GÓR-STAL®
SANDWICH PANELS



GS insPIRe®
SANDWICH PANELS

INSTALLATION GUIDE FOR SANDWICH PANELS



01. TRANSPORT OF SANDWICH PANELS

01.1 Packing

Sandwich panels manufactured by Gór-Stal and flashings are placed on two types of pallets during the packing process, namely wooden pallets (load-bearing, for flashings) and polystyrene pallets (non-load-bearing, for sandwich panels). Each package is then wrapped in film to protect it. The packing date should be understood as the date of manufacture of the Gór-Stal sandwich panels.

Basic parameters of the panel parcel:
- Parcel height – max 1.36 [m]
- Parcel width – max 1.17 [m]
- Parcel length – max 16.50 [m]
- Parcel weight – max 4500 [kg]

Should the Client fail to collect the manufactured order within 30 days of the production date, the Manufacturer shall not be liable for defects arising from prolonged storage (dents from pallets, reduced effectiveness of the protective film, mechanical damage arising from the need to transport the panels between plants or within a plant, etc.). We also wish to inform you of the possibility of corrosion caused by water vapour condensation occurring after this period. This may lead to the formation of rust stains on the panel surface; in such a case, the Manufacturer shall not be liable for any resulting damage and claims in this regard will not be accepted. Similarly, claims arising from a long (more than 30-day) storage period will not be considered for products that have been collected from the Manufacturer and are being stored by the Client to avoid any risk of damage.

Walking on the panels is prohibited; therefore, they must not be placed on walkways.

To protect the stored material, the storage area must be fenced off, clearly marked and secured against access by unauthorised persons.

01.2 Transport

- Only vehicles that are in good working order, whether open or covered, with a load bed that allows for loading from the top and the side, may be used to transport Gór-Stal sandwich panels.
- Load beds must be clean. The surfaces of the walls and floor must not have any protruding elements that could cause damage to the loaded goods
- The length of the means of transport (load bed) must be such that the parcel rests along the entire length of the vehicle. The parcel may protrude beyond the load bed of the vehicle by no more than 3.0 [m].
- In road transport, parcels may be stacked in accordance with the principle shown in Figure 1.
- Considering the condition of public roads, drivers are required to periodically (the first time after 5 km, the next after 25 km, and every subsequent time after 100 km) check the effectiveness of the load (parcels) securing and, if necessary, improve the securing of the load.
- The recommended width of the load bed is 2450 [mm], the required height of the load space in covered vehicles is at least 2600 [mm].
- The vehicle collecting the panels must be equipped with transport straps (min. width 50 [mm]), used to secure the load on the load bed. The number of straps depends on the length of the panels; the spacing between straps is approx. 2 [m].
- Parcels of flashings transported together with parcels of panels must be secured individually (with separate straps), independently of the parcels of sandwich panels.

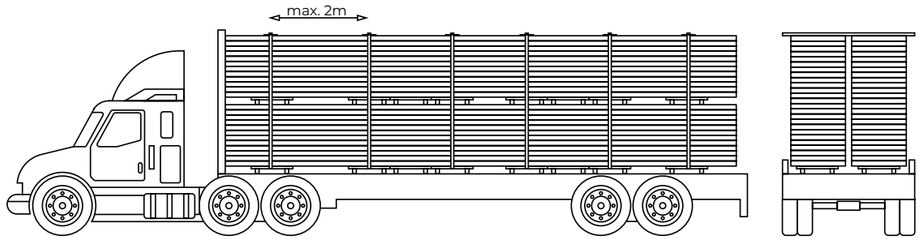


Fig. 1: Method of securing sandwich panel parcels on a vehicle.

01.3 Unloading

Before handling a package of Gór-Stal sandwich panels, check the condition of the packaging by visual inspection.

» Before unloading, it is essential to remove the transport beams from the goods. Unloading with the beams still in place may cause damage to the products.

» Depending on the length of the panels and the type of core, the parcels can be unloaded using a forklift truck or by means of an overhead crane, a crane or a jib crane, using a spreader beam and 4-leg rope slings featuring flat slings and thimbles, approximately 6 m in length].

» The required length for panel parcels to be unloaded by forklift must not exceed 7.5 m for PIR core panels, and for mineral wool panel parcels, with a weight not exceeding 2 tonnes. Packages that do not meet these criteria may only be unloaded using a crane or a forklift truck equipped with a carriage with a fork width equal to half the length of the parcel. When unloading using an overhead crane, a crane or a jib crane, using a spreader beam and 4-leg rope slings featuring flat slings and eyes, approx. 6 [m] in length, the parcels must be hooked using transport straps. In the upper part, spacers must be used – Fig. 6, with a length of L = 1.2 [m] and a minimum thickness of 30 [mm], maintaining the spacing of the straps at a distance greater than the width of the parcel, so as not to damage the top sandwich panels. It is prohibited to hook straps onto polystyrene pallets

» It is prohibited to load or unload packs of panels without using flat slings with loops.

» If you notice any damage to the goods before or during unloading, note this in the documents and on the delivery note. You must take photographs as evidence.

» **Do not install damaged panels! Gór-Stal will not cover the cost of replacing installed, damaged panels.**

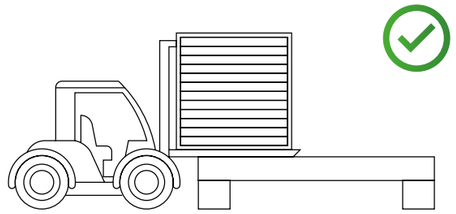


Fig. 2: A trolley used for unloading parcels of sandwich panels must be fitted with forks featuring vertical guards to protect the edges of the panels from damage.

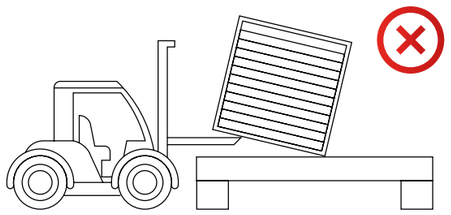


Fig. 3 Note the length of the forklift truck forks. If the forks are too short, the parcel of sandwich panels may fall.

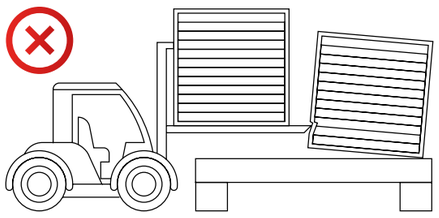


Fig. 4 Note the length of the forklift truck forks. Forks that are too long may damage the adjacent parcel of sandwich panels.

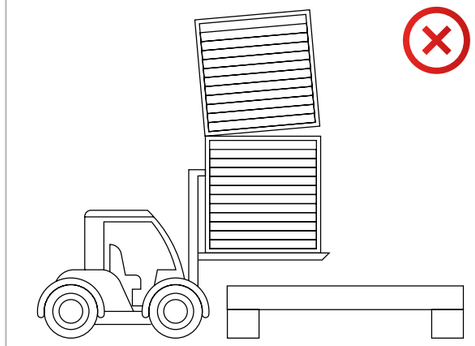


Fig. 5: Parcels of sandwich panels must only be unloaded one at a time.

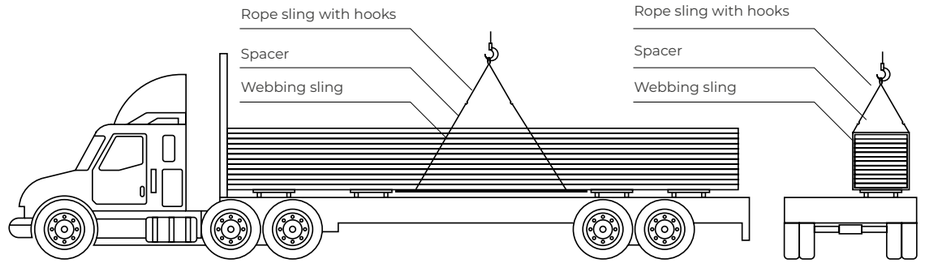


Fig. 6: Unloading using a sling for panels with a mineral wool core up to 6.5 m in length and for panels with a PIR core up to 7.5 m in length

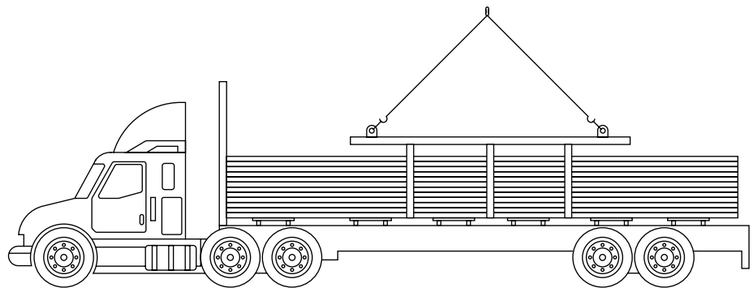


Fig. 7: Unloading using a sling for sandwich panels with a mineral wool core longer than 6.5 m and for panels with a PIR core longer than 7.5 m.



GS insPIRe® sandwich panels

02. STORAGE AND INTERNAL TRANSPORT ON SITE

» Gór-Stal sandwich panels should be stored with a slight slope along the side edge so that any rainwater entering the stack can run off freely – Fig. 8

» Panels stored in the open must be thoroughly protected against the sun, rain, snow, strong winds and contamination. Textile tarpaulins should be used to protect the panels properly. Tarpaulins are breathable and allow accumulated moisture to be quickly wicked away. It is essential to avoid the accumulation of water between the panels, as this may, over a prolonged period of time and in the absence of ventilation, cause damage to the panels (white rust, paint blistering).

» To prevent marks and dents from forming on the panel cladding at the construction site, stacking of panel bundles is not permitted – Fig. 9.

» The ground on which the panels are placed must be level and compacted to prevent permanent damage to the panels. Partially unpacked parcels must always be protected from the sun, precipitation and strong winds.

» Temporary storage of roof panels on the roof and during installation may, due to the additional load on the structure, only take place on the rafters of the load-bearing frame and must be agreed with the site supervisor each time. For safety reasons, it is prohibited to leave uninstalled panels on the structure.

» Do not stack parcels of panels directly on the roof structure as this may cause damage and scratching the paint finish of the bottom panel in the parcel.

» The parcels of panels must be supported by polystyrene base pads on the load-bearing frames. For safety reasons, stacking panels on the roof structure is not permitted.

» It is prohibited to transport stacked panels around the site.

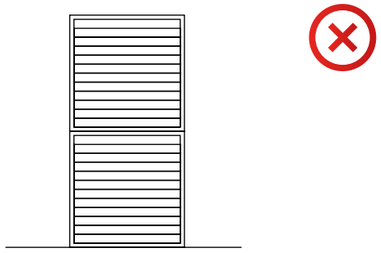


Fig. 9 It is prohibited to stack parcels of panels on the construction site.

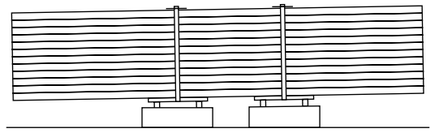
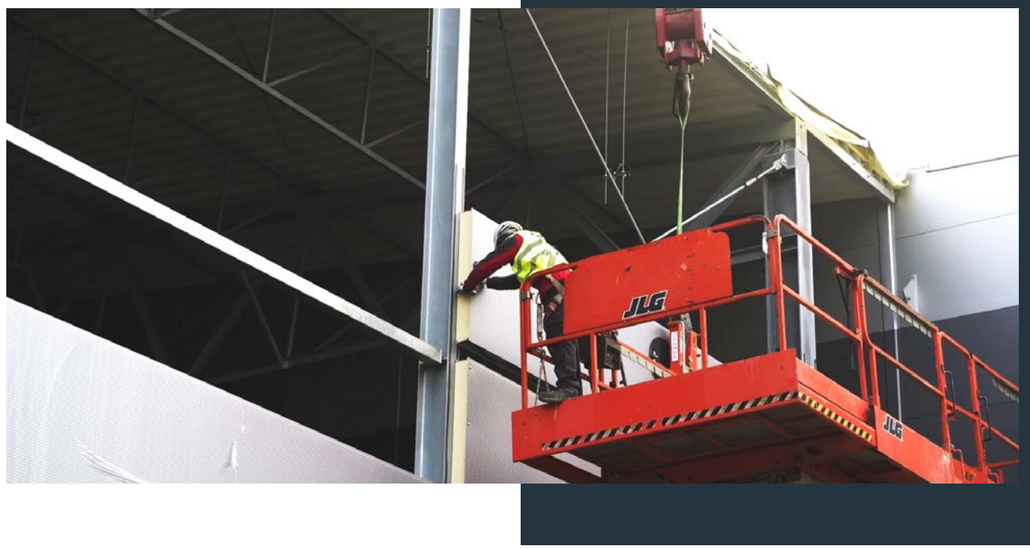


Fig. 8 Storing panels with a slope along the long side edge of the panels.



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03. INSTALLATION OF SANDWICH PANELS

03.1 Weather conditions

Weather conditions – wind speed, precipitation and visibility – have a significant impact on the correct and safe installation of Gór-Stal sandwich panels. Wind speed should not exceed 4 on the Beaufort scale (9 m/s) due to the relatively low weight of the panels in relation to their large surface area. Panel installation should not be carried out during precipitation (rain or snow). If visibility deteriorates as dusk falls and there is no artificial lighting, panel installation should be suspended. It is recommended that installation work be carried out at temperatures above -5°C. If the panel lock does not have a factory-applied seal, work involving the use of sealants should be carried out at an ambient temperature above 4°C. Information on the installation temperature for dark-coloured panels (colour group III) can be found in section 5.

03.2 Health and Safety Regulations

All work carried out during the installation of Gór-Stal sandwich panels must be conducted in accordance with generally applicable health and safety regulations for installation and roofing work, and under the supervision of authorised personnel. Furthermore, the following fall protection equipment must be used during the installation of the panels:

» Rope safety barriers to secure the perimeter of the building

» Ropes and safety harnesses of the type used by fitters

» Safety devices

03.3 Lifting panels from the parcel

When laying roof panels, the most practical method is to use a crane.

- When laying panels using a crane, the roof pitch must be taken into account, as otherwise the panel edges may be damaged.
- Panels with a low unit weight can be lifted from the parcel and laid on the roof by hand.
- Before laying the panels on the roof structure, remove the protective film from the inner facing of the panels.
- During laying and installation, workers moving across the panels must wear safety footwear with soft soles to avoid damaging the panel coating.
- Each subsequent panel must be positioned against the previous one by placing the trapezoidal tongue of the top cladding onto the ridge of the adjacent panel.
- To protect the seals, longitudinal displacement must be kept to a minimum.

03.4 Installation tools

Vacuum lifters

Vacuum lifters are one of the basic tools recommended for the installation of sandwich panels. VIAVAC vacuum lifters are designed for the easy, safe and damage-free lifting and handling of wall panels in horizontal and vertical positions, as well as roof panels at various angles of inclination. The selection of a specific device from the VIAVAC range depends on the type and length of the sandwich panel, as well as the specific requirements of the installation. To eliminate the risk of damaging the panel during handling, always follow the instructions provided by the appropriately trained technical department of the company renting out VIAVAC machinery.
Particular attention should be paid when selecting suction cups for the vacuum lifter for the installation of sandwich panels with a mineral wool core. In this case, it is recommended to use only low-profile suction cups which, once the required vacuum has been created, adhere across their entire surface to the outer cladding of the sandwich panel (photos 4 and 5).
This prevents local damage to the sandwich panel (where the sheet metal detaches from the panel core) in the area where it comes into contact with the suction cup. Multi-suction vacuum lifters (a group of individual suction cups mounted on a common frame – photo no. 1) or vacuum lifters with a central suction cup – photo no. 2 – may be used. When using a multi-suction vacuum device, only suction cups with a width not exceeding 15 cm should be used (photo no. 5). When using a central suction cup, its contact surface must be internally divided into several independent sections (photo no. 3).

The use of a single-section central suction cup is prohibited when installing sandwich panels with a mineral wool core.



Photo 1. Multi-suction vacuum device.

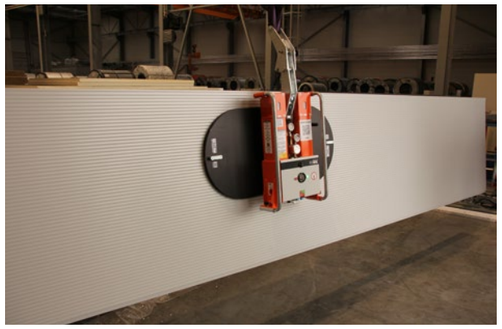


Photo 2. Vacuum device with a central suction cup.



Photo 3. Required multi-section central suction cup (divided into four sections).



Photo 4. Low-profile suction cup for a vacuum device. Once a vacuum is created, the suction cup's flexible peripheral seal ensures support across the entire contact surface between the suction cup and the sandwich panel.

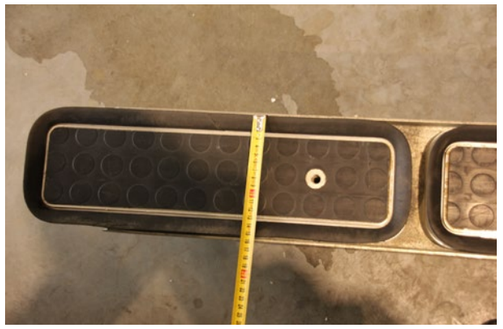


Photo 5. Maximum permissible suction cup width: 15 cm.

For safety reasons, the protective film must be removed from the panel each time before lifting it using the VIAVAC vacuum device.

Screw guns

For screwing fasteners, it is recommended to use specialist screw guns fitted with a suitable head for guiding long fasteners and with an adjustment mechanism for the relative depth of the fastener head. It is also permissible to use a universal screw gun, equipped with adjustment of the relative depth of fastener installation, with the following parameters:

- power: 600–750 W,
- operating speed at this power: 1500
- 2000 rpm, – torque 600 – 700 Ncm.

Do not exceed the recommended speed, as this may damage the fastener's drilling element.

Saws and shears

For cutting Gór-Stal sandwich panels, it is recommended to use saws with fine-toothed blades or special circular saw blades for metal, which may be used provided they are fitted with sufficiently precise guide systems. Sawdust resulting from cutting must be removed immediately. The use of angle grinders and other equipment that may cause excessive heating in the cutting area, leading to the destruction of anti-corrosion coatings, is prohibited when cutting panels and flashings.

Use hand-held or cordless shears for cutting flashings.

03.5. Preparation for installation

Before commencing the installation of Gór-Stal sandwich panels, you must:

- Check the structure for accuracy of workmanship and compliance with the design (any discrepancies must be rectified).
- Check that the spacing of purlins, columns and rafters corresponds to the design and complies with the guidelines contained in the static load tables.
- Check that the purlin surfaces form a plane.
- Check the straightness of the columns and rafters in the building's wall structure (permissible deviations according to PN-EN 1090-2:2018 Execution of steel and aluminium structures). In the event of errors or non-conformities, inform the Site Manager and a member of the Gór-Stal Sales Department. Correct the curvature of the panels using spacer plates.
- Check the completion of works related to the plinth and other wet works.
- Prepare the tools required for installing the panels. Proper preparation of the structure will facilitate installation, ensure the correct functioning of the panel fasteners and give the building's cladding the desired appearance. No welding work of any kind is permitted in the vicinity of the panels, as this may cause permanent damage to the coating

3.6. Protective film

- The cladding on sandwich panels manufactured by Gór-Stal is protected against dirt and mechanical damage by a protective film during transport and installation
- For sandwich panels with steel cladding and standard connectors, as well as for insulated panels for refrigeration, the surface protected by the protective film is the outer surface of the panel. Where the protective film is applied to both sides, the outer surface is always at the top of the stack
- The buyer is obliged to remove the protective film from the sandwich panel cladding within a maximum of 60 days from the date of production of the order. This requirement stems from the fact that, as a result of exposure to atmospheric conditions, the film undergoes vulcanisation, which results, amongst other things, in: a change in the colour of the film, difficulty in removing the film, the film tearing, the presence of adhesive residue after removal of the film, and damage to the decorative coating.
- The manufacturer advises that the protective film used in the production of sandwich panels with a steel cladding should be removed at above-zero air temperatures; at sub-zero temperatures, the acrylic adhesive hardens and the adhesive film delaminates, which may result in some adhesive remaining on the panels. In such cases, the Manufacturer will not accept complaints regarding adhesive residue left by the protective film. It is prohibited to remove the protective film at temperatures below 0°C.
- The manufacturer hereby states that it shall not be held liable for any difficulties in removing the film after 60 days from the date of manufacture, nor for any damage resulting from a reduction in the film's protective properties after this period, including, in particular, any damage occurring during transport, storage at the Client's or the Manufacturer's premises, installation, etc. We justify this decision on the grounds that the protective film retains 100% of its properties for up to 60 days from the date of manufacture; after this period, the protective film's properties are reduced as a result of ageing, prolonged storage, and the effects of weather and environmental conditions. To ensure that the protective film can be easily removed from the workpieces, they must be protected from adverse weather conditions.
- Notwithstanding the time limit specified in the point above, the Buyer is required to remove the protective film no later than before installation begins or immediately after the panel in question has been installed. Where installation is carried out using vacuum lifters (VIAVAC), the film must be removed before the device is attached to the panel surface. Where installation is carried out using vacuum lifters (VIAVAC), the Buyer is also obliged to familiarise themselves with the operating instructions for the device (VIAVAC). If a defect in the sandwich panel is revealed after the film has been removed, the Buyer undertakes to cease the installation of further sandwich panels and to report the defects to the Seller immediately, i.e. no later than before installing further panels. The Seller shall not be liable for any loss or damage suffered by the Buyer as a result of installing defective goods, in particular for the costs of dismantling and re-installing the sandwich panel cladding.

03.7. Cutting panels and flashings on site

- Cut-outs in roof and wall elements, which are made prior to the installation of the panels, weaken the cross-section; therefore, these areas should be adequately reinforced.
- To protect the coating from damage, panels and flashings should be cut on stands lined with a soft material, e.g. felt..
- The edges of panels and flashings cut on site must be protected

immediately after cutting. If the flashings are film-coated, the protective film must be removed before installation.

» It is prohibited to cut panels on roofs, mechanical working platforms, scaffolding, etc

» If a hole to be cut is more than 30% of the panel's width, it is recommended that the panel be cut all the way through.

3.8. Fasteners for installing sandwich panels

To fix Gór-Stal sandwich panels to the supporting structure, use the self-tapping fasteners recommended by the panel manufacturer. The type of fastener depends on the type of supporting structure and the thickness of the panel being installed. To ensure the panel is correctly fixed to the structure, it is essential to maintain the perpendicularity of the fastener during installation, which is why it is recommended to use specialist screw guns with a head designed to guide long fasteners. Self-tapping fasteners made of stainless steel should be used when fixing panels in buildings, where:

» The indoor environment is characterised by a constant relative humidity of over 70%

» The interior of the building is subject to a chemically aggressive environment

» There is a need for particularly careful protection of the stored equipment

Thanks to the use of a specially selected support thread, the thread-free zone beneath the fastener head and the sealing washer with a vulcanised EPDM layer, a permanent, watertight connection is achieved in a single screw-in cycle, which eliminates any clearance between the sandwich panel and the support (rafter, purlin or other steel structural element) – Fig. 10
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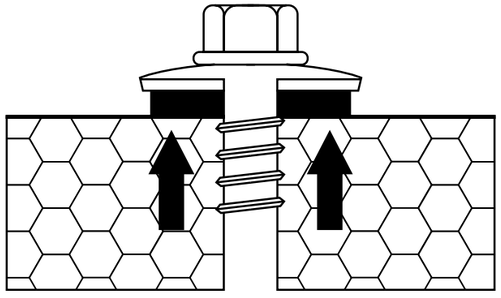


Fig. 10. Correct installation of the fastener.

3.9. Important information for designers and installation contractors

» Careful planning of the building's individual elements (edges, continuous colour elements in different colours, continuous strips of window frames, etc.) as early as the architectural planning stage can visually lighten the building and mask minor colour variations.

» The installation contractor should install the panels in accordance with the numbering sequence of the parcels (this applies mainly to panels with metallic-coloured cladding, e.g. RAL 9006, RAL 9007).

» The installation of panels and flashings should always be carried out in accordance with the production direction. Rotating an element by 180° will automatically result in colour differences at the joint between that element and the rotated element. These colour differences will be repeated at the joint with a panel installed in accordance with the production direction.

» When installing panels over large areas, it is necessary to assess the colour consistency achieved on an ongoing basis as construction work progresses, from a distance of at least 10–25 metres and from various angles. The further away the assessor is from the object being assessed, the more noticeable even relatively minor colour differences become. When installing panels with metallic-coloured cladding, assessments should be carried out as frequently as possible and from various angles (from different locations). Furthermore, the protective film should be removed as work progresses, which will facilitate the assessment. The façade should not be assessed when it is directly exposed to strong sunlight.

» When combining sandwich panels from different production batches on a single building / a single facade, after installing a panel from a different batch to the previous one, it is recommended to peel back the protective film to check for any differences in colour shades. If a visible difference in shade is detected, installation of the panels must be halted, and the Sales Department must be informed immediately. Otherwise, Gór-Stal reserves the right to not be held liable for any differences in colour shade noted during and after the installation of the sandwich panels.

» The manufacturer does not guarantee the same RAL colour shades when ordering or combining different types of products including: sandwich panels of varying widths, panels with a mineral wool core, flashings, and panels made from sheets, nor does it guarantee the same RAL colour shades or identical embossing depth where individual products come from different production batches. The manufacturer also does not guarantee the same shades of RAL colours for the external and internal surfaces of sandwich panels with steel cladding, nor for panels differing in thickness, lock type, modular width or profiling.

» The manufacturer reserves the right that different goods delivered as part of the same order may differ in shade, despite having the same RAL designation. In the event that the the Buyer orders several different products or products of the same type but differing in sheet thickness, the Buyer must agree with the Seller in writing as to which batch of goods must be produced in a uniform shade. In the absence of such an agreement, the Manufacturer shall not be liable for the aforementioned differences in shade.

» METALLIC COLOURS: Due to the complexity of the manufacturing processes, the Seller does not guarantee colour shade consistency across successive deliveries. This applies in particular to sheets in the metallic colours RAL 9006 and 9007. In order to avoid differences in shade and to maintain colour uniformity in sandwich panel cladding, the Buyer should, prior to concluding the sales contract or delivery agreement, agree in writing with the Seller which part of the order/contract relates to deliveries for a single facility. In the event that such an agreement is reached, the Seller undertakes to manufacture the goods from a single batch of raw material. Otherwise, the Seller reserves the right not to be held liable for any differences in colour shade.

» Sandwich roof panels with a mineral wool insulation core offered by Gór-Stal are manufactured by an external supplier. Consequently, the profiling of the top and bottom cladding of sandwich panels with a moneral wool core differs in geometry from that of sandwich panels with a PIR foam insulation core produced by Gór- Stal. Combining mineral wool and PIR roof panels on a single roof surface is impossible. Complaints resulting from differences in profiling and colour shades of the steel sheets in mineral wool-core and PIR-core roof panels will not be accepted by Gór-Stal. The manufacturer reserves the right that different goods delivered under the same order may vary in shade, despite having the same RAL designation

3.10. Installation of roof panels

Before installing the panels, it is essential to affix a protective seal to each purlin (to ensure the panel does not rest directly on the purlin). Failure to use a seal will result in loud creaking noises during the roof's operation (the seal accommodates movement between the panel and the purlin).

Lifting the panels
Roof panels must be lifted using suitably configured vacuum lifting devices (section 3.4). The procedure is illustrated in the diagram and photograph below:

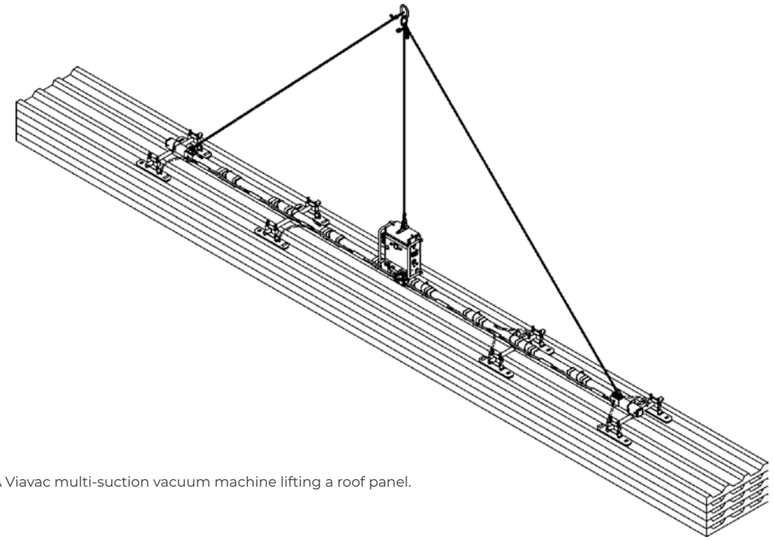


Fig. 11. A Viavac multi-suction vacuum machine lifting a roof panel.



Photo 6. Lifting a roof panel from a stack.

Positioning the panels

Before installing the first panel, you must:
1. Check whether the structure is rectangular or 'angled'; if so, you must:
a. ensure that the side edge of the panel is aligned with the eaves and the ridgepole; and/or
b. ensure that there is a right angle between the panel and the eaves line (or ridgepole line);

Note:

1. It is practically impossible (or very difficult) to adjust the position of subsequent panels relative to the first one.
2. The accuracy of the entire roof installation depends largely on the accuracy of the first panel's installation.
3. If the design and structural conditions allow, it is recommended to lay the panels so that the overlap on the panel is oriented in the direction of the prevailing winds.

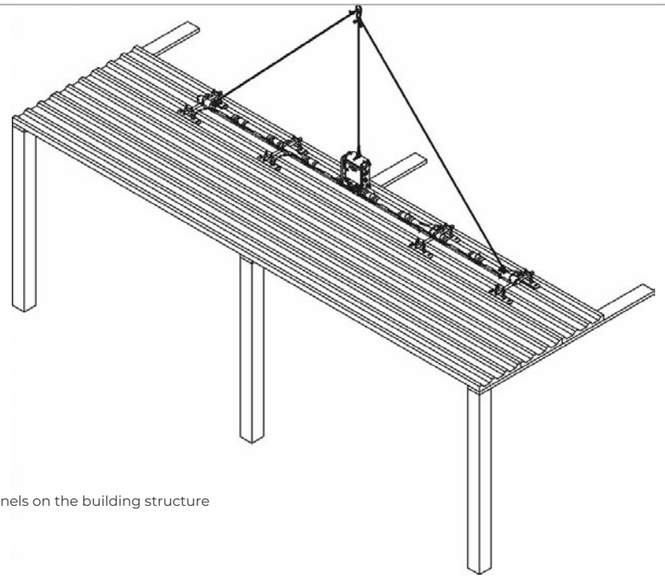


Fig. 7. Laying roof panels on the building structure



Photo 7. Laying roof panels on the building structure

Fixing the panels

a. The panels are fixed to the purlins using self-tapping fasteners/screws with a hexagonal head and a sealing washer. (The length of the screws should be selected according to the Gór-Stal technical catalogue; the penetration depth of the screws should be adjusted to the thickness and type of purlin – this information should also be included in the design).
b. It is necessary to use so-called storm washers under the screws (to ensure adequate clamping of the panel).

Note:

1. Before laying each panel, check that there are no expansion joints or beam joints in the purlin where the screws will be positioned
2. Mark the screw positions (perpendicular to the panel, directly above the purlin)
3. Position calotte exactly in the centre of the ridge to avoid creating a gap between the panel and the calotte
4. There must be no metal filings or other debris or dirt under the calotte
5. Screw the fasteners in perpendicular to the panel (particularly important with thick panels)
6. To facilitate screwing, the sheet metal of the panel can be pierced with a screw and a hammer; (drilling with a drill bit causes metal shavings to form, which, if not removed, may scratch the panel's coating; furthermore, after rain or dew, they become a source ofcorrosion)
7. Metal filings must be removed immediately
8. Do not allow the screw to 'strip' (break the thread in the purlin) –> use a screw gun with a clutch;
9. The fastener should be screwed in to the correct depth (so that the seal is neither loose nor overly compressed/ damaged)
10. In critical areas, use a roofing sealant approved for outdoor use and forbonding to sheet metal (not silicone)
11. Use screws only on the ridge (fixing in other places may damage the panel)

Number and placement of fasteners

Unless the design specifies otherwise, the following fastening pattern is recommended as a minimum.

» On the three lowest purlins, counting from the gutter, install one fastener on each panel ridge. The fastening zone must extend at least 2 m from the gutter.

» On the three highest purlins, counting from the ridgepole, install one fastener on each panel ridge. The fastening zone must extend at least 2 m from the ridgepole.

» On all purlins within a zone extending at least 2 m inwards from each roof gable flashing (gable wall), install one fastener on each panel ridge.

» At each purlin in the remaining areas, install one fastener at the panel lock and one additional fastener on a selected panel ridge.

Order of fastener installation – recommendations

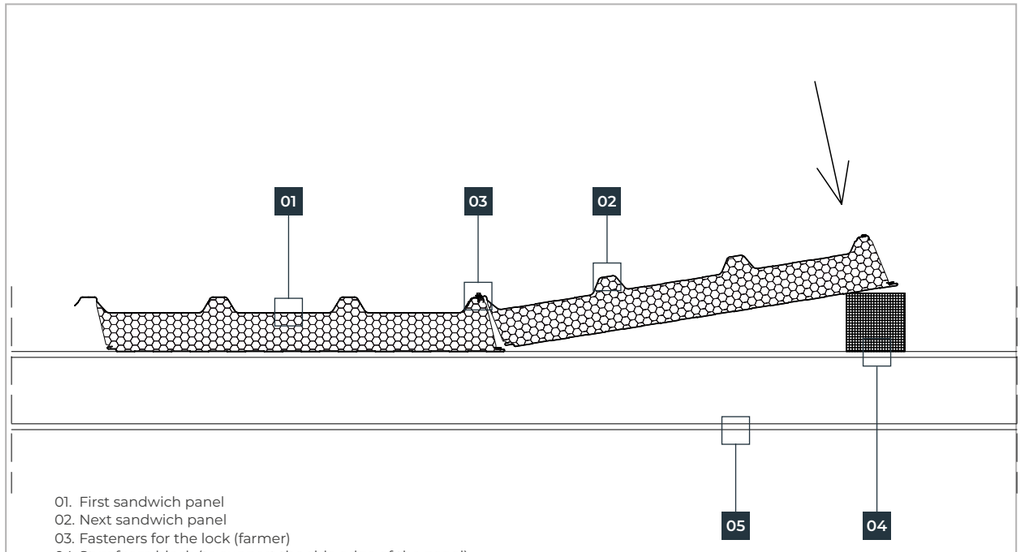
» Position and secure the first panel in the standard manner

» Position the next panel, press it against the previous one* and secure it in accordance with the following guidelines:
  1. First, screw in the fasteners securing the lock (on each purlin).
  2. Screw the remaining fasteners into the centre ridges of the panel.

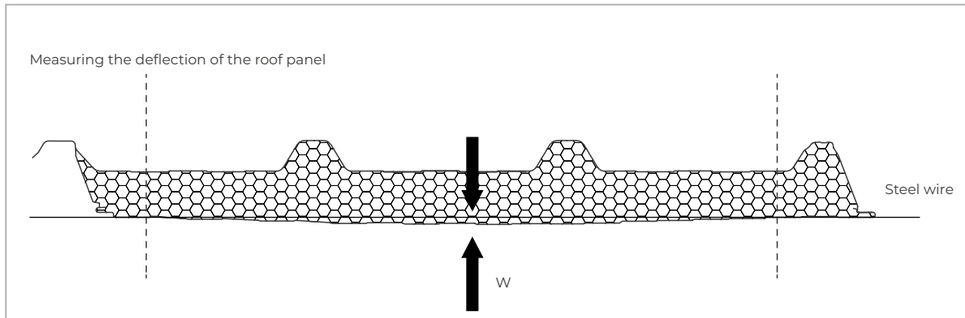
* Due to differences in stress between the inner and outer cladding, panels may bend across their width – depending on temperature conditions– by up to 1 cm.

In this case, when fixing subsequent panels:

1. Lift the loose side of the panel slightly to better align the lock (you can place a piece of polystyrene or other soft material under the raised side of the panel).
2. Screw in the fasteners securing the lock.
3. Remove the supporting material, press the panel against the purlin, and then fasten the remaining fasteners.



01. First sandwich panel
02. Next sandwich panel
03. Fasteners for the lock (farmer)
04. Styrofoam block (to support the side edge of the panel)
05. Roof purlin



Note:

1. Once the roofing work has been completed, it is recommended that you re-check the tightness of the fasteners (due to the 'settling' of the panels caused by structural stresses and work involved in installing flashings, skylights, etc.)

Securing locks

» Each joint between panels (lock) should be additionally secured using short self-tapping screws with sealing washers ("farmer' screws").

» Position the screws in the centre of the ridge, spaced at 40 cm intervals or closer.

03.11 Installation of wall panels

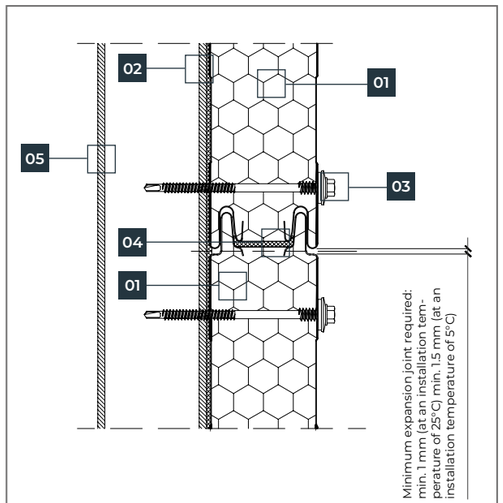
Important general notes regarding installation (all types of wall panels):

Before installing the wall panels, it is essential to apply a protective seal to every rafter or column (to prevent the panel from coming into direct contact with the rafter or column). Failure to use a seal will result in loud creaking noises during the wall's operation (the seal compensates for movement between the panel and the building's rafter or column) – Fig. 8.

It is essential that, after installing the panels, the polyurethane seal at the joint between the cores (in the panel lock) adheres across the entire surface to the adjacent panel – Fig. 8.

To ensure proper sealing of the longitudinal joint between the panels, the elements must be pressed together without damaging the panel edges.

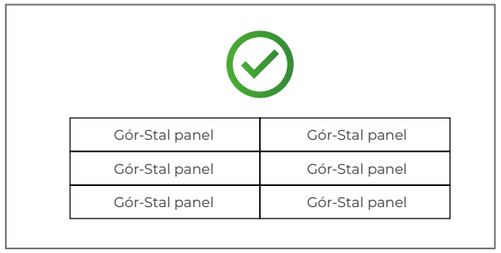
The expansion joint between the metal cladding of the joined panels must not be less than 1 mm (when installing panels at a temperature of approximately 25 degrees) and 1.5 mm (when installing panels at a temperature of 5 degrees) – Fig. 8.

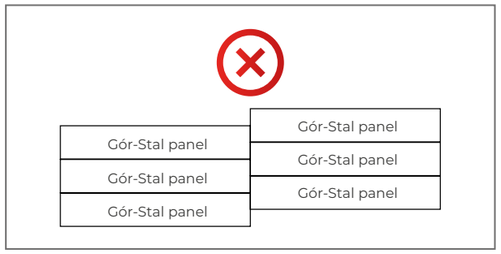


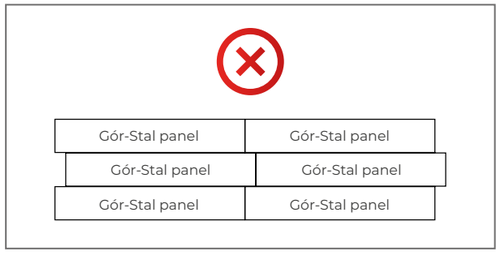
01. Wall sandwich panel
02. Self-adhesive polyethylene sealing tape (PES)
03. Self-tapping fastener for fixing sandwich panels
04. Polyurethane seal in the panel lock (after installation, it must adhere to the entire surface of the core of both panels)
05. Rafter as per structural design

.Fig. 8. Minimum expansion joint between the cladding of the installed panels..

Regardless of the type of panel, it is important to ensure that horizontal and vertical joints are aligned.







Proper checking of the modular width is always required, with particular attention to cases where different types of panels are installed in adjacent spans..

Lifting of wall panels during installation

Sandwich panels must be lifted using suitably configured vacuum lifting equipment (section 3.4). The procedure is illustrated in the drawings and photographs below:

Fig. 9. Lifting a panel from a stack using a vacuum suction cup (for horizontal installation)

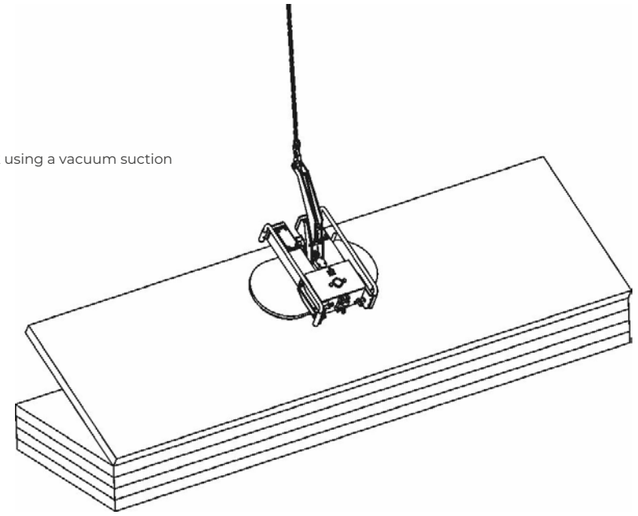




Photo 8. Lifting a panel from a stack using a vacuum suction cup (horizontal installation).

Fig. 10. Horizontal installation of sandwich wall panels.

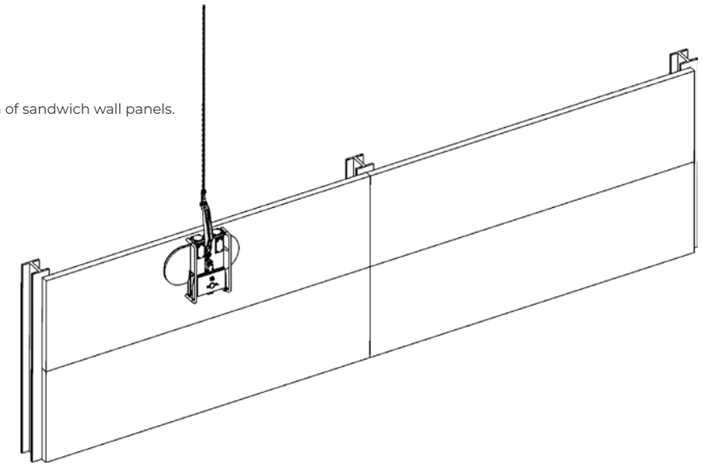




Photo No. 9. Horizontal installation of wall sandwich panels.

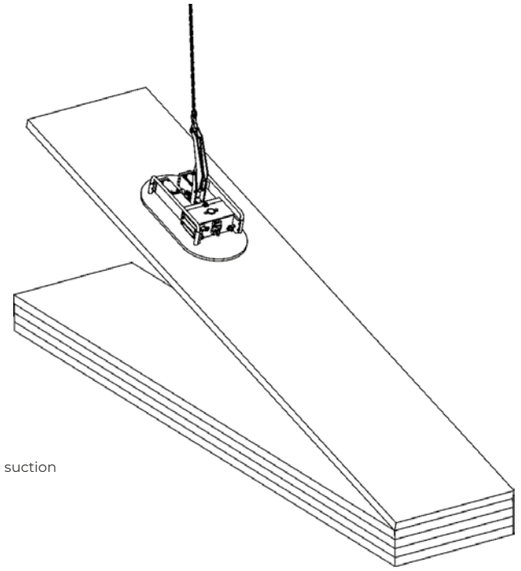


Fig. 11. Lifting a panel from a stack using a vacuum suction cup (for vertical installation)



Photo 10. Lifting a panel with a vacuum suction cup (vertical installation).

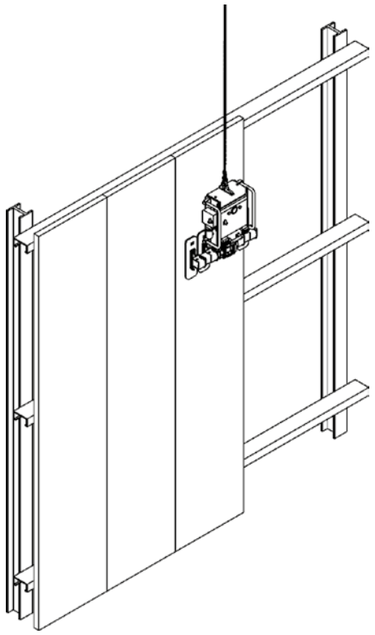


Fig. 12. Vertical installation of sandwich wall panels.



Photo 11. Vertical installation of sandwich wall panels.

Installation of sandwich panels with concealed fasteners

The installation of all sandwich panels with concealed fasteners from the Gór-Stal range strictly requires the use of a special PM-1 washer and two fasteners at the fixing point. The PM-1 washer prevents excessive deformation of the lock at the fixing point of the sandwich panel.

Once the first panel has been levelled, the fixing point is the appropriately profiled edge of the panel, into which the PM1 washer must be inserted. The panel should then be fixed via the PM1 washer to the building's rafter or column using suitable self-tapping screws from the Gór-Stal range – Fig. 13.

The next panel covers the lock with its tongue, using a tongue-and-groove mechanism; therefore, to achieve a tight seal, it must be pressed down and secured with self-tapping screws via the PM1 washer as described above.

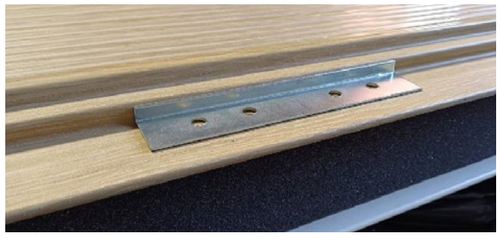
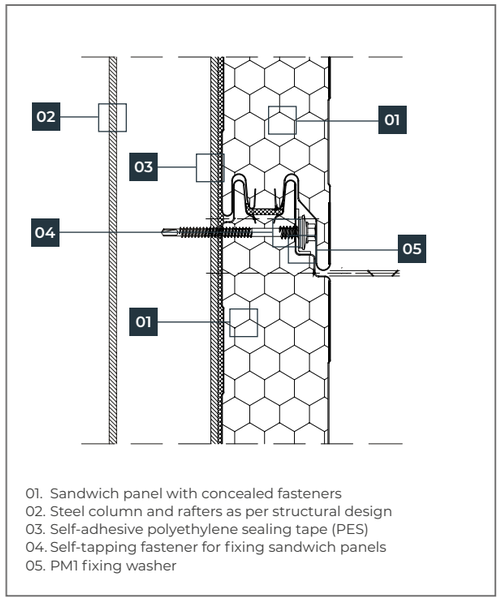
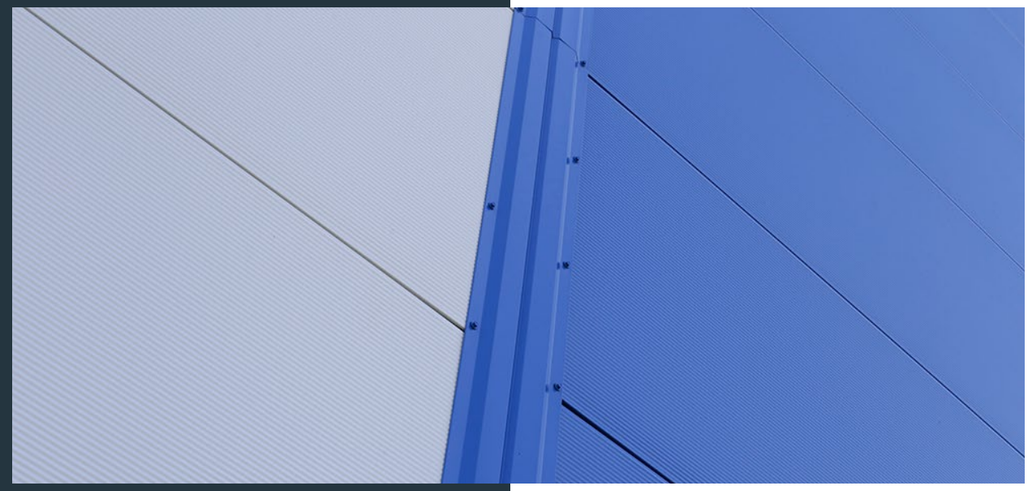


Photo no. 12. Position of the PM1 washer in the lock of the panel with a concealed fastener.



01. Sandwich panel with concealed fasteners
02. Steel column and rafters as per structural design
03. Self-adhesive polyethylene sealing tape (PES)
04. Self-tapping fastener for fixing sandwich panels
05. PM1 fixing washer

Fig. 13. Fixing a sandwich panel to the building structure using a concealed fastener

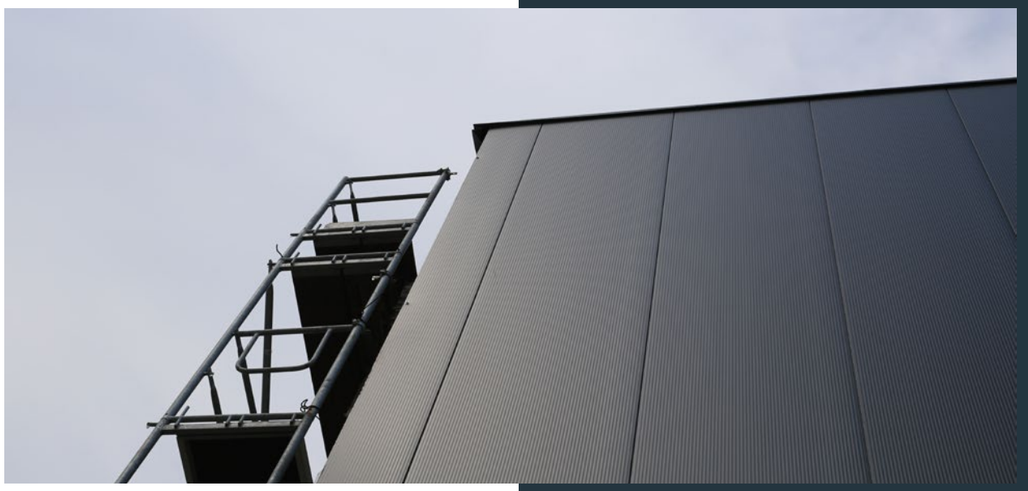


04. CLASSIFICATION BY COLOUR GROUP

The colour grouping shown in the table relates to the effect of thermal loads on cladding made from sandwich panels. When exposed to solar radiation, the steel outer cladding heats up more in the case of darker colours. Due to the large temperature difference (Δt) between the external and internal cladding, thermal stresses arise which affect the performance of the sandwich panel attached to the structure. These stresses may result in surface warping or, in extreme cases, damage to the panel at the intermediate support. In the PN-EN 14509:2013 standard, which sets out the requirements for sandwich panels, colours are divided into three groups: very light, light and dark. The temperature value for the external cladding is determined by the group to which a given colour is assigned and is +55°C for very light colours, +65°C for light colours and +80°C for dark colours, respectively

Colour group	Colours: RAL
Group 1 – very light colours	1015, 1016, 1018, 6019, 9001, 9002, 9010
Group 2 – light colours	1002, 1003, 1004, 1014, 1017, 1019, 1021, 1023, 1035, 2000, 2003, 2004, 2008, 2009, 5012, 5018, 5024, 6018, 6021, 6033, 7000, 7035, 7037, 7040, 9006, 9022
Group 3 – dark colours	3000, 3002, 3003, 3005, 3011, 3013, 5002, 5005, 5009, 5010, 5011, 5022, 6000, 6003, 6005, 6011, 6020, 6029, 7015, 7016, 7022, 7024, 8016, 8017, 8023, 9005, 9007

Table 1. Classification of sandwich panel colours into colour groups



05. GUIDELINES FOR THE USE OF PANELS IN DARK-COLOURED CLADDING

External cladding panels in dark colours (colour group 3), due to significantly higher thermal loads than for light colours, may be subject to deformation and warping. The building designer must take this into account during the design process and, to avoid damage to the panels, adopt a solution that meets all three of the following conditions:

1. select the appropriate fixing method and structural static layout,
2. limit the maximum length of the panels,
3. take into account the temperature at which the sandwich panels will be installed.

1. Static layout and fixing method

For both wall and roof panels, the installation layout must be verified by a qualified designer. The proposed installation layout (static) must meet the SGU (Serviceability Limit State, SLS) and SGN (Ultimate Limit State, ULS) criteria. It is recommended that dark-coloured wall sandwich panels be installed exclusively in single-span configurations. The use of multi-span configurations may result in undulations appearing on the intermediate support due to higher thermal loads. Although such undulations are formally permitted by the product standard, they may give rise to aesthetic concerns on the part of the client and be the cause of a complaint.

Gór-Stal does not provide a guarantee for the flatness of the surface of dark panels used in multi-span systems, unless such use has been agreed in writing with a representative authorised to represent Gór-Stal.

2. Maximum panel lengths

The maximum length of wall panels with cladding in colour group 3 is 9.0 m. The maximum length of roof panels with cladding in colour group 3 is 13.5 m. Gór-Stal does not provide a warranty for dark-coloured panels longer than those listed above, unless such use has been agreed in writing with a representative authorised to represent Gór-Stal.

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3. Installation temperature

The installation of sandwich panels with dark-coloured cladding at low temperatures increases the effect of thermal loads during the summer. It is therefore recommended that the installation of these panels be carried out at a temperature above 10°C. Gór-Stal does not provide a warranty for panels with dark cladding installed at temperatures below 10°C, unless such use has been agreed in writing with an authorised representative of Gór-Stal.



06. GUIDELINES FOR THE USE OF SANDWICH PANELS WITH SMOOTH CLADDING

Non-profiled panels may exhibit undulations greater than those specified in the PN-EN-14509 standard. Panels with smooth cladding may only be installed in a single-span configuration, following prior verification of this possibility by a qualified designer. The use of panels with smooth cladding in other installation systems may lead to undesirable visual effects, i.e. undulation of the cladding. These may be temporary (transient), i.e. occur only under specific conditions, e.g. very high solar exposure of the façade

None of these effects adversely affect the panel's load-bearing capacity, but they may give rise to a complaint from the client due to the deterioration of the façade's appearance. Gór-Stal does not provide a warranty for smooth panels used in multi-span systems, unless such use has been agreed in writing with a representative authorised to act on behalf of Gór-Stal. Gór-Stal shall not be liable for damage to the panels resulting from the designer's failure to take the above guidelines into account



07. MAINTENANCE AND REPAIR OF SANDWICH PANELS

Regular cleaning and maintenance of sandwich panels

Regular cleaning and proper maintenance of sandwich panels is essential for keeping them in good condition and extending their service life. This process not only improves the aesthetic appearance of façades and roofs, but also prevents serious damage to the protective coating. Maintenance should include regular cleaning and the use of specialist protective agents; naturally, the manufacturer's recommendations must be followed. It is important to use agents with the appropriate strength that will not damage the organic coating of the panels, whilst effectively protecting against external factors, such as UV rays or harsh environments.

The frequency and scope of cleaning and maintenance of sandwich panels depend on the operating conditions. In industrial facilities, where the panels are more exposed to dirt and damage, maintenance should be carried out regularly. The condition of the coating should be carefully assessed, particularly on roof and façade surfaces, to prevent serious damage and extend the service life of the panels.

Cleaning methods should be tailored to the type of soiling and the specific characteristics of the cladding. For heavy soiling, it is recommended to apply cleaning agents with the appropriate strength; however, these should not be left on the surface for longer than 30 minutes. Such agents should be used at temperatures up to 30°C. For greasy soiling, the water temperature may be increased to 50°C. It is important that, after each use of strong detergents, the surface of the sandwich panels is thoroughly rinsed with clean water to avoid leaving behind any chemical residues that could affect the cladding.

Maintenance of cut edges on flashings and sandwich panels

The presence of minor corrosion spots on the cut edges of sheet metal is normal and does not pose a direct threat to the durability of the cladding, provided that the corrosion is confined to the edge of the sheet metal. Steel sheets used as cladding, in addition to a paint coating, are protected by a galvanised coating that forms a surface electrochemical barrier against corrosion. In the case of sheets with thicknesses of no more than 1 mm, the cut edge is subject to the principles of electrochemistry corroding only to a certain extent (within the thickness of the cut edge), after which the process stops – hence the natural corrosion of the edge. Where corrosion spots extend beyond the edge, affecting parts of the surface adjacent to the edge, there is a risk of corrosion spreading to the sheet surface. This is caused in most cases by the use of unsuitable cutting equipment or secondary mechanical damage to the paint coating at the edges. In such cases, where an increase in the area of corroded surfaces is observed, it is recommended to protect the sheet metal edges as follows:

1. Cut away and remove any remaining metal filings and paint coating within the corroded area down to the undamaged surface.
2. Remove rust and corrosion spots mechanically – by gentle sandblasting, brushing or treatment with abrasives until a metallic sheen is achieved on the sheet metal surface, leaving the metal surface matt. Thoroughly wash and degrease the surface in accordance with the manufacturer's guidelines for protective coatings.
3. Apply the first coat of primer to the cleaned and prepared surface, in accordance with the manufacturer's instructions.
4. Once the first coat of primer has dried, apply a second coat of primer in such a way that it overlaps the undamaged areas of the original paintwork.
5. Once the primer coats have dried, paint the treated area with a topcoat in accordance with the manufacturer's guidelines.

When carrying out the above protective measures, you may use generally available protective products (primers and topcoats) intended for galvanised and coated steel sheets (polyester paints), or contact GÓR-STAL SP. Z O.O. to obtain information on specialist suppliers of these materials (Pvf2, Celestia or HPS 200)
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Repair of sandwich panels

Identifying the need for renovation of a sandwich panel structure is essential for maintaining its technical condition and aesthetic appearance. Regular inspections should be carried out to quickly detect any defects, such as cracks, delamination or signs of corrosion. Early detection of problems allows for prompt intervention and helps avoid costly repairs in the future.

Methods for repairing and maintaining sandwich panel coatings should comply with the manufacturer's recommendations. When repairing coatings, the damaged area must be thoroughly cleaned and degreased, followed by the application of appropriate repair materials, such as specialist varnishes or paints. It is important that renovations are carried out by a professional company, which will ensure their effectiveness and durability. Where more serious damage has occurred, a complete repair or replacement of entire panel sections may be necessary.

General maintenance and refurbishment of sandwich panels

Maintenance of sandwich panels is essential when signs of ageing or damage to the coating become apparent. This process should include thorough cleaning of the surface, removal of old layers of paint and any dirt that may affect the adhesion of new coatings. It is important to thoroughly degrease and prepare the surface before painting, as this will ensure better adhesion of the new coating.

Coating restoration requires the use of suitable varnishes and paints. Attention should be paid to the properties of the paints, such as resistance to weather conditions and UV radiation. For large surfaces, such as roofs or the facades of industrial buildings, it is recommended to engage a professional company to ensure even application and the durability of the renewed coating.

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GÓR-STAL®
SANDWICH PANELS





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