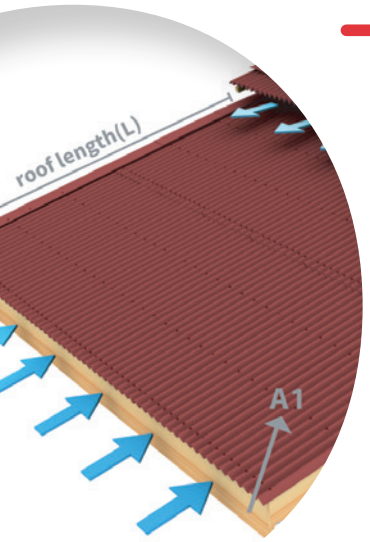
ONDULINE® SYSTEM

TECHNICAL BOOK

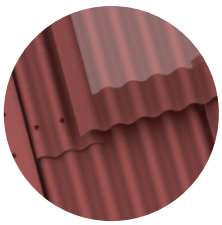


Onduline®
Lightweight roofing systems

INDEX

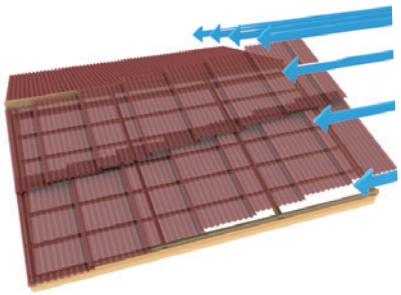
SUMMARY / GENERAL

SHEET LAYOUT



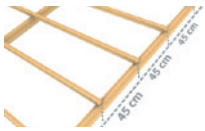
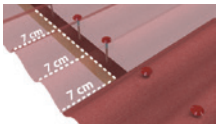
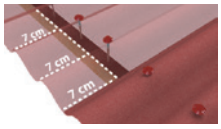
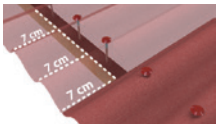
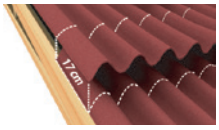
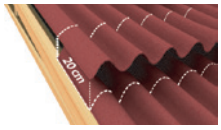
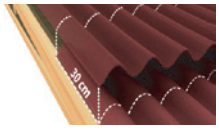
GENERAL

1. Start fixing sheets at the opposite to prevailing winds end of the roof.
2. Start every second raw with a sheet cut in half vertically in other to avoid side overlaps in the same line on all length of the roof, thus creating a broken bond pattern.
3. Using a broken bond pattern reduces the overall thickness of the overlapping.

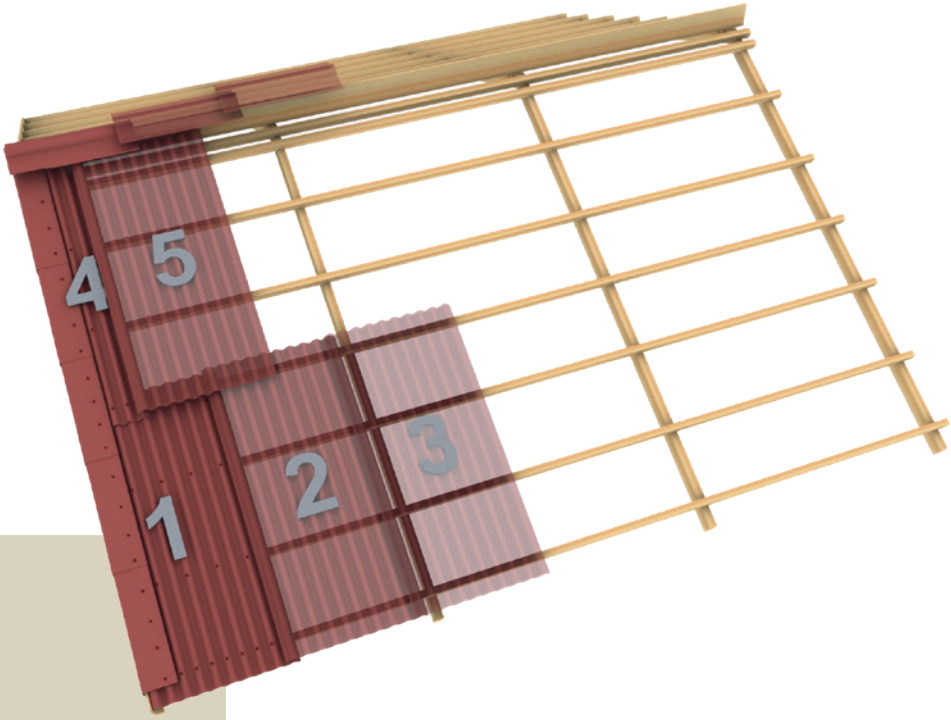


OVERLAPPING RULES

Following the overlapping rules is important to ensure a total waterproofing over time.
Side and end overlapping vary according to the roof pitches.

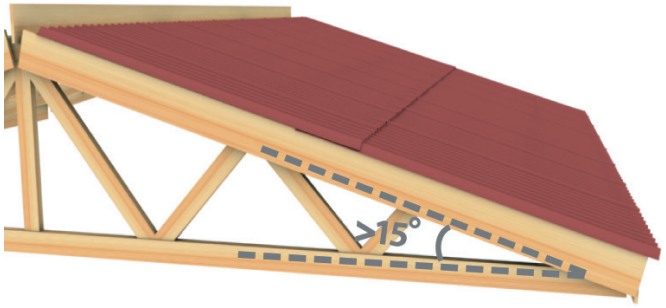
ROOF PITCHES	> 15° (over 27%)	10° - 15° (17% - 27%)	5° - 10° (9% - 17%)
Maximum purlin distance	61 cm 	45 cm 	Full deck or close batten 
Overhang at eaves	7 cm 	7 cm 	7 cm 
Minimum end overlap	17 cm 	20 cm 	30 cm 
Minimum side overlap	1 corrugation 	1 corrugation 	2 corrugations 

WOOD FRAME WITH ROOF PITCHES OVER 15° (> 27%)



FRAME

For roof pitches over 15 degrees, ONDULINE® sheet shall be supported by purlins with maximum width distance of **61 cm**.
In particularly high conditions of temperature and humidity, Onduline recommends an installation with 3 intermediate purlins – that is to say to reduce the span from 61 cm to 45 cm and to follow installation steps described for pitches 10°-15°.

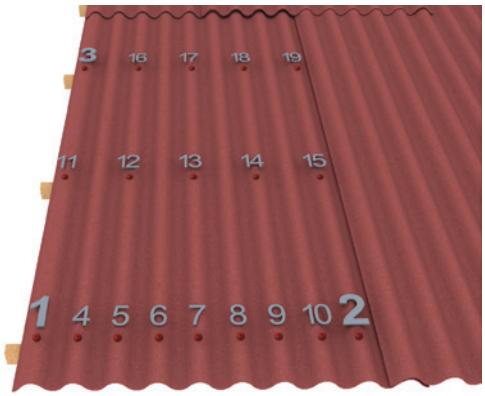


FIXING

19 fasteners should be used per sheet.

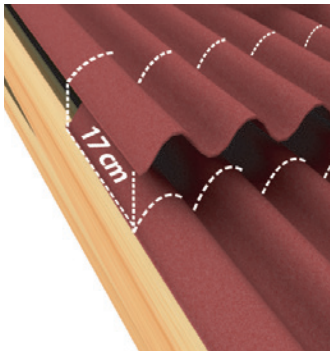
- Every corrugation should be fixed at eaves, overlaps and ridges.
- 1 corrugation out of 2 should be fixed at 2nd and 3rd intermediate purlin.

To have a longlasting and garanted roof, it is mandatory to follow the fixing order and pattern.

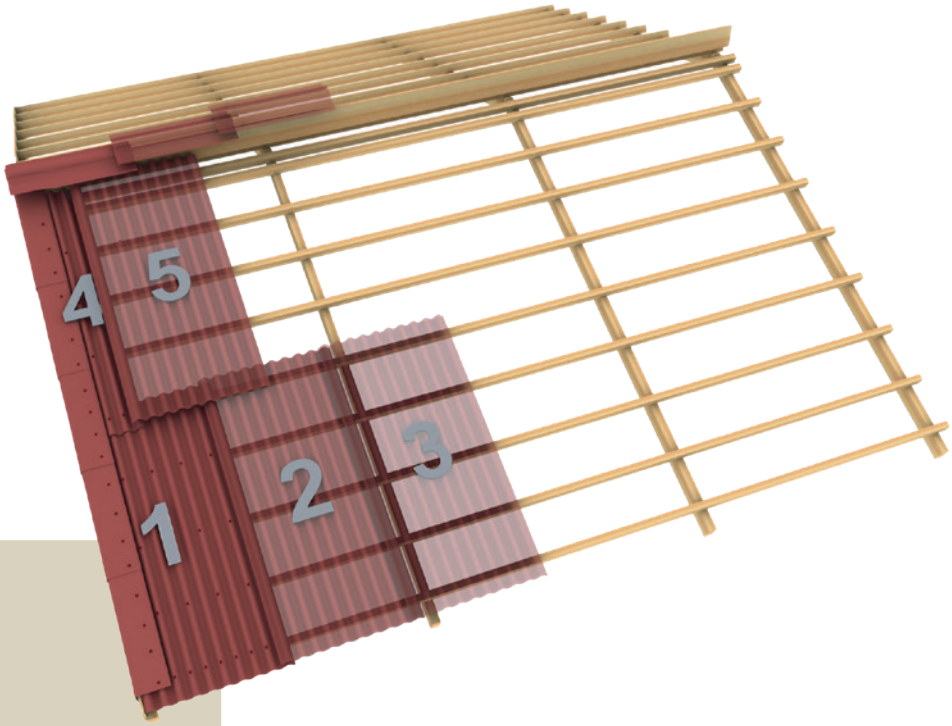


OVERLAP

- For the end overlap, use minimum **17 cm**.
- For the side overlap, use minimum **1 corrugation**.

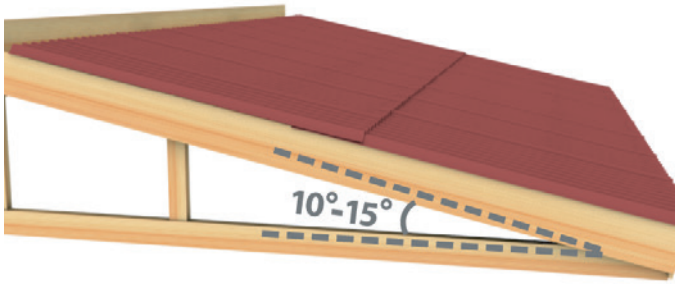


WOOD FRAME WITH ROOF PITCHES 10° - 15° (17% - 27%)



FRAME

For roof pitches 10 to 15 degrees, ONDULINE® sheet shall be supported by purlins with maximum width distance of **45 cm**.

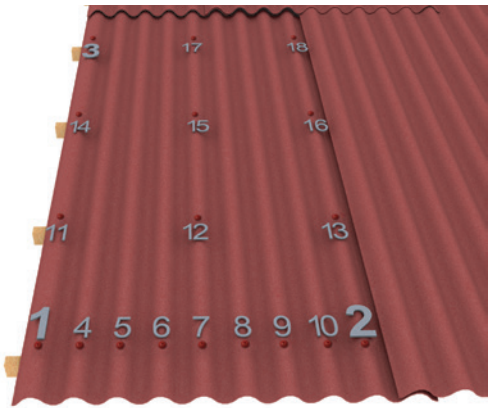


FIXING

18 fasteners should be used per sheet.

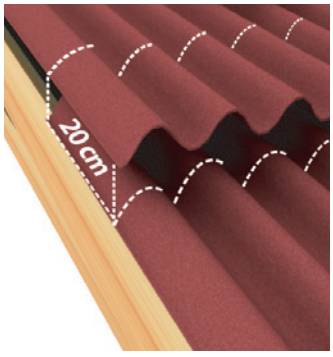
- 9 fasteners at each corrugation at the end overlap or eaves.
- 3 fasterners at each intermediate purlin.

Fasteners should be used at each corrugation at the end overlap and side overlap.
To have a longlasting and garanted roof, it is mandatory to follow the fixing order and pattern.



OVERLAP

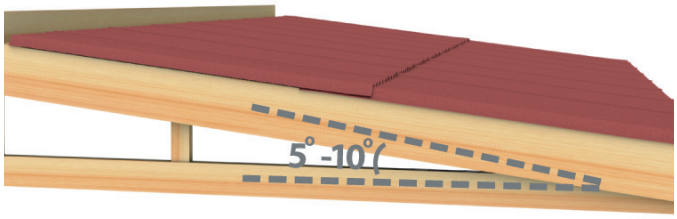
- For the end overlap, use minimum **20 cm**.
- For the side overlap, use minimum **1 corrugation**.



WOOD FRAME WITH ROOF PITCHES 5° - 10° (9% - 17%)

FRAME

For roof pitches 5 to 10 degrees, ONDULINE® sheet shall be supported by **full deck frame or close battening**.

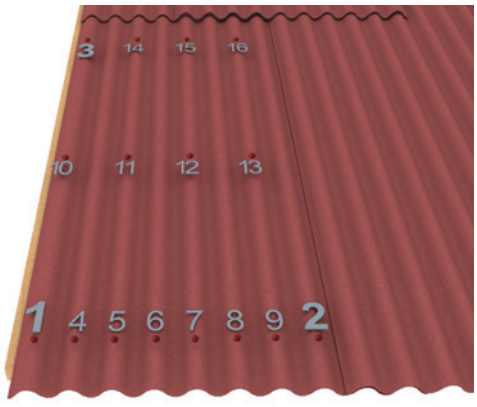


FIXING

16 fasteners should be used per sheet.

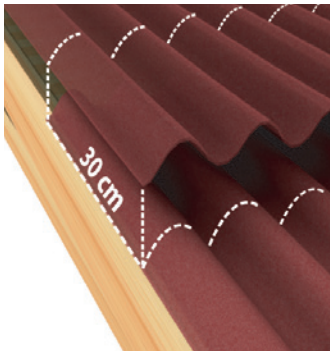
- 8 fasteners at each corrugation at the end overlap or eaves.
- 2 intermediate rows of 4 fasteners.

Fasteners should be fixed at each corrugation at the end overlap and side overlap.
To have a longlasting and garanted roof, it is mandatory to follow the fixing order and pattern.

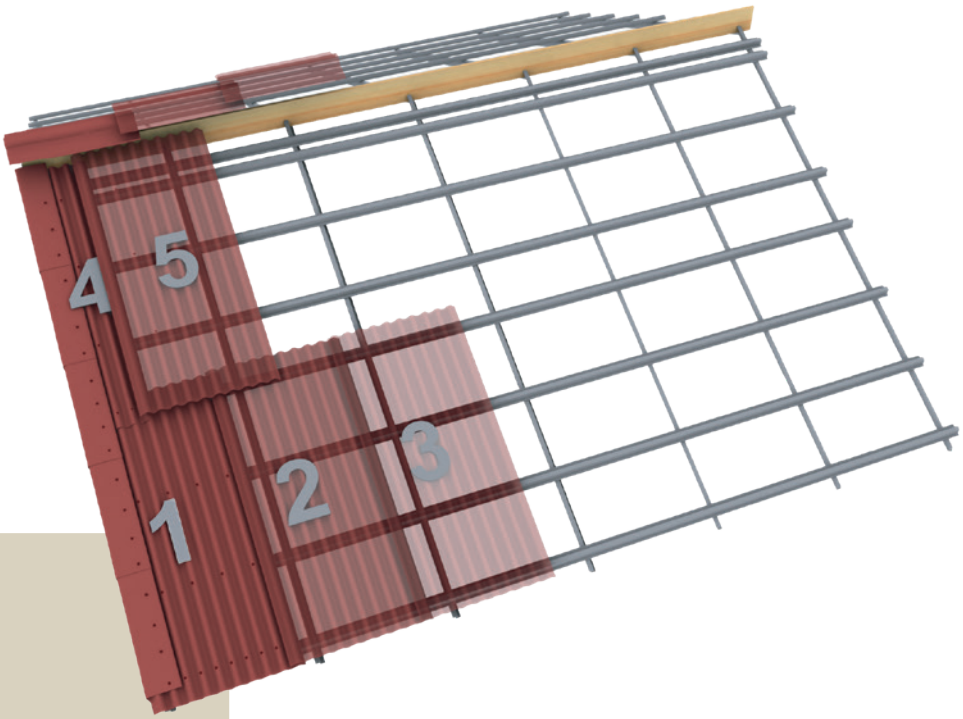


OVERLAP

- For the end overlap, use minimum **30 cm**.
- For the side overlap, use minimum **2 corrugations**.

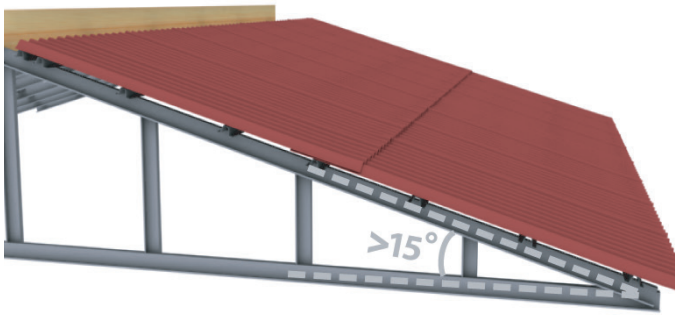


METAL FRAME WITH ROOF PITCHES OVER 15° (>27%)



FRAME

For roof pitches over 15 degrees, ONDULINE® sheet shall be supported by purlins with maximum width distance of **61 cm**.
In particularly high conditions of temperature and humidity, Onduline recommends an installation with intermediate purlins – that is to say to reduce the span from 61 cm to 45 cm and to follow installation steps described for pitches 10-15°.

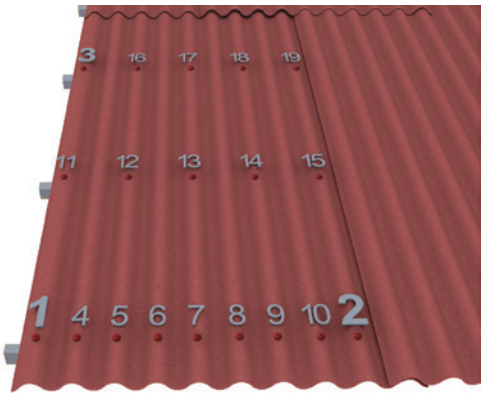


FIXING

19 screws should be used per sheet.

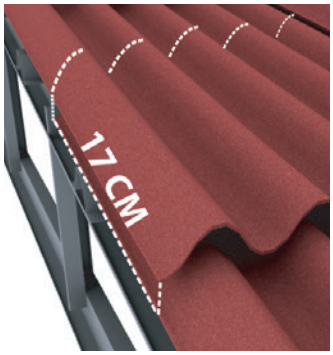
- Every corrugation should be fixed at eaves, overlaps and ridges.
- 1 corrugation out of 2 should be fixed at 2nd and 3rd intermediate purlin.

Screws should be drilled at each corrugation at the end overlap and side overlap.
To have a longlasting and garanted roof, it is mandatory to follow the fixing order and pattern.

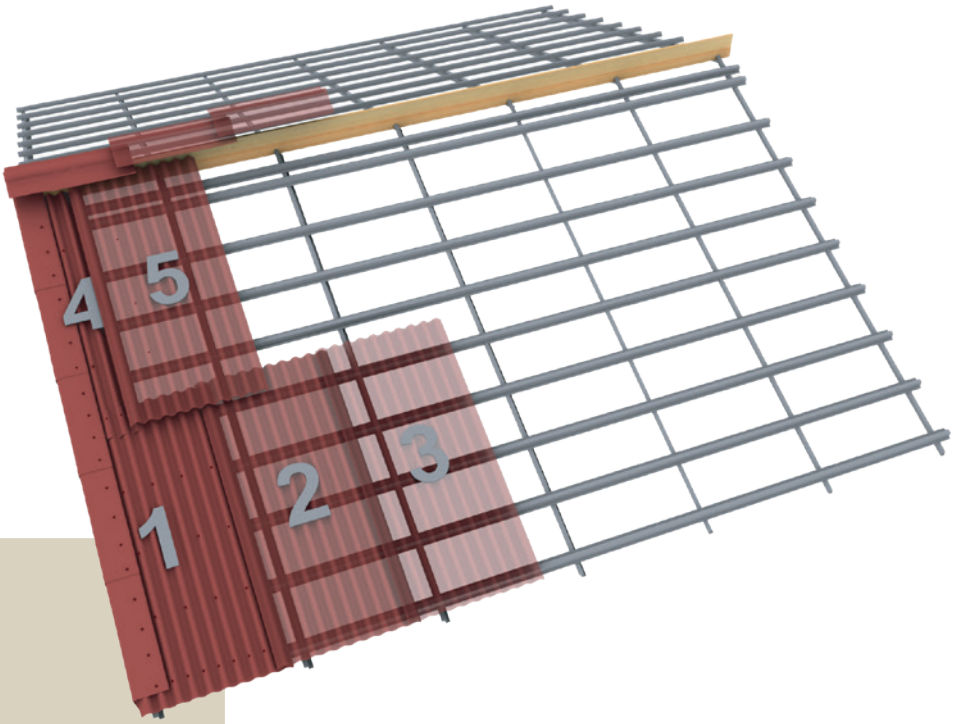


OVERLAP

- For the end overlap, use minimum **17 cm**.
- For the side overlap, use minimum **1 corrugation**.

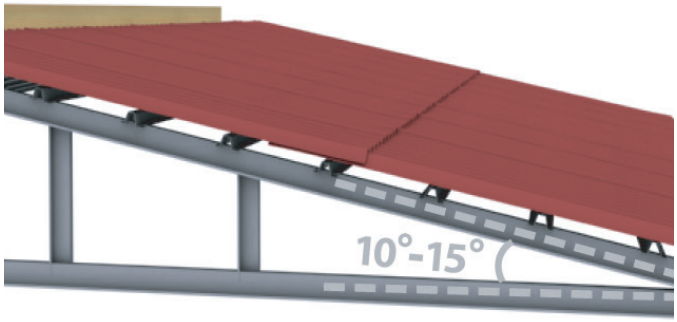


METAL FRAME WITH ROOF PITCHES 10° - 15° (17% - 27%)



FRAME

For roof pitches 10 to 15 degrees, ONDULINE® sheet shall be supported by purlins with maximum width distance of **45 cm**.

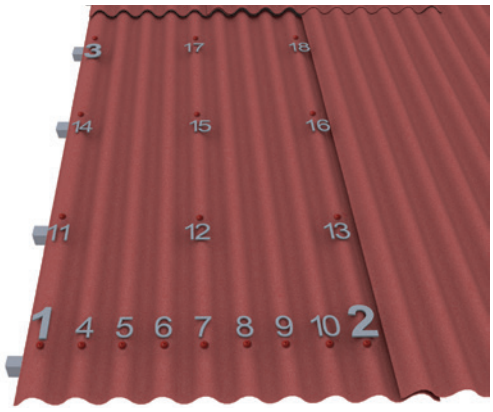


FIXING

18 screws should be used per sheet.

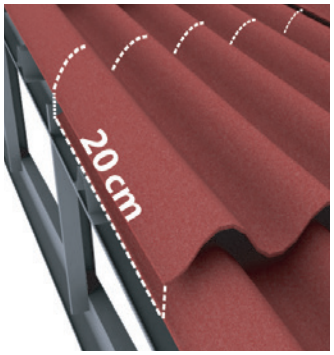
- 9 screws at each corrugation at the end overlap or eaves.
- 3 screws at each intermediate purlin.

Screws should be used at each corrugation at the end overlap and side overlap.
To have a longlasting and garanted roof, it is mandatory to follow the fixing order and pattern.



OVERLAP

- For the end overlap, use minimum **20 cm**.
- For the side overlap, use minimum **1 corrugation**.



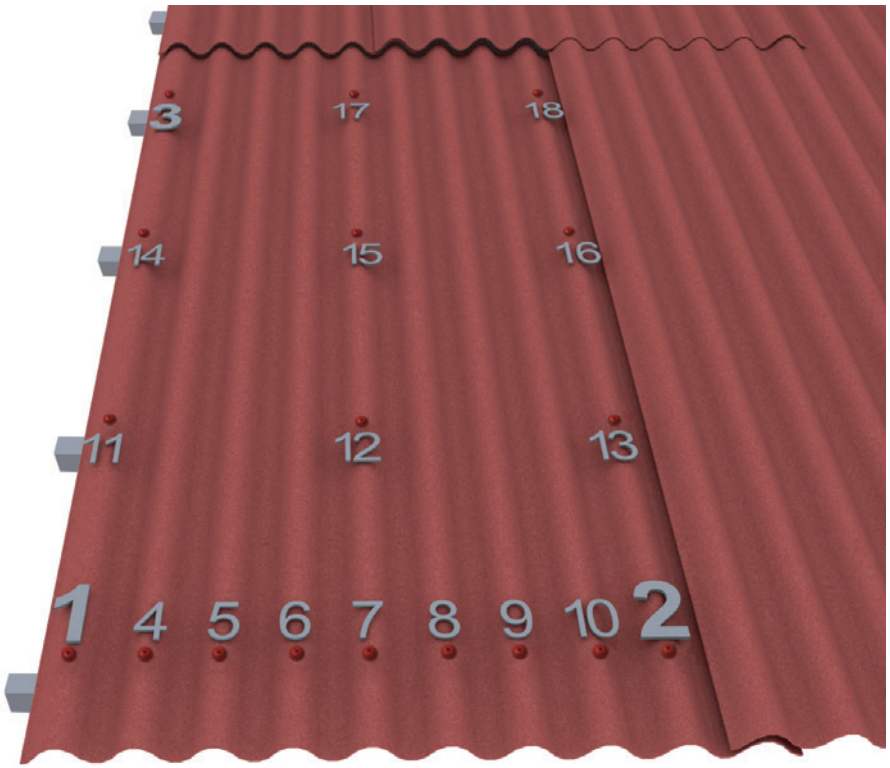
DETAIL FIXING STEPS

› To maintain waterproofing performance over time (and as mentioned in the warranty document), you must follow the fixing guide according to the pitch and the roof frame.

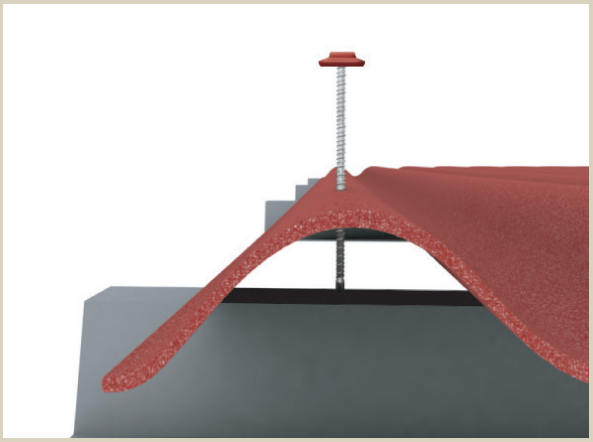
Use only ONDULINE® fasteners

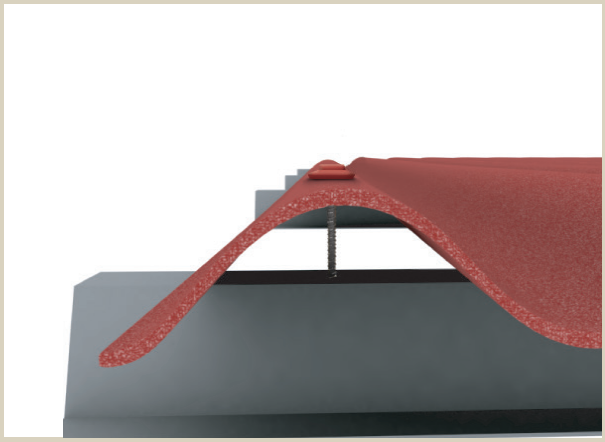
Their washer (with a minimum diameter of 16 mm) secures waterproofing and wind uplift resistance. Warranty can be valid only if Onduline® fasteners have been used.

› Fasteners should be fixed on top of the corrugation, following the drawing on the right.
› Fastening must always be carried out at the top of corrugation.



1. Select the correct type of drill screw to suit purlin type.
2. Drive the drill screw through the top of the corrugation.
3. Be careful to avoid over compressing of the corrugation.

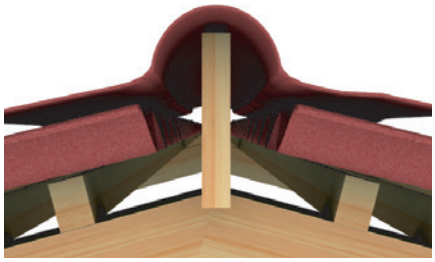




INSTALLATION DETAILS

RIDGES

1



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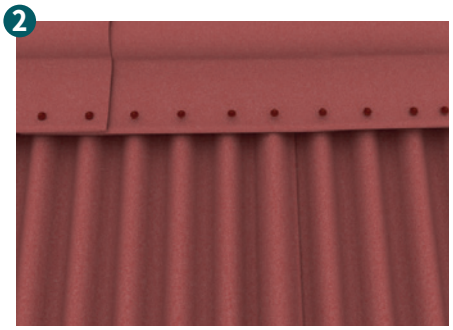

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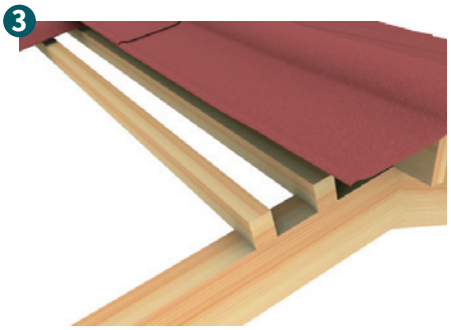

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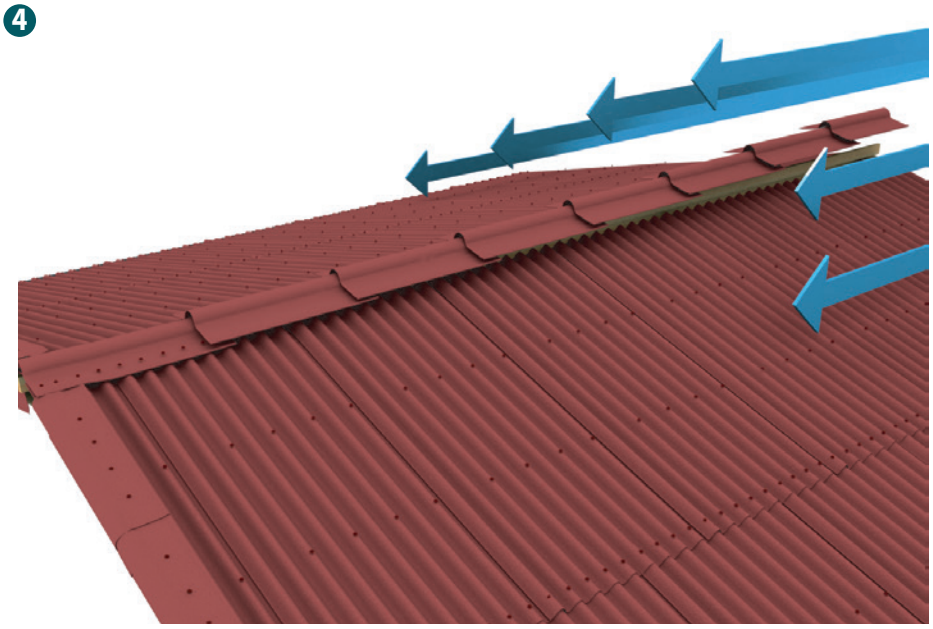

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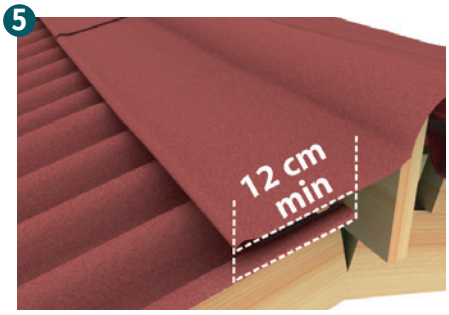

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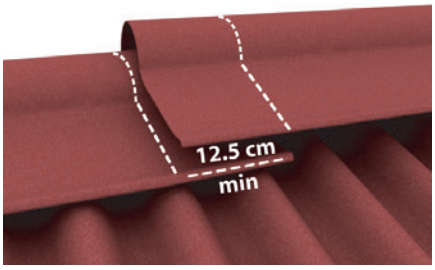

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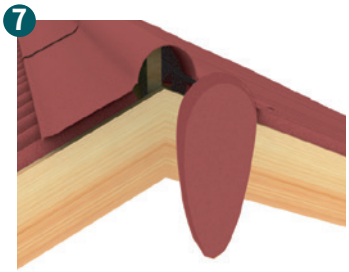
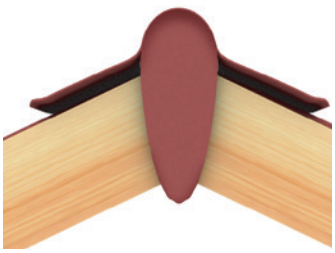


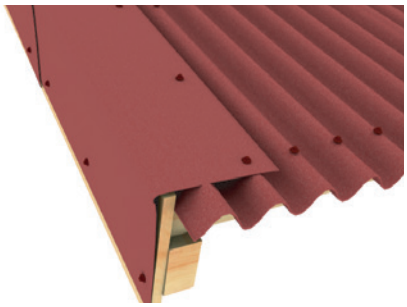


1. Use a **ridge plank** to support the ridge.
2. The ridge element should be fastened at each corrugation of the overlapped sheet.
3. Add an **extra purlin** when necessary if the distance between the last purlin and the ridge is too wide.
4. Start fixing the ridge element at opposite to the prevailing winds end of the roof.
5. The ridge element should overlap the ONDULINE® sheet minimum **12 cm**.
6. Lay ridge elements with a minimum overlap of **12.5 cm**.
7. A ridge cap can be cut out of the flat part of a ridge element.

EDGES / VERGES

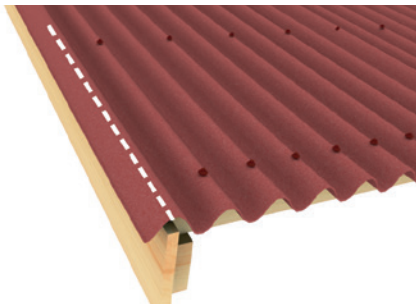
COVERING WITH AN ONDULINE® VERGE ELEMENT

1. Fasten bargeboard level with top of ONDULINE® sheet.
2. The ONDULINE® verge is then overlaid and fixed into position.
   It is possible to use a ridge element for this purpose.



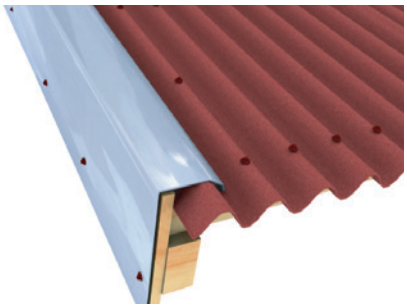
COVERING WITH AN ONDULINE® SHEET CORRUGATION

1. Fasten bargeboard to reach the underside of ONDULINE® of overhang corrugation.
2. Fold down and fix into position.



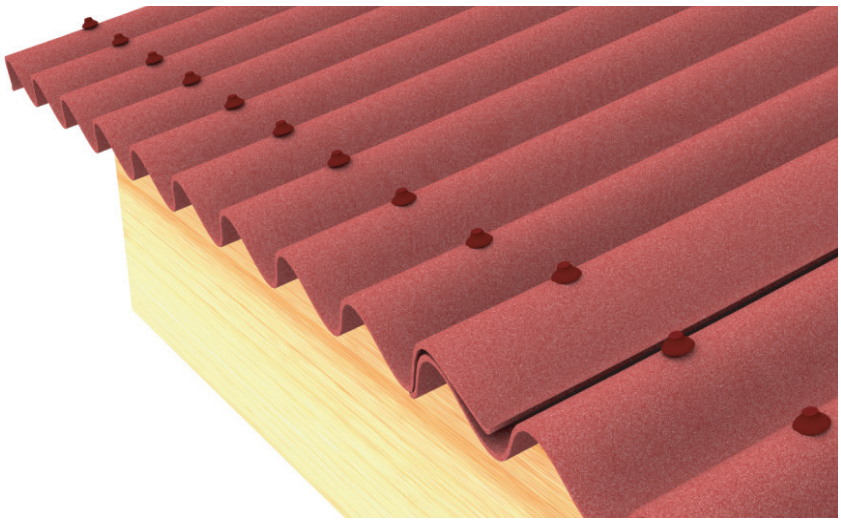
COVERING WITH A METAL FLASHING VERGE UNIT

1. Fasten bargeboard level with top of finished ONDULINE® roof.
2. Covering with the metal verge unit is then overlaid and fixed into position.

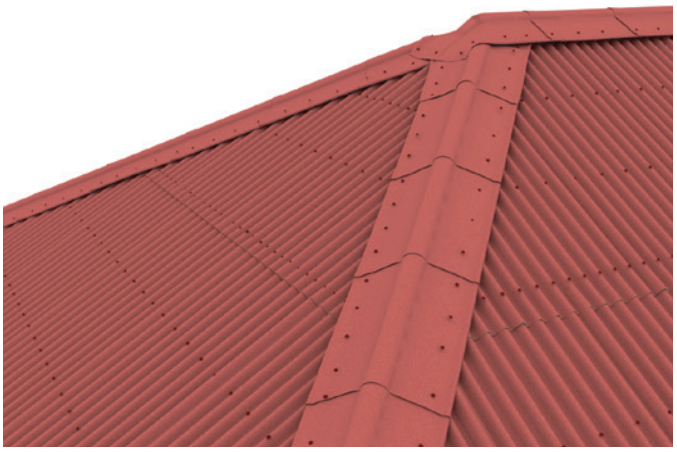


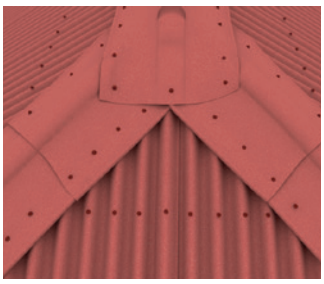
EAVES

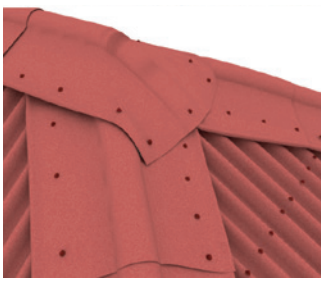
The sheets overhang at the eaves should not be more than 7 cm. Please set this distance while elaborating the roof project.



HIP DETAIL

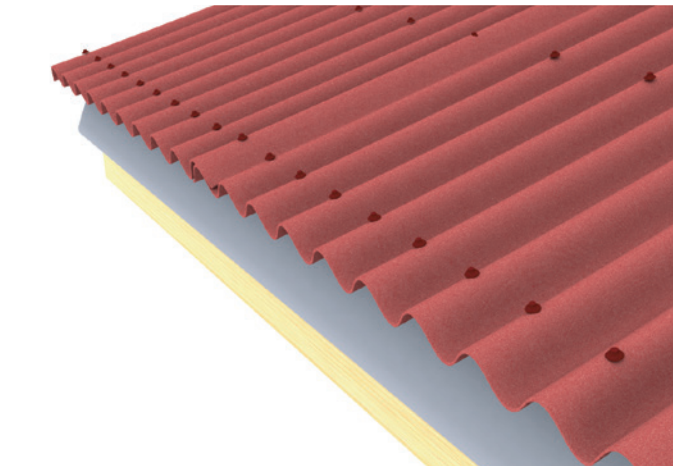


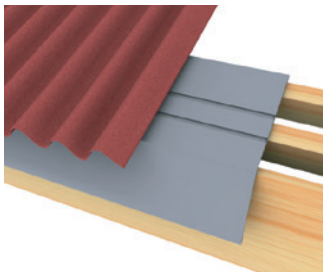




- Fix the hips before the ridge element.
- Overlay with the hip elements and fix it as shown on the picture.

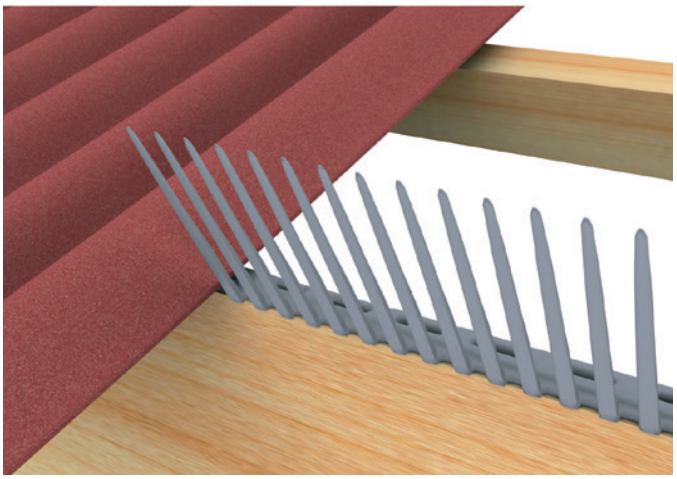
EAVES TRAY

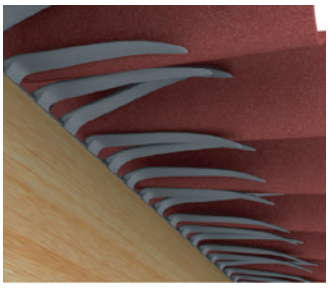




- Developed for oversheeting applications with ONDULINE® Sheets.
- The eaves tray can also be used to reduce the overhang at eaves and provides waterproofing.

EAVES VENTILATION STRIP



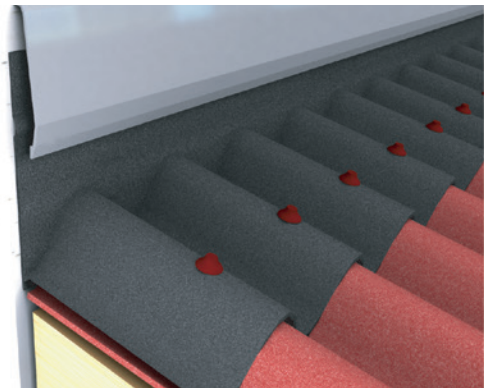


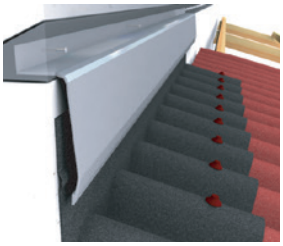
- Fix the ventilated strip on the purlin to stop ingress of birds and rodents.

END WALL ABUTMENTS

3RD PARTY FLASHING

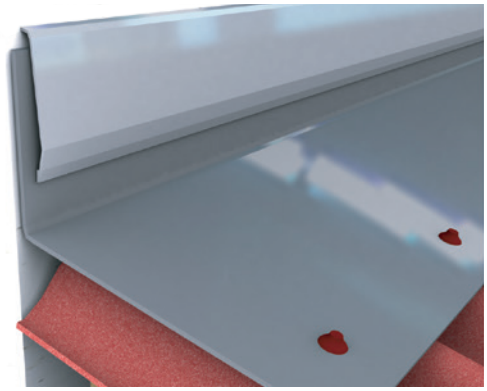
1. Use ONDULINE® pre-formed plate of metal to seal end wall abutment enabling the ventilation.
2. Use a separate cover flashing for the wall.

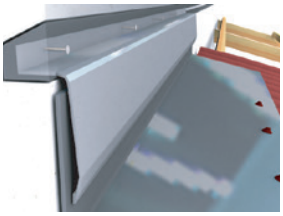




3RD PARTY FLASHING

1. Use ONDULINE® pre-formed plate of metal to seal end wall abutment enabling the ventilation.
2. Use a separate cover flashing for the wall.

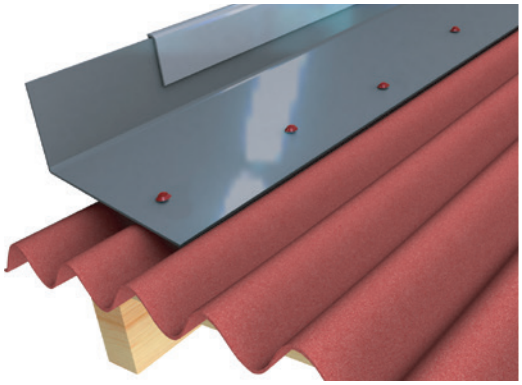


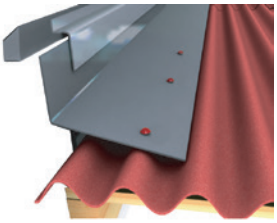


SIDE WALL ABUTMENTS

HARD COVER FLASHING TO WALL

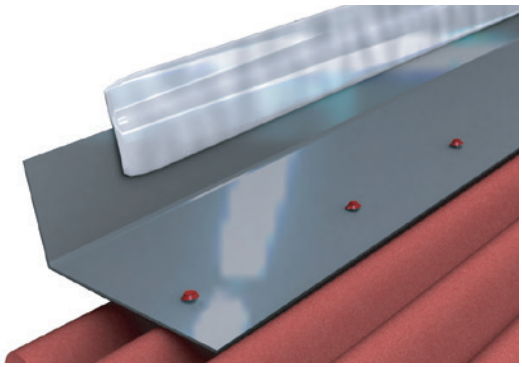
1. Use a pre-formed plate of metal flashing to seal side wall abutment. Take into consideration the possible dilation while drilling.
2. Use separate cover flashing to the wall to allow for movement.



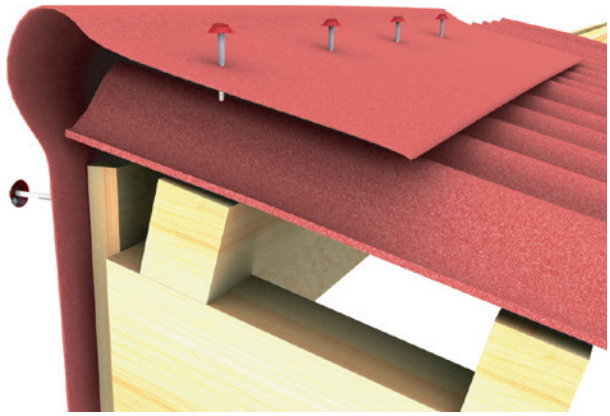


ONDULINE® FLASHING BAND TO WALL

1. Use a pre-formed plate of metal flashing to seal side wall abutment.
   Take into consideration the possible dilation while drilling.
2. Use ONDULINE® FLASHING BAND (ONDULINE® FLASHING BAND) as cover flashing to the wall.

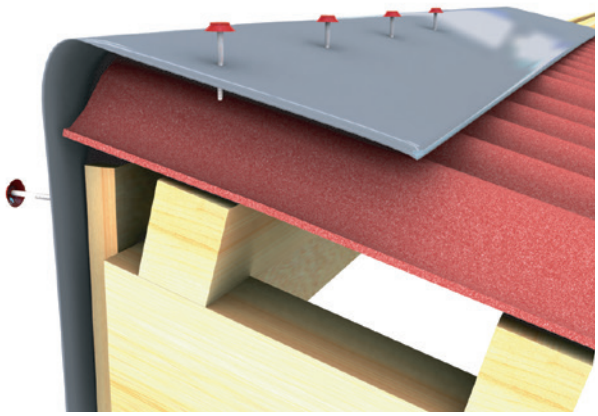


END ROOF



USING ONDULINE® RIDGE UNIT

- Fit ridge board and purlin. The ONDULINE® ridge unit is then overlaid and fixed or screwed into position.



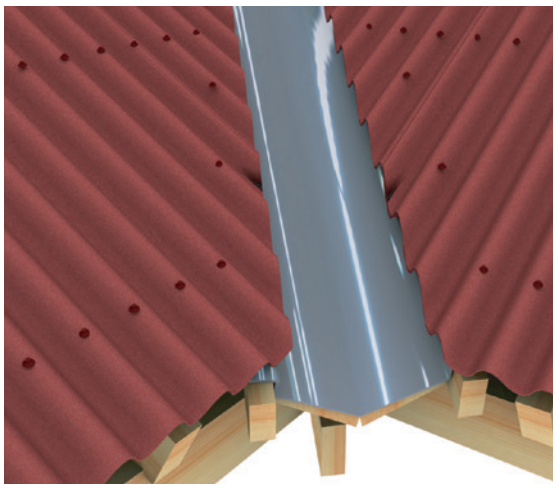
USING A PIECE OF METAL RIDGE ELEMENT

- Fit metal ridge element and purlin. The metal ridge element is then overlaid and fixed or screwed into position.

VALLEY

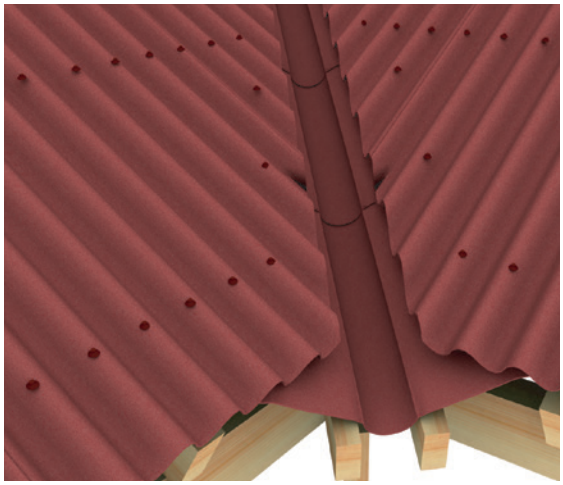
USING A PLATE OF METAL

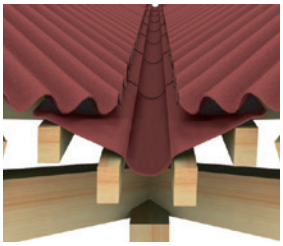
- Fix valley board / trim purlin and line with metal pre-formed unit.
- The vertical valley depth should be sufficient to allow the water to flow.
- The sheets are cut across (parallel to the valley line).
  The overhang is max 4 cm.



USING ONDULINE® VALLEY

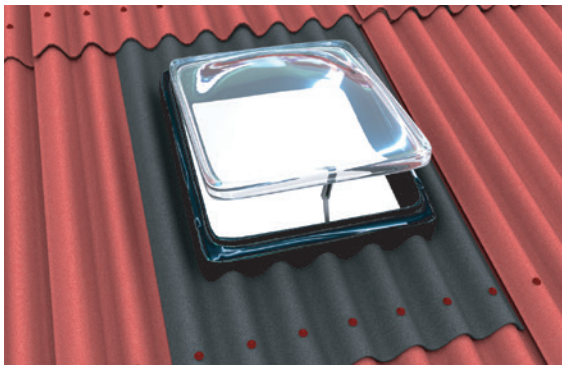
- Fix valley board / trim purlin and line with ONDULINE® valley.
- The vertical valley depth should be sufficient to allow the water to flow.
- The sheets are cut across (parallel to the valley line).
  The overhang is max 4 cm.

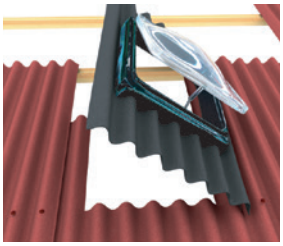




ONDULINE® ROOF WINDOW

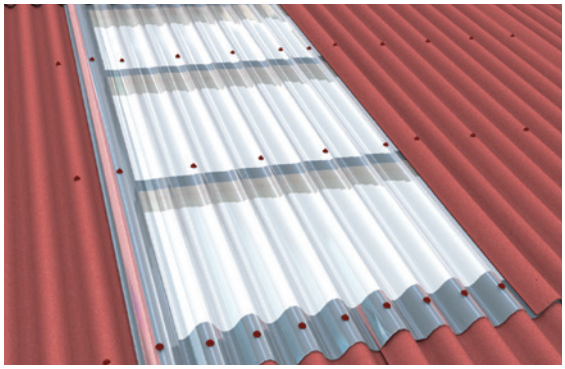
- Provides lighting and ventilation but does not reduce the thermal insulation performance of the roof.
- Cut opening in the sheet and fix in position.

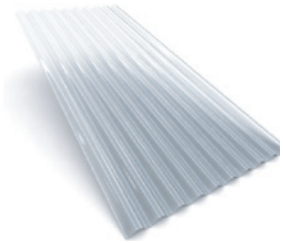




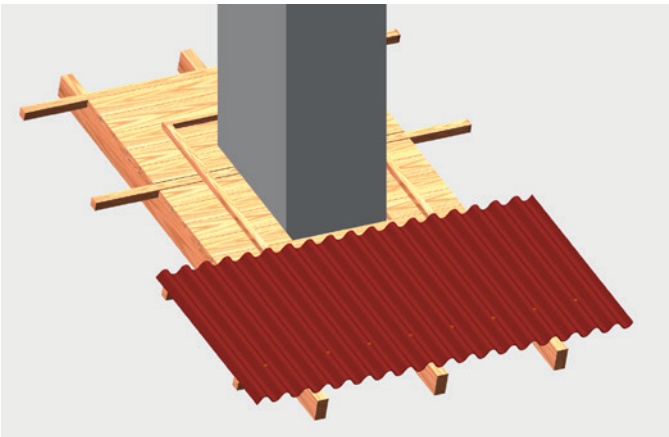
SKYLIGHT - ONDUCLAIR®

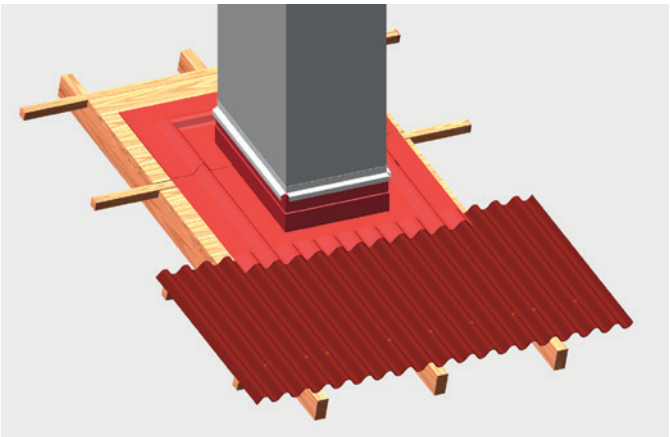
- Perfect complement to the ONDULINE® corrugated sheet.
- Please refer to the manufacturer specific fixing guide on installation for the different types of ONDUCLAIR® products.

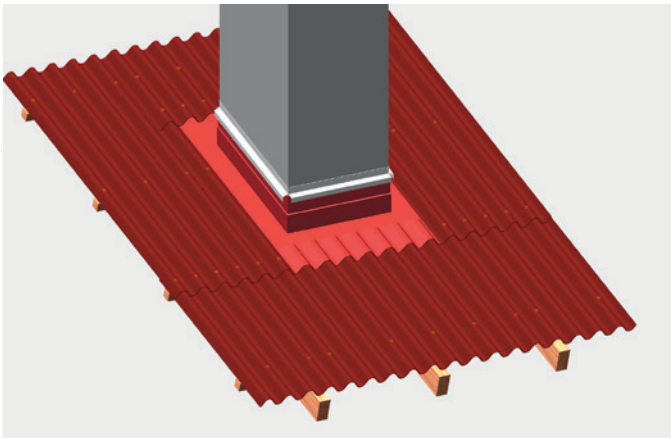




CHIMNEYS

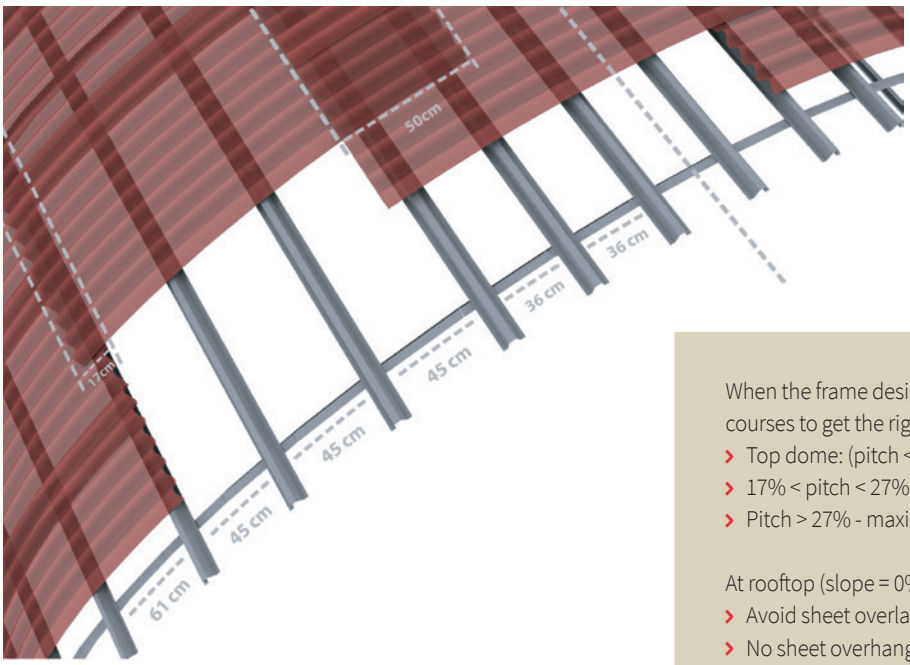






- Fixing must be done to make it totally waterproof and ensure no water accumulation at the back.
- Full deck is necessary for the roof part around the chimney. Surround the chimney with a batten of 3 cm x 3 cm entering the corrugations of the sheets installed at the lower part of the roof.
- Apply a layer of of ONDULINE® FLASHING BAND or ONDUBAND® around the chimney, covering also the battens. Finish upper edge with the Z profile.
- Zinc or GRP chimney flashing can also be used.

CURVED ROOFS / DOMES

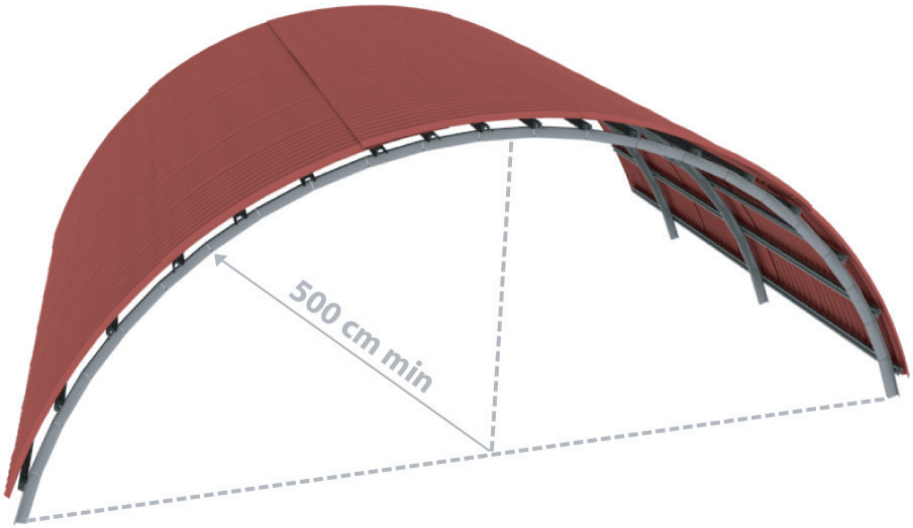


When the frame design is established, continuously setup the lines courses to get the right positions of purlins :

- Top dome: (pitch < 17%) - maximum span is **36 cm**.
- 17% < pitch < 27% - maximum span is **45 cm**.
- Pitch > 27% - maximum span is **61 cm**.

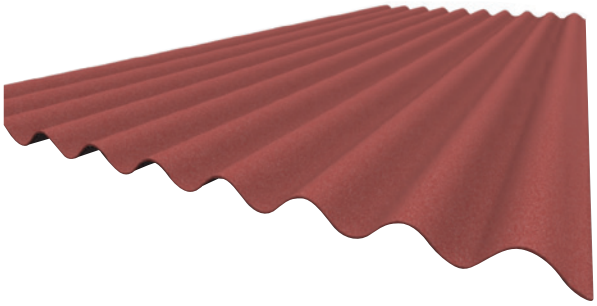
At rooftop (slope = 0%)

- Avoid sheet overlap (lay the top sheet centered in its middle).
- No sheet overhang **more than 7 cm**.
- Side lap: **2 corrugations**.



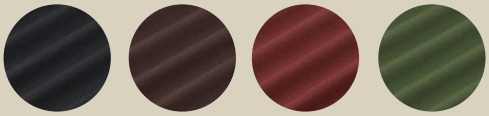
PRODUCT SPECIFICATIONS

ONDULINE® CLASSIC SHEET

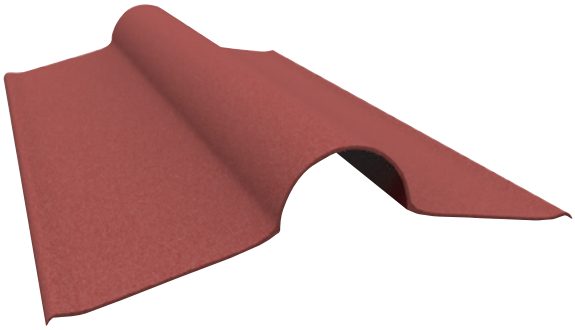


- The original bitumen-saturated corrugated roofing sheet with characteristics, versatility and benefits that are suitable and applicable for most types of building and others use such as undersheeting and oversheeting.

Available in Black, Brown, Red and Green.

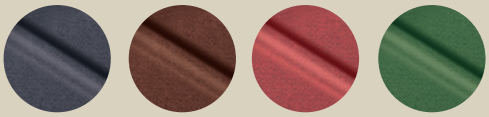


ONDULINE® RIDGE

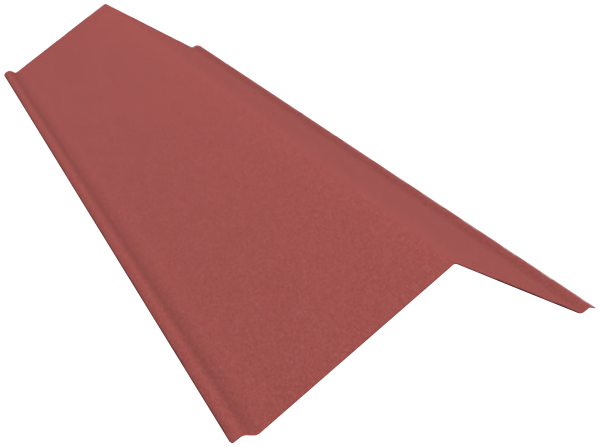


- Manufactured from the same material and quality as ONDULINE® CLASSIC. Flexible double wings accommodate a wide range of roof angles.

Available in same 4 colors as the ONDULINE® CLASSIC.

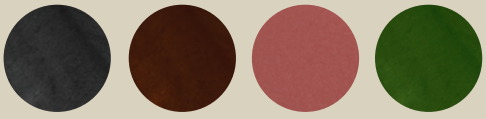


ONDULINE® VERGE



- Designed to provide a weatherproof seal at the verge, this unit is made from the same quality material as ONDULINE® CLASSIC.

Available in same 4 colors as the ONDULINE® CLASSIC.



ONDULINE® NAIL

› The washer is resistant to UV radiation and with its weatherproof seal provides an adequate resistance to wind uplift.

Available in same color ranges as the sheets.

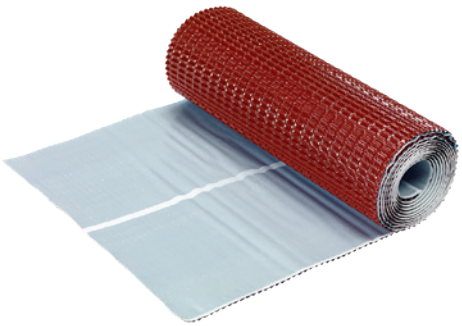
ONDULINE® UNIVERSAL SCREW

› ONDULINE® UNIVERSAL SCREW can be fixed on wood or steel purlins using a power drill. This self-tapping screw has a PVC washer to prevent the sheet riding up on the threat. It enables correct tension to be achieved avoiding over tightening and distorsion.

Available in same color ranges as the sheets.

ONDULINE® FLASHING BAND

› Butyl-based aluminum self-adhesive tape used to seal the roof and flashings at chimneys, wall abutments, and other sensitive roof details (roof windows, roof hatches, roof junctions...).

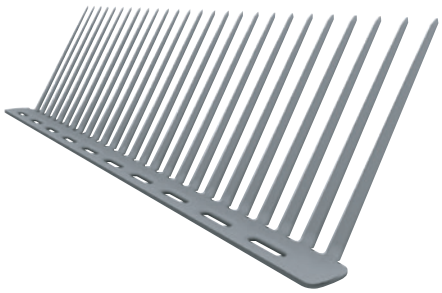


ONDUBAND®

› Multifunction self-adhesive type, which can be used for the waterproofing of the chimney, valley...

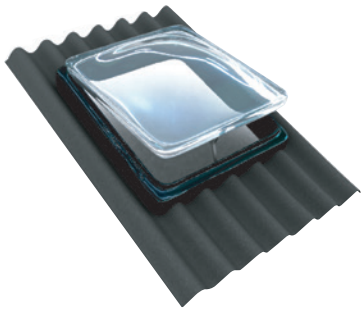
ONDULINE® VENTILATED EAVES FILLERS

- It is fixed at eaves to allow ventilation and to prevent the ingress of birds and rodents.



ONDULINE® ROOF WINDOW / SKYLIGHT

- The ONDULINE® Roof Window/Skylight provides light and air to the roof and also serves as an exit to roof areas.
- Same corrugation size as ONDULINE® products.
- Modern design prevents infiltration of snow and rain.
- Quick and easy to install.



ONDULINE® APRON FLASHING

- Manufactured from Polypropylene, this apron flashing is designed to seal the gap between ONDULINE® sheets, and vertical wall abutment.
- Suitable for any roof pitches.

VENTILATION

When designing a roof, you should ensure proper ventilation of the roof.

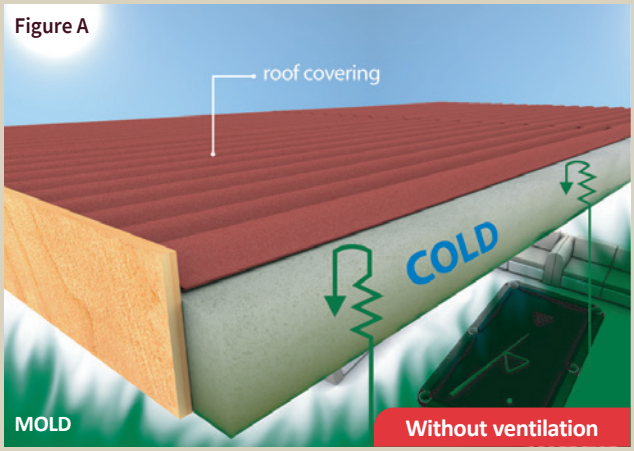
ROOF VENTILATION

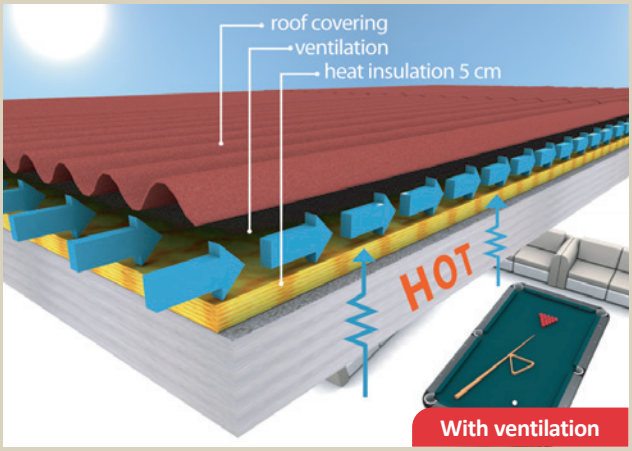
BEWARE OF THE RISK OF CONDENSATION AND ITS CONSEQUENCES

There is always water inside every heated space such as the kitchens and bathrooms of residences, indoor swimming pools, factories with lots of water usage, barns or poultry houses where a great number of animals discharge heat and moisture from their bodies.
Vapor condenses immediately if it comes in contact with cold surface of the building walls. If vapor condenses within building material of the roof construction, it can generate serious problems by causing damages such as blooming and mold on ceiling (fig. A).

Ventilating the roof space prevent condensation and it affects the heat insulation positively as well. In most cases a difference of 10° C can be appreciated between the inside temperature of a non vertilated roof and a ventilated roof with insulation.
Furthermore, in regions with cold climate and high precipitation, snow accumulation on ventilated roofs is more homogeneous and excessive pilling on the eaves can be kept under control.

ROOF WITHOUT HEAT INSULATION AND VENTILATION





EFFECT OF VENTILATION ON ROOF WITH SNOW ACCUMULATION

RELATIVE HUMIDITY / MOISTURE LEVEL WITHIN BUILDING

The balance between the contribution of water (w in g/m³) and the ventilation rate (n) determine the relative humidity. The moisture level depends on the ratio w/n.

Ratio w/n (g/m³)	Moisture level
< 2.5	Low
From 2.5 to 5	Medium
From 5 to 7.5	High
> 7.5	Very high

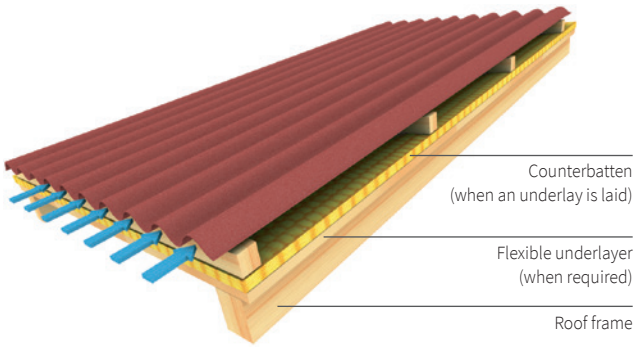
ONDULINE® CLASSIC sheets are recommended for moisture level from low to medium i.e w/n (g/m³) < 5.
If it is not the case, we recommend to diminish the moisture level by appropriate means (vapor barrier, additional ventilation...).

VENTILATION

Ventilation shall be provided by two series of openings permitting air entry and exit; the minimum cross-sectional area for each series is 1/800th of the total roof area.

Corrugations provide a ventilation area of 170 cm² per meter.

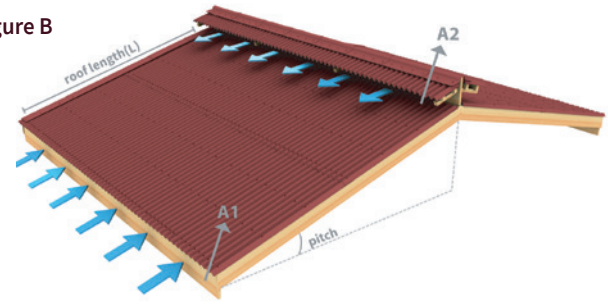
Do not close these openings at eaves and ridges, it would prevent the air movement.



ROOF USING RIDGE

Inlet and outlet ventilation areas provided by **ONDULINE® CLASSIC: 170 cm² per meter (for an horizontal length = 1 meter)**

Figure B



N.B : These are average values for Northern Europe. For other countries, please contact the technical department in the respective country.

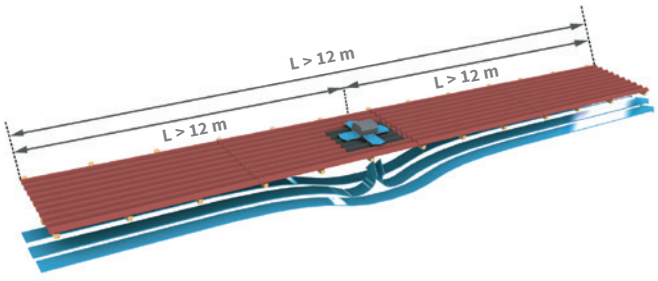
- For roof length < 8 meters, regardless the pitch, ventilation is provided by corrugations of ONDULINE® CLASSIC
- For low-pitched roofs (20%), over 5 meters long, area of ventilation must be 200 cm² at least
- For roofs with a slope greater than 30%, over 15 meters long, area of ventilation must be provided, the ventilation area of which is indicated in the table.

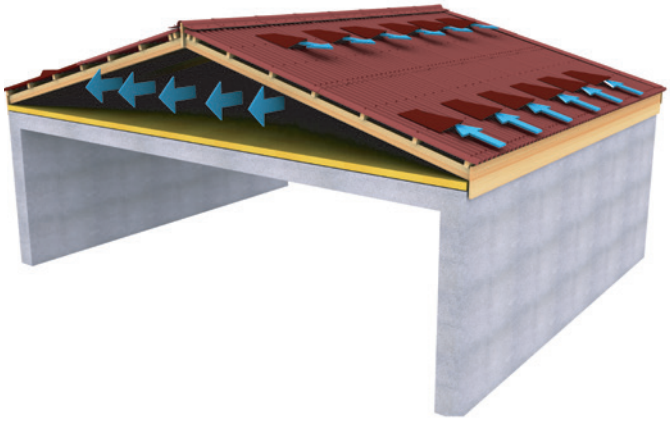
Extra openings are usually performed with ONDULINE® aerators G 3 (additional ventilation of 110 cm²) or WG 33 (330 cm²) that are designed according to ONDULINE® profile.

A1 = A2 = Distributed ventilation inlets and outlets needed (in cm²) :
Ventilation openings A1 and A2 should be provided at each eave and at the roof ridge (see figure B).
If the roof pitches are longer than 12 meters, an extra opening should be included at an intermediate point on the pitch. Refer to the following chart to determine the ventilation needs especially for low pitches less than 15°.

Roof length (m)	Pitch 20% Angle 11,3°	Pitch 30% Angle 16,7°	Pitch 40% Angle 21,8°	Pitch 50% Angle 26,5°
5	corrugations	corrugations	corrugations	corrugations
8	200 cm²	corrugations	corrugations	corrugations
10	250 cm²	corrugations	corrugations	corrugations
15		180 cm²	174 cm²	168 cm²
18		216 cm²	209 cm²	201 cm²
20		239 cm²	232 cm²	224 cm²

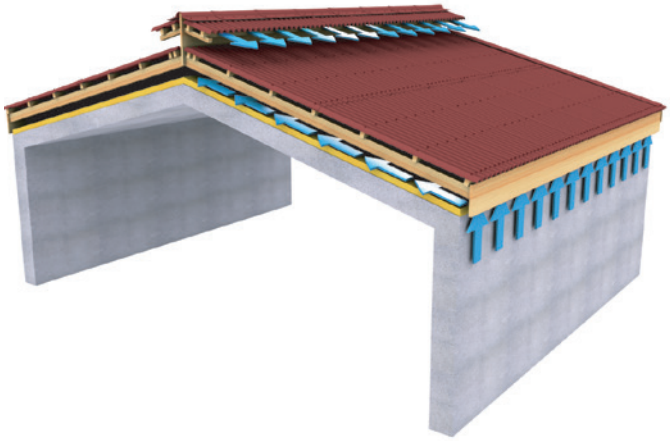
With ONDULINE®, it is better to avoid low pitches combined with big roof lenghts.





In order to obtain desired efficiency from ventilation, air inlet and outlet locations should be adequately dimensioned and selected according to the roofs physical properties.
In principle, air movement is upward, air inlets should be arranged at the eaves while the air outlets are at the ridge level : special attention should be paid that no elements block the air flow on the eaves and ridge line air.
If there is any unused space between the roof and the last slab, ventilation can be created by having air inlets and outlets being placed on the roof at intervals.

VENTILATION BETWEEN ROOF LAYERS



If ventilation is between the roof layers only, continuous air inlet and outlet locations should be established and unblocked.

Narrow buildings with high pitched roofs are better ventilated when compared with wide buildings with lowpitched roofs. That is why the horizontal distance between the eaves and ridges and the roof inclination must be taken into consideration when determining the space necessary for ventilation.

GENERAL INFORMATION

PRECAUTIONS ON ROOF USAGE

Roof traffic

Only walk on the roof if this is necessary. To distribute the loads, planks or ladder should be laid flat and by the roof purlins to carry out maintenance and related work. All precautions should be taken and safety regulations must be observed and applied.

Roof maintenance

Maintenance of the roof is the responsibility of the owner.
To ensure long life we recommend that the following maintenance procedures are carried out.

- Remove moss and debris. Do not allow leaf debris to build up on the surface of the corrugated roofing sheets, the debris will form leaf mould which can soften the material and reduce the effective life of the product.
- Check that branches are not in contact with the roof surface as wind generated movement can result in mechanical damage to the surface of the sheets.
- Clean all rainwater gutters, down-pipes and gullies regularly ensuring efficient water run-off from the roof.
- Maintain a good state of roof elements such as flashing, chimney stacks, etc.
- Maintain a good state of the roof and its ventilation.

See Bitumen Sheets Maintenance Guide.

SITE STORAGE

ONDULINE® is delivered to site on pallets of 50 to 420 sheets (depending on means of transport and sheet specification) shrink wrapped.
It is not recommended to stack pallets. Sheets must be stored flat and covered at all times to protect against weather and dust. In hot climates ONDULINE® must be protected from direct sunlight.

HANDLING

ONDULINE® may be stored in freezing temperatures but installation should not be attempted in these conditions.
ONDULINE® should be lifted from the pallet, not dragged across it.
The material should then be handled using conventional techniques for corrugated sheeting.
It is recommended to use protective equipments (PPE): Safety Shoes (SBP, SP1, S3), Mechanic Gloves, Eye Protection Equipment (safety glasses).

TECHNICAL SERVICES

ONDULINE® provide a comprehensive technical and laboratory advice service for all applications of ONDULINE® system. Please always refer to our specific technical guides for complete installation details and check with our representative, your local dealer or your specifier for your country building codes and regulations.

RE-USE OF ONDULINE® SHEETS

In the event of sheets having to be removed from a roof, the nails are extracted with an ordinary claw hammer levered against a piece of wood shaped to the corrugation.

PRECAUTIONS

When using ONDULINE® in conditions of high internal humidity it is important to use a vapour barrier and adequate ventilation on the roof space.

CONDITIONS OF SALE

The color impregnation is long lasting, but weathering effects cannot be entirely discounted and will affect ONDULINE® in the same way as they affect natural material roofs. The ONDULINE® group assumes no responsibility for the effect of structural movement.
Details are correct at the time of printing, but the manufacturers reserve the right to vary specifications and details at any time without notice.
To avoid any possible misunderstandings, we require that a customer seeking advice on suitability or performance of goods or relating to the nature of services supplied should put such requirements to us in writing. Goods are not tested or sold as fit for any particular purpose unless so agreed in writing. There might be slight variations in size, weight and color.

HEALTH AND SAFETY

The photographs and drawings in this brochure are of installations in many parts of the world; building practices shown may not therefore comply with the recommended safety standards in other countries. See Material Safety Data Sheet.

DISPOSAL INFORMATION

Residue code: 170302 (bituminous mixtures other than those mentioned in 170301).

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Onduline reserves the right to amend product specifications without prior notice. Product thicknesses shown in this document should not be taken as being available ex-stock and reference should be made to the current Onduline price-list or advice sought from Onduline Customer Service Department. The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to uses described. Recommendations for use should be verified for suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Onduline offers a Technical Advisory Service, the advice of which should be sought for uses of Onduline products that are not specifically described herein. To ensure you are viewing the most recent and accurate product information, please scan the QR code directly above.

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Onduline®
Lightweight roofing systems