membrane
c) protected with a hard surface like gravel or paving stone

Renovations

Renovation of a flat roof will eventually become necessary due to strong climatic loads, natural aging of the product or new insulation requirements. Renovation work should be carefully thought through and planned. There are many factors to consider, including the current state of the existing roof, whether there is a change in the use of the roof or building, and if the building is to remain in use during the renovation process.

Before determining the scope of the renovation, the roof must be opened at one or more points to check whether the existing roof structure is still functional.

- Is there a vapor barrier and is it still functional?
- Is the insulation dry and functional?
- Is the insulation thickness sufficient or should it be increased?
- Are there any thermal bridges in the roof structure?
- Is the roof layer package still stable with respect to wind suction forces, e.g. sufficient adhesion, have the mechanical fasteners corroded?
- Does the roof have a sufficient slope?
- Does the existing drainage system meet the requirements?

- Are there enough emergency drains for internally draining roof surfaces?
- Is the load-bearing capacity of the roof structure still sufficient?
- Are the junction heights sufficient?
- Are there any movement joints?
- Do built-in parts such as downpipes or skylights have to be replaced or supplemented?

A renovation plan can be prepared after evaluating all of these points.

Renovation without removal of the old roof

If the entire roof structure is still intact and meets the requirements, renovation can be carried out directly over the existing waterproofing layer without removal of the roof layer package. If built-in parts are being replaced or are additionally required, they must be professionally installed in the roof layer package, including the junction to the vapor barrier. All installation instructions for waterproofing with KÖSTER roofing membranes must be observed.

Old bitumen roof

KÖSTER roofing membranes are bitumen compatible and can be installed directly over old bitumen roof waterproofing. If the positioning of the roof structure is stable, fleece-laminated KÖSTER TPO and ECB roofing membranes can be adhered with KÖSTER PUR Membrane Adhesive or KÖSTER 2C PUR Membrane Adhesive.

Mechanical fastening of KÖSTER F roofing membranes or KÖSTER roofing membranes without fleece lamination is also possible. This option particularly makes sense if the old waterproofing is no longer stable. If non-fleece backed KÖSTER roofing membranes are to be used, then a polyester fleece with a minimum of 300 g/m² must be installed as a separating layer.

KÖSTER TPO SK (FR) is also suitable for direct installation over bitumen waterproofing. If the self-adhesive KÖSTER membrane is to be used, the roof surface has to be cleaned well and pre-treated with KÖSTER TPO SK-Primer.

It should be noted that light-colored KÖSTER TPO roofing membranes can discolor if installed directly onto bitumen waterproofing. Using the fleece backed material will minimize this. Discoloration has no influence on the quality and durability of KÖSTER TPO / ECB roofing membranes. Ballasted roofs are dealt with as explained in the earlier section with a protection layer between the membrane and the ballast as well as a polyester fleece with 300 g/m² (included with KÖSTER TPO F) between the old roof and the new waterproofing layer.

Old synthetic roofs

KÖSTER TPO and ECB roofing membranes can be installed directly over old rubber or synthetic membranes and liquid membrane roofs due to their material compatibility with all conventional waterproofing membranes. In order to avoid adverse effects on the roof structure, the existing waterproofing must be cut at all junctions and transitions and if necessary also in the surface, there must be no bridging between the old membrane and the roof / upstands.

For mechanically fixed roofs subject to weathering, a glass mat fire protection layer of at least 120 g/m² must be provided between the old polyester roof and the KÖSTER roofing membrane. KÖSTER roofing membranes must be mechanically fastened in accordance with EN 1991-1-4.

Renovation with removal of the waterproofing layers

If the old waterproofing is no longer stable and a secure fixing cannot be achieved to the roof structure, or if the insulation material is partially soaked through, then the old roofing build-up must be removed.

Subsequently, the KÖSTER waterproofing layer can be installed as described in the sections above. Damp insulation must be replaced.

If KÖSTER TPO F / TPO SK roofing membranes are to be adhered to existing insulation, it must be fastened in a windproof manner and the surface must have an appropriate finish for the type of adhesive being used.

Renovation with additional insulation

Flat roof renovation with additional insulation of a dry roof structure with a functional vapor barrier can usually be carried out without extensive calculation or evaluation. The old waterproofing layer can be retained in this case. The requirements for stability of the roof layer package must be observed.

The thickness of the additional insulation should be at least 5 cm, irrespective of the thermal requirements.

In the event of an existing damp roof structure, renovation with additional insulation must be precisely analysed and thorough knowledge of the building's structure is required. The widespread view that damp insulation in a flat roof dries out within a short time is untenable. The drying process takes many years and is determined by the thermal transfer resistance of the thermal insulation and especially by the diffusion resistance of the new waterproofing.

In most cases, the drying out of the roof is significantly altered by the application of additional insulation and new waterproofing.

If the old waterproofing layer is perforated, the moisture is transferred to the new insulation. The drying process of the moisture from both insulation layers takes many years and cannot be reliably calculated in terms of the buildings assessment.

In practice it has been found that the installation of 1 x KÖSTER Roof Vent DN 70 per 25 m^2 of roof surface has proven a useful technique in helping to dry out insulation.

In the case of new, relatively diffusion-resistant waterproofing or moisture-sensitive additional insulation, perforation of the old waterproofing should be avoided. By not perforating the old membrane, drying time of the existing insulation will be increased, but more importantly the new structure won't be adversely affected by moisture displacement.

The prerequisite in dealing with damp insulation is a functioning vapor barrier, as otherwise the moisture from the insulating material can seep inwards and cause damage to the building over a long period of time.

Renovation of a damp roof structure without replacing the wet insulation should only be undertaken in exceptional cases!

Complete renovation

If the damage to the roof structure is extensive and if the roof drainage or other built-in parts have to be renovated, it is more economical to carry out a complete renovation. All of the waterproofing and the thermal insulation layer will be replaced during this renovation.

The waterproofing methods described in this manual are to be applied for the renovation.

Information for working with KÖSTER TPO /ECB

Tools

The basic equipment required includes: a hand held hot-air gun with a temperature range of +400 °C - +620 °C and a 40 mm wide slot nozzle, scissors, a 40 mm wide silicone roller, a penny roller, a knife, a seam tester, a wire brush, a folding rule, and for larger roof surfaces an automatic membrane welding machine. A digital temperature measuring device is recommended if you are using welding devices without a digital welding temperature digital display.

Welding

KÖSTER TPO roofing membranes and KÖSTER ECB roofing membranes can only be welded with hot air. The seams can be welded during the normal course of construction without any special preparation, other than ensuring that both surfaces are clean. Chemical activation of the seam or chamfering of the edges is not necessary.

The welding temperature can be between +400 °C and +620 °C. The setting depends on the material thickness and the working conditions. For welding KÖSTER pre-formed accessories, the welding temperature should be approx. +400 °C - +450 °C.

Depending on the material thickness, the forward speed of the automatic welding machines varies between 1.5 m/min and 5 m/min.. At the beginning of each day's work and in strongly changing weather conditions, test welds must be carried out in order to determine the required welding parameters by welding two KÖSTER TPO / ECB strips. After the weld test sample has cooled to the ambient temperature, cut out an approx. 5 cm wide strip and perform a peel test. It must not be possible to separate the two strips manually. Failure of the material outside the weld seam is permissible.

The KÖSTER BAUCHEMIE AG recommends storing the welding test samples for documentation purposes. After ≥ 24 hours, a seam inspection of all welds must be carried out with the KÖSTER weld seam tester.

Weathered TPO and ECB roofing membranes

KÖSTER TPO and ECB roofing and waterproofing membranes can be welded homogeneously over their entire service life.

When welding older TPO or ECB membranes, a test weld will show whether pre-treatment is required. If the welding result is not satisfactory, patina and dirt must be mechanically removed.

For cleaning the welding surfaces of older or heavily soiled TPO sheets, it is recommended to use a burnishing machine, a mechanical wire brush, or disc sander. Only use enough force to remove the surface contamination without damaging the membrane.

General comments:

Thermoplastic materials made of polyolefin are subject to dimensional changes in all directions; they expand when hot and contract when cold. This property has no effect on the quality and service life of the polymer membranes. KÖSTER TPO / ECB roofing and Waterproofing membranes are free of plasticisers and are flexible at low temperatures down to at least -50 °C. This ensures a long service life with consistent quality. Experience has shown that the formation of visual irregularities decreases over time.

Accessories

A wide variety of accessories and materials are available for professional waterproofing with KÖSTER TPO / ECB roofing membranes.

For more information, please refer to the current price list and the accessories brochure.

Service Forms: Wind load calculations

The KÖSTER BAUCHEMIE AG provides wind load calculations for its customers on request as a free service.

Site categories in accordance with EN 1991-1-4/NA:2010:12

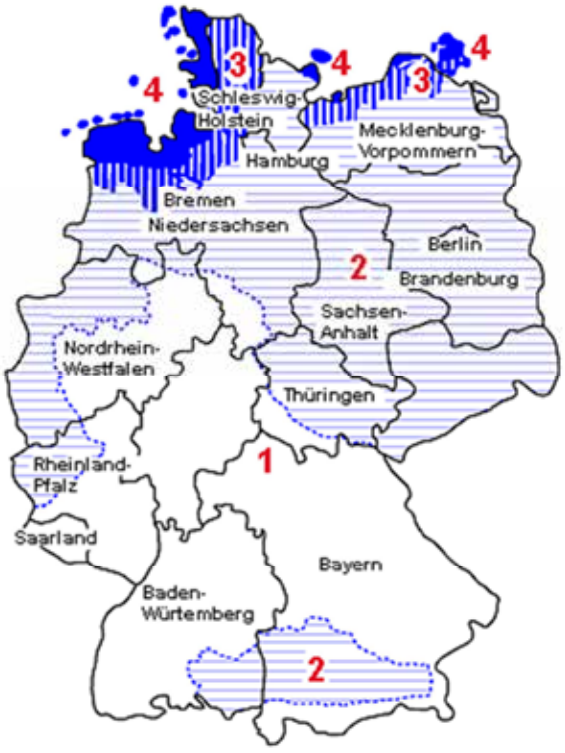
Site category I:	Open lakes; lakes with at least 5 km of open area in wind direction; smooth, flat land without obstacles
Site category II:	Site with hedges, individual farms, houses or trees, e.g. an agricultural area
Site category III:	Suburbs, industrial or commercial areas; forests
Site category IV:	Urban areas where at least 15% of the area is covered with buildings with an average height exceeding 15 m

Mixed profile Coast: Describes the relationships in a transition area between site category I and II

Mixed profile inland: Describes the relationships in a transition area between site category II and III

Service form: Wind zone map of Germany

Wind zone map of the Federal Republic of Germany, according to DIN EN 1991-1-4 / NA: 2010: 12

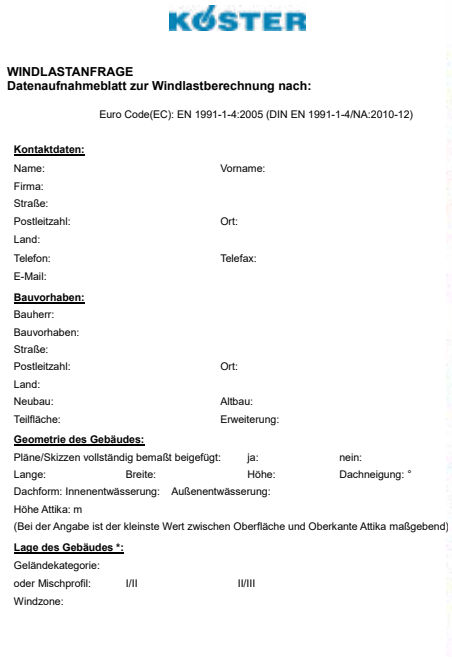


Specification service

KÖSTER is pleased to help architects, planners, and roofers with the preparation of detailed drawings and specifications.

Flat roof planning checklist (new or renovation)

Upon request, KÖSTER supports our customers with this checklist during the planning phase of the new flat roof or renovation project.



KÖSTER

WINDLASTANFRAGE
Datenaufnahmeblatt zur Windlastberechnung nach:

Euro Code(EC): EN 1991-1-4:2005 (DIN EN 1991-1-4/NA:2010-12)

Kontaktdaten:
Name: Vorname:
Firma:
Straße:
Postleitzahl: Ort:
Land:
Telefon: Telefax:
E-Mail:

Bauvorhaben:
Bauherr:
Bauvorhaben:
Straße:
Postleitzahl: Ort:
Land:
Neubau: Altbau:
Teilfläche: Erweiterung:

Geometrie des Gebäudes:
Pläne/Skizzen vollständig bemaßt beigefügt: ja: nein:
Lange: Breite: Höhe: Dachneigung: °
Dachform: Innenentwässerung: Außenentwässerung:
Höhe Attika: m
(Bei der Angabe ist der kleinste Wert zwischen Oberfläche und Oberkante Attika maßgebend)

Lage des Gebäudes *:
Geländekategorie:
oder Mischprofil: I/II II/III
Windzone:

KÖSTER

Checkliste Planung Flachdach Neubau

KÖSTER

Checkliste Planung Flachdach Neubau

Legal Notice

The information in this technical manual is based on the generally accepted

rules of technology and on the standards and guidelines necessary for implementing roof waterproofing work.

Compliance with the information in this manual and with the KÖSTER TPO Installation Instructions is a prerequisite for the KÖSTER BAUCHEMIE AG warranty.

Sources:

- Flat roof guideline of the ZVDH
- DIN 18195
- DIN 18531
- DIN 1991-1-4

Notes

We are there for you – worldwide.

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// Contact us

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