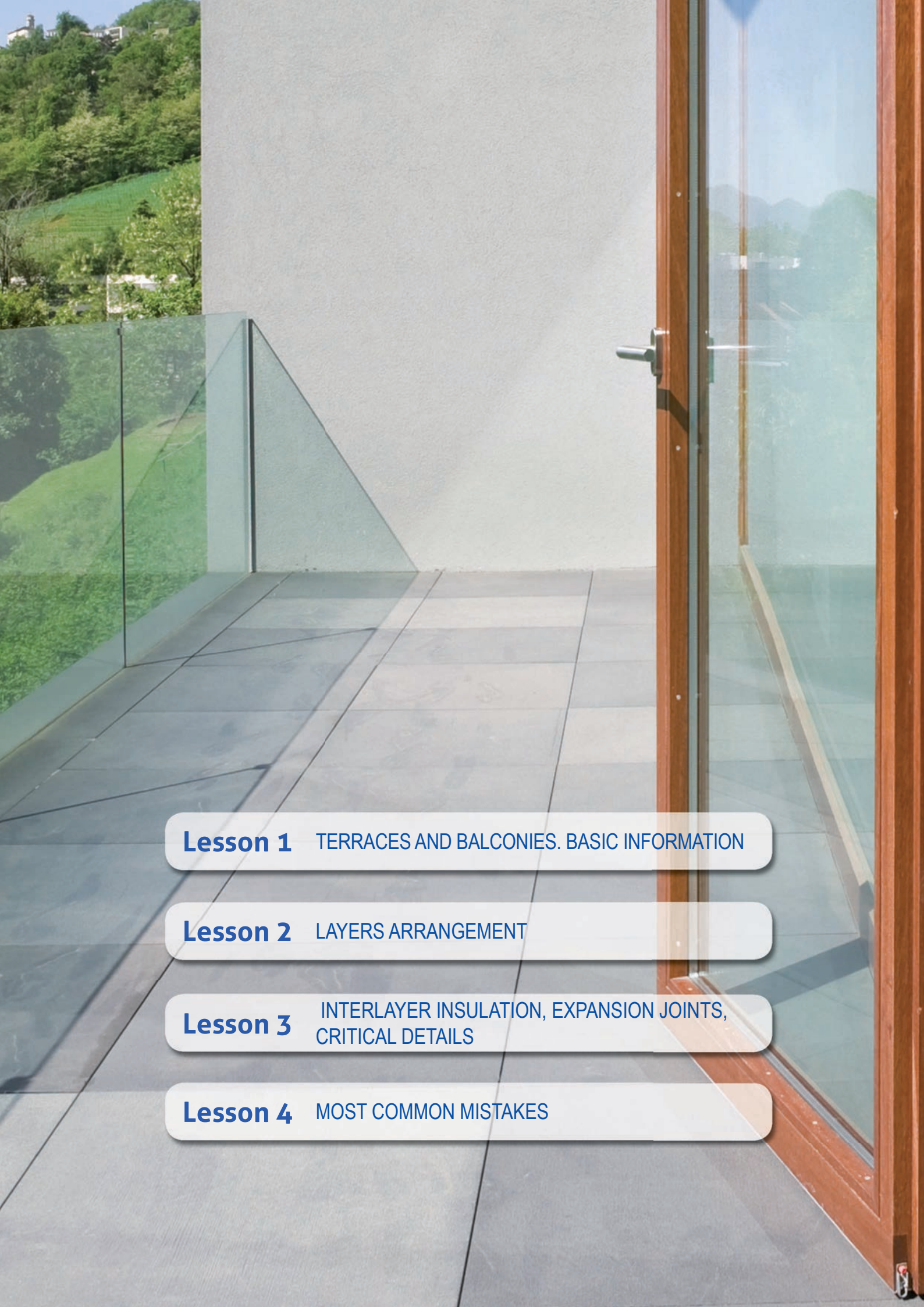

School
of Terraces
ATLAS



Lesson 1 TERRACES AND BALCONIES. BASIC INFORMATION

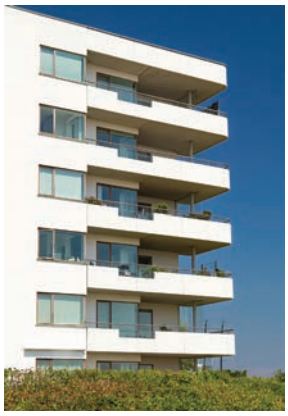
Lesson 2 LAYERS ARRANGEMENT

Lesson 3 INTERLAYER INSULATION, EXPANSION JOINTS, CRITICAL DETAILS

Lesson 4 MOST COMMON MISTAKES

LESSON 1

School of Terraces



Professionals very often concern about proper construction of terraces and balconies. Therefore, in this brochure we are going to take a careful look at them. We hope that with our new brochure "School of Terraces" no balcony, loggia, nor terrace will bring problems to you anymore. We begin with basic concepts related to the renovation and building of the terraces.

Balcony and terrace are the elements which enhance the utilitarian value of the building. Their possible designations are countless: from a relax zone to the additional space of a living room. But, in order to protect the owner from any future problems, it is necessary to apply appropriate design and executive solutions.

BASIC DEFINITIONS

Balcony is an architectural element in the form of slab projecting from the wall of a building, enclosed with a balustrade and connected with an adjacent room with a door.

Loggia is a niche formed in the building façade as a result of the wall/walls move back, enclosed with a balustrade and accessible from one or several rooms.

The essence of **the overground terrace** is that there is an utility room beneath the slab. When comparing the aforementioned definitions we can easily see that the operating conditions of the balcony slab and the terrace surface are completely different. They determine the choice of a particular technical-material solution.

Usually, the balcony is constructed as a cantilever. Therefore, the possible static designs are: beam-slab or cantilever slab. Less frequently one can see balconies which are suspended or supported with an adjoined construction (columns or walls). A common feature of all the balconies is that there are no rooms beneath them. This means that both the top and the bottom of the balcony are in contact with the ambient air.

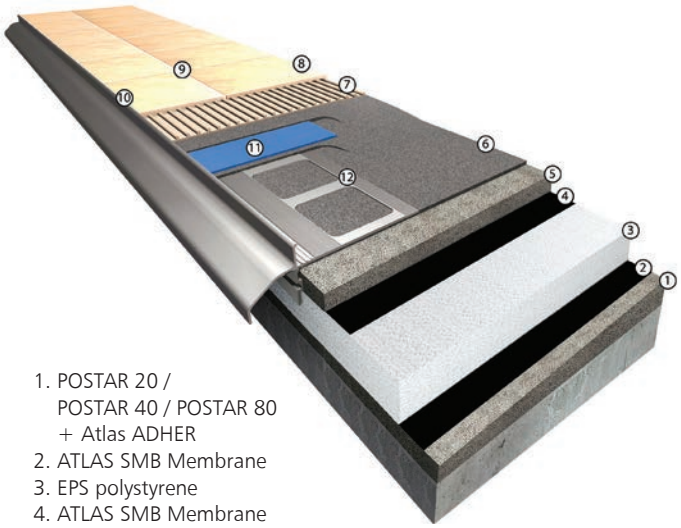
IF NOT A BALCONY, THEN WHAT...?

The concept of terrace is broader – basically we can distinguish overground and ground terraces. **An overground terrace** is simply a type of a flat roof over a part of a building. It is designed and constructed in the way enabling the residents to stay there. This issue requires the terrace slab to have appropriate load-bearing capacity. Therefore, an effective waterproofing, which protects the compartments located beneath the terrace, is essential. Moreover, it is also necessary to provide appropriate thermal insulation and vapour barrier against the ingress of the indoor water vapour into the partition.
One of the terrace variants is the, so-called **green terrace**, known also as the green roof. Another type of a terrace is a ground terrace, which is often used in recreational zones, since it goes well with holiday houses and gazebos (especially those constructed on sloped ground). Technically, the surface of such terrace is limited only by the parcel size and investor's financial capabilities.

Experience shows that in case of any surface damage or leaks, most contractors and investors blame poor quality of the materials used. One can hear about insulation materials which do not meet the quality standards, because first leaks occur already in springtime. Others say that tiles on a terrace are absolutely pointless as after maximum 2 years they will come off or break. Finally, some note that not until fourth attempt they found appropriate construction chemicals, because prior repairs with the use of other brands were ineffective. Naturally, such opinions, unsupported with actual analysis of the damage cause and the parameters of the materials used, can hardly be considered meaningful. Further consequences are frequent generalizations among professionals: "tiles do not work", "it is the best to lay gravel and plates", "drainage system does not work, because the mat silts up", etc.

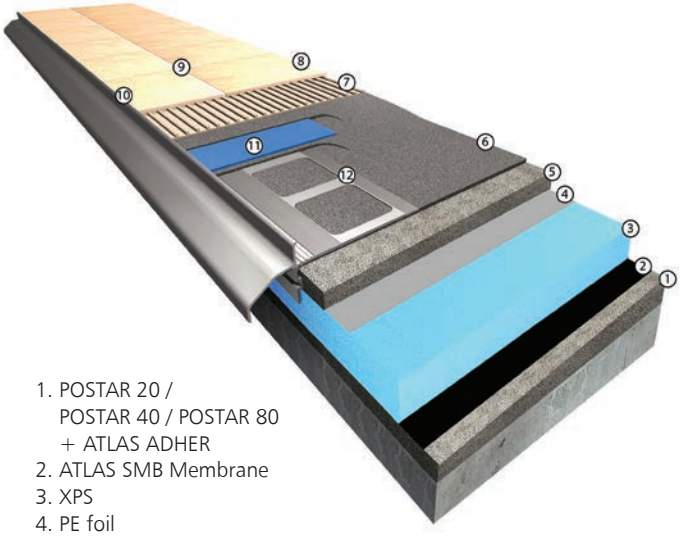
AT THE BEGINNING THERE WAS CHAOS ONLY

We should always antecede the correct design of a balcony, terrace or loggia with the following actions:



1. POSTAR 20 / POSTAR 40 / POSTAR 80 + Atlas ADHER
2. ATLAS SMB Membrane
3. EPS polystyrene
4. ATLAS SMB Membrane
5. POSTAR 20 / POSTAR 40 / POSTAR 80
6. ATLAS Woder Duo
7. ATLAS Plus Mega
8. Ceramic cladding
9. ATLAS Artis Grout
10. ATLAS Artis Silicone
11. ATLAS Hydroband 3G
12. ATLAS 150 main profile

Photo 1. Terrace layers arrangement, option A.



1. POSTAR 20 / POSTAR 40 / POSTAR 80 + ATLAS ADHER
2. ATLAS SMB Membrane
3. XPS
4. PE foil
5. POSTAR 20 / POSTAR 40 / POSTAR 80
6. ATLAS Woder Duo
7. ATLAS Plus Mega
8. Ceramic cladding
9. ATLAS Artis Grout
10. ATLAS Artis Silicone
11. ATLAS Hydroband 3G
12. ATLAS 150 main profile

Photo 2. Terrace layers arrangement, option B.

- precise definition of the functions they are to fulfill in the future,
- analysis of the structural design,
- determination of the loads and destructive factors (this means clear evaluation of the intensity of destructive factors),

Then, on this basis only we can choose technically appropriate material and construction solution (waterproofing course, thermal insulation, drainage and the top finish).
Another element which is equally important is the work execution consistent with the good building **practice**. Design and application must go hand in hand. Currently, the market is dominated by minimalism. It starts with the lack of comprehensive analysis of the phenomena occurring in the designed elements and ends with the omission of careful planning of project and construction details. Some contractors modify the system solutions on their own in order to cut costs – it is absolutely forbidden and in the worst case may lead to necessity of execution of repair works (which often require removal of all layers down to the construction slab) just after the next winter. Other effects may show up much later, though it does not mean they will be easy to remove.

SUCCESS GUARANTEED

Requirements which a terrace structure must meet are very extensive. We can distinguish two main factors leading to terrace destruction: water and thermal load. This allows to identify the requirements which an overground terrace must stand up to:

- Total tightness which prevents the penetration of rainwater into structure, despite the nature and type of the thermal load.
- The above is related to the capacity and efficiency of rainwater drainage beyond the terrace contour.
- This requires adequate construction and insulation of the eave profiles, gutters and downspouts (or drains if installed).
- It is necessary to fix the balustrade in a fully tight way, so the finishing layers (damp proofing and top finish) are not vulnerable to damages.
- Top coats must have the possibility of thermal moves compensating the stress resulting from temperature changes.
- The room beneath the terrace must be protected with the thermal insulation layer of appropriate thickness. In addition, the layer should be hard enough so it is not crushed by live loads.
- It is necessary to construct a layer of vapour barrier which blocks the possibility of water vapour ingress into the structure from the side of the room beneath the terrace.
- The top finishing coat should be aesthetic, easy to maintain, clean, appropriately protecting against sliding and resistant to washing.

In practice there are two technological-material solutions in use. The essence of the superficial water drainage is to apply the finishing coat (ceramic cladding) assuring full drainage of the rain-

water beyond the terrace. This imposes the execution of under-tile waterproofing which prevents the layers of terrace/balcony from damp ingress (Photo 1 and 2). On the other hand, the technology of the drainage system projects partial water penetration through the permeable layer (e.g. washed broken stone and drainage mat (Photo 3)) and its drainage beyond the terrace contour through special profiles with holes (Photo 4).

GOOD CHOICE

When you plan to build a house, you can buy a so-called typical design, which then must be adapted to the specific conditions by a qualified architect or order an individual design. In the first case it is usually an **architectural-structural design**, which is essential to obtain a building permit. Very often it either does not contain the detailed designs of balconies and terraces or it describes them very superficially. If you leave it without proper adjustments, it is possible that in future you will have to face time-consuming and costly problems with moisture. Therefore, this issue needs to be specified before the commencement of works.

In case of individual design we recommend the investor to cooperate with the architect in terms of balcony and terrace structural designs. Strange as it may sound, it allows the investor to save not only time and nerves, but also money. We should remember that the cost of proper execution of aforementioned elements is not low and it's the investor who pays for potential repairs. It all leads to the conclusion that we should choose the optimum **damp proofing system** (not individual materials) taking into account the thermal insulation already at the design stage. The appropriate design should provide adequate thermal comfort for residents of rooms located beneath the terrace. Moreover, it should protect against mould growth on the ceiling and on the adjacent wall parts. We cannot forget about the requirements on appropriate acoustic insulation and operational safety – the finishing top layer should be appropriately anti-slip.

SOLUTIONS IN PRACTICE

In most cases, when executing terraces in single- or multi-family housing we use the solution with tiles and surface water drainage. The drainage systems most often occur on balconies and terraces with encased balustrades and on terraces located on roofs. The comparison concerning typical thickness of the terrace and balcony layers (from the top of structural slab up to the top of the finishing layer) for the variant with composite insulation is shown in the Table 1.

The architect or structural designer should take into account the **height margin** for proper execution of all layers when designing structural elements such as ceiling or balcony/terrace slab. But it is not all. Layers thicknesses listed in the Table 1 concern the balcony/terrace layers only. In practice the door threshold must be higher due to the necessity of ensuring absolute tightness in this area, which does not exclude installation of barrier-less passes.

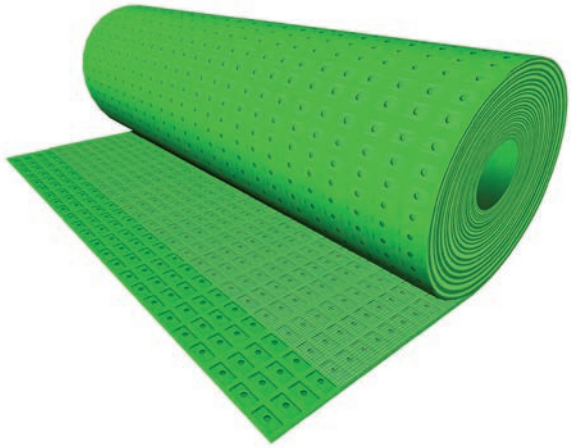


Photo 3. Atlas 630 drainage mat

Photo 4. Atlas 150 terrace profile

This is achieved by implementation of well-conceived and planned solutions at the execution stage of the project.

How to start works then? The first step is to choose the sealing concept, the type of the finishing layer and to design the construction (reciprocal level of ceiling structural slab in the room and the terrace/balcony slab and top floor in the room and a finishing layer on terrace/balcony), so the problem-free application of construction layers and water drainage are possible.

What materials should be used to execute the construction layers? What are the details to pay attention to? These are the questions which require the investor's answers not just before the commencement of application of terrace layers but at the concept stage. There the specific materials should be listed (if not by the names, then at least by the type of material and the most important parameters) and these materials only should be used then. The design must contain detailed drawings of so-called difficult and critical areas such as: zone and boundary expansion joints, inlets, railings, eaves, etc.

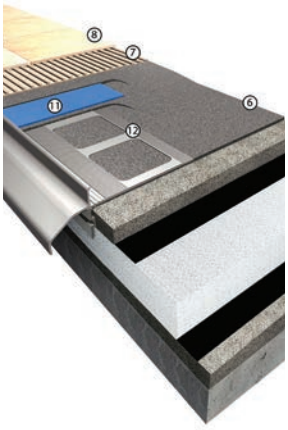
Table 1. Exemplary Arrangement of Balcony and Ground Terrace Layers in Various Configurations.

Layer	Material Type	Estimated Thickness
Exemplary Arrangement of Balcony and Ground Terrace Layers (from Top to Bottom) with Surface Water Drainage		
top finish	ceramic cladding	8 – 10 mm
adhesive	thin-coat C2 S1 or C2 S2 adhesive	usually from 4 mm
composite insulation	elastic mass	2 – 3 mm
slope layer	PCC mortar*	from 1 mm
	dry compound mixed with water at the construction site	depending on manufacturer's guidelines, usually from 10 mm
	mortar prepared at the construction site	from 30 mm
Exemplary Arrangement of Balcony and Ground Terrace Layers with Water Drainage System – Top Finish Made of Ceramic Tiles Fixed on the Drainage Mat		
top finish	ceramic cladding	8 – 10 mm
adhesive	thin-coat C2 S1 or C2 S2 adhesive	usually from 4 mm
drainage layer	drainage mat	1.5 – 2 cm
damp proofing	self-adhesive bitumen membrane	4 – 6 mm
	bitumen-polymer mass (KMB)	3 – 4 mm
	elastic mass (micro-mortar)	2 – 3 mm
slope layer	PCC mortar	from 1 mm
	dry compound mixed with water at the construction site	depending on manufacturer's guidelines, usually from 10 mm
	mortar prepared at the construction site	from 30 mm
Exemplary Arrangement of Terrace Layers (from Top to Bottom) over a Heated Room with Surface Water Drainage		
top finish	ceramic cladding	8 – 10 mm
adhesive	thin-coat C2 S1 or C2 S2 adhesive	usually from 4 mm
composite insulation	elastic mass	2 – 3 mm
pressure layer	cement screed	5 cm
separation layer**	plastic foil	0.5 mm
interlayer damp proofing **	polymer-bitumen membrane	4 – 8 mm
	self-adhesive bitumen membrane	4 – 6 mm
thermal insulation	XPS or EPS polystyrene	usually over 10 cm (according to the thermal and moisture calculations)
interlayer damp proofing	polymer-bitumen membrane	4 – 8 mm
	self-adhesive bitumen membrane	4 – 6 m
	bitumen-polymer mass (KMB)	3 - 4 mm
water vapour barrier	water vapour barrier membrane	4 mm
	self-adhesive bitumen membrane	2 – 3 mm
	vapour-barrier plastic foil	usually from 1 mm
	bitumen-polymer mass (KMB)	3 – 4 mm
slope layer	PCC mortar	from 1 mm
	dry compound mixed with water at the construction site	depending on manufacturer's guidelines, usually from 10 mm
	mortar prepared at the construction site	from 30 mm
Exemplary Arrangement of Overground Terrace Layers (from Top to Bottom) with Water Drainage in Traditional Arrangement – Top Finish Made of Ceramic Tiles Fixed on the Drainage Mat		
top finish	ceramic cladding	8 – 10 mm
adhesive	thin-coat C2 S1 or C2 S2 adhesive	usually from 4 mm
drainage layer	drainage mat	1.5 – 2 cm
damp proofing	polymer-bitumen membrane	4 – 8 mm
	self-adhesive bitumen membrane	4 – 6 mm
	bitumen-polymer mass (KMB)	3 – 4 mm
	elastic mass (micro-mortar)	2 – 3 mm
pressure layer	cement screed	5 cm
thermal insulation	XPS or EPS polystyrene	usually over 10 cm (according to the thermal and moisture calculations)
water vapour barrier	water vapour barrier membrane	4 mm
	self-adhesive bitumen membrane	2 – 3 mm
	vapour-barrier plastic foil	usually from 1 mm
	bitumen-polymer mass (KMB)	3 – 4 mm
slope layer	PCC mortar	from 1 mm
	dry compound mixed with water at the construction site	depends on manufacturer's guidelines, usually from 10 mm
	mortar prepared at the construction site	from 30 mm
Exemplary Arrangement of Overground Terrace Layers (from Top to Bottom) with Water Drainage in Reverse Arrangement – Top Finish Made of Concrete or Stone Plates on Washed Stone		
top finish	concrete plates	from 4 cm
	stone plates	from 2 cm
water permeable layer	washed aggregate	depends on aggregate, from approx. 3 cm for 2-8 mm aggregate, from 6 cm for thick aggregate (8-16 mm)
protective/protective-filtration layer	geotextile	0.5 mm
thermal insulation	XPS extruded polystyrene	usually over 10 cm (according to the thermal and moisture calculations)
drainage layer	drainage mat	1.5 – 2 cm
damp-proofing	polymer-bitumen membrane	4 – 8 mm
	self-adhesive bitumen membrane	4 – 6 mm
	bitumen-polymer mass ((KMB)	3 – 4 mm
slope layer	PCC mortar	from 1 mm
	dry compound mixed with water at the construction site	depends on manufacturer's guidelines, usually from 10 mm
	mortar prepared at the construction site	from 30 mm

* PCC – polymer-cement mortar for concrete repairs
** Selection between 5a/5b and 7a/7b variants cannot be rash – it results in certain consequences (details will be given in the following lessons)

LESSON 2

School of Terraces



In the second lesson of the "School of Terraces" we will focus on the layers arrangement in case of ground terrace finished with ceramic tiles. We will also list the details concerning the slope layer, water vapour barrier and thermal insulation.

IN THE FIRST LESSON WE LISTED BASIC DEFINITIONS CONCERNING THE TERRACE CONSTRUCTION AND RENOVATION. ADDITIONALLY, WE SHOWED TWO VARIANTS OF THE TERRACE LAYERS ARRANGEMENT WITH THE USE OF ATLAS PRODUCTS.

IN THE THIRD LESSON WE ARE GOING TO SHOW THE TECHNOLOGY OF INSULATION OF JOINT BETWEEN THE TERRACE SURFACE AND THE TERRACE DOOR. WE WILL ALSO DISCUSS THE EXECUTION OF CONSECUITVE TERRACE LAYERS.

The bottom layer of the terrace structure is **the structural slab**. It is a load-bearing element which bears both live load and terrace layers load. The slab is usually made of ferroconcrete. It must always be constructed according to the design documentation. Usually the slab is horizontal, therefore the appropriate slope must be formed. The minimum slope is 1%, the optimum one is from 1.5 up to 2%. Contrary to appearances, the slope layer is an important construction element and cannot be made of random materials or in a rash way.

MATERIALS

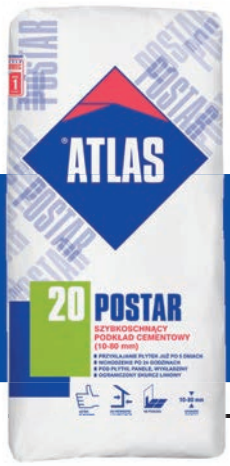
There are several materials which can be used for the slab construction and the selection of particular ones depends on two issues: **cost and necessary technological break**. Basically one should ensure appropriate substrate preparation and structural slab maturing. When executing the layers installation the concrete must already have the designed strength. It should be matured (min. 28 days) and dry (moisture content - 5-6 % by mass). The surface must be clean, stable and free of cracks. One should remove carefully the laitance, mortar, bricks or hollow blocks residues, loose and unbound elements or impurities.
One should use two types of mortars to form the slope layer:

1. Ready-to-use dry mortars to be mixed with water, designed for execution of bonded floors (in ATLAS offer: **cement screeds** Postar 20, Postar 40, Postar 80, Postar 100 or ATLAS ZW 330 leveling mortar);

2. PCC* mortars from the ferroconcrete repair system (in ATLAS offer: **mortars from Atlas Betoner** system: Adher – contact coat, Ender – repair layer, Filer – finishing coat)

The advantage of the ATLAS Betoner system is that with the use of ATLAS Ender mortar we can reduce the slope layer thickness almost "to zero". However, in case of large terrace surfaces and broad range of the slope layer thickness, one cannot apply the slope layer with ATLAS Ender mortar only. If the layer thickness exceeds 10 mm then one must apply ATLAS Filer mortar.

*PCC – polymer - cement repair mortars for concrete

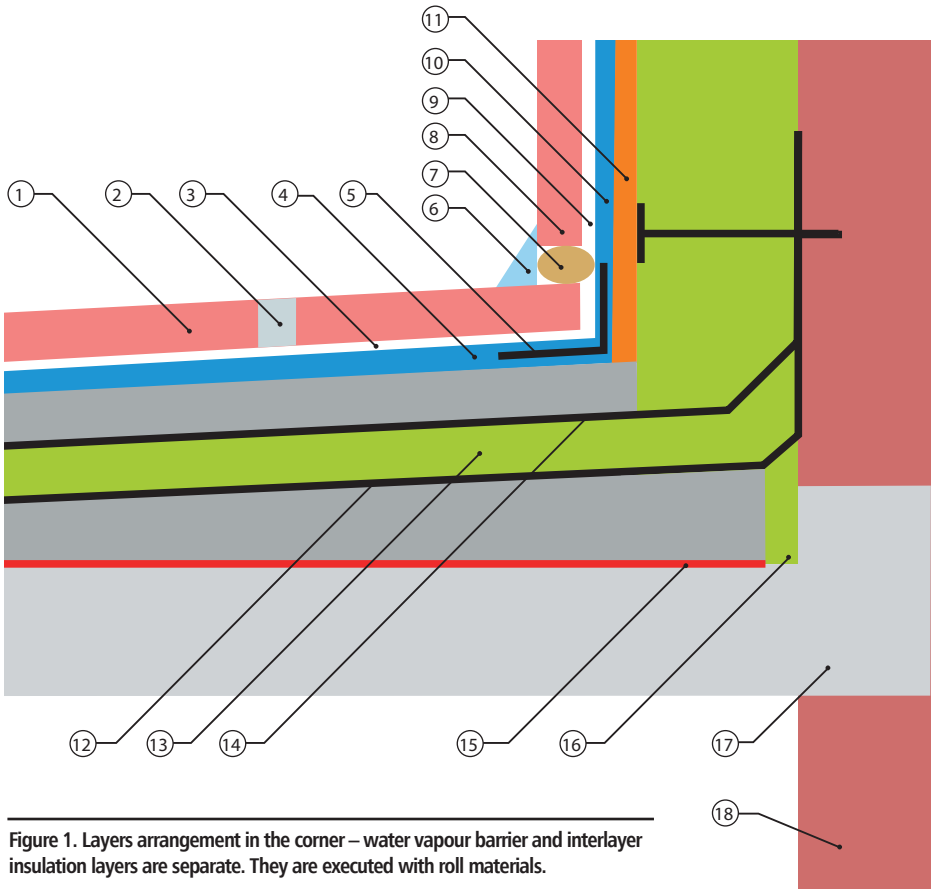


ATLAS POSTAR 20
fast-setting cement screed

Cement screed used under ceramic and stone tiles, PVC and carpet flooring, panels – recommended for any type of surfaces of medium and high load. Enables further works after already 5 days and foot traffic after 24 hours.

ATLAS ZW 330
fast-setting leveling mortar

Designed for repairs of construction substrates indoors and outdoors, under tiles, finishing coats, plasters, screeds. Enables to fill cracks, cavities and to level the substrate irregularities.



1. Ceramic tile
2. ATLAS Artis grout
3. ATLAS Plus Mega, ATLAS Plus or AVAL KM 17 adhesive
4. Surface sealing – ATLAS Woder Duo waterproofing
5. Sealing tape, e.g. ATLAS Hydroband 3G
6. Elastic silicone mass, e.g. ATLAS Artis
7. Backer rod
8. Ceramic tile on the plinth
9. ATLAS Plus or AVAL KM 17 adhesive
10. Plinth waterproofing – ATLAS Woder Duo elastic sealing mass
11. Plinth thermal insulation – fixed to the wall with adhesive and anchors and base coated
12. Water vapour barrier – ATLAS SMB self-adhesive bitumen membrane
13. Thermal insulation – polystyrene of min. EPS 200 class or XPS
14. Interlayer waterproofing –e.g. 2 x heat-welded membrane
15. Contact coat and slope layer (e.g. ATLAS Betoner system mortars)
16. Polystyrene strip
17. Ring beam and ceiling slab
18. Wall

Figure 1. Layers arrangement in the corner – water vapour barrier and interlayer insulation layers are separate. They are executed with roll materials.

The slope layer must always be executed on the contact coat. For mortars from Postar line it is formed by ATLAS Adher mortar, or alternatively: mixture of water, ATLAS Elastic Emulsion and dry mortar. The substrate surface must be wetted to the matt-wet state and then the contact coat material rubbed into the substrate with a brush or a paintbrush. The slope layer is applied with "wet on wet" method (when the contact coat still makes fingers dirty).

WATER VAPOUR BARRIER

The next layer is the water vapour barrier. It should be made of the material characterized by **as high as possible diffusion resistance** (it cannot be rashly replaced by other material). ATLAS SMB self-adhesive bitumen membrane is a perfect solution here. The upper edge of the membrane which is curled up onto the vertical surface should be mechanically fixed to the substrate, for example with pins and shims or with pressure lath.

The table attached to the first lesson of this brochure shows us that the water vapour barrier (SMB self-adhesive bitumen membrane in our case) may be the interlayer waterproofing. In such case the thermal insulation layer is covered with a separation foil. It works as the water vapour barrier only if the thermal insulation layer is covered with the interlayer waterproofing made of heat-welded polymer-bitumen membrane, e.g. Izolmat Plan PYE G200 S4.0.

ATLAS WODER DUO
two-component waterproofing

Recommended as under-tile waterproofing on terraces, balconies, in wet rooms and as foundation sealing. Forms damp proofing and waterproofing coats. Layer thickness: 2-3 mm, consumption approx. 1.5 kg/m²/1 mm.

ATLAS ADHER BETONER system contact coat

Provides appropriate adhesion of consecutive layer with the substrate. Does not cause reinforcement corrosion; very small linear contraction; high adhesion to concrete and steel.

Photo 1. Dampness of floor area caused by the errors in the waterproofing execution

DIFFERENCES BETWEEN VARIANTS

Actually the difference occurs only when the finishing coat **becomes damaged** (tiles + under-tile sealing mass). If the continuity of the under-tile waterproofing is interrupted then water can penetrate the terrace layers. Provided that the interlayer waterproofing is executed above the thermal insulation then usually the pressure layer is damaged only. On the other hand, if there is no interlayer waterproofing above the thermal insulation then water is stopped just at the slope layer level. The water vapour barrier is curled up onto the wall at least up to the top level of the thermal insulation. If it works as an interlayer insulation then it must be curled up onto the wall at least up to the level of the top finishing coat. Figure 1 shows the layers arrangement in the corner providing that the vapor barrier layer and interlayer are independent and made of roll materials (respectively SMB bitumen membrane and heat-welded membrane, e.g. offered by Izolmat). The roll materials **require forming** a wedge in the corner. The thermal insulation is placed on the water vapour barrier.

INSULATION OF TERRACE-WALL JOINT

The joint between terrace and wall is a critical detail for two reasons. Firstly, errors in the waterproofing execution may result in the floor area dampness (Photo 1). Secondly, it is a potential area of thermal bridging. Assuming that the wall adjoining the terrace is insulated with ATLAS ETICS system, the interlayer waterproofing, regardless its position (on slope layer or thermal insulation), must be curled up onto the wall (on the structural part, under polystyrene) and the under-tile waterproofing must be applied up on the base coat. The plinth should be slightly moved back (2-3 cm), which protects against washing by rainwater (Photo 2). In this area, due to the polystyrene reduced thickness, we recommend the use of thermal insulation material of higher thermal performance. The thermal insulation of the terrace surface and the adjacent wall must be **continuous**.

It imposes proper organization of work: if the interlayer waterproofing functions at the same time as the water vapour barrier (self-adhesive bitumen membrane) then it is placed on the structural slab (or slope layer) and curled up onto the wall. One should place the wedges in the corner instead of forming a cove. Next, one installs the thermal insulation of the plinth area, which must reach up to the water vapor barrier layer/interlayer waterproofing. Furthermore, it must be cut to wedge size, so the air void does not form (for this reason we do not form coves). The next stage is the **application of the thermal insulation of the terrace slab**.

The joint between terrace and wall is a critical detail for two reasons. Firstly, errors in the waterproofing execution may result in the floor area dampness. Secondly, it is a potential area of thermal bridging.

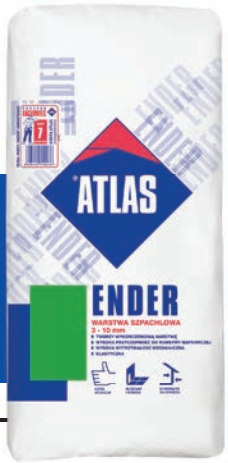
The reverse layers arrangement is feasible as well: first the terrace thermal insulation is applied – it must be moved to the wall and cut so it adjoins the wedge. Then, one carries out the thermal insulation of the plinth area.

ATLAS FILER
BETONER system
repair layer

Enables to level the substrate irregularities – both in case of local unevenness and entire surface repairs. Consumption: approx. 20 kg/1 m²/10 mm, layer thickness: 10-50 mm, very high compressive strength: min. 43 N/mm².

ATLAS ENDER
BETONER system
finishing coat

Forms the outer, finishing coat of the previously leveled and formed surface. Elastic, of high compressive strength: min. 19 N/mm², efficient (approx. 2 kg/1 m²/1 mm).



1. Wall
2. Adhesive for thermal insulation
3. Plinth thermal insulation
4. Thermal insulation base coat
5. Plinth waterproofing - ATLAS Woder Duo
6. ATLAS Plus or AVAL KM 17 adhesive
7. Plinth tile
8. Façade rendering
9. Wall thermal insulation
10. Base track with drip
11. Elastic silicone mass, e.g. ATLAS Artis
12. Backer rod

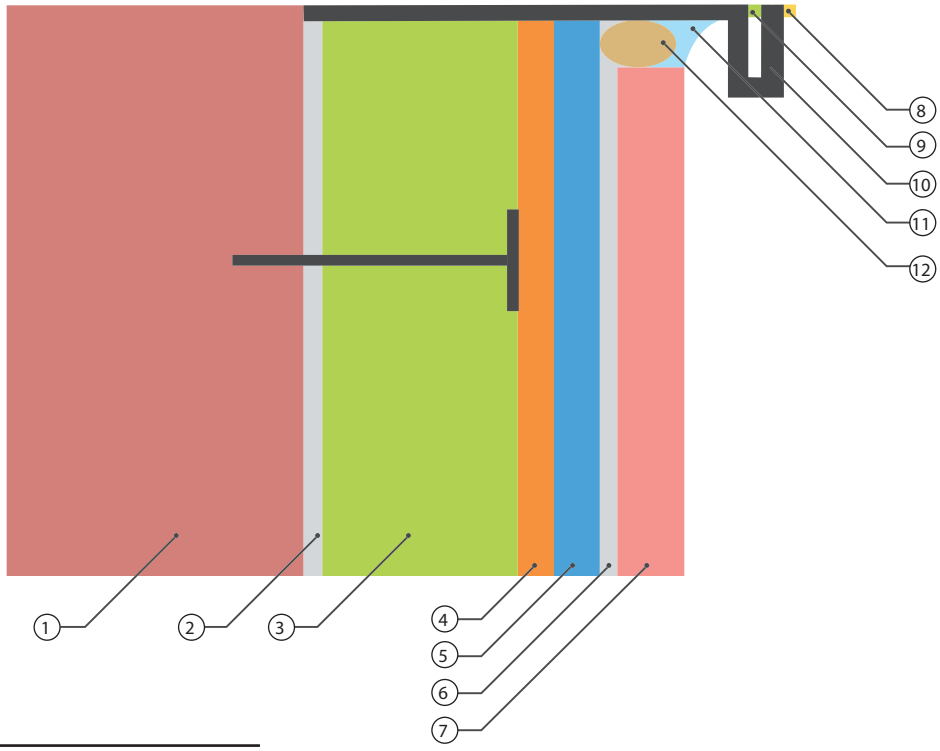
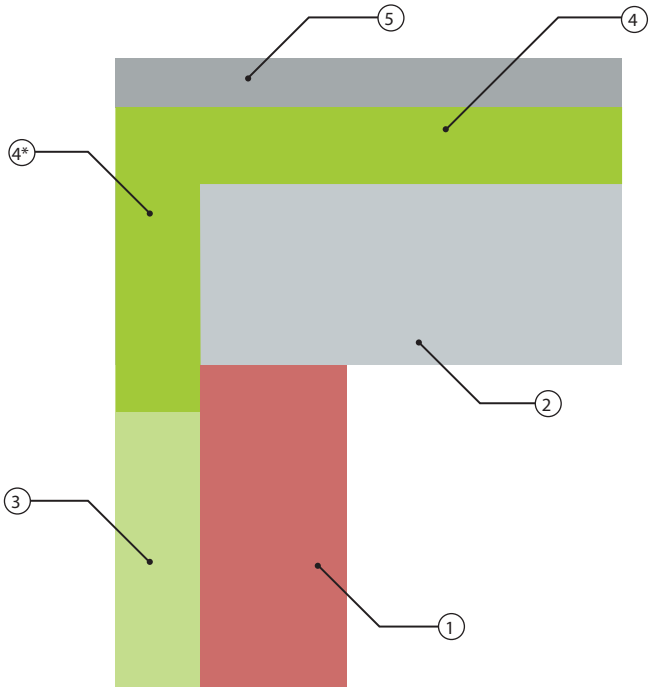


Figure 2. Set back of the plinth prevents from soaking by rainwater



1. Wall
2. Ceiling
3. Wall thermal insulation
4. Terrace thermal insulation – min. EPS 200 or XPS

4*. Thermal insulation of the wall strip under the eave – min. EPS 200 or XPS

5. Pressure cement screed

Figure 3. Vertical insulation strip, installed before the terrace thermal insulation, must be of the same material as the horizontal surface insulation (XPS or hard EPS)

The works execution is similar if the interlayer insulation is applied on the thermal insulation, provided that the interlayer insulation is curled up onto the structural part of the wall.

THERMAL INSULATION

Having applied the water vapour barrier, one should fix **the thermal insulation** boards and remember about keeping the proper work order at the area of the wall-floor joint. The thermal insulation thickness and type is determined by the technical documentation (usually it is 15 cm or more). It does not only refer to the U-value coefficient, but also aims to avoid the interlayer and surface condensation. One can firstly notice the fungi growth in the area where at least two linear thermal bridges meet (e.g. wall-ceiling joint, room corner). Thus, it is significant to provide proper thermal **insulation of external** walls of rooms under the terrace as well as walls above the terrace surface. Note that these are not all crucial parameters. Each thermal insulation material is characterized with little **compressibility**. For this reason, one should use XPS (best choice, but expensive), EPS 250 (recommended) or EPS 200 (barely sufficient) when applying the terrace thermal insulation layer. Use of XPS provides one additional advantage: standard façade EPS is an absorbent material, therefore if it gets wet in result of the terrace surface damage then it loses its insulating characteristic. In the eave zone, directly beneath the surface thermal insulation, one should apply a vertical strip of insulation (1 board) using the same material as for the horizontal surface (XPS or hard EPS) (Figure 3).

LESSON 3

School of Terraces

In this lesson of the "School of Terraces" you will learn more about the interlayer insulation, expansion joints and terrace zones requiring special attention – balustrades and inlets.

IN THE SECOND LESSON WE DESCRIBED THE ARRANGEMENT OF GROUND TERRACE LAYERS AND TOP LAYER MADE OF TILES. WE ALSO DISCUSSED THE SLOPE LAYER, WATER VAPOUR BARRIER AND THERMAL INSULATION WITH THE USE OF ATLAS PRODUCTS.

IN THE FOURTH LESSON WE WILL FOCUS ON FREQUENT ERRORS RESULTING FROM IMPROPER CONSTRUCTION PROJECT EXECUTION.

If we apply interlayer waterproofing on **the thermal insulation**, the optimum solution is to use two layers of heat-welded membrane, e.g. Izolmat Plan PYE G200 S4.0 + Izolmat Plan PYE PV 250 S5.0. The first membrane layer is applied directly on the thermal insulation (without heat-welding). Next, the second membrane layer is heat-welded with the first one. It is crucial to curl up the membrane onto the structural part of the wall up to the level enabling its fixing. In practice, this is at least 15 cm above the tiles surface.

If we choose the solution with **separation layer**, then we execute the layer with a plastic foil. One should not use foil thinner than 0.2 mm as it's very vulnerable to potential mechanical damage. It is recommended to use a foil at least 0.3 - 0.4 mm thick.

The pressure layer is made of mortars, e.g. ATLAS Postar 20, Postar 40 or Postar 80. The compressive strength of such screed must not be lower than 20 MPa (25 MPa is recommended). ATLAS mortars of Postar line comply with this requirement. The recommended thickness of the pressure layer is 5 cm, and the minimum one is 4 cm.

EXPANSION JOINTS

TYPES OF EXPANSION JOINTS:

- construction joints – they cross all the buildings elements. Their location, width and construction are given in the design documentation.
- isolation joints (peripheral, edge) – they separate terrace layers from the adjacent elements, such as walls or columns.
- control joints (intermediate) – they divide the surface into smaller areas to compensate thermal deformation. The width of control and isolation expansion joints should exceed 10 mm.
- assembly joints – they separate the surface from elements such as inlets and balustrade railing. Their width should vary between 5 and 10 mm.

Expansion joints in the screed layer must strictly reflect the expansion joints in the ceramic cladding. Therefore, they shall be considered together. Control expansion joints go through waterproofing (under-tile) and both aforementioned layers. They must overlap and be of the same width. One must not cover these expansion joints with tiles as they will definitely crack.

The spacing between the expansion joints on terraces and balconies should not exceed 3 m, assuming that the maximum size of an area without division does not exceed 5 m^2. The optimum shape of an area separated with expansion joints is a square. In other situations, one should try to design the area sides as even as possible so their length ratio is not greater than 2:1. One should apply expansion joints also wherever the surface direction changes.

WHAT TO AVOID?

Why the proper execution of the pressure screed is of such great importance? It is due to the fact that any potential errors may lead to damages or even complete failure of waterproofing and ceramic cladding. A very common mistake which used to and actually is still made, is the application of the pressure screed made of mortar prepared in an old-style way on site. This type of mortar must have good spreading abilities (high water/cement ratio), which results in low resistance, significant setting contraction and surface dusting. In addition, the thickness of such layer is usually 2.5-3 cm. The screed of such thickness definitely cannot operate well.

What are the possible results of these errors? **Expansion joints compensate thermal and contraction deformations, so lack of them results in tensions and uncontrolled damages of screed, tiles and within the joints**. Furthermore, terrace layers must bear deformations resulting from loads influencing the structure. Improper arrangement or lack of expansion joints causes the intensification of damaging factors and finally leads to a major damage of the top finish and the screed.

SCREED APPLICATION

So, how should one execute the screed and its critical details? Let's start with the screed then. If we choose a factory made dry mix, which is mixed with clean water on site, it is advisable to select quick drying, fast-setting mortars, e.g. ATLAS Postar 20 or ATLAS Postar 80. These materials enable, similarly to the slope layer, quick execution of further works.

If we use concrete or on-site mortars based on regular cement to install the pressure layer, then we need to stabilize them for at least 3-4 weeks before the execution of further works.

It is crucial to make the screed surface even and to keep the previously moulded slope. Any irregularities may cause future problems with the water drainage. In extreme cases, it may lead to formation of puddles. Hence, the surface must be polished to get smooth. Additionally, the screed needs to be of air-dry state (maximum moisture content – 4-5% of mass) before commencing further works.

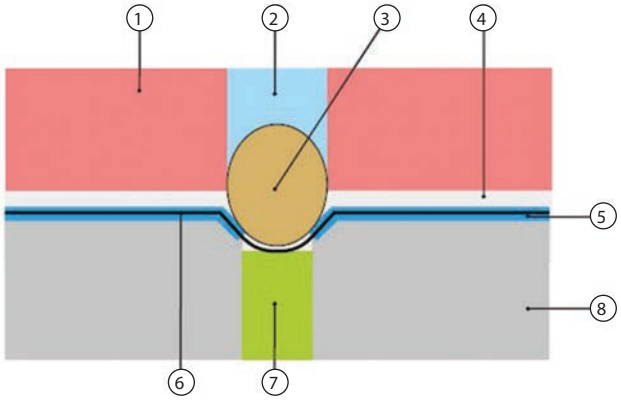


Fig. 1. Terrace above a heated room: control expansion joint in the ceramic cladding; top layer of ceramic tiles.

1. Ceramic tile
2. Elastic silicone mass, e.g. ATLAS Artis
3. Backer rod
4. Adhesive for tiles: ATLAS Plus Mega, ATLAS Plus or Aval KM 17
5. Flexible waterproofing ATLAS Woder Duo
6. Sealing tape, e.g. ATLAS Hydroband 3G
7. Joint filling (polystyrene strip)
8. Pressure screed, e.g. ATLAS Postar 80

The easiest way to execute the control expansion joint is to fill the joint with a polystyrene strip of appropriate width (Fig. 1). After the screed application, one should apply the base coat on the wall at the plinth area. It forms the substrate for the subsequent layer – the plinth insulation.

WATERPROOFING

The expansion joint is waterproofed with a tape embedded in the ATLAS Woder Duo mortar. One should apply a layer of waterproofing on the screed edge, next to the expansion joint. Then place the tape edge (e.g. ATLAS Hydroband 3G), embed it in the freshly applied waterproofing using a float or a trowel and then coat the embedded edge, starting from the top immediately after. The tape should be arranged in the shape of an omega (Ω). The aperture is to be filled with a backer rod. Next, the opposite edge of the tape should be fixed in the analogous manner (Fig. 1).

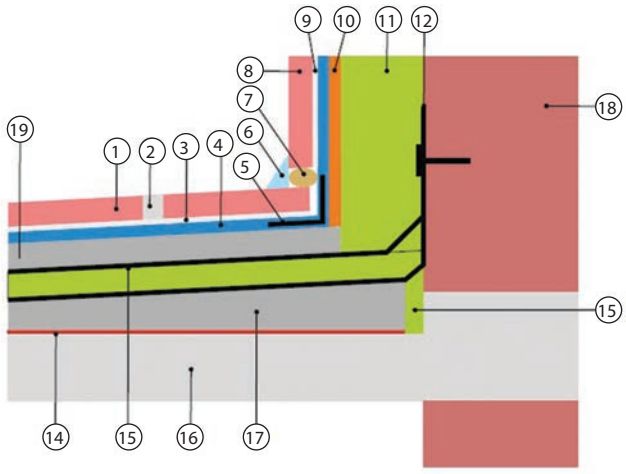


Fig. 2. Isolation expansion joint in terrace surface over a heated room – top layer of ceramic tiles

1. Ceramic tile
2. ATLAS Artis grout
3. Adhesive for tiles: ATLAS Plus Mega, ATLAS Plus or Aval KM 17
4. Elastic waterproofing – ATLAS Woder Duo
5. Sealing tape, e.g. ATLAS Hydroband 3G
6. Elastic silicone mass, e.g. ATLAS Artis
7. Backer rod
8. Plinth tile
9. Adhesive for tiles – ATLAS Plus or Aval KM 17
10. Thermal insulation base coat
11. Water vapour barrier – ATLAS SMB self-adhesive bitumen membrane
12. Thermal insulation: min. EPS 200 or XPS
13. Interlayer waterproofing, e.g. Izolmat Plan PYE G200 S4.0 heat-welded membrane + Izolmat Plan PYE PV250 S5.0
14. Contact coat: ATLAS Adher or ATLAS Elastic Emultion + mortar
15. Polystyrene strip
16. Structural slab
17. Slope layer, e.g.: ATLAS Postar 80 or ATLAS Filer
18. Wall
19. Pressure screed, e.g. ATLAS Postar 80

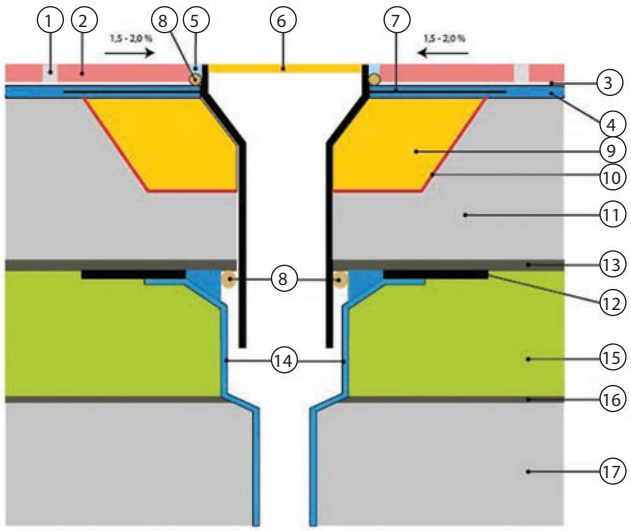


Fig. 3 Mounting and sealing a point floor inlet in a terrace slab over a heated room – top layer of ceramic tiles.

1. ATLAS Artis grout
2. Ceramic tile
3. Adhesive for tiles: ATLAS Plus Mega, ATLAS Plus or Aval KM 17
4. Elastic waterproofing – ATLAS Woder Duo
5. Elastic silicone mass, e.g. ATLAS Artis
6. Floor inlet (upper part)
7. System inlet sleeve
8. Backer rod
9. PCC ATLAS Filer mortar
10. Contact coat – ATLAS Adher
11. Pressure screed, e.g. ATLAS Postar 80
12. Bitumen sealing sleeve
13. Interlayer waterproofing, e.g. Izolmat Plan PYE G200 S4.0 heat-welded membrane + Izolmat Plan PYE PV250 S5.0
14. Floor inlet (lower part)
15. Thermal insulation: min. EPS 200 or XPS
16. Water vapour barrier – ATLAS SMB self-adhesive bitumen membrane
17. Structural slab with slope (Slope layer, e.g.: ATLAS Postar 80 or ATLAS Filer)

The diameter of a backer rod should be 20-30% larger than the width of an aperture. The tapes are bonded together with the use of the waterproofing mass. They should not be divided unnecessarily. In order to seal the corners, one should use the prefabricated profiles.

One should also be careful while applying the isolation expansion joints (Fig. 2). The joint with a wall is also sealed with the combination of the sealing tape and the elastic waterproofing mass.

INLETS AND BALUSTRADE

When assembling a balustrade one should try to avoid puncturing the waterproofing (so the balustrade is assembled on the side or underside of the slab).

There are two basic principles related to the selection and installation of floor inlets:

1 Use only the floor inlets with a system sleeve which can be embedded in the waterproofing mass (or other type of bonded sealant).

2 Floor inlet should be installed with the use of the polymer-cement (ATLAS Betoner system) or assembly mortar (ATLAS Monter type mortars). The detail of the floor inlet waterproofing is shown in Figure 3.

Posts can be an issue in case of renovated terraces. It often happens that the decision on replacing the post is made when the top layer is already finished (sometimes even after waterproofing and tiling works). There are usually two reasons for the replacement: poor technical condition of the anchors or change of the usage concept (moving the railing to other location).

Therefore, it is necessary to use base plates to which the railing/balustrade posts (or special connectors) are welded. Base plates are steel sheets of rectangular shape and side length of not more than twenty centimeters. They are attached to the substrate (pressure screed) with dowels. A base plate needs to be protected against corrosion and assembled in the substrate. The horizontal part of base plate and the bottom part of the post should be protected with ATLAS Woder Duo waterproofing. In addition, a joint between the cement substrate and the base plate needs to be sealed with the sealing tape, e.g. ATLAS Hydroband 3G (Fig. 4). Hoever, this solution is not always feasible due to the thickness of the screed and the size of the base plate.

ATLAS HYDROBAND 3G

- Protects the substrate against water and moisture ingress. It is applied in combination with the under-tile waterproofing mass: ATLAS Woder E, Aval KL 51, ATLAS Woder W, ATLAS Woder Duo or ATLAS Woder S.
- Increases the tightness at areas where waterproofing made of ATLAS Woder products is not sufficient – especially in wet and damp room corners, along the joints of walls and floors, along the expansion joints.

ATLAS WODER DUO

- Material recommended for under-tile waterproofing of terraces, balconies, wet rooms and for foundations sealing.
- Forms light-, medium- and heavy weight type of damp proofing or waterproofing.
- Forms protective layer against pressurized water or infiltrating water, banking up or not banking up water, against unpressurised water.
- For indoor and outdoor use.

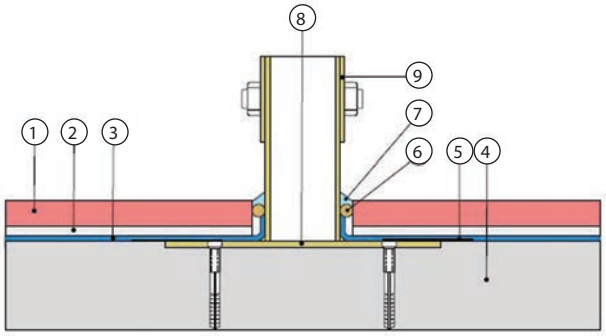


Fig. 4. The method of assembling and sealing the railing when repairing a terrace – top layer of ceramic tiles.

1. Ceramic tile
2. Adhesive for tiles: ATLAS Plus Mega, ATLAS Plus, Aval KM 17
3. Elastic waterproofing – ATLAS Woder Duo
4. Pressure screed
5. Sealing tape, e.g. ATLAS Hydroband 3G
6. Backer rod
7. Elastic silicone mass, e.g. ATLAS Artis
8. Steel base plate for assembling the railing post (protected against corrosion)
9. Steel railing post (protected against corrosion)

DOOR THRESHOLD

In order to ensure complete sealing in the area of the door threshold, one must provide appropriate connection between the waterproofing coat and the door/window frame or assembly profile. Thus, suitable height margin becomes crucial. Additionally, the threshold execution can result from the method of the frame installation. An example of the door threshold sealing is shown in the Figure 5.

PROTECTIVE LAYER MADE OF TILES

Technically, the arrangement with superficial water drainage (combined sealing) imposes the use of tiles as a top layer. Combined waterproofing (known also as "under-tile" waterproofing) got its name from the fact that the waterproofing coat is covered with ceramic tiles – they form the protective layer at the same time.

The first stage consists in sealing the control and isolation expansion joints with the use of ATLAS or ATLAS Hydroband 3G sealing tapes and profiles (Fig. 1). Then, ATLAS Woder Duo under-tile waterproofing is to be applied over the entire surface. The first layer of the mass is applied with a brush and strongly rubbed into the substrate – so as to close and fill the existing pores. This increases the adhesion of the coating with the substrate. The next layer may be applied with a brush, a roller or a trowel but only when the first layer dries completely (not earlier than after approx. 3 hours). The thickness of the waterproofing coat should be at least 2 mm.

Tiles should be fixed onto already bonded waterproofing. We strongly recommend to use ATLAS Plus Mega adhesive as it is a pourable product and provides full support of the cladding. Alternatively, one can use ATLAS Plus or Aval KM 17 adhesive. In this case the adhesive must be applied both onto the tile and the substrate. Tiles which are fixed on the plinth must be placed at least 5 mm above the horizontal tiles. Joints width cannot be smaller than 5 mm. In case of 30 cm x 30 cm tiles, the joint should be 7-8 mm wide and filled with ATLAS Artis grout. The expansion joint should be filled with a backer rod (of a diameter approx. 20-30% larger than the width of joints) first and then filled completely with a silicone mass, e.g. ATLAS Artis silicone.

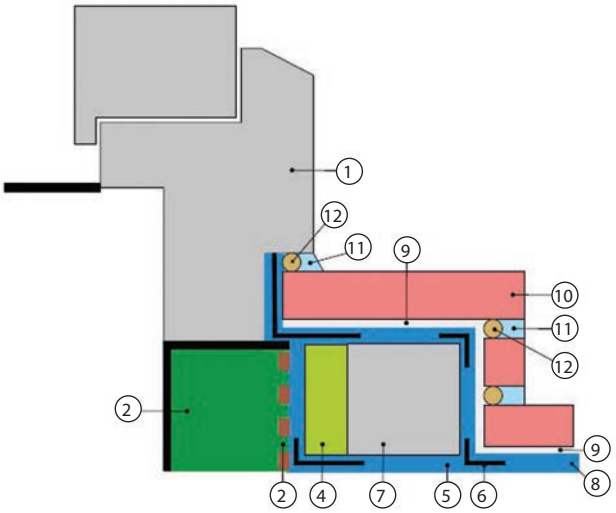
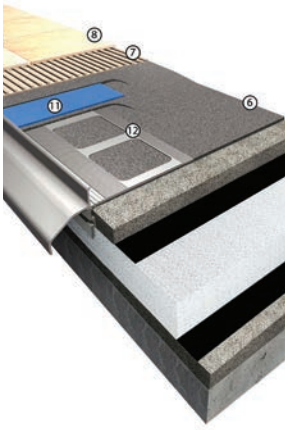


Fig. 5. Sealing the door frame threshold on a terrace or a balcony

1. Door/window frame
2. Base profile/frame wall base
3. Substrate preparation (optionally; depends on the method of the frame installation)
4. Polystyrene strip
5. ATLAS butyl tape
6. Sealing tape, e.g. ATLAS Hydroband 3G
7. Concrete block fixed to the substrate with an adhesive mortar
8. Elastic waterproofing – ATLAS Woder Duo
9. Adhesive for tiles: ATLAS Plus Mega, ATLAS Plus, Aval KM 17 (ATLAS Plus or Aval KM 17 required on vertical surfaces)
10. Ceramic tile
11. Elastic silicone mass, e.g. ATLAS Artis
12. Backer rod

LESSON 4

School of Terraces



Terrace is an architectural element which needs to be constructed very precisely. The slightest mistake, sooner or later leads to a failure and results in destructive processes which negatively impact the terrace structure.

IT IS THE LAST LESSON OF THE SCHOOL OF TERRACES. IN THE THIRD LESSON WE DISCUSSED THE PROPER WATERPROOFING OF JOINTS BETWEEN THE TERRACE STRUCTURE AND THE TERRACE DOOR. ADDITIONALLY, WE DESCRIBED THE INSTALLATION OF THE CONSECUTIVE TERRACE LAYERS.

IF YOU HAVE ANY QUESTIONS DO NOT HESITATE TO CONTACT ATLAS EXPORT DEPARTMENT: export@atlas.com.pl OR OUR TECHNICAL ADVISOR pmarciniak@atlas.com.pl.

Any mistake, even the smallest one, in the terrace design or execution results in serious damages. It's just a matter of time. Furthermore, mistakes resulting from improper maintenance lead to destructive processes which impact the terrace structure. It is not easy to list all the mistakes which can be made in the design, execution or terrace maintenance, but at least we can observe some common ones. The mistakes made in the design documentation (or in the given technology) are usually repeated in the execution stage. This usually results in the intensification of destructive processes. Moreover, there is renovation needed already in the first year of the operation. Sometimes the repair is necessary even before the investor starts the terrace use (if the construction process is extended in time). Many mistakes are made when altering materials or trying to reduce the costs. Uncritical change of certain products to other cheaper ones is the main reason of destructive processes. It is not because the substitute is cheaper, but because it does not meet the required parameters.

Among main maintenance mistakes we may list: lack of regular service or minor repairs (if required). As an example, the flashing is teared in the result of mechanical damage. During a longer period of time this small defect can lead to massive negative results. Sometimes it is even necessary to tear off the wall insulation under the plinth.

MISTAKES IN DESIGN AND EXECUTION OF TERRACE/BALCONY

AT THE STAGE OF EXECUTION

- Deviations from a properly developed design.
- Execution which is not in accordance with the principles of technical knowledge and technical conditions.
- Use of low quality materials.
- Insufficient evaluation and preparation of the substrate.
- Insufficient installation and sealing of the expansion joints, flashings and similar details.
- Not keeping technical and technological regimes during preparation and application of materials.
- Ignoring atmospheric conditions, such as temperature, humidity, etc., during application.
- Shortening the time of technological breaks, stabilizing and maturing of particular partition layers.
- Desire to reduce the execution costs by limiting some system layers or reducing their thicknesses.
- Lack of sufficient supervision and acceptance of installation of layers which are then covered with top finishes.

AT THE STAGE OF OPERATION

- Overload of structural elements.
- Excessive overload of balustrades.
- Secondary installation of machinery or equipment causing damage to the partition layers, especially waterproofing.
- Lack of mandatory periodic inspections of the technical condition of outdoor elements.
- Lack of on-going repairs or maintenance.

Repair or remove?

When can we retain some terrace structure layers, and when is it necessary to install them again? Most of all, one should follow a basic principle first: remove any mistakenly executed layers which cannot be repaired. We must understand what repair means here – namely, it means forming the surface in a correct way (size, shape, thickness, functions, etc.), so it meets the requirements of the good building practice and it may work well with the new structure layers.

ANALYSIS OF RESULTS OF SOME MISTAKES


1

LACK OF EXPANSION JOINTS = TILES DAMAGE

Critical zone: top layer made of tiles.
Problem: damage to the terrace top layer.
Reason: lack of expansion joints or too small spacing between them (execution contrary to the principles of technical knowledge and technical conditions).
Solution: Appropriate expansion joints must be implemented obligatorily. If there are no expansion joints or there is too small spacing between them, a terrace is subject to intensive loads. This is due to the forces resulting from thermal movements which influence the terrace structure. To imagine how immense they are, let's suppose that the expansion joints keep 2 m spacing . The daily change in the length of this screed section is approx. 1.1 mm (with temperature change from: +20°C at night to +70°C in sunlight). To prevent a 1 m wide and 5 cm thick screed strip from becoming longer, we would need to load it with 84 tons. It represents the force with which the screed impacts the adjacent elements (e.g. railings) when the expansion joint is not properly executed. If we make a mistake and execute the expansion joints with, e.g. 6 metres spacing, then the change of the expansion joint width is 3.3 mm. The result we can see in the picture no. 1. Note that the repair technology must be adjusted to the specific situation.

INCORRECT MOUNTING = LEAKS

Critical zone: eave.
Problem: damage to the tiles, leaks.
Reason: unstable installation of the flashing, too deep insertion beneath the tiles, no adhesion between the waterproofing and the flashing (failure to abide technological regimes during the preparation and application of materials). The result is shown in pictures 2 and 3.
Solution: Application of ATLAS system eave profiles.


2


3

INCORRECT SELECTION OF WATERPROOFING = CORROSION

Critical zone: flashings.
Problem: corrosion.
Reason: incorrect selection of waterproofing, metal sheet, improper mounting (failure to abide technological regimes during the preparation and application of materials).
Solution: When discussing the flashings, one should understand the word "system" as an accurate selection of waterproofing, metal sheet and its installation method in order to avoid mutual destructive impact. The consequences can be seen in the picture no. 4. Therefore, the best solution is to use system profiles combined with ATLAS Woder Duo – flexible waterproofing which does not cause corrosion when using certain types of metal sheet


4

THOUGHTLESSLY EXECUTED EXPANSION JOINT ON THE EDGE = LEAK

Critical zone: plinth.
Problem: lack of tightness.
Reason: incorrect execution of the expansion joint on the edge (implementation contrary to the principles of technical knowledge and technical conditions).
Solution: In the picture no. 5 we can see the interlayer, bath-like insulation made of heat-welded roofing membrane placed over the screed surface and fixed onto the walls. Technically, sealing this zone is impossible. If the terrace surface is supposed to be tight then the joint between the slab and the wall must be tight as well. But, what material may be combined with this form of waterproofing in order to ensure absolutely secure and tight sealing in case of such membrane fixing? With which material should we finish, protect, cover or seal the protruding part of the membrane? How to execute the expansion joint on the edge in such situation? One should consider it before the work commencement.


5

Repair of the terrace is possible only if one:
- removes all the layers until reaches the structural slab,
- reconstruct the entire terrace in accordance with the rules of the building practice (and common sense), providing proper order of works in the plinth area, use of compatible, considered, systematic construction and material solutions.

POOR QUALITY OF METAL SHEET = CORROSION

Critical zone: coated metal sheet.
Problem: corrosion.
Reason: the flashing resistance against corrosion resulting from the atmospheric conditions was not checked before use.
Solution: To avoid such situation (picture no. 6), we need to check the corrosion resistance of the flashing first. The declaration of performance and/or the declaration of conformity are the manufacturer's official documents which include the parameters, properties and range of use. They often specify the environment corrosivity category of the metal sheet resistance (with symbols from C1 to C5, respectively from very small to very big – EN ISO 12944-2: 1998 Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments). This applies to the weather conditions only, but says nothing about the resistance to other aggressive factors. The best solution is to use ATLAS terrace system profiles resistant to this type of environmental risks.

TWO-COMPONENT WATERPROOFING ATLAS WODER DUO

Recommended as under-tile waterproofing of terraces, balconies, wet rooms and for foundations sealing.
Forms damp proofing and waterproofing – light-, medium-or heavy weight type.
Flexible – bridges scratches and cracks up to 1 mm wide.
Reinforced with polymer fibres
Resistant to negative water pressure

Consumption:
1.5 kg/m²
(coat thickness - 1.5 mm)
Packages: 16 kg, 32 kg


6

AIR VOID = CONDENSATE DROPS

Critical zone: window and door frames.
Problem: flow of condensate drops from underneath the window and door frames (picture no. 7); moisture in the next to the door zone. The building was insulated with the polystyrene-based system, while the balconies were insulated from both sides.
Reason: the air void at the joint between the terrace structure and the thermal insulation results in the moisture condensation (failure to abide the building principles, indolence, lack of supervision).
Solution: the original repair included application of the waterproofing and fixing the tiles on the existing layer of tiles. As it did not solve the problem, one decided to remove the tiles, apply the waterproofing and fix the tiles. Neither this solution was effective. Only comprehensive diagnostics including outcrops revealed the air voids at the joint between the balcony structure and the thermal insulation layer, both at the top and bottom of the balcony structure (picture no. 8).

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7


8

Keep this in mind and avoid defects...

There are many results of mistakes in execution which may arise during renovation and construction works on terraces and balconies. They mostly include: tiles which come off, cracks in the structural slab, leakage of water into the rooms located beneath, wall dampness in the room adjacent to the terrace. Thus, not only the correct design and execution of terrace layers are of great importance, but also the use of quality materials and proper execution of details. Another crucial issue is the determination of loads and potential destructive factors. If all the above is taken into account during the construction or renovation, then we can be sure that we avoid many faults which may occur during terrace use.

CHECK OTHER BROCHURES ABOUT ATLAS TECHNOLOGY:

MAKE IT BONE DRY

WATERPROOFING SYSTEMS

ATLAS WODER DUO

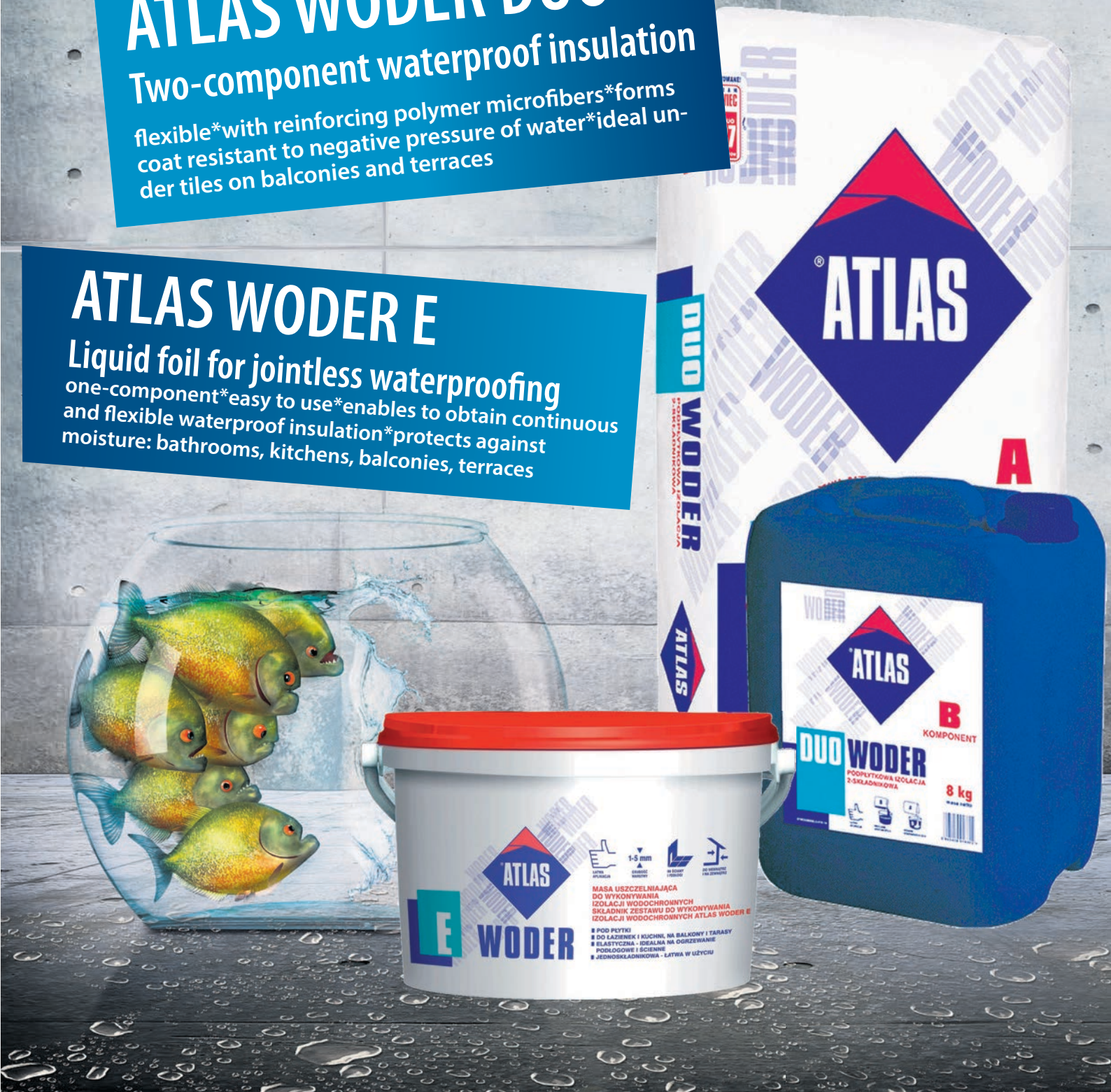
Two-component waterproof insulation

flexible*with reinforcing polymer microfibers*forms coat resistant to negative pressure of water*ideal under tiles on balconies and terraces

ATLAS WODER E

Liquid foil for jointless waterproofing

one-component*easy to use*enables to obtain continuous and flexible waterproof insulation*protects against moisture: bathrooms, kitchens, balconies, terraces



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