PRODUCT DESIGN, STORAGE AND INSTALLATION MANUAL

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Summary

1. Introduction

The information and instructions presented in this manual are intended as suggestions to ensure a successful application of our products and should be regarded as a general guideline for the installer.
Such content refers only to the corrugated and trapezoidal profiles we supply and market under our own brand name, as it is based on continuous tests and controls in production aimed at guaranteeing the final quality of the products.
This manual contains general information on the products, and instructions for their correct installation, transportation, and maintenance.
Should you have any questions regarding the contents of this manual, please contact our technical department directly at: tecnico@sandrinimetalli.it.

2. Materials used and their properties

2.1 Main features of metallic materials

In order to orient our customers in the choice of the right product for their needs, we list below some of the main characteristics of the most commonly used materials, which are always available in stock. Other types of metal and/or coatings can be supplied on request.

GALVANISED STEEL
Carbon steel coated on both sides with a zinc (Z) alloy. It can be supplied in natural and/or prepainted finishing through 'coil coating', a continuous painting system based on polyester resins. The inner surface is treated with a layer of primer in a colour that can vary for each individual batch and does not affect the colour of the external side. Featuring excellent mechanical qualities, it can be supplied with an inorganic coating in different grammages (Z100, Z140, Z225, Z275) depending on the circumstances in which it is to be installed (the higher the grammage, the thicker the coating and thus the greater the corrosion resistance). Thanks to its extreme strength, durability and cost-effectiveness, it is one of the most widely used products for roofing and/or façade cladding.

	Description	**Ref. Standard**
Commonly used steel grade:	S250 – S280	UNI EN 10346
Standard inorganic coatings:	Z100 – Z140 – Z225 – Z275	UNI EN 10346
Specific weight:	7,85 Kg/dm^3	
Linear expansion coefficient:	12 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	60 W/m°K	

ALUZINC®
Carbon steel coated on both sides with an alloy consisting of aluminium and zinc (AZ). This material is characterised by excellent thermal and light reflection properties as well as an extremely high resistance to corrosion, which is the result of the combined action of aluminium and zinc. It can be supplied with an inorganic coating in different grammages (70 to 200 g/sqm) depending on the circumstances in which it is to be installed (the higher the grammage, the thicker the coating and thus the greater the corrosion resistance). Our business choice is to supply only AZ185 (185 g/sqm) material with a special anti-fingerprint protective surface treatment, which is one of the most widely used products for roofing and/or façade cladding.

	Description	**Ref. Standard**
Commonly used steel grade:	S250 – S280	UNI EN 10346
Standard inorganic coatings:	AZ 185	UNI EN 10346
Specific weight:	7,85 Kg/dm^3	
Linear expansion coefficient:	12 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	60 W/m°K	

MAGNELIS®

Carbon steel coated on both sides with an alloy consisting of zinc, aluminium and magnesium (ZM). This innovative inorganic coating provides a corrosion resistance up to 10 times higher than common galvanised steel. Featuring excellent mechanical properties, it can be supplied with an inorganic coating in different grammages (from 90 to 430 g/sqm) depending on the circumstances in which it is to be installed (the higher the grammage, the thicker the coating and thus the greater the corrosion resistance). Our business choice is to supply only ZM310 (310 g/mq) material with a special anti-fingerprint surface treatment, which is one of the most widely used products for roofing and/or façade cladding even in the most hostile environments.

	Description	**Ref. Standard**
Commonly used steel grade:	S250 – S280	UNI EN 10346
Standard inorganic coatings:	ZM 310	UNI EN 10346
Specific weight:	7,85 Kg/dm^3	
Linear expansion coefficient:	12 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	60 W/m°K	

NATURAL ALUMINIUM

A metal obtained from bauxite, mainly used in the form of pure aluminium alloys combined with other elements which improve its mechanical properties and corrosion resistance. It can be supplied in natural and/or prepainted finishing through 'coil coating', a continuous painting system based on polyester resins. The inner surface is treated with a layer of primer in a colour that can vary for each individual batch and does not affect the colour of the external side. The main features of this material are: lightweightness, good mechanical properties and excellent corrosion resistance. It is one of the most widely used products for roofing and/or façade cladding, also thanks to its eco-sustainability

	Description	**Ref. Standard**
Commonly used alloy:	3003 – 3105	UNI EN 485-02
Standard inorganic coatings:	None	
Specific weight:	2,73 Kg/dm^3	
Linear expansion coefficient:	24 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	210 W/m°K	

STAINLESS STEEL

Stainless steel is an iron alloy consisting of several elements (mainly chromium) that can passivate and protect the metal from external chemical agents. A metal characterised by remarkable mechanical properties and an excellent corrosion resistance, as well as its pleasant aesthetic appearance. It can be supplied natural (smooth, mirror-polished or satin-finished) and/or prepainted through the 'coil coating' system. The inner surface is treated with a layer of primer in a colour that can vary for each individual batch and does not affect the colour of the external side.

	Description	**Ref. Standard**
Commonly used type:	AISI 304 (X5CrNi18-10)	UNI EN 10088-4
Standard inorganic coatings:	None	
Specific weight:	8,00 Kg/dm^2	
Linear expansion coefficient:	16 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	15 W/m°K	

COPPER

Copper is a metal that can last for thousands of years, is weather-resistant and beautiful. Characterised by a bright and unmistakable natural colour, as time passes its elegant initial shine fades away and the material acquires different colourings: at first, it produces a brownish oxide until it eventually takes on the characteristic green or blue-green

colouring. The extreme malleability makes this material easy to machine, to the detriment of its mechanical strength, which is lower in comparison to that of steel.

	Description	**Ref. Standard**
Commonly used alloy:	Cu-DHP	UNI 9329
Standard inorganic coatings:	None	
Specific weight:	8,98 Kg/dm^3	
Linear expansion coefficient:	17 x 10^{-6} K^{-1}	
Reaction to fire:	A1 (fireproof)	
Thermal conductivity:	390 W/m°K	

The technical data above refer to natural materials (not prepainted) and are to be considered indicative only.
It is up to the designer, or, in any case, the technician commissioned by the customer to select the appropriate or most suitable material.

2.2 Compatibility of metallic materials

The difference between the electrical potential among various metals, when exposed to moisture and/or electrolyte liquid (water or other), generates a passage of ions between the metals themselves, which causes galvanic corrosion phenomena. The main incompatibilities between metals are listed below: great care must be taken to ensure that they do not come into direct contact with each other so that any corrosive phenomena that could compromise the roofing are avoided.

	ALUMINIUM	*GALVANISED STEEL*	*ALUZINC®*	*MAGNELIS®*	*TITANIUM ZINC*	*STAINLESS STEEL*	*COPPER*
ALUMINIUM	✓	✗	✗	✗	✓	✓	✗
GALVANISED STEEL	✗	✓	✓	✓	✓	✓	✗
ALUZINC®	✗	✓	✓	✓	✓	✓	✗
MAGNELIS®	✗	✓	✓	✓	✓	✓	✗
TITANIUM ZINC	✓	✓	✓	✓	✓	✓	✗
STAINLESS STEEL	✓	✓	✓	✓	✓	✓	✓
COPPER	✗	✗	✗	✗	✗	✓	✓

Metal compatibility

3. Product dimensional tolerances

3.1 Dimensional tolerances of corrugated and trapezoidal sheets

Dimensional tolerances of corrugated and trapezoidal metal sheets based on the height H of the rib*

Type	**U.M.**	**Deviation Hgr ≤ 50 mm**	**Deviation 50 < Hgr ≤ 100 mm**	**Deviation Hgr ≥ 100 mm**	**Reference standard(s)**
Rib height	mm	+/- 1	+/- 1.5	+/- 2	EN 508-1 EN 508-2 EN 506
Centre distance between ribs (measured at least 200 mm from the ends)	mm	+/- 2	+/- 3	+/- 4	
Sheet length *l* <= 3000 mm	mm	+10 /-5	+10 /-5	+10 /-5	
Sheet length *l* > 3000 mm	mm	+20 / -5	+20 / -5	+20 / -5	
Ribs crest and trough width (at least 200 mm from the ends)	mm	+2 / -1	+2 / -1	+2 / -1	
Useful width (measured at least 200 mm from the ends)	mm	+/- 5	+/- 0,1 x Hgr	+/- 0,1 x Hgr	
Out-of-square (in relation to useful width)	%	0.5	0.5	0.5	
Edge waveness (on 500 mm section)	mm	+/- 2	+/- 2	+/- 2	
Out-of-axis (measured at least 200 mm from the ends)	mm/m	2 (max tot 10)	2 (max tot 10)	2 (max tot 10)	

* *Any processing on the corrugated and trapezoidal sheets such as notching, calendaring, maxi-bending with controlled deformation, as well as special applications such as anti-condensation felt, cross-linked polyethylene and others may cause tolerances to exceed those specified*

3.2 Thickness tolerances

Tolerances on nominal thickness are set in accordance with the standards listed below, depending on the material and width of the laminate:

- UNI EN 485-04: Aluminium and aluminium alloys;
- UNI EN 10143 : Steel (normal tolerance);
- UNI EN 1652: Copper;
- UNI EN 10088-2: Stainless steel.

3.3 Machining tolerances

Bending processes*:

- +/- 10% on bending radius
- +/- 10 mm on notched area centre distances for lengths up to 5 m
- +/- 15 mm on notched area centre distances for lengths between 5 and 9 m
- +/- 25 mm on notched area centre distances for lengths above 9 m

* *The inherent flexibility of corrugated and trapezoidal sheets and the way they are handled can lead to slight differences in bending with respect to the theoretical design; however, these can be easily compensated for during installation. For this reason, we do not accept any responsibility for the incompatibility of the sheets with the relevant roofing. Any bending discrepancies must be reported immediately upon receipt of the goods.*

4. Product Supply and Storage

4.1 Packaging and packing

In order to maintain their durability throughout use, great attention should be paid in not damaging metal roofing elements during storage, transportation, handling and installation. The materials are supplied in simple standard packaging, with timber or polystyrene strips and simple polyethylene outer protection. Any requests for packaging other than the above and/or those listed in the order confirmation should be communicated in advance and may be charged to the invoice.

4.2 Applications on corrugated and trapezoidal sheets

On request, corrugated and trapezoidal sheets can be supplied with one of the following anti-condensation and/or anti-noise products applied to the internal side:

- Non-woven cloth;
- Bitumen sheath;
- Cross-linked polyethylene.

Corrugated and trapezoidal sheets with a sheath or polyethylene layer applied on the internal side may be packaged and exhibit a ‘U’ shape: this is not a defect but a natural behaviour of laminated products. Due to the aesthetic imperfections of the materials, we do not advise using a sheath or polyethylene for applications where the internal side is visible. To prevent the non-woven cloth from detaching and/or altering its performance, provide a non-hygroscopic bridge of approximately 20 cm at the end-to-end overlaps and on the ends of the sheets conveying water to the eaves. This is to neutralise the very action of the non-woven cloth for the first few centimetres of the sheets.

4.3 Application and removal of the protective peelable film

In order to preserve the visible side of our products from possible scratches and/or abrasions, upon ordering, the customer can request a protective polyethylene film (which can be either a peel-off adhesive or simply wrapping the product) to be applied.
Under certain circumstances, the company may apply this peelable film for technical warranty and/or processing requirements, even if not expressly requested; in this case the user may not claim any reimbursement for any removal. For corrugated and trapezoidal sheets intended for wall installation or in case of non-standard colourings, the application of the peelable film on the 'A-side' (visible) is mandatory. If you do not wish to receive your sheets with the peelable film applied, no claims for scratches and/or scuffing will be accepted. The peelable film must be completely removed no later than 5 days from the date of application, and in any case within 20 days from the date on which the preparation of the material ordered was completed. We recommend that you do not expose the material with the peelable film applied to sources of heat as this may cause difficulties in removing it and glue could be released on the substrate. If following the customer's request, the material is not collected or delivered, the company cannot be held liable for any issue that may arise as a result of not having removed the peelable film within the technical timeframe specified above.

4.4 Collection of prepared material

The material ordered shall be collected within 15 days from the notice of goods ready for collection; during this timeframe the material shall be stored indoor at our facility. Once this time frame has elapsed, we shall be entitled to invoice said material and receive the corresponding payment. In the event of prolonged storage (beyond 15 days) of the prepared products, we reserve the right to move the goods in an outdoor area, after duly notifying the customer; in this case, we shall not be held liable for theft, damage or deterioration. Should the goods then, due to further impediments beyond our control, be stored for more than one month on the Company's premises, an additional storage charge of 1% of the value of the goods shall be applied for each week of storage; this charge will be duly invoiced.

4.5 Transportation

The material shall be transported in such a way that:

- The packs are placed on spacers, made of timber or expanded plastic material, positioned at a distance from each other suitable to the characteristics of the product;
- The support surface matches the shape of the pack (it shall be flat if the pack is flat; if the pack is curved, the support should be designed to maintain the curvature: this support should also be available on site once the material is unloaded and until it is installed);
- Packs are always stacked using suitable spacers, if these are not present in the timber or expanded plastic material;
- Packs do not have overhangs of more than 1 m;
- The points where packs should be secured for hoisting can be clearly indicated at the specific request of the customer when placing the order;
- Any other prescriptions of the manufacturer are complied with;
- The packs shall be secured by the carrier to the means of transport by means of transverse bindings with straps placed at a maximum distance of 3 m from the centres and in any case each pack shall have no less than two transverse bindings;
- During transport, the bundle shall always be covered by a waterproof element;
- If the Buyer arranges collection, shall instruct the drivers accordingly;
- The bundle shall be loaded on a totally free and clean platform: vehicles already partially loaded with other materials or unsuitable material will not be accepted for loading;
- the goods on the vehicles shall be arranged in accordance with the instructions of the carrier, who is solely responsible for the integrity of the bundle, and who shall take particular care to ensure that the weight bearing on the bottom packs as well as the pressure exerted by the tie-points does not cause damage and that the straps do not cause deformation of the product;

- special loading conditions may only be accepted upon written proposal by the Buyer, who accepts full responsibility.
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4.6 Checking the material upon receipt

The customer is obliged to check the goods upon delivery.

The Buyer assumes all the risks connected to the goods transportation even when they're sold CPT. Visual defects, shortfalls and ascertainable defects must be reported upon delivery by means of a note on the Transport Document and by notification to the Company no later than 12 hours after receiving the goods. **Any defective goods delivered must not be installed: the installation will invalidate any warranty on them.**

4.7 Storage of material

The prescriptions relating to elements storage are given in EN 10372:2013 (see Section 9.10.3 of the standard). The packs must be kept off the ground using spacers that provide sufficient space to allow good ventilation and placed at a sufficient distance from each other to prevent any permanent deformation of the material. The support surface must be compatible with the shape of the packs: it should be flat if the pack is flat, whereas if the pack is curved, it should be designed to maintain the same curvature. The packs must be stored in places sheltered from moisture, at an angle to the horizontal plane; they must be kept away from rain, as well as from moisture, otherwise water stagnation and condensation, which is highly aggressive on metals, will occur on the less ventilated internal elements, leading to the formation of oxidation. Packs should be stored in such a way as to facilitate water run-off, especially when it is necessary to temporarily store them outdoor (see fig. 1).

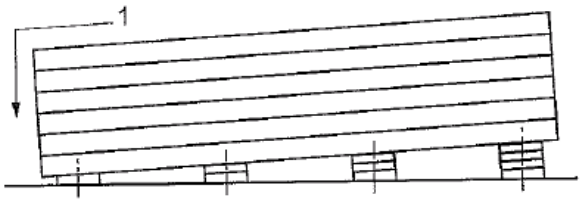

Figure 1
Slight slope - minimum 5%

If the material is not installed right after storage, the packs should be covered with protective tarpaulins. It is generally preferable not to stack the packs: if, given the low weight of the material, stacking them is considered possible, an adequate number of spacers made of timber or expanded plastic material with a support base as large as possible should always be used to support the packs placed at the bottom (see Fig. 2).

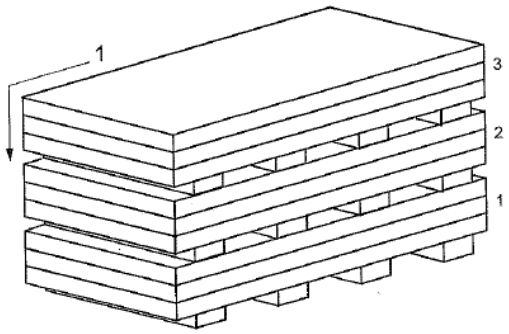

Figure 2
Slight slope– minimum 5%

The best storage conditions are in closed, lightly ventilated, moisture-free and dust-free environments. In any case, and especially if the material is stored at the construction site, it is necessary to provide a suitable

stable support surface that does not allow water to stagnate. Failure to comply with the above instructions may result in changes to the appearance of the sheets themselves, i.e. damage to the superficial coating, including, but not limited to:

- blackish stains (oxidation) on natural aluminium and aluzinc®, whitish and/or rust red stains on galvanised, prepainted and aluzinc® sheet metal;
- more or less spread flaking of paint on prepainted aluminium and prepainted sheet metal;
- detachment of the primer/back coat and/or the paint with consequent effect transferring onto the sheet in contact in the pack (or coil in the case of strips).

Furthermore, the packages must not be placed in areas close to processing (e.g. metal cutting, sandblasting, painting, welding, etc.) or in areas where transiting or parked operating vehicles may cause damage (impacts, splashes, exhaust gases, etc.).

Our company is not liable and does not provide any guarantee for materials presenting defects attributable to failure to comply to proper storing condition as per the aforementioned regulatory requirements.

4.8 Handling the packs

If, unloading operations require the material to be moved by mechanical means, such as a crane, forklift, or similar, great care must be taken during handling to avoid any damage.
Packs must always be prepared for hoisting by securing them from at least two points, the distance between said two points should be no less than half the length of the pack itself. Lifting should preferably be carried out with synthetic fibre (nylon) woven straps with a width of no less than 10 cm so that the load is distributed on the strap and does not cause deformation (see figure 3). Special spacers, consisting of sturdy flat elements of timber or plastic material, must be placed below and above the pack to prevent direct contact of the straps with the pack. These spacers must be at least 4 cm longer than the width of the pack and at least as wide as the strap.

In any case, the bottom spacers must be wide enough to prevent the weight of the pack from causing permanent deformation of the elements at the bottom.

Care must be taken to ensure that slings and supports cannot move during lifting and that manoeuvres are carried out carefully and smoothly. Packs may be deposited on the roofing structure only on surfaces that are suitable to support them, both in terms of strength and support and safety conditions, also depending on any other work in progress. Packs stored at a height must always be adequately secured to the structures: it is advisable to always ask the construction management for approval. Handling of the elements must be carried out using appropriate means of protection (gloves, safety shoes, overalls, etc.), in compliance with the regulations in force. The manual handling of the individual element must always be carried out by lifting the element itself, without dragging it over the one below and by turning it into an upright position on the side of the pack; the transportation must be carried out by at least two or more persons depending on the length, keeping the element in an upright position (see figure 4). Grasping equipment, as well as work gloves, must be clean and such that no damage is caused to the elements.

The use of forklift trucks for handling the elements is not recommended, as this can cause damage. In any case, the above instructions must be observed.

Figure 3

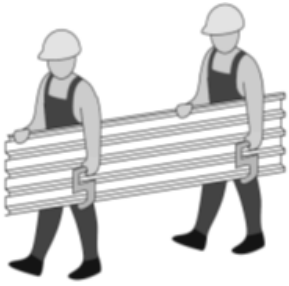

Figure 4

5 Guidelines for design and product installation

5.1 Regulatory references

Due to its importance, it is essential that the construction of a roofing is carried out on the basis of a preliminary plan, issued by a competent designer, in which, in addition to the indications of the products to be used, construction details and instructions for their application are defined. The calculation methodology for roofing elements must follow the applicable national and/or European regulations. The load-bearing capacity performance tables published in our technical documentation and/or load reports on specific cases are drawn up in accordance with the following standards currently in force:

- UNI EN 1993-1-3 (Eurocode 3) for steel elements;
- UNI EN 1999-1-4 (Eurocode 9) for aluminium elements;
- Technical Standards for Construction (M.D. 14 January 2008);
- UNI 10372 (“Discontinuous roofing: instructions for design and execution with metal sheet elements”).

The data shown in such performance tables and/or load and/or calculation reports on specific cases are always provided merely as an indication, since the technical choice and stability calculation of the materials involved in the work are the responsibility and task of the designer/user of the work itself, in accordance with the provisions of the laws and regulations in force.

With regard to deformability, the deflection of the element must not be greater, for roofing, than 1/200 of the span between the supports in the less favourable condition according to current legislation. The main factors that the designer must consider when designing a roofing are as follows (see UNI EN 10372).

Action of the wind
For the determination of the action of the wind, please refer to the provisions of current legislation (M.D. 14 January 2008 – ‘Approval of the new Technical Standards for Construction’) and UNI EN 1991-1-4. Current legislation distinguishes nine areas into which Italy is conventionally divided, each of which is associated with a reference speed ranging from 25 m/s to 31 m/s (the highest values refer to the Trieste area and the islands, excluding Sicily and Sardinia). It should be noted that the depression, plus any internal pressure, can lead to depressions of more than 2000 N/m^2 on the contour of the roofing and particularly in the corners. Because of this possibility, the fixing system of the roofing sheet metal to the supporting element is extremely important.

Snow load
For the definition of the snow load, please refer to the provisions of current legislation (M.D. 14 January 2008 – ‘Approval of the new Technical Standards for Construction’). These prescriptions provide for three areas into which Italy is conventionally divided, which in turn are distinguished according to the reference altitude q_s (altitude of the ground above sea level at the building site). These include also coefficients that take into account the conformation of the roofing and the relative possibility of uneven accumulation of snow. One aspect to be considered properly is the possibility of puddles forming as a result of localized snowmelt (e.g. around chimneys). Under these conditions, the joints could be under water and thus impair the watertightness of the roofing. Appropriate measures can be taken to prevent the formation of ice and the total or partial accumulation of snow, provided, of course, that the proper effluent water run-off is guaranteed.

Rainfall
It is necessary to consider statistical data, in the various seasons and for the area in which operation takes place, regarding the duration and quantity (in millimetres) of rainfall with the most significant intensities (in mm/hour). Statistical data can be obtained from surveys of the Air Force meteorological stations, the

stations of the Central Agricultural Ecology Office of the Ministry of Agriculture and Forestry. When designing the roofing, the simultaneous occurrence of rain and wind must also be considered, along with the dominant direction and maximum speeds of the latter. The roofing sheets produced by us provide for an installation with a longitudinal overlap increased to one and a half ribs (SAND28 - SAND20/1125), two full ribs (SAND20/975) or single rib overlap with SANDdry drainage channel (SAND27 – SAND35 – SAND40/200 – SAND40/250). All types of overlap of our profiles are listed on page 10 of this manual.

Local exposure situations
With regard to aspects relating to watertightness on the basis of the concomitant wind-rain effect (slope and length of pitches, product overlapping, etc.) or aspects relating to the anchoring of products in relation to the action of the wind (minimum number of fixing points, etc.), local exposure situations should also be considered:

- protected site: valley floor surrounded by hills and sheltered in the directions from which the most violent winds blow from;
- normal site: flat terrain that may have not relevant slopes;
- exposed site: coastal area near the sea, mountain valleys where violent winds are present, isolated and exposed mountain areas.

Condensation
In particular climatic conditions, condensation of water vapour may occur at night at the soffit of the sheets, due to the elements cooling by radiation towards the sky (very clear nights, etc.) or condensation of humid air on the soffit of the corrugated/trapezoidal metal sheet in contact with the cold surface of the same. The problem of possible condensation water can be solved during the design phase, to prevent water from wetting the underlying layers, through specific measures such as:

- special waterproof layer (vapour barrier) to be placed on the soffit of the insulation (internal side);
- application of a special polyester cloth on the soffit of the sheet metal (internal side) to retain condensation water.

In special situations (e.g. geographic areas with very low night temperatures, buildings with high relative moisture and/or poor ventilation, etc.) it is advisable to carry out a thermos-technical study during the design phase to check that condensation does not form inside the roofing stratification under the climatic conditions inside and outside the building.

Ventilation
If a ventilated roofing is used, a cavity must be created below the supporting element to ensure the free passage of air, with a minimum height of 4 cm for pitches up to 12 m and a minimum height of 6 cm for longer pitches. Ventilation air flow must be ensured by means of a ventilated ridge, openings along the eaves and possible air outlets.

Pitch slope
The minimum slope of the roofing pitch required to ensure watertightness and maintain the useful life of the sheet is a function of the following factors:

- climate zone and local exposure situation (protected site, normal site, exposed site);
- length of the roofing pitch;
- type of sealing element and extent of overlap.

5.2 Checks required before starting working on site

Upon delivery of the supporting structure, it must be checked whether:

- The support surfaces are aligned and arranged according to the project;
- The surfaces of the supports that will be in contact with the roof sheet metal are protected from possible corrosion by electrochemical effects;
- There is interference with overhead power lines above the roof or in the manoeuvring area for lifting or laying materials;
- Work at height is compatible or not with other work being carried out above, next or under the roofing;

- The site area is suitable for storing the material so that it is not damaged;
- The conditions to put in place all the safety measures that the work requires in order to prevent accidents are met.

5.3 Overlaps between corrugated/trapezoidal sheets

5.3.1 Lateral overlaps

Depending on the type of profile adopted, the lateral overlap is done:

Profile	Useful width (mm)	1 Rib overlap 	1 Rib overlap with foot 	1.5 Ribs overlap 	2 Ribs overlap 
SAND 18*	836	✓			
	1064	✓			
	1292	✓			
SAND 20	750			✓	
	900				✓
	975	✓			
SAND 28	1125			✓	
	680			✓	
	900			✓	
	1120			✓	
SAND 27	1045		✓ + SD		
SAND 35	800		✓ + SD		
	1000		✓ + SD		
	1200		✓ + SD		
SAND 38	732	✓			
	915	✓			
	1098	✓			
SAND 40/100	600		✓		
	800	✓			
	900			✓	
SAND 40/200	1000		✓ + SD		
SAND 40/250	1000	✓ + SD			
SAND 40/300	1200		✓		
SAND 42	1000	✓			
SAND A55 P600	600	✓			
SAND A55 P800	800	✓			
SAND 65	600	✓			
	750	✓			
	900		✓		

* For roofing use provide double overlap
SD = exclusive “SAND DRY” drainage channel”

5.3.2 Overlap orientation

The overlap must be oriented against the direction of the prevailing winds in the area:

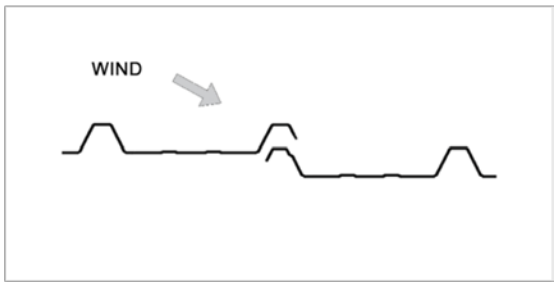

Figure 5: 1 Rib overlap

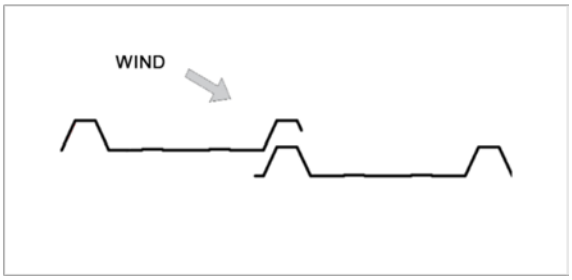

Figure 6: 1 Rib overlap with foot

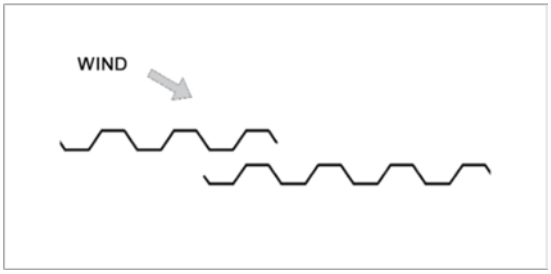

Figure 7: 1.5 Ribs overlap

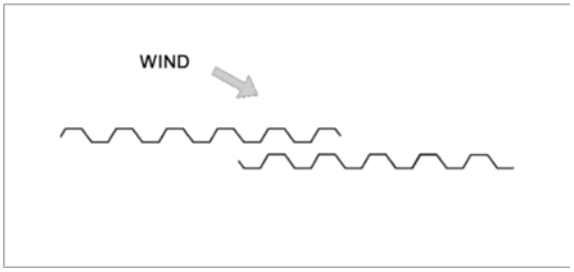

Figure 8: 2 Ribs overlap

5.3.3 Longitudinal overlaps and admissible slopes

For roofing with pitch elements without intermediate joints (pitch formed by a single corrugated/trapezoidal sheet), the minimum slope that can be used is 7%. However, in favourable climatic areas, the minimum acceptable slope can be up to 5% if the corrugated and trapezoidal profiles used allow for the overlapping of one and a half or two whole ribs. In areas of high snowfall and when using the corrugated and trapezoidal sheets at the maximum permissible load-bearing capacity, bending may occur in the area of the overlap, which, due to the snow permanent load, can lead to possible infiltration hazards. In the case of an intermediate pitch joint, provide an adequate overlap in accordance with the provisions of Table 1 § 5.3.1.2 standard UNI 10372:2013:

Slope %	Overlap mm
7%< S ≤ 10%	250
10%< S ≤ 15%	200
15%< S	150

In the case of corrugated/trapezoidal elements of great length and produced from material with high thermal expansion (e.g. aluminium), it is advisable to arrange an overlap that allows the possibility of expansion as shown below (Figure 9 and 10) (UNI EN 10372:2013).

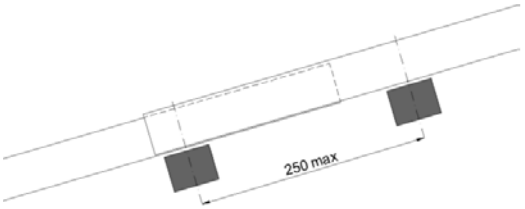

Figure 9

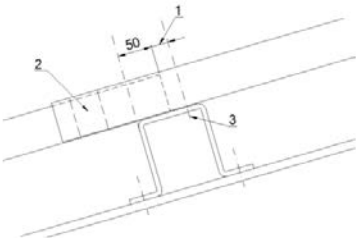

Figure 10

5.4 Fixing corrugated and trapezoidal sheets

The type of fixing and the density on the supports must be determined on the basis of calculations prepared by the roofing designer. The support must be over the entire support width and must be at least 50 mm. The safety conditions must be verified taking into account the actions induced both by the design loads and by any depression loads (wind).
In any case, it is recommended that all ribs are fixed at the eaves line, the ridge line, and the transverse connection of the sheets. In the case of thin sheets, it is advisable to fix them along the lateral overlap edge ('seam') as well. Below are the recommended screw arrangement diagrams, depending on the profile types of the corrugated and trapezoidal sheets and the different characteristic areas of the roofing. **These diagrams are valid for areas subject to normal weathering stress.** For particular geographical areas (highly windy), increase the number of fixing points, especially in the perimeter parts of the roofing.

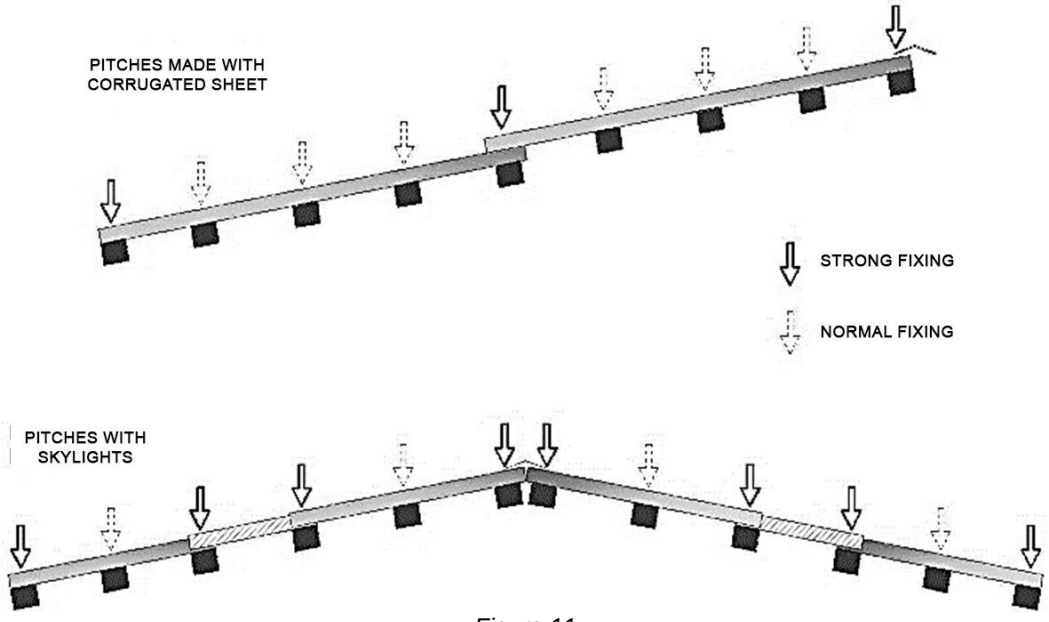

Figure 11

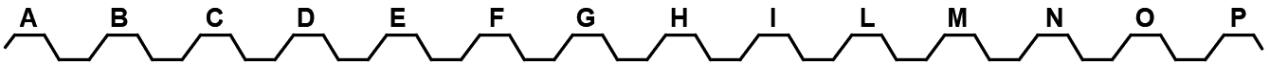

Figure 12: SAND 20 - L = 900mm

↓ **STRONG FIXING:** Fixings on ribs **A-C-E-G-I-M-O(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately C/D)-(alternately G/H)-(alternately L/M)-O(A)**

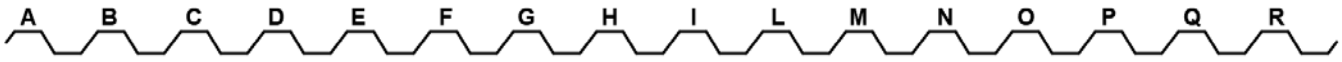

Figure 13: SAND 20 - L = 1125mm

↓ **STRONG FIXING**: Fixings on ribs **A-C-E-G-L-N-P-R(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately D/F)-(alternately H/L)-(alternately N/P)-R(A)**

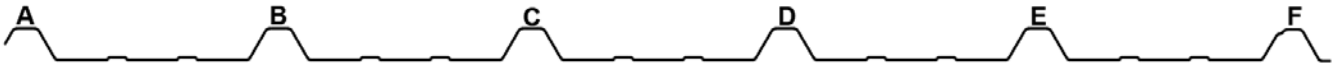

Figure 14: SAND 27 – L = 1045mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately D/E)-F(A)**

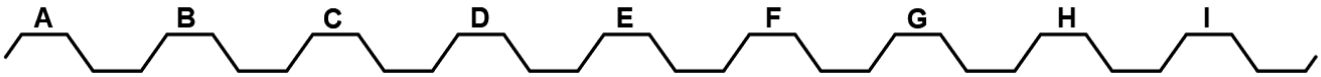

Figure 15: SAND 28 – L = 900mm

↓ **STRONG FIXING:** Fixings on ribs **A-C-E-G-I(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately C/D)-(alternately F/G)-I(A)**

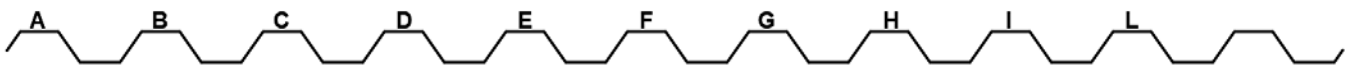

Figure 16: SAND 28 – L = 1120mm

↓ **STRONG FIXING:** Fixings on ribs **A-C-E-G-L(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately C/D)-(alternately G/H)-L(A)**

Figure 17: SAND 35 - L = 1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately D/E)-F(A)**

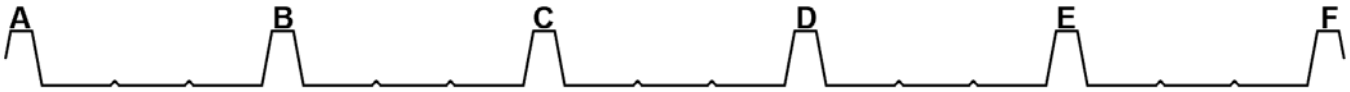

Figure 18: SAND 38 – L = 915mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately D/E)-F(A)**

Figure 19: SAND 40/100 - L = 800mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F-G-H-I(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately C/D)-(alternately F/G)-I(A)**

Figure 20: SAND 40/100 - L = 1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F-G-H-I-L(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately E/F)-(alternately H/I)-L(A)**

Figure 21: SAND 40/200 - L = 1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately D/E)-F(A)**

Figure 22: SAND 40/250 - L=1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

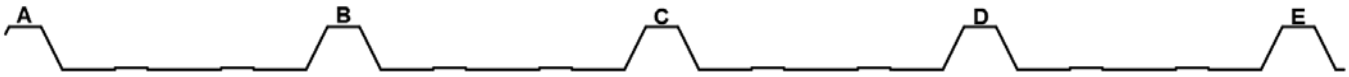

Figure 23: SAND 40/300 - L=1200mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

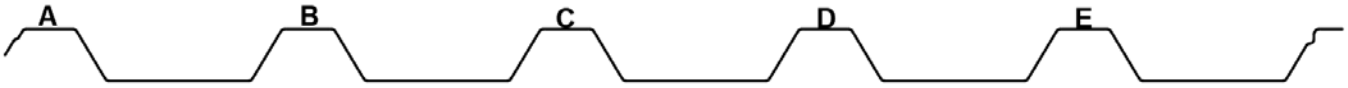

Figure 24: SAND 41 – L=1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

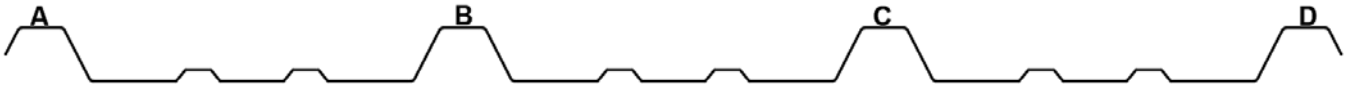

Figure 25: SAND 42 - L=1000mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-D(A)**

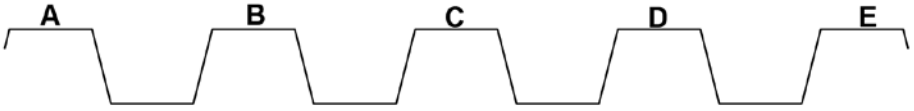

Figure 26: SAND A55 P600 - L=600mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

Figure 27: SAND A55 P750- L=750mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

Figure 28: SAND A55 P750- L=750mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-C-E(A)**

Figure 29: SAND A55 P800 – L=800mm

↓ **STRONG FIXING:** Fixings on ribs **A-B-C-D-E-F(A)**
↓ **NORMAL FIXING:** Fixings on ribs **A-(alternately B/C)-(alternately D/E)-F(A)**

5.5 Types of fixing

The type of screws to be used must be chosen according to the nature of the substrate to which the corrugated and trapezoidal sheets are to be fixed, as well as the forces acting on them. We recommend using screws with EPDM gaskets, always paying attention to the electrochemical compatibility of the materials. Below are some examples of screws used. (Figure 30).

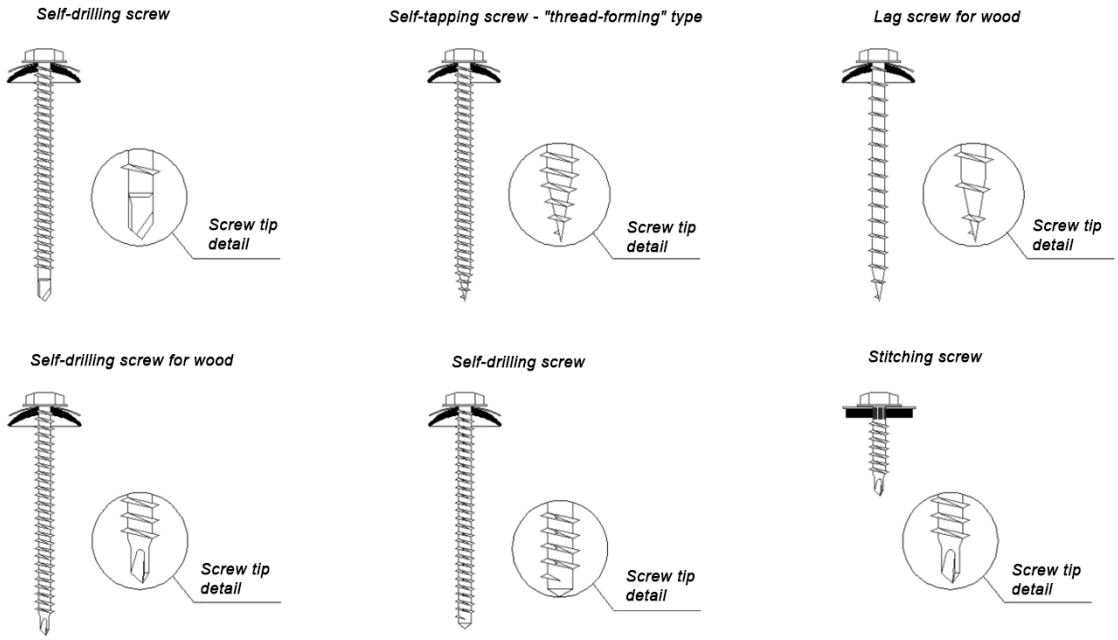

Figure 30

Special care must be taken when screwing in to ensure that the fixing device remains perpendicular to the corrugated/trapezoidal sheet and to avoid excessive deformation of the seals or in the sheets (Figure 31).

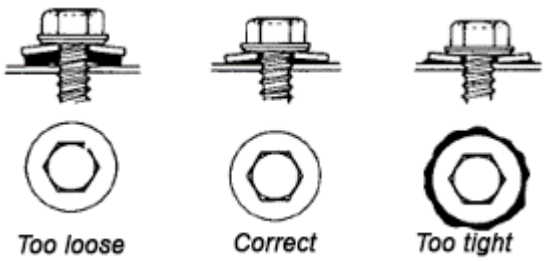

Figure 31

5.6 Fixing on prefabricated structures

Figure 32 below shows the main shape types for corrugated and trapezoidal sheets used as **roofing of prefabricated structures with Y-beams (or similar)**, in relation to the intended use (e.g. photovoltaic). Upon request, our Technical Department can provide useful suggestions on the most appropriate use.

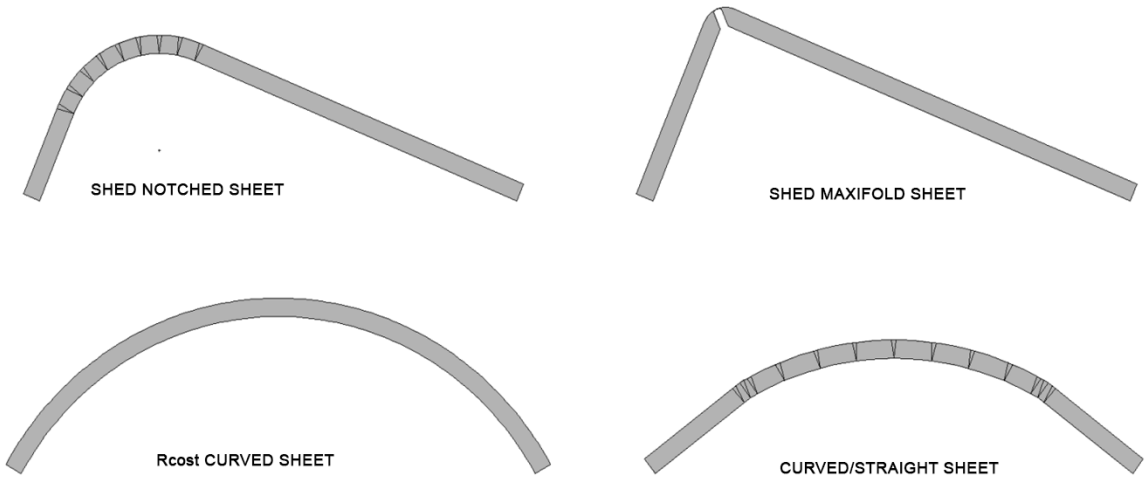

Figure 32

Fixing is normally done on the upper part of the rib, to reduce the risk of water seepage. **Only if curved corrugated and trapezoidal sheets are used as roofing for prefabricated structures with Y-beams (or similar), it is necessary to fix them acting on the lower part of the rib, ensuring that any water infiltration occurs within the beam itself (see Figure 33).**

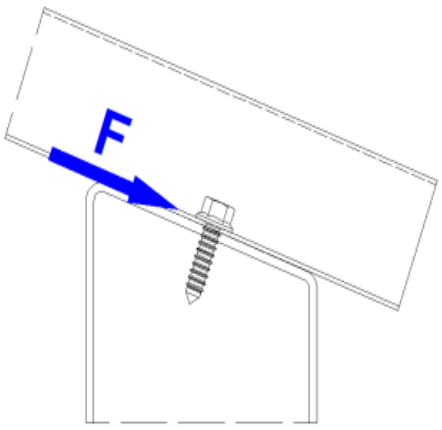

Figure 33

A dedicated illustrative case report can be requested for this type of application by contacting our Technical Department. This report can provide the designer and/or project manager with indicative values referring to the lateral thrust stresses F on the constraints of the sheets themselves, in order to allow the professional to dimension the anchoring structure and establish the number of fixings required.

It is understood that the data provided by us are for information purposes only, and that is the Designer and/or Project Manager responsibility to use them accordingly.

5.7 Installation of photovoltaic system

It is recommended to pay particular attention to the interaction between the corrugated/trapezoidal sheet material and the fasteners/bracket of the photovoltaic system in order to avoid galvanic corrosion phenomena (see *section 1.2*). It is also recommended to avoid fixing the elements is such a way that would require holes to be drilled on the sheet metal at the lower part of the rib in order to avoid possible water infiltration. We therefore recommend fixing at the upper part, using fixing elements that are also fitted with a suitable gasket. The identification of the appropriate technical solution for the installation of the photovoltaic system is the responsibility of the customer, who must take into account the materials used and the possible fixing solutions that can be adopted.

Therefore the company accepts no liability resulting from incorrect installation of this system on our corrugated and trapezoidal sheets by the installation company.

5.8 Periodic maintenance

In order to maintain the integrity of the existing roofing, its watertightness, and its load-bearing capacity, it is necessary to carry out periodic inspections and scheduled routine maintenance, also including the control of any technological installations present (chimneys, smoke evacuators, rainwater drainage, lightning protection system, etc.). Inspections must be carried out at regular intervals, the first one should occur at the same time as the inspection of the building or the cladding elements in the case of re-roofing. Inspections are carried out at least once a year; however, it is preferable to carry out two inspections, preferably in spring and autumn.
During the first inspection, it is necessary to check that no foreign materials or processing waste are left on the cladding elements. These materials could trigger corrosion phenomena to the detriment of the cladding elements themselves or, if they corrode themselves, lead to a deterioration of the surface appearance; they could also obstruct proper run-off of rainwater or result in an accumulation of unwanted substances (dust, sand, leaves, etc.). Subsequent inspections consist of a check of the general condition of the roofing: state of preservation of the elements, ridges, flashings, eaves, tightness of fixings, any sealing and assessing whether it is necessary to clean the roofing so that no dirt deposits, that could cause degradation, are left.
The efficiency of the rainwater drainage system and other technological installations should also be checked. Scheduled routine maintenance depends in its extent and frequency on the product used for the cladding element and must be performed in accordance with the instructions provided by the manufacturer and/or designer. In any case, in order to preserve the aesthetic characteristics of the elements and to prolong the efficiency of any protective cladding of the elements, regular cleaning may be necessary. Furthermore, should the inspection lead to the detection of ongoing problems, an immediate extraordinary intervention has to be carried out in order to restore the initial conditions. If corrosion phenomena occur on metal elements, it is necessary to intervene on the affected areas according to any instructions to be obtained from the manufacturer. Please refer to § 11 standard UNI EN 10372:2013).
Every time routine maintenance is carried out, it will be necessary to draw up a report indicating any damage or changes with respect to the initial installation conditions or the last inspection carried out.

The Technical Customer Service of Sandrini Metalli S.p.A. is available for any useful suggestion and/or advice regarding the choice and application of the materials produced and/or marketed.