termPIR®
insulation boards

Insulation boards from Gór-Stal

termPIR® INSULATION BOARDS

INSTALLATION INSTRUCTIONS FOR termPIR® PRO-F INSULATION BOARDS

1. INTRODUCTION

Gór-Stal manufactures termPIR® Pro-F insulation boards, which are perfect for a variety of flat roof layouts, including systems with single-ply TPO synthetic membrane coverings on concrete and trapezoidal sheet or timber substrates. Installing PIR insulation boards on flat roofs definitely increases the energy efficiency of the building if done correctly.

This installation manual describes technical solutions of Gór-Stal on flat roofs. Before installing insulation boards on flat roofs, read and carefully follow the installation instructions below.

2. STORING AND HANDLING INSULATION BOARDS

To ensure high performance of the insulation, the following recommendations must be observed:

- The termPIR® insulation boards must always be dry. This applies to both the storage and installation of the boards. At the end of the working day, the installed boards shall be covered and protected from rain, snow and ice. Moist insulation cannot be used in roof systems and must be replaced. At all times during the installation of the flat roof, it must be protected against penetration of water into the system.
- Protect the boards, packages and stacks of termPIR boards from direct sunlight during storage.
- The packaging of termPIR® insulation boards cannot be regarded as a shield against water and solar radiation.
- Boards should not be stored directly on the ground (use washers). A minimum distance of 12 cm between the substrate and the first board is recommended.
- Stacks of insulation boards should not be higher than 3m.
- Stacks of termPIR® boards should be protected from slipping or being dropped by gusts of wind.
- Storage of the boards on the roof should be done close to the place of installation to avoid unnecessary movement (and thus the possibility of mechanical damage) of the boards.
- When storing boards on the roof, consider guidelines for roof structure load capacity, fire safety and wind protection. Stored boards must never block safety paths. Boards must not be stored in the immediate vicinity of heat sources such as: membrane welding equipment or hot bitumen spreaders.
- Only packages from which boards will be mounted and covered on the same working day may be opened.
- The termPIR® boards should be stored on site only for the time necessary for the standard construction process, i.e. continuous work associated with the installation of all elements of the roof system
- Do not place any sharp objects on the insulation boards to avoid damaging the surface of the boards.
- Inspect boards for damage before installation. If you have any doubts as to the condition of the board, contact the Gór-Stal technical department.

Detailed information on the transport and storage of boards is available on the website www.termPIR.eu

3. FLAT ROOF DESIGN

3.1 Roof system design

PIR insulation boards made by Gór-Stal can be installed only in a roof of classic structure. This means that the insulation layer is located above the load-bearing substrate, but only under the waterproofing.

FM-approved roof assemblies must be used for all installations, as stated in RoofNav. Ensure that the assembly has an appropriate rating for wind and hail resistance and exposure to external fire. Using individual FM-approved components that are not approved for common use does not constitute an FM-approved assembly

Determine the recommended wind load factor values for roof assemblies in accordance with the FM approval using the RoofNav rating calculator and data sheet 1-28, Wind Design. Do not use any system beyond its FM approval. Select assemblies based on the required wind resistance for the specific roof area (Zone 1', 1, 2 or 3). Alternatively, refer to Sections 2.2.10.1 for recommended enhancements for Zone 2 and Zone 3. Recommended enhancements for Zone 2 and Zone 3 apply to a roof system installed in Zone 1 only.

Ensure a minimum roof pitch of 1.2° (1/4 in 12) to facilitate drainage and optimise roof durability. Additional guidance on roof pitch and drainage can be found in Data Sheet 1-54. Do not exceed the roof pitch listed in RoofNav for installation as this will adversely affect the external fire resistance.

Use FM-approved materials that have the FM approval mark on the packaging or on the material itself.

3.2 Vapour barrier

In order to avoid problems with condensation, it is necessary to install a suitable vapour barrier layer. A vapour barrier is characterized by its Sd value, which is an indicator of the product's resistance to water vapour permeability. The performance of this layer will depend on the type of building and its use, often determined by standards in individual countries. The correct installation of a vapour barrier is described by the manufacturer of that coating. Documentation should include information on how to attach the vapour barrier membrane, details, connections, seals, etc. The PIR insulation board can only be installed if the correct type of vapour barrier is used and installed correctly. The most common types of vapour barriers are PE foils, bitumen membranes on glass veils, bitumen membranes on polyester fleece backing, bitumen vapour barriers with aluminium liner and reinforced aluminium foils.

Do not use vapour barriers directly over steel decking unless specifically included in RoofNav assemblies for steel decking. Some vapour barriers are FM-approved only for use directly over concrete slab or thermal barriers on steel decking; use directly over steel decking will result in the roof assembly being classed as Class 2. All side and end laps of the vapour barrier should be sealed.

3.3 Thermal insulation

Use termPIR® Pro-F boards for the thermal insulation of a flat roof. Use insulation boards with sizes within the required upper and lower limits specified in the RoofNav installation guidelines. Boards with dimensions up to 1.2 × 2.4 m in projection may be used, except as described in section 2.2.10.6.2 of the RoofNav guidelines (with a proportionate increase in the number of fasteners, adhesive tapes etc., rounded up to the nearest integer number). Do not use insulation boards smaller than those approved by FM, unless in accordance with section 2.2.10.7.

3.4 Flat roof covering - TPO membrane

Synthetic coverings of the TPO type are usually single-ply. There is a wide range of possible membrane types (mechanically unreinforced, reinforced, weldable, with non-woven backing, etc.) and installation methods (e.g. mechanical fixing, cold bonding, single-sided (e.g. PU adhesive) or double-sided (e.g. contact adhesive), loose lay and ballasting, self-adhesive, etc.). Each system has its own specifications, guidelines and accessories. The roofing manufacturer's instructions must be followed.
For the completion of a flat roof system with termPIR® Pro-F boards, Gór-Stal provides only TPO membranes fixed to the substrate only mechanically.
This type of covering has a great advantage on large roofs due to its very rapid installation, which is very accurate thanks to the use of computer-controlled hot-welding machines. These membranes can be welded at lower temperatures than their PVC counterparts.

In areas prone to tropical cyclones and where the design wind speed is 100 miles per hour (45 m/s) or greater, if there is exposure to wind-borne particles at roof level (such as glass in atriums or higher walls or sheet metal enclosures for mechanical equipment projecting above the exposed roof) and the building is highly susceptible to water damage (high property damage), a roof covering and insulation or cover board directly below must be used that provides a minimum puncture resistance value of 10 joules according to the dynamic puncture resistance of the roof covering in a test in accordance with FM Approval Standard 4470 (tested in accordance with ASTM D5635).

Experience in the field of losses has shown that even properly protected single-ply roofing can be punctured or torn by wind-borne debris such as metal sheets and broken glass, which can cause water damage to the building interior and its contents.
Single-ply TPO membranes can be damaged by some materials commonly discharged onto the roof. It is also necessary to separate these membranes from incompatible substrate materials. In particular, ensure that single-ply membranes do not come into contact with asphalt or coal tar-based materials.
Some FM-approved single-ply membranes contain flame retardants on top. Install them with this surface upwards only. Membranes meeting this requirement are specially marked on the underside.

4. INSTALLATION INSTRUCTIONS

4.1 General installation recommendations

The mechanical installation of termPIR® insulation boards in a flat roof system is carried out in three stages:

1st stage - installation of vapour barrier.
2nd stage - mechanical installation of insulation boards to the substrate.
3rd stage – mechanical roofing installation.

During termPIR® installation of Gór-Stal insulating boards, the following rules must be observed:

- Insulation boards should be laid over the vapour barrier or existing roofing. In the case of renovations, the condition of the existing waterproofing membrane (which acts as a vapour barrier) should be checked.
- The substrate must be even, dry (without water, ice, snow or frost) and free from dirt and dust before the boards are installed.
- During the installation of a flat roof, it should be protected against ingress water to the system
- It is unacceptable for the already installed boards to get wet, i. g. by rain, snow, or dew on the boards unprotected with waterproofing covering. The most sensitive to moisture are boards with AL-type cladding. It is absolutely forbidden to cover dank thermal insulation boards with roofing. Non-adjustment to the above condition may cause loose of dimensional stability of the thermal insulation board
- The termPIR® insulation boards are laid in a continuous, tightfitting manner (no gaps) to avoid thermal bridges and leaks, thus creating a continuous insulation layer.
- The boards should be laid with staggered joints (Photo below). Ideally, the board joints should be offset by half the length of the board side. If it is not possible to offset the joints of the boards by half, the boards should be offset by at least 250 mm.
- When insulation is laid in a single layer, it is recommended that only milled boards be used..
- When using boards in large format (1200 x 2400 mm), or medium format (1200 x 1200 mm), use only milled boards with LAP type lock.
- It is not recommended to use elements with sides smaller than 500 mm.
- Ducts for pipes and other building installation components cannot be drilled in the termPIR® insulation boards. A levelling layer should be provided over the potential ducts system.
- Boards cannot be cut to reduce thickness. If a thinner board is required, such as around roof drains, use a board of the required thickness.
- The roof membrane and the vapour barrier must form a completely closed layer around the insulation boards (e.g. by overlapping the vapour barrier with the waterproofing membrane in the roof eaves)..
- A flat roof system is always a combination of several layers and materials, in which thermal insulation is only one part. To achieve a positive end result, follow the guidelines of the manufacturers of the materials used. This includes the application of the adhesive (curing time, amount of adhesive, temperature during the work, etc.), the laying of the waterproofing membrane (joint sealing, membrane relaxation, etc.), and the use of mechanical fasteners(type of fasteners, pull-out strength in a given substrate, etc.).

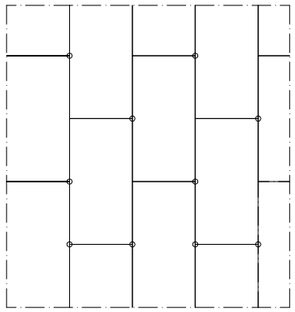


Photo 1. Placement of first layer boards

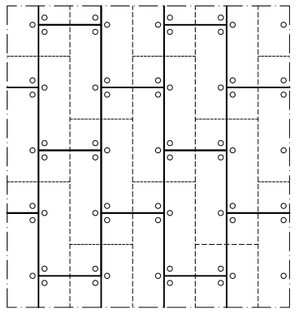


Photo 2. Laying the second layer

4.2 Mechanical installation of termPIR® Pro-F insulation boards to the substrate (roof structure sheathing)

4.2.1 General remarks

Each insulation board must be properly secured to the substrate with mechanical fasteners to prevent detachment by suction wind forces.

The selection of the fastener type should be made according to the recommendations of the fastener/pin/anchor supplier based on the characteristics of the particular roof and wind load calculations

The number of mechanical fasteners securing the board to the substrate per m² of insulation board should be determined on a case-by-case basis by the relevant designer in accordance with FM Global guidelines.
The designer determines the recommended wind load factor values for roof assemblies in accordance with FM approval using the RoofNav rating calculator and data sheet 1-28, Wind Design.

The type of fasteners and the depth of their embedding depending on the ground are specified by the fastener manufacturer and must be strictly observed..

The minimum fastener embedment depths specified by FM Global must also be observed:

A. Structural concrete substrate: 1 inch (25 mm), with a guide hole at least 1-1/2 inches (38 mm) deep for self-tapping screw.

B. Wood deck: 1 inch (25 mm). Note: For a 3/4 inch (19 mm) thick plywood deck, approximately 1/4 inch (6 mm) of screw will protrude through the underside of the deck.

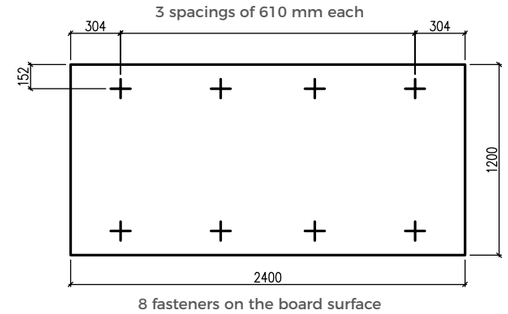
C. Steel bridge: For screw fasteners on new construction, use the shortest screw that is at least 3/4 inch (19 mm) longer than the assembly being fastened. Make sure the fasteners go into the top hump of the deck. If re-covering with a steel underlayment, the fastener must be long enough to be driven through the existing roof system and into the steel underlayment to a depth of at least 3/4 inch (19 mm). Although it is recommended that the fasteners connect to the top hump of the sheeting in all cases, in the case of re-roofing, it is acceptable for the insulation fasteners to connect to the bottom hump of the bridge. In this case, it is very important that the fastener is not over-tightened, as this may cause the above-ground elements to crack at the opening of the deck rib.

- Install fasteners only on dry substrates. Wet construction may cause deterioration of fasteners, including corrosion resistant fasteners with FM approval..
- To be effective, the fasteners must be hammered perpendicular to the roof surface. This will ensure that the contact surface of the fastener can evenly distribute the stresses on the surface of the insulation to be fixed.
- Ensure that the edge fasteners are 6 inches (152 mm) from the edge of the board, with a tolerance of +- 38 mm.
- Ensure that the fasteners are evenly distributed over the board surface.
- The waterproofing membrane must be fixed separately from the termPIR® insulation boards. These fixings must not be considered as fixing the insulation boards to the substrate. The use of fasteners with improved insulation performance (telescopic fasteners) is recommended to reduce heat loss due to the thermal bridge effect occurring in the insulation layer on the metal part of the fastener. Use fasteners which have a circular flange with a diameter of at least 50 mm, so that the tension is sufficiently distributed over the insulation board. The fasteners should not be pressed too tightly to prevent damage to the cladding and the core of the boards. At the same time, the fixing must be strong enough to resist wind suction and to ensure that the pad adheres to the insulation board. The contact part of the fastener should be slightly recessed into the board to avoid damage to the underlying waterproofing membrane. The manufacturer's proprietary installation tool should be used to avoid over- or under-screwing the fasteners. A less desirable option for self-tapping or self-drilling screws is using an adjustable clutch screwdriver.

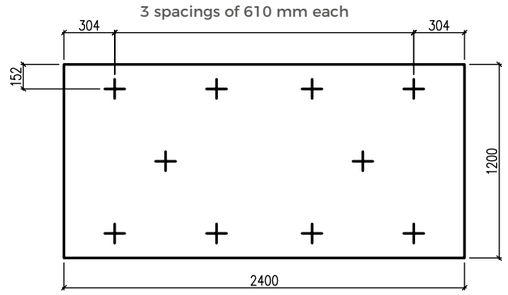
4.2.2 Fastener arrangement for large boards (1200x2400 mm) on a steel substructure (module 150 mm)

In order to ensure safe operation of the roof system, it is important not only to determine the minimum number of mechanical fasteners per m² of insulation, but also the correct distribution of fasteners on the surface of the board.

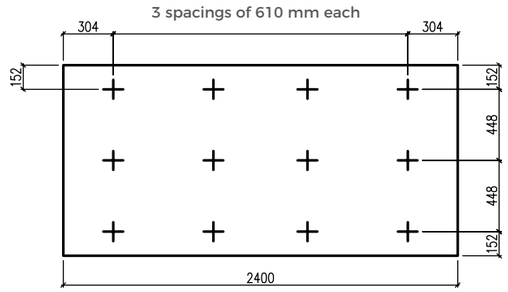
The mechanical fasteners should be evenly spaced on the internal surface of the termPIR® board not exceeding the limit of 152 mm from the external board perimeter.



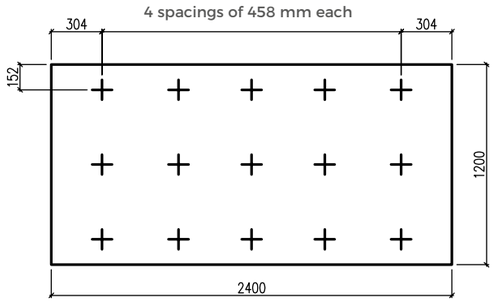
8 fasteners on the board surface



10 fasteners on the board surface



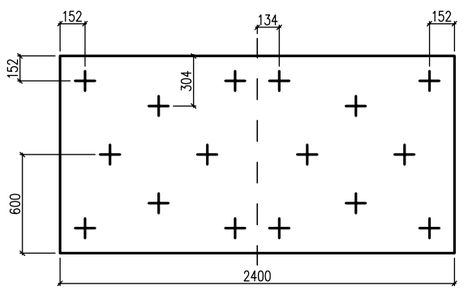
12 fasteners on the board surface



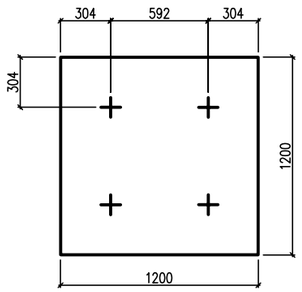
15 fasteners on the board surface

4.2.3 Fastener arrangement for medium-sized boards (1200x1200 mm) on a steel substructure (module 150 mm)

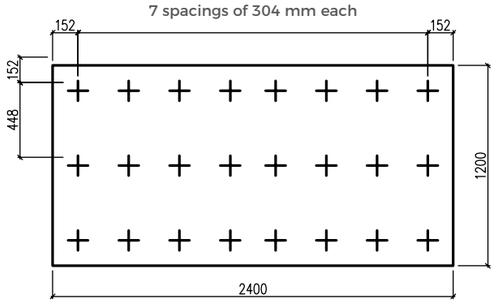
To ensure safe operation of the roof system, it is important not only to determine the minimum number of mechanical fasteners per m2 of insulation but also the correct positioning of the fasteners on the board surface. The mechanical fasteners should be placed evenly on the internal surface of the termPIR® board without exceeding the limit of 152 mm from the external board perimeter.



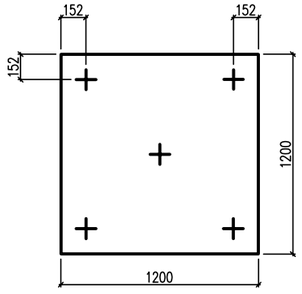
15 fasteners on the board surface



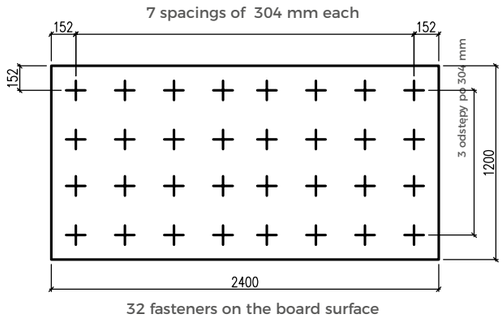
4 fasteners on the board surface



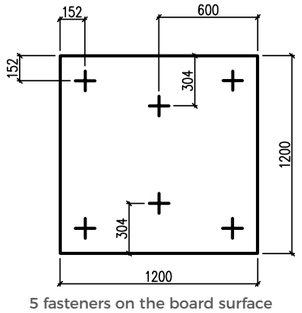
24 fasteners on the board surface



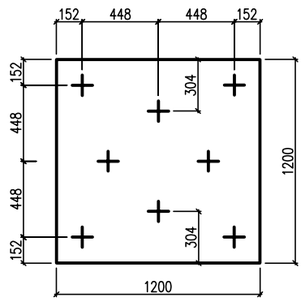
5 fasteners on the board surface



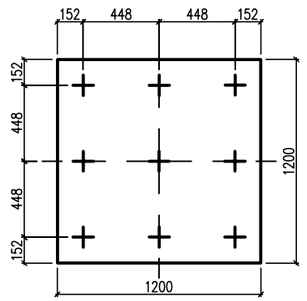
32 fasteners on the board surface



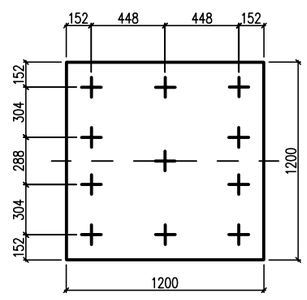
5 fasteners on the board surface



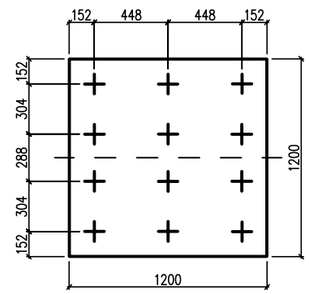
8 fasteners on the board surface



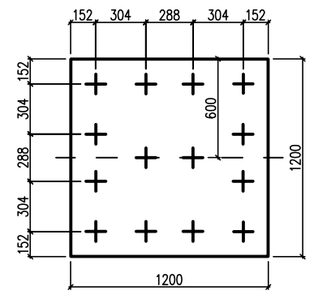
9 fasteners on the board surface



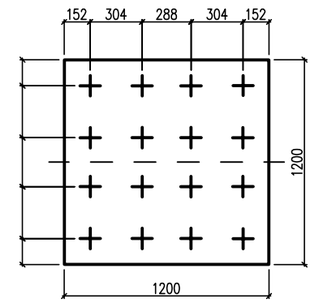
11 fasteners on the board surface



12 fasteners on the board surface



14 fasteners on the board surface

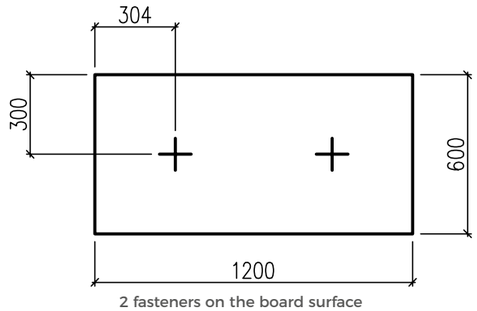


16 fasteners on the board surface

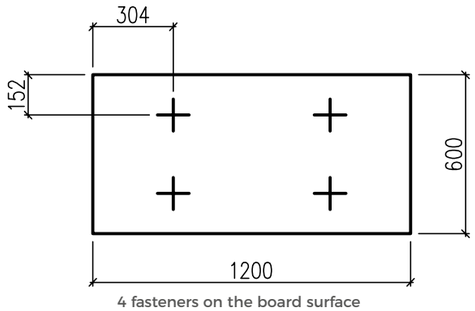
4.2.3 Fastener arrangement for medium-sized boards (1200x1200 mm) on a steel substructure (module 150 mm)

To ensure safe operation of the roof system, it is important not only to determine the minimum number of mechanical fasteners per m2 of insulation but also the correct positioning of the fasteners on the board surface.

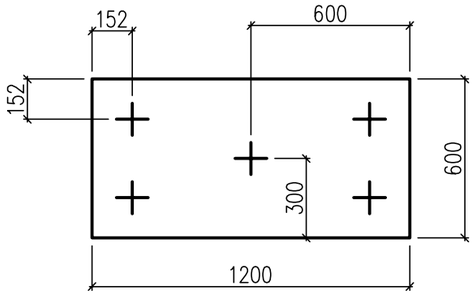
The mechanical fasteners should be placed evenly on the internal surface of the termPIR® board without exceeding the limit of 152 mm from the external board perimeter.



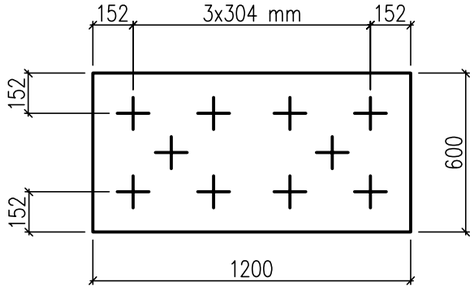
2 fasteners on the board surface



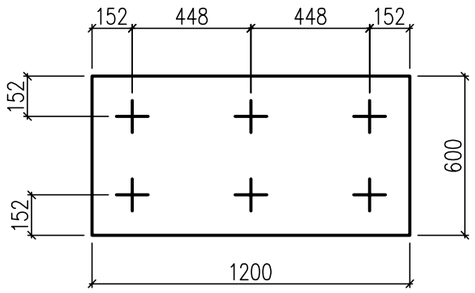
4 fasteners on the board surface



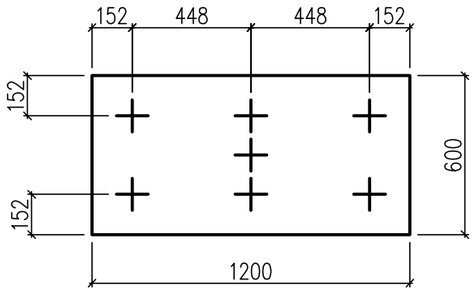
5 fasteners on the board surface



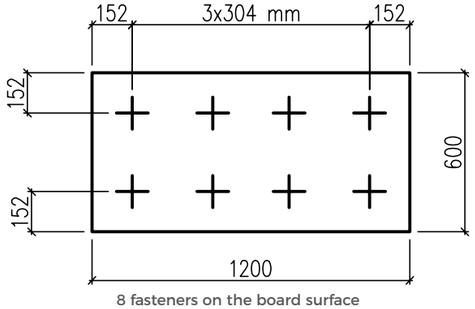
10 fasteners on the board surface



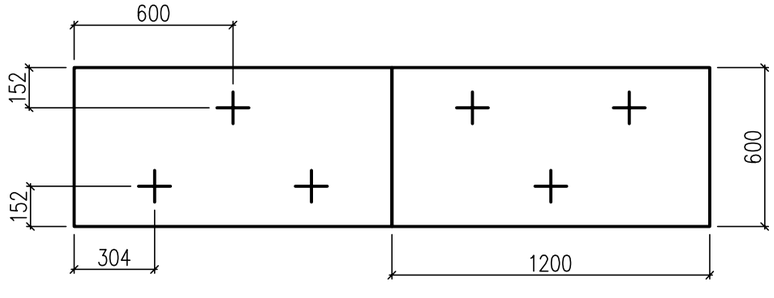
6 fasteners on the board surface



7 fasteners on the board surface



8 fasteners on the board surface



3 fasteners on the board surface

4.2.5 Concrete or reinforced concrete substrate

Mechanical fastening to concrete substrates usually requires predrilling and is therefore more time consuming and costly compared to fastening to trapezoidal sheets or wood substrates. Special fasteners are required. The fastener manufacturer must provide the necessary information on the method of installation, the depth of embedding of the dowels and screws and the tear strength of the fasteners. Mechanically fastened systems on concrete substrates are typically used for large format insulation boards.

If the reinforced concrete substrate (e.g. precast TT slabs or hollowcore slabs) is too thin, fastening is only permitted at the rib locations. The exact method of attachment is specified by the manufacturer of the reinforced concrete slabs. The insulation boards are laid with the longer side perpendicular to the length of the precast reinforced concrete slab.

4.2.6 Trapezoidal sheet substrate

The steel roof sheathing (trapezoidal sheeting) provides structural support for the roof assembly. It should have sufficient strength and stiffness to prevent excessive bending and separation of the above-ground layers under imposed loads (snow, construction work, wind) or dead loads. Some decks, such as structural concrete, are inherently rigid. For others, such as steel, special attention must be paid to the design to ensure limited deflection and stresses in the deck. This is achieved by: (1) limiting the span of the deck, (2) adequately fixing the boards to the trusses, and (3) fixing the side laps of the boards.

Other methods of limiting deflection and stresses in the steel deck to acceptable limits, especially at higher wind pressures, include using higher strength steel, using a thicker or stiffer deck (depth, rib configuration) or using even more reduced spans. Excessive deflection can cause cracking of the over-deck insulation and delamination of the roofing, while excessive stresses within the deck can cause buckling of the deck. The combination of relatively high required wind resistance and relatively large deck spans can result in buckling of the steel deck

Large format insulation boards are usually installed on trapezoidal sheet substrates. The termPIR® boards should be installed with the longer side perpendicular to the ribs (profile) of the sheet. The recommended fastener distances from the edge of the insulation board must be observed, but a slight adjustment may be needed given that the boards can only be fastened to the top fold of the sheet profile.
It is recommended to lay the insulation boards in such a way that all edges are supported on the trapezoidal folds. Where this is not possible, a restricted support is allowed. The maximum distance between the upper folds of the board (unsupported section of the board between the ribs of the board) must not exceed three times the thickness of the insulation board. Board support is only permitted when the thickness of the insulation board is at least 50 mm. A safe rule is to limit the board bracket to 100 mm. When thin boards are used, in some trapezoidal sheets the distances between the folds are too large to properly support the insulation boards. Then fill the trapezoidal cavities with insulation of adequate compressive strength (not less than 120 kPa).

4.2.7 Wood substrate

For wooden substrates, the same fastener fixing schemes apply as described above. Insulation boards on wooden substrates in a flat roof system should always be laid on a continuous sheathing (e.g. OSB or plywood). Direct installation of boards on wooden beams is prohibited.

4.3 Mechanical installation of single-ply roofing (TPO membrane)

The number of mechanical fasteners securing the roof membrane to the substrate should be determined on a case-by-case basis by the relevant designer in accordance with FM Global guidelines.

In all cases, the roofing fastener rows should run perpendicular to the deck ribs and the sheathing should be designed to withstand the calculated wind pressure exerted at the spacing of the roofing fastener rows.
When using a ribbed deck, such as a steel deck, the fastener spacing of the fastener rows must be an even multiple of the deck rib spacing (6 inches [150 mm] for 1-1/2 inch [38 mm] deck depth) to ensure that the fastener will catch on the hump of the top deck surface. To adequately distribute the wind load on the roof sheathing and its fixing and to prevent buckling of the sheathing and damage to the deck fixing, install rows of fasteners perpendicular to the deck ribs. Increased fastener density for single-ply membranes is achieved by using narrower sheets, bottom-fixing methods or through-fixing shielded by sealing strips. Increased fastening is not achieved by increasing the number of fasteners in each row unless this is confirmed by FM approval. Greater security by reducing the distance between rows is recommended, as this also reduces the bending stresses on the deck and provides better load distribution to the fixings of the roof structure sheathing.

Remarks

These installation instructions should be read carefully before mounting the Gór-Stal insulating boards. Improper installation and/or the use of inappropriate tools can have undesirable effects on the properties of the boards and the overall system. If the insulation boards show visible visual defects or they get wet, stop the installation and contact Gór-Stal technical department.

Gór-Stal shall not be held liable if wet boards or boards with visible defects have been installed.

The client must ensure that the installation of the boards, and therefore the entire flat roof system, complies with all applicable laws, regulations, directives and national/international requirements. Installation must be done in accordance with good building practice.

Please note that technical specifications may vary from country to country. The contractor is obliged, at its own risk, to ensure that all specifications meet the technical and legal requirements of the project, for which it bears sole responsibility.

Gór-Stal Sp. z o. o. shall notbe liable for design errors, product selection or execution errors, or any consequences thereof.

This document does not create, define, modify or supersede any new or prior contractual obligations agreed to in writing between Gór-Stal and the user.

Gór-Stal Sp. z o. o. reserves the right to change this document, without prior notice.

termPIR®
insulation boards

GÓR-STAL®
SANDWICH PANELS

CONTACT

Insulation Board Factory
ul. Adolfa Mitery 9, 32-700 Bochnia, Poland
tel./fax: +48 14 698 20 60
e-mail: bochnia@gor-stal.pl, www.termpir.eu

Wydanie I, Bochnia, 28.06.2024 r.