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WATERPROOFING REHABILITATION OF PLATFORM ROOFS

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Abstract. Constructions need to be protected against moisture in the roof area to avoid the penetration of water in the internal areas and to protect the structural and non-structural components against possible damage. In time, people have looked for solutions to protect the structural components of buildings. Waterproofing solutions preserve the wholeness of the constructions, are useful to understand the nature of the forces acting upon constructions as well as their effect upon the buildings life cycle. Beginning with the years ’80-’90 , it become obviously necessary to rehabilitate significant surfaces from platform roofs, but unfortunately, in most cases, the rehabilitation works were limited to local repairs of the damaged areas, while still preserving the initial constructive system. In waterproofing works, provisions concerning the constructive structure of the component elements and waterproofing materials should be observed in order to reach performance requirements. Good waterproofing provides durability to building elements, blocks immediate and long term degradations that can be due to defects in design, erection or service.

Keywords: construction; infiltrations; hydroinsulation; degradation; prevention.

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1. Introduction

The platform roof constitutes a complex structure dedicated to the full building protection against water infiltration coming from rain and moisture penetrating the structure, which still observes the requirements concerning the heat transfer by implementing insulation. Dependent upon the inclination angle, the possibility or not of being crossed and the building purpose of the platform roof, it is recommended to put to work a type of hydroinsulation that corresponds to quality requirements, to technical conditions and to performance criteria.

2. Performance Criteria and Requirements for Hydroinsulations

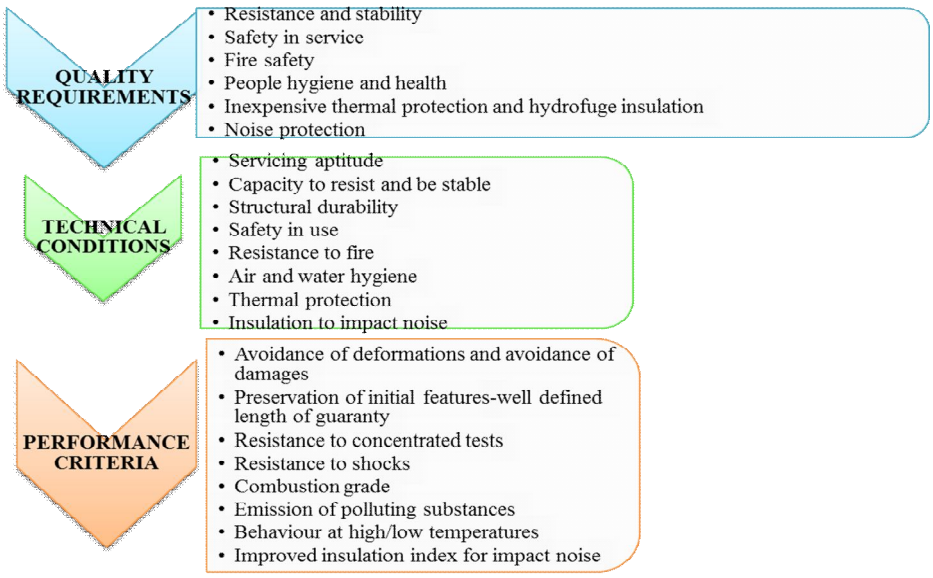
The minimal requirements to be met by the roof in view of a proper hydroinsulation concern:

a) the level of water infiltrations towards the inner side;

b) the limit level of the impermeability/sealing pressure;

c) the absence of water stagnating on external closures.

According to standard NP 040-2002, the hydroinsulations in building roofs subjected to meteoric rains must observe the following quality requirements, technical conditions and performance criteria:



The types of roofs for which these principles are given are (NP 040-2002):

a) plane platform roofs – with the slope between 0% (including) and 1.5%, in the mountain climate, no 0% slopes are permitted and slopes over 1.5% are recommended;

b) platform roofs – with slopes ranging between 1.5% and 5%;

c) other building members and elements.

3. Solutions of Hydrofuge Rehabilitation of Platform Roofs

3.2. Platform Roof Coverings

1º *The slope*, the inclination level affects the manner in which the roof hydroinsulation will be made:

a) 0º,…,3º (5%) crossed over platforms;

b) over 3º (5%) up to 50 (9%) platforms that are not crossed over.

2º *The constructive system*

a) cold platforms with ventilated layers;

b) warm platforms with unventilated compact layers, related to thermal insulation placement: conventional, inverted, double.

3º*The support structure*

a) horizontal structure, with or without attic;

b) outside or inside inclined structure;

c) discontinuous structure with covering support;

d) special structure (sheed, curved plates).

3.3. Materials Commonly used for Hydroinsulation

1º *Bitumen membranes with*:

a) polymers (PYE);

b) plastomers (PYP).

The membranes can be mounted by hot sealing with melted bitumen, or cold sealing, Fig. 1 (https://issuu.com/fac.arhitecturasiurbanism.upt/...).

2º *Plastic materials and rubber membranes*:

i) flexible polyolefin (FPO/TPO);

ii) polyvinylchloride (PVC-P);

iii) ethylen-copolemerisat-bitumen (ECB);

iv) polyisobutylen;

v) rthylen-vinyl-acetate-copolymer (VAE/EVA);

vi) chloride polyethylene (PEC).

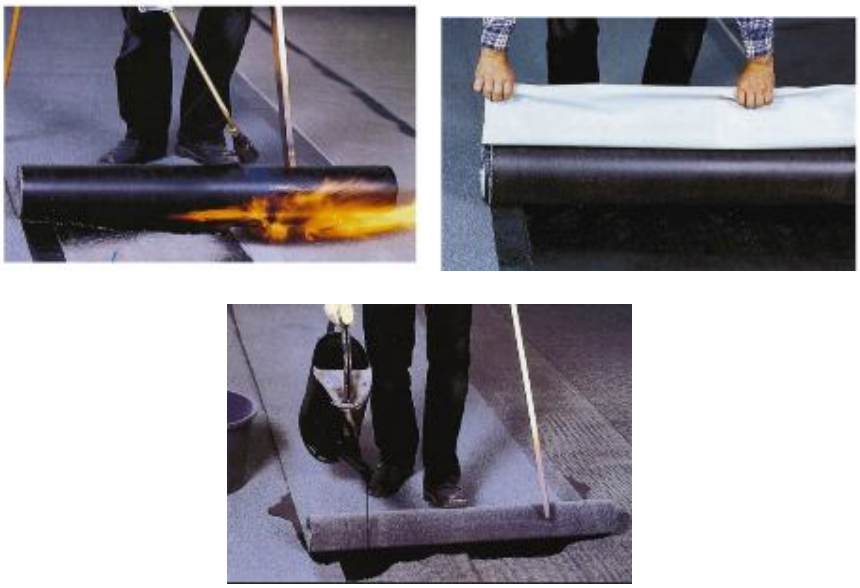


Fig. 1 – Bitumen membranes, and putting in work
(https://issuu.com/fac.arhitecturasiurbanism.upt/...).

This kind of membranes can be sticked together by gluing, by fitting with weights or with clips (mechanically). The common thickness of the membrane is: 1.2 mm; 1.5 mm; 1.8 mm; 2.0 mm; 2.4 mm, Fig. 2 (https://issuu. com/fac.arhitecturasiurbanism.upt/...).

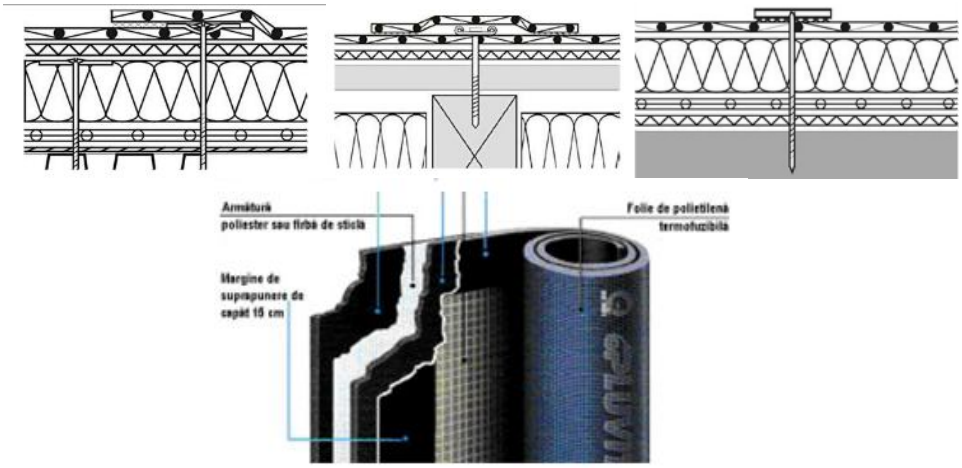


Fig. 2 – Plastic material and rubber membranes
(https://issuu.com/fac.arhitecturasiurbanism.upt/...).

3º *Synthetic rubber (elastomer) membranes*:

a) EPDM rubber, ethylene propylene diene monomer (M-class) rubber (EPDM);

b) chlorosulfonated polyethylene (CSM);

c) nitrile rubber (NBR);

d) butyl rubber (IIR).

Such membranes are installed by fitting with weights or mechanically fixing into position, Fig. 3 (https://issuu.com/fac.arhitecturasiurbanism.upt/...).

Fig. 3 – Synthetic rubber membrane.

3.4. Waterproofing Rehabilitation Solutions for Platform Roofs

a) Classical solutions;

b) Modern solutions.

Classical constructive solutions of rehabilitation can be grouped into two categories, Fig. 4 (http://www.mincon.ro/hidroizolatii-terase-circulabile/):

1º *A general solution that uses the following construction steps*:

a) removal of the protection layer of pearl gravel (7,…,15 mm);

b) cutting of bubbles and cleaning of the surface to rehabilitate;

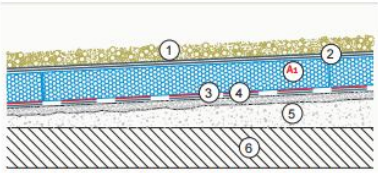
c) application of the primer, based on a hot applied bitumen layer, on the surfaces;

d) building the additional covering, made of two layers of woven bitumen glass fiber glued together with three layer of bitumen (2 ÎB + 3 B);

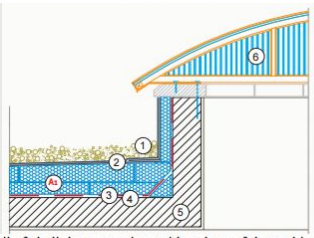
e) building the pearl gravel layer back.

The solution proved to have quite a limited solution; there are many cases where infiltrations and damage appeared again because of incorrect and/or incomplete identification of deteriorated areas.

2º *The solution based on cold application presents the same order of* operations as above, except that a rubber powder and non bitumen woven glass fibres are used to form a package of five layers, in alternation, with a waiting time of 24 hours of setting 5 after laying one rubber powder covered with one layer of glass fibre felt. The solution is more efficient than the former as it is more resistant to frost.



Field detail, hydroinsulation protected with a gravel layer,
concrete slope R'min = 5,00[m^2K/W]
1 gravel layer for water or thermal insulation
2 waterproofing membrane
3 vapour barrier
4 DCC layer for extremely moist areas
5 slope concrete (slope of 1.5-7%) and balance layer
6 horizontal floor of monolith reinforced concrete
A1 Austrotherm EPS TOP A 110



Detail of skylight connection, with a slope of thermal insulation
1 gravel layer for water or thermal insulation
2 waterproofing membrane
3 vapour barrier
4 DCC layer for extremely moist areas
5 slope concrete (slope of 1.5-7%) and balance layer
6 cylinder skylight
A1 Austrotherm EPS TOP A 110 and Austrotherm EPS TOP slope polysterene

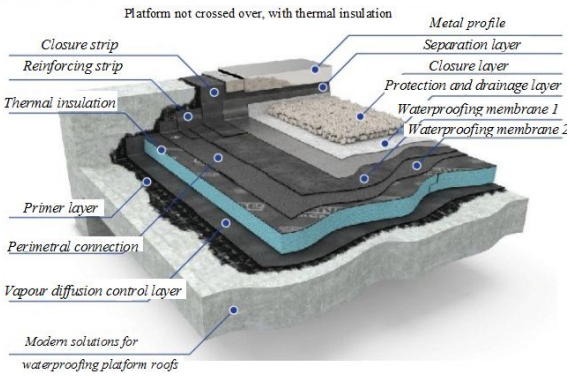


Fig. 4 – Details in the waterproofing of platform roofs
(http://www.mincon.ro/hidroizolatii-terase-circulabile/)

Modern solutions

The latest technology to waterproof platform roofs is met in *liquid waterproof membranes* which present the benefit of an easy application and a short drying time.

The technological process of application depends upon the number of layers installed. The operation requires:

a) the preparation of the substrate;

b) the mounting of the membrane in place.

Sikalastic-614 is an elastic, liquid, one-component, waterproof, material used for roofs, which has the following properties, Fig. 5:

a) it is easily applied by brush or roll;

b) covers cracks;

c) has high elasticity,

d) adheres very well to concrete, masonry, asbestos-cement, ceramic roof times, bituminous materials etc.

e) becomes resistant to water at 10 minutes after being applied.

Fig. 5 – Sikalastic-614 waterproof
(http://sporulcasei.ro/hidroizolarea-teraselor...).

The liquid polyurethane membrane is a membrane of one component with a special elasticity that can be applied to new roofs, to basements and onto concrete layers. It can also be laid over older bitumen layers, though its performance is not comparable to bitumen membranes when put on such a substrate, Fig. 6 (http://hidrocon.3x.ro/hidroizolatii.html).

Advantages:

i) life length of up to 25 years;

ii) easy cold application;

iii) impermeable barrier;

iv) resistance to UV rays;

v) resistance to vegetation roots;

vi) high flexibility even at –40°;

vii) monolith membrane with no joints;

viii) resistance at temperatures ranging from –40° C to + 90°C.

Fig. 6 – Liquid polyurethane memebrane.

Waterproof membranes with sprayed polyurethane foam

The polyurethane foam is a liquid double component product which increases its volme over 30 times once laid. The rigid polyurethane foam can be sprayed with specially designed devices made for in situ insulation purpose, Fig.7 (http://www.rallko.ro/galerie.html).

Advantages:

a) long in-time resistance;

b) low cost;

c) fast application;

d) high resistance to pedestrian traffic;

e) perfect sound, water and thermal insulation of the surface onto which it is applied.

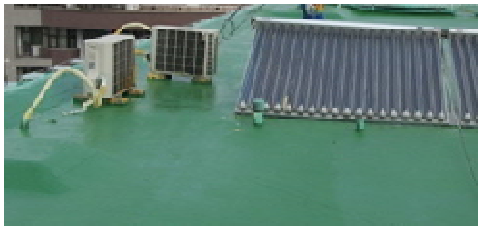


Fig. 7 – Waterproofing membranes applied by polyurethane foam spraying.

The green platform – Garden roofs, more and more often built especially in large cities have a vegetation layer made up of lawn, bushes, plants, etc, laid over the hydroinsulation layer.

Advantages:

a) increased thermal and sound insulation;

b) protection for the waterproofing material;

c) optimisation of rain water, Fig. 8 (https://issuu.com/fac.arhitectura siurbanism.upt/...).

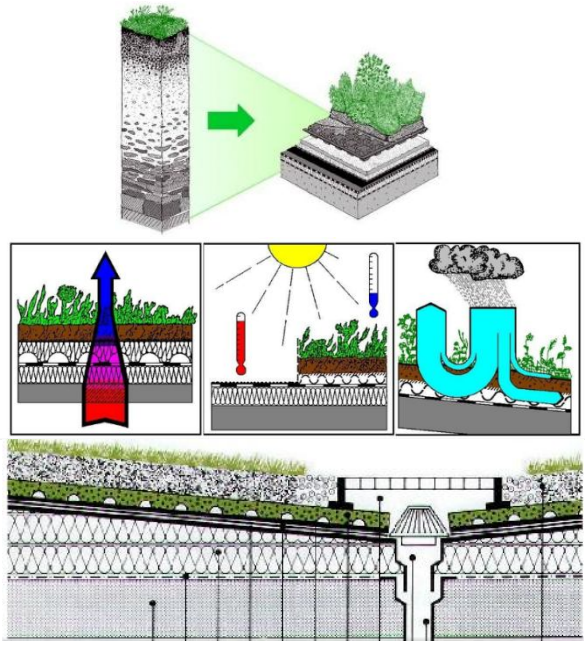


Fig. 8

4. Conclusions

A quality hydroinsulation confers construction elements durability and prevents the effects of immediate degradation due to potential defects in design, erection and service of a building. During the last decades, technological developments in the field of waterproofing materials have been recorded, among such materials being included whole waterproofing systems and advance waterproofing materials.

The role of waterproof roof coverings has become significant and with a major importance not only as a value in the building but rather because of its beneficial contribution to the users' comfort and to the protection against physical damage in building elements and sometimes in the plumbing and electrical tubing.

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* * * http://www.mincon.ro/hidroizolatii-terase-circulabile/, aprilie 2017.
* * * http://sporulcasei.ro/hidroizolarea-teraselor-cu-membrana-hidroizolanta-lichida/, aprilie 2017.
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* * * http://www.rallko.ro/galerie.html, mai 2017.

REABILITAREA HIDROFUGĂ A ACOPERIŞURILOR DE TIP TERASĂ

(Rezumat)

Orice construcție trebuie să fie protejată împotriva umidității în zona acoperişului pentru a preveni şi evita pe cât posibil pătrunderea apei în spațiile interioare, dar şi pentru a proteja componentele structurale şi nestructurale de posibile deteriorări.

De-a lungul timpului, omul a căutat soluții pentru a proteja elementele structurale ale construcțiilor. Soluțiile de hidroizolare conservă integritate construcțiilor, acestea sunt utile pentru a înțelege natura forțelor care acționează asupra construcțiilor dar şi efectul acestora de-a lungul ciclului de viață al clădirilor.

Începând cu anii ’80-’90 a apărut ca o necesitate reabilitarea unor suprafețe importante ale acoperişurilor terasă, dar din păcate lucrările de reabilitare s-au limitat, în majoritatea cazurilor, la reparații locale în zonele avariate, păstrându-se sistemul constructiv inițial.

În cazul lucrărilor de hidroizolații, pentru a atinge exigențele de peformanță trebuie respectate prevederile legate de alcătuirea constructivă a elementelor componente, dar şi de materialele de hidroizolare utilizate.

O bună hidroizolare oferă elementelor de construcție durabilitate, împiedicând efectele degradărilor imediate sau în timp, efecte care pot apărea datorită deficiențelor de proiectare, execuție şi exploatare.