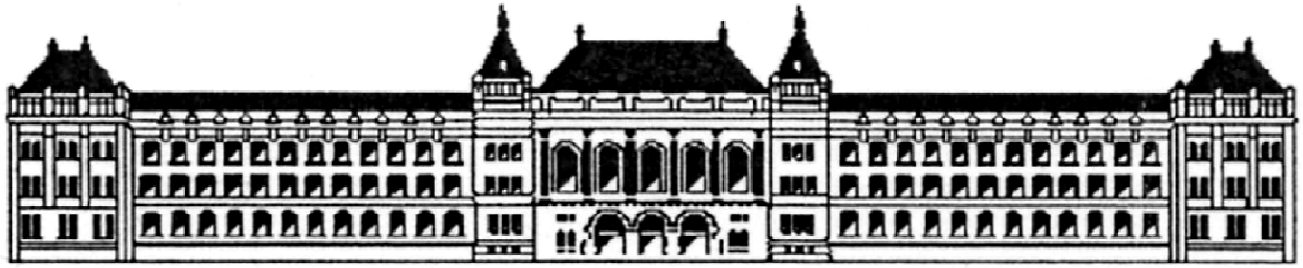

ROOF COVERINGS

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CLASSIFICATION OF ROOF COVERINGS

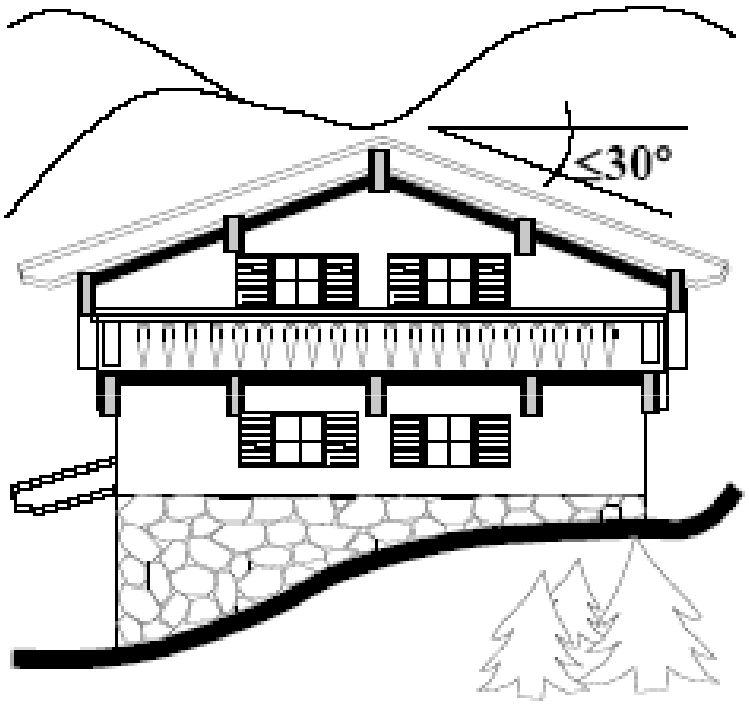
Classification based on system characteristics of the roof coverings:

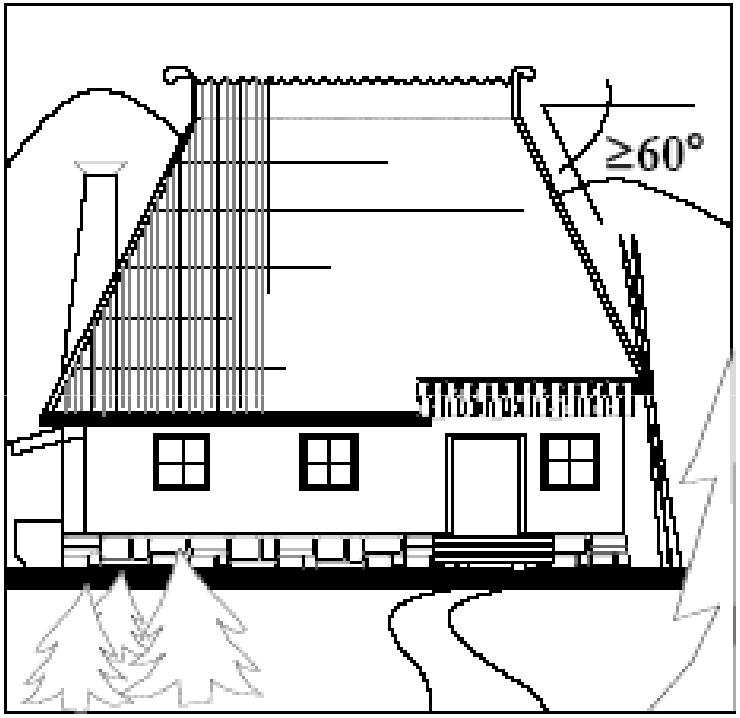
- Organic coverings (timber, thatched claddings)
- Scale-like claddings (pantiles, artificial slate etc.)
- Panel-like claddings (corrugated, trapezoid etc.)
- Metal sheets and metal strips
- Bituminous shingles

Scale like claddings are:

- Natural slate claddings
- Burned clay tiles
- Compression-molded concrete tiles
- Fibre reinforced cement (artificial slate)

PITCH ANGLE - ARCHITECTURE – ROOFING MATERIALS

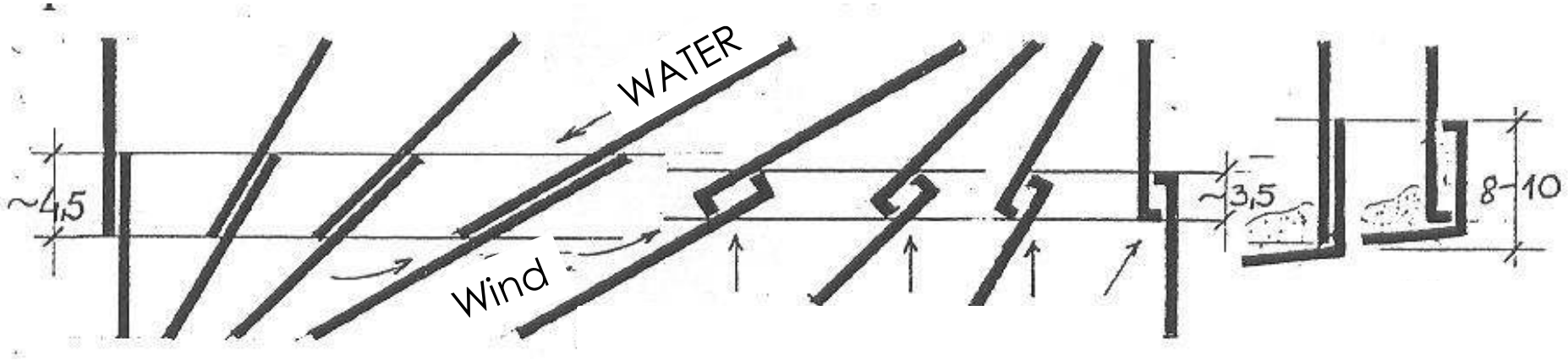




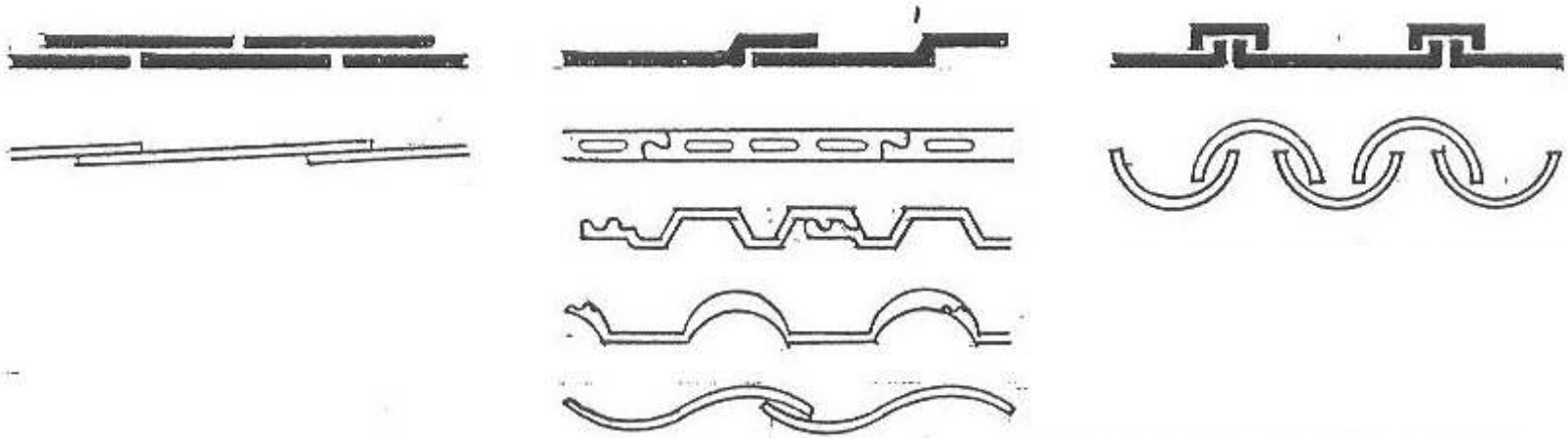
Pitch angle depends on:

- Quantity and type of precipitation (rain, snow, ice etc.)
- Local roofing materials (natural slate, stone ↔ timber shingle, sheaf, reed etc.

OVERLAPPING AND JOINTS OF THE ROOF COVERING ELEMENTS

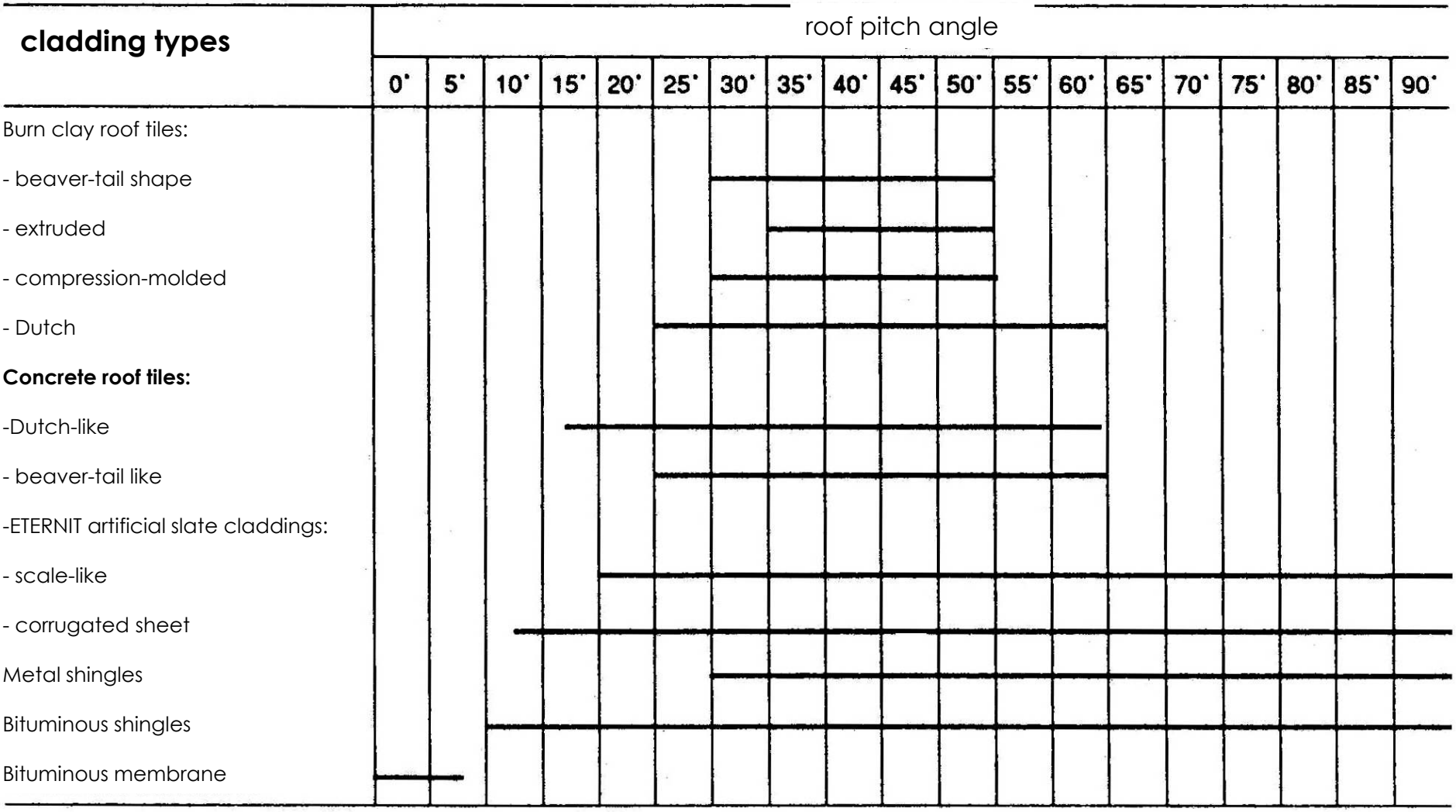


Overlapping of the roof covering elements – decompression gap

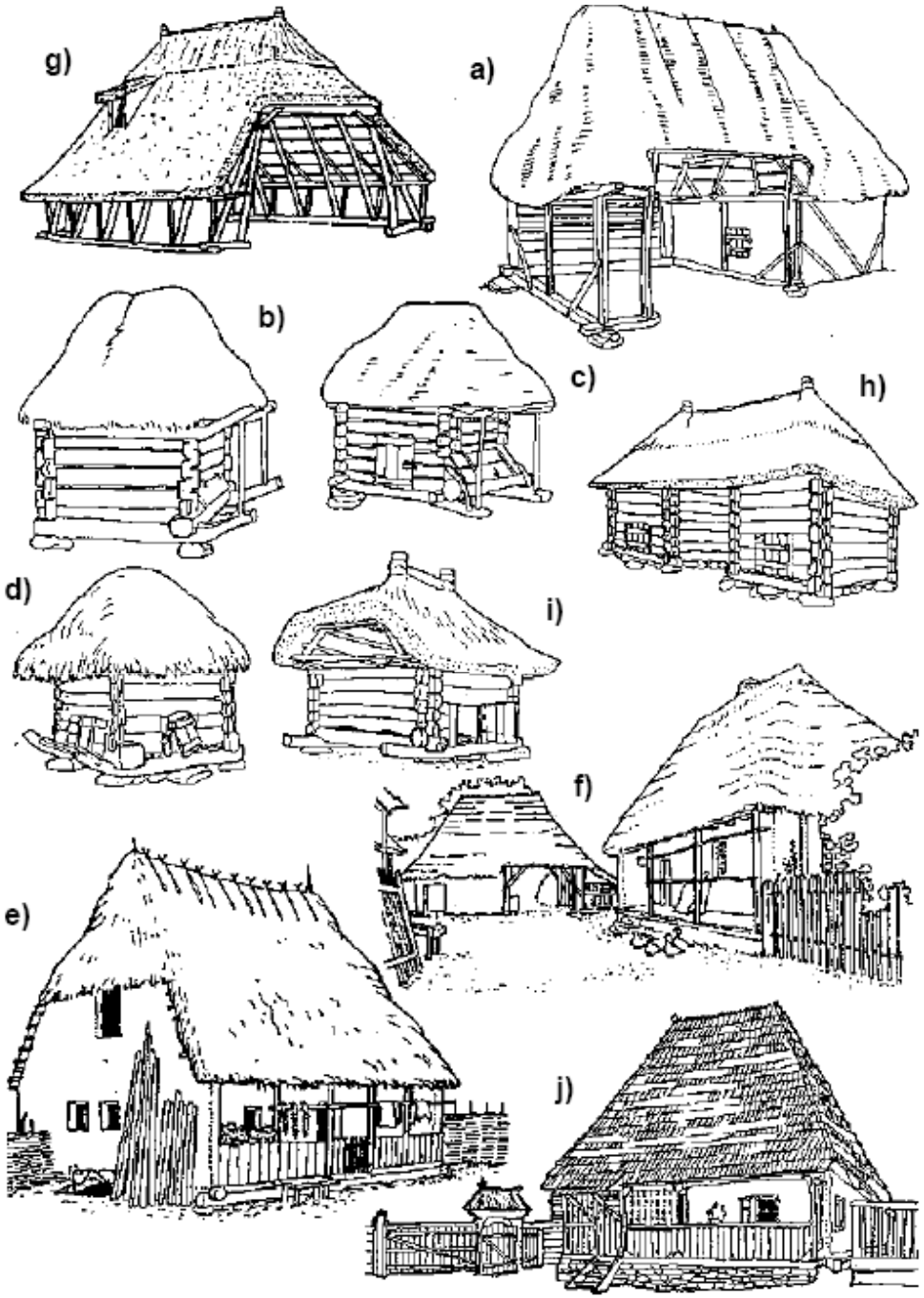


Single and double layer plain covering – interlocking roof covering – tegula-imbrex covering

ALLOWED PITCH RANGE OF ROOF COVERINGS



ORGANIC ROOF COVERINGS



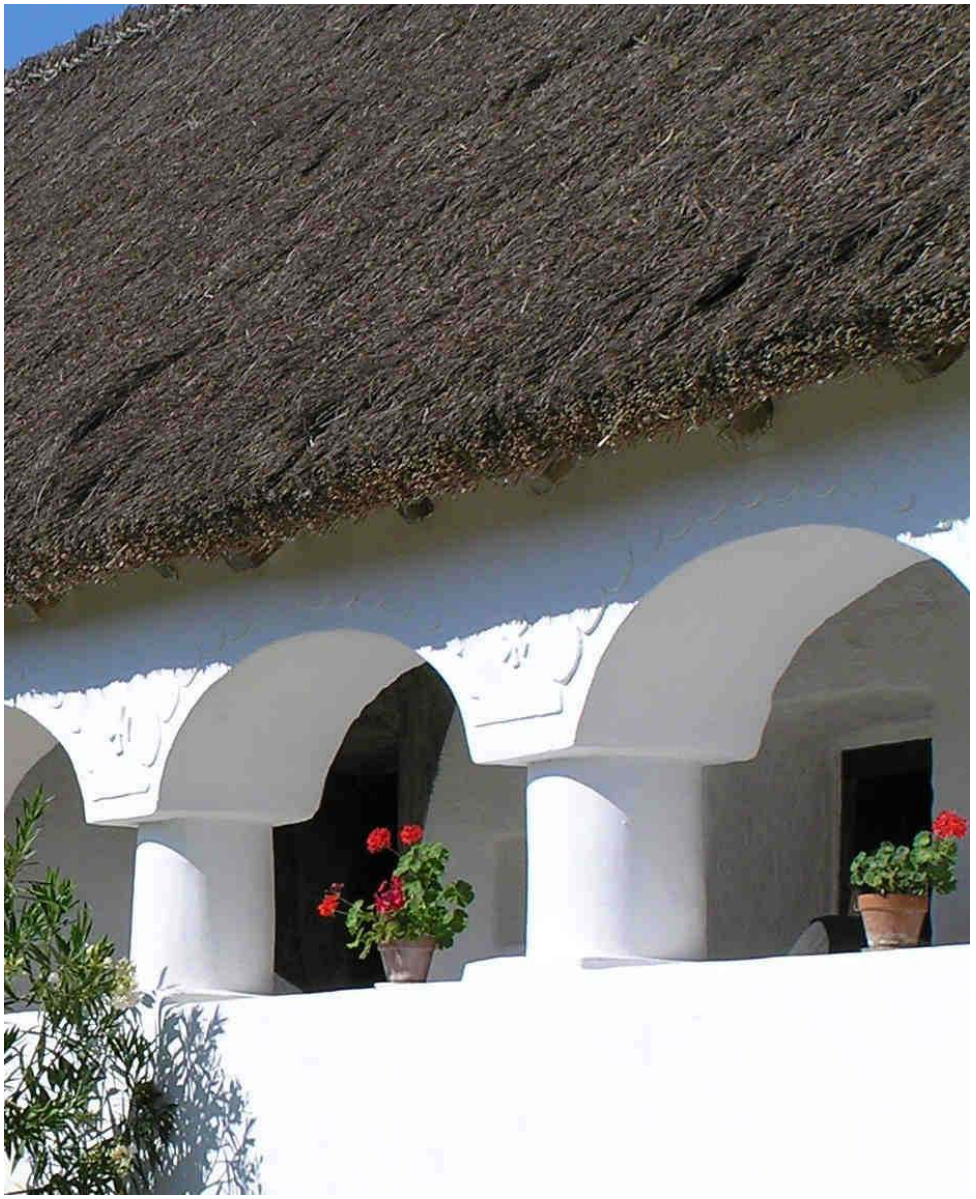
ORGANIC ROOF COVERINGS

a, b, c, d, e, f: straw roof coverings
g, h, i: thatched roofs made of reed)
j: timber shingles

Thatching is the craft of building a roof with dry vegetation such as straw, water reed, sedge, rushes and heather, layering the vegetation so as to shed water away from the inner roof.

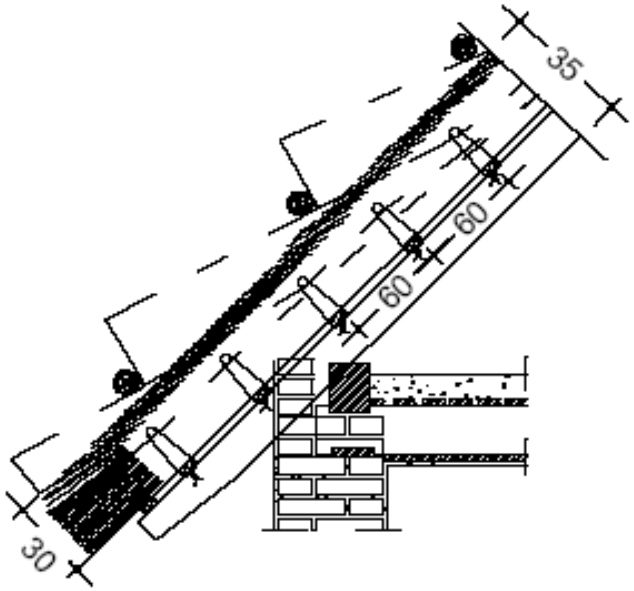
THATCHED ROOF COVERINGS

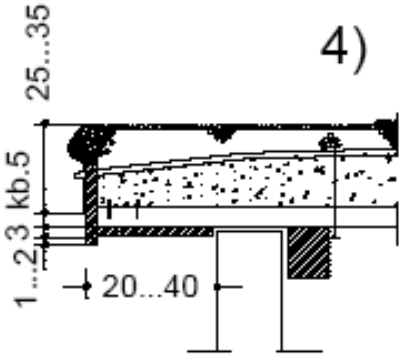
Straw (rye)



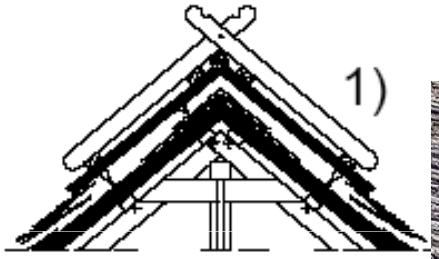
Reed (sheaf) roof cladding

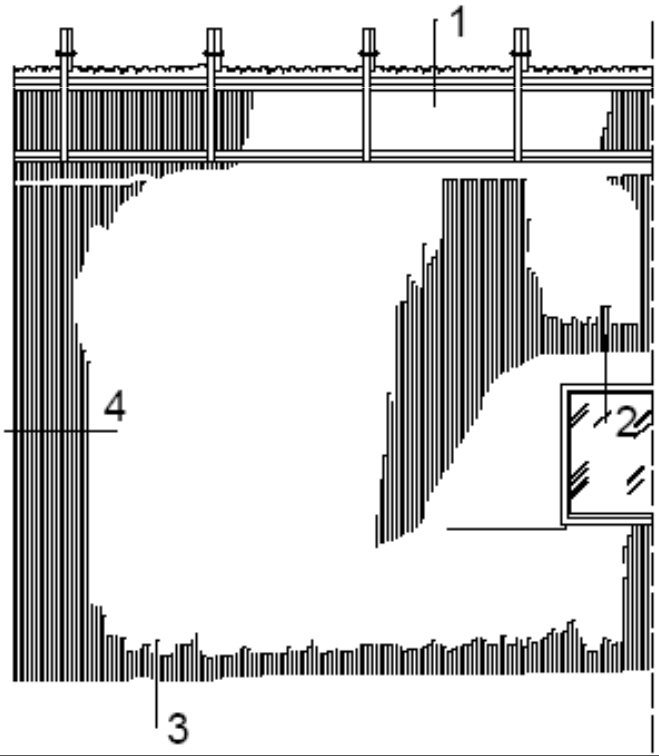
REED ROOF THATCHING

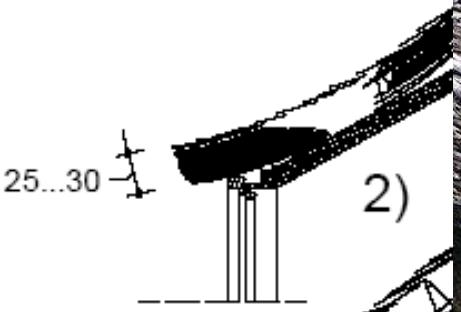


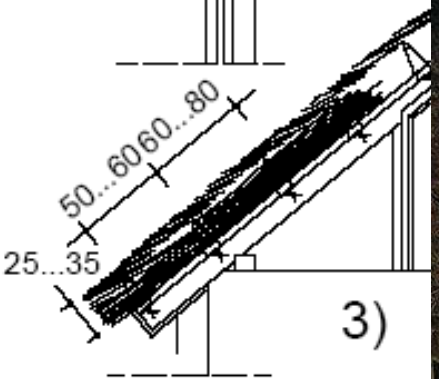


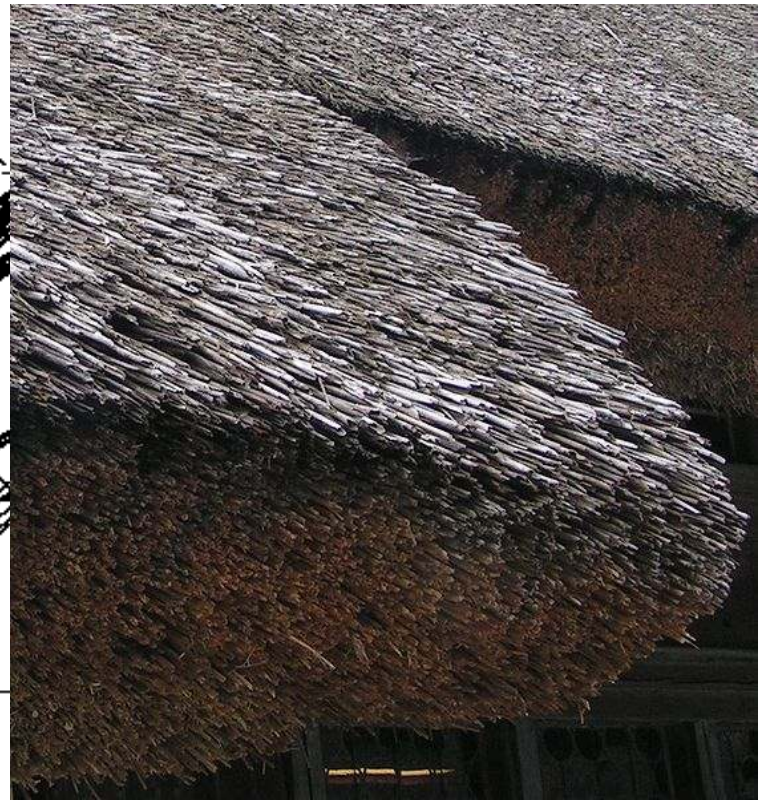
1: ridge
2: dormer window detail
3: eaves detail (without gutter)
4: verge wall



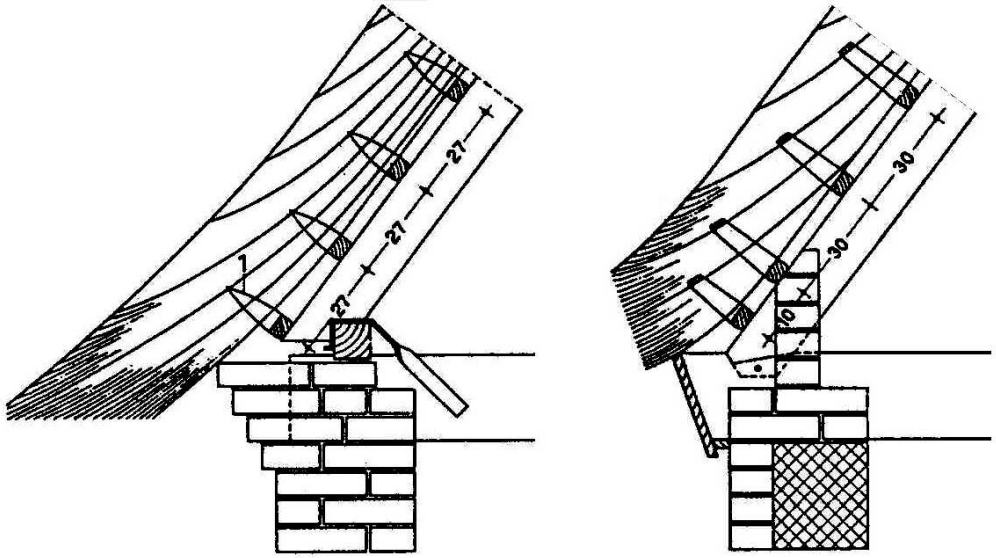








DETAILS AND APPLICATION OF THATCHED ROOFING MADE OF REED



THATCHED ROOF COVERING MADE OF REED
THE WILLIAMS ARMS AT WRAFTON, NORTH DEVON, ENGLAND

THATCHED ROOF COVERING MADE OF REED

The House Of Five Senses at the Efteling Theme Park in The Netherlands

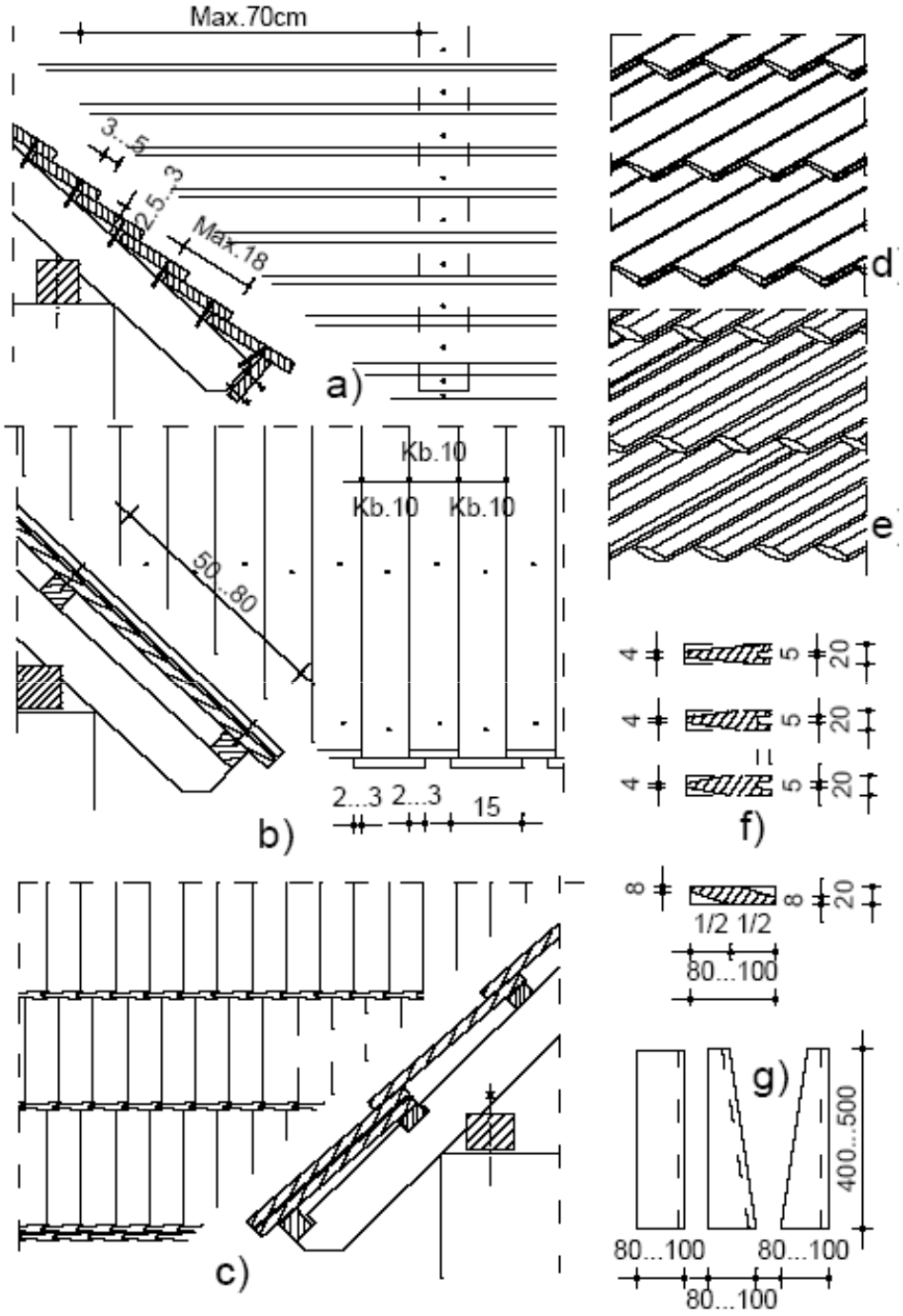
PROBLEMS OF THATCHED ROOFS

Moss and lichen on a thatched roof

Fire of a thatched roof in Debrecen
(the roof is covered with snow)

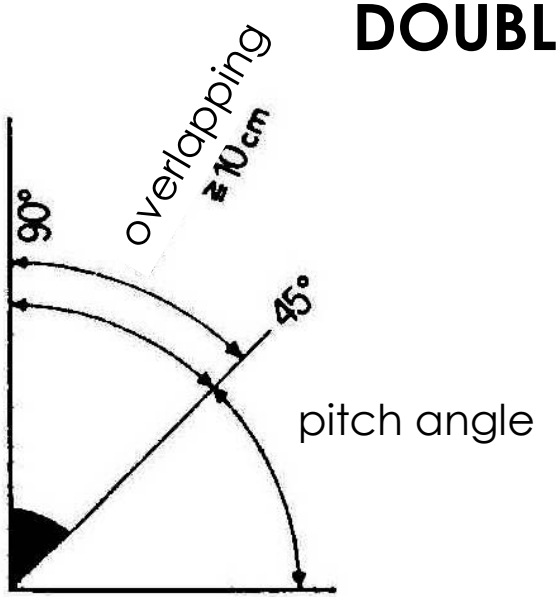
TIMBER BOARD ROOF COVERINGS AND ROOFING SHINGLES

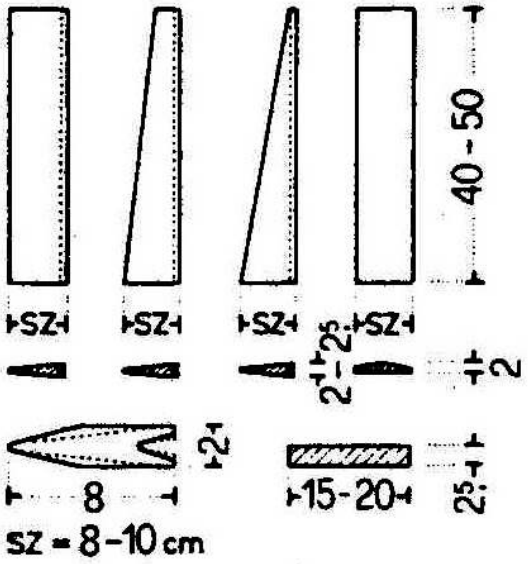
a) timber board roof covering parallel with the eaves
b) Timber board covering parallel with the inclination (laid to falls)
c) Single-layer timber shingle
d) Feathered shingle
e) Shingle without feather
f) Cross section of the shingles
g) Shingle forms

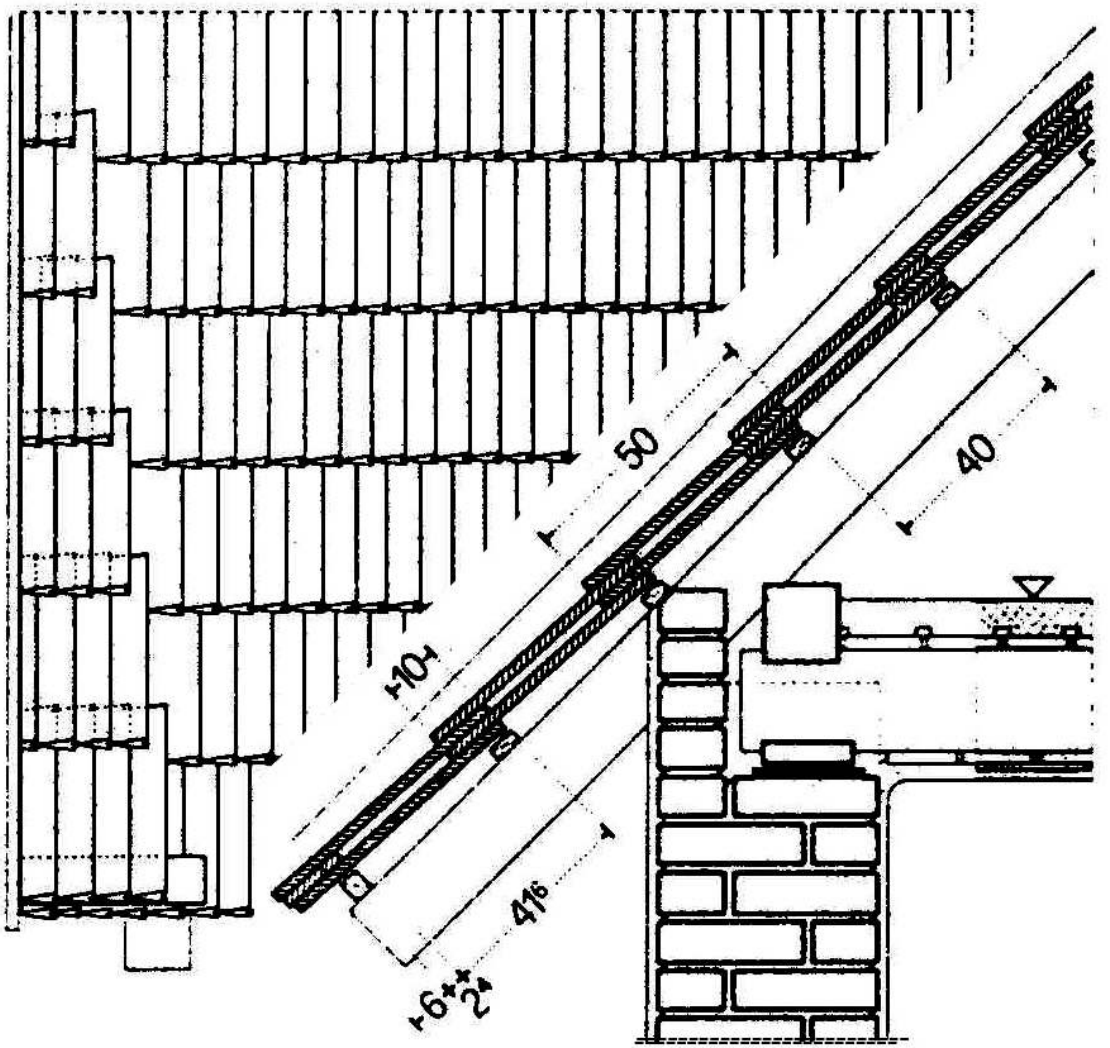


TIMBER BOARD ROOF COVERING: KAKASD, HUNGARY VILLAGE HALL, ARCHITECT: MAKOVECZ IMRE DLA

DOUBLE LAYER TIMBER SHINGLES







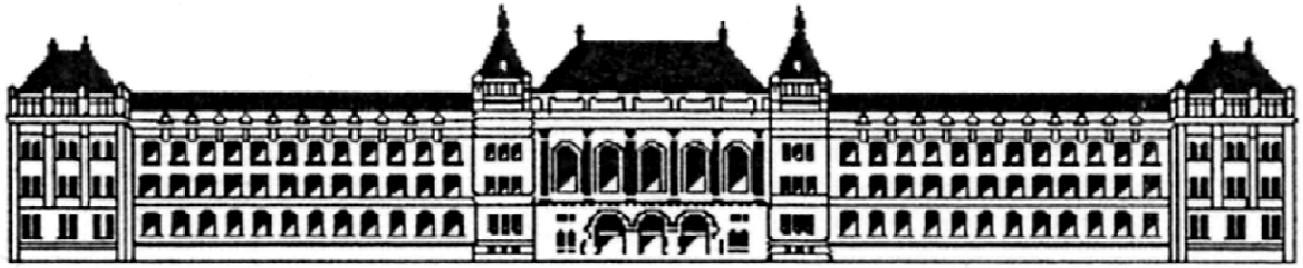
TIMBER SHINGLES

Traditional vernacular houses in Transylvania – the roof is covered with timber shingles

CONNECTION OF TIMBER SHINGLES

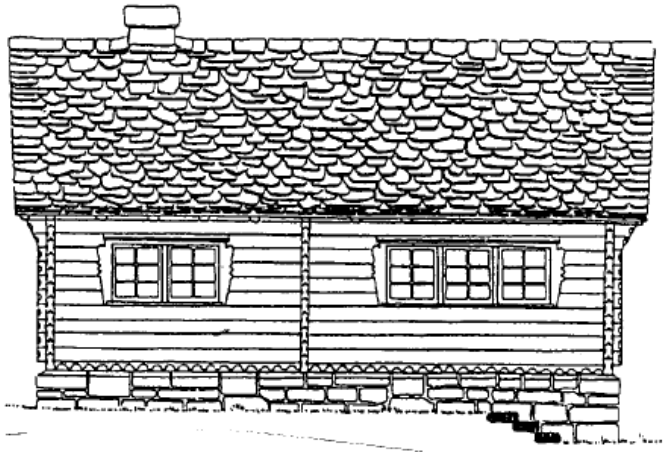
EAVES AND RIDGE DETAILS OF TIMBER SHINGLES

DORMER WINDOWS COVERED WITH TIMBER SHINGLES (ZAKOPANE, POLAND)



SCALE-LIKE ROOF COVERINGS

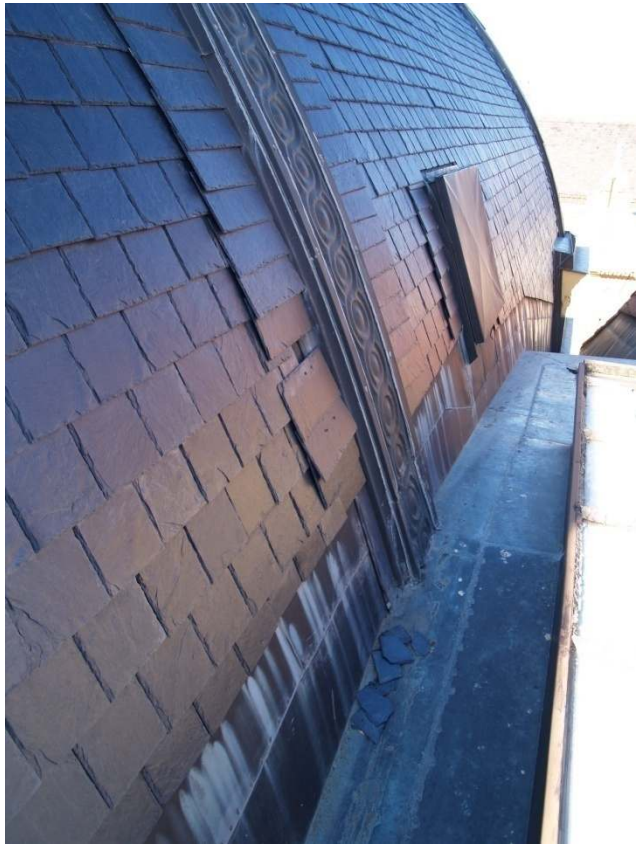
NATURAL STONE ROOF COVERINGS

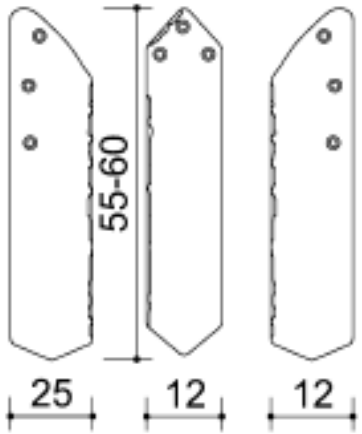


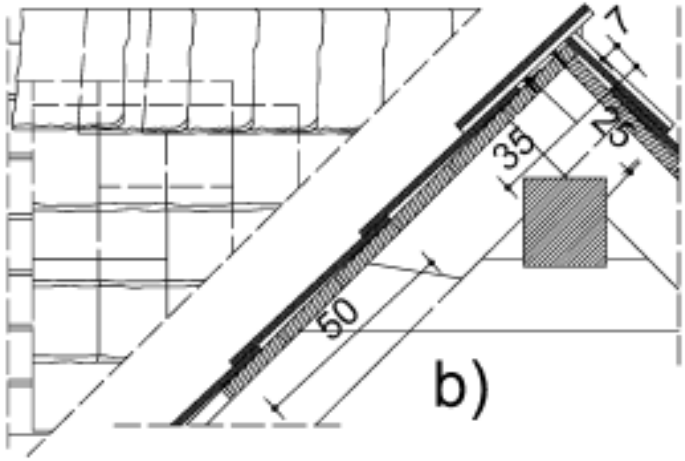
- Low pitch angle (roofing elements are placed without any mechanical fastening
- Large-scale and small-scale elements

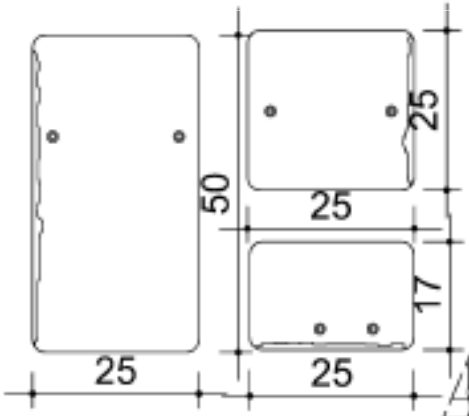
Traditional vernacular house in Westray, Orkney

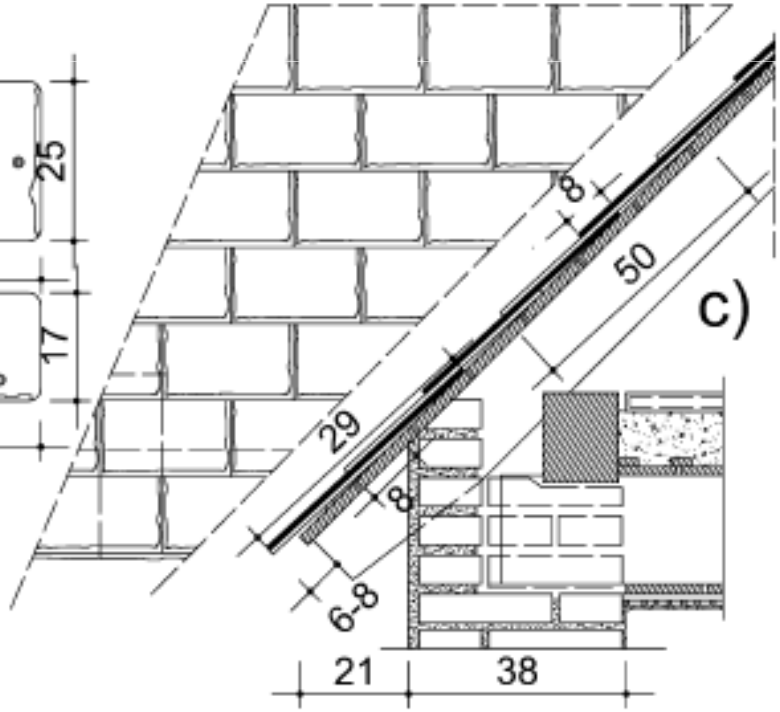
NATURAL SLATE ROOF COVERINGS









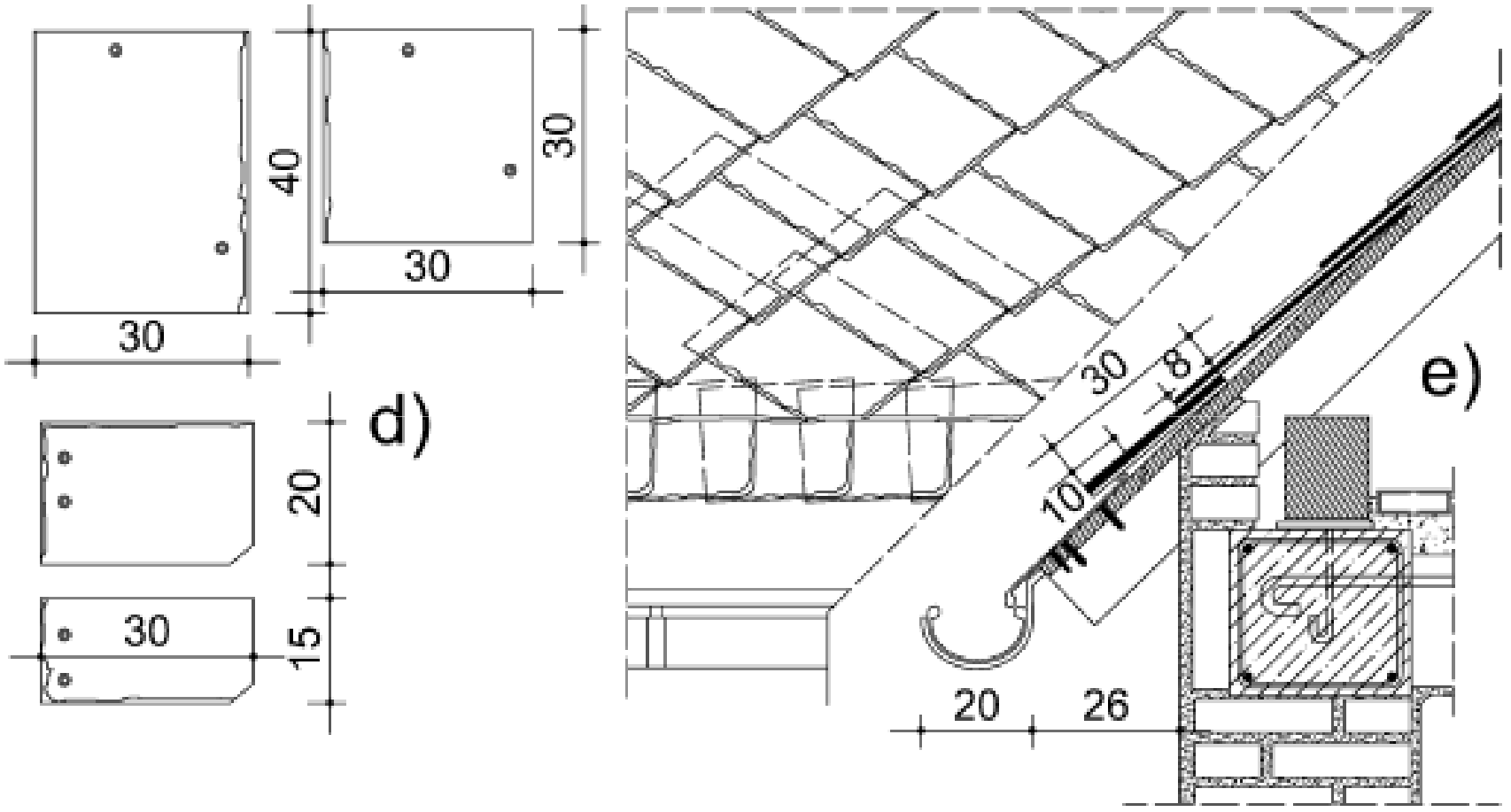


a) Elements of the double natural slate cladding
b) Ridge detail (overlapping - wind direction)
c) Eaves detail

NATURAL SLATE ROOF COVERINGS

NATURAL SLATE ROOF COVERINGS

NATURAL SLATE ROOF COVERINGS



d) Elements of the diagonal natural slate cladding
e) Eaves detail

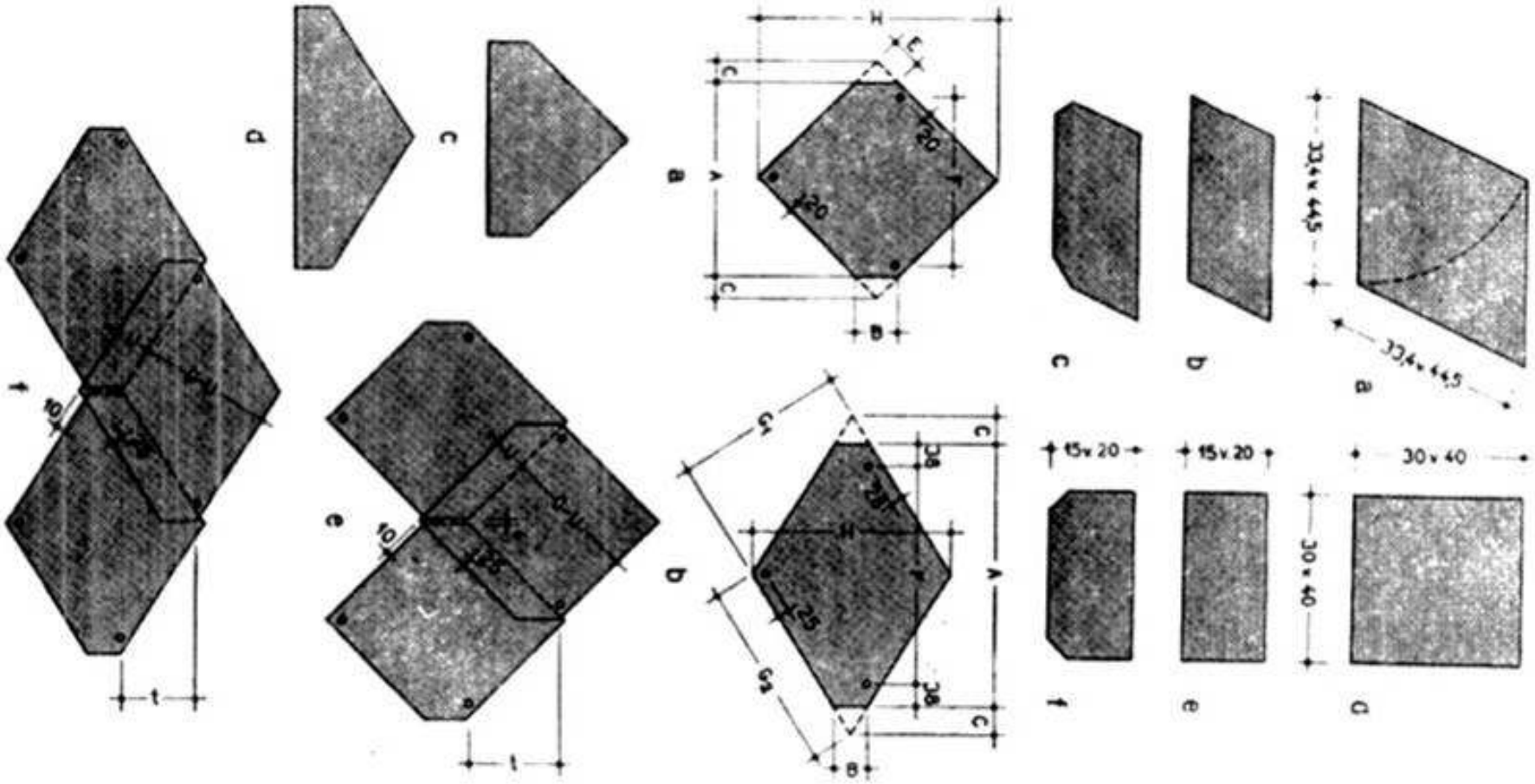
NATURAL SLATE ROOF COVERINGS

Paks, Church (architect: Makovecz Imre DLA)

NATURAL SLATE ROOF COVERINGS

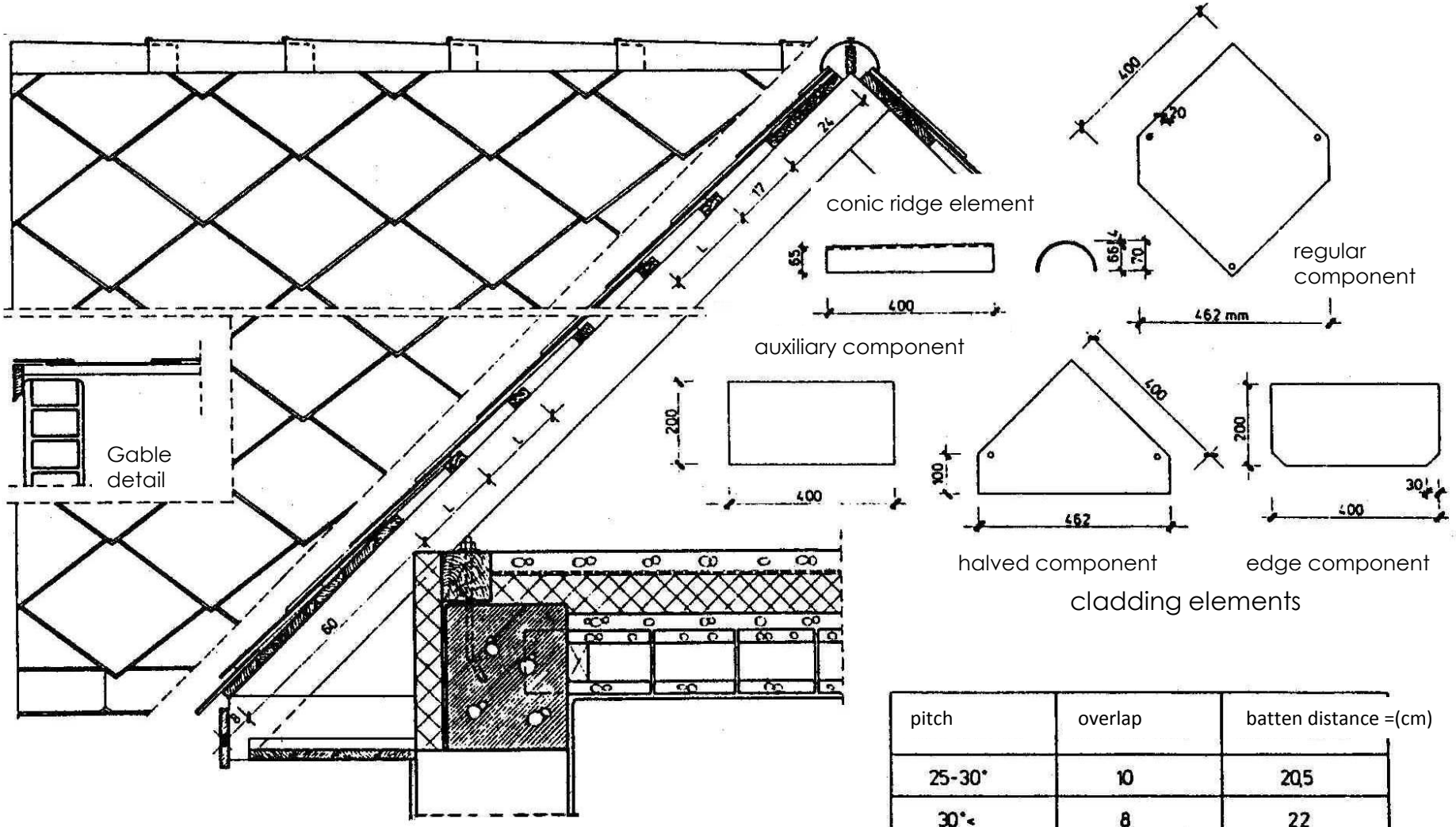
Sevilla, EXPO, Hungarian pavillon, 1992 (architect: Makovecz Imre DLA)

FIBRE REINFORCED CEMENT (ARTIFICIAL SLATE) ROOF COVERINGS - MATERIAL



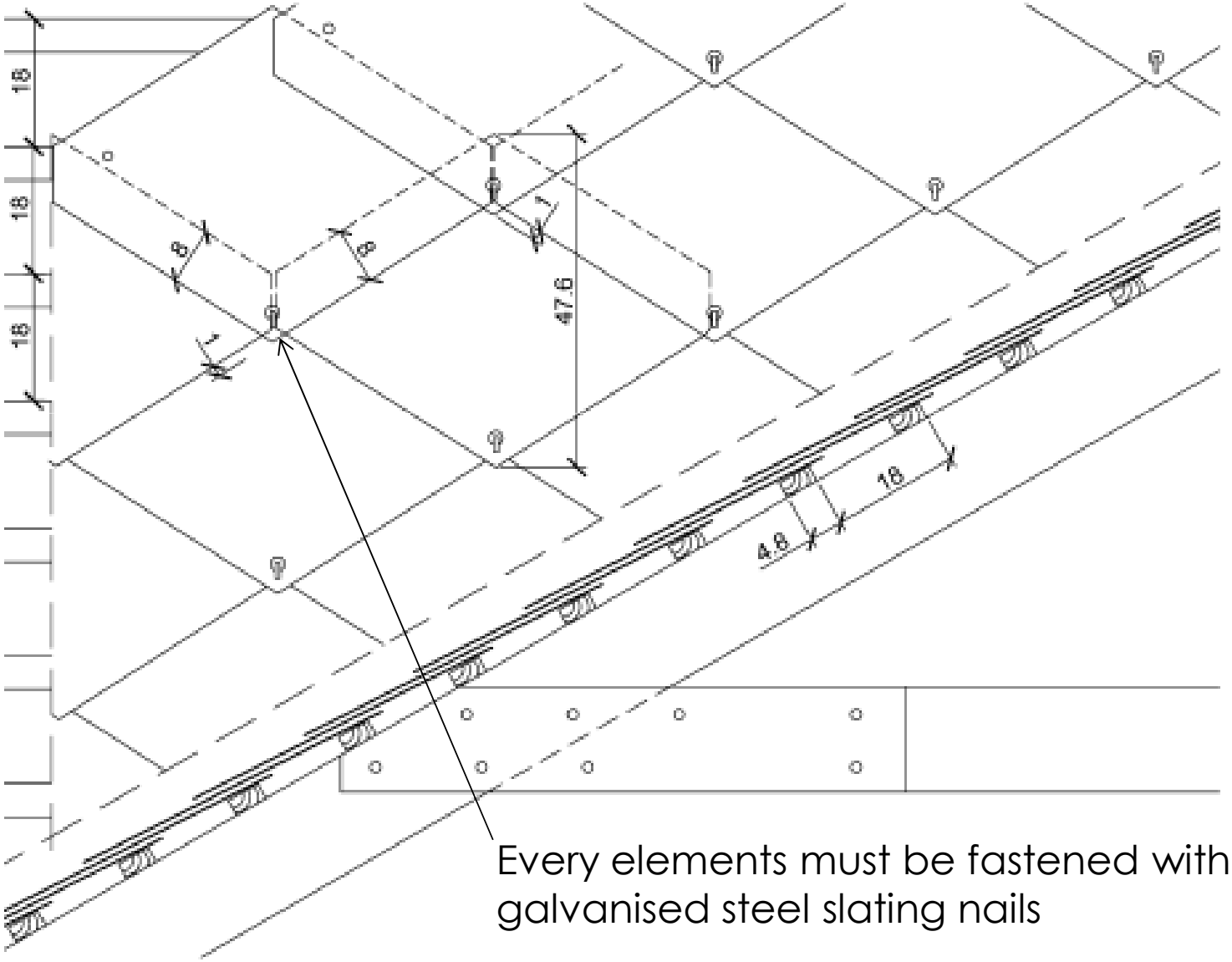
Material: originally was made of asbestos cement, but asbetsos is highly carcinogenic, nowadays the reinforcement is made of mineral fibres

FIBRE REINFORCED CEMENT ROOF COVERINGS – STANDARD (FRENCH OR DIAMOND) SLATING



pitch	overlap	batten distance =(cm)
25-30°	10	20,5
30°<	8	22

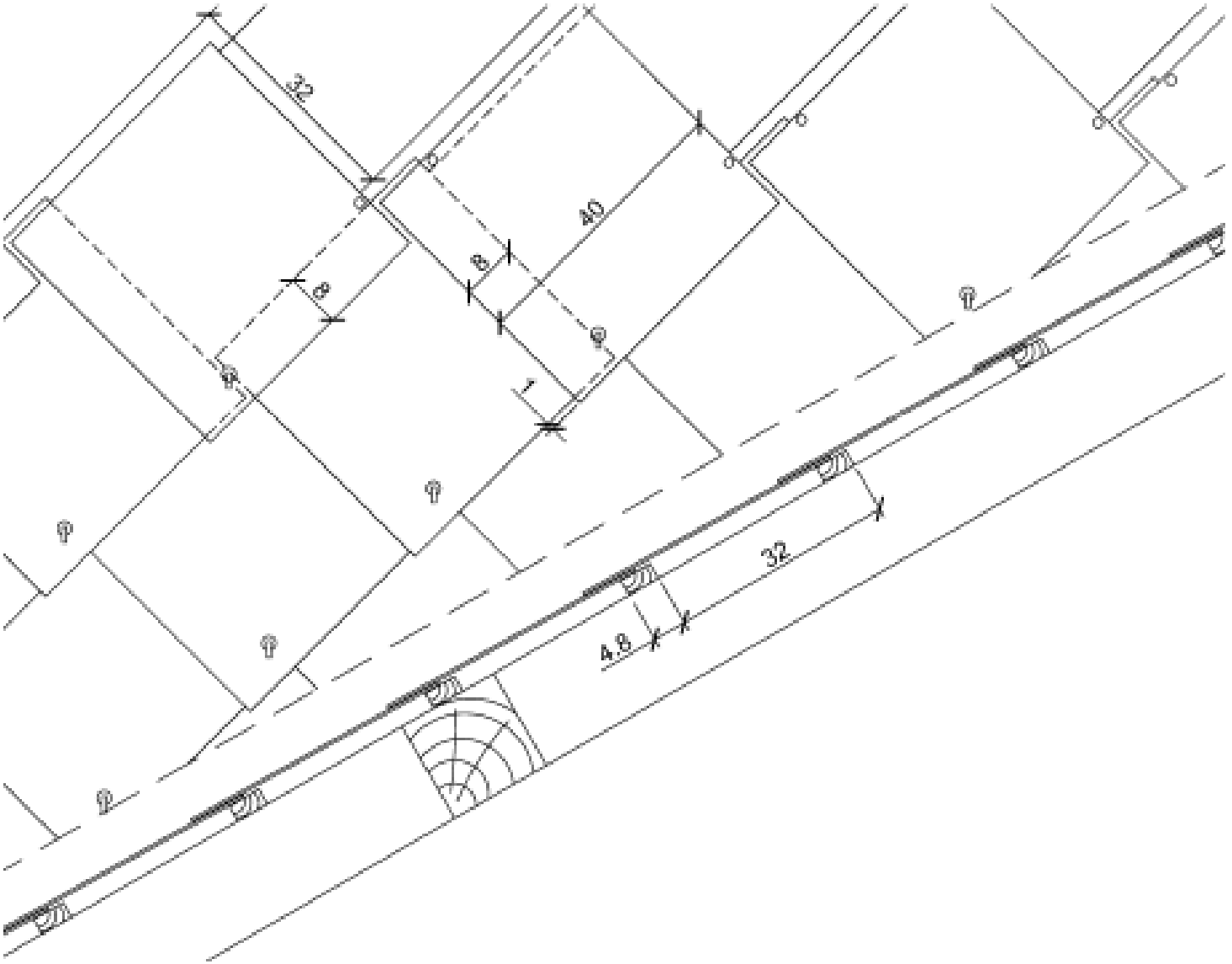
FIBRE REINFORCED CEMENT ROOF COVERINGS – STANDARD (FRENCH OR DIAMOND) SLATING



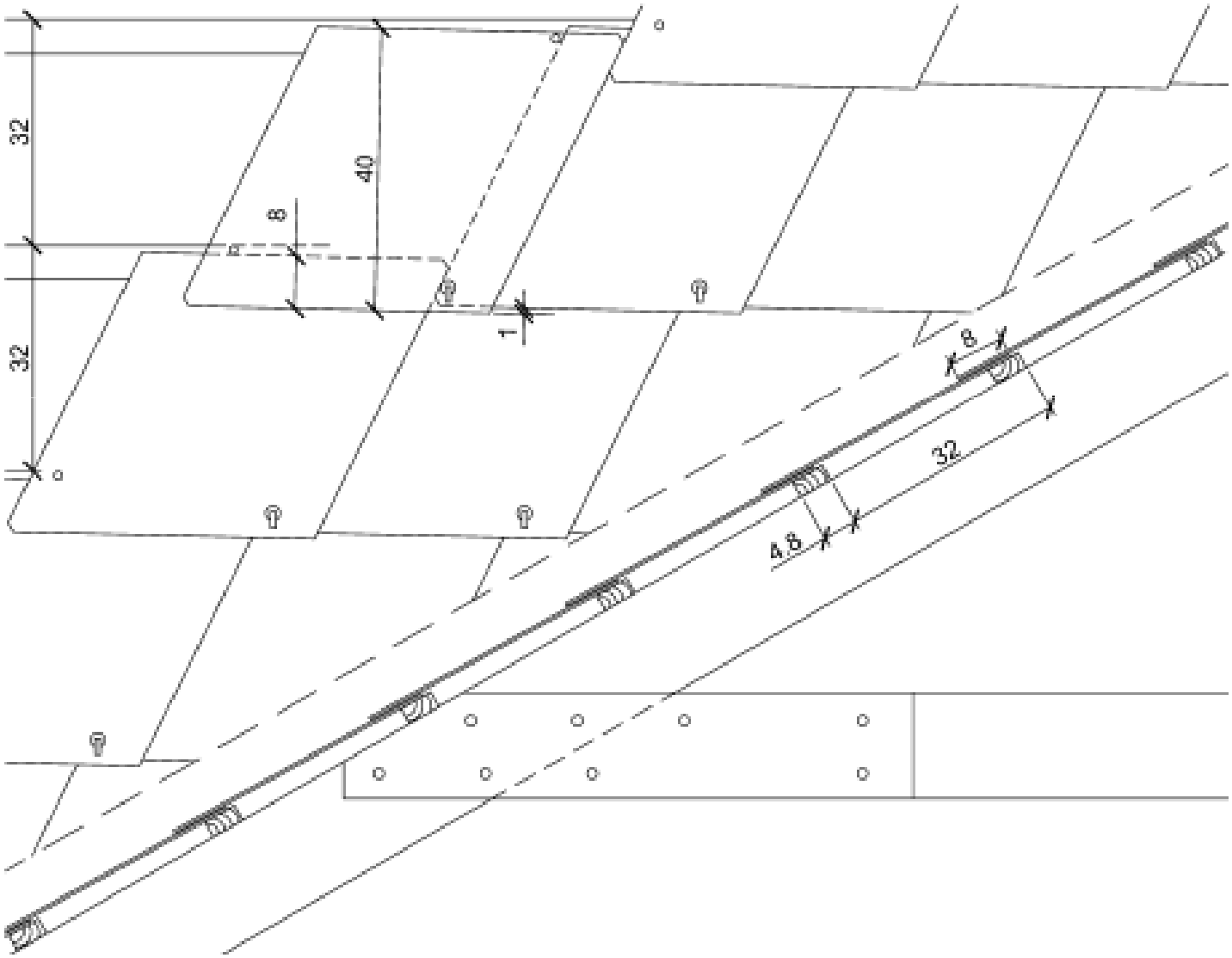
Every elements must be fastened with galvanised steel slating nails

FIBRE REINFORCED CEMENT ROOF COVERINGS – STANDARD (FRENCH OR DIAMOND) SLATING

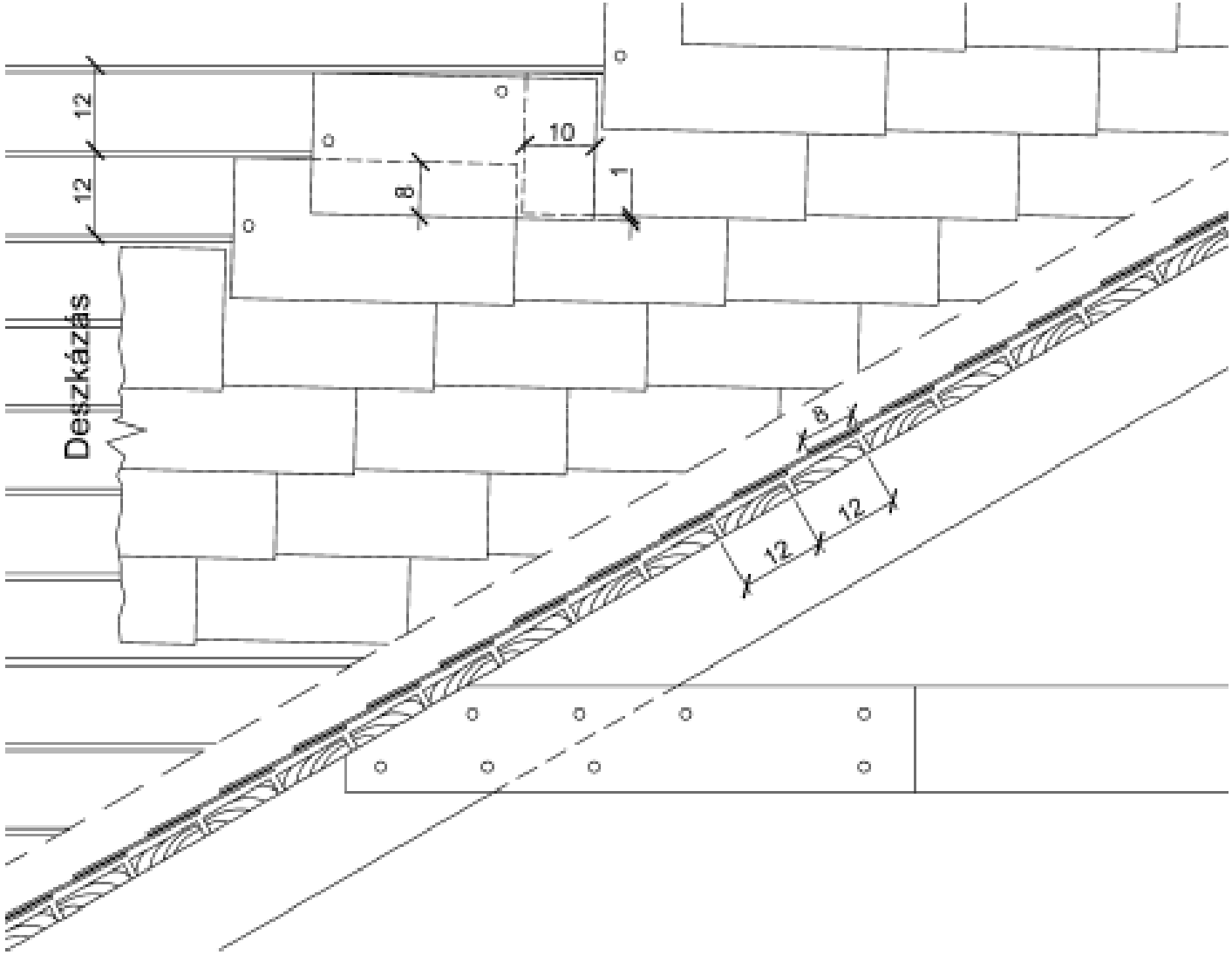
FIBRE REINFORCED CEMENT (ARTIFICIAL SLATE)
ROOF COVERINGS - DIAGONAL(GERMANIAN) ART. SLATE



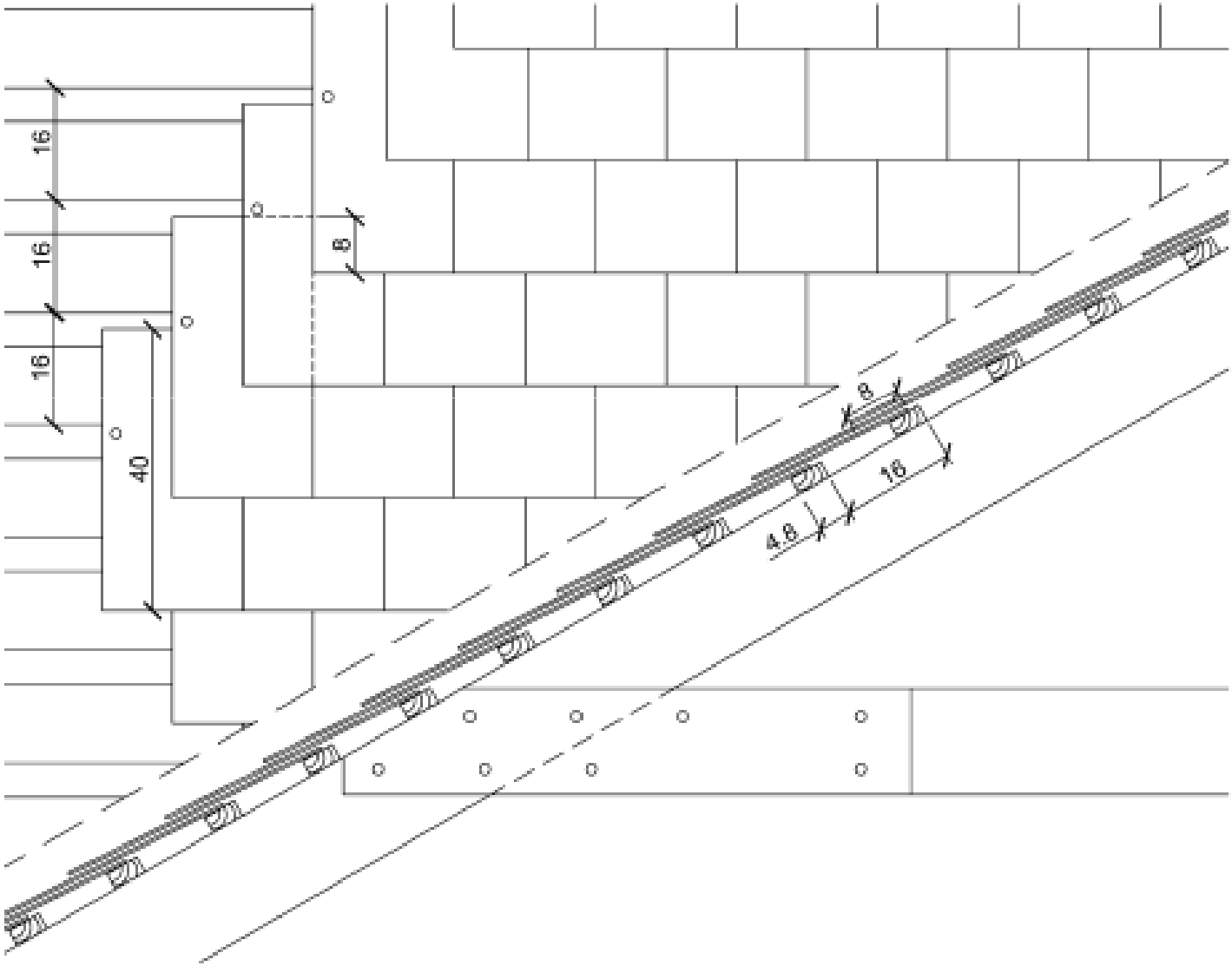
FIBRE REINFORCED CEMENT (ARTIFICIAL SLATE)
ROOF COVERINGS – HORIZONTAL (HUNGARIAN) ART. SLATE



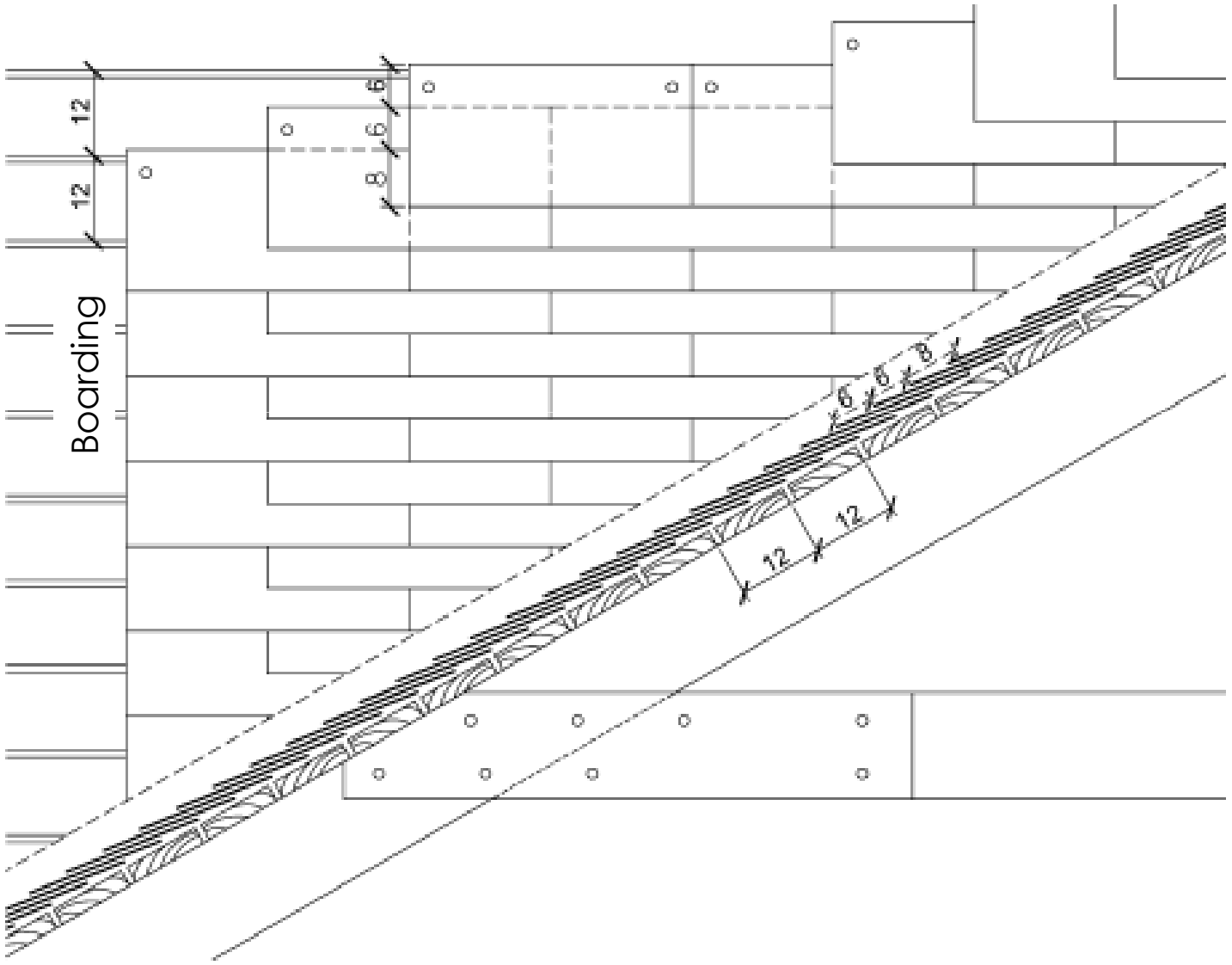
FIBRE REINFORCED CEMENT (ARTIFICIAL SLATE)
ROOF COVERINGS – SINGLE-LAYER (SWISS TYPE) ART. SLATE



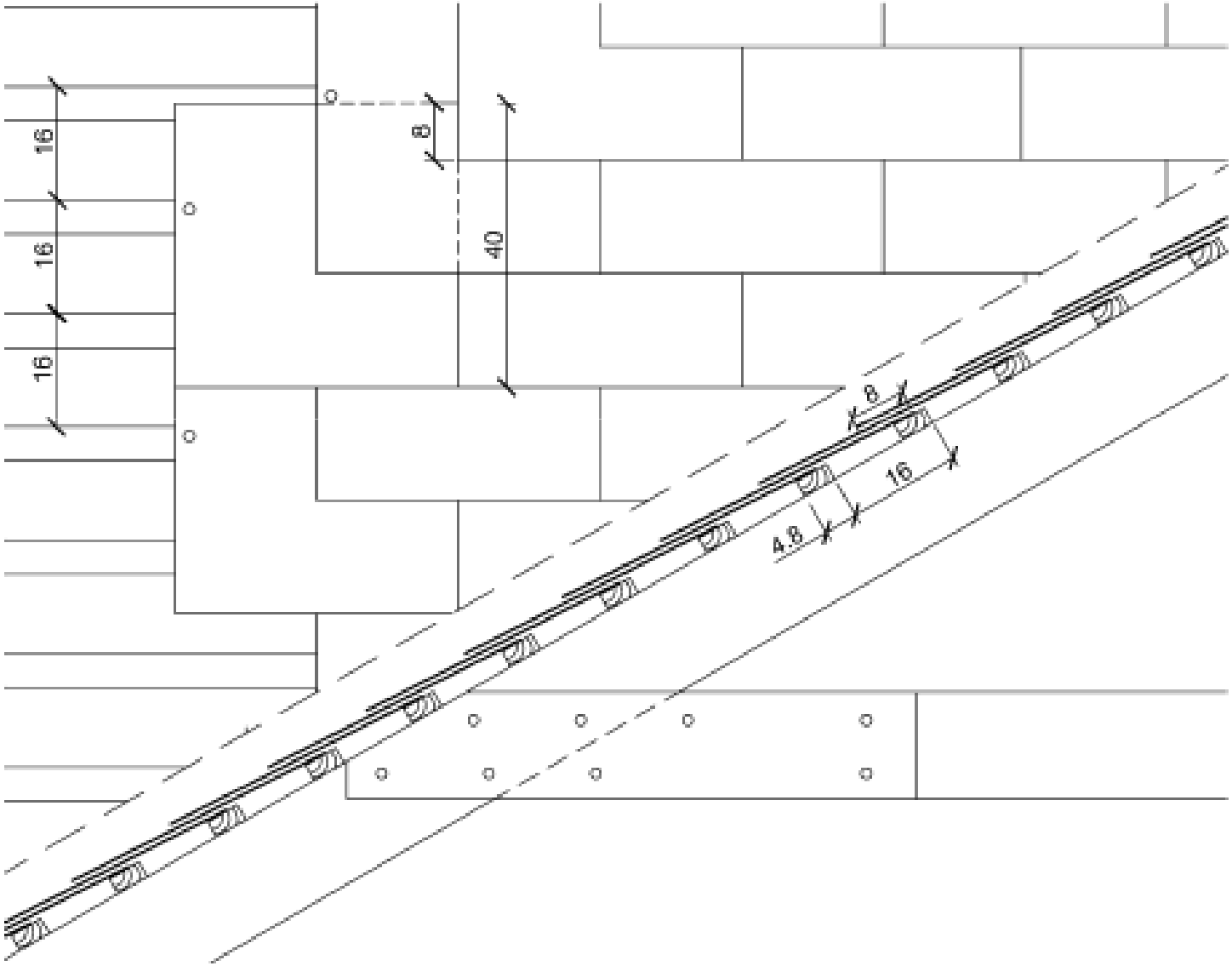
FIBRE REINFORCED CEMENT (ARTIFICIAL SLATE) ROOF COVERINGS – DOUBLE LAYER SLATING



DOUBLE LAYER FIBRE REINFORCED CEMENT ROOF COVERING MADE OF HORIZONTAL ELEMENTS



DOUBLE LAYER (ENGLISH) FIBRE REINFORCED CEMENT ROOF COVERING



BURNED CLAY TILES – DUBROVNIK, CROATIA

TILING SYSTEM ALTERNATIVES

Double layer plain tiles

Wire-cut tiles

Wire-cut tiles

Extruded tiles

Wavy tiles

Compressed tiles

Tegula-imbrex roof covering

Mission or barrel roof covering

TILING ELEMENTS MADE OF BURNED CLAY

Beaver-tail type

Wire-cut (extruded) burned clay tiles

Beaver-tail type

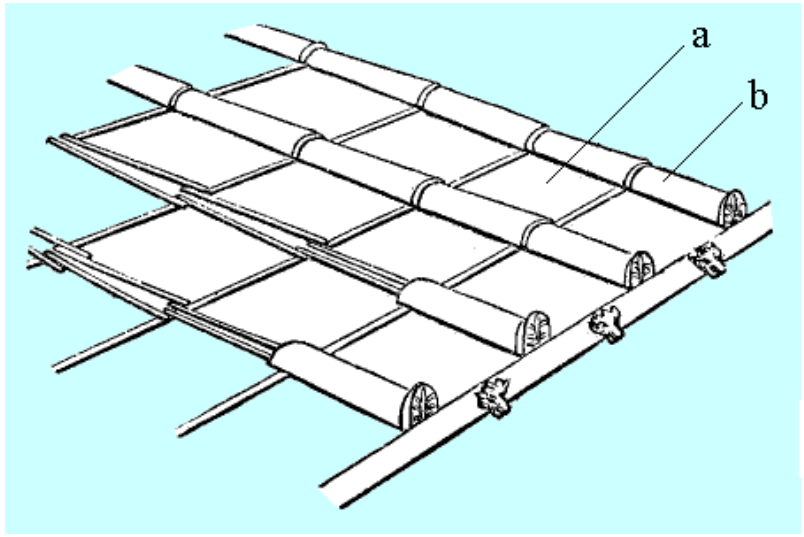
Wire-cut (extruded) tiles

Compressed (interlocking) tiles

Compressed (interlocking) tiles

AUXILIARY TILING ELEMENTS

BURNED CLAY TILES – GREEK AND ROMAN PERIOD

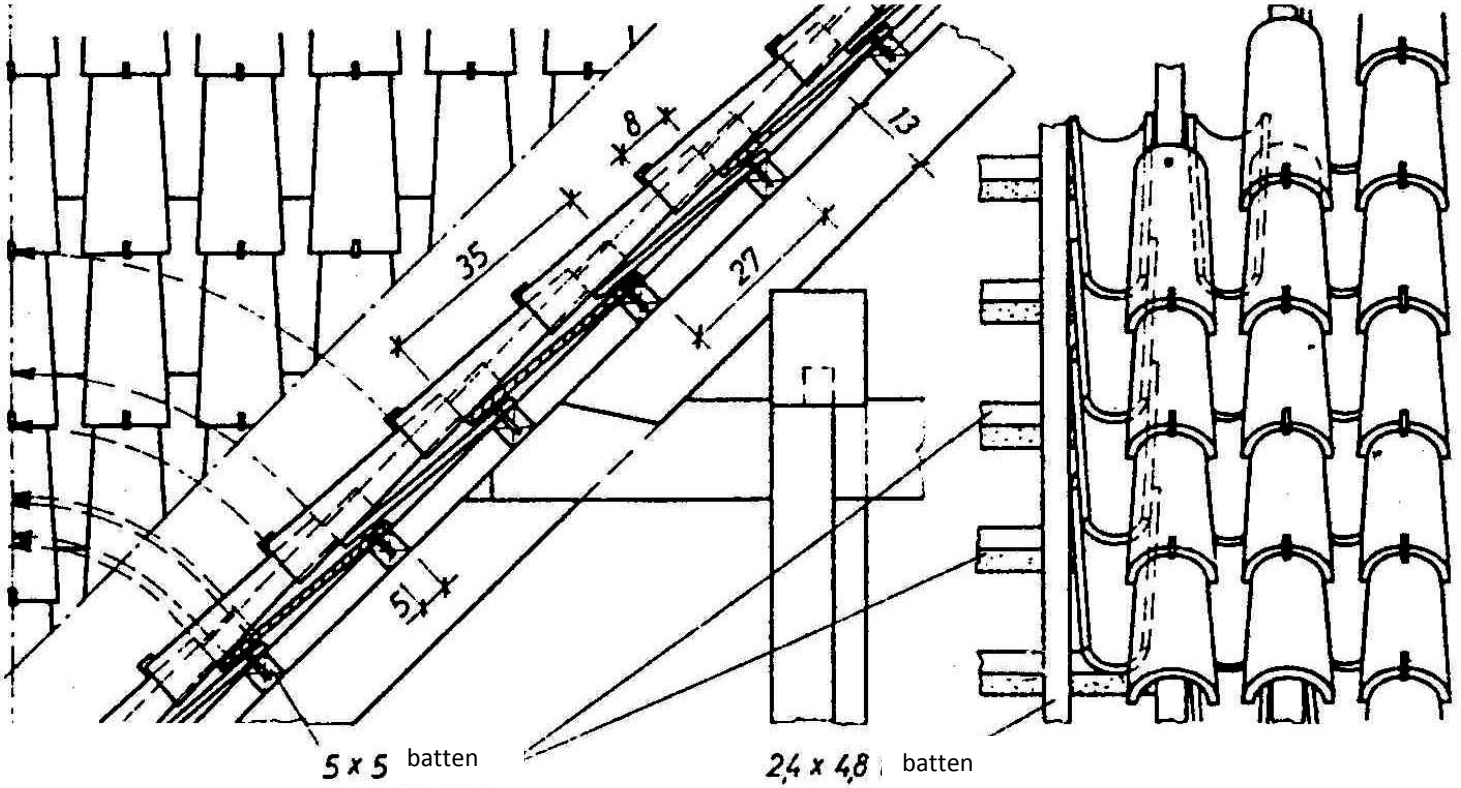


a) Tegula b) Imbrex

MISSION OR BARREL CLAY TILES

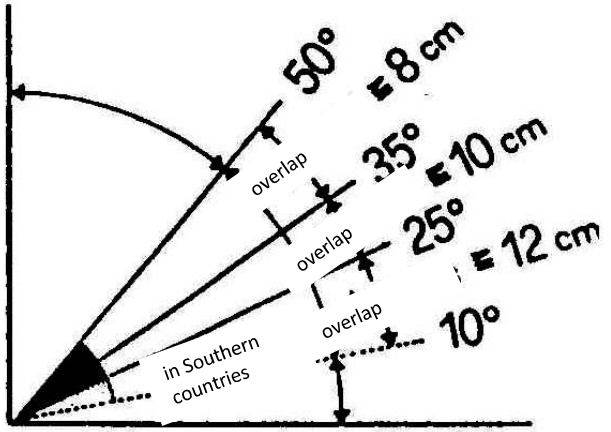
Visual appearance →

Layout: tiles laid in an alternating pattern on two-direction batten system ↓

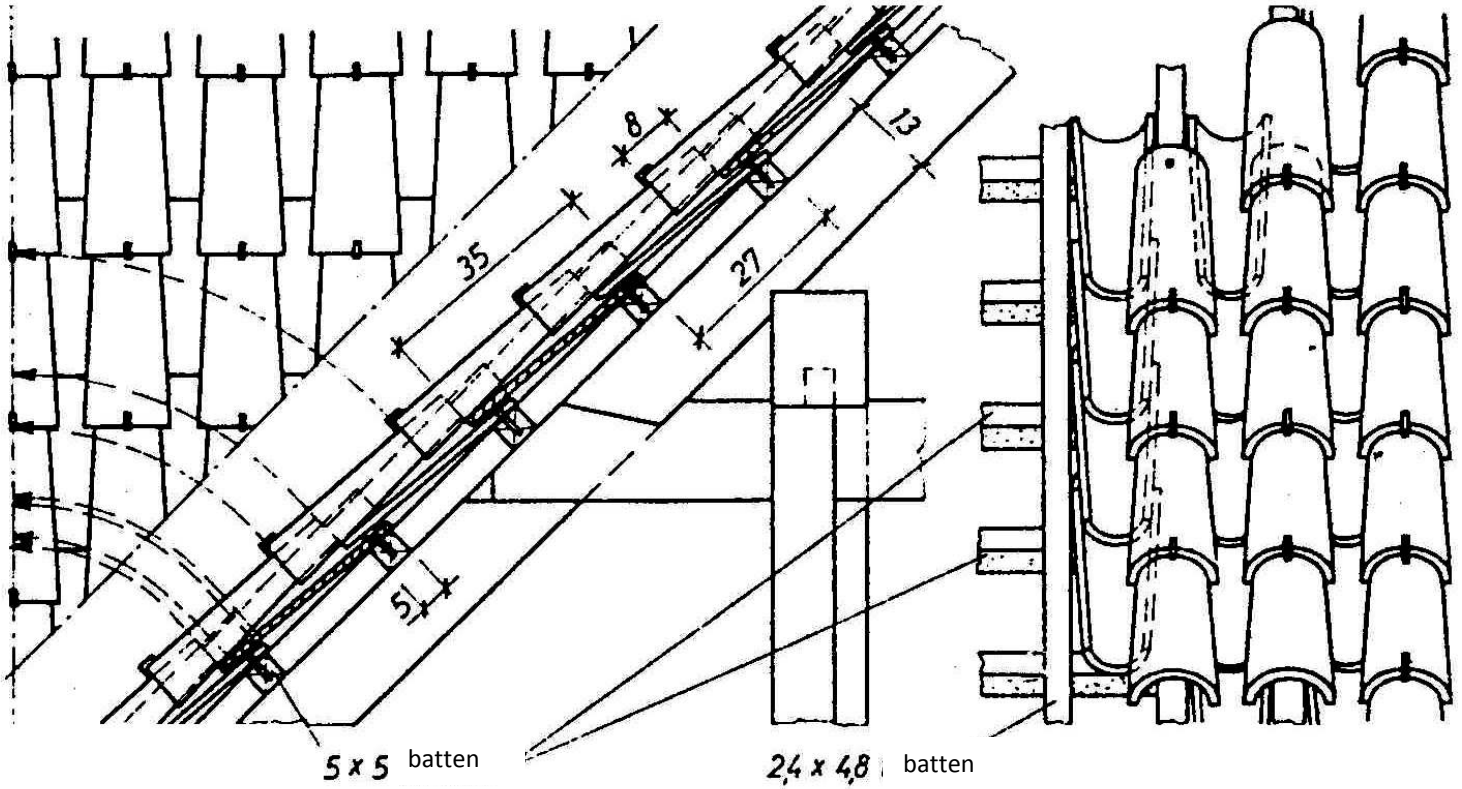


MISSION OR BARREL CLAY TILES

Pitches and required overlaps →



Layout: tiles layn in an alternating pattern on two-direction batten system ↓

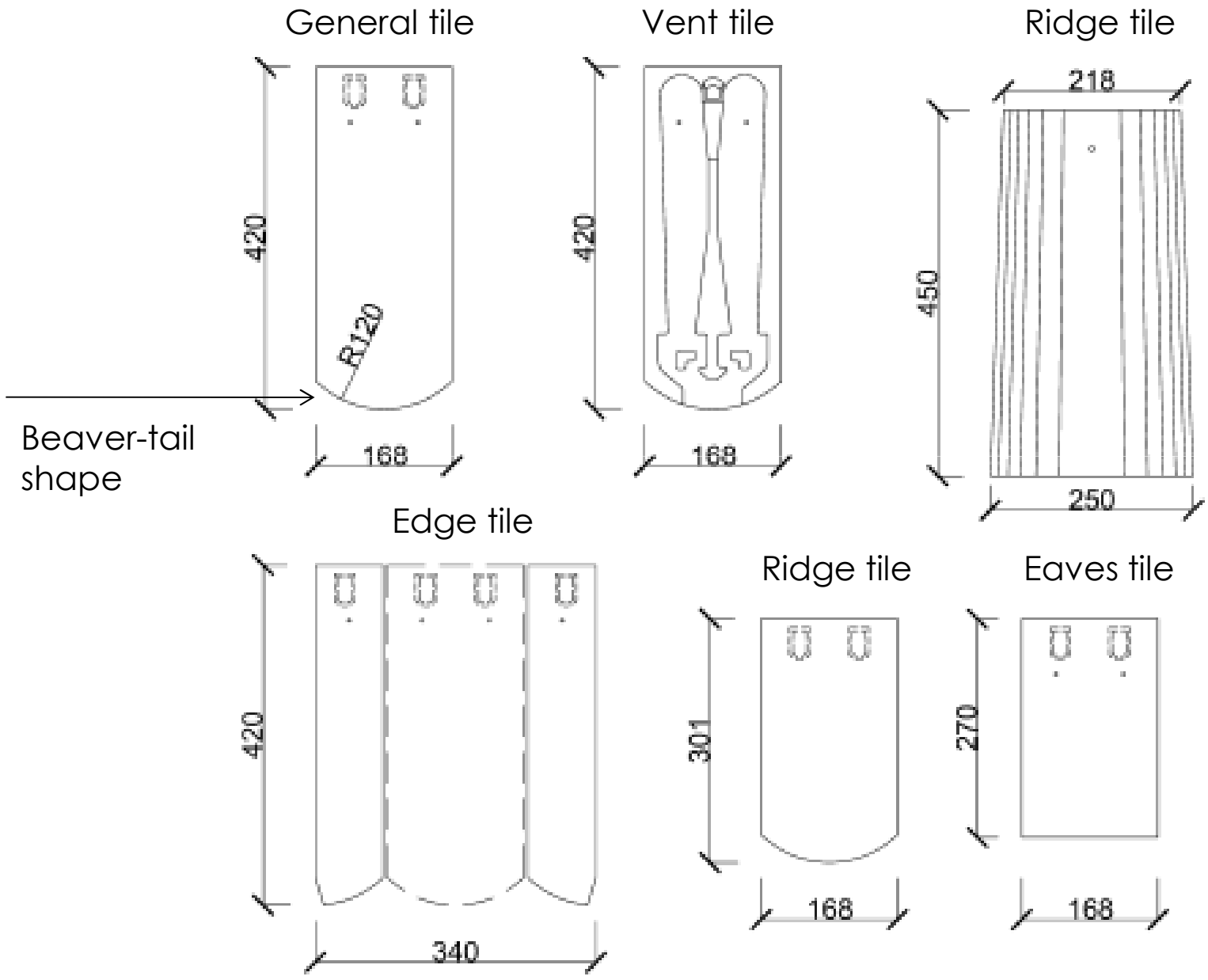


MISSION OR BARREL CLAY TILES

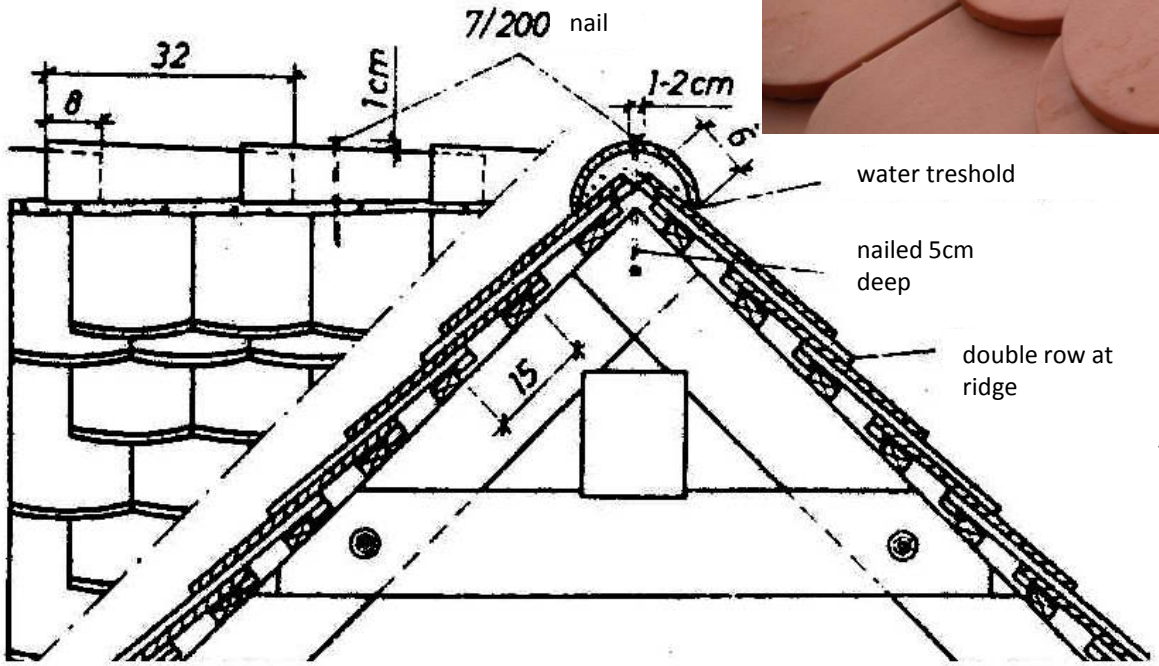
↑ Keeping the original appearance of the roof: new tiles on the bottom and old tiles layn over them

←Two-way batten system

ELEMENTS OF THE DOUBLE LAYER PLAIN TILE ROOF COVERING



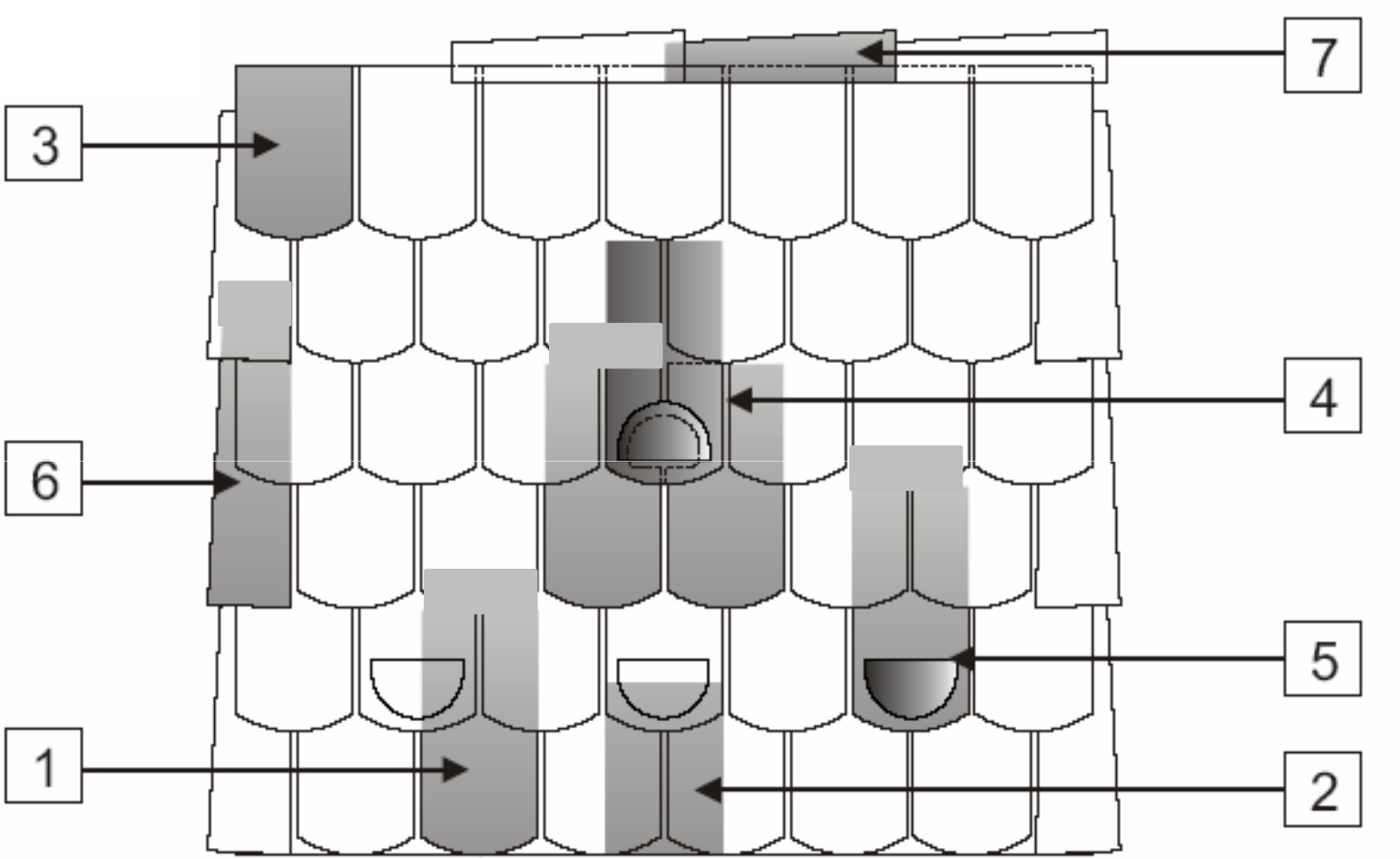
BURNT CLAY ROOF TILE „BEAVER - TAIL" SHAPE



Under construction↑

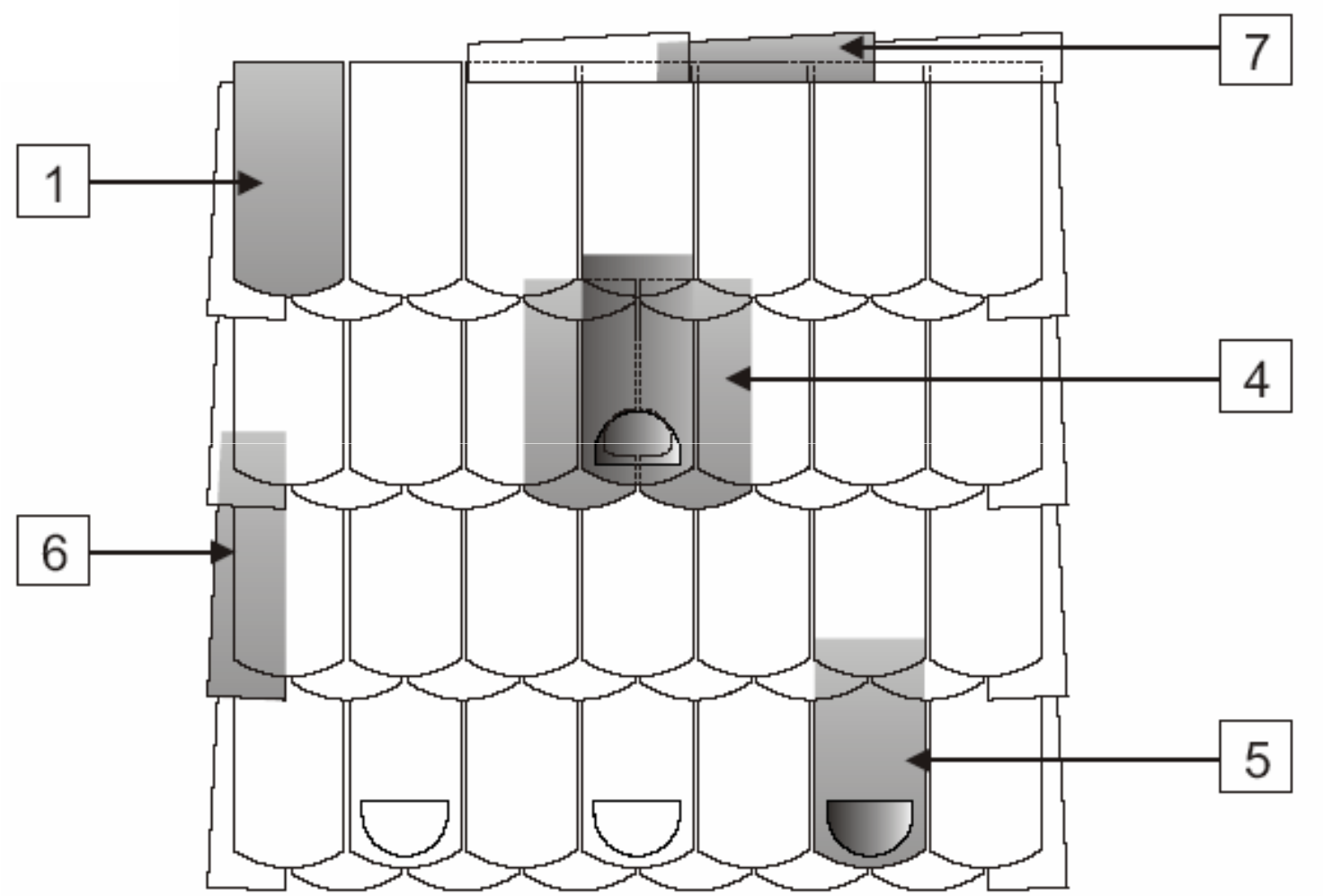
← Ridge detail with ridge tile

VIEW OF THE DOUBLE LAYER PLAIN TILE ROOF COVERING



1: normal „beaver tail" tile, 2: eaves element, 3: ridge tile, 4: roof vent set,
5: snow collecting element, 6: verge element, 7: convex ridge element

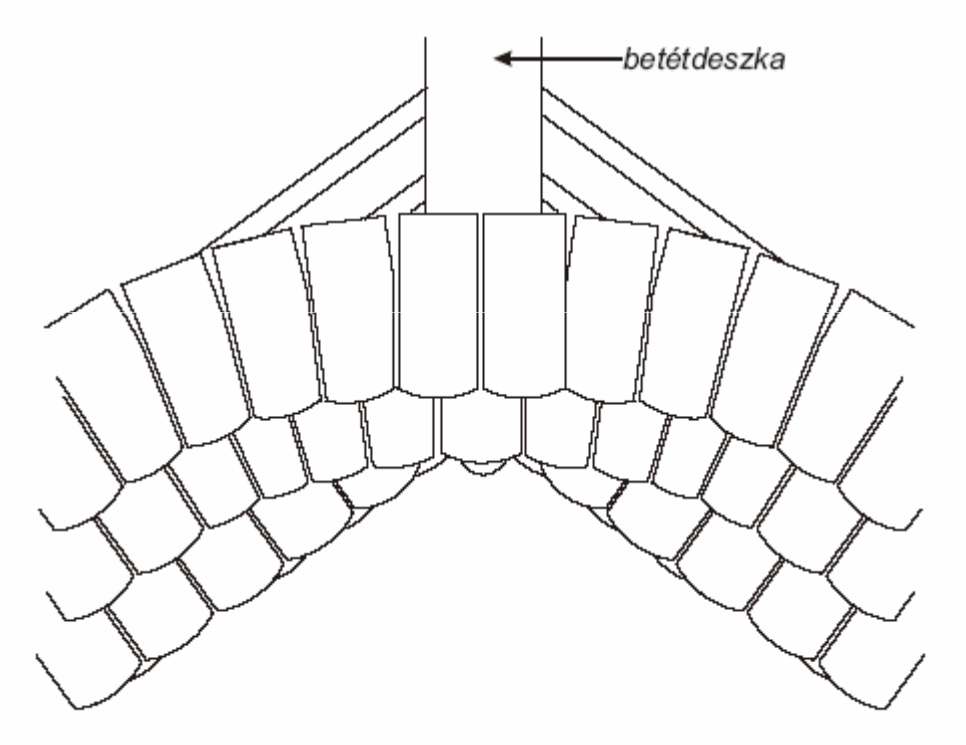
VIEW OF THE DOUBLE-LAP PLAIN TILE ROOF COVERING



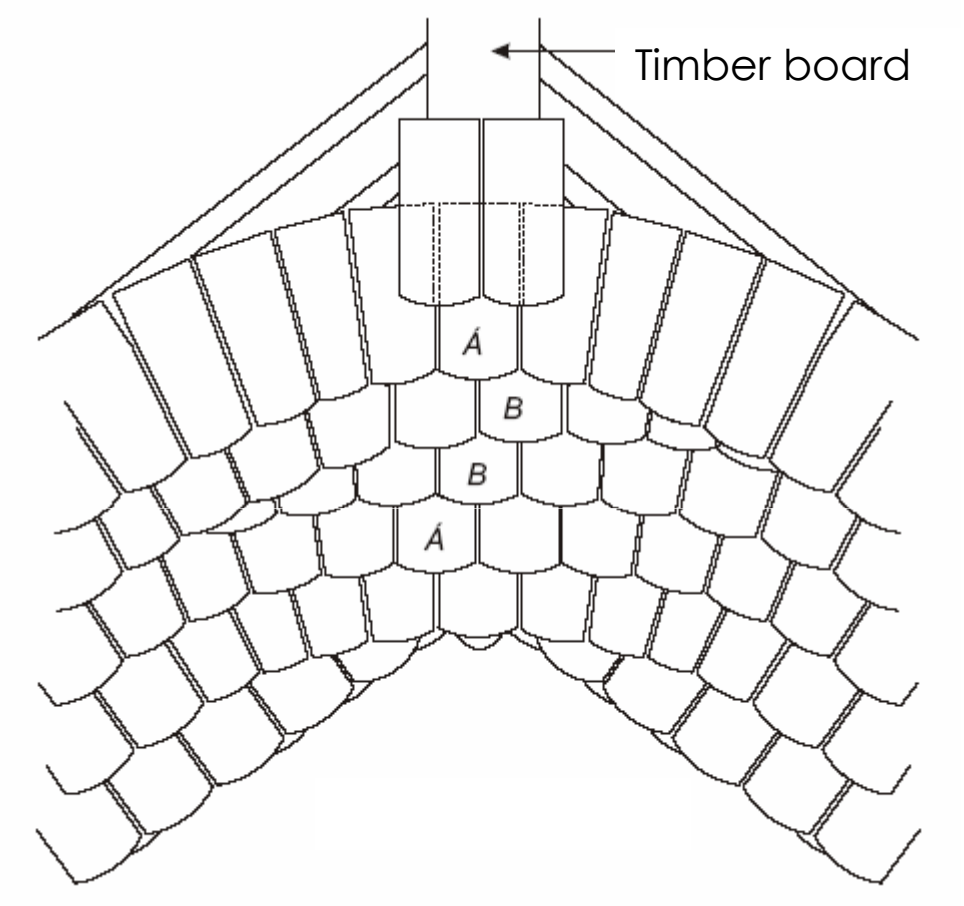
1: normal „beaver tail" element, 4: roof vent set, 5: snow collecting element,
7: convex ridge element

DOUBLE LAP PLAIN TILE ROOF COVERING

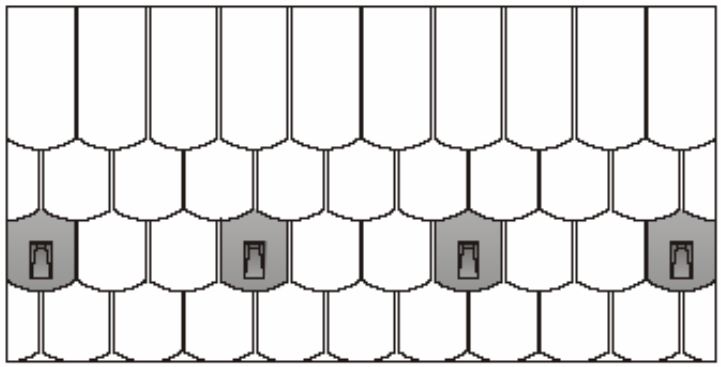
VALLEY MADE OF PLAIN TILES



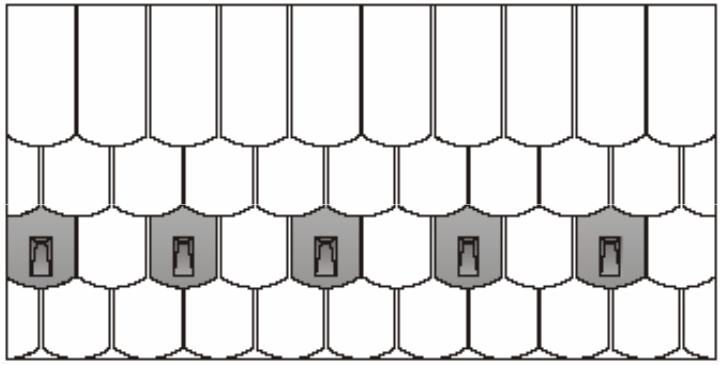
VALLEY MADE OF PLAIN TILES



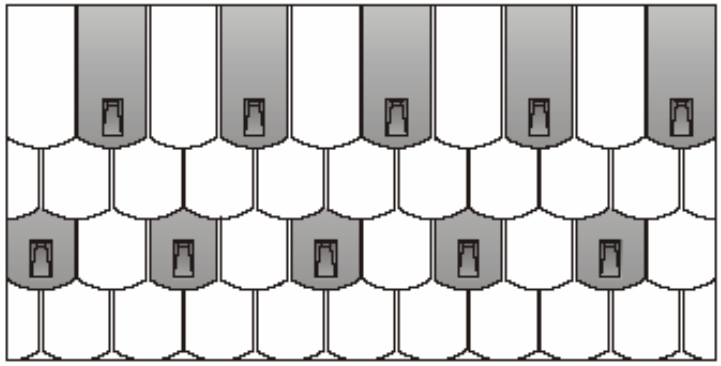
SNOW COLLECTING ELEMENTS OF PLAIN TILES



Between 25-30° pitch angle



Between 30-45° pitch angle



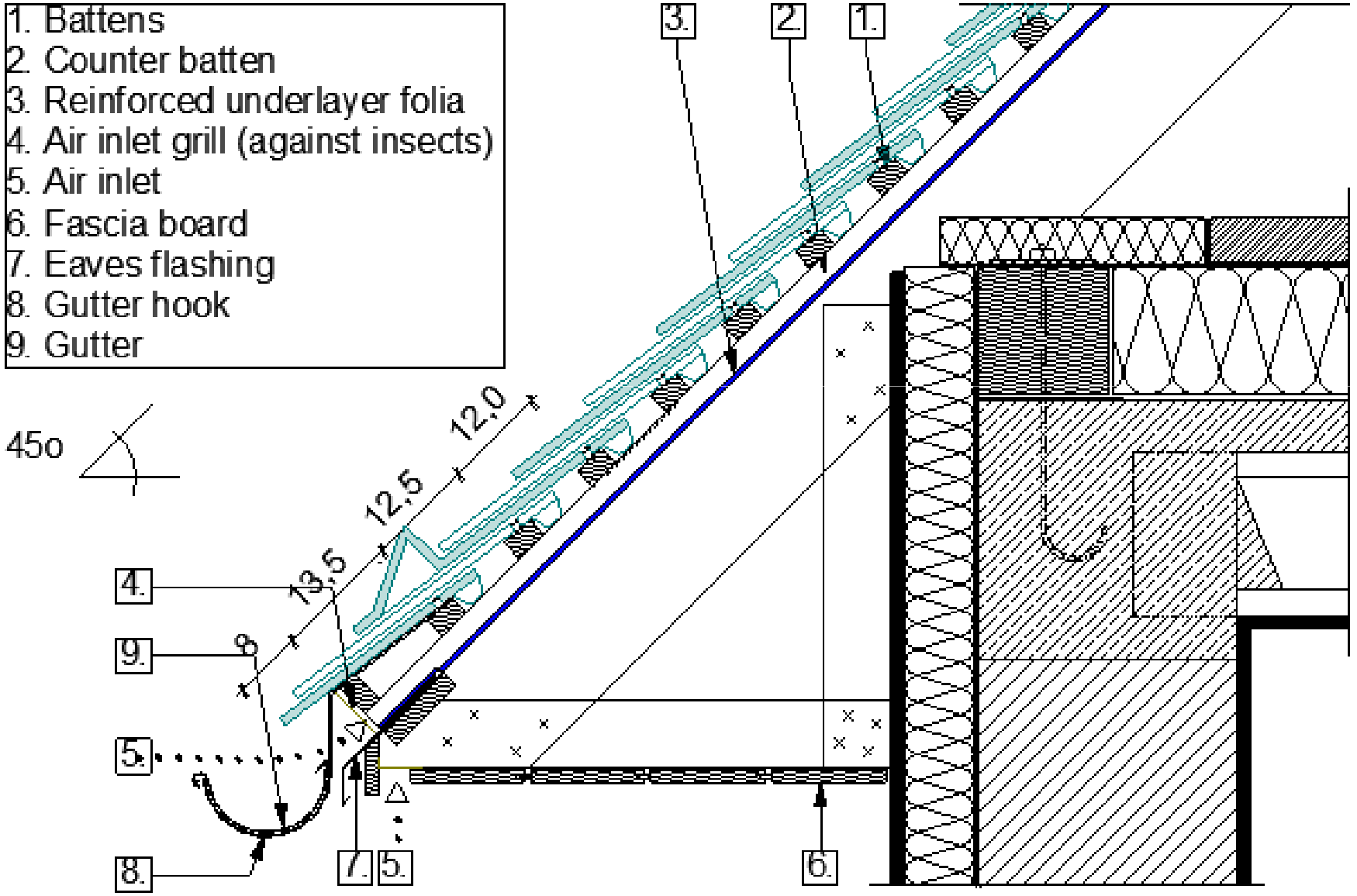
Above 45° pitch angle

EXAMPLES OF PLAIN TILE ROOF COVERINGS

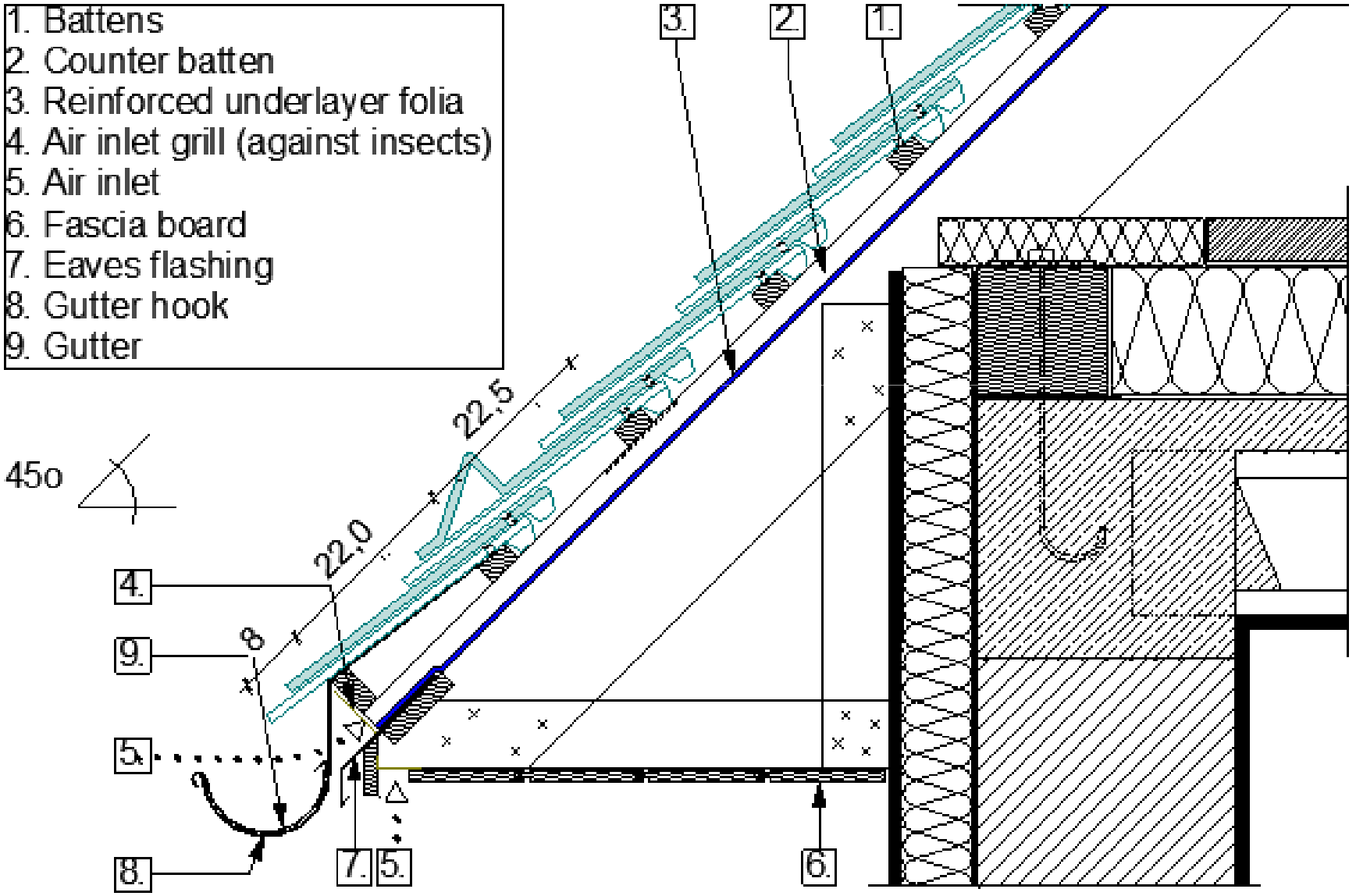
Elementary and grammar school in Budapest, Áldás street. 1911-12. Architect: Zrumeczky Dezső

Elementary and grammar school in Budapest, Városmajor street. Architects: Györgyi Dénes and Kós Károly

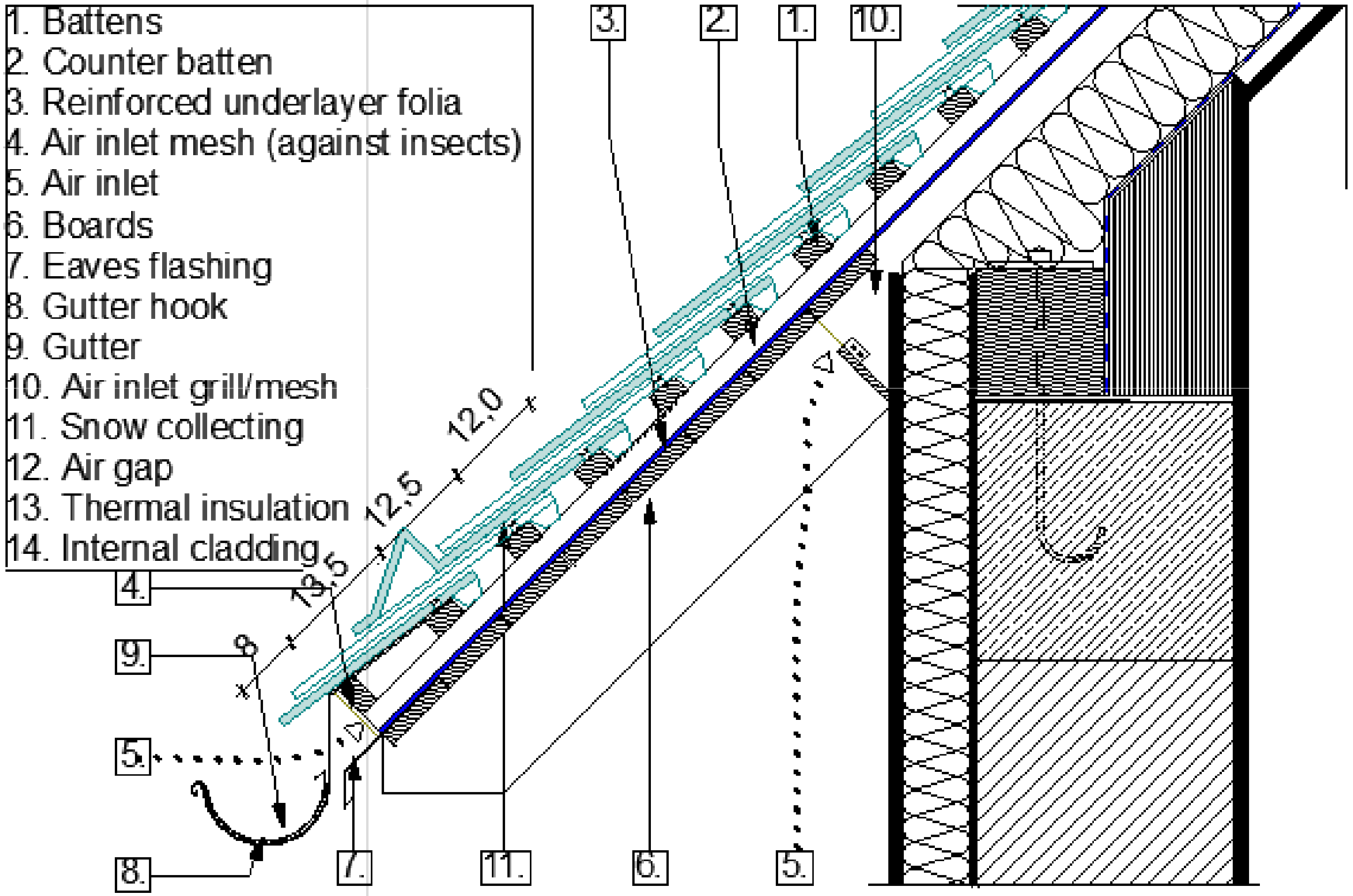
CLOSED EAVES – DOUBLE LAYER PLAIN TILE ROOF COVERING



CLOSED EAVES – DOUBLE LAP PLAIN TILE ROOF COVERING

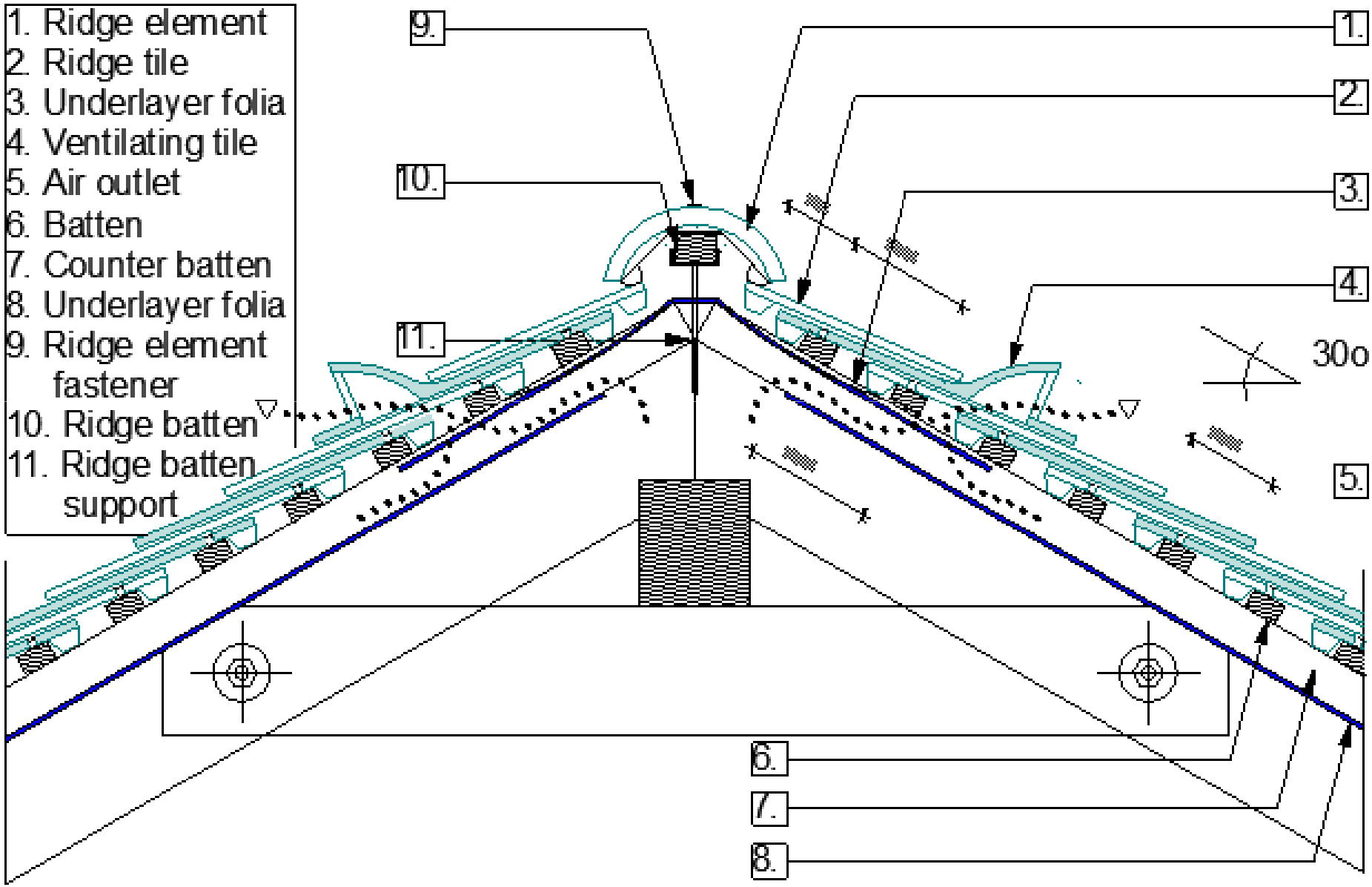


HANGING EAVES – DOUBLE LAYER PLAIN TILE ROOF COVERING

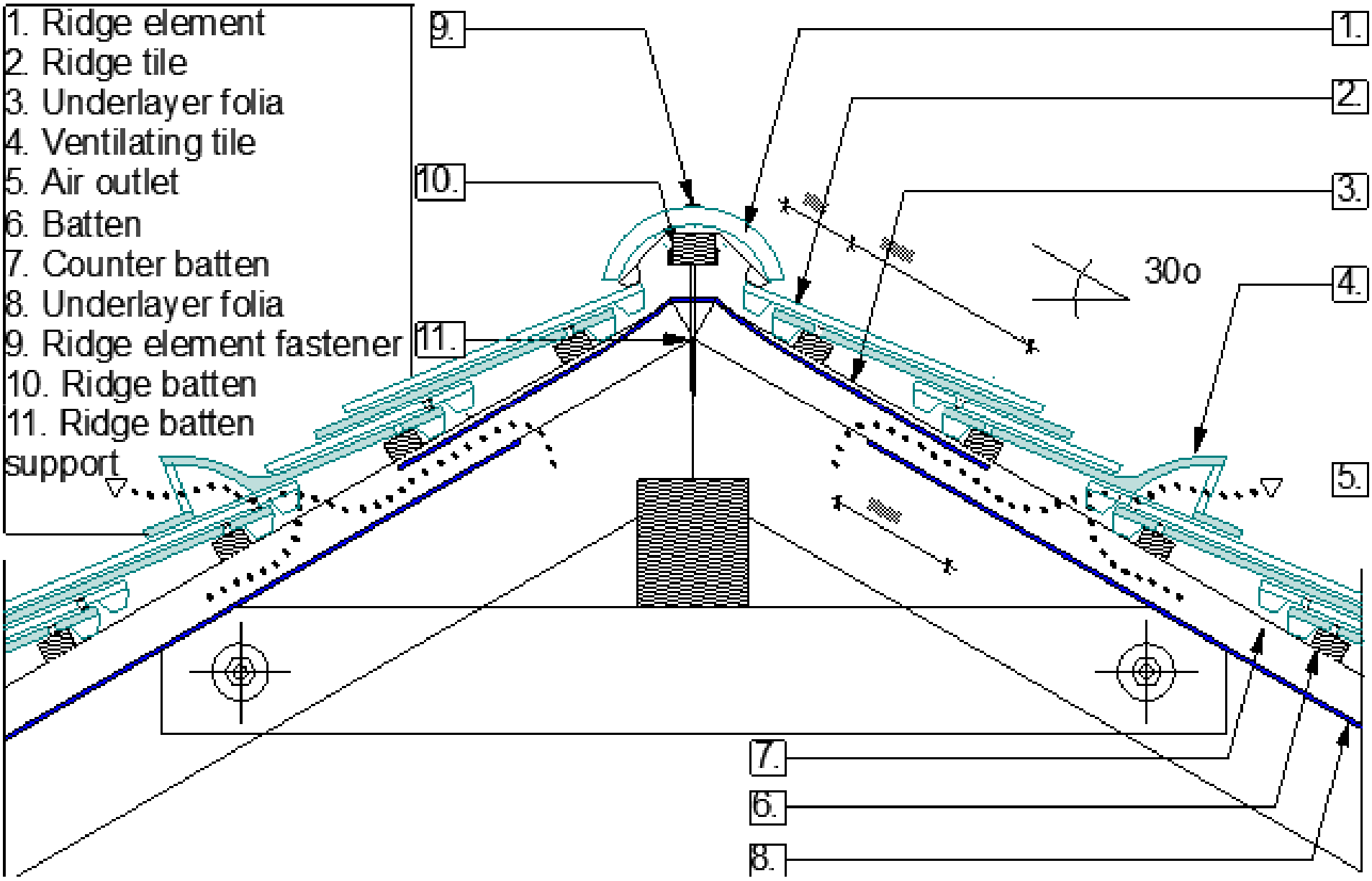


DOUBLE LAYER PLAIN TILE ROOF COVERING

RIDGE DETAIL – DOUBLE LAYER PLAIN TILE ROOF COVERING



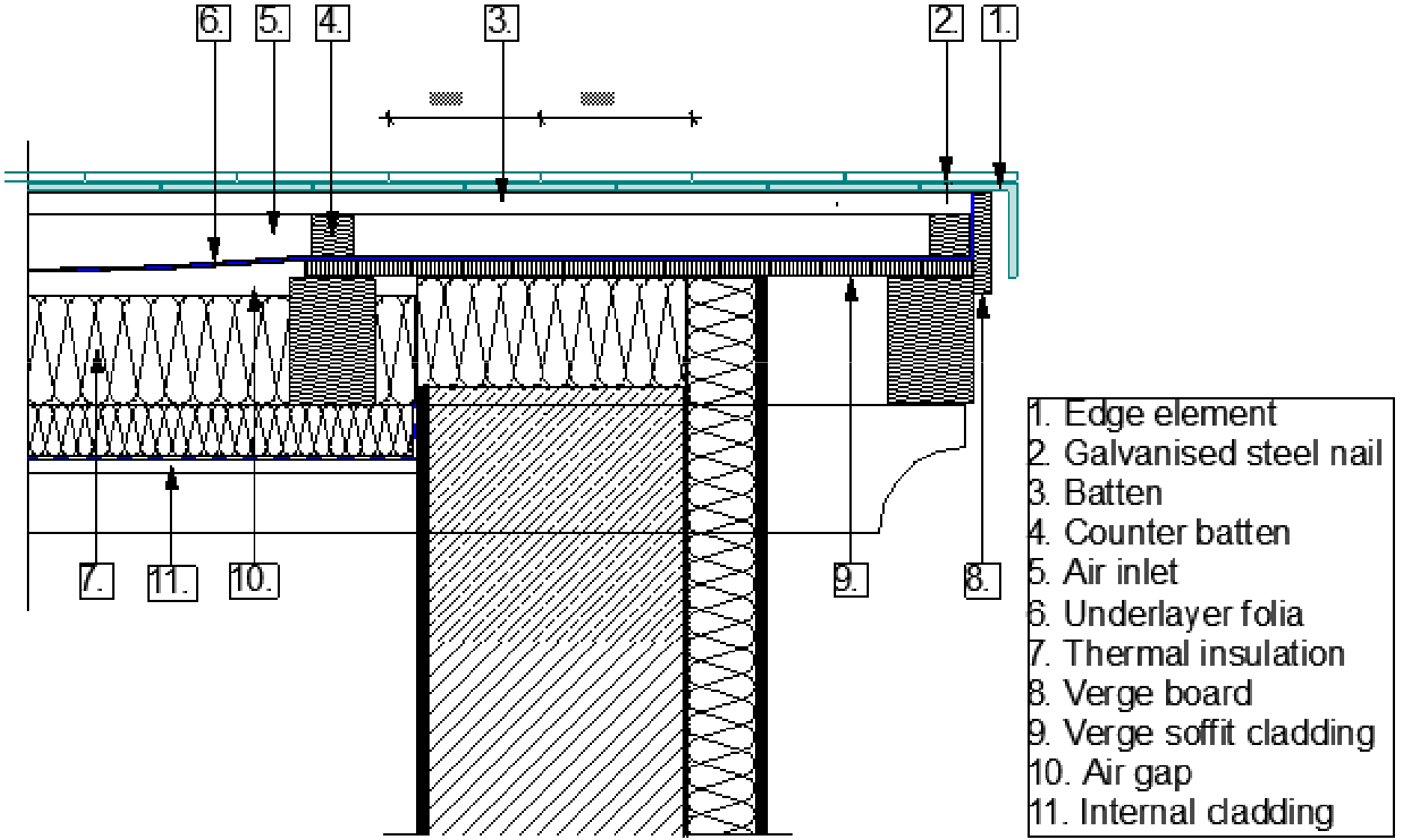
RIDGE DETAIL – DOUBLE LAP PLAIN TILE ROOF COVERING



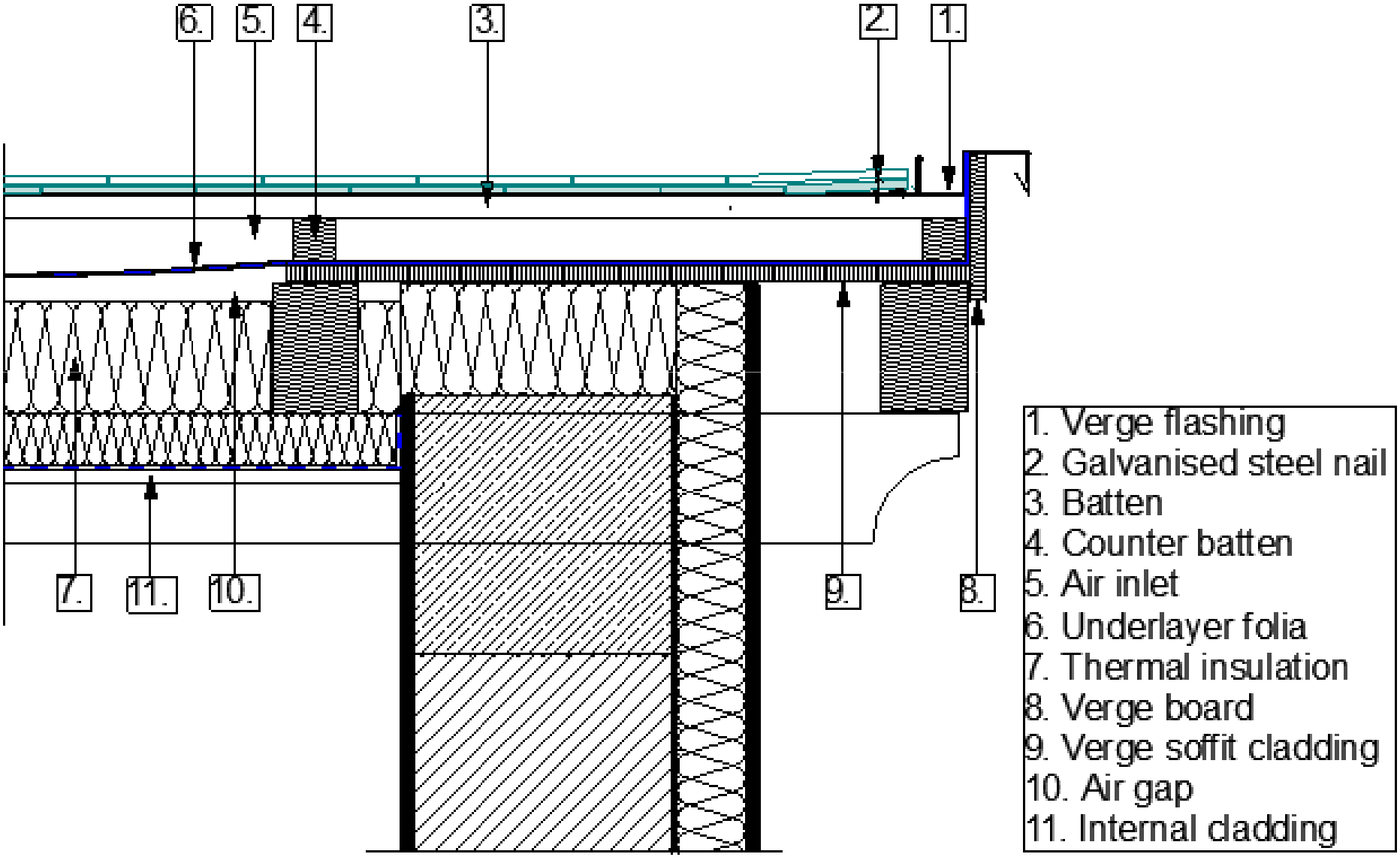
CSÍKMINDSZENT, TRANSYLVANIA – VILLAGE HALL

Curvy shapes can be covered only with double-layer plain tiles

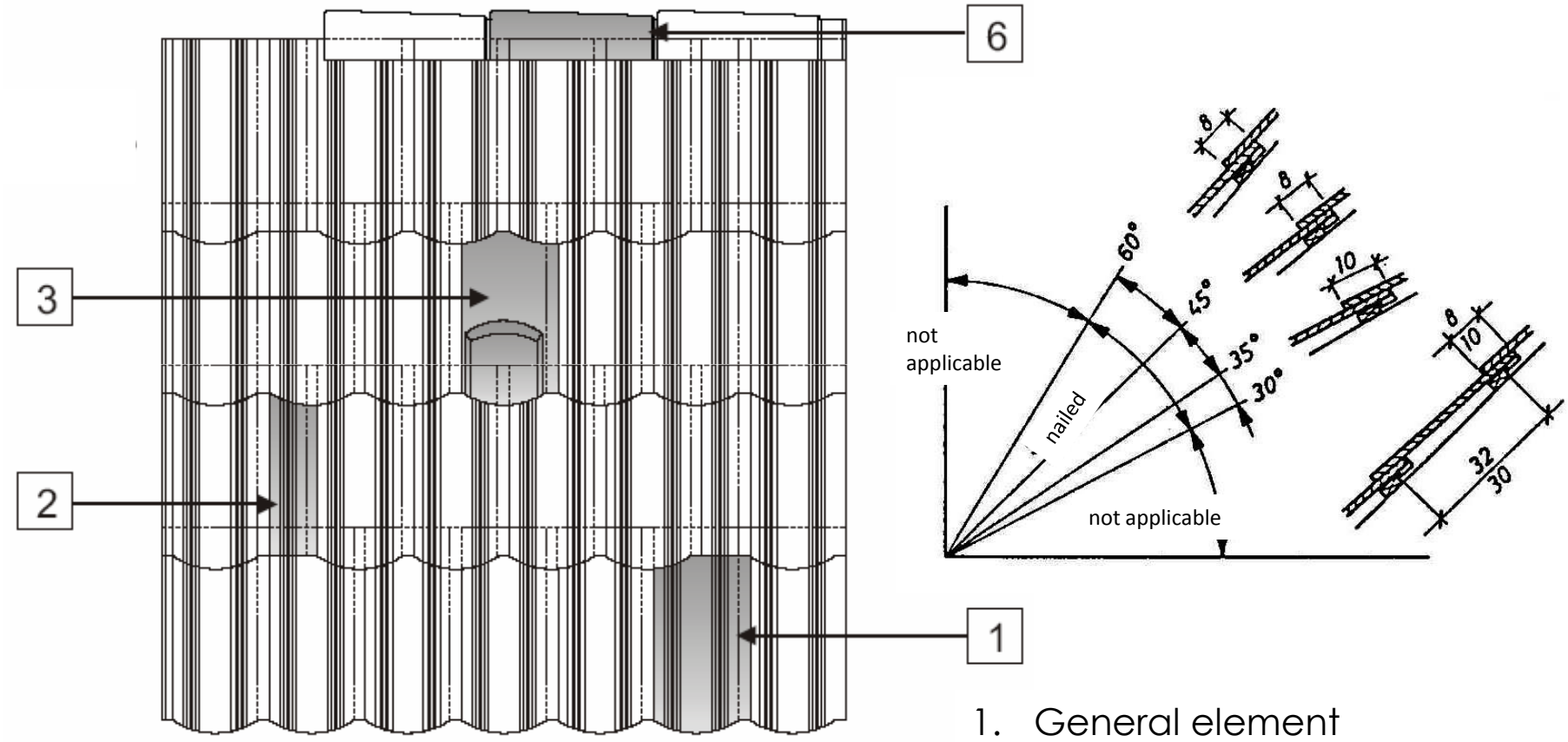
VERGE WALL DETAIL WITH SPECIAL VERGE TILES
DOUBLE LAYER PLAIN TILE ROOF COVERING



VERGE WALL DETAIL WITH VERGE FLASHING AND DOUBLE LAYER PLAIN TILE ROOF COVERING

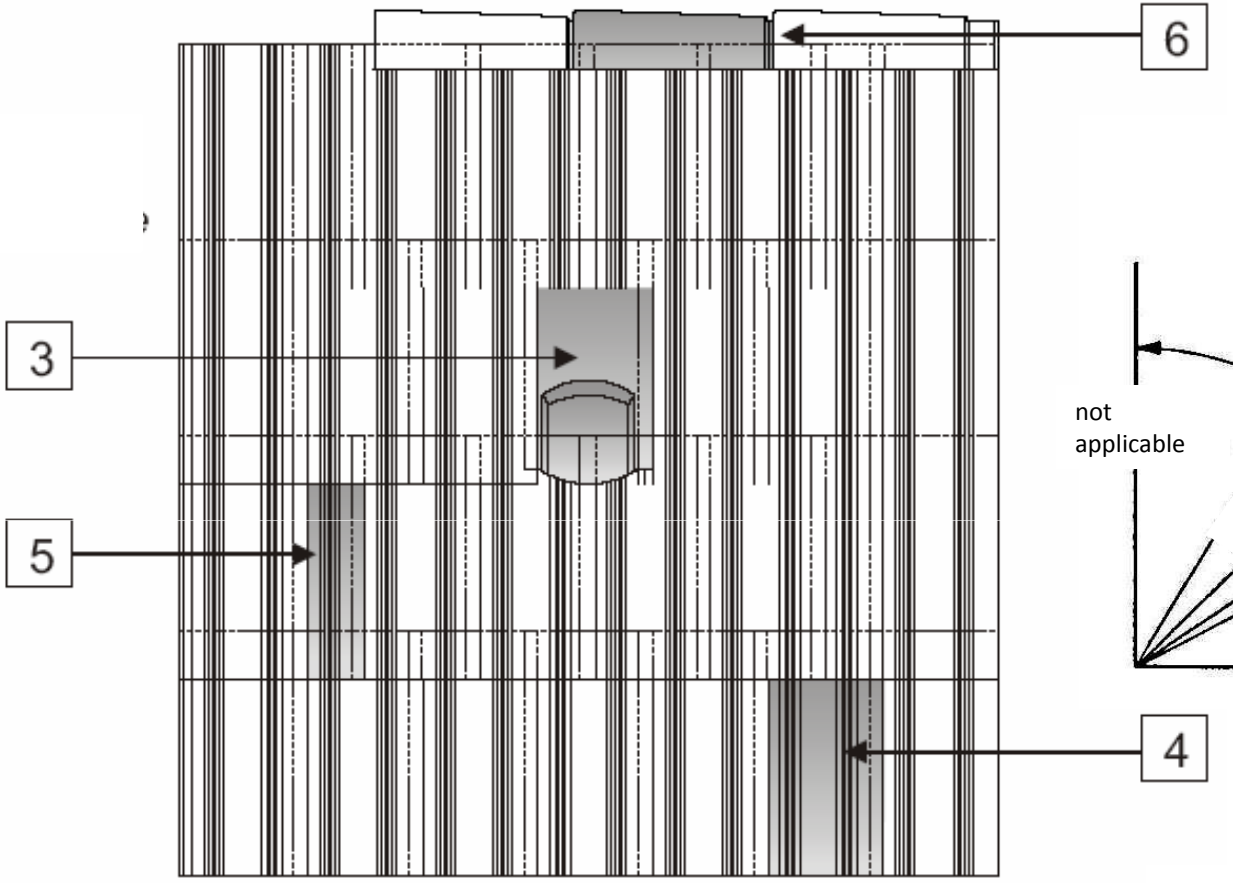


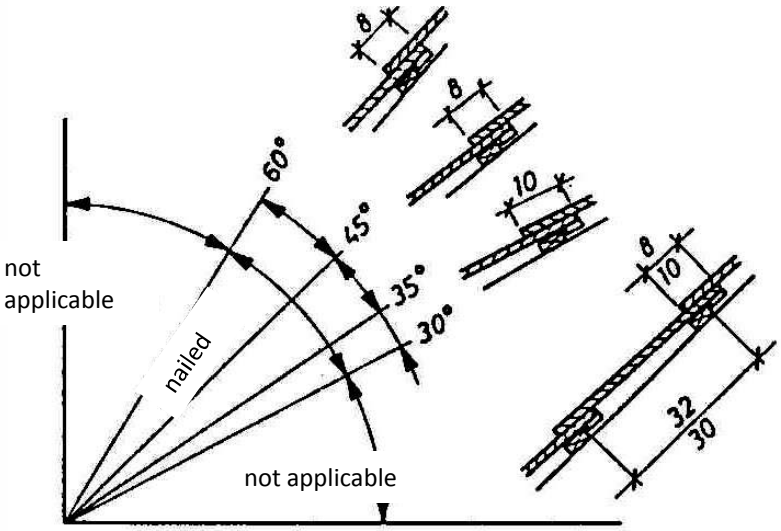
BEAVER-TAIL SHAPED WIRE-CUT (EXTRUDED) CLAY TILE ROOF COVERING



1. General element
2. General element
3. Vent tile
6. Ridge element

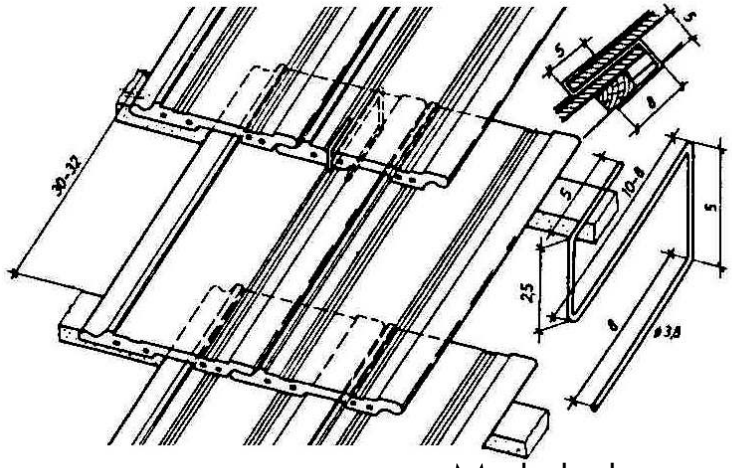
BEAVER-TAIL SHAPED WIRE-CUT (EXTRUDED) CLAY TILE ROOF COVERING





4. Vent tile
3. General element
6. Ridge element

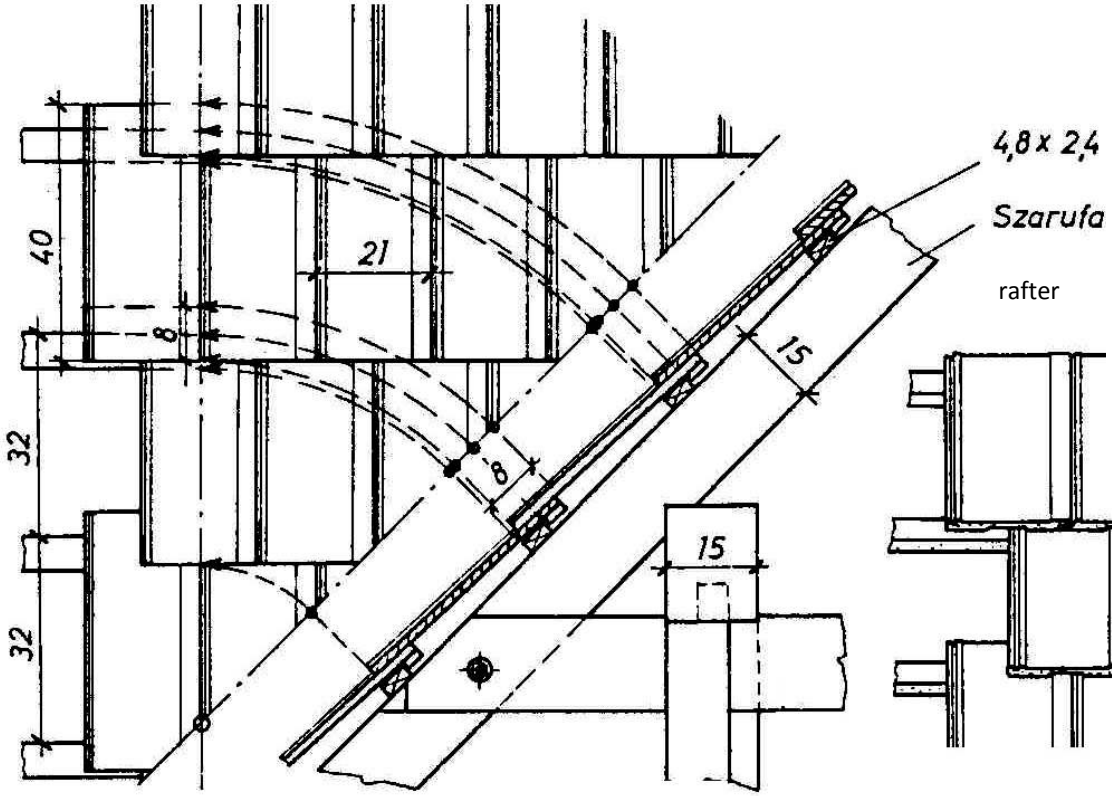
WIRE-CUT (EXTRUDED) CLAY TILE ROOF COVERING

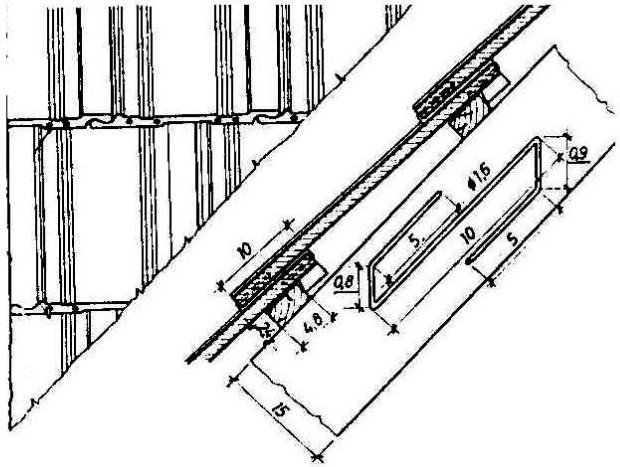


Fixing with metal clamps

Metal clamp

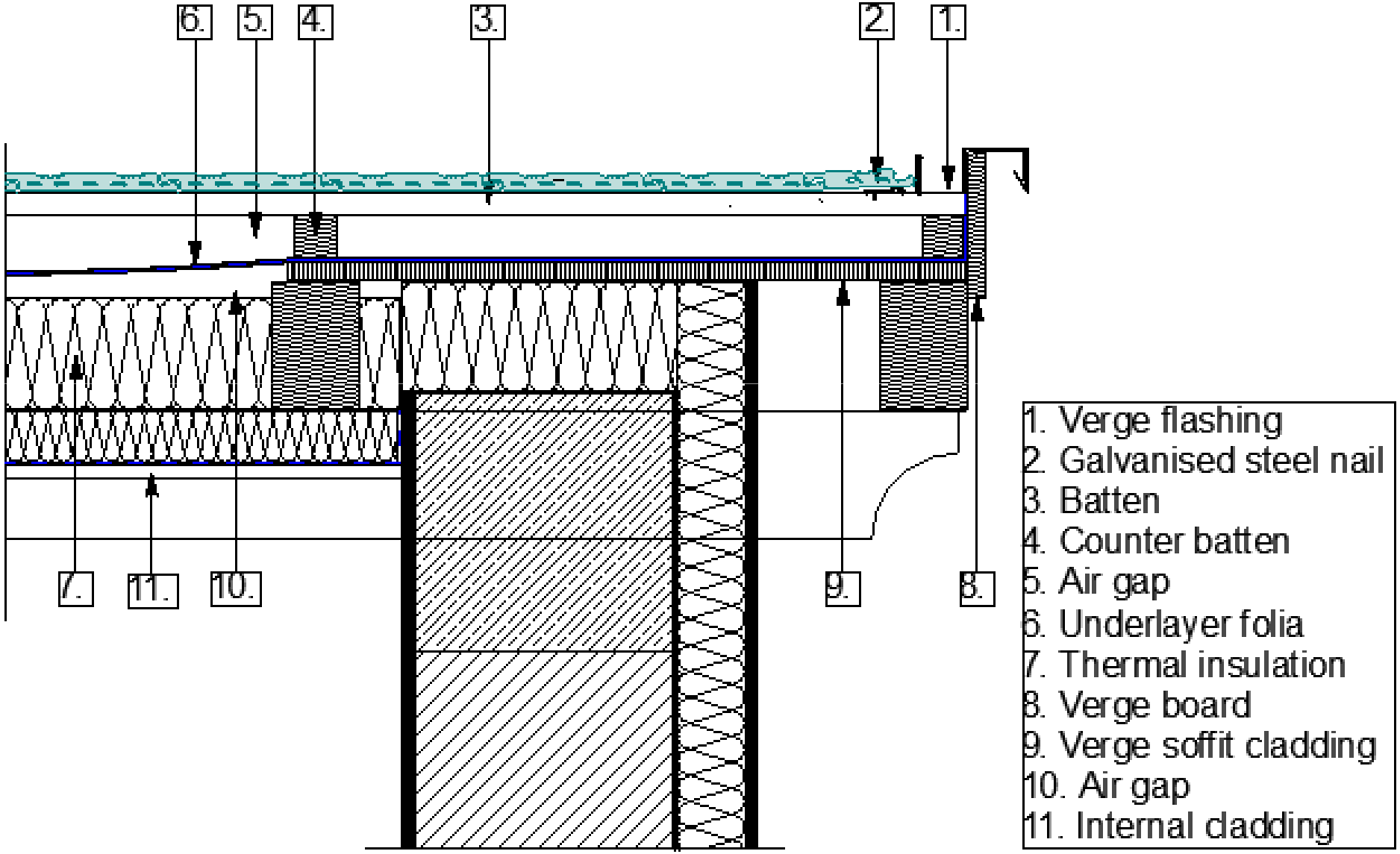
Layout: bond pattern



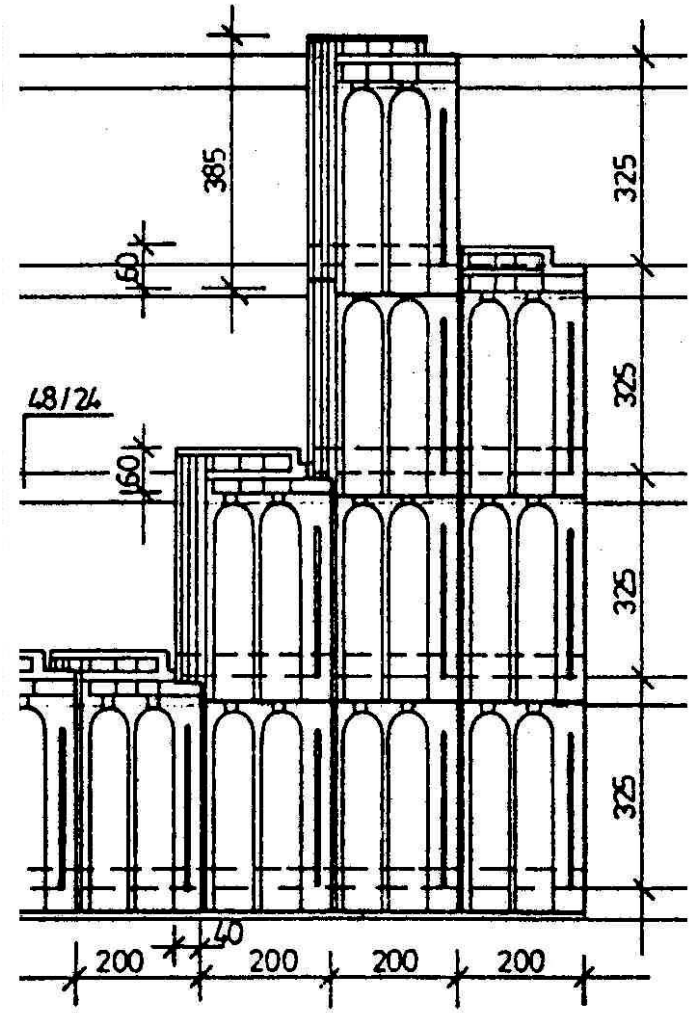


WIRE-CUT (EXTRUDED) CLAY TILE ROOF COVERING

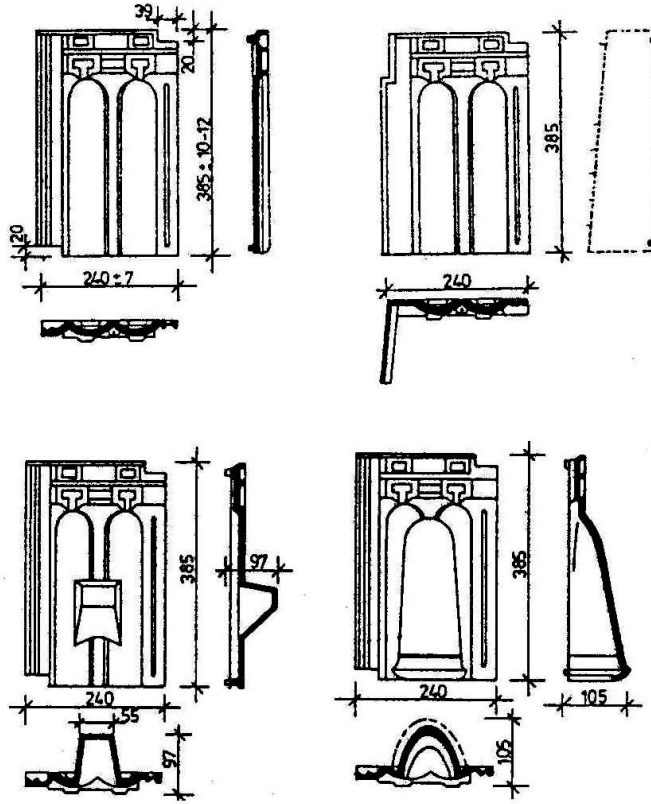
VERGE WALL DETAIL OF A WIRE-CUT (EXTRUDED) CLAY TILE ROOF COVERING WITH BARGE FLASHING



COMPRESSION-MOLDED BURNT CLAY TILE ROOF CLADDING



↑ Net pattern

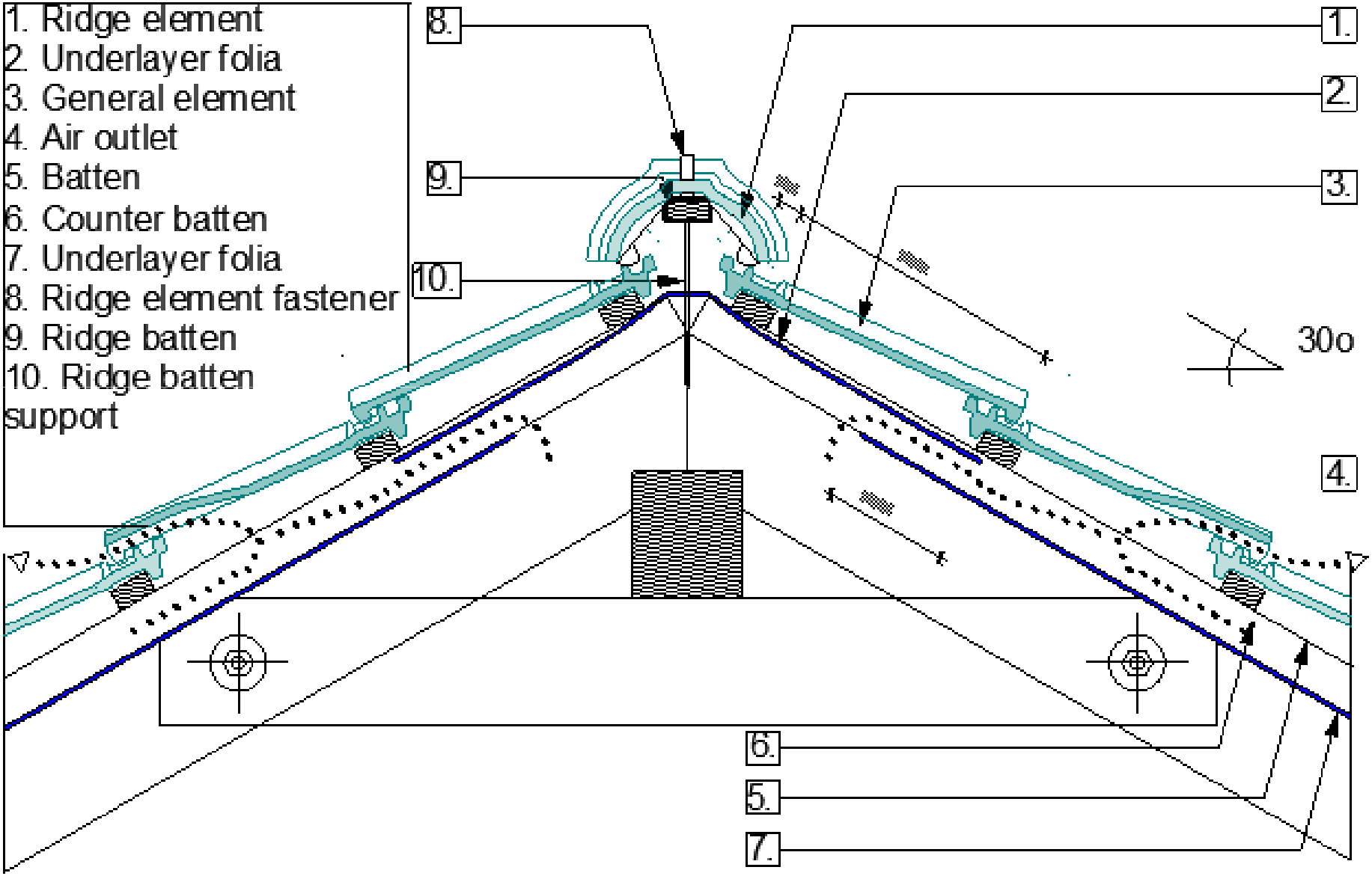


Tile shapes ↑
regular, gable edge, conic, snow-blocker and vent tile.

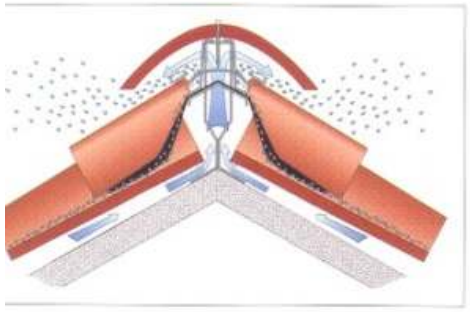
Chimney collar ↑

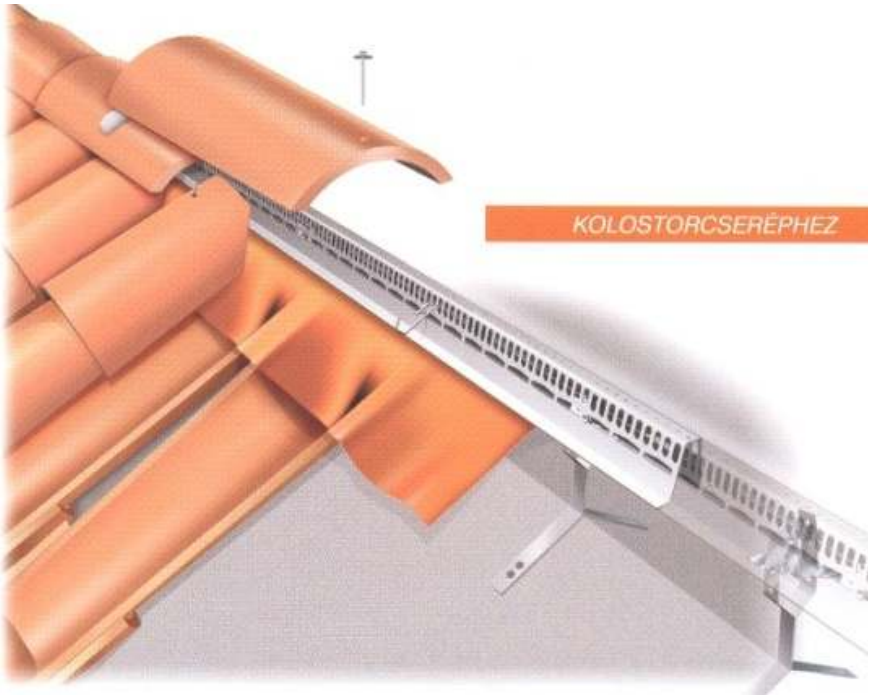
COMPRESSION-MOLDED CLAY TILE ROOF CLADDING

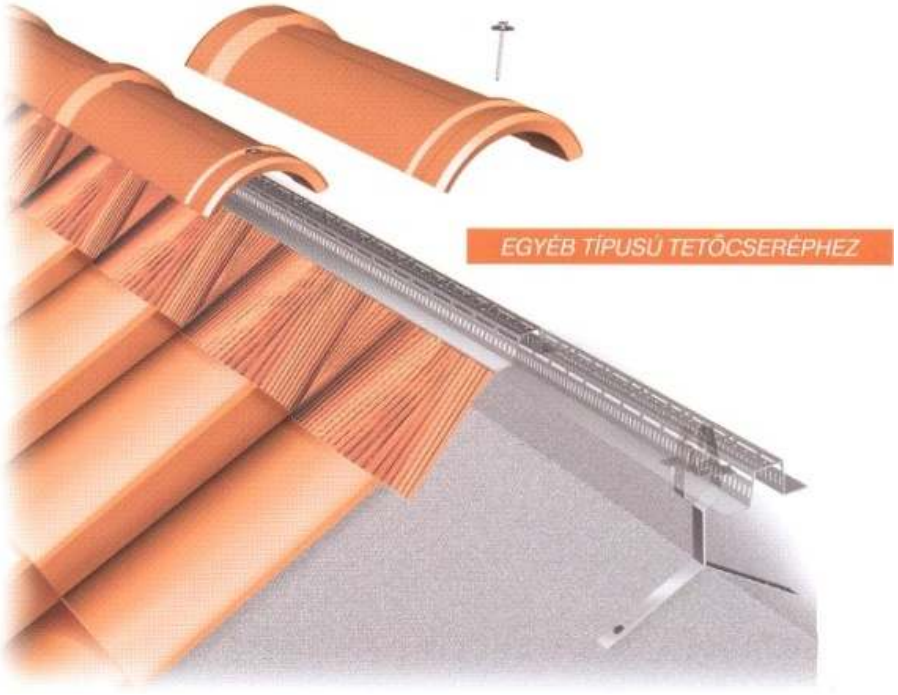
RIDGE DETAIL OF A COMPRESSION-MOLDED CLAY TILE ROOF CLADDING



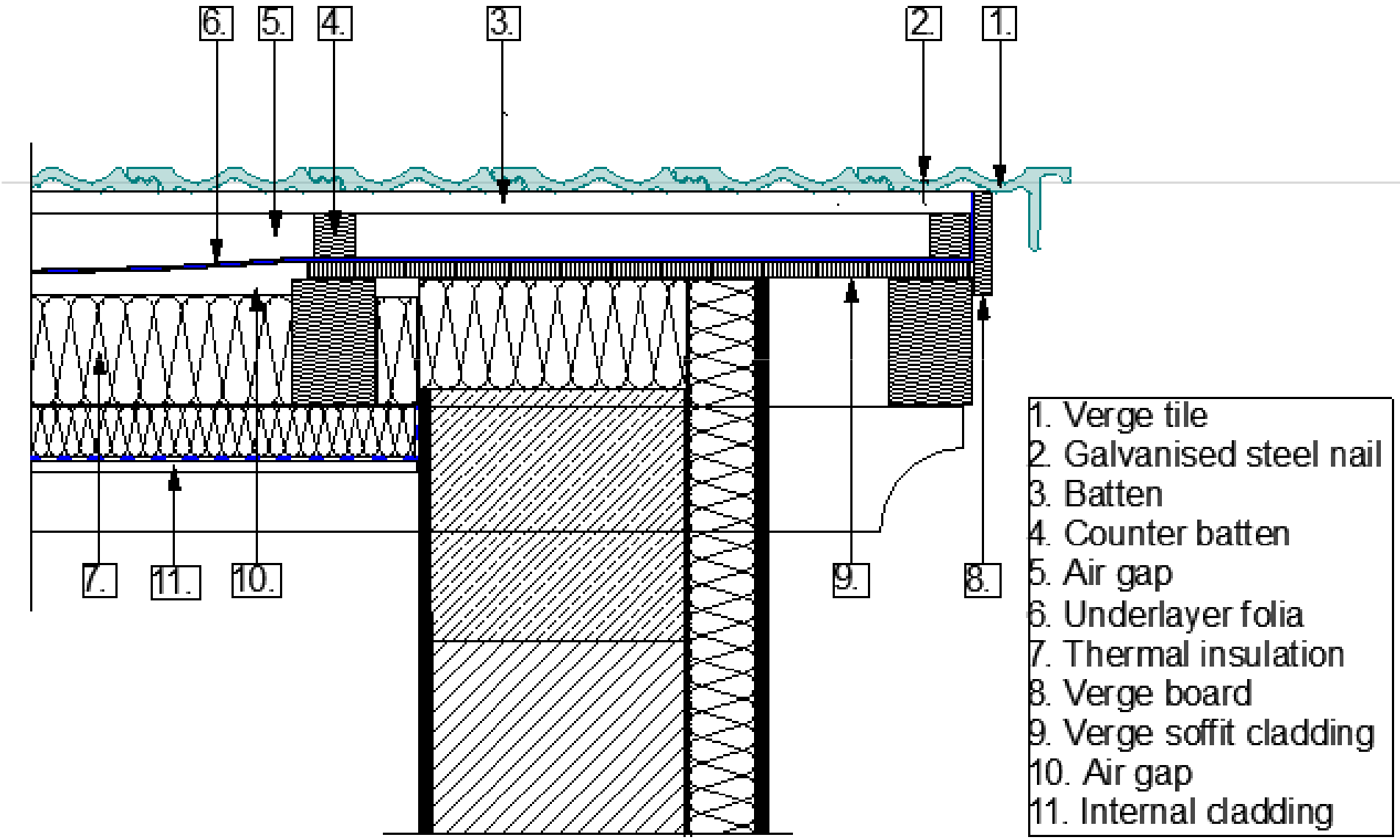
RIDGE AIR OUTLET SET FOR A COMPRESSION-MOLDED CLAY TILE ROOF CLADDING



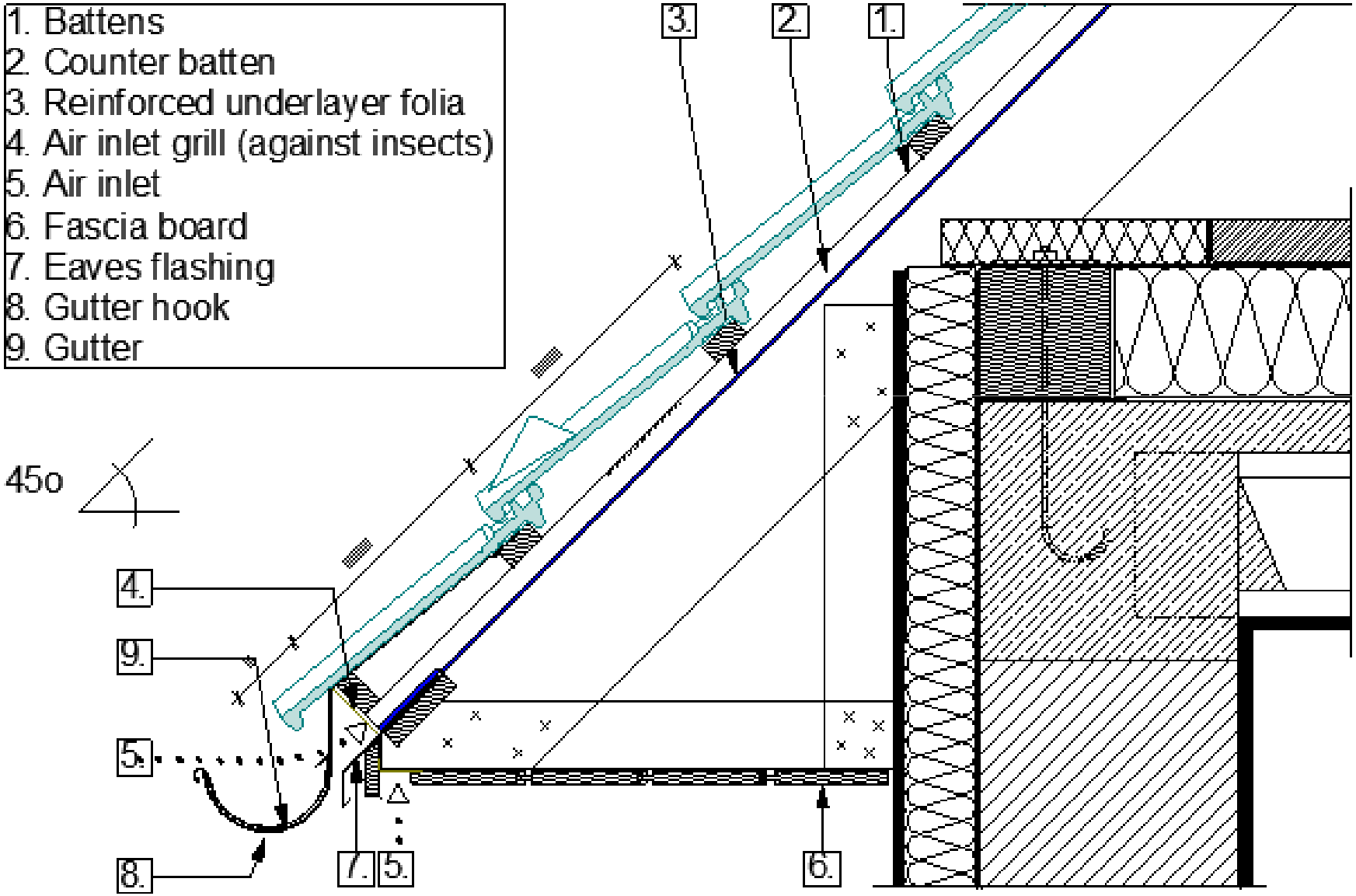




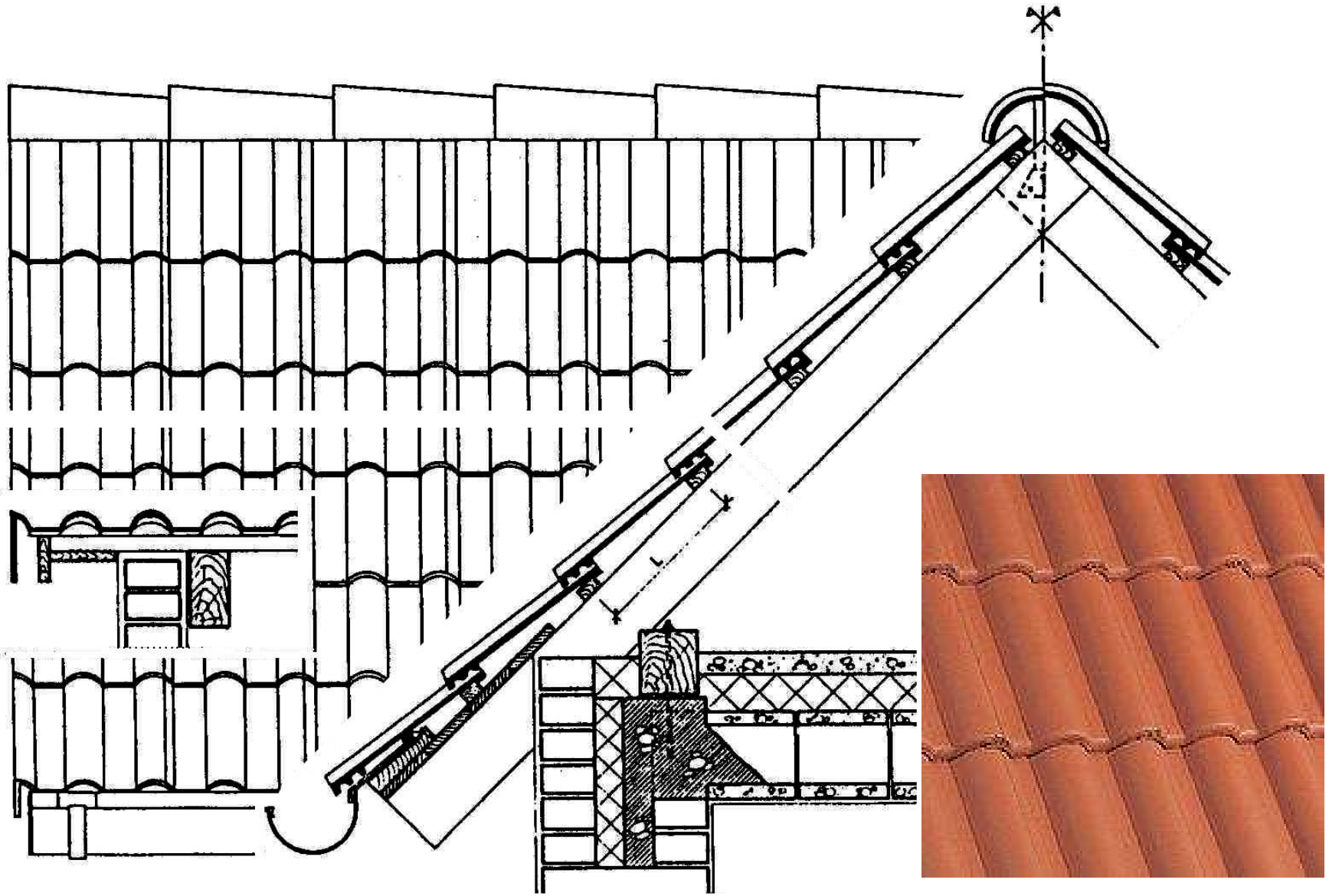
VERGE WALL DETAIL OF A COMPRESSION-MOLDED CLAY TILE ROOF CLADDING WITH SPECIAL TILE



EAVES DETAIL OF A COMPRESSION-MOLDED CLAY TILE ROOF CLADDING



CONCRETE TILE ROOF CLADDING

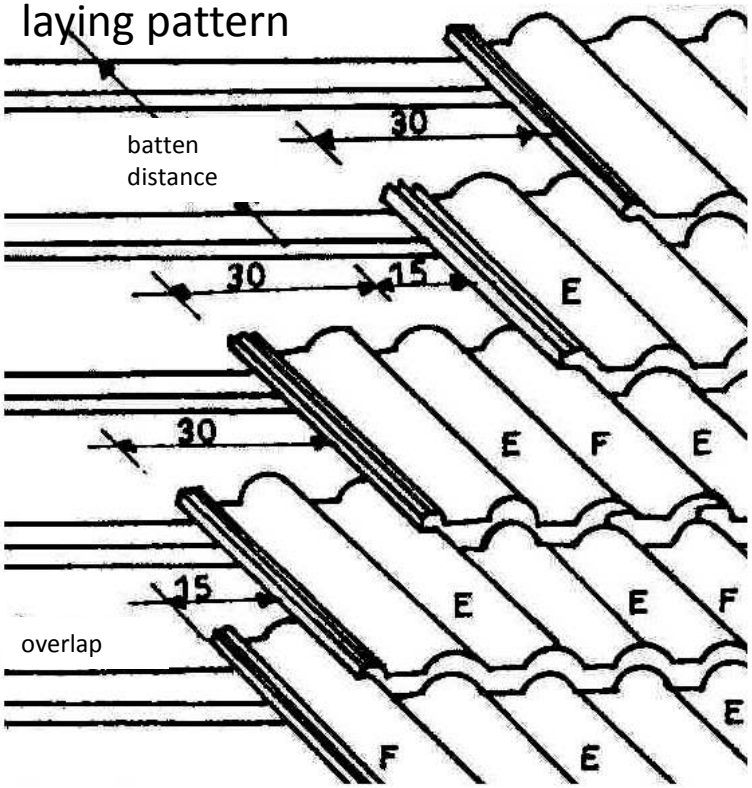


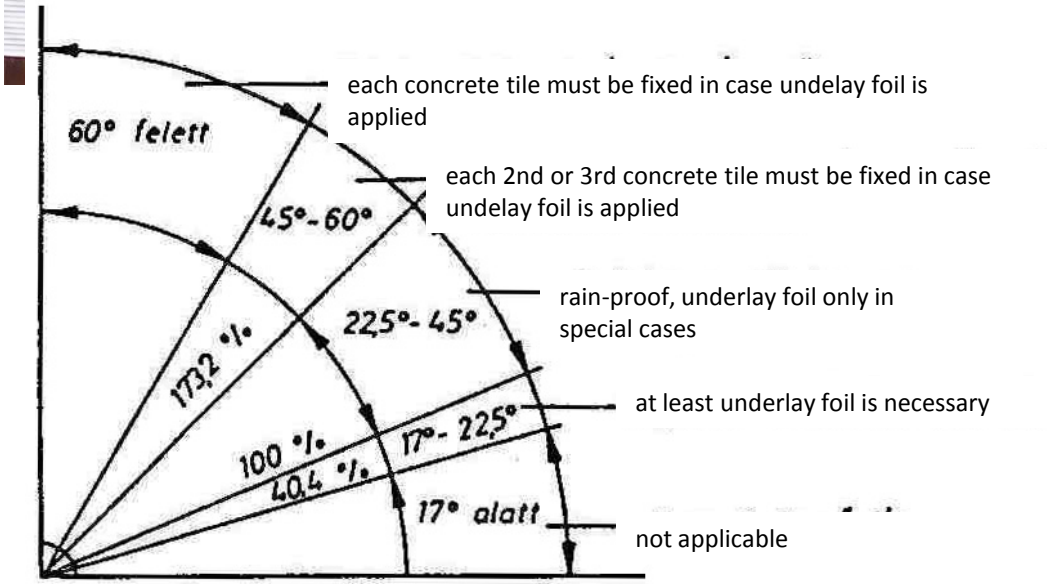
CONCRETE TILES

„Alpine" type: quartz sand surface finish

„Alpine Plus" and „Roman" type: colored protective layer

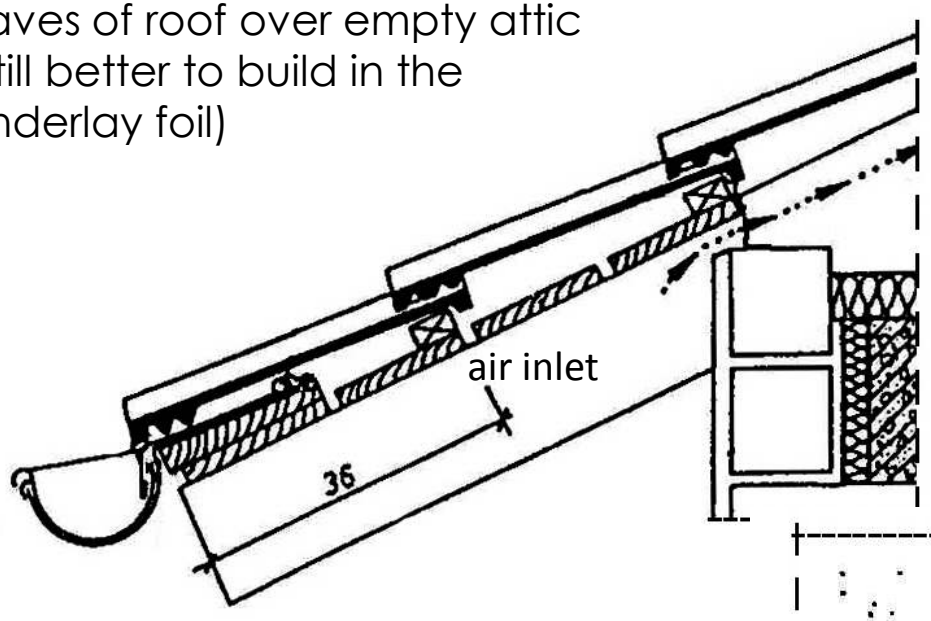
Pitches and structural requirements ↓



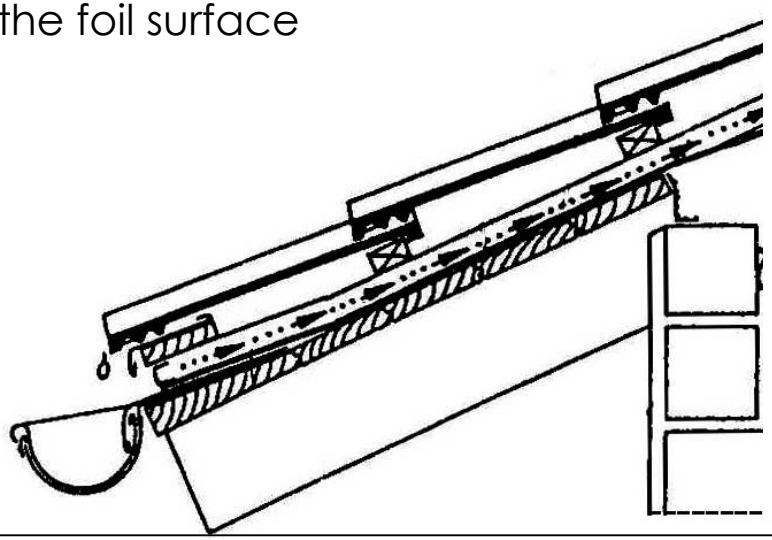


CONCRETE TILE ROOF COVERING : EAVES DETAILS

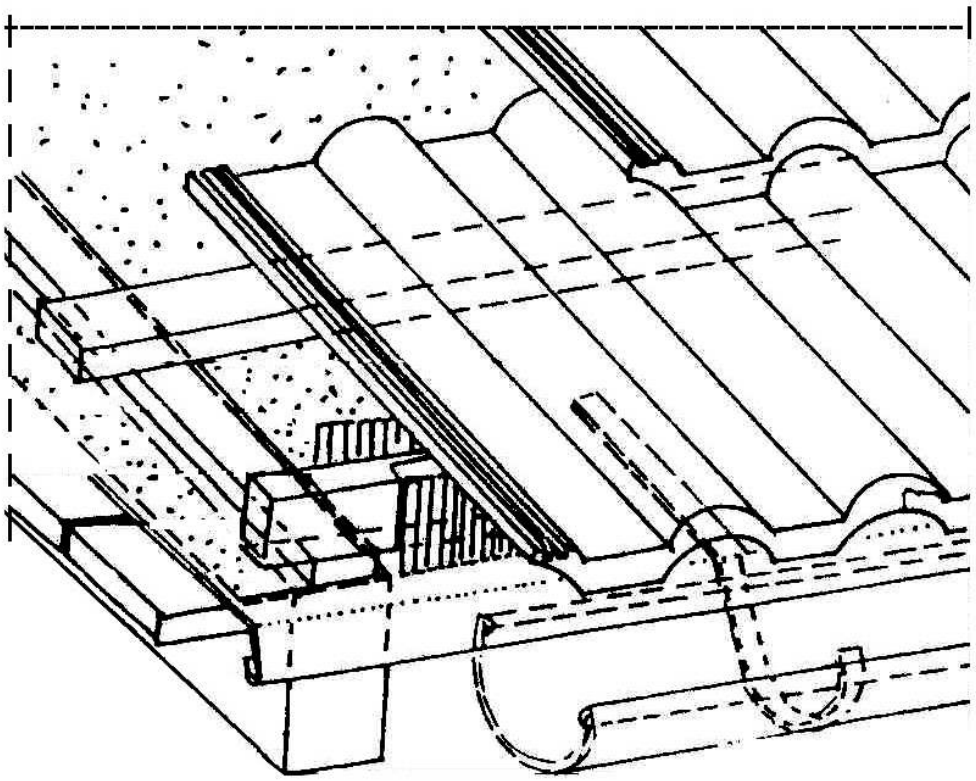
Eaves of roof over empty attic (still better to build in the underlay foil)



Eaves variation 1.:
water drips into the gutter from the foil surface

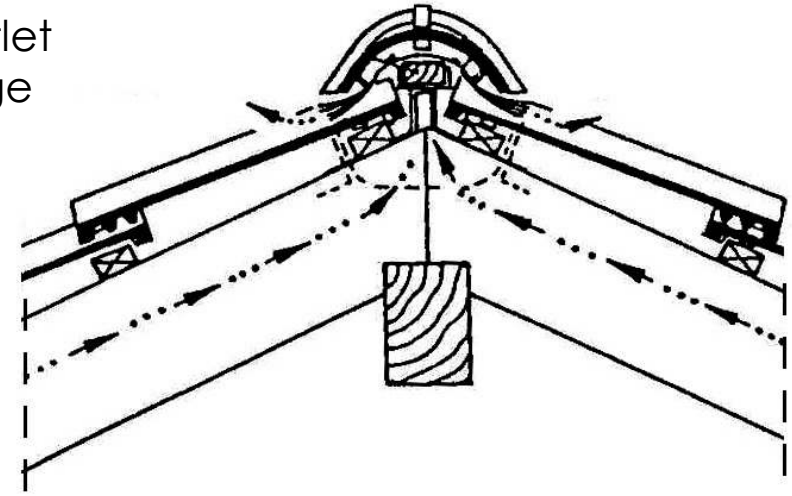


Eaves variation 2.: water drips down behind the gutter ↓

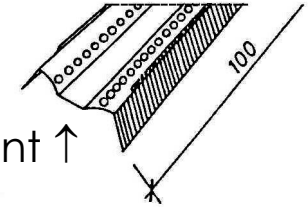


CONCRETE TILE ROOF COVERING

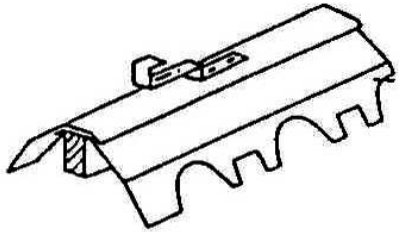
air outlet
at ridge



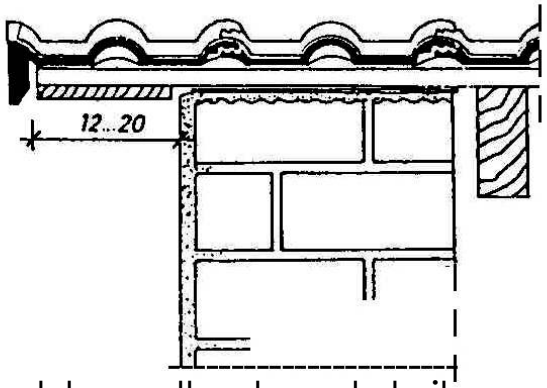
↓ „dry" conic component



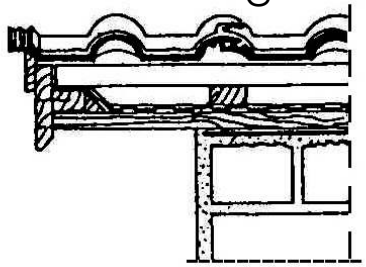
ridge component ↑



air outlet at ridge in
case underlay foil is applied

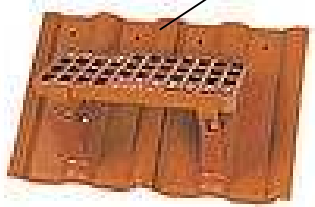


gable wall edge detail
with gable tile ↑
without gable tile ↓



CONCRETE TILE ROOF CLADDING – THE SYSTEM

Vent tile

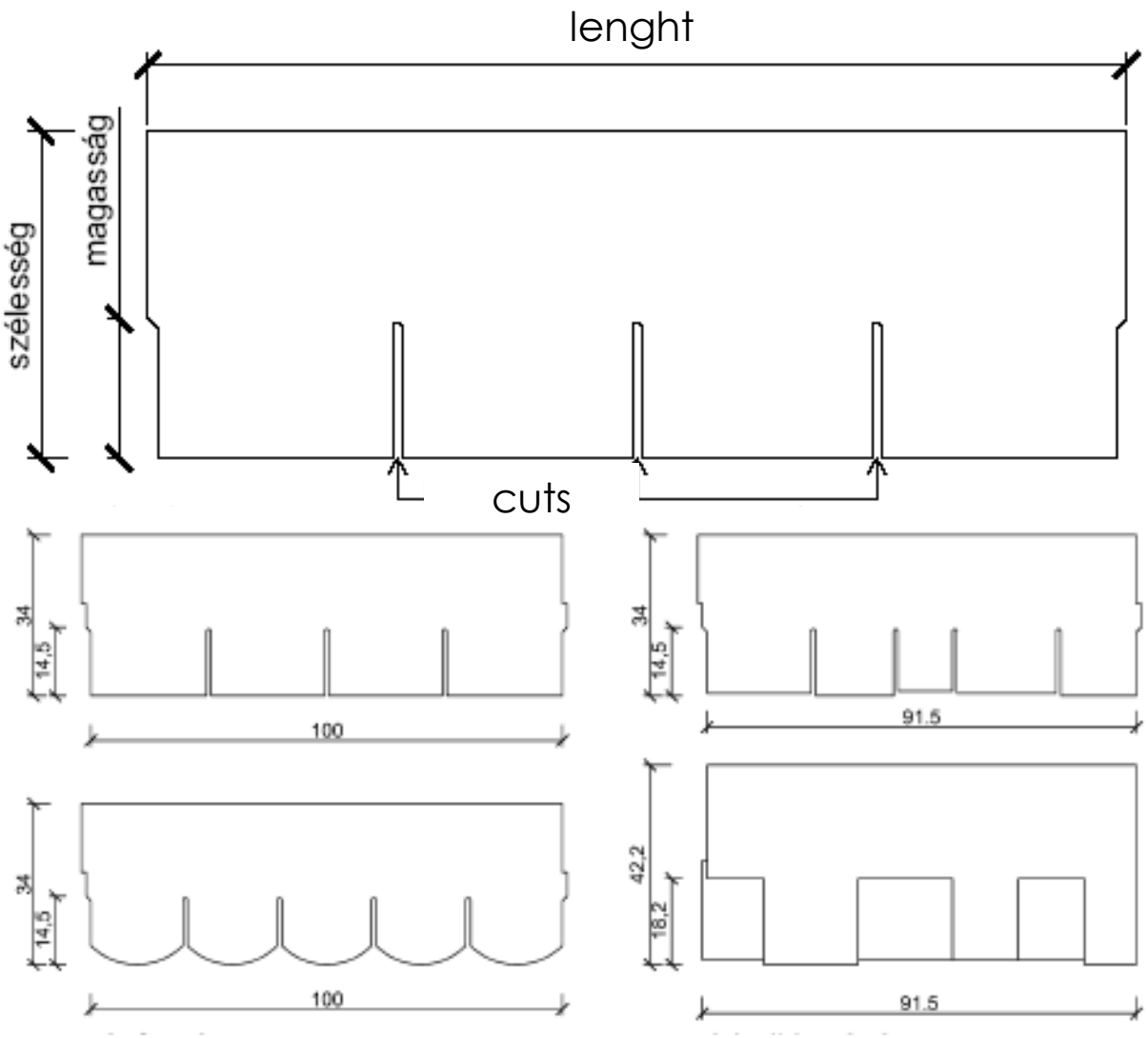


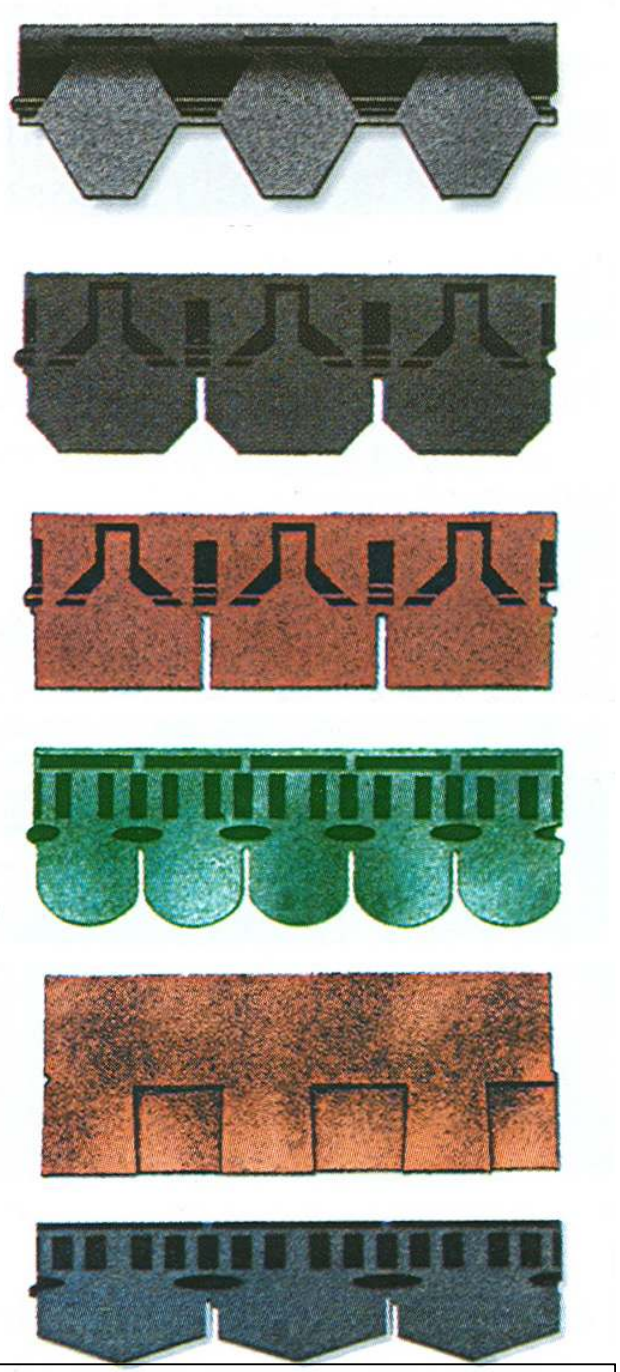
catwalk grill and tile

snow collector tile and metal element

valley element

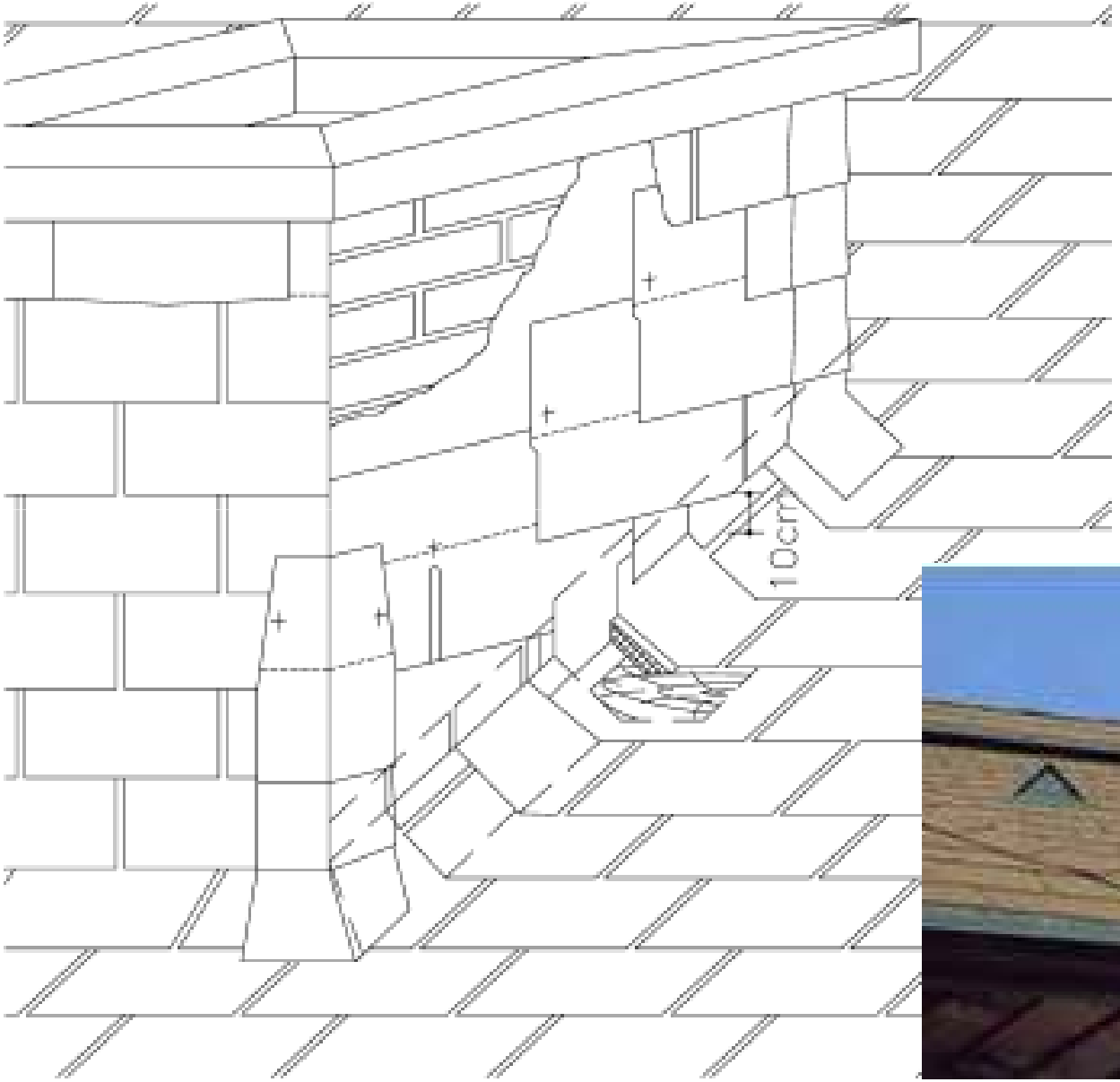
BITUMINOUS SHINGLES



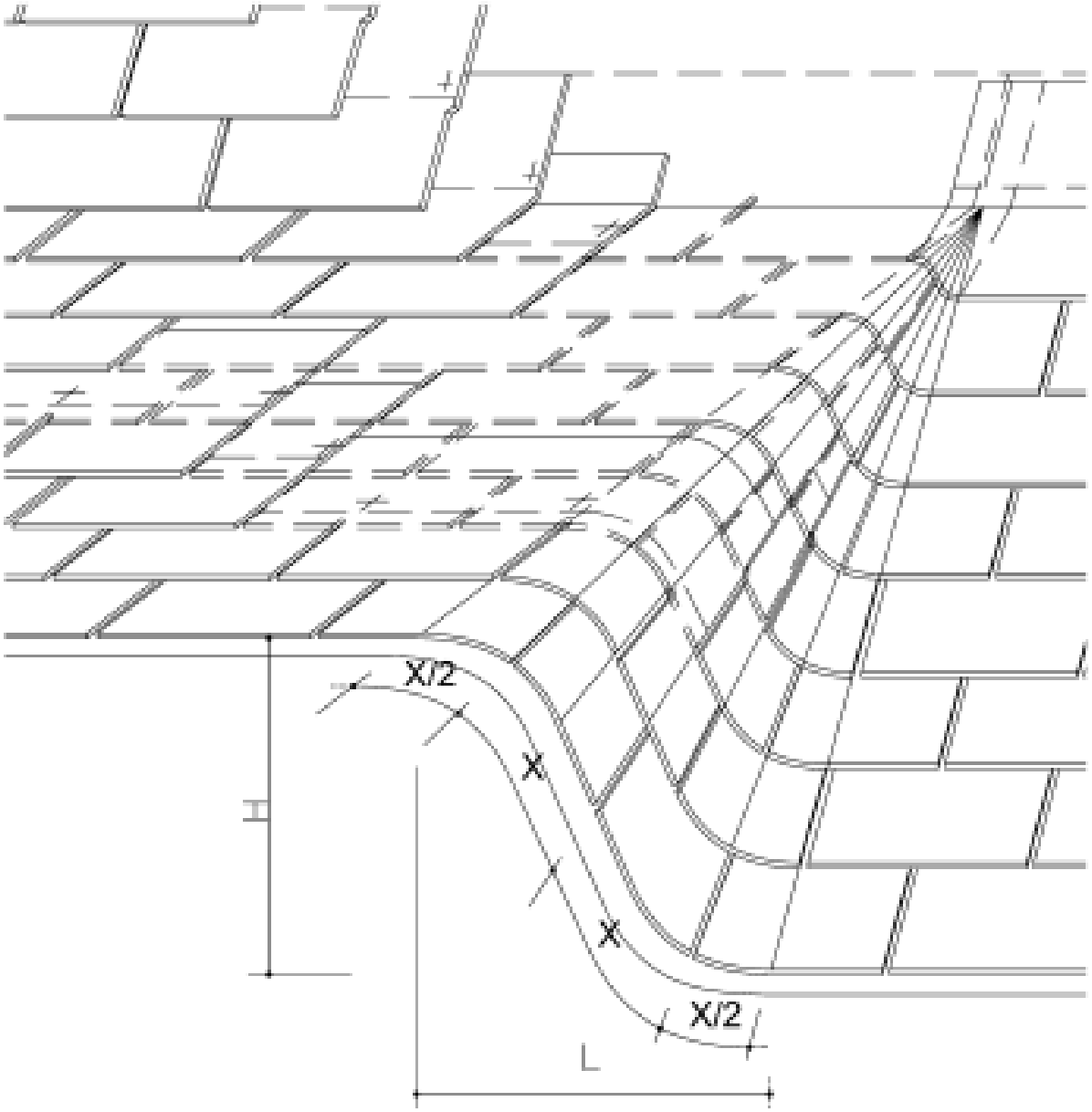


Bituminous shingle shapes

CHIMNEY FLASHING WITH BITUMINOUS SHINGLES

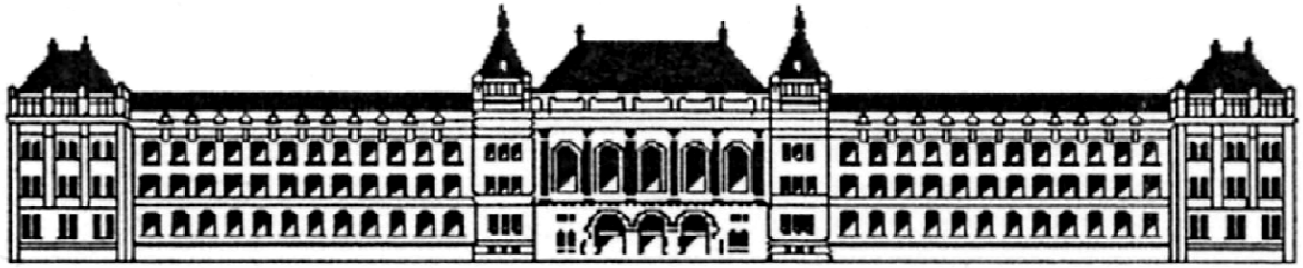


DORMER WINDOW COVERED WITH BITUMINOUS SHINGLES



BITUMINOUS SHINGLE WEAR

BITUMINOUS SHINGLE WEAR DUE TO CHANNELED WATER RUNNING DOWN THE ROOF



PANEL ROOF COVERINGS

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Website: http://www.epitesz.bme.hu/tsz/es/Courses in English/

CLASSIFICATION OF PANEL ROOF COVERINGS - MATERIALS

Materials:

- **aluminum** (material - anodic oxidation - or surface treated) corrugation pattern: trapezoid, wavy or composite profile panels, planks, strips
- **steel** (galvanised or coated) trapezoid, wavy or composite profile panels,
- **copper** profile panels.
- **titanium zink** – modular roof covering (soldered roof coverings will be introduced separately)

Contact corrosion has to be considered when building in / connecting metal components :

- water drained away from copper surfaces may not make contact with any other metal;
- a separating layer must be built in between incompatible components;
- the majority of timber conservation substances attack metals;
- concrete and plastered surfaces release calcium-hidroxide that destroys aluminum and zinc.

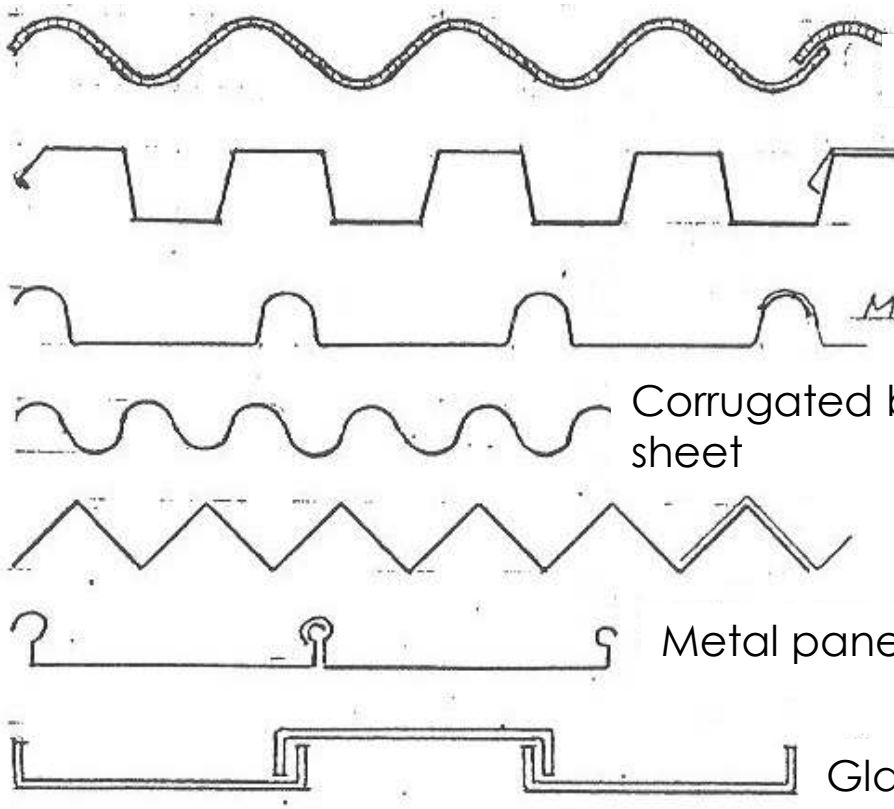
Weathered aluminium

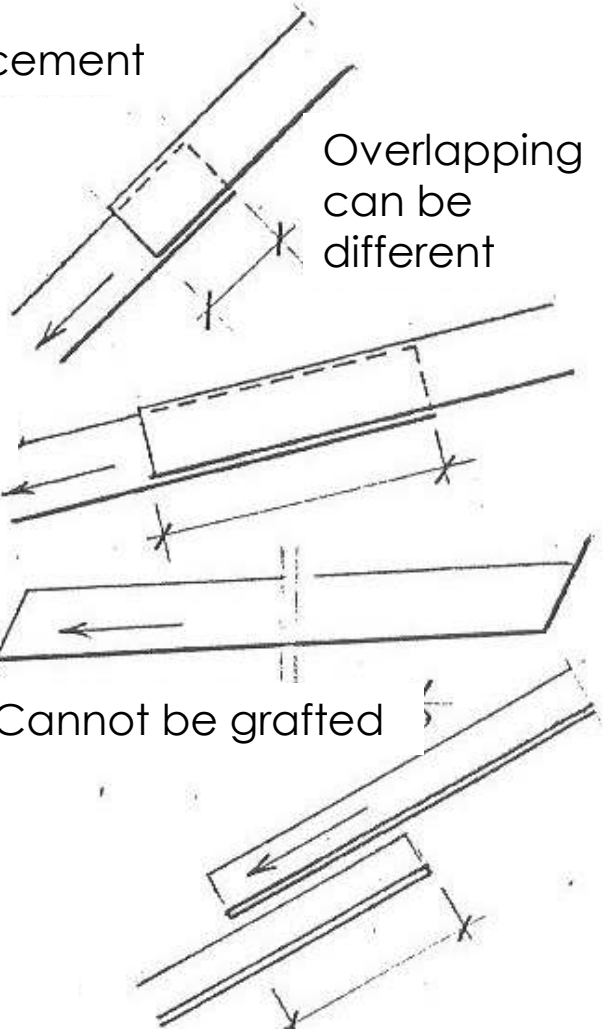
Copper

Coated steel

Titanium zink

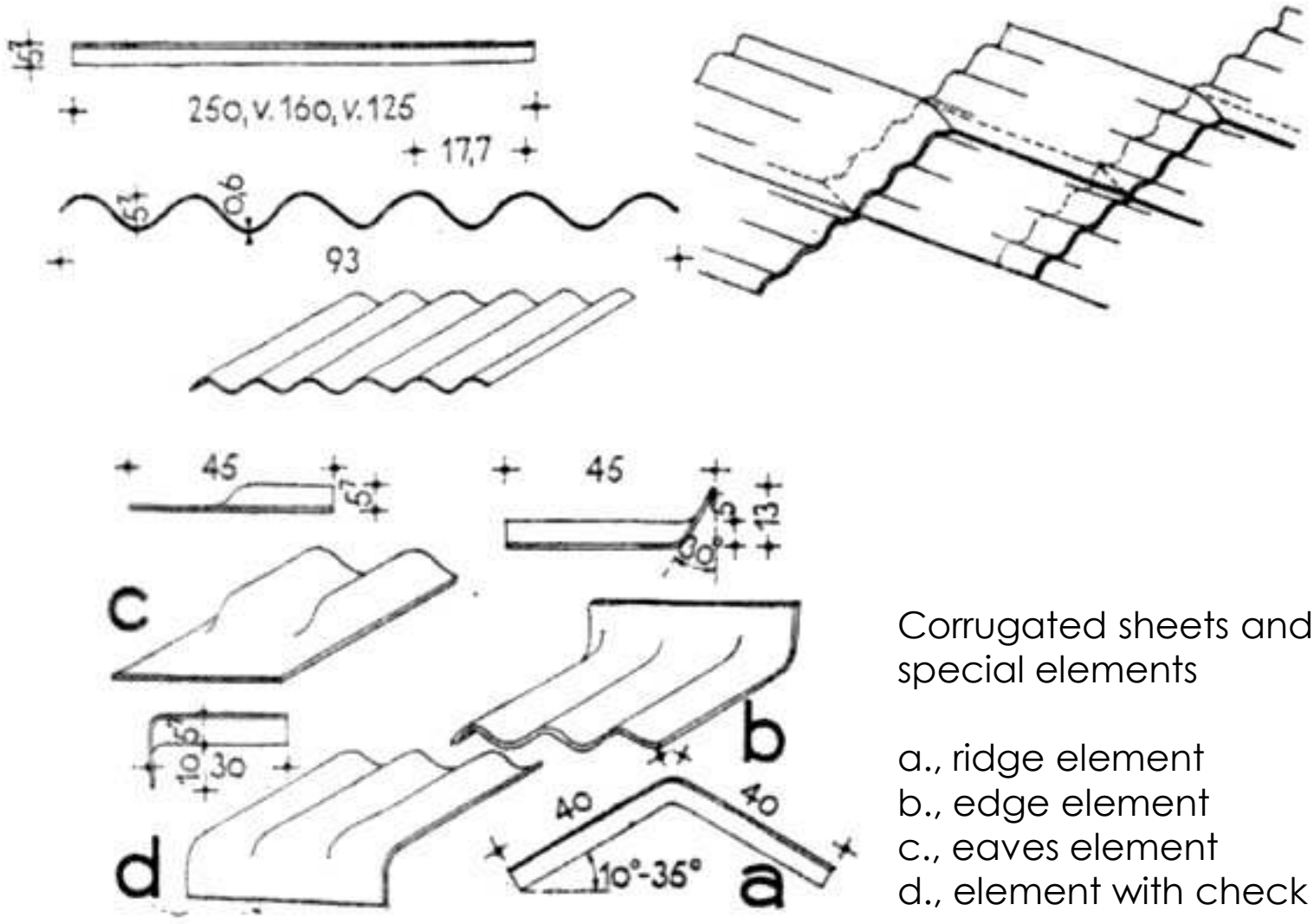
CLASSIFICATION OF PANEL ROOF COVERINGS - SHAPE





Axial and transversal joints of different panel and strip claddings

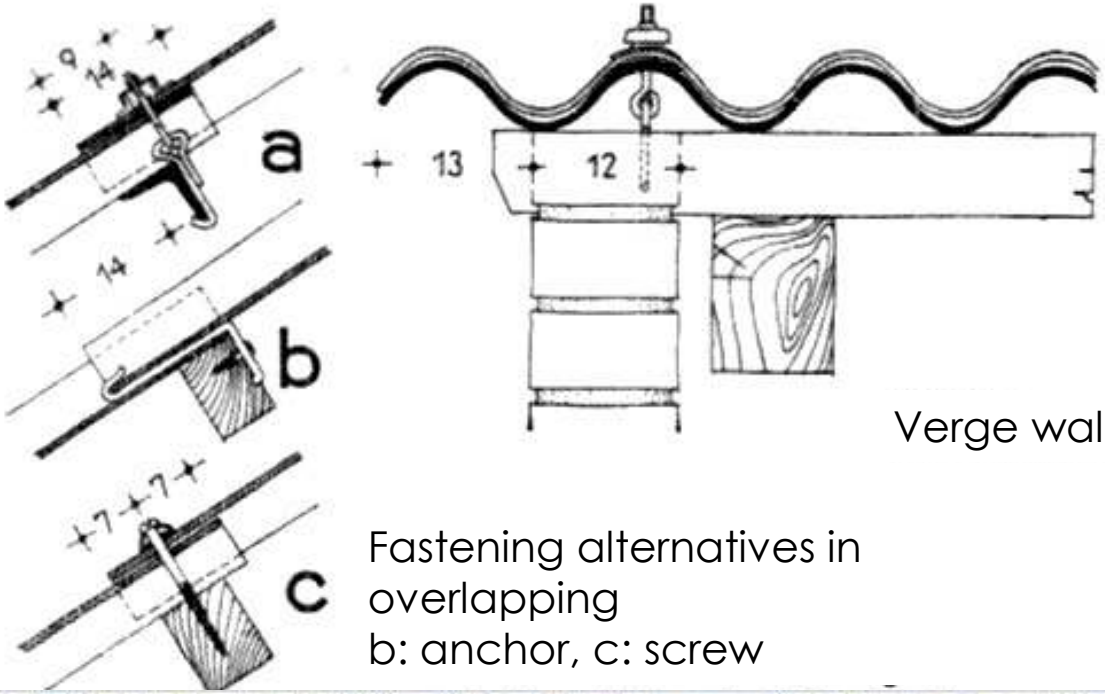
FIBRE-CEMENT CORRUGATED SHEETS



Corrugated sheets and special elements

a., ridge element
b., edge element
c., eaves element
d., element with check throat

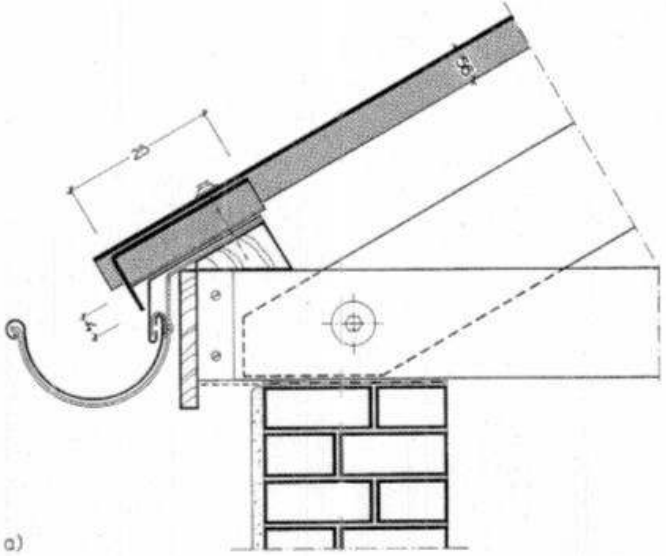
FIBRE-CEMENT CORRUGATED SHEETS

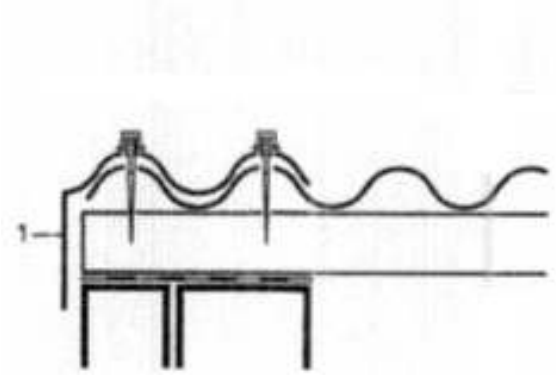


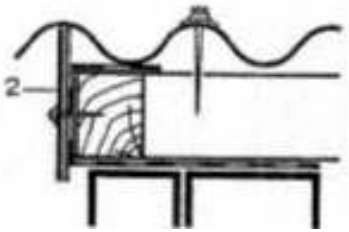
Verge wall detail

Fastening alternatives in overlapping
b: anchor, c: screw

DETAILS OF FIBRE-CEMENT CORRUGATED SHEET ROOF COVERINGS



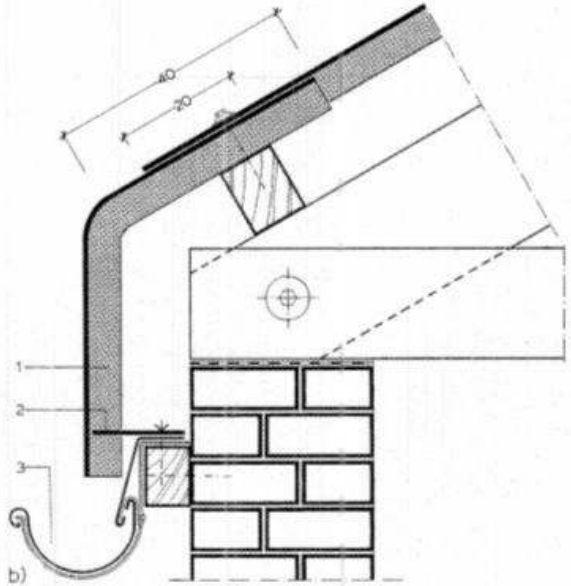


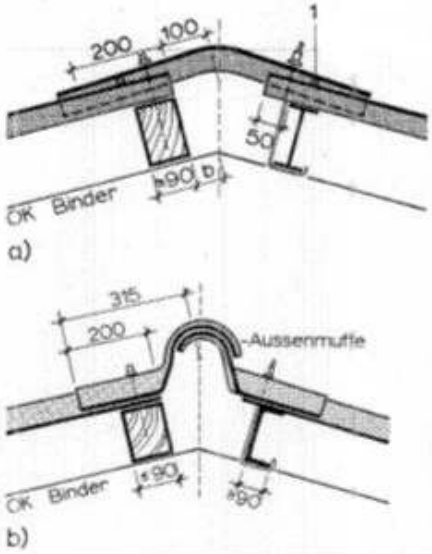


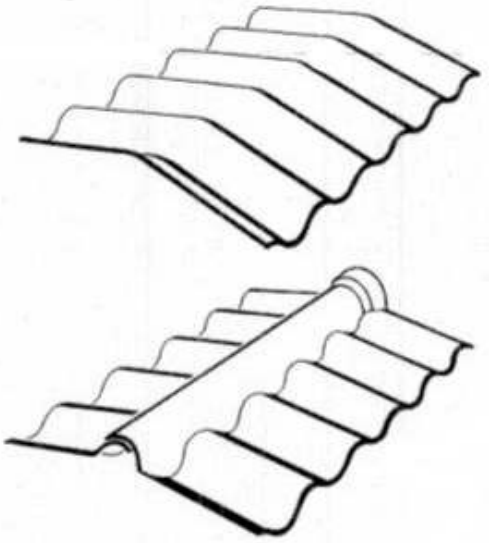
Verge wall details

Eaves alternatives

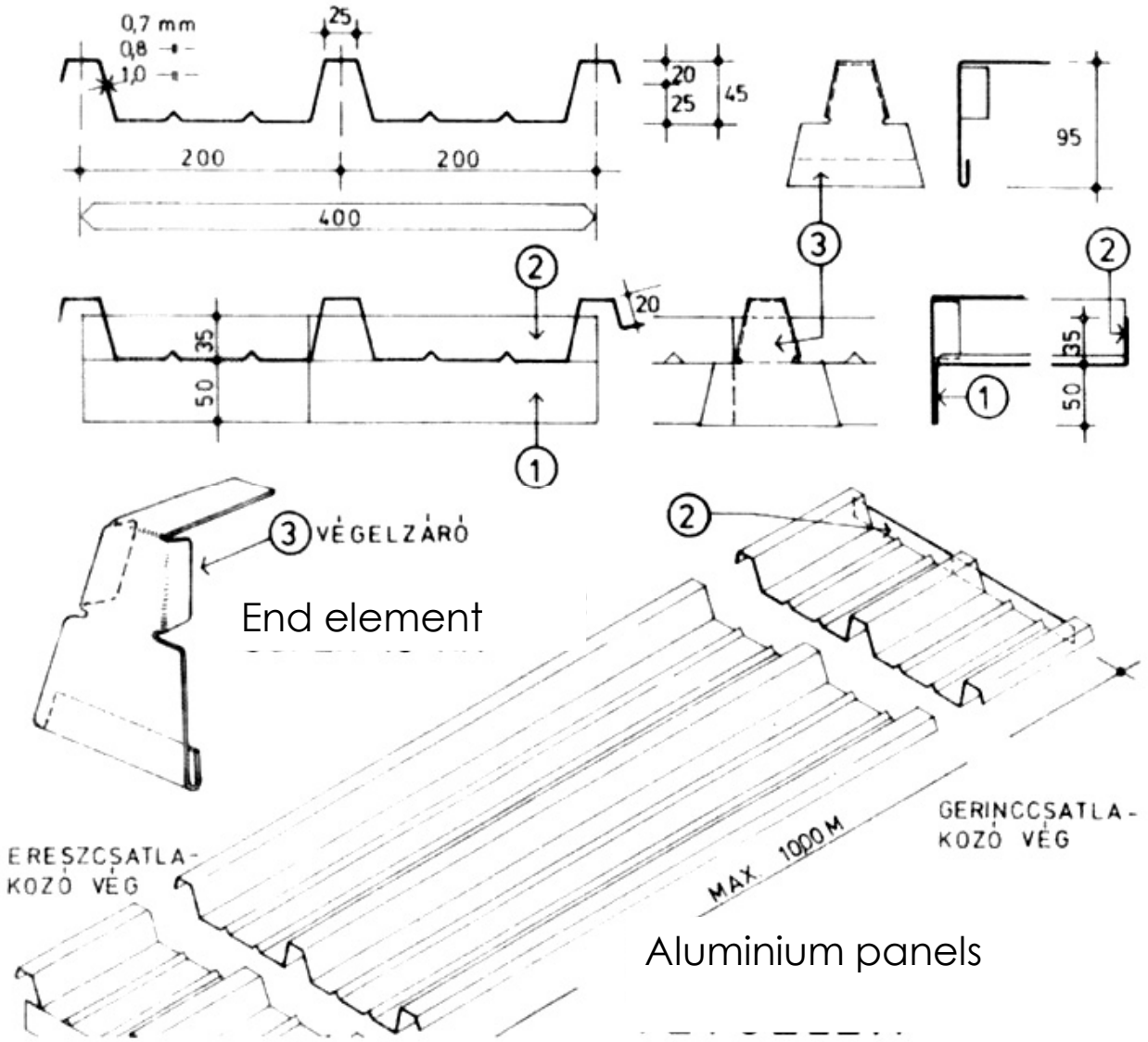
Ridge element alternatives







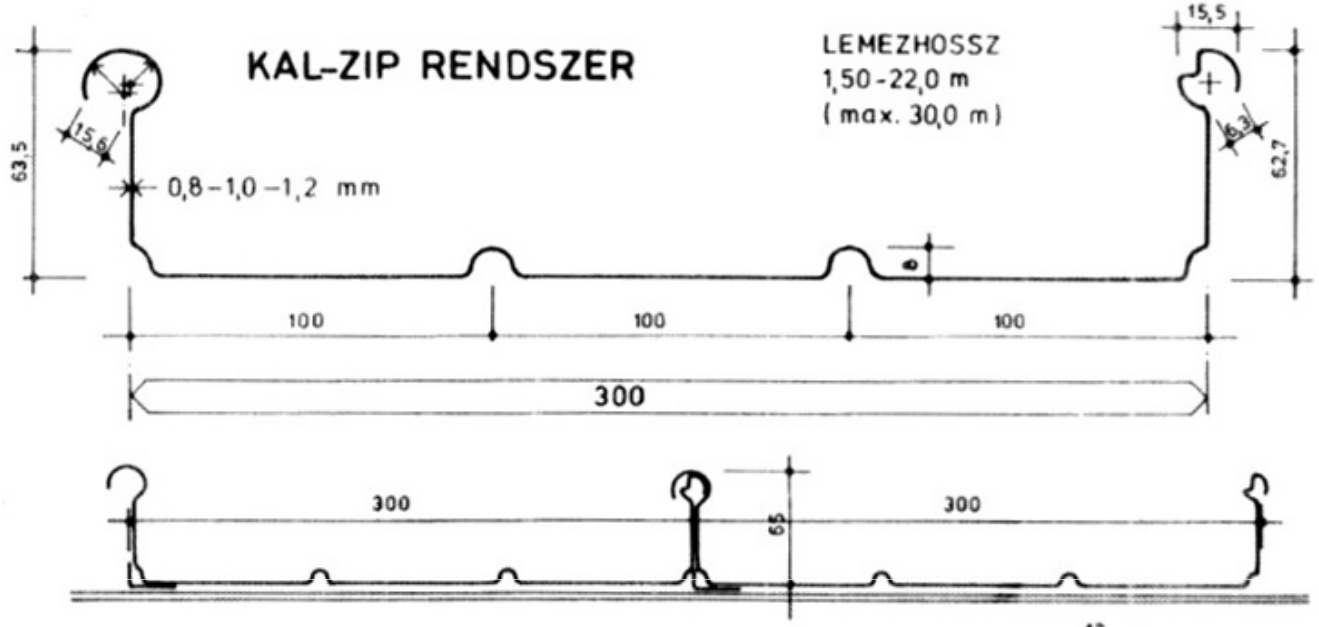
TRAPEZOID ALUMINIUM PANELS



End element

Aluminium panels

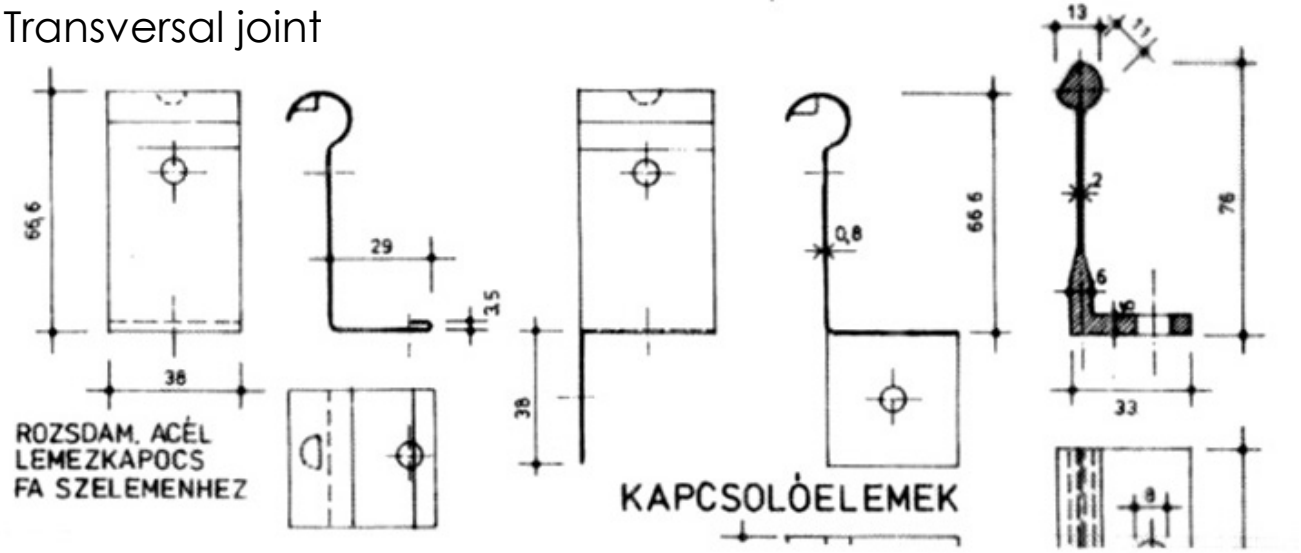
KALZIP ALUMINIUM SYSTEM

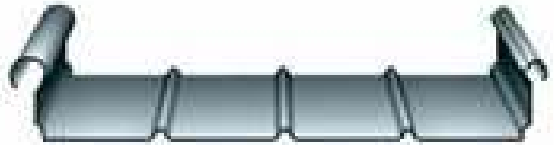


Kalzip 50/333

Kalzip 65/305

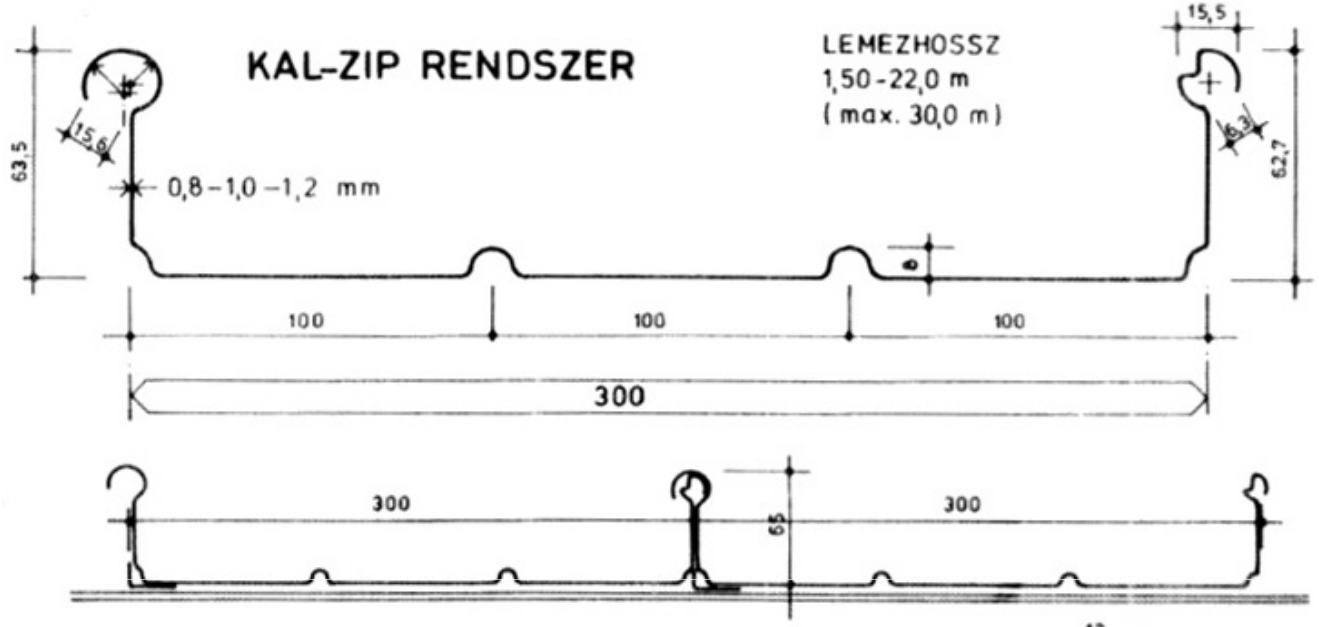
Transversal joint



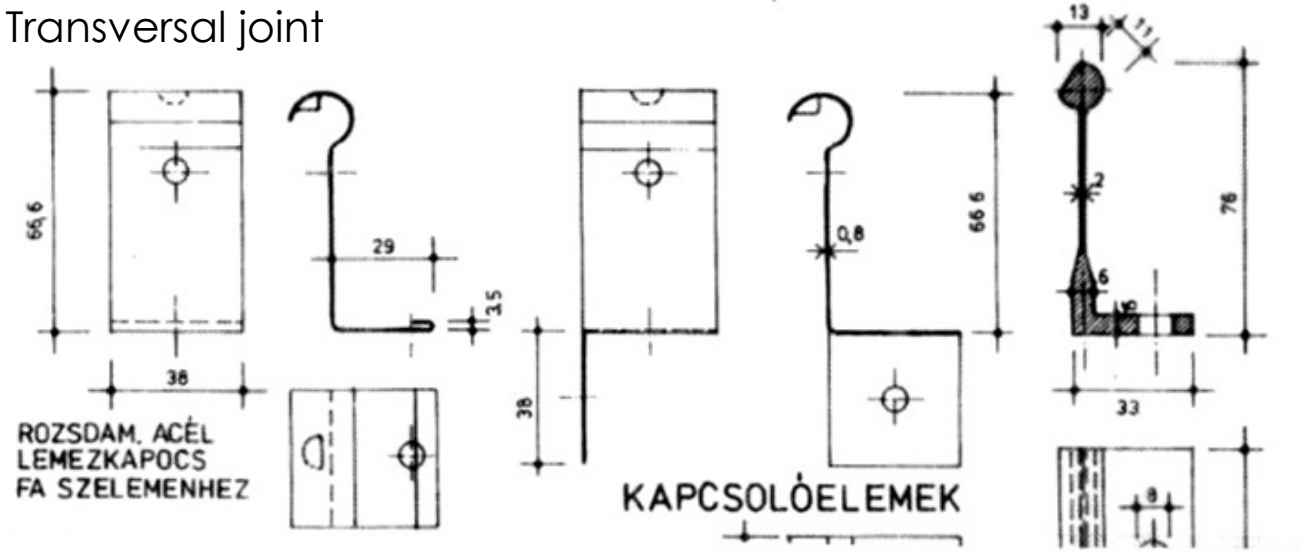


Kalzip 65/400

KALZIP ALUMINIUM SYSTEM

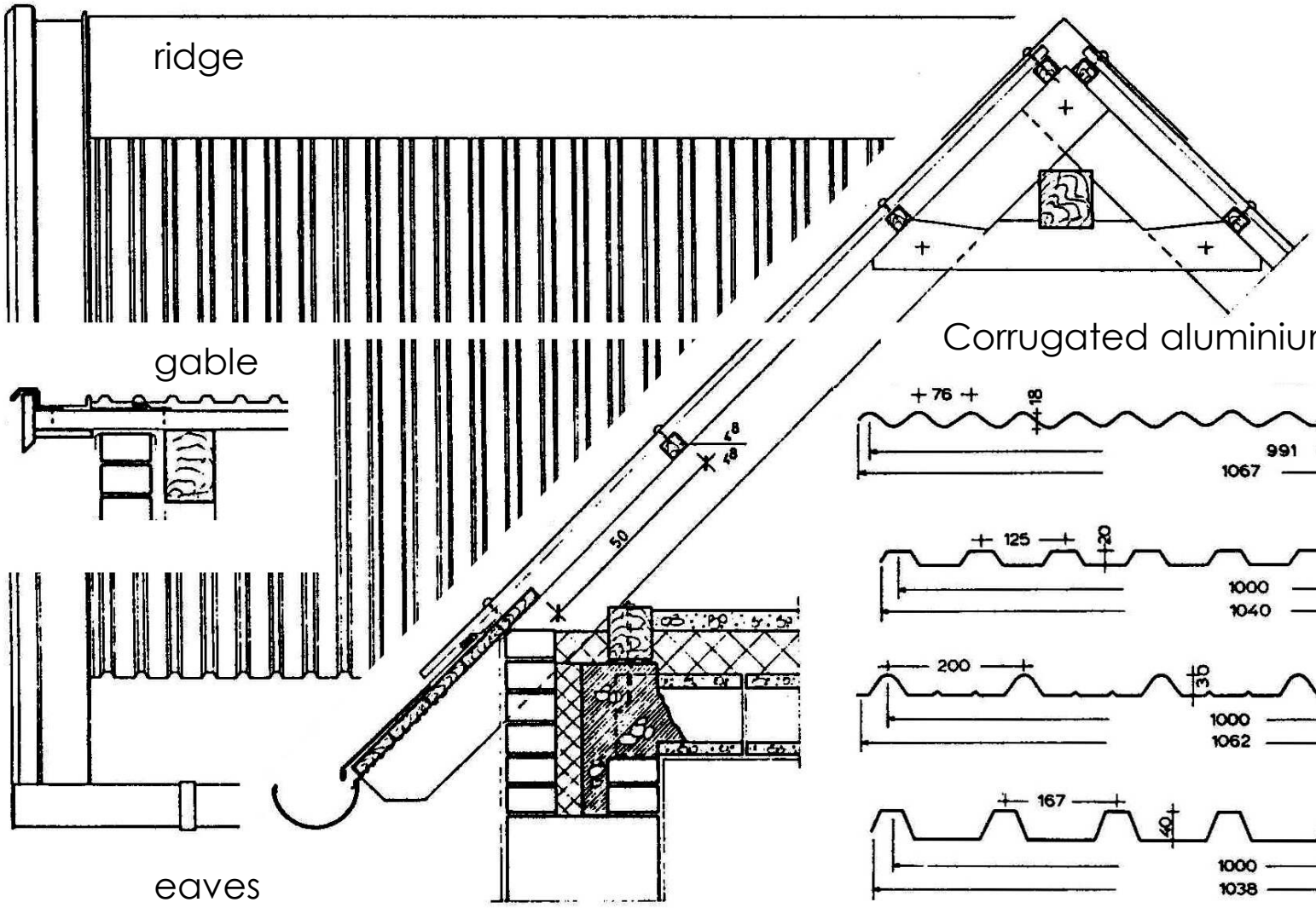


Transversal joint

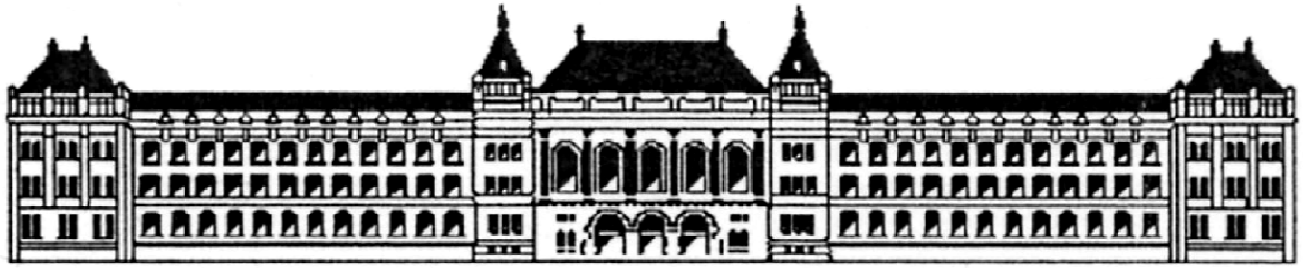


KALZIP SYSTEM

METAL CORRUGATED SHEETS: ALUMINUM ROOF PANELS

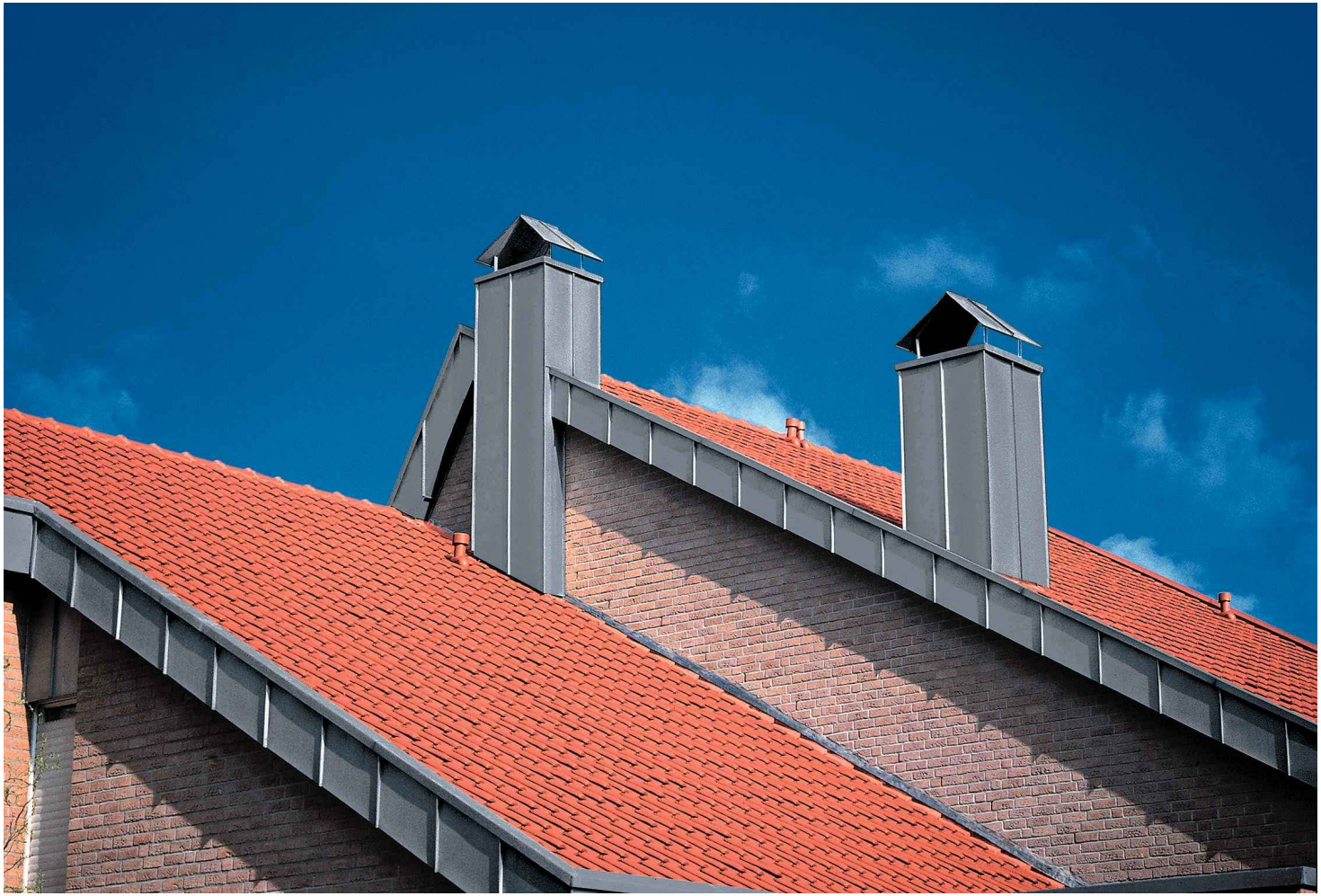


Corrugated aluminium panel profiles



ROOF DRAINAGE SYSTEMS AND ROOF FLASHINGS

FLASHINGS



Wall-, chimney-, eaves, verge, valley flashings

REVIEW – MATERIALS OF FLASHINGS

Materials:

- **aluminum** (material - anodic oxidation - or surface treated) corrugation pattern: trapezoid, wavy or composite profile panels, planks, strips
- **steel** (galvanised or coated)
  trapezoid, wavy or composite profile panels,
- **copper** profile panels.
- **titanium zink** – modular roof covering (soldered roof coverings will be introduced separately)

Contact corrosion has to be considered when building in / connecting metal components :

- water drained away from copper surfaces may not make contact with any other metal;
- a separating layer must be built in between incompatible components;
- the majority of timber conservation substances attack metals;
- concrete and plastered surfaces release calcium-hidroxide that destroys aluminum and zinc.

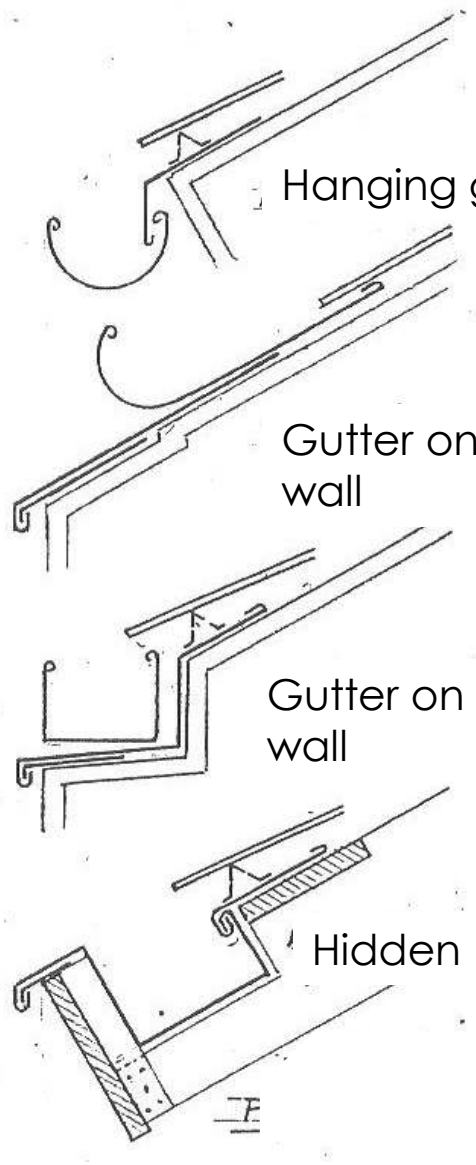
Copper

Coated steel

Pre-weathered aluminium

Titanium zink: bright-rolled, natural and pre-weathered

CLASSIFICATION OF GUTTERS



Hanging gutter

Gutter on the wall

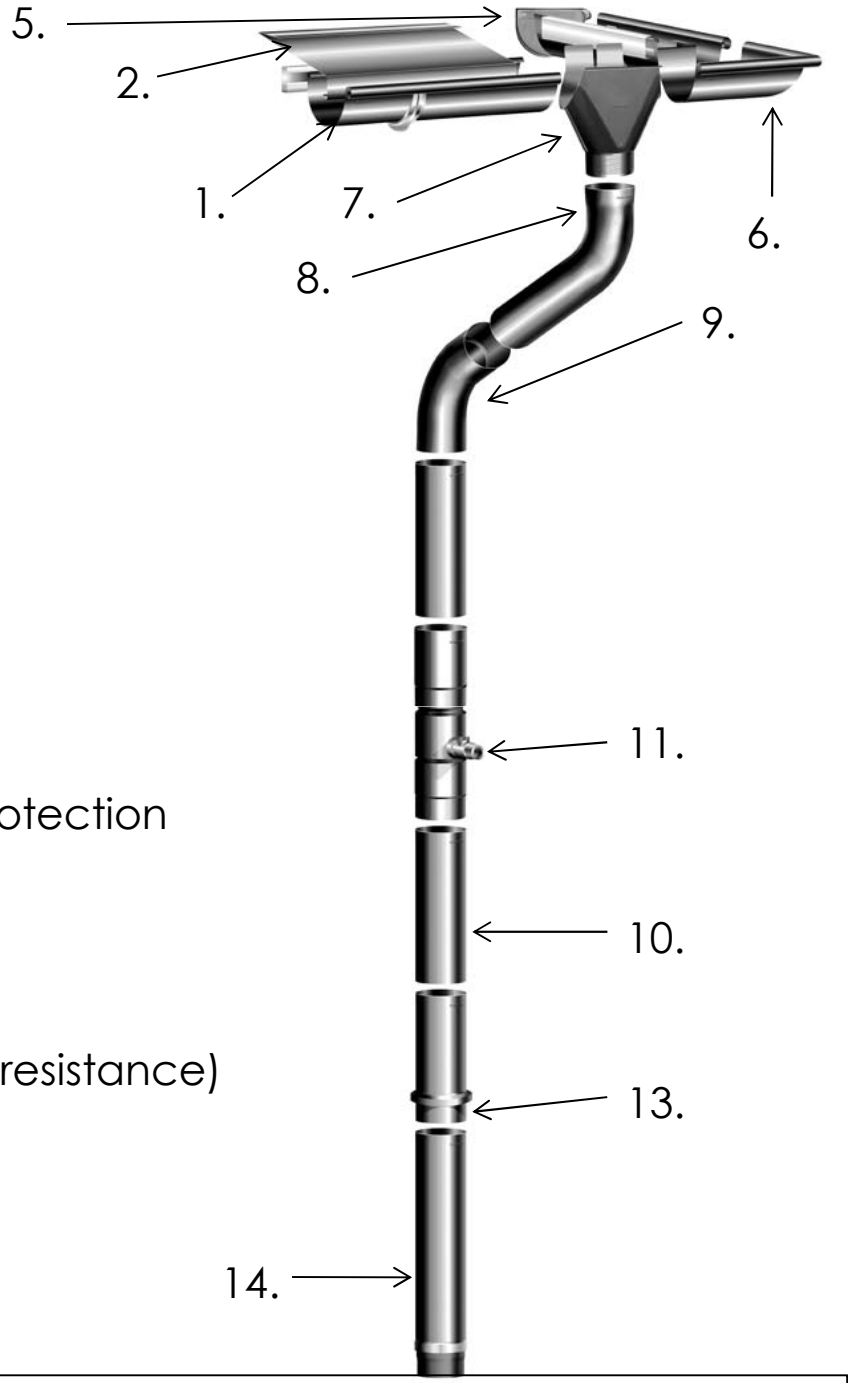
Gutter on the wall

Hidden

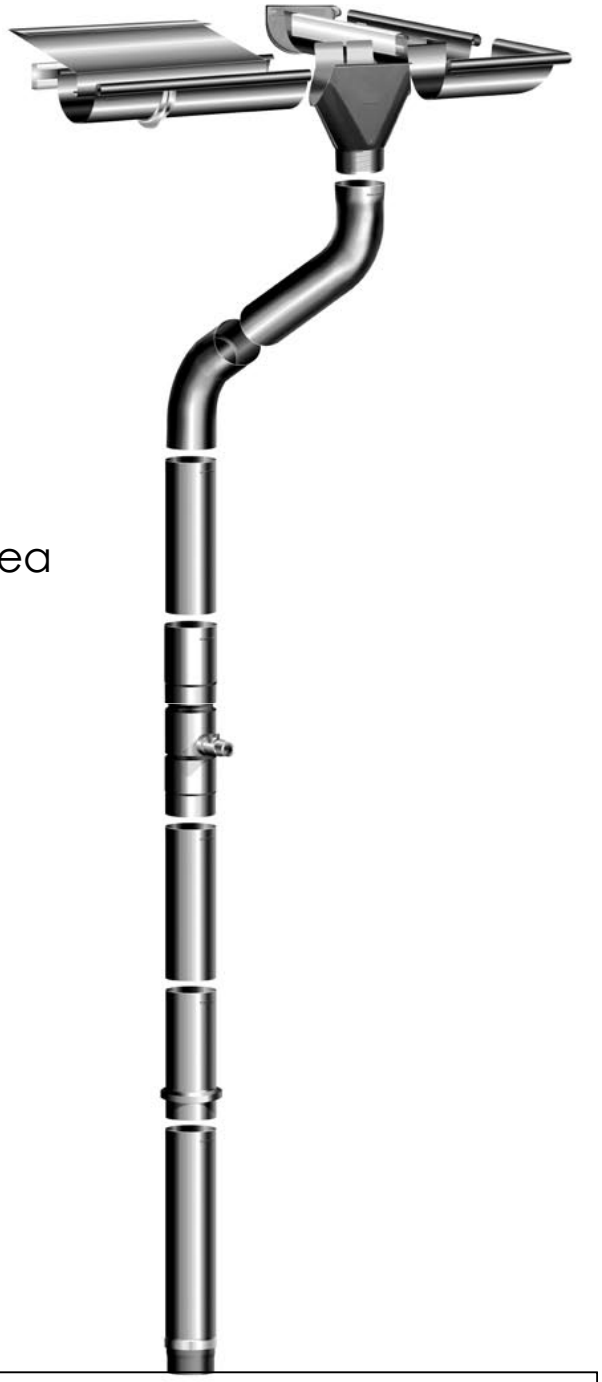
Leaf basket and galvanised steel protecting mesh

DRAINAGE SYSTEM FOR PITCHED ROOFS

1. Half round gutter
2. Drip Edge (eaves flashing)
3. Leafguard
4. Gutter brackets/Snap-lock system
5. Stop end
6. Gutter corner
7. Plug-in gutter outlet
8. Pipe section
9. Elbow
10. Universal downpipe bracket with lightning protection attachment
11. Water butt connector
12. Patented high frequency welded downpipe
13. Cover sleeve
14. Stand Pipe (made of cast iron – mechanical resistance)



DRAINAGE SYSTEM FOR PITCHED ROOFS



Calculating gutter and downpipe size (German method):

$$Q_r = A * r * \Psi$$

Q_r: quantity of rauinwater drained (l/sec)
A: roof surface area (m^2),
R: rain intensity factor, characteristic of building area location, for example: in Hungary it is 274 [l/sec, ha]
Ψ: drainage coefficient related to roof pitch

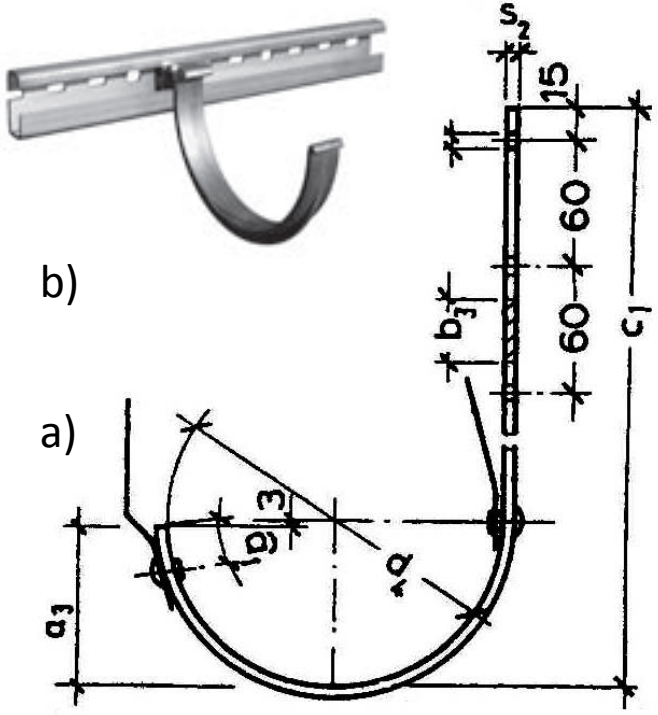
GUTTER AND DOWNPIPE SIZES

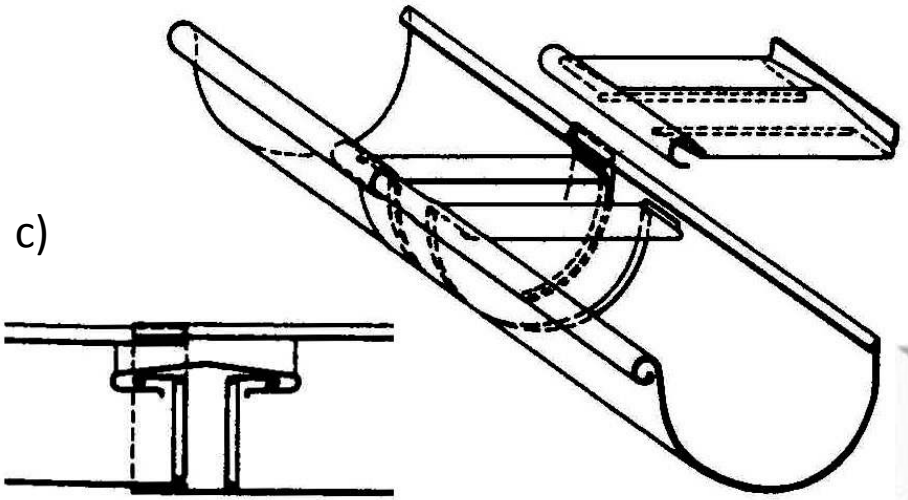
Roof area	Q_r	downspout Φ	downspout cross section area
m^2	l/s	mm	cm^2 .
83	2,5	80	50
150	4,5	100	79
243	7,3	120	113
443	13,3	150	177

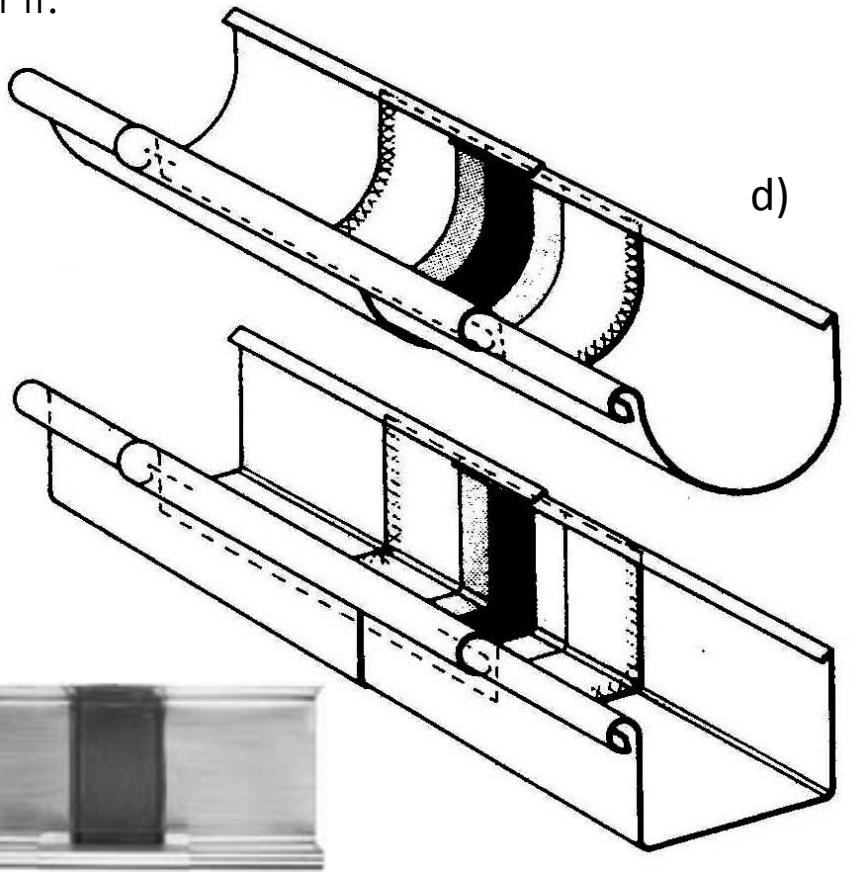
Roof area	gutter	gutter cross
m^2	reference size: mm	section area cm^2
83	250 (283)	43 (63)
150	333	92
243	400	145
443	500	245

GUTTERS

a) Traditional gutter bearer
b) Snap-lock bracket system
c) traditional thermal expansion gap at highest point of gutter.
d) up-to-date thermal expansion gap: water may pass over it.

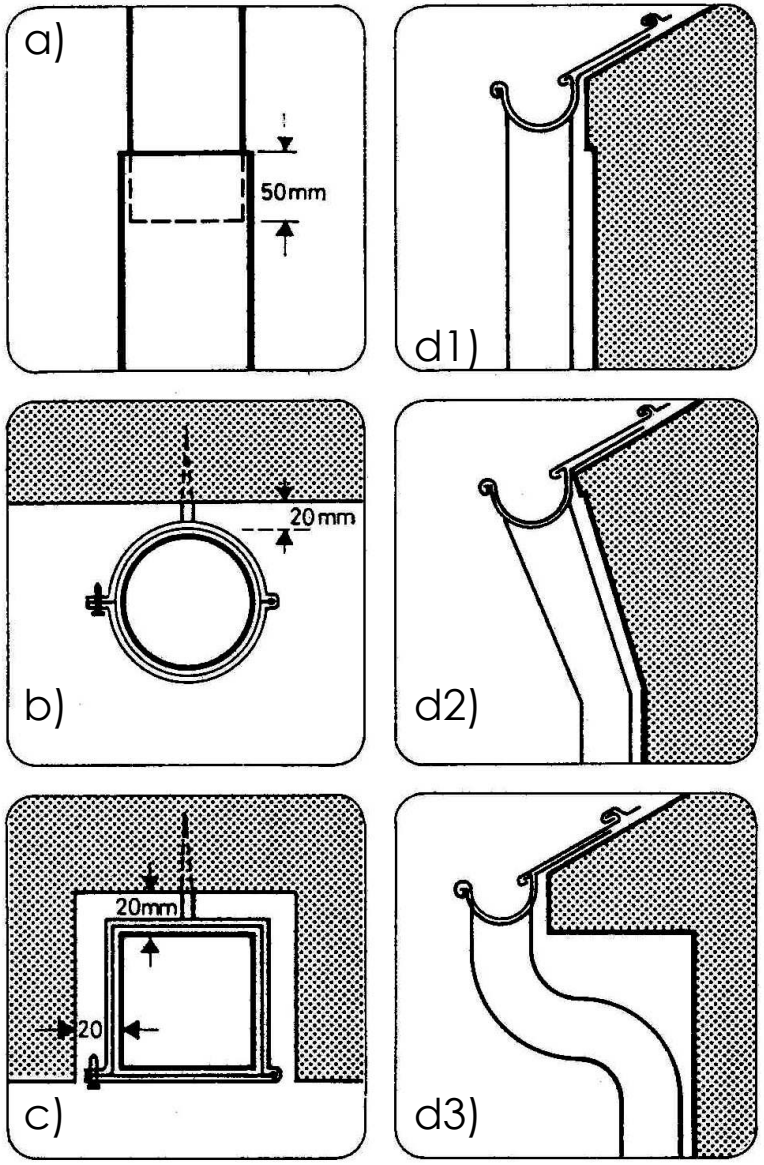






GUTTER BRACKETS

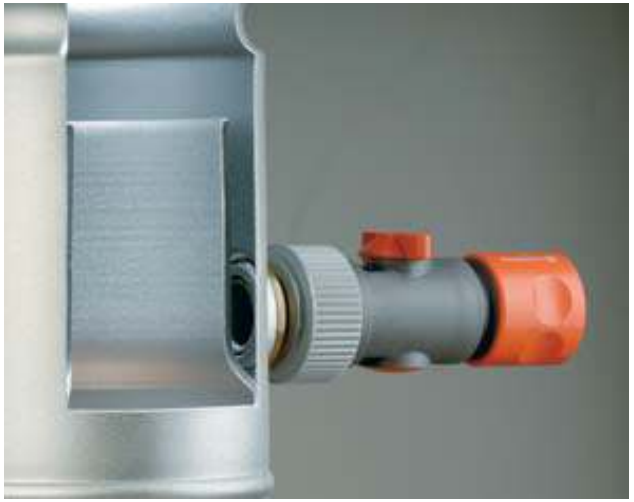
GUTTERS AND DOWNPIPES



Hidden and visible (stainless steel) fixing

a) Downpipe lengthening
b) Downpipe fixing
c) Downpipe in wall recess
d) Gutter / downspout connection variations

AUXILIARY ELEMENTS OF GUTTERS

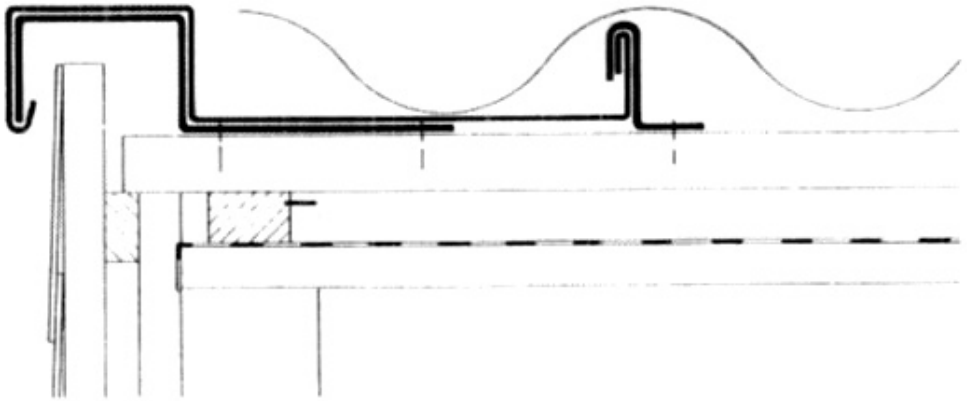


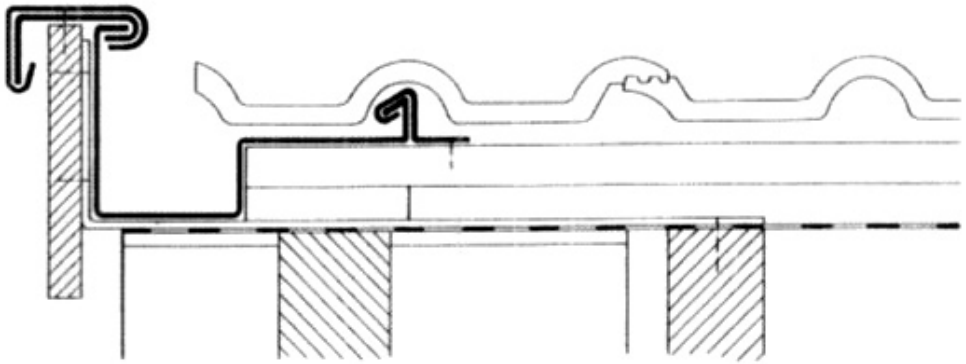
Water butt connector

Downpipes, plug-in gutter outlet, stop end, corners

Leaf basket and galvanised steel leafguard system

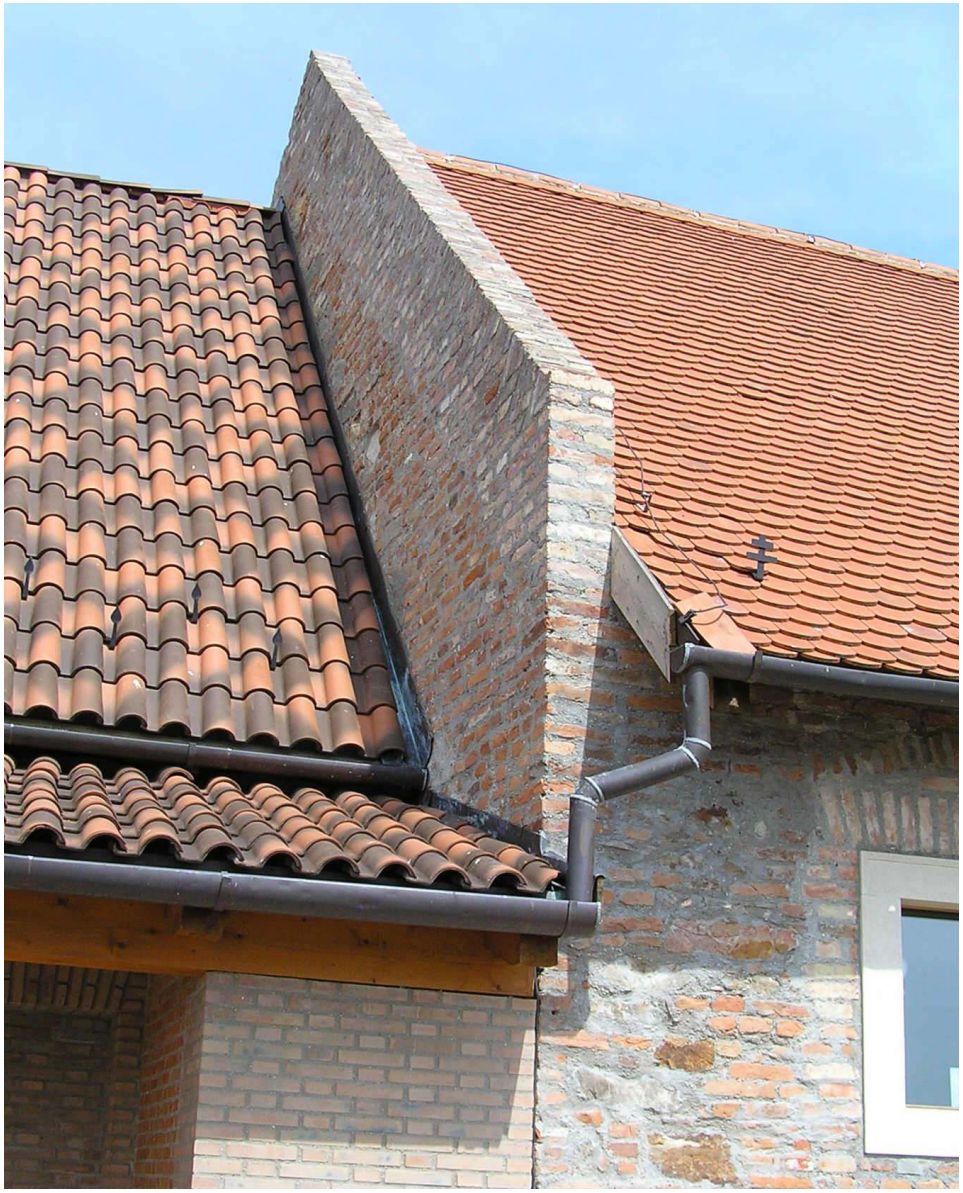
VERGE FLASHINGS





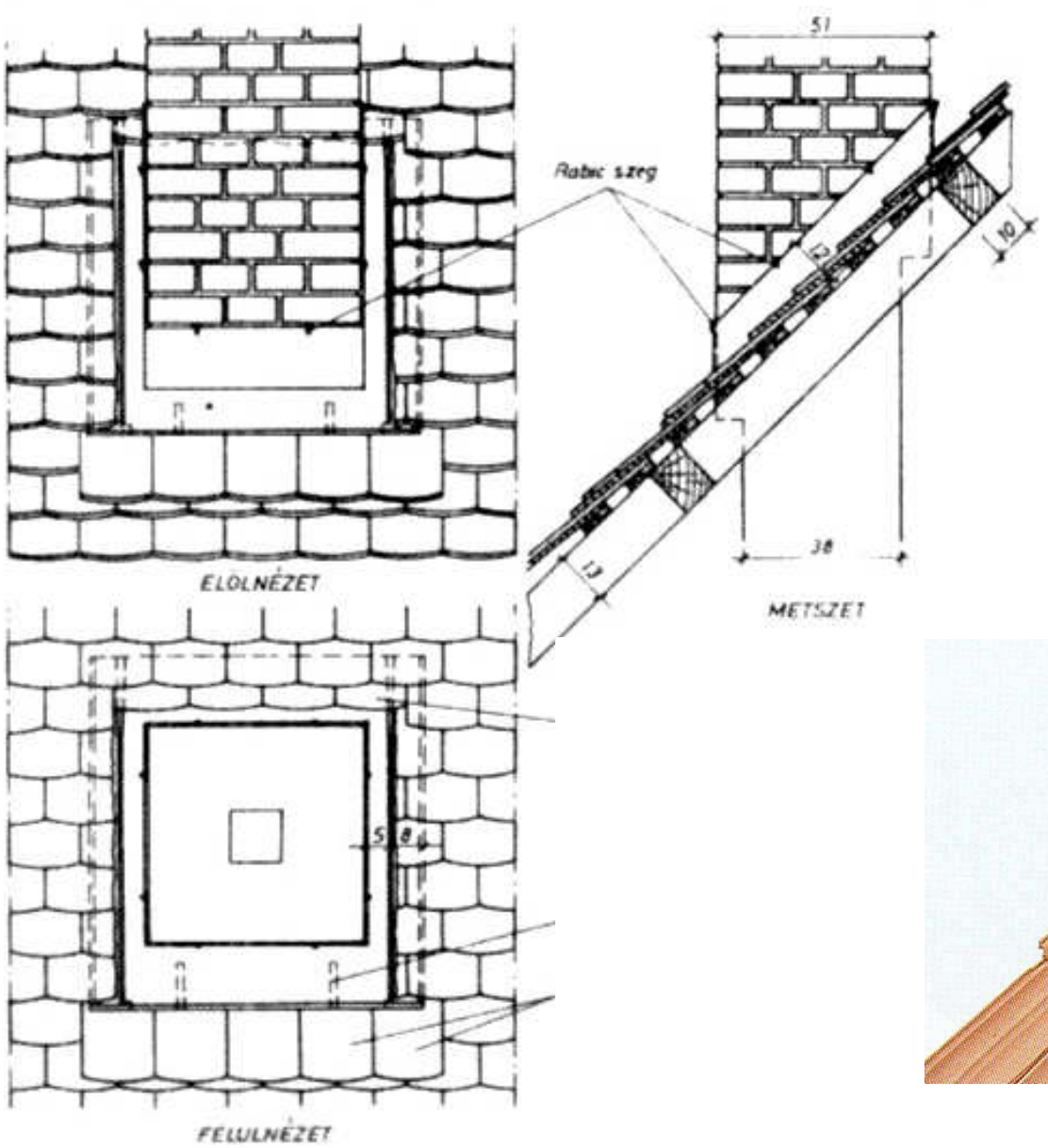
Up-to-date profilised verge flashing for the perfect connection to the tiles

WALL FLASHINGS



FASCIA BOARD CLADDING

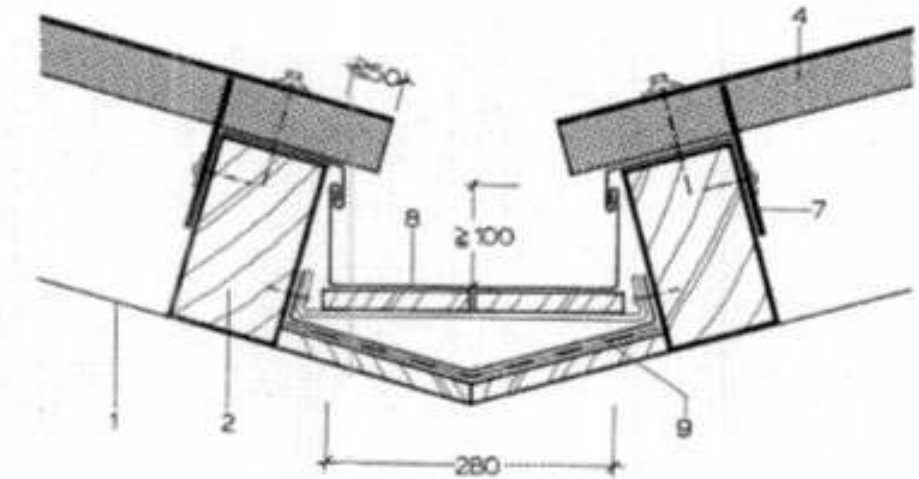
CHIMNEY FLASHINGS - PLAIN AND COMPRESSION MOLDED TILES



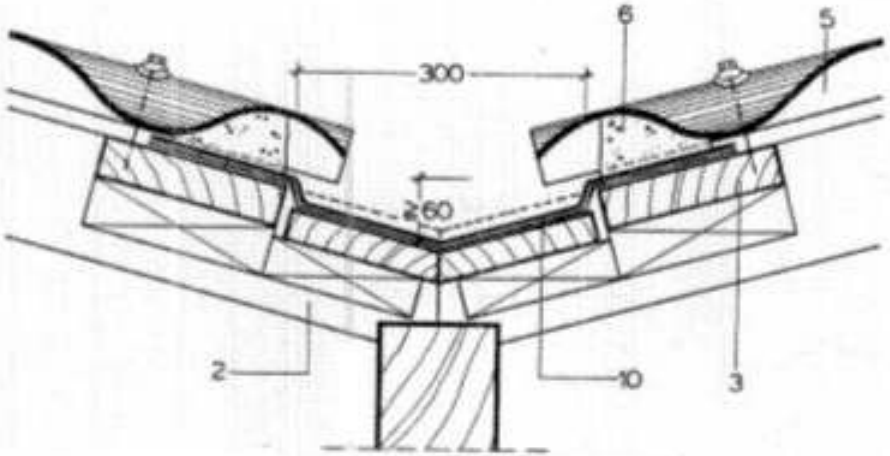
SKYLIGHT WINDOW FLASHING – FOR CORRUGATED TILES

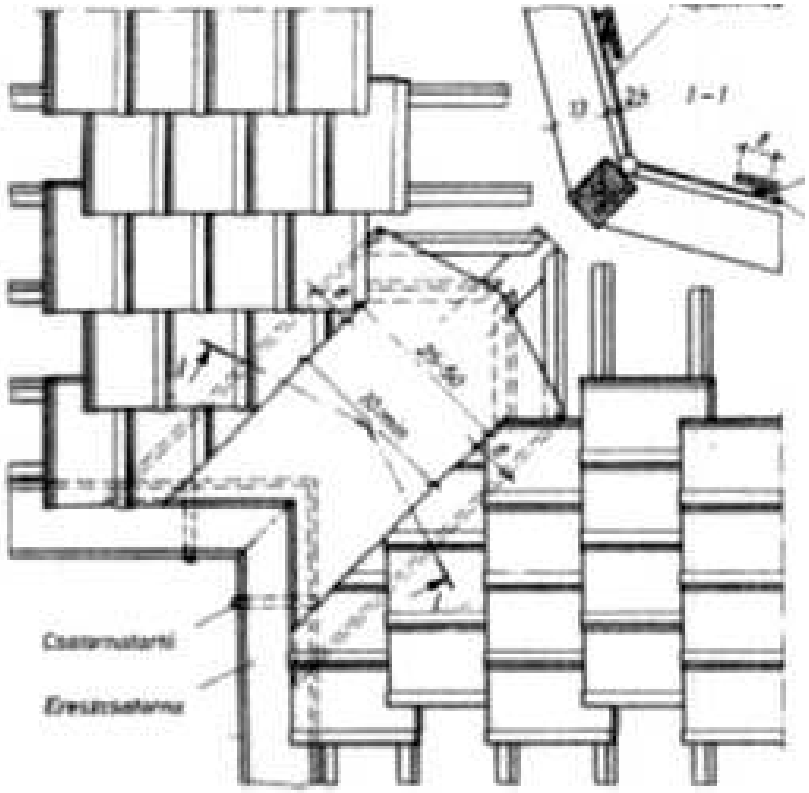
SKYLIGHT WINDOW FLASHING

VALLEY FLASHINGS



Double valley





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