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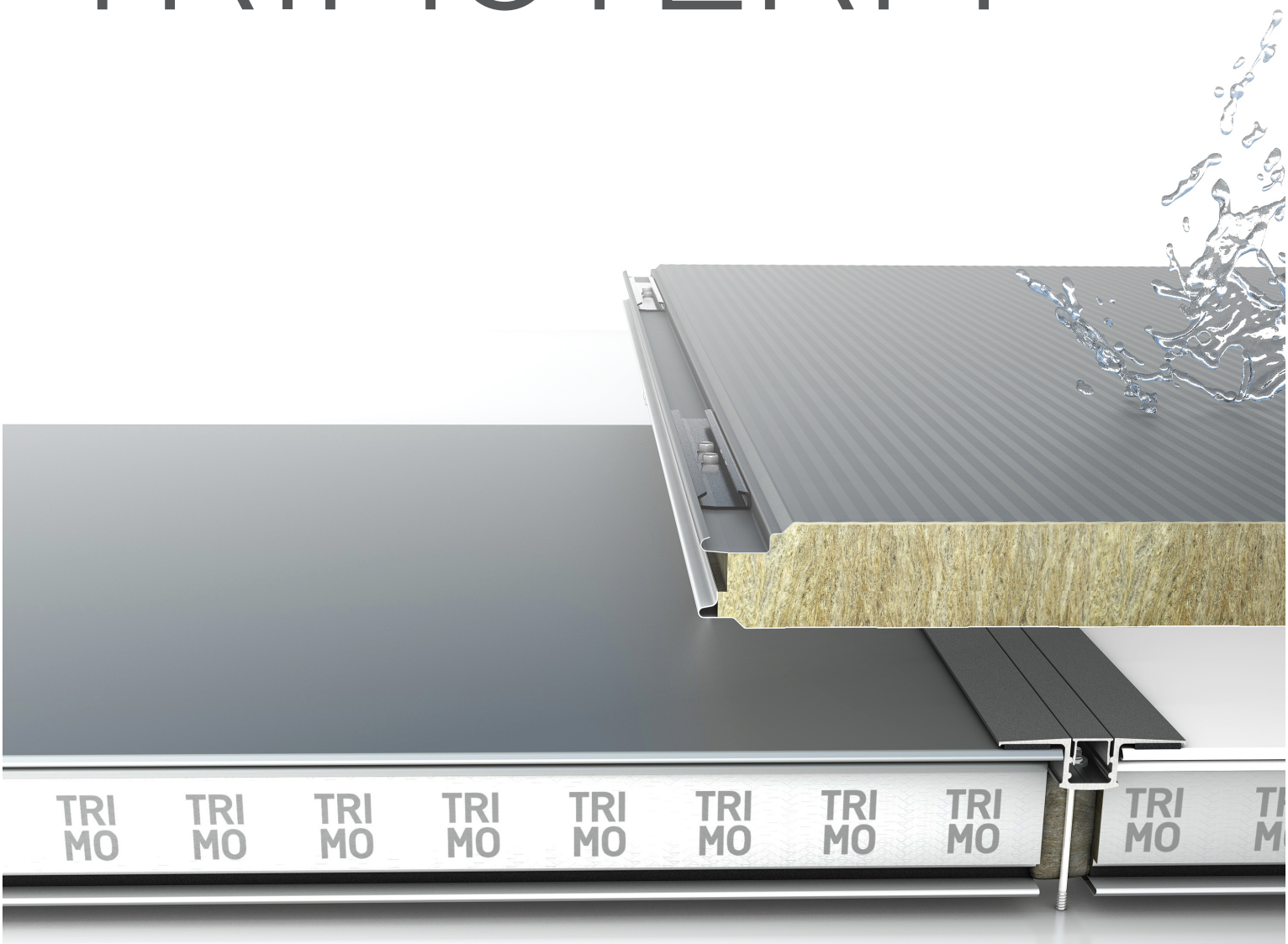
TRIMOTERM



TRIMOTERM FTV HL

BOOK

Comprehensive technical book for Trimoterm FTV HL panels.

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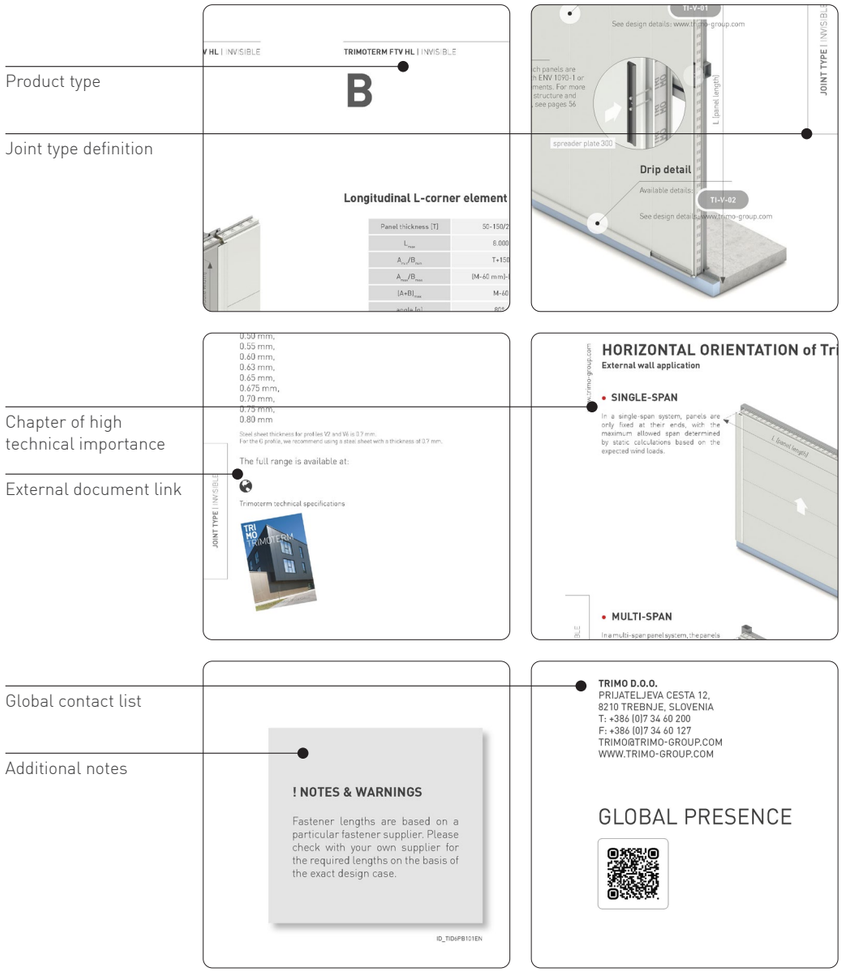
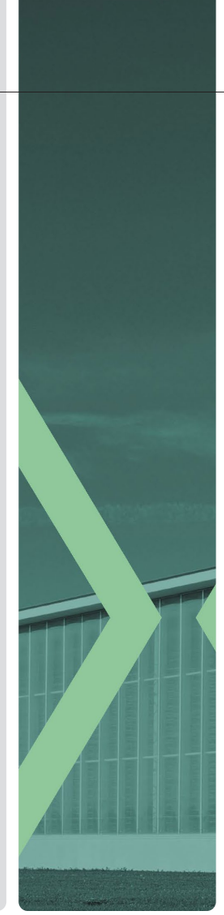
How to use this document?

The navigation tools in this document allow you to navigate and browse easily in several ways. You can find image explanations and links to downloads of external documents such as detailed technical guides and design data, and you can go to specific headings and pages using the interactive table of contents, and much more. Content tailored for various project stakeholders is listed on page 5.

Find all the navigation options in the explanation boxes below.





Content for architects

- Panelised building history,
- Product portfolio,
- Trimoterm profile types,
- Technical data for Trimoterm panels,
- Colours,
- Trimoterm corner elements,
- Trimoterm curved panels,
- Trimoterm ArtMe solution,
- Trimoterm joint options,
- Decorative aluminium elements,
- Design tools and panel specification,
- Project consulting,
- References

Content for contractors

- Product description,
- Technical data for Trimoterm panels,
- Performance of Trimoterm Sound panels,
- Protection against corrosion,
- Trimoterm system benefits,
- Trimoterm high build speed,
- Types of load-bearing structure for Trimoterm panels,
- How to read the calculations,
- Project consulting,
- Other application documents

Content for installers

- Product description,
- Panel composition,
- Trimoterm panel tolerances,
- Trimoterm panel orientation,
- Installation direction,
- Panel fastening scheme and options,
- Installation of aluminium, elements,
- Substructure tolerances,
- Fast adjustable levelling system,
- Trimoterm system sealing,
- Installation of additional façade elements,
- Panel penetration recommendation,
- Project consulting,
- Other application documents

www.trimo-group.com

JOINT TYPE | TRAPEZOIDAL
JOINT TYPE | INVISIBLE
JOINT TYPE | STANDARD

A
Discover Trimoterm

A1 Panelised building history

Mineral wool sandwich panels are an example of a technology influenced by developments in many industries, including engineering and aerospace (in particular, its lightweight design), and one developed to meet the challenges of 20th Century architectural design. Here are the most recognised milestones in insulated panel development:

1849 Engineer William Fairbairn develops the concept of sandwich construction.

1928 The first preassembled metal house, the Dymaxion House by architect Buckminster Fuller.

1945 Metal finishing company Lincoln Industries Inc. launches the first housing application of metal sandwich panels for prefabricated homes.

1953 Jean and Henri Prouvé build a petrol station suitable for series production.

1959 US Materials company Koppers Inc. starts the first mass production of sandwich panels for building construction.

1961 Sandwich panel production begins at several manufacturers in Italy, Germany, Slovenia, Finland, and Ireland.

1965 Engineer Giorgio Tognelli creates the first continuous production line for insulated sandwich panels at Metecno in Italy.

1987 Trimo starts the production of mineral wool (stone wool) insulated sandwich panels on a continuous line.

2010 Panel manufacturer Trimo launches ArtMe, a new decorative surface treatment for applying bespoke graphics.

2014 Publication of the EN 14509 harmonised standard for self-supporting double-skin metal-faced insulating panels – factory-made products.

2021 The United Nations approves a set of common principles which have been developed by the International Fire Safety Standards (IFSS) Coalition, and which can be applied to buildings around the world.

A

A2 Product portfolio

As an architectural product, mineral wool core panels are used as a visually appealing and cost-effective solution in construction. Applications include cladding for insulated walls, partition walls, wall backing, and roofs. They can be specified to provide weatherproofing, aesthetics, fire performance, and both thermal and acoustic insulation.

Trimoterm provides comprehensive details, including a wide range of versatile accessories such as sealants, aluminium profiles, flashings, and fasteners for panels and flashings.

Panel core material (see page 16)

4 different types of mineral wool core with densities of 90-120 kg/m^3

- **Perform C**
- **Power T**
- **Power S**

Trimoterm SNV trapezoid profile

Trimoterm SNV roofs are a perfect solution for roofs with inclines. Due to their technical characteristics and complete range of technical solutions and elements, Trimoterm roofing systems enable active adaptation to all the requirements of a building. The external facing has a trapezoid profile.

Trimoterm FTV HL joint (invisible fastening)

Trimoterm FTV HL mineral wool sandwich panels offer a hidden fastening system (with a multi-span system) with a clean façade appearance and no visible fastenings. Trimoterm panels with hidden joints are mainly intended for vertical installation, but under certain conditions they can also be used for horizontal installations.

Trimoterm FTV joint (standard fastening)

The standard fastening system for Trimoterm FTV mineral wool sandwich panels (with a multi-span system) represents a visible fixing method, and is suitable for the horizontal, vertical, and segmental curved installation of panels.

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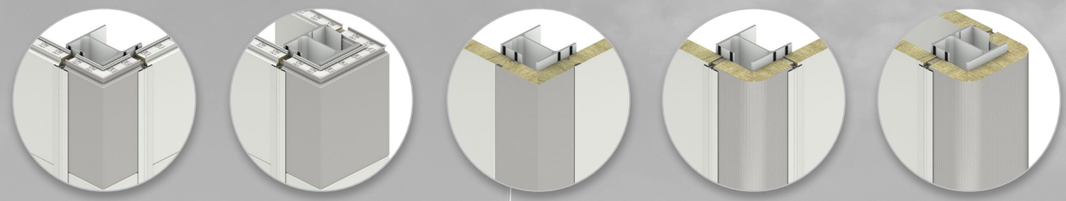
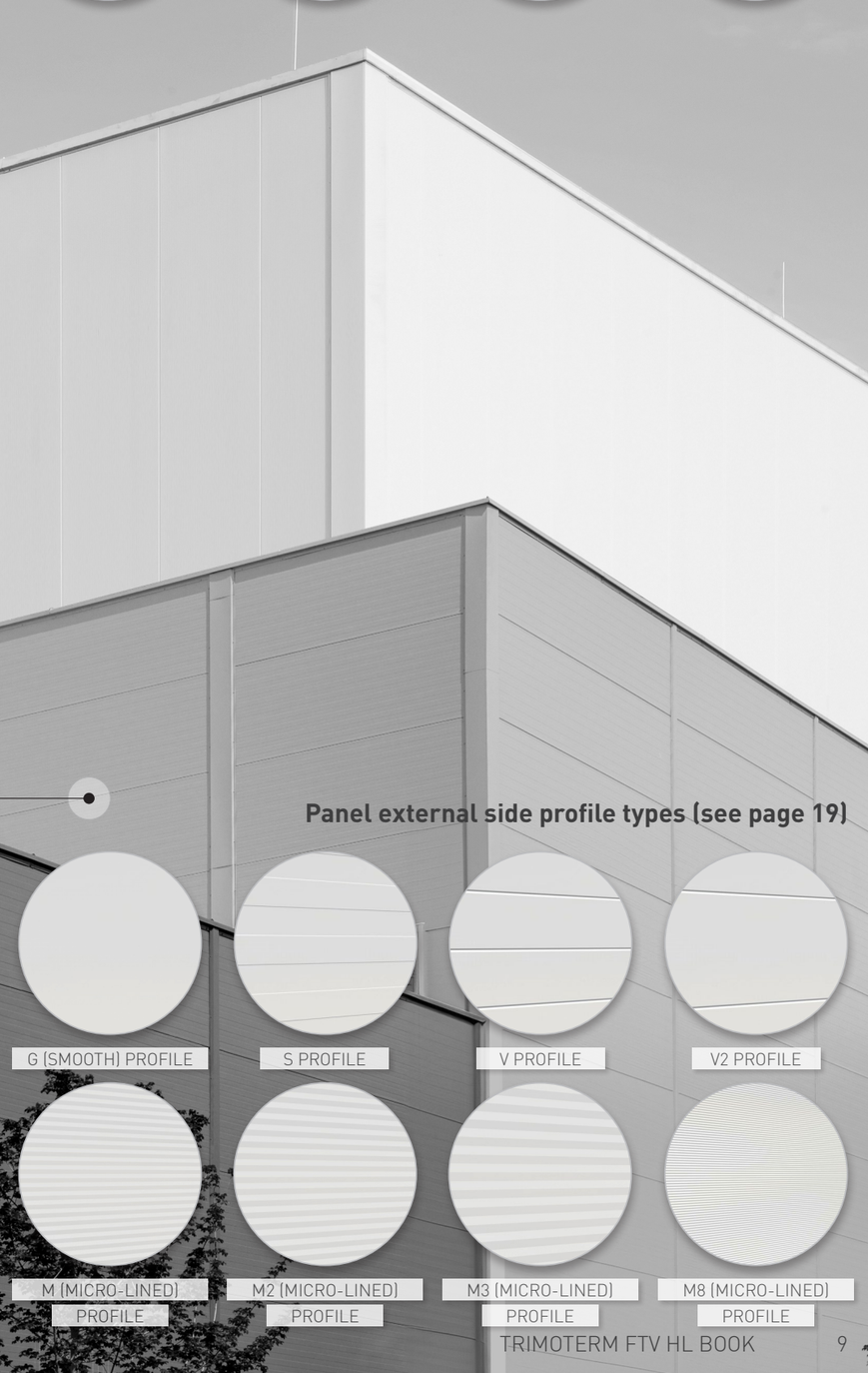
Trimoterm special elements (see page 37)



Panel external side profile types (see page 19)



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JOINT TYPE | TRAPEZOIDAL

JOINT TYPE | INVISIBLE

JOINT TYPE | STANDARD

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A

A2.1 Trimoterm technology and workshop

All components of the mineral wool panels are sourced from Europe and shipped to the manufacturing facility in Trebnje, Slovenia. The manufacturing process involves steel de-coiling, roll forming, sheet alignment, mineral wool cutting, adhesive application, panel pressing, cutting, and packaging.

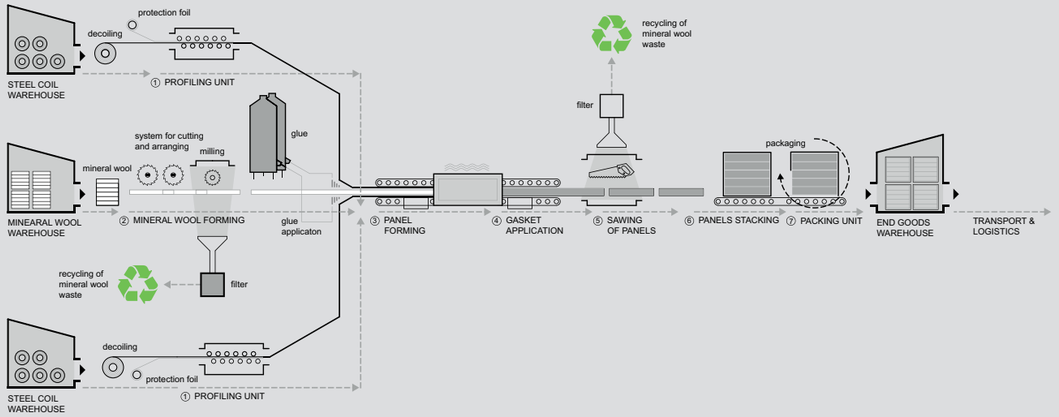


Fig. 1.0: Graphical representation of Trimoterm manufacturing process

A

A2.2 Trimoterm sustainability; a holistic approach

The sustainability performance of Trimo was assessed by Ecovadis for the first time in 2021, and has been each year since. A silver rating has been achieved and the score shows that Trimo was among the top 15% of all rated companies (more than 130,000 globally at the time of writing). The results also show that Trimo is better than the industry average in all rated categories (Environment, Labour & Human Rights, Ethics, and Sustainable Procurement).

Trimo is committed to sustainability and has set ambitious greenhouse gas emission reduction targets in alignment with the Science-Based Targets initiative (SBTi). By integrating the latest climate science into its sustainability strategy, Trimo aims to significantly lower its carbon footprint and to contribute to global efforts to limit temperature increase to well below 2°C, with a vision of 1.5°C. Trimo's ultimate goal is to have net-zero greenhouse gas emissions across the value chain by no later than 2050.

Company's & product's perspective

Sustainable products (reducing consumption of natural resources)

Trimo's panels are a sustainable solution for building construction. They are produced with up to 45% recycled content and after the end of their use stage, up to 99% of them can be recycled. The panels also contribute to an excellent indoor environment as the measurements of VOCs (Volatile Organic Compounds) show full compliance with European requirements.

TRIMOTERM DISCOVER TRIMOTERM

A

www.trimo-group.com

JOINT TYPE | TRAPEZOIDAL
JOINT TYPE | INVISIBLE
JOINT TYPE | STANDARD

A. Material reuse

Panels are designed for reuse or repurposing. This process has already been successfully implemented and, with effective planning, it can be applied to any existing or new Trimo panels.

B. Renovation

The panels are appropriate for building renovation as well. They can be used to replace old panels or they can be used as an "add-on" to an existing façade to renew its architectural design or to improve its thermal and acoustical performance.

C. Reducing energy consumption

High airtightness and excellent thermal insulation, with a U-value as low as 0.15 W/m^2K, significantly reduces energy consumption for heating and cooling, thereby minimising carbon emissions in the use phase of the building.

D. Reducing embodied carbon in carbon-neutral buildings

At Trimo, we are dedicated to minimising the environmental impact of our products, particularly in reducing the embodied carbon of our panels. We are investing significant effort and resources into innovative design, into sustainable materials, and into optimising manufacturing processes. In line with our commitment to transparency and sustainability, Environmental Product Declarations (EPDs) have been issued for all our product groups, providing detailed insights into environmental performance throughout their lifecycles.

E. Complete customer support in carbon-neutral buildings

With our products, you can achieve the highest ratings in sustainability certifications such as BREEAM, LEED, and DGNB. We are dedicated to providing full customer support in the development of carbon-neutral buildings, ensuring that your projects meet the highest environmental standards while contributing to a sustainable future.

B
Panel product sheet

B1 Product description

Trimoterm mineral wool panels offer the perfect combination of functionality and durability. Due to their non-combustible core, their hygienic characteristics, and their excellent thermal and sound insulation, Trimoterm panels can be successfully used in the most demanding environments, such as in the energy production and food-processing sectors and in the pharmaceutical industry.

The hidden joint system (FTV HL) provides a clean façade appearance with no visible fixings. The intermediate fixing details offer a high level of load-bearing capacity and make full use of the panel's integral strength without compromising its flatness. Trimoterm FTV HL panels are primarily designed for vertical installation, but under certain conditions they can be used for various horizontal cladding applications.

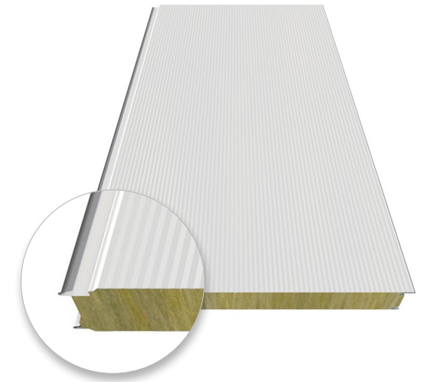


Fig. 1.1: Trimoterm FTV HL panel

www.trimo-group.com/en/products/facades-and-walls/trimoterm

B.1 Key features of insulated sandwich panels

- Self-supporting (up to 10 m single span),
- Manufactured up to 14 m multi-span,
- Economical to install
- Single factory-manufactured unit,
- Watertightness and airtightness,
- Extreme thermal values,
- Moisture resistant,
- 98% recyclable

B1.2 Benefits of mineral wool insulated panels

- Single factory-manufactured unit,
- A sustainable choice,
- Safety and performance,
- Design flexibility,
- Lightweight factory system,
- Low life-cycle cost,
- First-class service

B2 Panel composition

Trimoterm FTV HL mineral wool sandwich panels consist of two profiled, coated sheet faces in thicknesses of 0.55 mm to 0.70 mm. The steel sheet is bonded to the panel core, which is made of non-combustible mineral wool lamellas of class A1 (EN 13501-1). Two-component polyurethane adhesive is used to glue the faces to the core. The three layers combine to form a solid Trimoterm FTV HL panel.

The panel outline edges are formed by a longitudinal joint and a cut joint. The longitudinal joint is formed with a tongue and groove while the cut joint is recognised by the straight panel cut edge.

B2.2 Mineral wool

Stone wool is an insulation material made of melted stone of volcanic origin that is then fiberised. It is recyclable, non-combustible, and available in three types with densities ranging from 90 to 120 kg/m³ for use in Trimoterm panels:

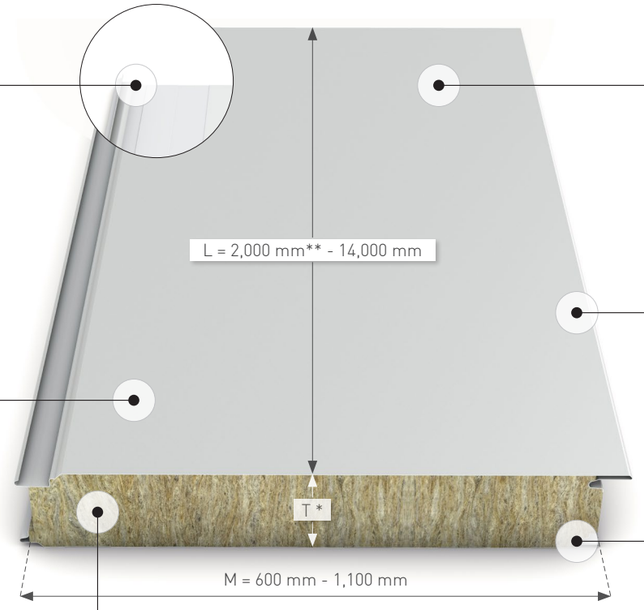
Perform C
Robust and compact mineral wool core type,

Power T
Mineral wool core type with high thermal insulation properties,

Power S
Mineral wool core type with higher structural spanning capabilities.

INSULATED SANDWICH PANEL
TRIMOTERM FTV HL | INVISIBLE
B
www.trimo-group.com
JOINT TYPE | INVISIBLE

B2.1 Product dimensions



Internal steel sheet

The steel sheet consists of several layers (galvanisation, primer, coating, and protective foil), providing protection against corrosion and contamination.

Profilation: see page 19
Thickness: 0.55-0.70 mm (see page 18)
Colour: see page 38
Coating: see page 37

External steel sheet

Steel sheet can be corrugated, slatted, micro-ribbed, or smooth. It consists of several layers, providing protection against corrosion and contamination.

Profilation: see page 19
Thickness: 0.55-0.70 mm (see page 18)
Colour: see page 38
Coating: see page 37

Mineral wool core

Select a suitable core based on thermal and structural requirements. See chapter B4.1.

Surface protection

A protective foil is applied to the panel surface to help prevent damage during installation.

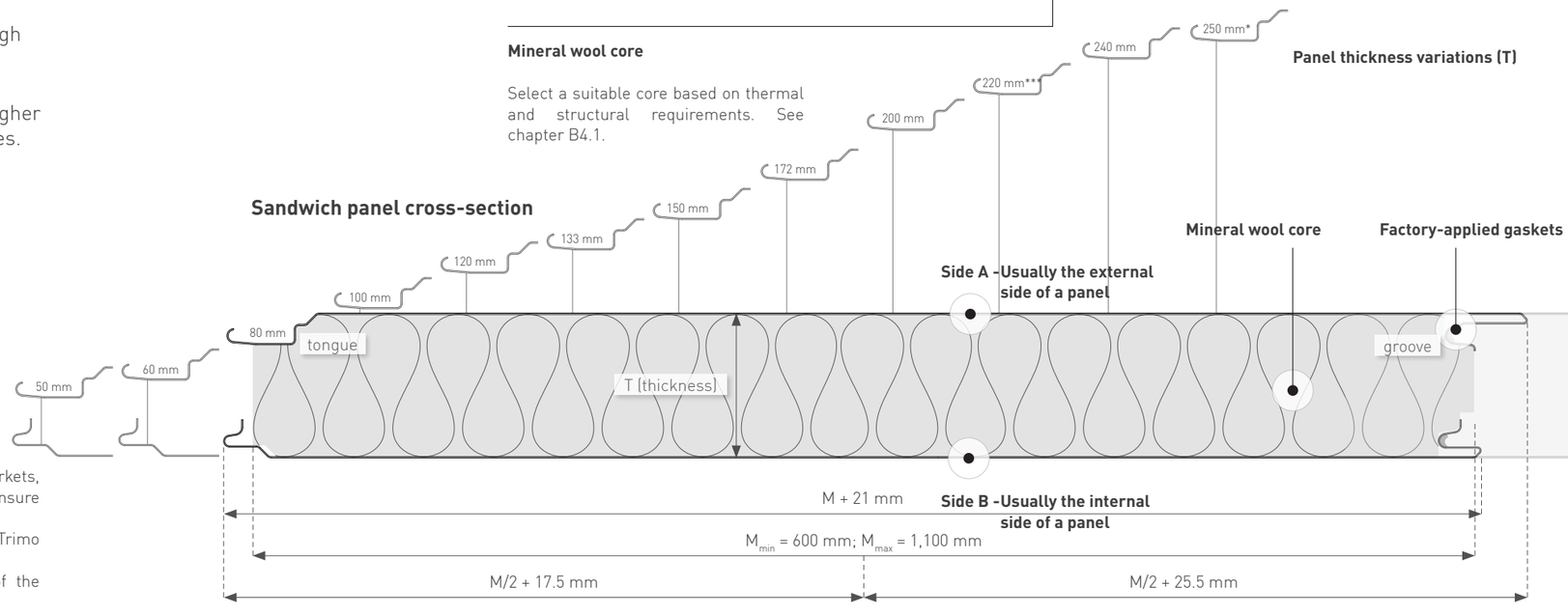
The application of the protective foil depends on the chosen packing type.

Longitudinal joint

The longitudinal joint is formed by the tongue and groove in order to prevent water and other liquids seeping into the core insulation when interlocked with adjacent panel sidelaps. This joint principle enables clean façade appearance with hidden fastening.

Factory-applied gaskets

Sandwich panel cross-section



Cross-section A - A

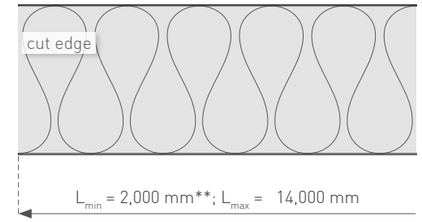


Fig. 1.2: Typical cross-sections of a Trimoterm panel

L - Length (mm)
M - Module width (mm)
T - Panel thickness

* For the French and German markets, consult Trimo's technical support to ensure compliance with regional legislation.
** For shorter panels, check with Trimo technical support.
*** Please check the availability of the product.

B

B2.3 Steel sheet thickness and profile

Trimoterm FTV HL mineral wool sandwich panels are distinguished by a wide range of profiles that enable the design of a large number of different solutions tailored to individual buildings.

The steel sheet of the sandwich panels is manufactured using an advanced profiling tool. The panel order must specify the profile for both internal and external steel sheet surfaces.

Internal and external steel sheet thicknesses available:

0.55 mm,
0.60 mm,
0.63 mm,
0.65 mm,
0.675 mm,
0.70 mm,

Steel sheet thickness for profiles V2 is 0.7 mm.
For the G profile, we recommend using a steel sheet with a thickness of 0.7 mm.

The full range is available at:

Trimoterm technical specifications

Trimoterm FTV profile type	A	B
S (standard) profile	•	•
V profile (V, V2, V6*)	•	•
G (smooth) profile	•	•
Micro-lined profile (M, M3)	•	
Micro-lined profile (M2)		•
Micro-lined profile (M8)	•	

* Available with 1,200 mm module width only.

Trimoterm FTV HL profile type	A	B
S (standard) profile	•	•
V profile (V, V2)	•	•
G (smooth) profile	•	•
Micro-lined profile (M, M3)	•	
Micro-lined profile (M2)		•
Micro-lined profile (M8)	•	

Trimoterm SNV profile type	A	B
Trapezoid	•	
S (standard) profile		•
V profile (V, V2)		•
G (smooth) profile		•
Micro-lined profile (M2)		•

B

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Profile types

S (standard) profile

V profile

V2 profile

G (smooth) profile

M (micro-lined) profile

M2 (micro-lined) profile

M3 (micro-lined) profile

M8 (micro-lined) profile

Trapezoid profile

! NOTES & WARNINGS

The arrangement of the V profile (and all others) typically starts in the middle (centre) of the panel's steel sheet prior to the forming stage. The module end, the groove, and the distance from the panel edge depend on the Trimoterm panel module and may vary. Any other V profile arrangements are declared as non-standard and subject to individual order. The arrangement of the S profile typically starts in the middle (centre) of the panel's steel sheet prior to the forming stage. The module end and the distance from the panel edge depend on the Trimoterm panel module and may vary.

Some combinations are mutually exclusive depending on the type of profile and product. For approval of the requested profile combination, please contact Trimo's technical support team.

Courtesy of Trimo d.o.o.

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B

B2.4 Panel tolerances

Tolerance is the upper and lower acceptable limit for measurements. It can be applied to every measurable aspect of a manufacturing element. Tolerances for rectangular Trimoterm FTV HL panels are in accordance with the EN14509 standard.

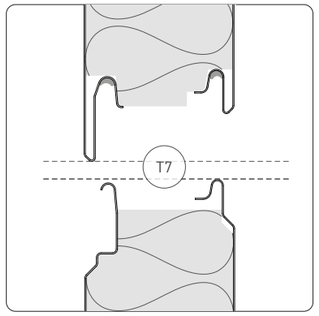
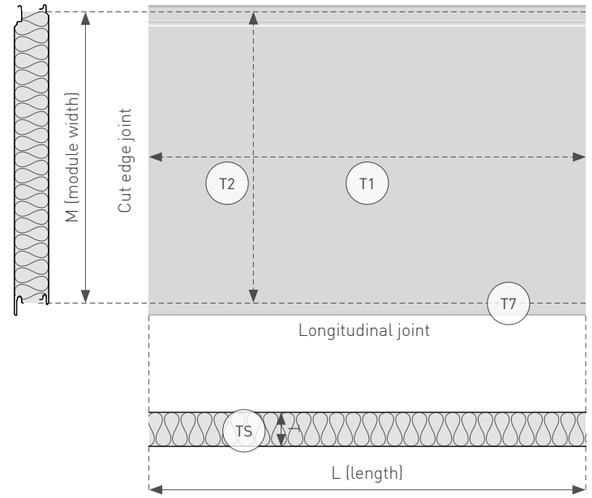


Fig. 1.3: Panel end shift



Name	Dimension	Tolerance	Value (mm)	Remarks
Panel thickness	T	TS	T ⩽ 100 mm ... ± 2mm T > 100 mm ... ± 2%	Tolerance of element thickness
Panel length	L	T1	L ⩽ 3 m ... ± 5 mm L > 3 m ... ± 10 mm	Tolerance of external steel sheet length
Panel width	M	T2	± 2	Tolerance of the external steel sheet module width
Panel flatness (longitudinal)			0.6 mm 1.0 mm 1.5 mm	Flatness deviation of the external steel sheet surface in the longitudinal direction. Measurement length: L = 200 mm L = 400 mm L > 700 mm
Panel end shift (transversal)		T7	± 2	Deviation of internal / external steel sheet position

Tab. 1.0: Trimoterm FTV HL panel tolerances

B

B3 Technical data

• B3.1 Technical data for the Trimoterm FTV HL mineral wool façade panel

Explore the indicative values for Trimoterm sandwich panels in façade application. For more product values and product availability, see the Trimo technical specifications document.

Panel thickness (mm)	50	60	80	100	120	133	150	172	200	220	240 [5]	250 [1]
CORE: POWER T												
Weight (Fe 0.55/0.5) (kg/m²)	-	15.3	17.1	18.9	20.7	21.9	23.4	25.4	27.9	29.7	31.5	32.4
Max. achievable fire resistance (EN 14509) [2]	-	-	up to EI30	up to EI60	up to EI120	up to EI120	up to EI180	up to EI240	up to EI240	up to EI240	up to EI240	up to EI240
U - Thermal transmittance (W/m² K) [3]	-	0.60	0.46	0.37	0.31	0.28	0.25	0.22	0.19	0.17	0.16	0.15
Airborne sound insulation: $R_w(C;C_{tr})$ dB (EN 14509) [4]	-	30 (-1;-3)	30 (-1;-3)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)
Combustibility of the material core (EN 13501-1)	-	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1
Water permeability (EN 14509)	-	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)
Air permeability (C (m^3/Pa s);n)	-	C=0,00504 m^3 (Pa s); n=0.95										
CORE: POWER S												
Weight (Fe 0.55/0.5) (kg/m²)	15.8	17.0	19.4	21.8	24.2	25.8	27.8	30.5	33.8	-	38.6	-
Max. achievable fire resistance (EN 14509) [2]	-	up to EI30	up to EI60	up to EI120	up to EI120	up to EI120	up to EI180	up to EI240	up to EI240	-	up to EI240	-
U - Thermal transmittance (W/m² K) [3]	0.77	0.65	0.50	0.41	0.34	0.31	0.28	0.24	0.21	-	0.17	-
Airborne sound insulation: $R_w(C;C_{tr})$ dB (EN 14509) [4]	-	31 (-1;-3)	31 (-1;-3)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	-	31 (-2;-4)	-
Combustibility of the material core (EN 13501-1)	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	-	Class A1	-
Water permeability (EN 14509)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	-	Class A (1200Pa)	-
Air permeability (C (m^3/Pa s);n)	C=0,00504 m^3 (Pa s); n=0.95									-		-
CORE: PERFORM C												
Weight (Fe 0.55/0.5) (kg/m²)	15.8	17.0	19.4	21.8	24.2	25.8	27.8	30.5	33.8	-	38.6	-
Max. achievable fire resistance (EN 14509) [2]	-	up to EI30	up to EI60	up to EI120	up to EI120	up to EI120	up to EI180	up to EI240	up to EI240	-	up to EI240	-
U - Thermal transmittance (W/m² K) [3]	0.75	0.64	0.49	0.40	0.33	0.30	0.27	0.24	0.20	-	0.17	-
Airborne sound insulation: $R_w(C;C_{tr})$ dB (EN 14509) [4]	-	31 (-1;-3)	31 (-1;-3)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	31 (-2;-4)	-	31 (-2;-4)	-
Combustibility of the material core (EN 13501-1)	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	Class A1	-	Class A1	-
Water permeability (EN 14509)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	Class A (1200Pa)	-	Class A (1200Pa)	-
Air permeability (C (m^3/Pa s);n)	C=0,00504 m^3 (Pa s); n=0.95									-		-

(1) For the French and German markets, consult Trimo's technical support to ensure compliance with regional legislation.
(2) A request for fire resistance must be clearly specified by the customer.
(3) Values valid for the featured application in the centre of the panel.
(4) According to EN ISO 140-3 and EN ISO 354.
(5) Please check the availability of the product.

B

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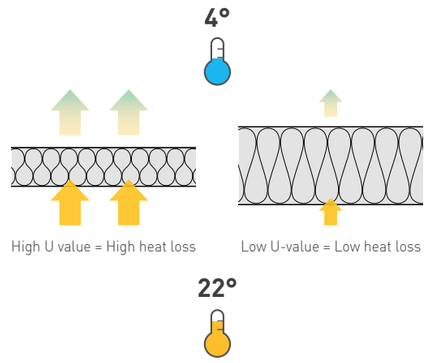
JOINT TYPE | INVISIBLE

B3.2 Thermal transmittance

One of the most important parameters when it comes to heat losses in buildings is the thermal transmittance, or U-value. When we talk about sandwich panels, we're describing the rate at which the component transmits heat from the inside (usually) to the outside.

The higher the U-value, the more heat flows through an object within a certain time and the lower the insulation. Low U-values therefore mean good thermal insulation properties.



Thermal conductivity

Thermal conductivity or lambda (λ) is a material property that describes how well a material conducts heat. It is defined as the amount of heat (in watts) that passes through a material with a thickness of 1 metre and a surface area of 1 square metre when the temperature difference between the two sides is 1 degree Celsius (or 1 Kelvin).

In the context of sandwich panels, the core material's thermal conductivity plays a crucial role in determining the overall U-value of the panel. The lower the thermal conductivity of the core, the better the panel insulates.

Power T λ = 0.039 W/mK
Perform C λ = 0.042 W/mK
Power S λ = 0.043 W/mK

100%

Customised product

Whether your applications involve industrial buildings, logistics centres, shopping malls, or steel structures –including roofs, façades, partition walls or other elements – we can customise mechanical performance to meet your specific requirements.

B

B3.3 Sound

Sound insulation in buildings is of great importance for wellbeing and health. Acoustic performance can be divided into two important phenomena. These are sound insulation and sound absorption. Here is the full list of sound-related properties:

- Airborne sound insulation
- Sound absorption
- Sound transmission through the construction
- Sound reflection from element surface
- Structure-borne sound transmission

Sound insulation

Sound insulation refers to the process of reducing the transmission of sound between different areas. This can be achieved through various materials and construction techniques that absorb, dampen, or block sound waves. All Trimoterm panels are used as effective sound insulation materials.

Sound absorption

Sound absorption refers to the process of reducing sound within an enclosed area. This is achieved by a material, structure, or object that absorbs sound energy when sound waves encounter it, as opposed to reflecting the sound. Trimoterm Sound panels with perforated faces are used as an effective sound absorption solution.

Class A: $\alpha_w \geq 0.90$
Class B: $0.80 \leq \alpha_w < 0.90$
The coefficient a_w ranges from 0-1 (1 indicates total absorption with no reflection).

Terms

The decibel (abbreviation dB) is a logarithmic value for the measurement of sound pressure level. It is a unit without any dimension that expresses a relationship between an acceptable quantity and a fixed reference.

A weighted sound reduction index (R_w) is a number used to rate the effectiveness of a soundproofing system such as walls, ceilings, or roofs. The value R_w is supplemented by the data C and C_{tr}:

- The sum of R_w + C stands for sound insulation for low frequencies in dB.
- The sum of R_w + Ctr stands for sound insulation for traffic frequencies in dBA.

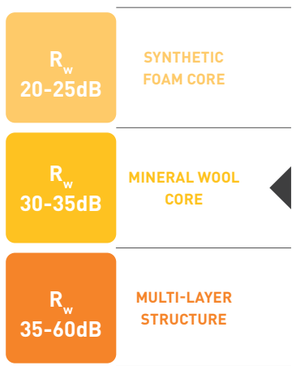


Fig. 1.5: Sound insulation range for different panel cores

B

Airborne sound transmission

Airborne sound is the most common type of sound transmission. It occurs when sound waves travel through the air from a sound source to a receiver.

When airborne sound encounters a building element such as a wall, part of the sound energy is transmitted through the material, while another part is reflected or absorbed. The transmitted sound can then be heard on the other side of the wall in a different space.

The STC, or sound transmission class, is a single-number method of rating how well wall partitions reduce sound transmission.

Sound reflection from a surface

When sound waves strike a surface, some of the energy is absorbed and some is reflected back into the space. The way that sound reflects off of surfaces in a room can have a significant impact on how sound is perceived by those within the space.

Structure-borne sound transmission

Impact sound transmission happens when an object or surface is struck or impacted, transmitting vibrations through the building's fabric.

These vibrations can travel through walls, floors, and ceilings and can be heard as noise in adjacent areas. Impact sound insulation measures focus on minimising the transmission of vibrations through the structure.

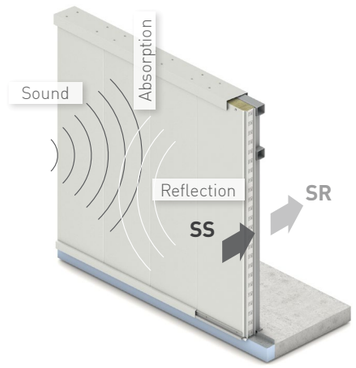


Fig. 1.5: Trimoterm wall sound related properties

STC	What can be heard
25	Normal speech can be understood.
30	Loud speech can be understood.
35	Loud speech is audible but not intelligible.
40	Loud speech is audible as a murmur.
45	Loud speech is heard but not audible.
50	Loud sounds are faintly heard.
60+	Good soundproofing, most sounds do not disturb neighbouring residents.

Fig. 1.6: Sound transmission classes

SS - Sound source
SR - Sound reception

Performance of Trimoterm Sound panels

In addition to excellent fire protection and thermal insulation properties, Trimoterm Sound panels have good sound insulation and absorption. For the Trimoterm Sound panel acoustic ratings, see the Trimoterm technical specifications document.

The default configuration of the Trimoterm Sound panel includes a perforated steel sheet on side B (internal) with an RV 4×8 pattern. This side is lined with polyester felt, followed by a mineral wool core (Power T) and a profiled steel sheet on side A (external). All elements are bonded together using a specialised adhesive. The integrated protective felt serves a dual purpose: it prevents dust from entering the panel core and stops mineral wool particles from escaping into the environment.

The Trimoterm Sound panel is available in a modular width of 1,000 mm. It offers the following steel sheet profile combinations:

- **Side A** (external): S (standard), M (micro-lined), V (V - profile), G (smooth)
- **Side B** (internal): S (standard), V (V - profile)

Ensure that Side B is oriented on the correct side so that the acoustic performance of the panel is fully utilised.

The reaction of Trimoterm Sound panels to fire has been tested in compliance with the SIST EN 13823 standard. In compliance with the SIST EN 13501-1 standard, Trimoterm Sound panels achieve a classification relating to the reaction to fire of B-s1,d0.

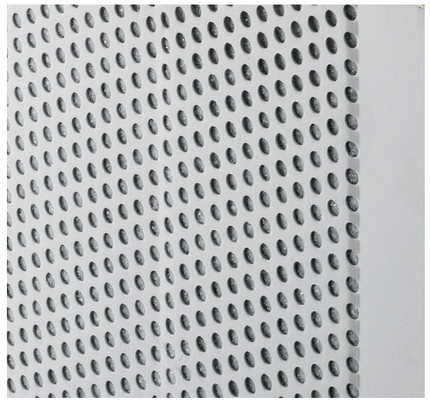


Fig. 1.7: Trimoterm FTV HL Sound panel (perforated steel sheet on side B - default selection).

! NOTES & WARNINGS

Tables of permissible distances for Trimoterm panels are not valid for Trimoterm Sound panels. Sound panels cannot be used for external applications on heated facilities in the EU climate zone (check the building physics calculation).

Penetrations through Trimoterm Sound panels significantly influence the structural performance of the panel and therefore must be a subject of an individual static calculation.

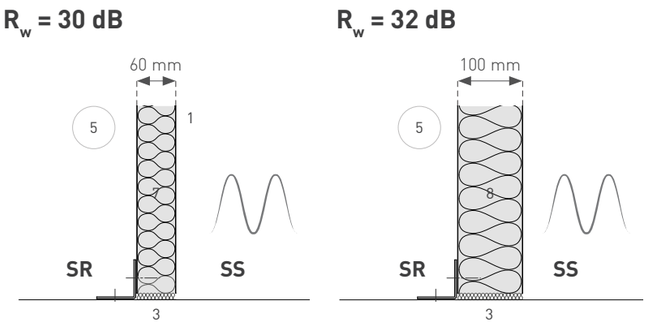
Real cases and non-standard applications need to be discussed individually with Trimo technical support.

Trimoterm single- and multi-layer panel system sound performance

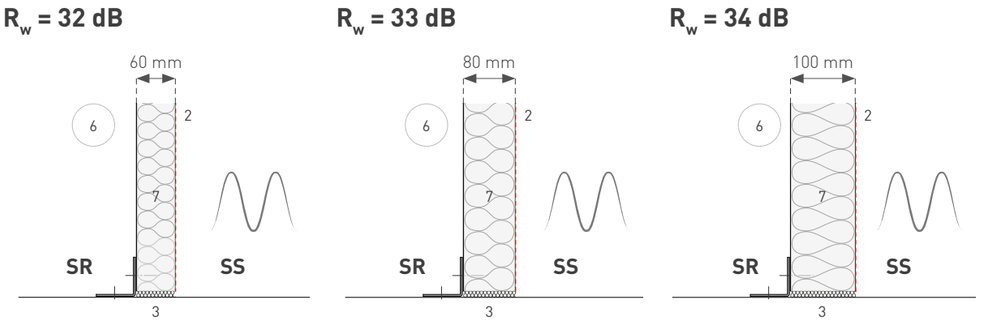
The number of panels in a wall system, the presence of a perforated panel steel sheet surface, and the additional layer of material play crucial roles in influencing the sound absorption and insulation properties, allowing for tailored acoustic solutions.

Explore examples of tested wall compositions:

1. Single Trimoterm FTV HL panel wall:



2. Single Trimoterm Sound panel wall:



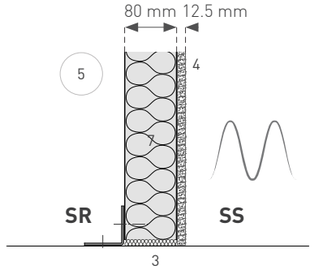
1. Steel sheet,
2. Perforated steel sheet,
3. Mineral stone wool,
4. Gypsum board,
5. Trimoterm FTV HL,
6. Trimoterm Sound,
7. Power T mineral wool core,
8. Power S mineral wool core

SS - Sound source
SR - Sound reception

B

3. Single Trimoterm FTV HL panel wall + gypsum board wall:

R_w = 33 dB



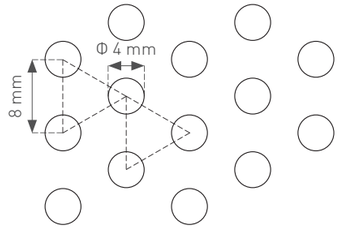
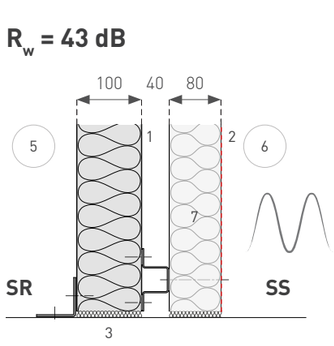


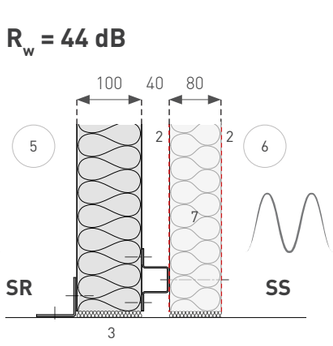
Fig. 1.8: Trimoterm Sound perforation RV 4x8 pattern

4. Trimoterm FTV HL panel + Trimoterm Sound panel wall:

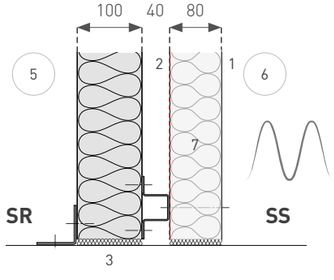
R_w = 43 dB



R_w = 44 dB



R_w = 52 dB



1. Steel sheet,
2. Perforated steel sheet,
3. Mineral stone wool,
4. Gypsum board,
5. Trimoterm FTV HL,
6. Trimoterm Sound,
7. Power T mineral wool core,

SS - Sound source
SR - Sound reception

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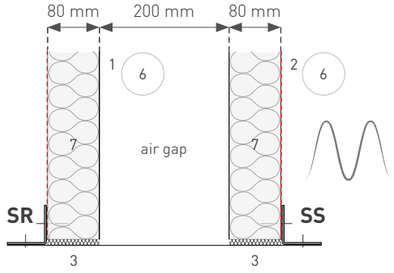
B

5. Trimoterm Sound panel + air gap + Trimoterm Sound panel wall:

R_w = 49 dB



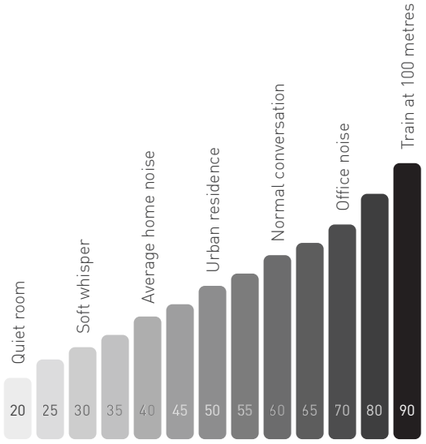
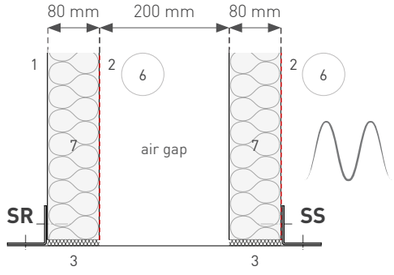


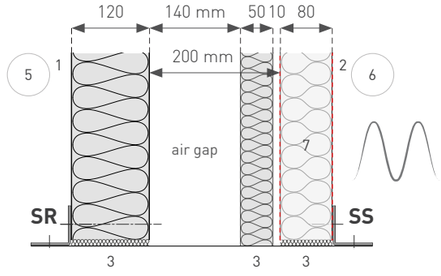
Fig. 1.9: Noise levels (dB)

R_w = 54 dB



6. Trimoterm FTV HL panel + air gap + layer of mineral wool + Trimoterm Sound panel wall:

R_w = 56 dB



1. Steel sheet,
2. Perforated steel sheet,
3. Mineral stone wool,
4. Gypsum board,
5. Trimoterm FTV HL,
6. Trimoterm Sound,
7. Power T mineral wool core,

SS - Sound source
SR - Sound reception

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B

B3.4 Fire safety

Trimoterm FTV HL panels are designed to meet the highest standards of passive fire protection, ensuring safety, performance, and compliance across a wide range of building applications.

The fire performance of mineral wool sandwich panels is evaluated using the following criteria:

- Fire resistance
- Reaction to fire

Fire resistance

Fire resistance is the ability of the panels to maintain their structural capacity, integrity, and insulation properties during a fire. The standard fire resistance rating values are 15, 30, 45, 60, 90, 120, 180, and 240 minutes. This rating typically means the period during which a passive fire protection system can withstand a standard fire resistance load. Fire resistance criteria classes are:

R (load-bearing capacity)
Ability to maintain load-bearing without a loss of structural stability.

E (integrity)
Ability of the product to prevent the passage of fire and hot gases into an area not affected by the fire.

I (insulation)
Ability to limit heat transmission through the element.

For complete technical specifications, span tables, and certified installation details, refer to this document: Trimoterm fire application.

Trimoterm fire application

FACT

Test with FTV HL 150 mm, L = 6.0 m achieved EI result of 180 minutes

The FTV HL panel is asymmetrical, meaning fire performance depends on the direction of fire exposure. Trimo provides tested fire resistance values for both scenarios.

Each year, Trimo conducts around 10 fire tests and collaborates with international research facilities to evaluate and enhance the fire resistance of its materials.

B

Reaction to fire

Reaction to fire is an essential characteristic of building/construction products. Reaction to fire classification (EN 13501-1) assesses how much a material/product contributes to the development of a fire in its early stages. The key criteria include:

- Ignitability: How easily the material catches fire.
- Flame spread: The speed at which flames spread across the surface of the material.
- Heat release: The amount of energy released as the material burns.
- Smoke production: The density and volume of smoke produced.
- Flaming droplets: The potential for burning droplets to fall from the material.

The EN 13501-1 classification system for the reaction of construction products to fire includes the main combustibility classes, as well as additional classes for smoke and flaming droplets.

The first symbol of classifications (A1 / A2 / B / C / D / E / F) denotes their combustibility and contribution to fire. The second symbol (s) refers to the level of smoke propagation and the third symbol (d) indicates the presence of flaming droplets in the first 10 minutes.

1st symbol (combustibility fire class)
Materials classified A1 and A2 are incombustible, class B are non-flammable, while class F is, in the specific case of sandwich panels, not tested for fire.

2nd symbol (smoke propagation level)
This parameter deals with the emission of fumes.
- s1: Little or no smoke production.
- s2: Limited smoke production.
- s3: High smoke production.

3rd symbol (presence of flaming droplets)
This parameter deals with the presence of flaming droplets or particles that develop during combustion and can spread the fire.
- d0: No flaming droplets or particles.
- d1: Limited flaming droplets or particles.
- d2: High quantities of flaming droplets or particles.

Trimoterm mineral wool sandwich panels are

A2-s1,d0

rated with no significant contribution to fire growth.

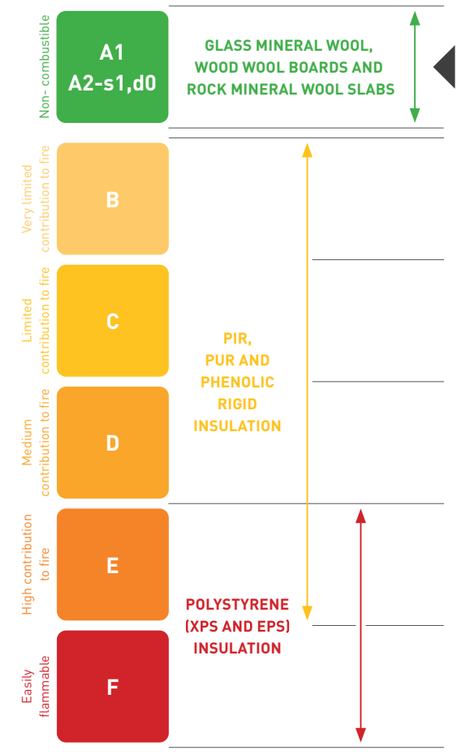


Fig. 2.0: Combustibility Classes (EN 13501-1):

A1: Non-combustible, no contribution to fire.
A2: Limited combustibility.
B: Very limited contribution to fire.
C: Limited contribution to fire.
D: Acceptable contribution to fire.
E: Acceptable performance in case of a small fire.
F: No performance determined.

B

B3.5 Protection against corrosion

Unprotected steel in the atmosphere is subject to corrosion. The corrosion of structural steel is an electrochemical process that requires the simultaneous presence of moisture and oxygen.

Trimoterm insulated sandwich panels have two metal faces that correspond to the external environment (external steel sheet) and internal environment (internal steel sheet). The choice of corrosion protection for the steel sheet is a determining factor that designers and installers must specify. The metal steel sheet is protected with a coating of corrosion protection in compliance with EN 10346, and additionally protected by an organic coating in accordance with the coil-coating process (EN 10169/1).

Atmospheric corrosivity categories (C)

The ISO 12944:2019 standard divides environmental corrosion risk into six categories, with explanations for atmospheric corrosivity categories provided below.

Corrosivity cat.	Exterior	Interior
● C1 (Very low)	None	Heated buildings with a clean atmosphere.
● C2 (Low)	Atmosphere with low pollution.	Buildings not heated, where condensation may occur
● C3 (Medium)	Urban and industrial areas with low SO_2 pollution.	Buildings for production with high atmospheric humidity
● C4 (High)	Industrial areas and coastal areas with moderate salt impact.	Chemical manufacturers, swimming baths, and shipyards by the sea.
● C5-I (Very high)	Industrial areas with high SO_2 levels and an aggressive atmosphere.	Buildings with almost permanent condensation and high pollution.
● C5-M (Very high)	Coast and offshore areas with a high salt content.	Buildings with almost permanent condensation and high pollution.
● CX (Extreme)	Areas with high salinity and a sub-tropical or tropical atmosphere.	Industrial with extreme humidity.

Corrosion resistance categories (RC)

In order to ensure that coated steel can withstand various environmental conditions, the corrosion resistance categories in EN 10169:2022 are defined based on extensive testing and performance criteria.

Based on test results, samples are classified into different corrosion resistance categories (RC1 to RC5+). Each category represents a different level of resistance, with RC5+ being the highest, and therefore suitable for extremely aggressive environments.

Corrosion protection categories for building interiors (CPI)

The CPI categories in EN 10169:2022 are determined through a series of tests and evaluations designed to assess the performance of coated steel products under various environmental conditions.

Based on test results, samples are classified into different CPI categories (CPI 1 to CPI 5). Each category represents a different level of resistance, with CPI 5 being the highest, and therefore suitable for extremely aggressive environments.

Corrosion protection (interior) cat.	● **CPI1**	● **CPI2**	● **CPI3**	● **CPI4**	● **CPI5**
Test duration (h)	None	500	1.000	1.500	1.500

UV resistance categories (R_{UV})

Resistance against loss of gloss and colour. At locations with high solar radiation, or for objects with high aesthetic requirements or those that have intensive colours, the use of material with high UV resistance (min. R_{UV} 4) is required.

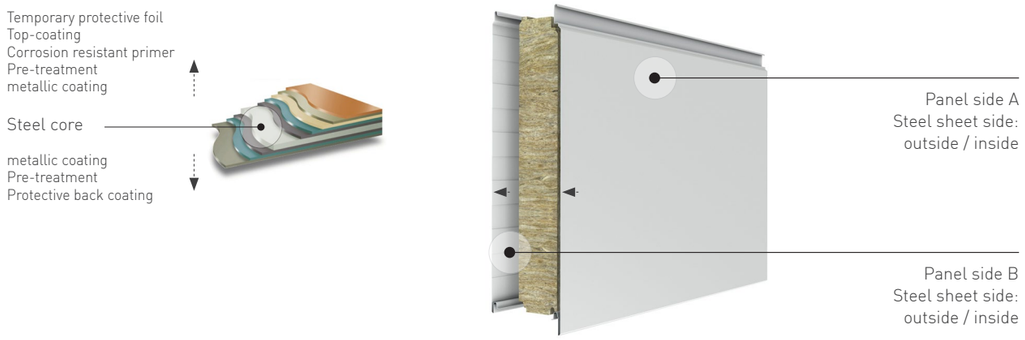
B

Type of coating			SP	PVDF	PVDF+	PUR/PA	PRISMA	HPS*	PVC(F)	Stainless st.
Total organic thickness (µm) [EN 13523-1]			25	25	35-57	50-65	40-65	200	120-150	304, 304L, 316, 316L
Corrosion resistance category	External [EN 10169]		RC3	RC3	RC4	RC5	RC5+	RC5	/	
	Internal [EN 10169]		CPI3	CPI3	CPI5	CPI5	CPI5	CPI5	CPI3	
Types of outdoor atmosphere/ corrosively category	Rural - normal	● C2	OK	OK	OK	OK	OK	OK	OK internal use only	
	Urban and light industrial (low SO_2)	● C3	OK	OK	OK	OK	OK	OK	OK internal use only	
	Industrial (Moderate SO_2)	● C4	Unsuitable	Unsuitable	Contact Trimo	OK	OK	OK	OK internal use only	
	Marine > 5 km from the sea	● C5- M	Unsuitable	Unsuitable	Contact Trimo	Contact Trimo	OK	OK	OK internal use only	
	Marine 0-5 km from the sea	● C5- M	Unsuitable	Unsuitable	Contact Trimo	Contact Trimo	OK	OK	OK internal use only	
	Severe industrial	● C5 - I	Unsuitable	Unsuitable	Contact Trimo	Contact Trimo	Contact Trimo	Contact Trimo	Contact Trimo	
Temperature resistance (°C)			80	110	110	80	100-110	70	60	
UV resistance category [EN 13523-10]			R_{UV} 3	R_{UV} 4	R_{UV} 4	R_{UV} 4	R_{UV} 4	R_{UV} 4	/	

Tab. 1.1: Steel sheet coatings and their suitability for atmospheric corrosivity categories.

* Contact our technical support for application.
The information provided in this table offers a general overview of the available steel sheet coatings and their suitability for various atmospheric categories. For detailed guidance, and to ensure the appropriate coating selection for your specific project, please consult with a Trimo representative.

Fig. 2.1: Panel composition and coating structure example



B

B3.6 Colours

A wide range of colour finishes is available for any building, and are engineered to capture the perfect appearance of the building design, both internally and externally. The colour range does not define the delivery terms.

Trimoterm steel sheet metal is hot galvanised in compliance with EN 10346, and additionally protected by an organic coating in accordance with the coil-coating process (EN 10169/1). Please note that not all colours are available for every type of coating. For details on specific colour options, consult your Trimo representative.

The colour of the external steel sheet influences the self-heating temperature of the panel surface when it is exposed to sun rays, which can result in thermal expansion properties. We distinguish three colour groups:

- Group I - very bright colours
- Group II - bright colours
- Group III - dark colours

We advise against using wall panels with dark colours in multi-span systems due to the possibility of steel sheet deformation. It is recommended to install such panels at ambient temperatures above 10°C.

Fig. 2.2: The colours shown represent only a fraction of the colours available.

B

Wuppermann Hungary Production and Office Building, Hungary

B

B4 Special elements

B4.1 Trimoterm FTV HL corner elements

From the basic Trimoterm FTV HL panel, we can prefabricate corner elements as shown on the following pages. Specific geometrical limitations are given separately for each corner element. Please also consider these general notes:

- All corner elements are closed on the internal side with a zinc-coated L-profile (this may be visible from the inside).
- Longitudinal rounded elements are only available in combination with a micro-lined (M) external steel sheet profile.
- Corner elements are made from Trimoterm FTV HL panels that are produced together with other flat façade panels.
- Consider the feasibility of use for specific projects, in terms of structural capacity, fire-related requirements etc.

Corner side designations

The principle for designating the sides of corner elements shown in a plan view of four corners of a building with side designations.

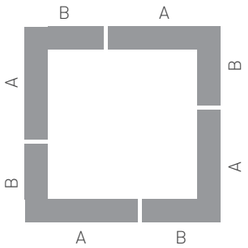


Fig. 2.3: L-corner element designation

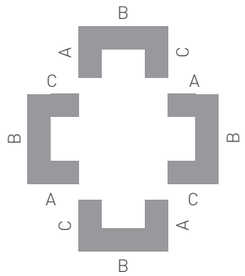


Fig. 2.4: U-corner element designation

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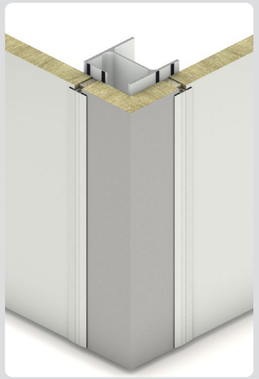
In addition to flat Trimoterm panels, Trimo produces various corner elements that enable aesthetic finishes for the façade edges. Explore the Trimoterm corner elements below:

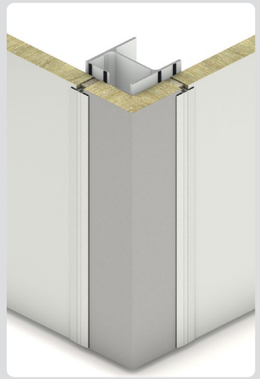


L-corner
Transversal

This element with a sharp edge can be used for the outside corner of a horizontal façade.

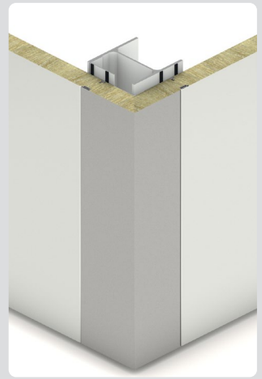
U-corner
Transversal

This element with a sharp edge can be used for the double outside corner of a horizontal façade.



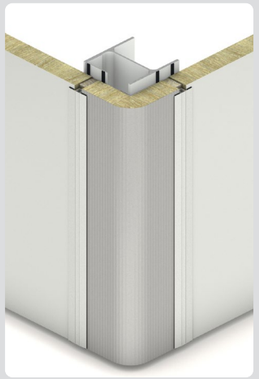
L-corner (cut edge)
Longitudinal

This element with a sharp edge can be used for the outside corner of a vertical façade.



L-corner (groove/tongue)
Longitudinal

This element with a sharp edge can be used for the outside corner of a vertical façade.



Rounded L-corner
Longitudinal

This element with a rounded edge can be used for the outside corner of a vertical façade.

Rounded U-corner
Longitudinal

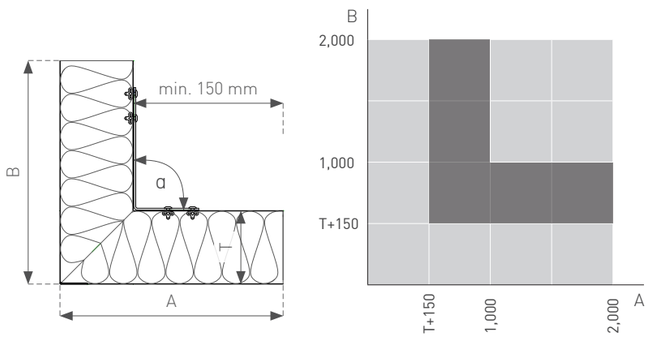
This element with a rounded edge can be used for the double outside corner of a vertical façade.

ID_TID6PB102EN

B

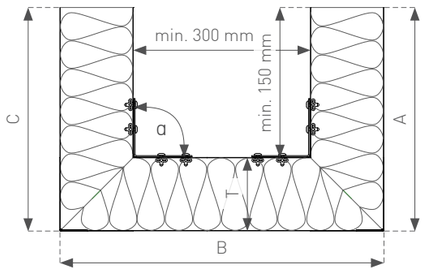
Transversal L-corner element

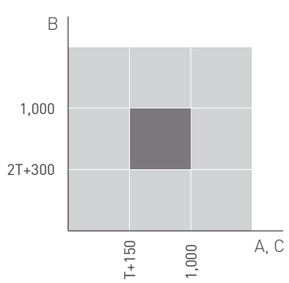
Panel thickness [T]	50-250 mm
$(A+B)_{max}$	3,000 mm
A_{min}/B_{min}	T+150 mm
A_{max}/B_{max}	2,000 mm
B_{max}/A_{max}	1,000 mm
angle [α]	75°-175°



Transversal U-corner element

Panel thickness [T]	50-250 mm
$(A+B+C)_{max}$	3,000 mm
B_{min}	2T+300 mm
A_{min}/C_{min}	T+150 mm
$A_{max}/B_{max}/C_{max}$	1,000 mm
angle [α]	75°-175°





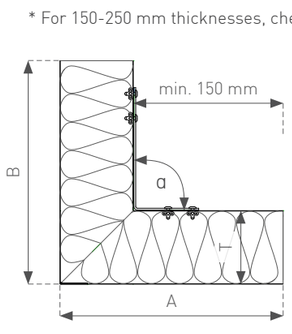
ID_TID6PB102EN

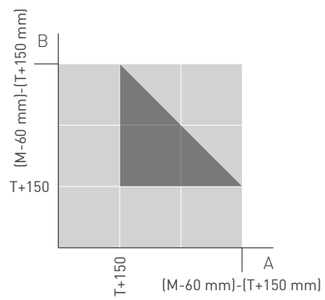
B

Longitudinal L-corner element (cut edge)

Panel thickness [T]	50-150/250* mm
L_{max}	8,000 mm
A_{min}/B_{min}	T+150 mm
A_{max}/B_{max}	(M-60 mm)-(T+150 mm)
$(A+B)_{max}$	M-60 mm
angle [α]	80°-175°

* For 150-250 mm thicknesses, check with technical support.

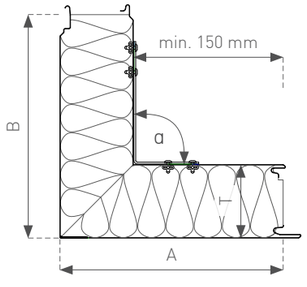


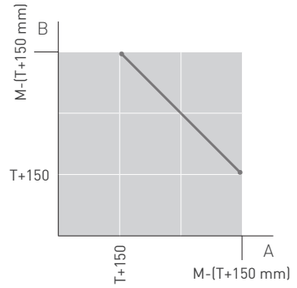


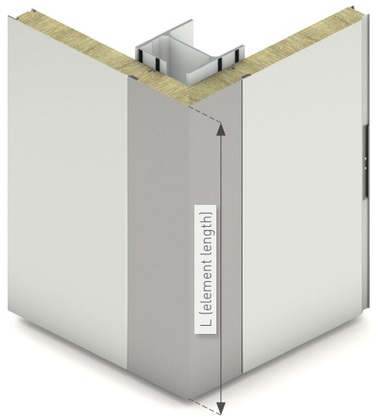
Longitudinal L-corner element (groove/tongue edge)

Panel thickness [T]	50-150/250* mm
L_{max}	8,000 mm
A_{min}/B_{min}	T+150 mm
A_{max}/B_{max}	M-(T+150 mm)
(A+B)	M
angle [α]	80°-175°

* For 150-250 mm thicknesses, check with technical support.







L - Length (mm)
M - Module width (mm)
T - Panel thickness

ID_TID6PB102EN

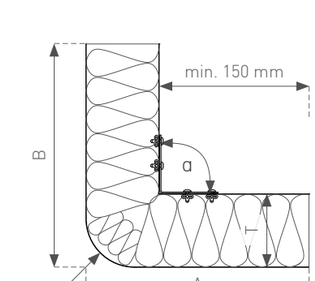
B

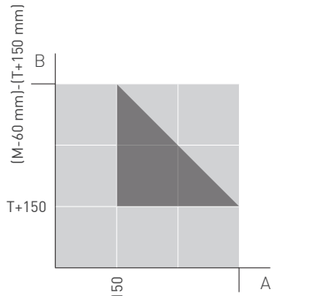
Arcadia Lightwear Office and Exhibition Building, Slovenia

B

Longitudinal rounded L-corner element

Panel thickness [T]	50-250 mm
L_{max}	10,000 mm
A_{min}/B_{min}	T+150 mm
A_{max}/B_{max}	(M-60 mm)-(T+150 mm)
$(A+B)_{max}$	M-60 mm
angle [α]	75°-175°

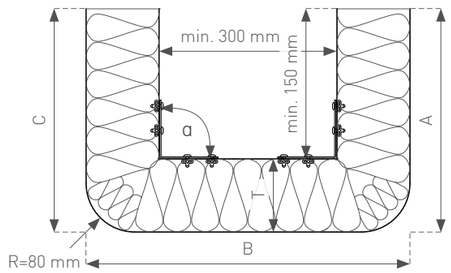


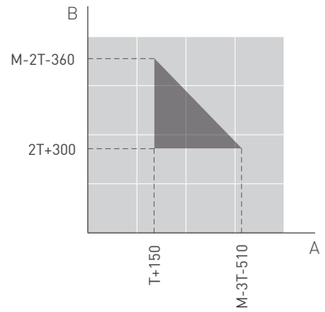


L - Length (mm)
M - Module width (mm)
T - Panel thickness

Longitudinal rounded U-corner element

Panel thickness [T]	50-133 mm
L_{max}	10,000 mm
$(A+B+C)_{max}$	M-60 mm
B_{min}	2T+300 mm
A_{min}/C_{min}	T+150 mm
angle [α]	90°-175°



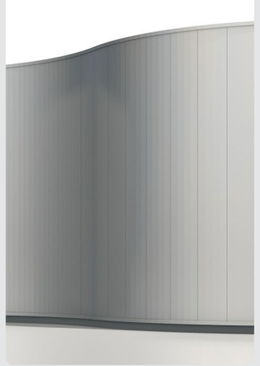


B

B4.2 Trimoterm FTV HL curved elements

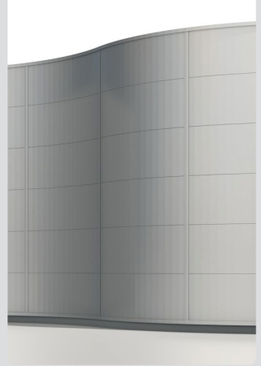
With Trimoterm panels, you can achieve curved shapes on façades using two methods:

- Installing flat panels in a curved shape without the need for special elements.
- Using segmentally curved elements.



Segmented elements
Longitudinal

Curvature is achieved with segmentally curved elements in the longitudinal direction. Visible lines may occur depending on the radius and steel sheet profile - check the limits on the following pages.



Segmented elements
Transversal

Curvature is achieved with segmentally curved elements in the transversal direction. Visible lines may occur depending on the radius and steel sheet profile - check the limits on the following pages.

B

Segmentally curved elements

From the basic Trimoterm FTV HL mineral wool sandwich panel, we can prefabricate segmentally curved elements as shown on the following pages. Specific geometrical limitations are given separately for each element. Please also consider the additional notes and warnings.

A - External surface of a curved element

The external surface of the element remains intact, but visible lines may appear where cuts are made on the internal side, as these lines can transfer to the outside. The density of the visible lines depends on:

- the radius (larger radiuses result in fewer visible lines) and
- the steel sheet profile (refer to the table for each element).

B - Internal surface of a curved element

During manufacture, the internal side of the element is segmented and the cuts are sealed with tape. Additionally, the panel is reinforced with straps placed perpendicular to the cut lines.

If the surface will be visible from the inside, we can, upon request, install straps parallel to the cut lines in the same colour as the steel sheet to make the surface more aesthetically pleasing.

! NOTES & WARNINGS

- The internal surface of the curved element has visible reinforcements
- The external surface of the curved element has visible bending lines
- Curved elements are made from Trimoterm FTV HL panels that are produced together with other flat façade panels.
- Consider the feasibility of use for specific projects, in terms of structural capacity, fire-related requirements etc.

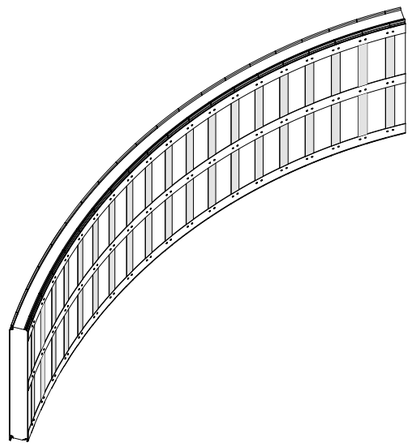


Fig. 2.5: Internal side of a segmentally curved element – perpendicular straps

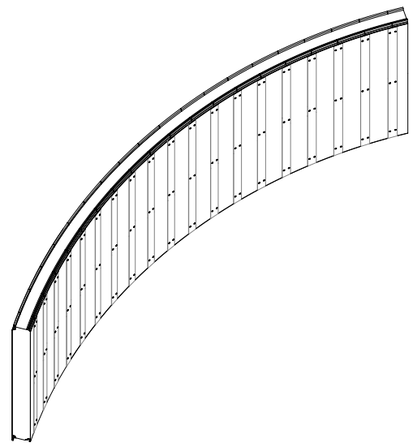
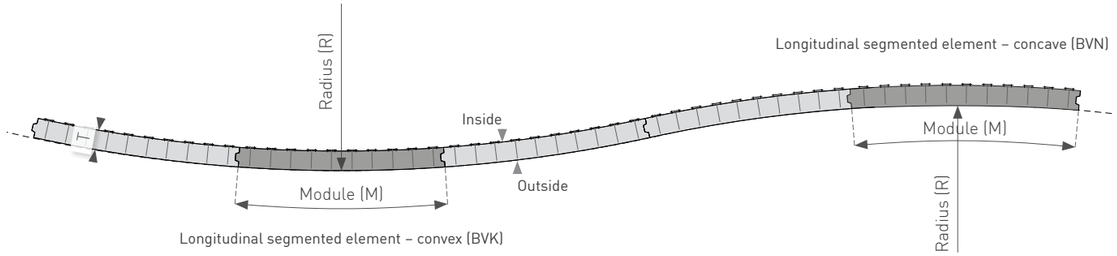


Fig. 2.6: Internal side of a segmentally curved element – parallel straps (upon request)

B

Longitudinal segmented elements



L_{max}	6,000 mm
Recommended support distance	2,000 mm
Module (M)	600-1,100 mm

Minimal radius (R) at panel thickness (T)	
T [mm]	R_{min} [m]
60	1.5
80	1.9
100	2.4
120	2.9
133	3.2
150	3.5
172	4.1
200	4.8
220	5.2
240	5.6
250*	6.0

* For the French and German markets, consult Trimo's technical support to ensure compliance with regional legislation.

Visibility of bending lines on the external side	
Steel sheet profile	Bending line visibility
S (standard) profile	Bending lines visible
G (smooth) profile	Bending lines visible
V, V2 profile	Bending lines visible
M, M2, M3, M8 (micro-lined) profile	Bending lines less visible

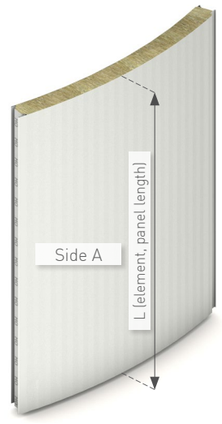


Fig. 2.7: Longitudinal segmented element – convex

Fig. 2.8: Longitudinal segmented element – concave

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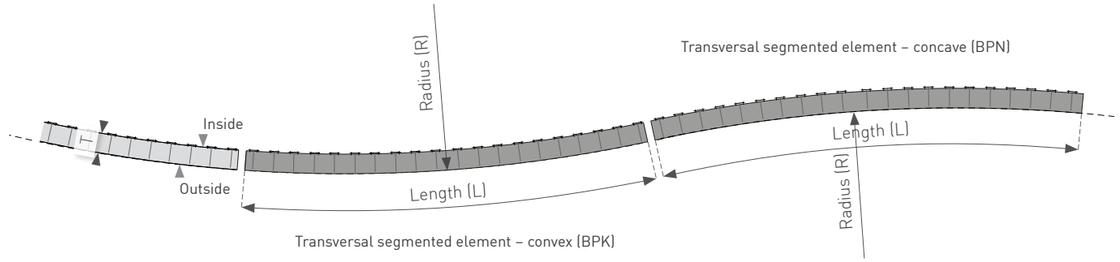
B

Transversal segmented elements



L_{max}	4,000 mm
Module (M)	600-1,100 mm

Minimal radius (R) at panel thickness (T)	
T [mm]	R_{min} [m]
60	3.0
80	3.9
100	4.9
120	5.9
133	6.5
150	7.3
172	8.4
200	9.8
220	11.5
240	12.5
250*	13.0

* For the French and German markets, consult Trimo's technical support to ensure compliance with regional legislation.

Visibility of bending lines on the external side (A)	
Steel sheet profile	Bending line visibility
S (standard) profile	Bending lines visible
G (smooth) profile	Bending lines visible
V, V2 profile	Bending lines visible
M, M2, M3, M8 (micro-lined) profile	Bending lines visible

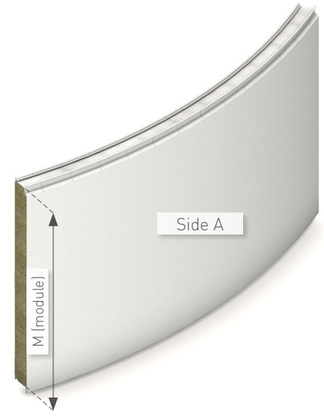


Fig. 2.9: Transversal segmented element – convex

Fig. 3.0: Transversal segmented element – concave

ID_TID6PB102EN

B

B4.4 Trimoterm FTV HL & ArtMe

ArtMe is a custom external façade face that allows a wide range of shapes, patterns, and visual effects to be expressed for dramatic, individual, creative results. It enables many design possibilities - from pictures to inscriptions, logos, brands, and bespoke creations.

By using highly controlled 3D-forming technology, an embossed design is achieved without any need for adhesives, additional elements, or structural devices. And most importantly, the original structural integrity and characteristics of the façade elements are preserved without compromise.

For more design options and instructions, go to:

ArtMe technical guide

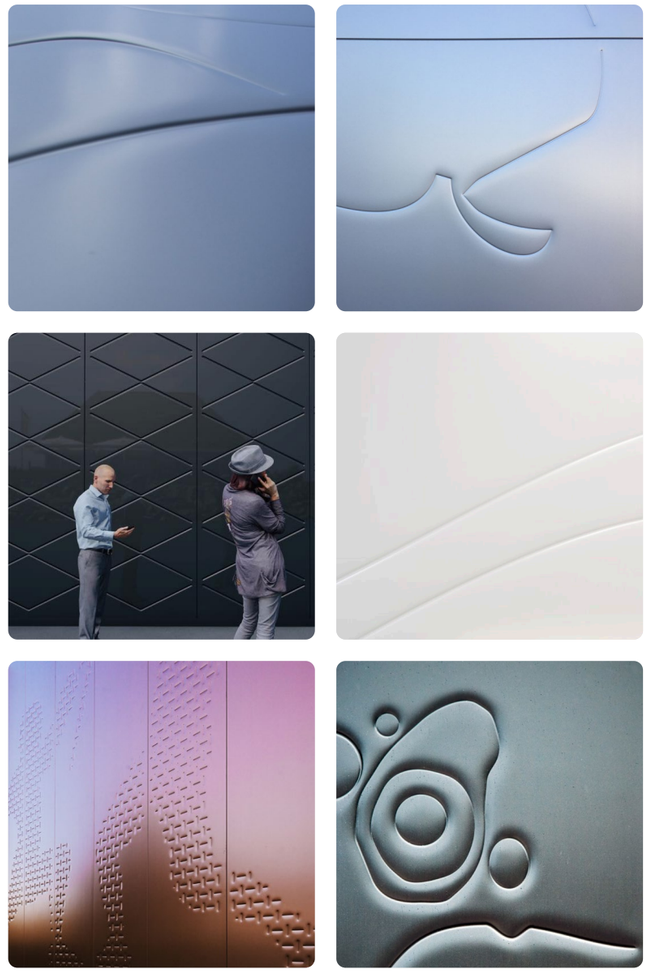


Fig. 3.1

Jodrell Bank Centre for Astrophysics, United Kingdom

C
Insulated panel system

C1 System composition

Performance benefits

- Complete envelope system,
- One vendor system,
- Multiple installation options,
- Optimal build speed,
- Design flexibility and aesthetic appeal,
- Superior thermal performance,
- System airtightness and watertightness

C1.1 Complete building envelope system

Trimoterm FTV HL panels offer a comprehensive solution for building envelopes, combining all the benefits of high-quality façades. With elements prefabricated and produced using the latest technology, the Trimoterm FTV HL panel system guarantees excellent thermal and sound insulation.

45-50%

Cut on-site time

Prefabricated panels can be quickly assembled on site, significantly reducing construction time.

Traditional methods typically involve more on-site work, which can be time-consuming and subject to delays due to weather or other factors.

C

C1.2 Panel orientation

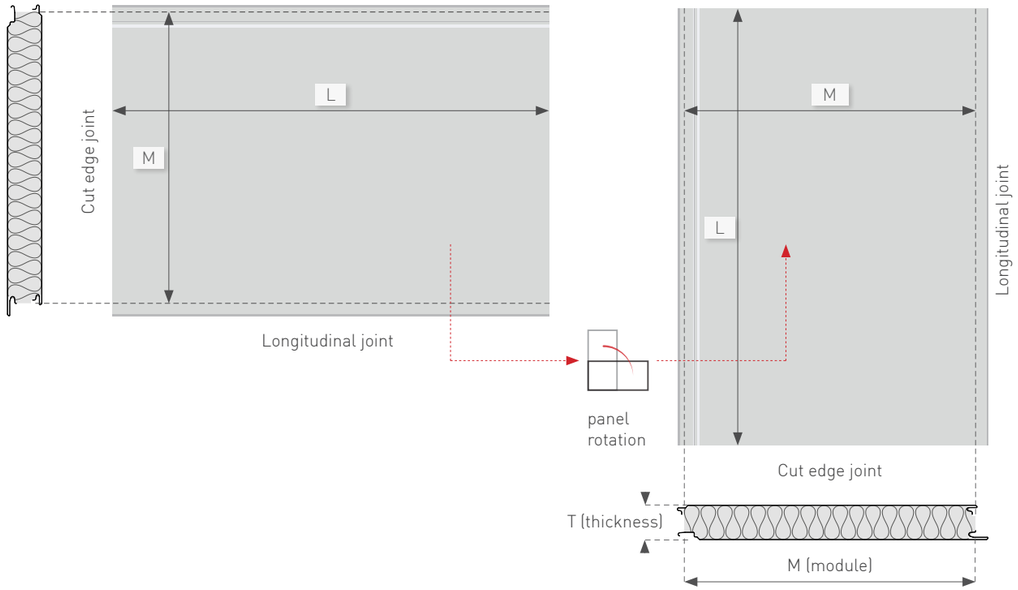
Trimoterm FTV HL panels can be installed in two primary orientations: vertical and horizontal. Panels can be rotated from horizontal to vertical in any direction, typically considered as counterclockwise (CCW) rotation.

• Trimoterm FTV HL horizontal orientation

Panels are installed horizontally. Horizontal joints are managed using the tongue and groove system of the panels. Vertical joints are managed with a prolongation detail, as explained in the following chapters.

• Trimoterm FTV HL vertical orientation

Panels are installed vertically. Horizontal joints are managed with a prolongation detail, as explained in the following chapters. Vertical joints are managed using the tongue and groove system of the panels.



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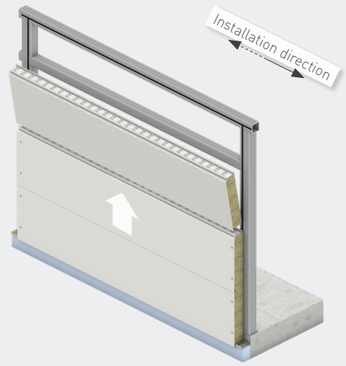
C

C1.3 Installation direction

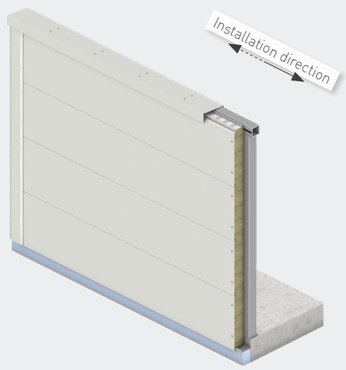
The panels can be installed in both left-to-right and right-to-left directions, providing versatility in planning and execution. However, it is crucial to note that the installation must always proceed from the bottom to the top. Installing elements from top to bottom is not permitted, as it may compromise the integrity and performance of the system.

HORIZONTAL PANEL ORIENTATION

Column installation
Installation direction: LEFT>RIGHT or RIGHT>LEFT

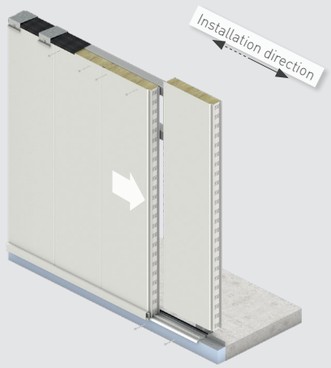


Column installation complete
Installation direction: LEFT>RIGHT or RIGHT>LEFT



VERTICAL PANEL ORIENTATION

Row installation
Installation direction: LEFT>RIGHT or RIGHT>LEFT *



Row installation complete
Installation direction: LEFT>RIGHT or RIGHT>LEFT *

* True if the following are respected:

- Panel rotation to change direction,
- Proper design of corner elements,
- Compliance with Trimo's technical documentation.

ID_TID6PB102EN

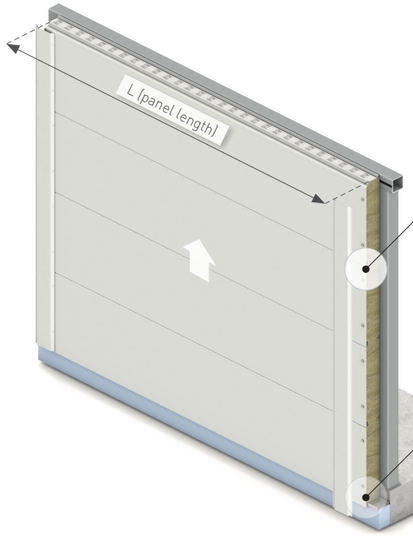
C

HORIZONTAL ORIENTATION of Trimoterm FTV HL panels

External wall application

• SINGLE-SPAN

In a single-span system, panels are only fixed at their ends, with the maximum allowed span determined by static calculations based on expected wind loads.



Prolongation

Cut edge available with:
- Steel flashing,
- Aluminium profile HF 102,
- Aluminium profile HF 140.

For more, see pages 56 and 57.
Available details:

TI-H-01

See design details: www.trimo-group.com

Drip detail

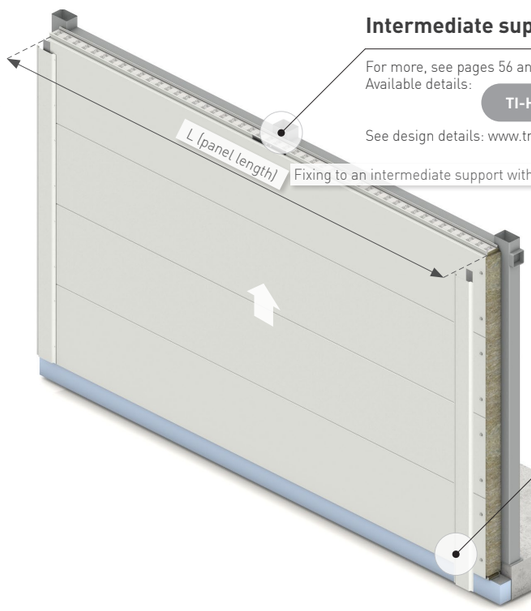
Available details:

TI-H-02

See design details: www.trimo-group.com

• MULTI-SPAN

In a multi-span panel system, the panels are fixed both at the end supports and at the intermediate supports. (fastening to steel substructure is done with min. two fasteners - through spreader plate 300). The maximum allowed spans between supports are defined by static calculations according to the expected wind and temperature loads.



Intermediate support

For more, see pages 56 and 57.
Available details:

TI-H-01

See design details: www.trimo-group.com

Substructure

Any steel structure to which panels are fixed should comply with ENV 1090-1 or with Trimo's internal requirements. For more information about the main structure and substructure principles, see pages 56 and 57.

Drip detail

Available details:

TI-H-02

See design details: www.trimo-group.com

C

VERTICAL ORIENTATION of Trimoterm FTV HL panels

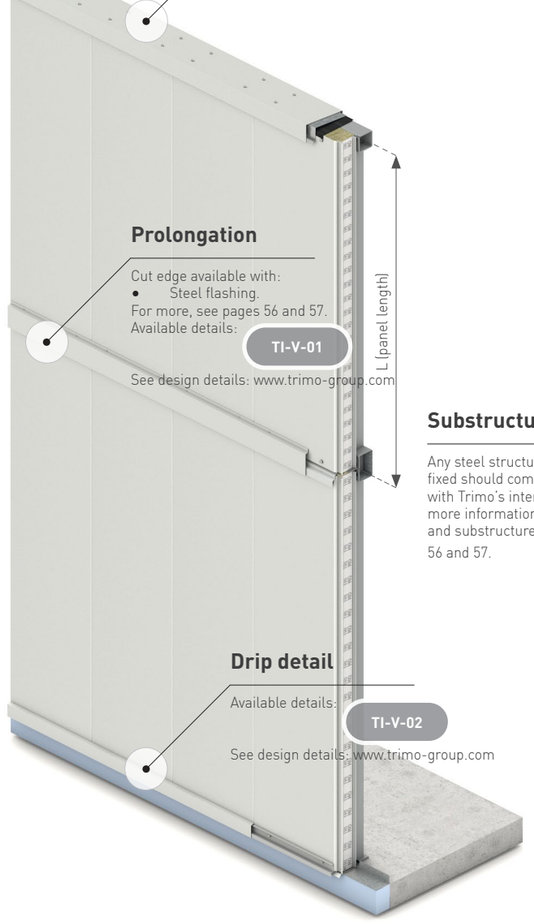
External wall application

• SINGLE-SPAN

In a single-span system, panels are only fixed at their ends, with the maximum allowed span determined by static calculations based on expected wind loads.

Parapet detail

Available details: TI-V-03,
See design details: www.trimo-group.com



Prolongation

Cut edge available with:
- Steel flashing.

For more, see pages 56 and 57.
Available details:

TI-V-01

See design details: www.trimo-group.com

Substructure

Any steel structure to which panels are fixed should comply with ENV 1090-1 or with Trimo's internal requirements. For more information about main structure and substructure principles, see pages 56 and 57.

Drip detail

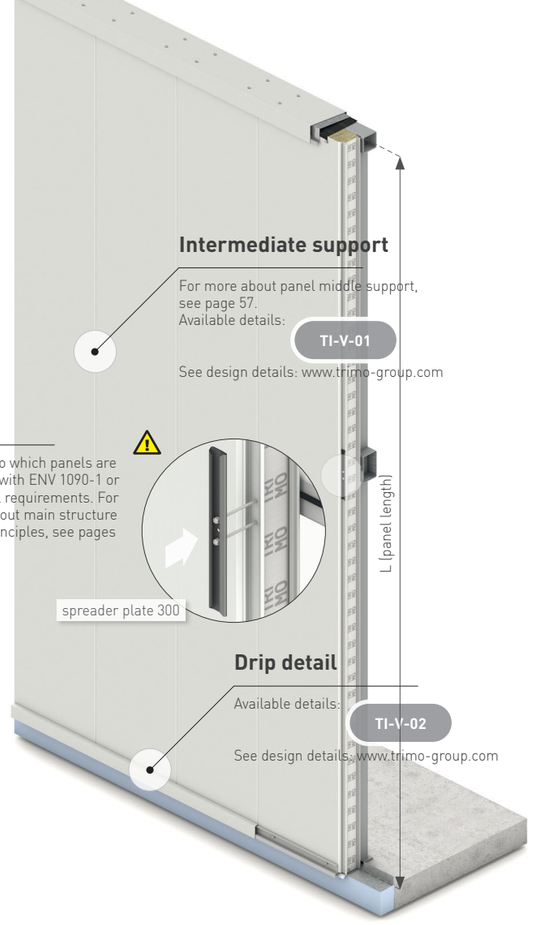
Available details:

TI-V-02

See design details: www.trimo-group.com

• MULTI-SPAN

In a multi-span panel system, the panels are fixed both at the end supports and at the intermediate supports. (fastening to steel substructure is done with min. two fasteners - through spreader plate 300). The maximum allowed spans between supports are defined by static calculations according to the expected wind and temperature loads.



Intermediate support

For more about panel middle support, see page 57.
Available details:

TI-V-01

See design details: www.trimo-group.com

Drip detail

Available details:

TI-V-02

See design details: www.trimo-group.com

C

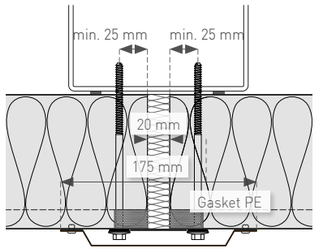
C2 Joints, prolongation and fastening

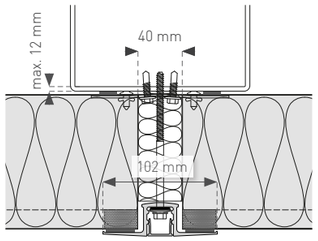
C2.1 Joints and prolongations

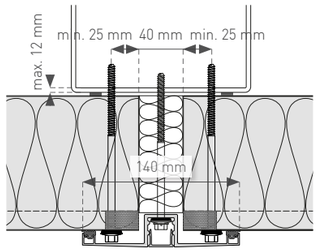
To achieve a basic prolongation, each panel should be secured with fasteners and covered with flashing, its gap filled with mineral wool and its watertightness ensured. Aside from standard flashing prolongation, there are two additional options for horizontally oriented panels, both of which use aluminium profiles (HF102 and HF140), offering a more aesthetically pleasing appearance.

For further details, refer to the descriptions of each prolongation type below.

HORIZONTAL CUT

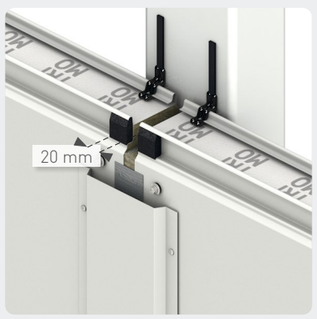






Prolongation with flashing

- **Fastening /** Screws (19 mm washer),
- **Colour /** Flashing can match the colour of the panel,
- **Spacing /** Free space between the panels: 20 mm,
- **Sealing /** Outside sealing with va-pour-permeable tape, inside sealing with PE sealing tape



Horizontal panel

Prolongation with HF 102 Aluminium profile

- **Fastening /** HF 102 aluminium profile and screws (16 mm washer),
- **Colour /** HF 102 is powder-coated in any agreed colour (on request, the cover profile can be in another colour),
- **Spacing /** Free space between the panels: 40 mm,
- **Sealing /** Outside sealing on HF 102, inside sealing with PE sealing tape

Horizontal panel

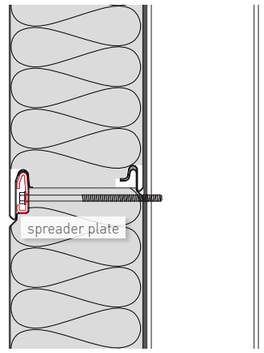
Prolongation with HF 140 Aluminium profile

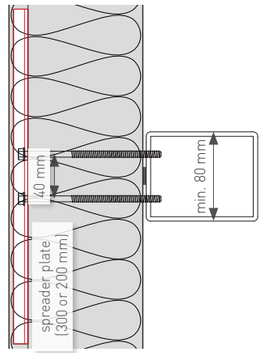
- **Fastening /** Screws (19 mm washer),
- **Colour /** HF 140 is powder coated in any agreed colour (on request, the cover profile can be in another colour),
- **Spacing /** Free space between the panels: 40 mm,
- **Sealing /** Outside sealing with HF 140, inside sealing with PE sealing tape

Horizontal panel

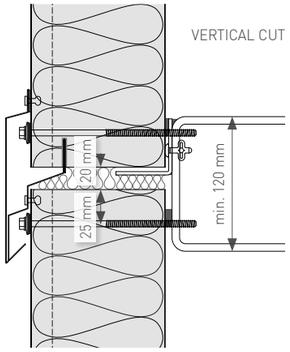
C

Trimoterm FTV HL system design details



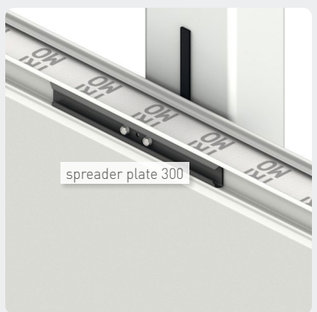


VERTICAL CUT



Intermediate support (multi-span system)

- **Fastening /** Screws without a washer through spreader plate. Using high-thread screw for intermediate fixing of FTV HL panels is not allowed.



Horizontal panel

Edge and intermediate support (multi-span system)

- **Fastening /** Screws without a washer through spreader plate 300. Using high-thread screw for intermediate fixing of FTV HL panels is not allowed.

Vertical panel

Prolongation with flashing

- **Fastening /** Fastening with screws (19 mm washer)
- **Colour /** Flashing can match the colour of the panel
- **Spacing /** Free space between the panels: 20 mm
- **Sealing /** Outside sealing with drip flashing, inside sealing with PE sealing tape

Vertical panel

C

C2.2 Fastening

Fasteners must be subject to static calculation to guarantee resistance to the stresses induced by both permanent and dynamic loads. In accordance with the instructions of the screw producer, the fastener length depends on the panel thickness, the type of detail, and the type of substructure. It is the responsibility of the designer/installer to choose the type, number, and position of the fasteners.

Special attention is needed when tightening the fasteners in order to ensure that they are not under- or over-tightened.

Screws of types A and B are used for fixing the panel to a steel substructure. A hole with a suitable diameter must be drilled through the panel and substructure in accordance with the instructions of the screw producer. The preliminary drilling of holes is not allowed for screws of type C.

For a list of fasteners compatible with Trimoterm panels, please refer to the Trimo Accessories Catalogue. Using stainless steel fasteners is the default selection for the fastening of Trimoterm FTV HL panels.

Trimo accessories catalogue

The fasteners play a crucial role in securely anchoring the Trimoterm FTV HL panel to the supporting structure. Typically, screws are used as fastening elements, and are chosen based on specific factors such as panel thickness, substructure thickness, and material. An exception to this is the HF102 profile, which not only serves a decorative purpose but also provides structural support.

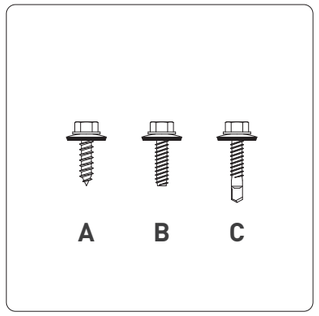


Fig. 3.2: Fixing screw types ABC.

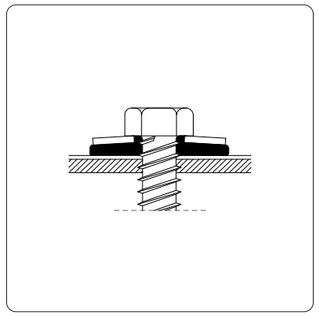


Fig. 3.3: Correctly tightened fastener.

! NOTES & WARNINGS

Fastener lengths are based on a particular fastener supplier. Please check with your own supplier for the required lengths based on the exact design case.

C

See below for a more detailed explanation of each fastening method.

A. Fastening with screws

- This method is suitable for fire resistance requirements.
- Screws take vertical (weight) and horizontal (wind, thermal) loads from the panel.
- So-called fastening through the panel requires a 19 mm washer (or bigger) and an EPDM gasket underneath.
- For visible fastening (where the fastener heads are not covered with flashing or alu profile), screws with a high thread are required.
- The number of fasteners per panel can be defined by Trimo based on the individual static calculation for each project.

B. Fastening with HF 102 Aluminium profile

- HF 102 profile takes horizontal loads (wind). For vertical loads (weight), short fasteners* are installed in the internal steel sheet.
- Hidden fasteners in the HF 102 profile must have 16 mm washers and EPDM gaskets underneath.
- The number of fasteners in HF 102 (pcs/m) can be defined by Trimo based on the individual static calculation for each project.

* An additional steel plate is riveted to the internal steel sheet to facilitate the installation of a short screw.

Fig. 3.6: Carrying the vertical load.

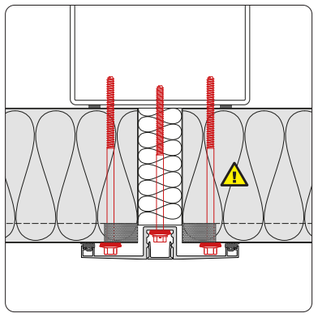


Fig. 3.4: Fastening principle A, fixing with screws.

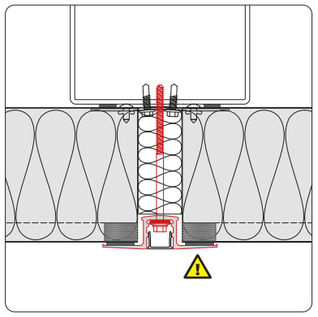


Fig. 3.5: Fastening principle B, fixing with HF 102 Aluminium profile.

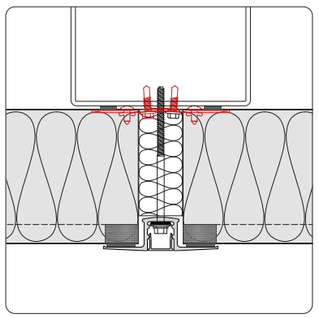


Fig. 3.7: Short fastener in combination with a steel plate.

C2.3 What the Trimoterm FTV HL spreader plate is

The spreader plate is a special structural steel accessory used when installing Trimoterm FTV HL façade panels. Its primary function is to spread the load of the panel's attachment screws over a larger support area. Trimoterm FTV HL panels use a hidden-joint system and attach to intermediate supports in a different way to standard FTV panels. The spreader plate ensures:

A. Load distribution

The spreader plate increases the load distribution area of each fixing point, preventing:

- panel indentation,
- local buckling,
- excessive point loading on sub-structure connections.

B. Multi-span flat façade

In a multi-span panel system, the panels are fixed both at the end supports and at the intermediate supports. The spreader plate is designed to function as an integral part of the intermediate fixing detail.

C. Ensuring the "hidden joint" function

The spreader plate and fasteners sit beneath the overlapping panel edge and are not visible on the finished façade.

Type and number of screws

The number and spacing of fasteners at each intermediate support is determined by the substructure thickness and the static calculation. In general, 2 to 3 screws are required for each spreader plate. Always check that the radius of the fastener corresponds to the radius of the hole in the spreader plate.

High thread screws are not allowed for intermediate fixing of Trimoterm FTV HL panels.

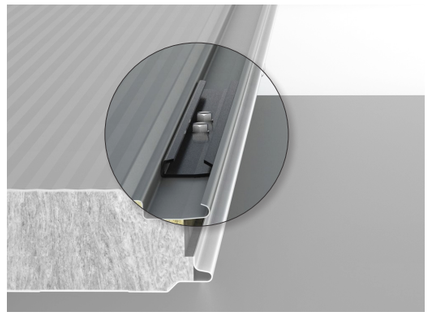


Fig. 3.8: Spreader plate 300 in vertically laid panels.

! NOTES & WARNINGS

The FTV HL spreader plate is a standard and integral part of the intermediate fixing detail. Its consistent use helps ensure that load transfer and panel performance remain in line with the intended behaviour of the Trimoterm FTV HL system and with the corresponding installation guidelines.

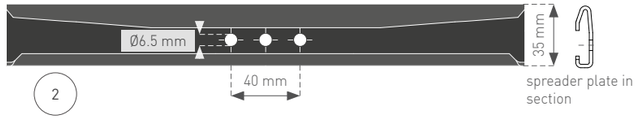
Fastening with spreader plate on the panel edge

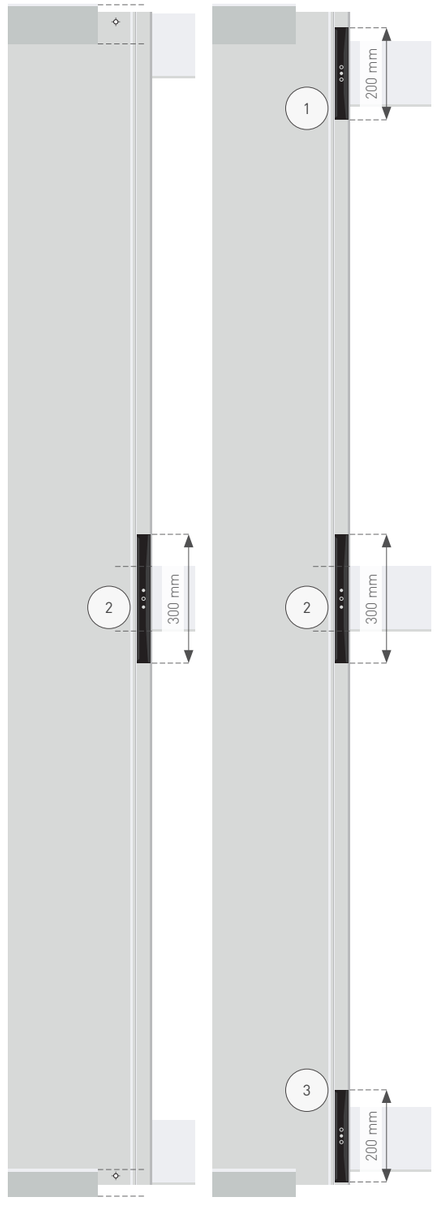
Although the Trimoterm spreader plate is primarily intended for intermediate supports, it can also be used for edge fixing in specific installation scenarios. When applied at the panel edge, the spreader plate eliminates the need for standard cut-edge fastening.

The edge spreader plate differs from the intermediate version in its dimensions. See the vertical panel diagram on the right for an illustration of where spreader plates may be used.

1. Edge spreader plate 200 length: 200 mm
2. Intermediate spreader plate 300 length: 300 mm

The type, number, and spacing of screws at each edge support depend on the substructure thickness and the static calculation. As a general guideline, a single screw is required at the upper or lower edge spreader bar unless otherwise specified.





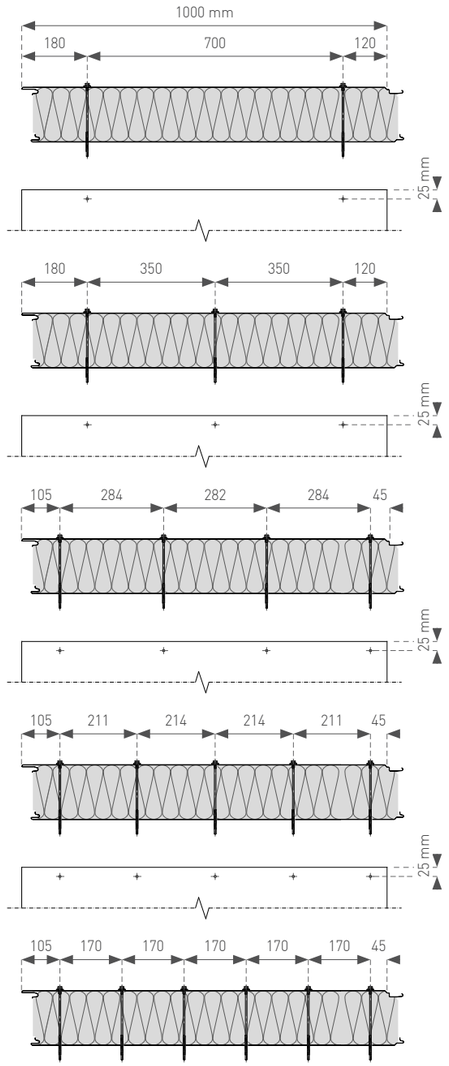
1. Panel edge spreader plate 200
2. Intermediate spreader plate 300
3. Drip panel edge spreader plate 200

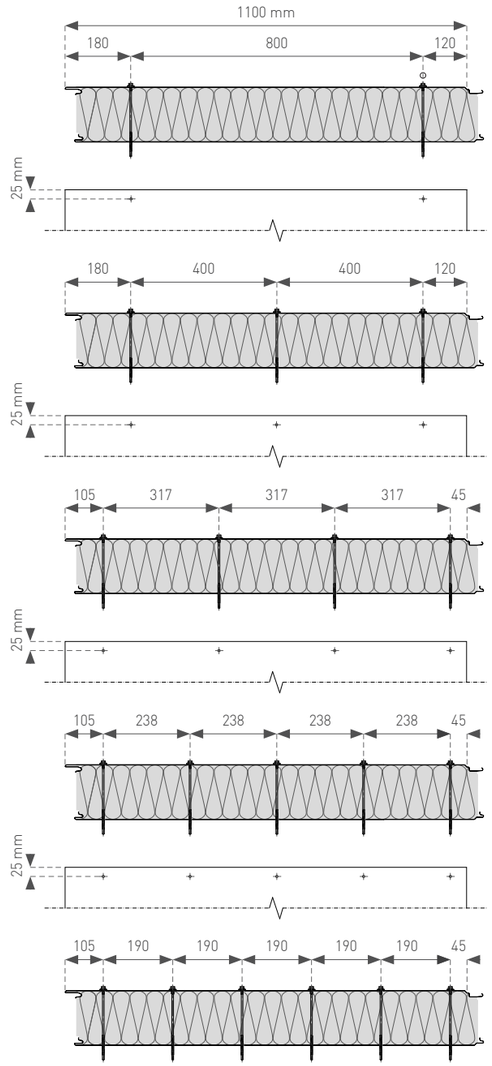
Pověe Metal d.o.o., Slovenia

C

C2.4 Fastening scheme on the panel edge

A scheme for fastening on the Trimoterm FTV HL panel edge for 1000 and 1100 mm width panels is presented below. The minimum number of fasteners is 2 pcs per panel end. The fastenings must be placed at a minimum distance of 25 mm from the cut edges of the panel.





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C2.5 Aluminium elements: decorative and prolongation

Trimo decorative profiles emphasise the selected façade line, cover visible panel joints, and give the building a touch of elegance. You can choose from various options manufactured from extruded and powder-coated aluminium.

Discover two types of aluminium profiles, each offering unique technical properties. All values are stated in millimetres.

- **Prolongation aluminium profiles**
  (for further information, see chapter C2)
- **Decorative aluminium profiles**

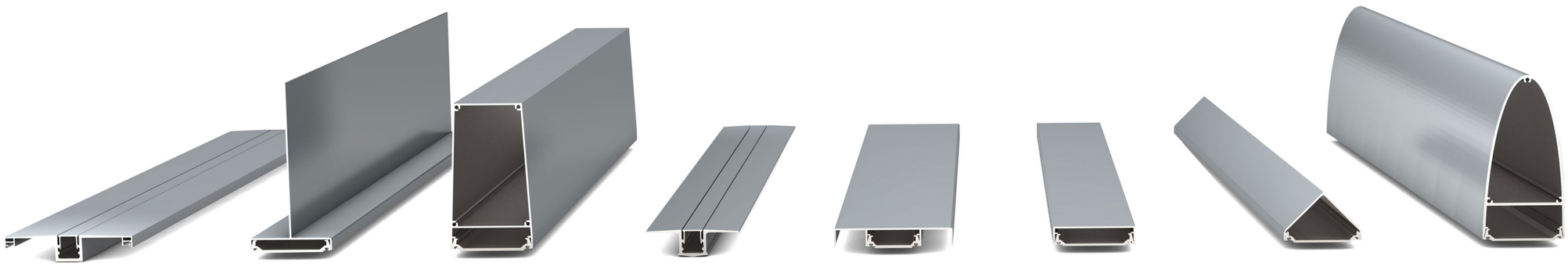
Installation of decorative aluminium profiles

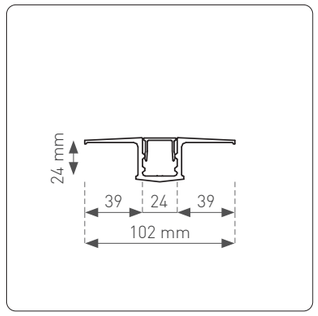
Each decorative profile consists of a support part and a cover (bottom and top part). The elements measure 6 m in length. In general, the installation procedure is the same for all decorative aluminium elements except for element HF7, where the installation procedure is slightly different due to the shape of the element support part.

For the applications listed below and other decorative aluminium element applications, see project specific details or system design details.

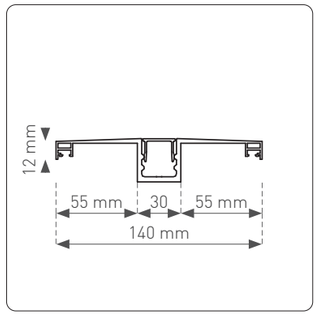
- Base detail
- Parapet wall cap
- Window framing
- Façade decoration

Trimoterm FTV HL system design details

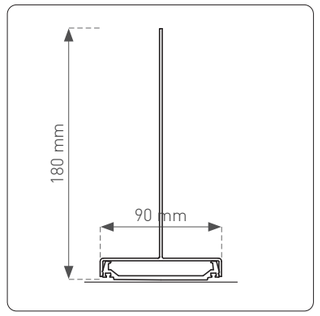




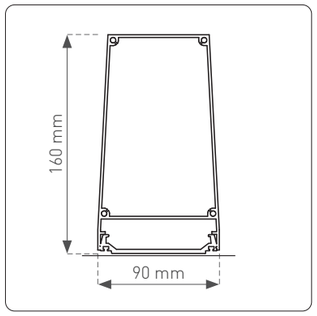
HF102 - Prolongation profile (supporting)



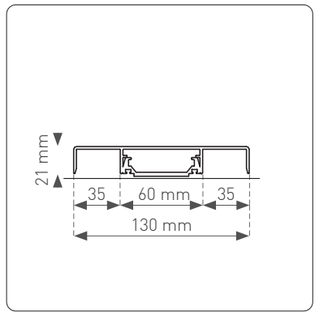
HF140 - Prolongation profile (covering)



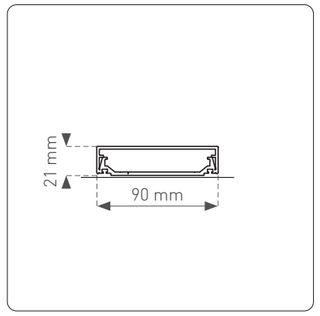
HF1 - Decorative profile



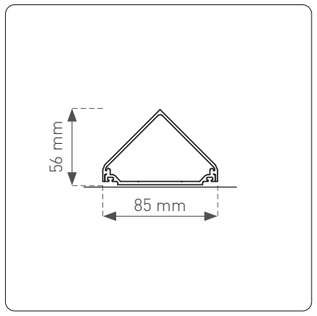
HF2 - Decorative profile



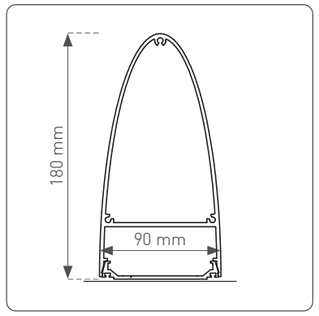
HF4 - Decorative profile



HF5 - Decorative profile



HF7 - Decorative profile



HF8 - Decorative profile

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C

C3 Substructure

The substructure of Trimoterm panels plays a crucial role in the overall performance and aesthetics of the façade. It serves multiple functions, including:

1. Load-bearing capacity
Every substructure must be statically verified by a structural engineer to ensure it can support the required loads.

2. Shape
The substructure significantly influences the flatness of the façade. Therefore, it is crucial that it is manufactured within precise tolerances.

3. Appearance
The substructure is often visible from the interior and contributes to the overall interior design. As a result, it can be made in various shapes and materials to suit different aesthetic preferences.

C3.1 Types of load-bearing structure

Steel is the most commonly used material for substructures. However, substructures can also be made from concrete or wood. Depending on the chosen construction, it is essential to ensure proper fastening of Trimoterm panels. For concrete and timber structures, an additional Fast Adjustable Levelling Substructure (FALS) is often employed to accommodate tolerances and fixing conditions.

Fig. 3.8: Steel structure within permissible tolerances

Fig. 3.9: Concrete structure within permissible tolerances (for single-span systems only!)

Fig. 4.0: Laminated wood structure

Fig. 4.1: Concrete structure with FALS

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C3.2 Substructure tolerances

When installing the panels, the prescribed tolerances of the load-bearing structure must be observed (IFBS guideline PA 09 - Performance tolerance in light metal structures point 3.1.1). If these tolerances are not met, use a Fast Adjustable Levelling Substructure (FALS). See page 67.

1. support structure alignment
single-span system ± 2L / 1,000 (L-column axis distance)
multi-span system ± L / 1,000 (L-column axis distance)

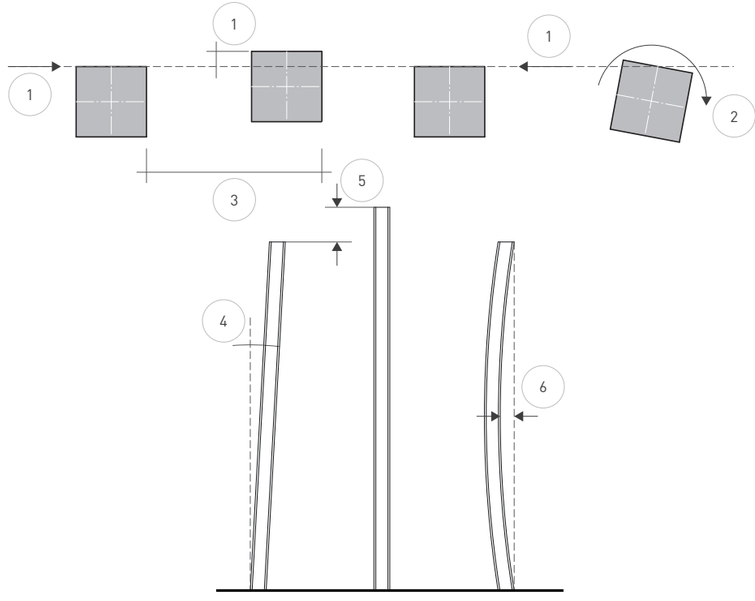
2. support structure torsion
single-span system ± 1°/ column torsion
multi-span system ± 0.5°

3. axis span tolerance
columns width <200: ± 10 mm / columns width >200: ± 20 mm

4. column inclination tolerances
± 1°

5. column height difference tolerance
± 20 mm

6. column curvature tolerance
± 10.0 mm / 10 m



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C3.4 Fast adjustable levelling substructure (FALS)

FALS is used to level out the main structure of the building or supporting wall in order to install the Trimoterm FTV HL mineral wool sandwich panel façade system.

The distances between anchor fasteners must be determined in accordance with a static calculation based on the properties of the building, on wind loads, on anchor type, and on the quality of the load-bearing structure. Support frames are fixed to the structure using certified anchor fasteners.

FALS components

FALS-B top view

FALS-A top view

120 / A55 / C - 4 - L120

- Length of profile FALS-A (=L120/L140)
- Thickness of profile FALS-A (= 4 or 5 mm)
- Fastening to a concrete (C) or steel (S) structure
- Height of profile FALS-B (= B55/B75)
- Width of a suitable profile FALS-B (= 120/140/160)

B55 - 2 / 120

- Width of profile FALS-B (= 120/140/160)
- Thickness of profile FALS-B (= 2 or 3 mm)
- Height of profile FALS-B (= B55/B65)

FALS

A quick mounting system

Fast adjustable levelling substructure (FALS), a quick mounting system, is suitable for use on uneven concrete or steel structures in order to achieve a finished level surface without additional welding and without adding material to the support structure.

C

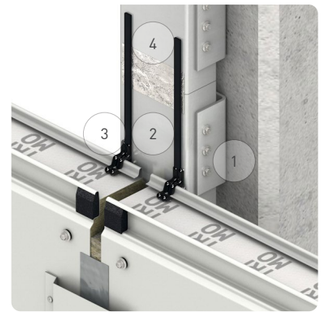
FALS offsets from the base structure

	Neutral	Minimal	Maximal
A55 / B55	70	60	85
A75 / B65	90	75	115
(A75 / B55)*	90	75	105

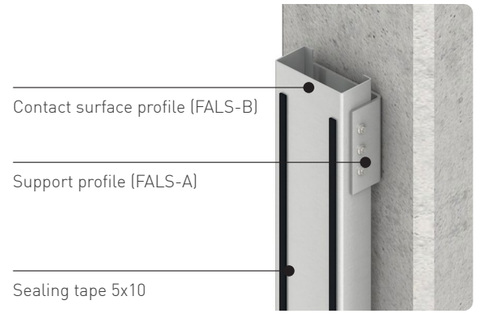
* Optional
All measurements are in millimetres (mm).

For the full FALS element range, see the Trimo accessories catalogue.

Trimo accessories catalogue



1. Support profile (FALS-A)
2. Contact surface profile (FALS-B)
3. Sealing tape 5x10
4. Adhesive tape Alu-PET



C

C4 System sealing

By sealing the façade envelope, we ensure airtightness and increase the energy efficiency of the building due to the associated lower heat losses.

In addition, by sealing the details properly, we prevent the retention of water in the core of the panel. This is achieved in two ways:

- By preventing the passage of water vapour from the hot side to the cold side. This prevents condensation from forming in the core.
- By preventing the ingress of rainwater or other water that appears on the surface of the façade (washing or wet rooms).

To enable water drainage means, the tongue of the longitudinal joint must face upwards. Sealing of the Trimoterm façade is achieved by using various elements:

1. Factory applied gaskets in the longitudinal joint
All Trimoterm panels come with EPDM gaskets pre-installed in the longitudinal joint groove. The gaskets must be compressed by the tongue of the neighbouring panel. In horizontal installations, the self-weight of the panel helps achieve this compression. For vertical installations, it is recommended to use a mechanical tool to assist in compressing the panels.

2. Longitudinal sealing tape between the panel and other steel elements (substructure or flashings)
Sealing tape ensures proper sealing between the panel and the substructure, as well as between the covering flashing and the panel. These self-adhesive tapes should be installed in place before panel installation. They come in various sizes and materials. If the sealing tape is expected to be exposed to sunlight and to the outdoor environment, EPDM material is recommended. Otherwise, PE materials are used.

3. Mastic sealant to seal possible points of water ingress into the panel
Mastic sealant is typically applied to the panel ends at the tongue joint. Before using the sealant for the first time, perform a compatibility test on a hidden part of the panel. Handle with care to avoid staining the visible surface.

4. Flashings or HF Alu. profiles in combination with sealing tapes
Flashings or HF Aluminium profiles can serve as a water barrier and are typically installed on the outer (cold) side of the façade. In combination with sealing tapes, they are commonly used in panel prolongations and internal corners. Profile drip flashing inserted at the lower part of the joint gap allows water to drain.

5. Membranes and tapes
Vapour-permeable elements are installed on the cold side of the façade to ensure that the system dries and to prevent moisture accumulation in the panel core. Vapour-tight elements are installed on the warm side of the façade to prevent water vapour from entering the panel core.

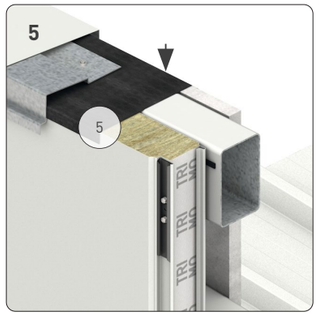


Fig. 4.2: TI-V-03.01 parapet wall sealing

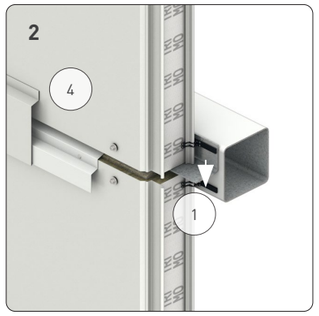


Fig. 4.3: TE-V-01.02 joint sealing elements

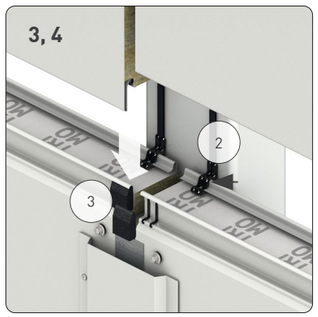


Fig. 4.4: TI-H-01.03 joint sealing elements

1. Self-adhesive sealing tape 5x10xL
2. Mastic seal
3. Gasket PE
4. Prolongation with steel flashing
5. Waterproof membrane or tape
6. Profile drip flashing

C

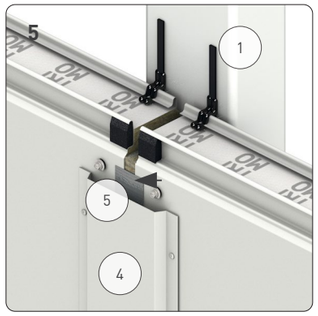


Fig. 4.5: TI-H-01.01 cut joint sealing

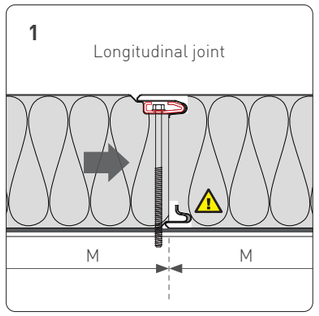


Fig. 4.8: Joint with sealing tubes compressed

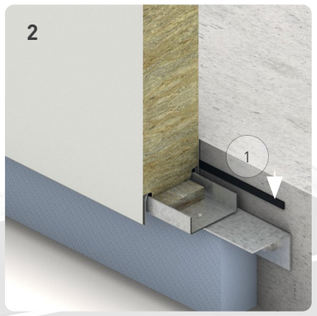


Fig. 4.6: TI-H-02.02 Joint base sealing elements

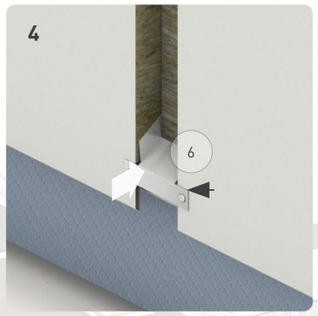


Fig. 4.7: TI-H-05.01 internal corner sealing elements

! NOTES & WARNINGS

Trimoterm façade panels must be protected from water and other liquids seeping into the insulation during unloading and right through to the end of the installation.

It is the installer's responsibility to ensure that the panels are protected until the end of the installation. Trapped water/ moisture in the panels can cause unfavourable internal corrosion in the panels. Panels should not be installed during snow, rain, or dense fog.

C5 Structural design and application of façade panels

The following chapter provides guidelines for the static calculation of Trimoterm FTV HL panels and additional façade elements. The text below presents basic information required for determining façade penetrations, spans, and fastenings.

C5.1 Static calculation

Static calculation of Trimoterm FTV HL panels is required in accordance with applicable legislation (EN 14509) and other national technical regulations for sandwich panel design. The dimensions and spans of the selected panels, along with the number of required fixing screws and the locations of penetrations and openings, must be checked for each individual building. A static calculation for panel selection is available from Trimo technical support.

The calculation requires the following input data:

1. Building location and data linked to location
- Location and address,
- Wind zone or basic wind speed,
- Terrain category (categories 0, I, II, III, IV),

2. Geometry and type of building
- Building shape and dimensions (height, length, width),
- Building parapet,
- Locations of penetrations and openings,
- Building type (open / partially open / closed),
- Building safety class (if prescribed)

3. Panel data
- Panel thickness, width, and length,
- Panel spans (single-span, multi-span),
- Panel support distances,
- External and internal steel sheet colour,
- External and internal profile types

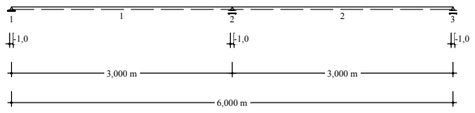
4. Permanent loads
- Additional layers (green façade, PV modules, or other decorative layers)

5. Additional input for the fastening calculation
- Type of fasteners required,
- Material and thickness of the substructure

How to read static calculations provided by Trimo?

1. STATIC SYSTEM

1.1 SKETCH



M = 1 : 50

wall-panel of 2 spans, horizontal installation.
-1: no definition from user. The necessary support width was determinated by the software.

1.2 PANEL SPECIFICATION

Sel. panel: Power T FTV HL MS 150 0,60 0,60 (outside-colour RAL 9007 = graualuminium)

Techn. Appr Z-10.49-625 from 24. 09. 2020 valid until 5. 04. 2029
Sandwichelemente "Trimoterm Power T" und "Qbiss One T" nach DIN EN 14509 mit einer Mineralwoll-Kernschicht zwischen Stahldeckschichten für Wand-, Deecken- und Dachkonstruktionen

2.2 INTRODUCED LOADS

1.	wind pressure over entire length	w_d = 0,600 kN/m2
2.	wind suction over entire length	w_s = -0,250 kN/m2
3.	summer temperatures for SLS	ϑ_{outs} = +63°C, ϑ_{ins} = +25°C
4.	summer temperatures for ULS	ϑ_{outs} = +80°C, ϑ_{ins} = +25°C
5.	winter temperatures	ϑ_{outs} = -20°C, ϑ_{ins} = +20°C

4.4 COMPRESSION STRESSES AT SUPPORT

The design of the compression stresses at the supports is carried out for each support with the decisive design procedure (ulitmate limit state, serviceability limit state, constructive demands).

support	$\gamma * A_S$ [1]	$\gamma * A_U$ [2]	exist. b [3]	$A_{SLS,rd}$ [4]	$A_{ULS,rd}$ [5]	req. b_S [6]	req. b_U [7]	req. b [8]	req. b_{dec} [9]
[-]	[kN/m]	[kN/m]	[cm]	[kN/m]	[kN/m]	[cm]	[cm]	[cm]	[cm]
1	1,50	1,35	-1,0	2,44	2,02	2,5	2,7	4,0	4,0
2	3,41	2,70	-1,0	3,67	3,02	5,6	5,4	6,0	6,0
3	1,50	1,35	-1,0	2,44	2,02	2,5	2,7	4,0	4,0

4.6.2 Design of tensile forces

The number of the required/chosen fasteners rely on the panel-width. Close attention must be paid to requirements of the basic calculation principle (screw-distance and -number etc.)!

panel-width:1000 mm in accordance with explicit user definition

support									
no	variation	material	tAA	asym.	Qty.	chosen fasteners	N_{Sd}	N_{Rd}	util.
-	-	-	[mm]	-	S/EL	-	[kN]	[kN]	
1	visible	S235	3,00	x	2	JT3-D-6H-5,5/6,3 x L (O19) [1]	1,93	3,29	58,6%
2	hidden	S235	3,00		2	JT3-6-5,5 x L (O -) LSP [2]	3,88	3,98	97,5%
3	visible	S235	4,00		2	JT3-D-6H-5,5/6,3 x L (O19) [3]	1,93	4,71	41,0%

explanations

asym. [x] - thin-walled und asymmetric sub-construction (e.g. Z- or C-shaped profiles).
LSP - load spreading plate

1) 2 × EJOT JT3-D-6H-5,5/6,3 x L (O19) w/ washer ETA-13/0177 ANX.5
2) 2 × EJOT JT3-6-5,5 x L (O ohne Dichtscheibe) C 300*35,7*9,8*6,5*2 ETA-13/0177 ANX.16
3) 2 × EJOT JT3-D-6H-5,5/6,3 x L (O19) w/ washer ETA-13/0177 ANX.5

1. INPUT DATA

A. Static system and panel selection

This section provides details on the static system used for the analysis, including the panel length and the positions of the supports. The panel specifications chapter contains all the relevant information about the selected panel.

1. INPUT DATA

B. Considered loads on the panel.

This section outlines the design loads applied to the panel.

2. RESULTS

A. Required minimum support widths

The minimum support width for each support is specified in centimetres. Please refer to the right-hand column of the table for these values.

2. RESULTS

C. Fasteners and spreader plate

This section specifies the fastening method for each support (visible/hidden), the type and number of fasteners for each support, and the type of LSP (Spreader Plate) for hidden fastening, as well as the thickness and type of the substructure.

Design tables of allowable spans

To assist in the pre-selection and design of Trimoterm panel façades, a table of allowed spans and minimum support widths for construction has been produced.

The data in these tables is intended for informational purposes only. The exact span between the supports must be calculated individually for each project.

According to the EN14509 standard, a min. support width of 40 mm is required for end supports and 60 mm for intermediate supports, unless a wider support is necessary. The required support width for each project is determined by static calculations.

Trimoterm structural design data document

C5.2 Additional façade elements installation

Additional façade elements in modern architecture have protective, environmental, commercial, or aesthetic purposes. They can be installed in the form of blinds, lights, security cameras, signs, advertisements, decorative elements, etc.

Starting points:

- **The options demonstrated apply to the external sheet thickness t = 0.70 mm.**
- It is necessary to ensure the most even distribution of additional equipment weight to the element.
- It is necessary to use min. 2 fasteners/equipment
- The minimum distance of fasteners/rivets from the edge of the panel and the minimum distance between fasteners/rivets needs to be more than 100 mm.
- The stated starting points apply to static loads. Fastening equipment causing dynamic loads is not allowed.
- Vertical load needs to be taken into account at the panel's design stage.
- Long consoles increase the pull-out forces on fasteners and rivets. Therefore, it's necessary to perform additional checks on the fasteners.

! NOTES & WARNINGS

External loads can affect panel behaviour during a fire. Consult a fire engineer about any additional façade elements when fire resistance is required.

Higher loads shall be distributed to more panels, supported with profiles, and translated to the load-bearing structure.

In any case, follow installation instructions provided by the supplier of the additional façade element.

C

Fastening to the external steel sheet

Weight of additional equipment 0 - 30 kg

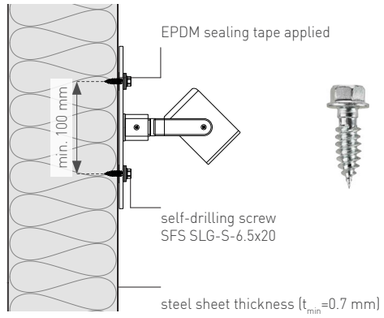


Fig. 4.9: Fastening with screws.

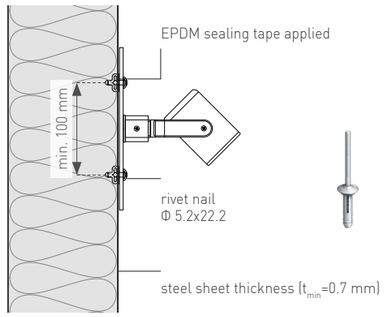


Fig. 5.0: Fastening with rivets.

Fastening through the element

Weight of additional equipment 30 - 50 kg

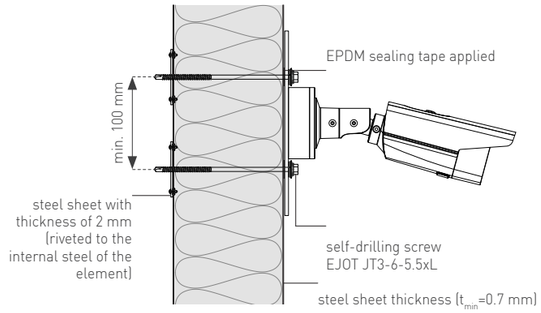


Fig. 5.1: Fastening through the panel to a 2 mm steel sheet with screws.

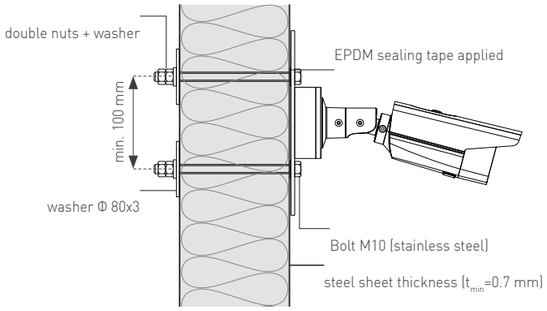


Fig. 5.2: Fastening through the panel with M10 bolts (stainless steel).

C

C5.3 Panel penetrations

In the building industry, penetrations are common. Trimoterm FTV HL sandwich panels can accommodate various cut-outs for pipes, windows, or doors. The guidance is consistent for both horizontal and vertical installation. Panels are delivered as full modules and must be cut on-site before installation using tools for "cold" cut-outs.

A.

The Trimoterm FTV HL panel can withstand openings without any additional reinforcement, as long as the utilisation of the panel's load-bearing capacity is not exceeded.

B.

When panel utilisation exceeds panel capacity, it is possible to transfer the excess amount to adjacent panels.

If the adjacent panels are also fully utilised, additional substructure is required to transfer the load directly onto the structure.

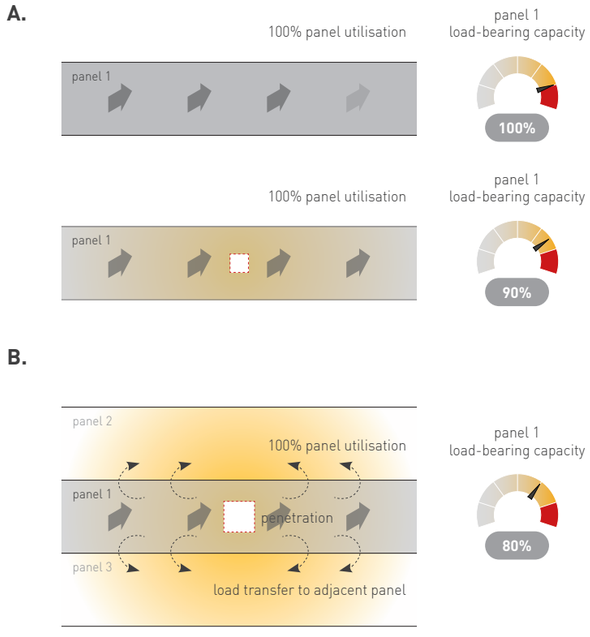


Fig. 5.3: Example of load distribution on a penetrated panel

Additional loads must be considered when sizing the adjacent panels. For load transfer factors, see the instructions below.

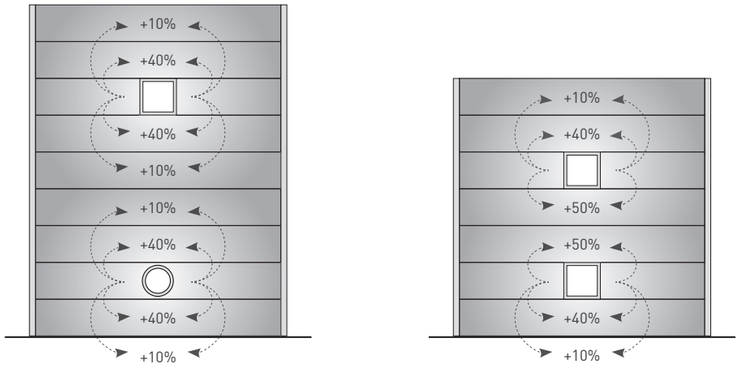


Fig. 5.4: Load transfer of a weakened panel to adjacent panels

Individual calculations for penetrated panels require additional data:

- Panel location on the façade,
- Cut-out size,
- Cut-out position on the panel.
- Geometrical form of the opening

For more, see:

Trimoterm fire application document

! NOTES & WARNINGS

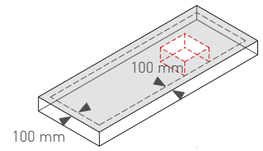
The impact of an opening on load-bearing capacity depends on its size and location on the panel. Therefore, we perform individual calculations for each project situation.

All support elements must be structurally checked based on the project situation.

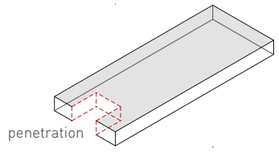
Recommended penetration positions

Some locations on the panel are more convenient for penetration openings than others. Therefore, it is essential to follow the guidance below when designing façade or installation penetrations.

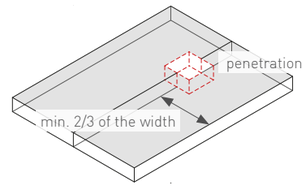
1. Further than 100 mm from the panel edge.



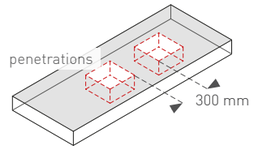
2. Aligned with the panel edge (modules > 1000 mm).



3. Central to the joint (2/3 of panel width must be intact).



4. Between penetrations min. 300 mm



! NOTES & WARNINGS

These recommendations shall be used as information regarding possible principles for penetration system solutions on Trimoterm panels. Actual cases need to be discussed individually with Trimo technical support.

Fire resistance of penetration system for cables, pipes, ventilation ducts, etc. is under the full responsibility of the installer, including selection and design, installation, and marking and labelling.

All fire-resistant penetrations shall be designed and executed in compliance with valid legislation and with the technical properties of the materials.

C

C6 Design tools and panel specification

C6.1 BIM & CAD Libraries

We provide support with advanced design tools (for AutoCAD, Revit, and Archicad) specifically developed to facilitate the seamless integration of Trimoterm products into your projects.

Our 2D and 3D Trimoterm product models, complete with all necessary parameters for both design and production phases, simplify and improve your design process.

We invite you to explore these innovative tools and elevate your design capabilities. Visit Trimo's website to download the libraries and begin integrating Trimoterm products into your projects today.

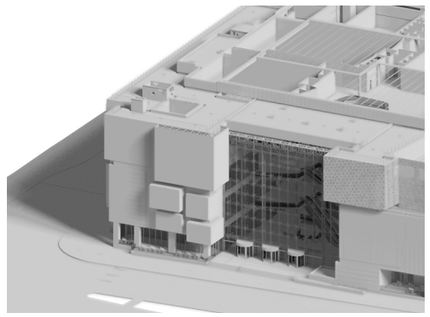


Fig. 5.5: BIM model including Trimoterm library panels.

C6.2 Details

Our extensive library of Trimoterm details is designed to address all the challenges of your project. Each detail is available in both PDF and DWG formats.

We invite you to explore and download these comprehensive details. Visit Trimo's website.

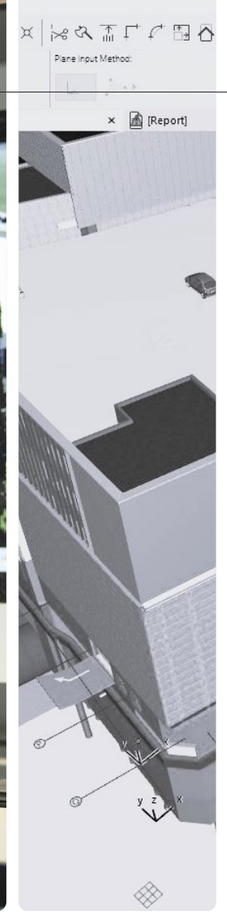
www.trimo-group.com/en

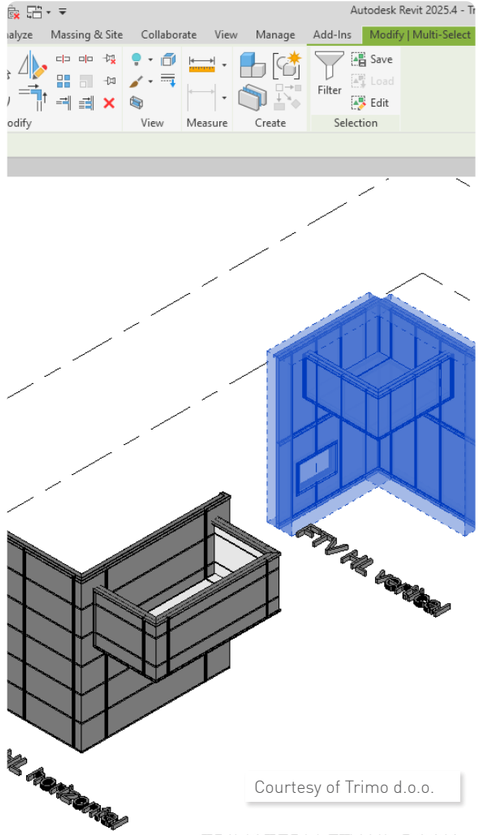
TRIMOTERM FTV HL | INVISIBLE

INSULATED SANDWICH PANEL SYSTEM

www.trimo-group.com

JOINT TYPE | INVISIBLE





Courtesy of Trimo d.o.o.

C

C6.3 Specification of façade system

Trimoterm FTV HL cutting list is a tool which helps you order Trimoterm FTV HL panels. By choosing specific variations of the panel, the tool gives you visual feedback so you can easily make your selection. When entering various panel dimensions, a tool warns you if any Trimoterm technical limitations are not met.

Cutting list requirements

By using the form, the client can communicate the information needed for production more easily and more quickly. The resulting set of ordering data is therefore more complete and clearer:

- Number of panels,
- Thickness of the façade elements,
- Length of panels,
- Module - M (width),
- Panel core type,
- Panel coating type,
- Panel colour for side A and B,
- Panel profile type,
- Dimensions of FTV HL sharp-edge L-shape corner,
- Dimensions of FTV HL round-edge L-shape corner,
- Dimensions of FTV HL round-edge U-shape corner.

Trimoterm FTV HL cutting list

Trimoterm abbreviations

The general abbreviations principle follows the rule of the first letter of the name. An example of an abbreviation can be seen below. The rule applies to all Trimo portfolio products.

(T) Element, panel thickness
(t) Thickness of steel sheet
(M) Module width
(R) Design length, raster
(L) Panel length

Trimoterm FTV HL panels are marked using the resulting scheme:

Trimoterm Power T FTV HL-60/1000 MS
External steel sheet:
0.55 mm SP 25 µm ANTHRACITE
Internal steel sheet:
0.50 mm SP 25 µm GREY WHITE

Trimoterm Power T FTV HL-60/1000 MS

- Product family
- Mineral wool core type
- Product type (FTV HL, FTV HL HL, SNV)
- Thickness
- Module width
- * A side - steel sheet profile type
- * B side - steel sheet profile type

* Side A is usually the external side of the panel.

Trimoterm details are marked using the resulting scheme:

TI-H-01.02

- Product family
- Panel orientation
- No. of detail group
- No. of specific detail

D
Service and support

D1 Project consulting

From the initial idea to the final implementation, Trimo's expert team supports you at every phase of your project, from planning and architectural design to construction and handover.

Contact us at: technical@trimo-group.com

Design

Trimo's design team comprises architects, designers, structural engineers, and design and project managers who collaboratively create design plans and drawings, understanding the customers' needs and expectations.

Technical support

Trimo's technical support team provides comprehensive assistance throughout the entire duration of the project. This includes visualisations, detailing, BIM engineering, virtual reality, structural calculations, changes, and resource management.

Material sampling

To give customers a taste of what to expect, Trimo can send metal swatches or small samples of façade products upon request.

Tender service

Trimo offers technical services to assist architects, engineers, specifiers, and installation contractors in fulfilling the required specifications.

On-site instructions

Trimo's field service engineering team provides contractor training on product installation, and advice on mechanical handling solutions.

Video, samples, and mock-ups

Trimo clearly showcases ideas by creating visual and static representations of products, services, and concepts.

Snack and learn office presentation

Trimo offers short, training-focused programmes during attendees' lunch breaks.

D

D1.1 Trimoterm FTV HL panel selection matrix

The matrix below is designed for architects (design), investors (strategic product selection), and installers (technical implementation selection).

Decision matrix and selection flowchart

Decision Parameter	Requirement	Recommended selection	Notes
Building application	Premium façade with invisible fixings	Trimoterm FTV HL	Hidden joint system provides clean architectural appearance.
↓	Industrial building	FTV HL + Power S or Perform C	Good structural and fire performance.
	Logistics centre / warehouse	FTV HL + Power S	Optimised for larger spans.
	Food, pharmaceutical, energy facilities	Trimoterm FTV HL	Non-combustible A1 core and hygienic properties.
	Renovation projects	Trimoterm FTV HL	Suitable as replacement or overcladding solution.
	Architectural façades	FTV HL + ArtMe or/and Digital print	Enhanced aesthetics and branding options.
Panel orientation	Vertical façade orientation	Preferred solution	Primary application of FTV HL.
↓	Horizontal façade orientation	Possible under specific conditions	Requires prolongation details (see page 56).
	Curved façade	Segmental curved panels	Radius depends on panel thickness (see page 44).
Structural system	Single-span	Panels fixed only at ends	Up to 10 m self-supporting depending on static calculations.
↓	Multi-span	Use intermediate supports + spreader plates	Panels up to 14 m long (see page 54).
Fire protection level	Standard non-combustible façade	Any Trimoterm FTV HL panel	A1 mineral wool core.
↓	EI30	>60 mm panel	Up to EI30 (see page 22).
	EI60	>80–100 mm panel	Up to EI60 (see page 22).
	EI120	>120 mm panel	Up to EI120 (see page 22).
	EI180	>150 mm panel	Up to EI180 (see page 22).
	EI240	>172 mm panel	Up to EI240 (see page 22).
Thermal insulation target	Best thermal performance	Power T mineral wool type	λ = 0.039 W/mK
↓	Balanced solution	Power C mineral wool type	Robust core (see page 22).
	Maximum spanning capability	Power S mineral wool type	Higher structural performance (see page 22).
	Passive/low-energy building	200–250 mm Power T mineral wool type	U-value down to 0.15 W/m²K.
Prolongation solution	Cost-optimised	Standard or custom shape	Steel sheet flashing (see page 56) Free space between panels: 20 mm.
	Hidden joint / premium architectural joint	HF102 or HF140 aluminium profile	Aluminium profile (powder-coated) Free space between panels: 40 mm.

D

D2 Trimoterm associated documents

This chapter contains all the relevant technical documents for additional information on Trimoterm panels. These documents include structural design data, technical specifications, guidelines, and other resources essential for a comprehensive understanding of the subject. Further information about the panels can be found on Trimo's website.

Insulated façade system - Trimoterm FTV

Fire-resistant internal wall system - Trimoterm FTV

Backing wall - insulated façade system - Trimoterm FTV

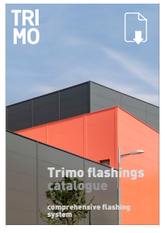
Foogiene - food and hygiene internal wall system - Trimoterm FTV

Flat roof system - Trimoterm FTV

Internal wall system - Trimoterm FTV

Trimoterm technical specifications

Trimoterm structural design data



Trimo flashing catalogue

Trimo accessories catalogue

Packaging, transport, and storage of Trimo products

E
Other applications

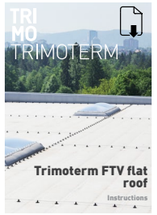
E1 Other application documents

Trimoterm sandwich panels can be used to build external walls, internal walls, ceilings, and roofs. They are widely applied in the construction of, among other things:

- Industrial production, commercial and storage halls,
- Partition walls
- Office and service complexes,
- Container skins,
- Agricultural and food industry facilities,
- Cold rooms and freezer rooms,
- Roofs.

While this product book provides comprehensive details on the properties and on the installation of Trimoterm sandwich panels for façades, these versatile panels can also be used in various other applications. Whether you're looking to install them as ceilings, flat roofs, internal walls, or fire walls, Trimoterm panels offer robust solutions for diverse construction needs.

For detailed technical solutions and requirements for specific applications, please refer to the individual documents listed below. These documents will guide you through the necessary additional specifications and considerations for each unique application.



Trimoterm FTV flat roof instructions

This document provides instructions for the application and installation of Trimoterm FTV HL sandwich panels within a flat roof system.

Trimoterm fire application

This document provides guidelines for fire-rated ceiling applications, detailing self-supporting systems, construction options, and installation requirements.

Trimoterm base backing-wall application

Coming soon.

Trimo green and PV façade application

An overview of Trimo's sustainable façade solutions for energy-efficient building design.

Trimoterm NEXT Panel, with lower carbon footprint

This document outlines the company's commitment to sustainability, highlighting the Trimoterm NEXT product, which reduces carbon emissions in construction through the use of sustainable materials.

Trimoterm FTV book

The Trimoterm FTV Book provides comprehensive information on Trimoterm FTV panels, including their history, product portfolio, and sustainability efforts.

Technical terms - Index

The technical terms in all Trimo technical documents are harmonised with ISO/ICSbuilding and civil engineering vocabularies, with the exception of technical terms describing a unique element used within the façade or roof product system.

Specific technical terms can be found in the corresponding product books in the index chapter. Terms are listed in alphabetical order.

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References

Explore some examples of commercial, industrial, and logistics buildings that benefit from Trimoterm FTV HL panels.

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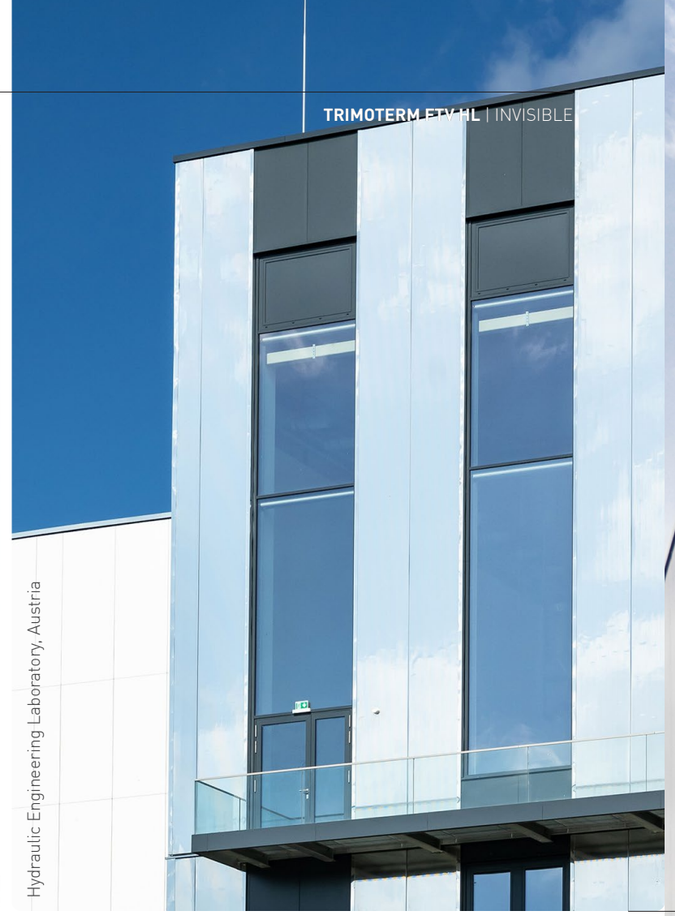
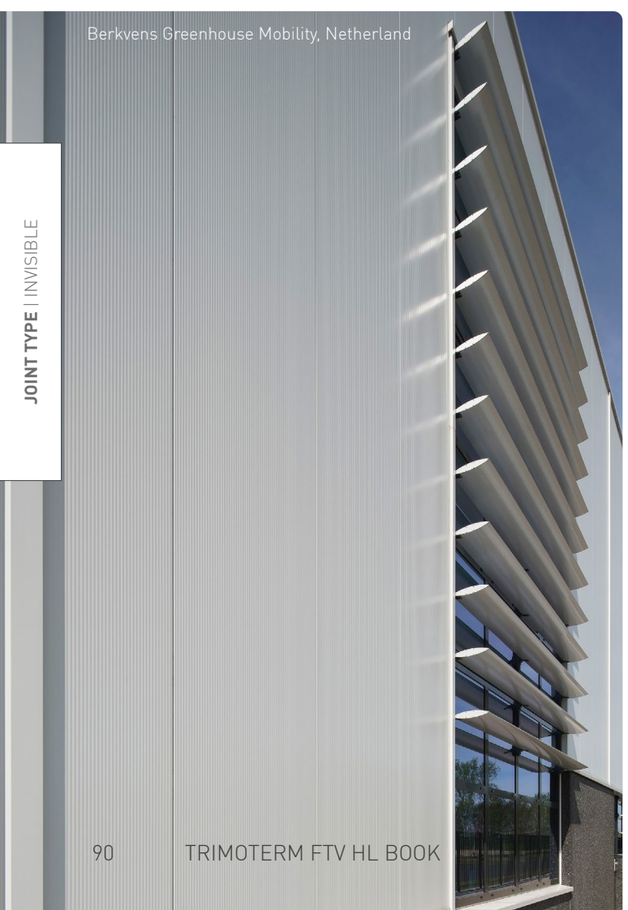
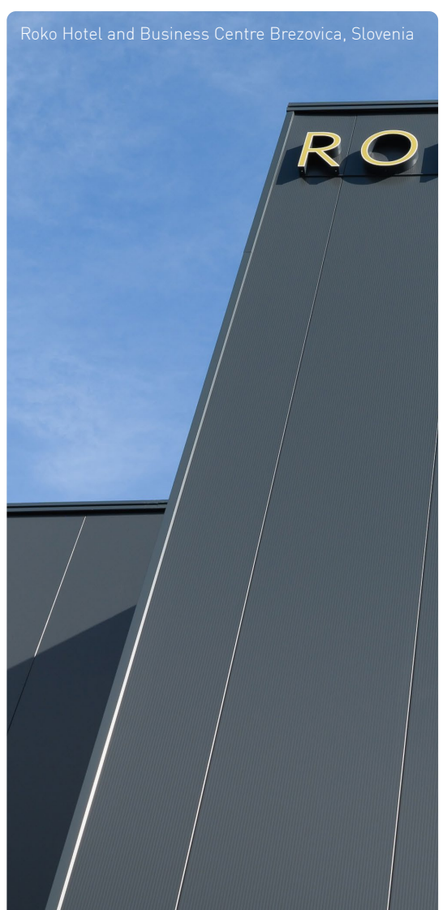


Hydraulic Engineering Laboratory, Austria



Berkvens Greenhouse Mobility, Netherland



Roko Hotel and Business Centre Brezovica, Slovenia

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