



0248-L-14/1  
24 September 2014

# Test report

Cambridge Xtreme shingles (130)





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**Kiwa BDA Testing B.V.**  
Avelingen West 35-37  
P.O. Box 389  
4200 AJ Gorinchem  
The Netherlands

Tel. +31 183 630 690  
Fax +31 183 630 630  
testing@bda.nl  
www.bda.nl

Commercial register 23059445

## Colophon

### Principal

IKO Sales International N.V.  
I.Z. Ravenshout 3.815  
B-3945 HAM

### Contact Person

K. Kesters  
Kurt.kesters@iko.be

### Email

### Date of order

13 August 2014

### Project number

0248-L-14/1

### Author

A.R. Hameete

### Subject

determination of the weather tightness /  
resistance tot wind driven rain

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# 1 Introduction

By order of IKO Sales International N.V., Kiwa BDA Testing B.V. has determined the weather tightness of **Cambridge Xtreme (130)** shingles.

On 4 September 2014 two test specimens, provided by Mr K. Kesters of IKO Sales International N.V. (BE) and Mr M. Matvej of IKO Sales International (SK), have been received at Kiwa BDA Testing B.V. for the purpose of testing.

According to the principal the test specimens have been built up as follows:

- substructure made of narrow solid wood planks with 5 mm gaps between the planks;
- Cambridge Xtreme shingles (130), mechanically fastened with five nails per shingle.

The following data regarding the products used have been revealed by the principal.

## **Description wooden planks (used for substructure)**

- Product : wooden planks
- Producer : not revealed
- Dimensions : 150 mm × 2080 mm, thickness 18 mm
- Production code : not revealed

## **Description shingles**

- Product : Double-layer shingle with “Cambridge Xtreme (130)”
- Producer : IKO Sales International N.V.
- Dimensions : 1038 mm × 349 mm
- Production code : not revealed

## **Description nails (used for fastening shingles)**

- Product : rustproof nails with a rough shaft
- Producer : not revealed
- Dimensions : length 25 mm with a 10 mm head of the nail
- Production code : not revealed

See annex II for drawings of the products and further package data.

## 2 Investigation

The weather tightness has been determined by performing wind driven rain tests in coherence with the stipulations mentioned in CEN/TR 15601:2012 – Hygrothermal performance of buildings – Resistance to wind driven rain of roof coverings with discontinuously laid small elements – Test method.

The test specimens have been mounted in the test equipment and subjected to the chosen wind-rain combination. In case of wind-rain combination B, a uniform suction pressure is applied to the underside of the test specimen, in increasing steps (one step every 5 minutes) until a leakage rate of  $10 \text{ g.m}^{-2}$  per 5 minutes time step is observed. The amount of suction required to bring about this level of leakage is the test result for that wind-rain combination and provides a measure of the rain tightness of the system.

By request of the principal the wind driven rain tests have been performed at the test conditions mentioned below. The tests 1, 2, 3 and 4 have been performed on the same test specimen.

Test 5 has been performed on a new test specimen.

The test conditions for wind-rain combination B for climate zone northern Europe, costal, have been set as follows.

### **Test 1: Wind-rain combination B at a slope of 15°**

- Wind speed : 13  $\text{m.s}^{-1}$ , after correction (slope) 11,1  $\text{m.s}^{-1}$
- Rainfall : 89  $\text{mm.h}^{-1}$
- Run-off water : 15,6  $\text{mm.h}^{-1}$

### **Test 2: Wind-rain combination B at a slope of 7,5°**

- Wind speed : 13  $\text{m.s}^{-1}$ , after correction (slope) 11,5  $\text{m.s}^{-1}$
- Rainfall : 89  $\text{mm.h}^{-1}$
- Run-off water : 15,6  $\text{mm.h}^{-1}$

Because the test equipment has not been calibrated at a slope of 7,5° in combination with the applied wind speed and the applied water rate, the actual wind speed and amount of water will deviate from the stated values.

### **Test 3: Wind-rain combination B (with extra wind) at a slope of 7,5°**

- Wind speed : 17  $\text{m.s}^{-1}$  (maximum of ventilator)
- Rainfall : 89  $\text{mm.h}^{-1}$
- Run-off water : 15,6  $\text{mm.h}^{-1}$

Because the test equipment has not been calibrated at a slope of 7,5° in combination with the applied wind speed and the applied water rate, the actual wind speed and amount of water will deviate from the stated values.

**Test 4: Wind-rain combination B (with extra wind and extra water) at a slope of 7,5°**

- Wind speed : 17 m.s<sup>-1</sup> (maximum of ventilator)
- Rainfall : 1750 l.h<sup>-1</sup> (double the amount in respect to test 1) <sup>1</sup>
- Run-off water : 1786 l.h<sup>-1</sup> (double the amount in respect to test 1) <sup>1</sup>

Because the test equipment has not been calibrated at a slope of 7,5° in combination with the applied wind speed and the applied water rate, the actual wind speed and amount of water will deviate from the stated values.

**Test 5: Wind-rain combination B at a slope of 15°**

- Wind speed : 13 m.s<sup>-1</sup>, after correction (slope) 11,1 m.s<sup>-1</sup>
- Rainfall : 89 mm.h<sup>-1</sup>
- Run-off water : 15,6 mm.h<sup>-1</sup>

The tests have been performed in the laboratory of Kiwa BDA Testing B.V. (NL-4202 MS/24) by Mr W.J.B. Middag and Mr A.R. Hameete of Kiwa BDA Testing B.V. in the presence of Mr K. Kesters of IKO Sales International N.V. (BE) and Mr M. Matvej of IKO Sales International (SK).

The investigation has been performed in week 36, 2014.

In annex I a photo report of the tests and the test results is given.

The turbulence intensity of the apparatus, the measurement of the initial pressure, the calibration of the fan system, rain generation and run-off water devices have been described in BDA-report 10-B-0939/2, dated 2013.01.29. This calibration is only valid for test 1.

---

<sup>1</sup> The amount of water applied on the test specimen is normally expressed in the unit [mm.h<sup>-1</sup>]. For the calibrated test equipment the rate of 89 mm.h<sup>-1</sup> of rainfall at a wind speed of 11,1 m.s<sup>-1</sup> at a slope of 15° results in an actual applied water flow of 875 l.h<sup>-1</sup>. By request of the principal the amount of water should be doubled from 89 mm.h<sup>-1</sup> to 178 mm.h<sup>-1</sup>. Because on this test configuration no calibration has been performed, in consultation with the principal the water flow has been doubled from 875 l.h<sup>-1</sup> to 1750 l.h<sup>-1</sup>. Whether this doubling of the water flow has resulted also in a doubling of the actual rate of water falling on the surface of the test specimen is at least doubtful. At test 3 additionally the wind speed has been increased from 11,5 m.s<sup>-1</sup> to 17 m.s<sup>-1</sup>, which resulted in more water blowing past the test specimen than falling on the test specimen.

### 3 Construction of the test specimens

The test specimens have been built up by the principal and subsequently delivered at Kiwa BDA Testing B.V. on 4 September 2014.

According to the principal the test specimens have been built up according to the technical guide (see annex II).

The dimensions of the test specimens are 2,5 m × 2,0 m (length × width). The edges of the external surface of the test specimens have been sealed to the edges of the test chamber using a butyl roofing repair tape. The effective area of the test specimens after sealing the edges is 2,4 m × 1,9 m (length × width).

## 4 Results

**Table 1 – Wind-rain combination B at a slope of 15°**

Test specifications		Test result [leakage in grams]
Pressure [Pa]	Time [min]	
0	5	0

**Table 2 – Wind-rain combination B at a slope of 7,5°**

Test specifications		Test result [leakage in grams]
Pressure [Pa]	Time [min]	
0	5	0

**Table 3 – Wind-rain combination B (with extra wind) at a slope of 7,5°**

Test specifications		Test result [leakage in grams]
Pressure [Pa]	Time [min]	
0	5	0

**Table 4 – Wind-rain combination B (with extra wind and extra water) at a slope of 7,5°**

Test specifications		Test result [leakage in grams]
Pressure [Pa]	Time [min]	
0	5	0
10	10	- <sup>1)</sup>
20	5	- <sup>2)</sup>

<sup>1)</sup> Leakage occurs at one position. The amount has not been measured, because the test conditions fall outside the calibration area.  
<sup>2)</sup> The leakage increased a little at one point. The amount is has not been measured because the test conditions fall outside the calibration area.

**Table 5 – Wind-rain combination B at a slope of 15°**

Test specifications		Test result [leakage in grams]
Pressure [Pa]	Time [min]	
0	5	0
10	5	0
20	5	0
30	5	0
40	5	227
50	5	613

See annex I for photos of the test.

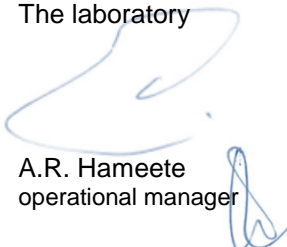


**Remark:**

The results are only related to the investigated samples, products and/or systems.  
Kiwa BDA Testing B.V. is not liable for interpretations or conclusions that are made in consequence of the results obtained.  
If sampling was not performed by Kiwa BDA Testing B.V., no judgement can be given with regard to the origin and representativeness of the samples.

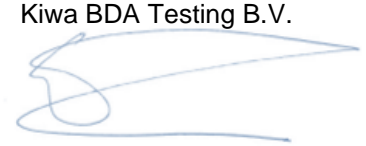
Gorinchem, 24 September 2014  
The laboratory

A.R. Hameete  
operational manager



Kiwa BDA Testing B.V.

C.W. van der Meijden MSc  
deputy director



# I Photos of the test

**Photo 1**  
Overview of test specimen 1  
before testing.



**Photo 2**  
Detail of test specimen 1  
before testing.



**Photo 3**  
Detail of the substructure of  
test specimen 1 before  
testing.



**Photo 4**  
Overview of wind-rain combination B on test specimen 1 at a slope of 15°.



**Photo 5**  
Overview of wind-rain combination B on test specimen 1 at a slope of 7,5°.



**Photo 6**  
Overview of wind-rain combination B (with extra wind) on test specimen 1 at a slope of 7,5°.



**Photo 7**  
Overview of wind-rain combination B (with extra wind and extra water) on test specimen 1 at a slope of 7,5°.



**Photo 8**  
Detail of wind-rain combination B (with extra wind and extra water) on test specimen 1 at a slope of 7,5°.



**Photo 9**  
Leakage which occurs at wind-rain combination B (with extra wind and extra water) on test specimen 1 at a slope of 7,5°.



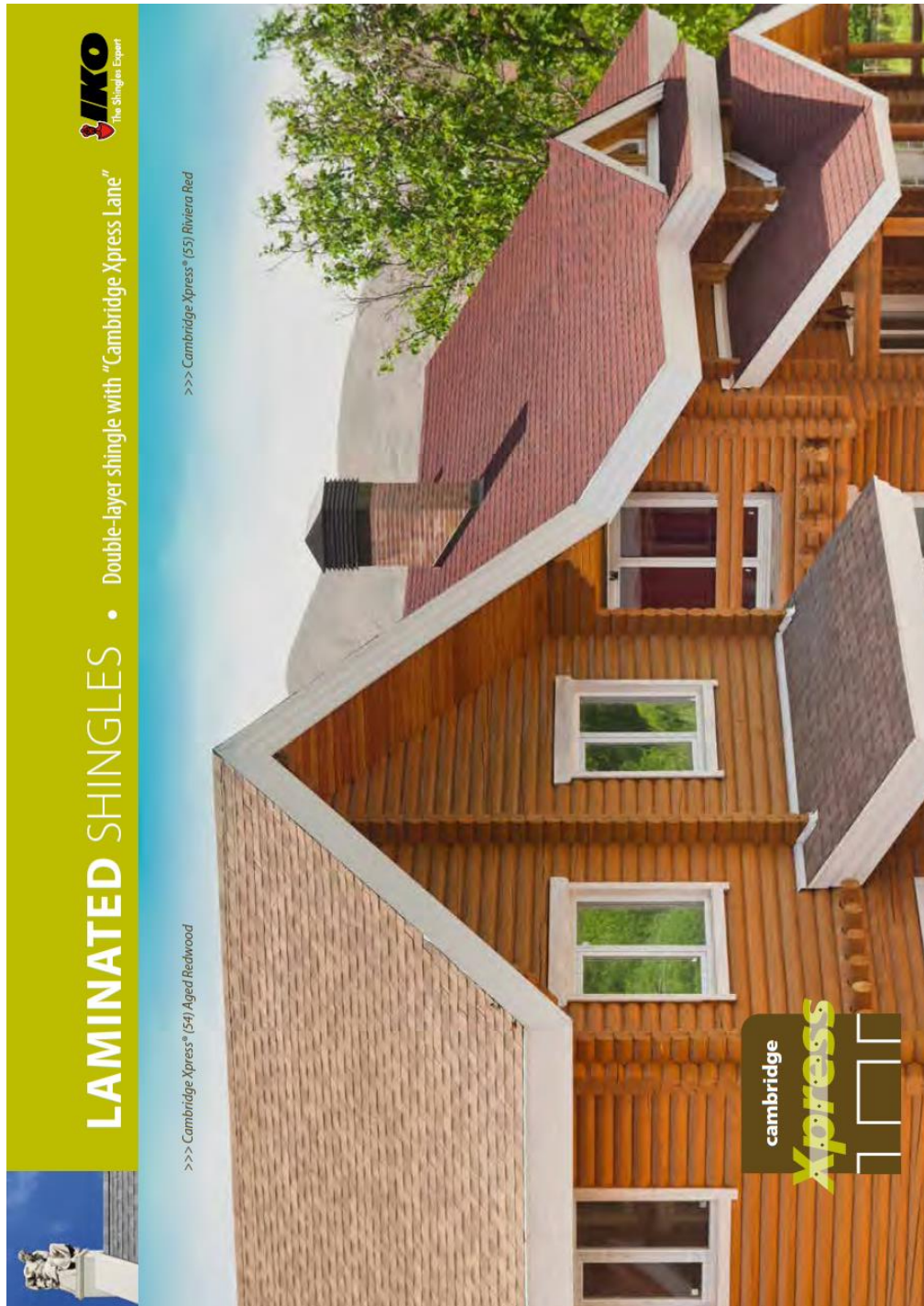
**Photo 10**  
Overview of wind-rain  
combination B on test  
specimen 1 at a slope of 15°.



**Photo 11**  
Detail of wind-rain  
combination B on test  
specimen 2 at a slope of 15°.



## II Technical Guide and product sheet of the shingles





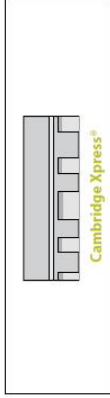
# LAMINATED SHINGLES • Double-layer shingle with "Cambridge Xpress Lane"

## Your Benefits:

- Most efficient laminated shingle in the world: larger shingle size (more coverage than any standard shingle) and very quick to install
- Extra large nailing area, known as the "Cambridge Xpress Lane", for improved nailing shingle performance (especially on steep roofs) and faster implementation of the shingles
- Double-layer shingle with a dimensional wood shake look in natural tones and colours
- Best choice for the home-owner with its water-shedding and weather-resistant construction
- Excellent solution for renovation projects



The information is subject to change without prior notice.  
 Consult our shingle overview leaflet on website [www.iko.be](http://www.iko.be) + [www.cambridgeexpress.eu](http://www.cambridgeexpress.eu)  
 for colour availability of the products and application instructions



Length (EN 544)	1038 mm (± 3)
Width (EN 544)	349 mm (± 3)
Weight (slope > 25°)	± 11,6 kg/m <sup>2</sup>
Coverage/bundle	3,1 m <sup>2</sup>
Shingles/bundle	20
Bundles/pallet	45

Granule adhesion (EN 12039)	max. 1,2 g
Tensile length* (EN 12311-1)	800 N/50 mm
Tensile width* (EN 12311-1)	550 N/50 mm
Elongation length* (EN 12311-1)	3,50 %
Elongation width* (EN 12311-1)	3,50 %
Nail tear resistance* (EN 12311-1)	130 N

External fire performance	B <sub>roof</sub> T <sub>1</sub>
Reaction to fire	Class E

\* Registered average values



**IKO Sales International NV**  
 LZ Ravenshout 39/74 • Tuilbroek 74 • 3945 Ham • Belgium  
 T +32 (0)11 34 01 20 • F +32 (0)11 34 01 30 • E support@iko.be • [www.iko.be](http://www.iko.be)



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Shingle application guide



## GENERAL CONDITIONS

- IKO assumes no responsibility for leaks due to improper application, or failure to properly prepare the roof surface. Shingles may not be installed directly over insulation; flow-through ventilated air space must be provided between the insulation and the nailable deck.
- Do not mix different production dates/codes on the same roof surface.
- Colour shading is inherent to shingles and is not a defect. In order to minimise shading, shingles should be picked and mixed randomly from different bundles and placed across and diagonally up the roof.
- Do not rack the shingles up the roof!
- Do not remove the tape from the back of the shingles. It is for packaging purposes and not for sealing.
- However, release film on the back of the **shield shingles** must be removed during application. (Figure 7 - 7)
- The factory applied sealing strip will become effective when exposed to the heat of the sun. Hand sealing is necessary for cold weather and steep slope application. Plastic cement must be approved by IKO to be compatible with IKO shingles.
- Bend bundle before opening for easier separation.
- Caution: During sunny, hot periods, avoid stepping on shingles on the sunny side of the roof to prevent marking.

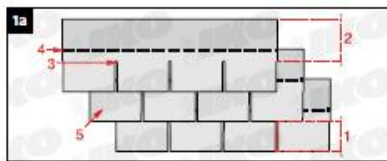


## MATERIAL REQUIREMENTS

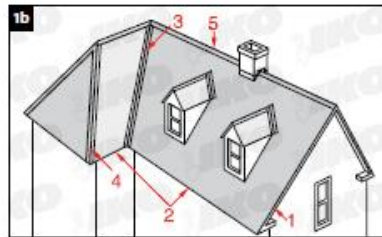
- **Shingles:**  
IKO's selection of more than 60 different types and colours of fibreglass based oxidised and APP modified bitumen shingles.
- **Underlays:**  
**IKO Armourbase:** a range of watertight roofing membranes.
- **Valley Coverings** (for Open Valley Method):  
**IKO Armourvalley:** a 4,5 mm APP modified membrane in matching shingle colours, or metal flashing.
- **Drip edges**
- **Fasteners:**  
Corrosion resistant nails (galvanised clout nails) 25 mm in length and a head diameter of 10 mm. The shaft should be 3 mm in diameter and barbed. Laminated shingles and nailing of hips and ridges require nails 30 mm in length.
- **Bituminous Cement:**  
**IKO Shingle Stick** or an IKO approved plastic cement.
- **Vents:**  
**IKO Armourvent:** a range of sufficient vents to satisfy minimum venting requirements.  
**IKO Armourvent Sanitary:** a sanitary vent used to satisfy minimum venting requirements.



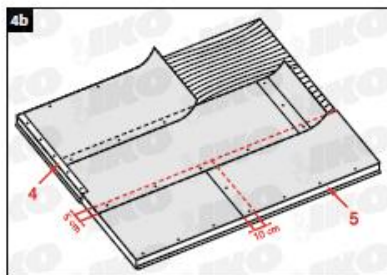
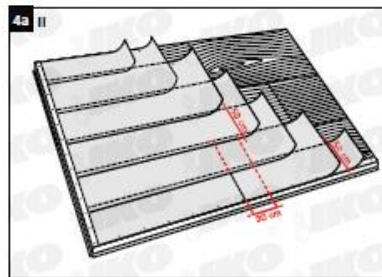
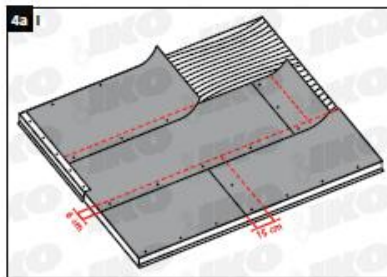
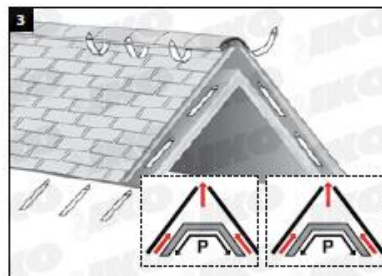
## TERMS



1. Exposure • 2. Headlap • 3. Cut-outs  
4. Self Sealing Strip • 5. Tabs

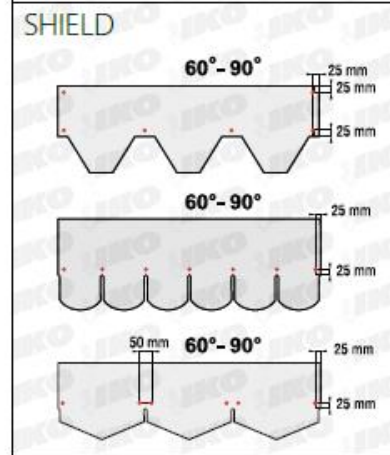
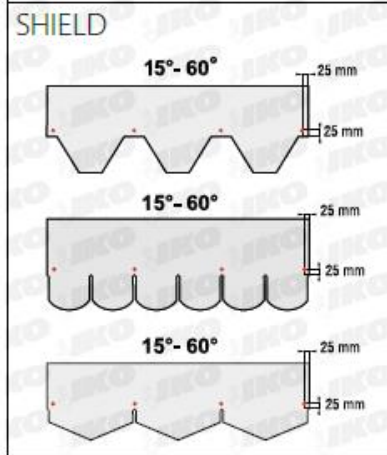
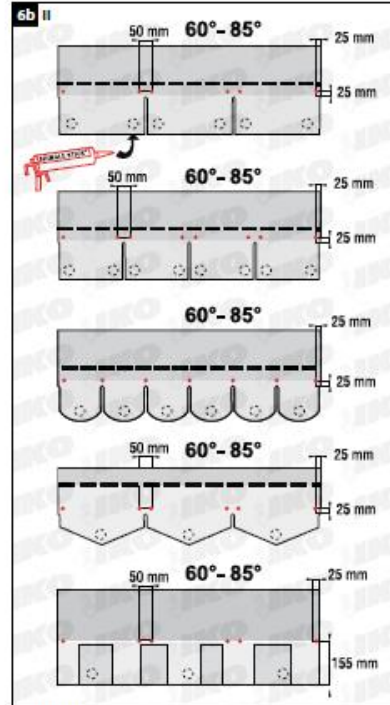
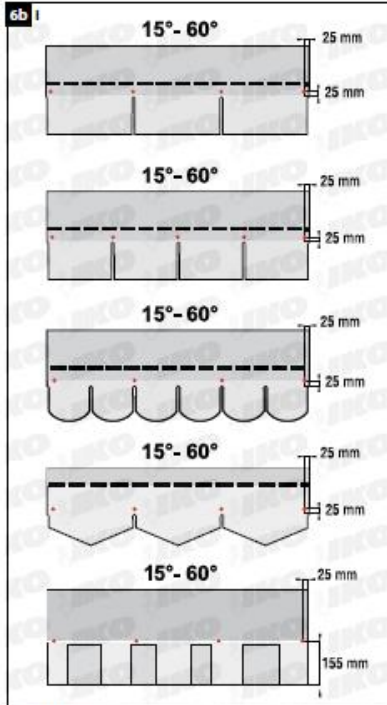
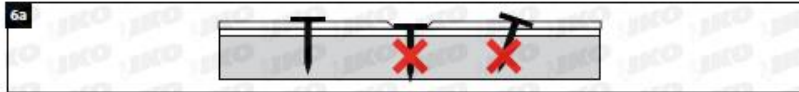


1. Rakes • 2. Eaves • 3. Valleys  
4. Hips • 5. Ridges

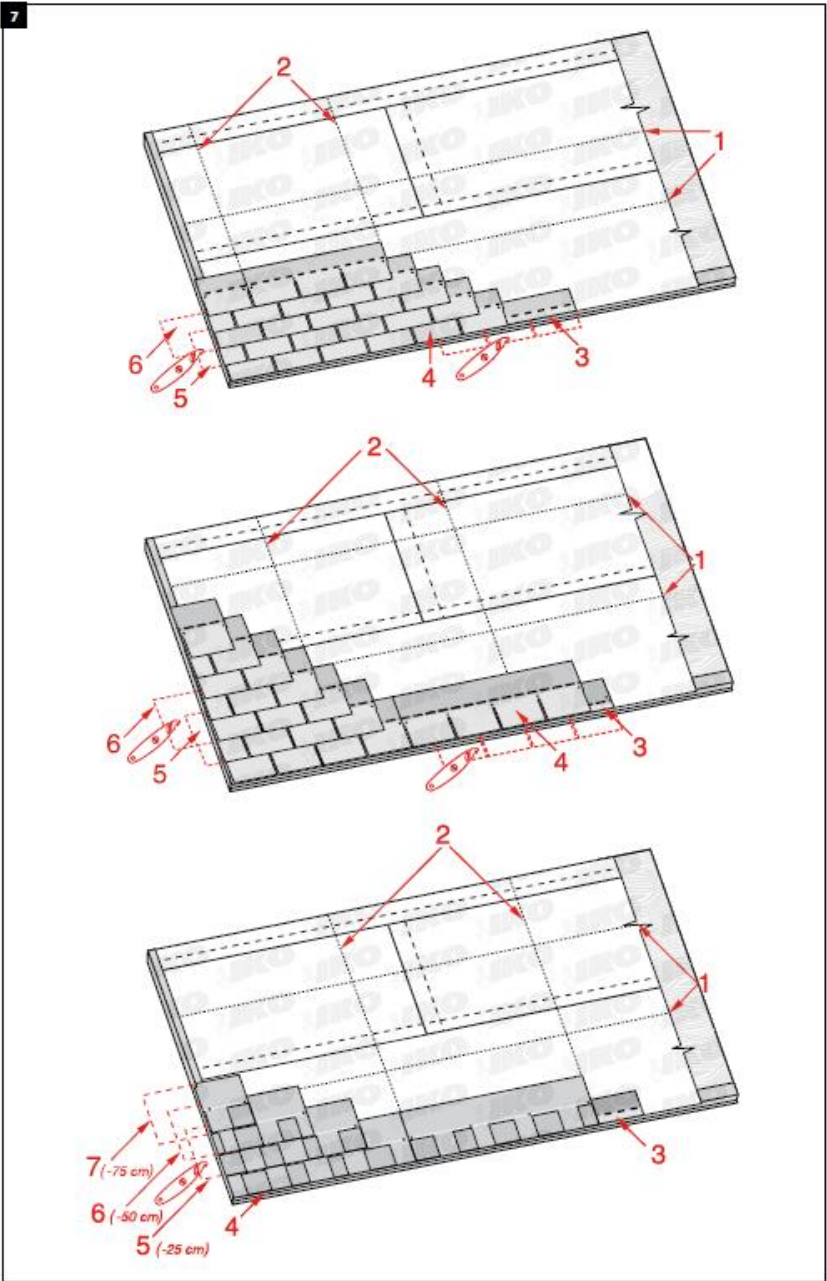


Shingle application guide

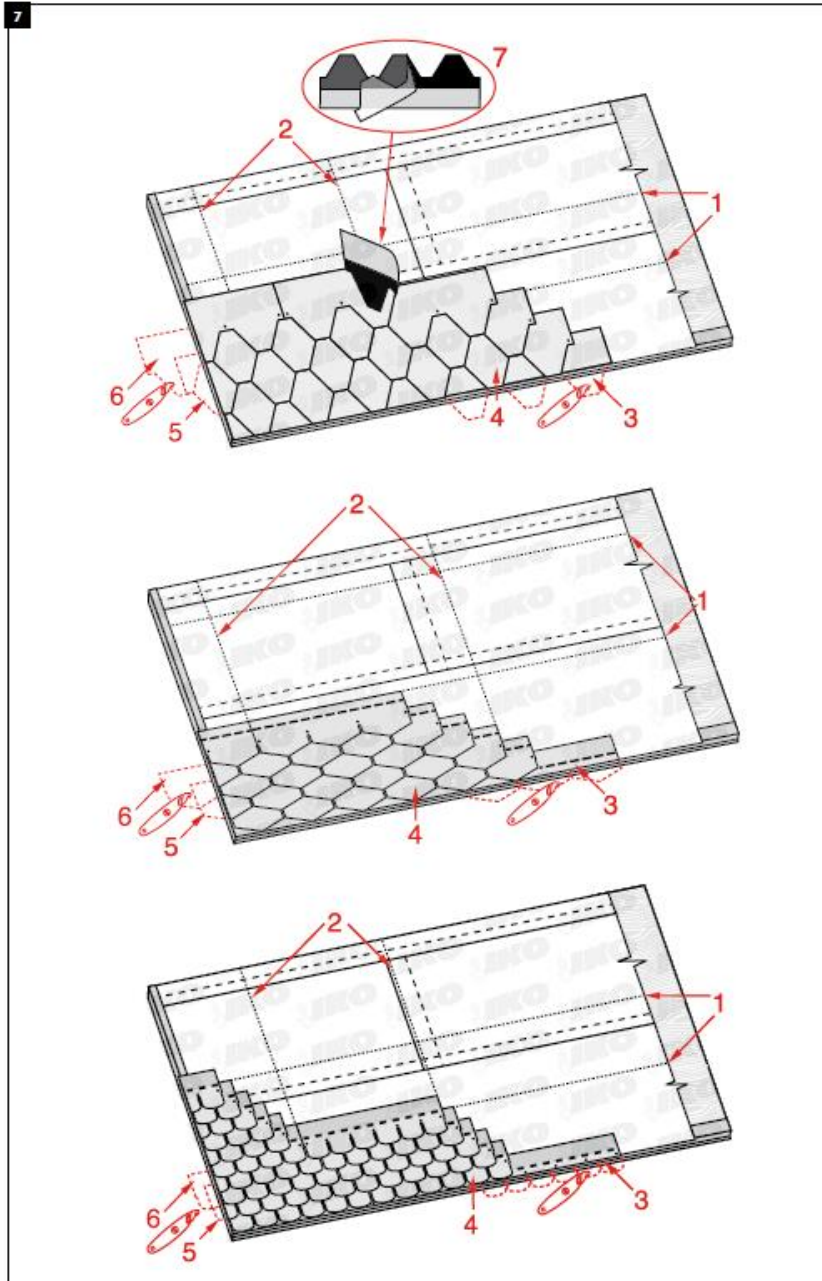
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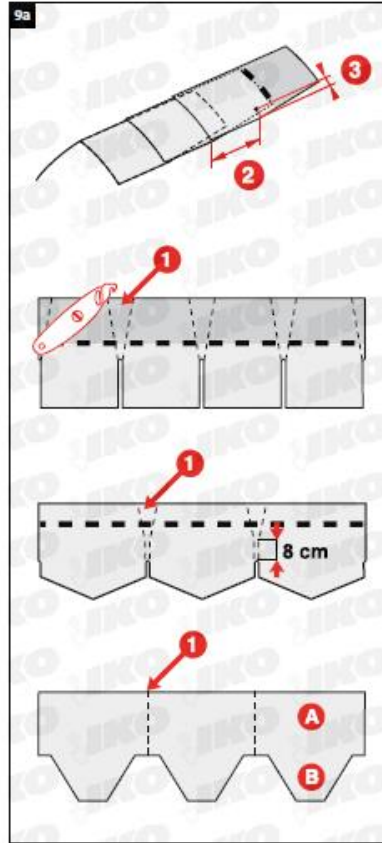
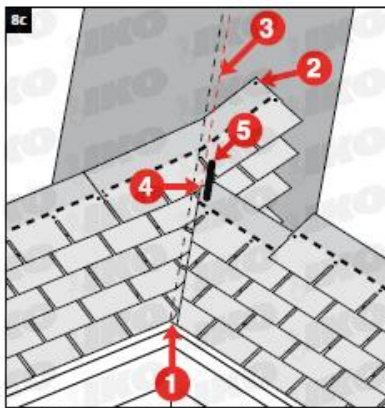
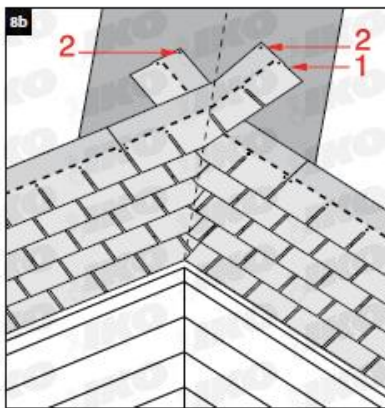
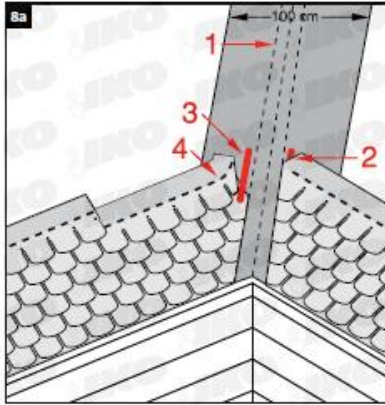


7



Shingle application guide





Shingle application guide

## ESTIMATING SHINGLE REQUIREMENTS

### I. FOR THE ROOF DECK

Shingle exposure is in function of the roof pitch as displayed in the table below.  
Shingles may not be applied on roof pitches not specified.  
Certain countries may have different regulations.  
Check local building codes.

### II. FOR THE HIPS AND RIDGES

A good approximation is to order an extra 10 - 15 % material (depending on the amount of roof detail) for coverage of the hips, ridges and starter strip.  
When applying rounded shaped or laminated shingles be sure to order rectangular shingles in matching colour to cover hips and ridges.

Shingle type	Roof pitch	Exposure	Roof coverage/Bundle	± kg/m <sup>2</sup>
Superglass	15° - 25°	12,5 cm	2,62 m <sup>2</sup>	11,0
	26° - 85°	14,3 cm	3,00 m <sup>2</sup>	9,6
Superglass – Biber	15° - 25°	12,5 cm	2,63 m <sup>2</sup>	10,5
	26° - 85°	14,3 cm	3,00 m <sup>2</sup>	9,2
Armourglass	15° - 25°	12,5 cm	2,62 m <sup>2</sup>	12,5
	26° - 85°	14,3 cm	3,00 m <sup>2</sup>	10,9
Victorian	15° - 25°	12,5 cm	2,62 m <sup>2</sup>	12,0
	26° - 85°	14,3 cm	3,00 m <sup>2</sup>	10,5
Diamant	15° - 25°	9,7 cm	2,62 m <sup>2</sup>	12,0
	26° - 85°	11,2 cm	3,00 m <sup>2</sup>	10,5
Oxford	15° - 25°	12,5 cm	2,63 m <sup>2</sup>	13,3
	26° - 85°	14,3 cm	3,00 m <sup>2</sup>	11,7
Harvard	15° - 85°	15,0 cm	3,10 m <sup>2</sup>	12,0
ArmourShield	15° - 90°	13,4 cm	3,00 m <sup>2</sup>	9,2
BiberShield	15° - 90°	14,3 cm	2,72 m <sup>2</sup>	12,1
DiamantShield	15° - 90°	11,2 cm	2,46 m <sup>2</sup>	11,2
Monarch	15° - 25°	12,5 cm	2,25 m <sup>2</sup>	13,5
	26° - 85°	14,3 cm	2,58 m <sup>2</sup>	12,4
Monarch – Diamant	15° - 25°	9,7 cm	2,13 m <sup>2</sup>	13,5
	26° - 85°	11,2 cm	2,46 m <sup>2</sup>	12,0



## ROOF PREPARATION

### I. ROOF DECK (Figure 2)

The roof deck must be smooth, firm, dry and securely fastened. The deck should be made of good quality plywood, sheathing boards or nonveneer structural panels (wafer or strand board). Wooden boards can be maximum 15 cm wide. All wood products must be properly conditioned to be at moisture equilibrium. Decking should be installed in a staggered manner and sufficiently supported. Failure to use proper decking material which can provide a rigid deck surface can result in deck movement which can damage the shingles.

### II. VENTILATION (Figure 3)

It is essential to allow heat dissipation and water vapour to escape the roof system through proper ventilation. Therefore, air must be able to circulate freely between insulation and the nailable roof deck, from the eaves to the ridges. On roof pitches 15°- 25° the minimum net free ventilation area is 33 cm<sup>2</sup>, on 25°- 85° min. net free ventilation area is 16 cm<sup>2</sup> for each 1 m<sup>2</sup> of insulated ceiling area (P), always divided evenly between the eaves and the ridge.

### III. UNDERLAY

Install as flat as possible to prevent unevenness from being projected in the shingle surface. Install parallel to the eaves.

#### *Slopes 15°- 20°*

Option 1 (Figure 4a I): it is advised to cover the entire roof deck with **IKO Armourbase Premium + adhesive underlay** or a similar modified base sheet which will seal the entire deck. End laps must be 15 cm and horizontal laps 8 cm.

Option 2 (Figure 4a II): use **IKO Armourbase underlay** or a similar base sheet, to provide a double coverage of underlay to the roof deck. Cut a starter strip 50 cm wide and lay succeeding courses fastened with 50 cm horizontal laps and 30 cm end laps.

#### *Slopes 21°- 85° (Figure 4b)*

The entire roof deck should be covered with **IKO Armourbase underlay** or an approved shingle underlay. The underlay should be installed parallel to the eaves with a 5 cm horizontal lap and 10 cm end laps. Secure the underlay with only enough nails to hold it in place.

#### *Slopes 85°- 90°*

No underlay required. Only **shield shingles** can be applied.

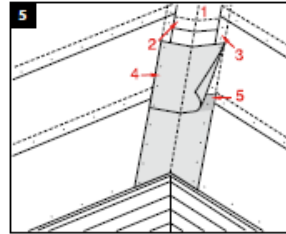


#### IV. VALLEYS

One may follow either the Open, Woven or Closed Cut method for shingle application in the roof valleys. Valley preparation depends on the method:

- **Open Valley Preparation (Figure 5).**

Cover the valleys with 1 m wide underlayment, **IKO Armourbase (1)**. Vertical laps must be 30 cm and cemented (2). The end laps from the roof deck underlay must overlap the valley by 15 cm (3). Finish the valleys by applying the **IKO Armourvalley** or metal flashing on top of the underlay in the valleys (4). Nail the Bi-Armour Valley at 40 cm intervals 2,5 cm from the edge. If lapping is unavoidable it must be 30 cm and cemented or torched (5). Metal flashing should be fastened every 25 cm and overlaps should be 30 cm and cemented.



- **Woven or Closed Cut Valley Preparation.**

Prepare the valley with one layer of **IKO Armourbase Premium + adhesive underlay** with 30 cm laps. Alternatively, use a layer of **IKO Armourbase** or an approved shingle underlay, nailed 2,5 cm from the edge. Laps should be 30 cm and cemented.

#### V. EAVES PROTECTION (Figure 4c)

In climates where average January temperatures are  $-1^{\circ}\text{C}$ , eaves should be protected against ice damming which can cause water to back up the roof under the shingles. Apply **IKO Armourbase adhesive underlay** from the eaves to the least 60 cm beyond the inside wall line. Use 8 cm horizontal laps and 15 cm end laps. Alternatively, use **IKO Armourbase underlay** and provide a double coverage of underlay to the eaves (Figure 4a II). Cut a starter strip 50 cm wide and lay succeeding courses cemented with 50 cm horizontal laps and 30 cm end laps to a distance 60 cm beyond the inside wall line.



#### VI. DRIP EDGES (Figure 4b)

Drip edges for the rakes and eaves of the roof should be made of corrosion-resistant material which extends at least 8 cm from the edge and bends downward over them. Drip edges should be applied over the underlay at the rakes (4) and under the underlay at the eaves (5).

#### VII. CHALK LINES (Figure 7)

Chalk lines provide visual guides that help align the shingles horizontally and vertically. They also align shingles on each side of a dormer or chimney. Horizontal lines can be snapped every 4 to 5 courses (1) and a vertical line (2) should be used on long shingle runs where a line is snapped in the centre of the run and shingles are applied to the left and right of the line. All chalk lines are to be considered as guiding lines not application lines.



## SHINGLE APPLICATION

### I. NAILING & SEALING

Proper fastening is essential for a good roof. Drive the nails straight so that the nail heads are flush with, but not cutting into the shingle surface (Figure 6a). Always nail 2,5 cm above the cut-out and 2,5 cm from each edge. For correct positioning and nail quantities per type of shingle and roof slope see Figure 6b I. Note that steep slope application (> 60°) or high wind areas require extra nails and hand sealing with **IKO Shingle Stick** as shown in Figure 6b II. During cold weather application extra cement must be added in the same manner. In high wind areas the tabs of each shingle should be cemented for at least the top five courses of the roof. Plastic cement should be applied in amounts no greater than 25 mm in diameter and used sparingly. Nail position for laminated shingles: WHITE LINE = NAILING LINE.

#### STARTER STRIP (Figure 7)

Prepare the starter strip by cutting off the shingle tabs along a line level with the top of the cut-outs. Begin the starter strip by cutting the strip half a tab short so that its joints will not line up with the joints of the first course of shingles. The starter strip should overhang the eaves by 6-10 mm and the rakes where applicable (3). For laminated shingles use rectangular shingles.

#### FIRST COURSES & APPLICATION PROCEDURE (Figure 7)

- **First course (4):**

Start with a complete shingle applied flush with the starter strip at rake and eaves. Nail as shown in Figure 6a and continue across the roof with full shingles.

- **Second course (5):**

Cut half a tab from a shingle and start at the rake end. Nail the shingle so that the lower edge of the tabs is flush with the top of the cut-out of the shingle in the first course. (Adjust as needed for roof slopes requiring different exposures, see p. 22 table/exposure).

- **Third and succeeding courses (6):**

Start the third course with a shingle from which a full tab has been cut. Cut off an additional half tab for each succeeding course. For maximum protection against wind driven rain, cement the shingle at the rake edges.

*Attention: When applying laminated shingles, trim off 25, 50, 75 ... cm respectively from the left end of the first shingle in the second (5), the third (6), the fourth (7), ... course.*

### II. SHINGLE APPLICATION IN VALLEYS

#### **Open Valley Method (Figure 8a)**

Snap two chalk lines from the ridge to the eaves 8 cm apart increasing in width by 1 cm per meter toward the eaves (1). Trim the shingles to these lines and cut a 5 cm triangle off

the top corner to direct the water into the valley (2).

Glue the valley end of each shingle with **IKO Shingle Stick** (3) and nail the shingles 5 cm back from the chalk line (4).

#### **Woven Valley Method** (Figure 8b)

Install the shingles through the valley intersection. The last shingle should extend at least 30 cm onto the intersecting roof surface (1) fastened with an extra nail at the upper corner of the shingle (2). Press the shingles tightly into the valley before nailing. No nailing within 15 cm of the valley centreline.

#### **Closed Cut Method** (Figure 8c) for slopes $\geq 23^\circ$

For best performance: start applying on roof plane with the lower slope or biggest surface. The starter strip must be woven (1) (extend +25 cm onto adjoining roof plane). Do not nail within 15 cm of valley centreline. Use one extra nail (2) at the end of each shingle crossing the valley. After completing this roof plane, snap a chalk line (3) 5 cm from centreline on roof plane still to cover. Apply the shingles onto second plane, trim shingles to the line and cut a 5 cm triangle (4) off the top corner to direct the water into the valley.

Glue the valley end of each shingle with **IKO Shingle Stick** (5).

### **III. HIPS AND RIDGES** (Figure 9a & 9b)



Adjust the last few courses of shingles so that the ridge capping will adequately cover the top courses of shingles equally on both sides of the ridge. Cut rectangular and diamond shaped shingles into individual pieces by dividing the shingle at the cut-outs (1).

(ArmourShield: (A) is visual part, (B) is covered part.) (Figure 9a).

Apply the hip and ridge shingles double thickness by stacking two pieces and bending them over the hip or the ridge.

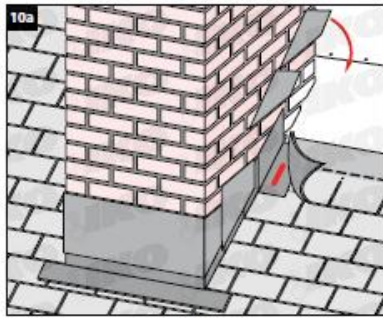
In cold weather warm the shingle before bending.

Nail the capping 16 cm from the tab edge (2) and 2,5 cm from each side (3).

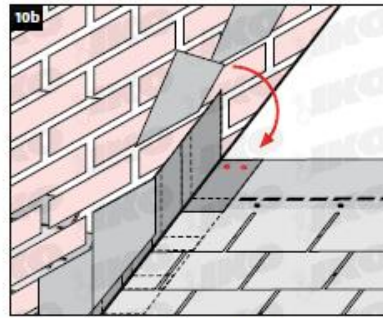
Start application from the end of the ridge opposite the direction of the prevailing winds (Figure 9b)



#### IV. FLASHINGS

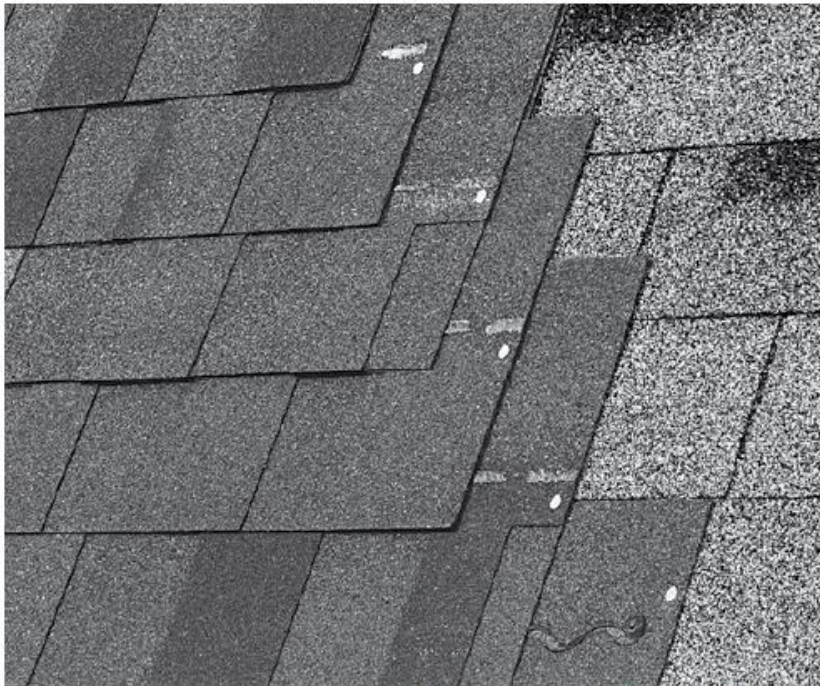


Chimneys



Step Flashing

#### V. REROOFING



Example of reroofing with laminated shingles roof

Shingle application guide

