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Vasyl Iliv, Yarema Iliv, Myron Gogol

TECHNOLOGICAL PECULIARITIES OF THE USE OF SILICON ORGANIC LIQUIDS TO OBTAIN OR RESTORE THE HORIZONTAL WATERPROOFING OF THE WALLS

Department of Building Production,
Lviv Polytechnic National University
vasililiv1960@gmail.com

The authors of the article have developed experimental waterproofing liquids 1 K, 2 K, 1 N and 2 N, based on GKZh-11N and GKZh-11K and possess the necessary technical properties. These liquids are ready-to-use solutions for hydrophobization and silicatization based on hydrophobic silicon compounds. They hydrophobize and narrow or cover the capillary structure in concrete, brick and stone masonry. The overlap of the capillary structure is caused by the interaction with the lime to form insoluble chemical compounds that stop capillary absorption. Liquids are used where it is necessary to stop the capillary suction of water by creating an internal hydrophobic effect and narrowing or closing the capillaries. Use the fluid to create a horizontal waterproofing barrier when repairing old buildings in the presence of lime in the masonry. The horizontal shutter with 1 K, 2 K, 1 N and 2 N materials can only be used in the absence of water load, ie where there is no water outlet. For waterproofing in conditions of hydrostatic pressure it is necessary to use waterproofing coatings made of polymer-cement materials. For these liquids, technical guidelines have been developed that apply to experimental waterproofing aqueous silicone solutions designed to create or restore horizontal waterproofing from capillary moisture by injection of self-fill into pre-drilled wall openings or under pressure. It is possible to use liquids for re-waterproofing basements or other damp walls from the middle by the method of silicizing layers, followed by plastering (plastering, seamless floors, slabs) and for hydrophobic treatment of wall surfaces in damp rooms with freshly applied slicks or bricks.

Key words: waterproofing fluids, hydrophobization, silicatization, hydrostatic pressure, capillary suction pump, waterproofing coatings, self-filling injection, hydrophobic treatment.

Introduction

Organosilicon materials have a wide scope in the construction and operation of buildings and structures to provide water-repellent properties to the work surface or an array of building materials, which significantly increases their operational properties (Sobolevskiy, Muzovskaya, Popelev, 1975) (Pashchenko, Voronkov, 1969). The use of organosilicone polymers and oligomers made it possible to form a class of new finishing materials with a number of valuable polyfunctional properties, these are atmospheric and waterproof coating materials for facades (decorative plaster, water-dispersive and organ-soluble primers and paints); resistant to ground and groundwater deep impregnation and surface treatment materials and the like (Kruglitskaya, Nikulin, Kovalenko, (1990) (Tsurgozen, Drobovinsky, Mikhalkov 1990). However, the question of the study of the mechanism of fixation after the use of organosilicon materials to the surface of the substrate, especially the developed surface of porous products, the stability of such materials in the long-term action factors, especially water and atmospheric impact, is not given enough attention (Slobodskikh, Trofimov, Krivtsov 1998) (Svidersiky, Volkov 1988).

A large number of imported waterproofing materials, including silicone based fluids, are being sold on the Ukrainian market. (Kruglitskaya, Nikulina, Kovalenko 1990) (Chernov, Statyukha, Borsuk, Vlasova, 1988) Such materials are successfully used to restore horizontal insulation by injection into pre-drilled holes

when carrying out repair and waterproofing works of old buildings, buildings and structures. In addition, according to the information in the technological instructions, the use of AQUAFIN – F by SCHOMBURG (GERMANY) is permitted; AIDA – KIESOL REMMERS (GERMANY); ADEXIN – HS DEITERMANN (GERMANY); WAKER BS 15, WAKER BS WAKER (GERMANY); RHODORSIL SILICONATE 51 T RHODIA (FRANCE); AHYDROSIL – K, AHYDROSIL – KT / K SIP (POLAND) for carrying out vertical waterproofing during wetting of walls through poor drainage, soil loose on foundations, damage to the basement wall; protection of fresh plaster or generally freshly constructed walls; protection of the outer surface of the walls from the action of water or snow due to its hydrophobization. Depending on the purpose and characteristics of the material consumption basis, the average is 0.2–0.5 kg/m^2. It is allowed to use this material as soil at a 1: 1 dilution followed by the application of other protective layers.

Target of this article

During the continuation of the research work with the obtained waterproofing liquids on the basis of products of SE "Kremnipolymer" it is necessary to establish the possibility and conditions of their application for carrying out works on obtaining horizontal and vertical waterproofing. To do this, use the method proposed by the authors to determine the permeability of waterproofing liquids.

In the study of fluids produced by SE "Kremnipolymer" and with the experimental waterproofing liquids obtained on their basis, it is necessary to establish the level of increase of physical and mechanical properties of wall materials, the level of their adhesion to each other after impregnation with such liquids and to develop the technological regulation of their application. In literary sources, this issue has not been sufficiently addressed.

Techniques used

It has been established that the main GKZh-11K and GKZh-11N hydrophobizers produced by the SE "Kremnipolymer" can be used for bulk and surface hydrophobization of building materials. When calculating the required amount of GKZh-11K and GKZh-11N always take into account their concentration – this information is available in the certificate of analysis for the delivered products. Water repellents do not affect the strength properties of construction products (after exposure for 21 days). As the water-soluble liquids GKZh-11N and GKZh-11K have been installed, as the main impregnating materials of SE "Kremnipolymer", they do not withstand excess water pressure of more than 0.02 MPa in the study according to the method developed on the basis of determination of water resistance of concrete (Iliv, Nazarevich, 2007).

The authors of the article have developed experimental waterproofing liquids 1 K, 2 K, 1 N and 2 N, based on GKZh-11N and GKZh-11K (Iliv, 2006) (Iliv, Givlyud, Iliv, 2015) (Reception and have the following technical properties (Table. 1).

Table 1

Technical properties of the developed waterproofing liquids

Basis	An aqueous solution based on potassium or sodium methyl silicone
Color	From clear, white to frosted to light yellow or light brown
Consistency	Liquid
Density	1.15–1.25 g / cm^3
The pH value	11.5–13
Method of purification	In the fresh state with water
The main method of using	Fill or Injection under low pressure
Costs of use	Depend on the absorbency of the wall, set by the method of test, but not less – 15–20 kg/m^2 cross section

He developed waterproofing fluids are analogues of AQUAFIN – F by SCHOMBURG (GERMANY); AIDA – KIESOL REMMERS (GERMANY); ADEXIN – HS DEITERMANN (GERMANY); WAKER BS 15, WAKER BS WAKER (GERMANY); RHODORSIL SILICONATE 51 T RHODIA (FRANCE); AHYDROSIL – K, AHYDROSIL – KT / K SIP (POLAND)

These waterproofing fluids are ready-to-use solutions for hydrophobization and silicatization based on hydrophobic silicon compounds. They hydrophobize and narrow or cover the capillary structure in concrete, brick and stone masonry. The overlap of the capillary structure is caused by the interaction with the lime to form insoluble chemical compounds that stop capillary absorption. They do not cause corrosion of reinforcing steel.

Developed fluids are not suitable for finishing (finishing) surfaces of such building materials as, for example, concrete, masonry, plaster and the like.

Liquids are used where it is necessary to stop the capillary suction of water by creating an internal hydrophobic effect and narrowing or closing the capillaries.

Apply these fluids to create a horizontal waterproofing barrier when repairing old buildings in the presence of lime in the masonry.

The horizontal waterproofing barrier with 1 K, 2 K, 1 N and 2 N materials can only be applied in the absence of water load, if where there is no water outlet. For waterproofing in conditions of hydrostatic pressure it is necessary to use waterproofing coatings made of polymer-cement materials.

The consumption of liquids is calculated on the basis of the absorbency of the wall according to the processing of the test hole – for example, not less than 15 kg/m^2 of the cross-sectional area of the wall, with a homogeneous brick masonry having a normal absorbency.

Injection molding (by SCHOMBURG technology) is recommended if the masonry is treated heavily or completely soaked in water. The location of the drilled holes (holes) is calculated depending on the type and condition of the masonry. The diameter of the holes should be 18 mm. The distance between the centers of the holes should, as a rule, be 12–15 cm. The holes can be drilled horizontally or with an angle of inclination up to 30°. The length of the hole should be approximately 5 cm less than the thickness of the wall. For dense, poorly or non-absorbent masonry, it is better to use double row holes. For absorbent masonry of natural stones, drill holes in the stones, and with dense rubble masonry –in the seams. Corners and walls over 60 cm thick should have holes on both sides. Before impregnation, it is necessary to remove dust from drilling.

The surface around the hole on both sides is treated with a polymer-cement agent – a waterproofing suspension to prevent the leakage of liquids. Reusable injection packs are installed in the holes. If large openings, void bricks, cracks or joints open up to 5 mm are open in the walls, then the holes are filled with a non-shrinking cement mixture by injection with a tip (180 mm) at a pressure of approximately 10 bar before injection. Waterproofing fluids are also injected at a pressure of about 10 bar by means of an injector with a tip of 400 or 600 mm.

The injection should be continued until the solution begins to protrude onto the wall surface. In this case, the wall material and the laying seam become wet, the hole is closed with non-stick cement mixes. Packers are removed after 24 hours.

The injection can be performed without forced pressure. Drill holes for injection should be drilled at intervals of no more than 15 cm, 30 mm in diameter and at an angle of 45 to 30°. The length of the hole should be approximately 5 cm less than the thickness of the wall. When drilling holes, it should be ensured that the hole runs through at least one horizontal seam of the masonry, and in the case of a thick wall, not less than two.

It is recommended to place the holes in two rows in height. The distance between the centers of the holes is calculated based on the absorption capacity of the masonry. The smaller this period, the higher the reliability of waterproofing. For drilling, it is recommended to use vibration-free electropneumatic drilling rigs or drill bits with appropriate drills.

If the wall thickness is more than 60 cm and the presence of corners, the holes should be placed on both sides. Before impregnation, drill dust must be removed.

Fluids are poured into the hole. It is most advisable to inject from an additional tank (funnel with valve). The impregnation time should be at least 24 hours, then the hole should be closed with non-stick cement mixtures.

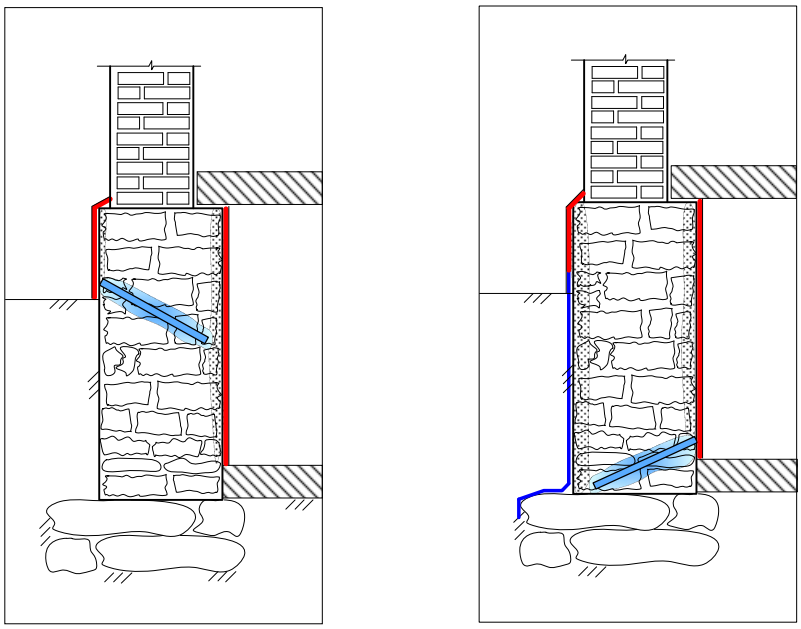
When laying open joints, cracks and openings, the same conditions apply as with injection molding technology.

For these liquids, based on the recommendations of leading manufacturers of such materials, technical recommendations for experimental waterproofing aqueous silicone solutions designed to create or restore horizontal waterproofing from the action of capillary moisture by injection of self-filling into pre-diluted holes. It is possible to use solutions of silicone liquids for re-waterproofing basements or other damp walls from the middle by the method of silicizing layers with subsequent coating (plastering, seamless floors, slabs), as well as for hydrophobic treatment of wall surfaces in wet rooms, in wet rooms concrete.

Conditions of use of waterproofing silicone liquids:

1. A horizontal diaphragm is arranged against the capillary rise of moisture. Therefore, above the level of the permeation boundary above the level of groundwater rising by 10–20 cm in the basements or 5–15 cm above the floor level (Fig. 1–2), holes with a diameter of 45–300 are drilled along the entire perimeter of the inner capital walls along the entire perimeter. at a distance of 15 cm from each other, not reaching the opposite side of the wall at 5–6 cm – when manually filled, or holes with a diameter of 18–20 mm at an angle of 30–350 at a distance of 15 cm from each other – when casting under pressure 0.3–0.7 MPa with a fill rate not exceeding 0.5 kg / min. through packers (fittings) inserted into the holes to completely saturate the wall material with the aid of an injection device or manually. The average cost is 2.0–3.0 kg per 1 m of wall for every 10 cm of wall thickness. Refined costs may be greater by 30 % or less by 20 %, depending on the degree of porosity of the material of the wall and masonry joints. Pouring is usually carried out in several work activities (2–3) times, allowing to absorb liquids after each action. After saturation, the openings are closed with highly mobile cement-sand solutions obtained on non-shrinkable or low-expansion cements (Iliv, Iliv, 2018).

Schemes for conducting or restoring horizontal insulation are shown in Fig. 1–2.

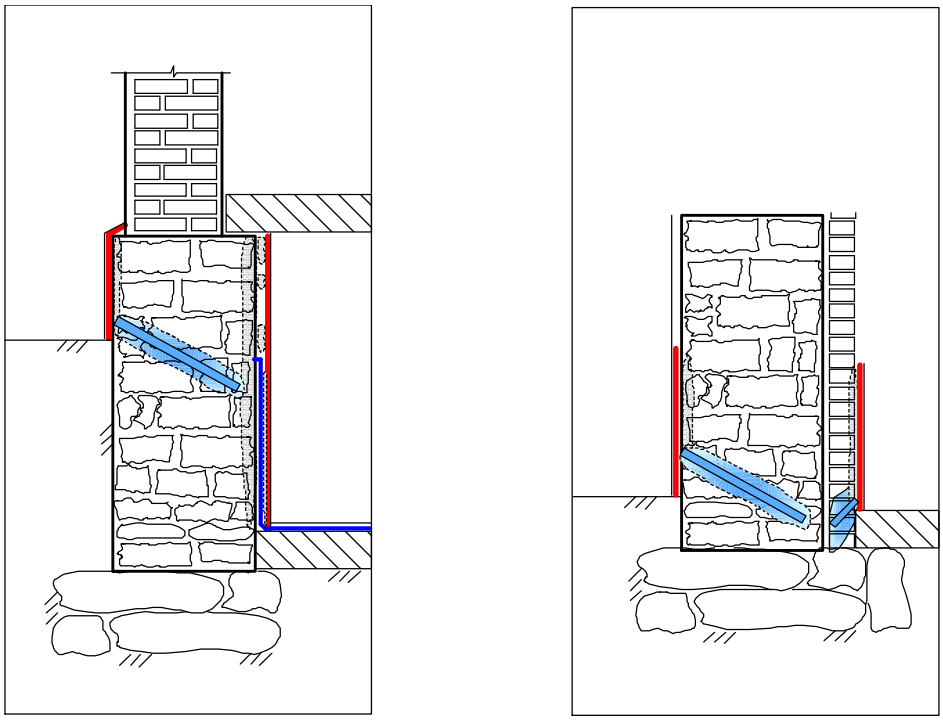


a) horizontal insulation from the outside *b) horizontal insulation from the inside*

Fig. 1. Use of waterproofing liquids for re-waterproofing of basement walls in the absence of water pressure

Exterior waterproofing according to the scheme shown in Fig. 1, and is carried out when moistening the soil with the application of sanitizing plaster vertically on the basement wall and above the horizontal insulation. In this case, horizontal isolation is carried out above ground level. Drying the masonry wall below the waterproofing line is not guaranteed. Requires additional measures to maintain the water-salt balance of the wall below the waterproofing line.

Internal waterproofing according to the scheme shown in Fig. 1, and is carried out when moistening the soil with waterproofing according to the seventh, presented in Fig. 1, is carried out when moistening the soil with excavation of the wall from the outside, applying vertical bitumen or polymer-cement vertical waterproofing. rehabilitating the plaster vertically in the basement wall and above the ground outside. Waterproofing is carried out for this case inside the basement, at the foot of the wall. The wall array will dry with external vertical insulation in place. Ground and storm water must be constantly drained. The hydrostatic pressure on the waterproofing area must be absent.



a) horizontal insulation when exposed to water under pressure

b) horizontal insulation from the inside

Fig. 2. Use of waterproofing liquids for re-waterproofing of basement walls under water pressure and double wall

In the presence of ground and drainage water, it is recommended to conduct waterproofing above the water mirror, mainly above ground level. The surface of the walls must be insulated from the middle by elastic bitumen or polymer-cement surface insulation. In order to avoid condensation in the isolation areas, a special repair plaster must be applied for rehabilitation.

In the case of double masonry, especially in the case of masonry with a large section thickness (more than 1 meter), the holes must be drilled on both sides, for insulation for waterproofing, both outside and inside of the walls (Iliv, Iliv, 2018).

2. Carrying out vertical waterproofing when wetting walls through poor drainage, loose soil foundations, damage to the basement wall, or protection of fresh plaster or generally freshly constructed walls. To achieve this goal, water-soluble silicone fluids are most often used, carrying out the process of soil silicatization. Depending on the purpose and characteristics of the base material consumption are

0.2–0.5 kg/m^3. It is permissible to use these materials as a primer when diluted 1: 1 with the subsequent application of other protective layers (Iliv, Iliv, 2016).

3. Protecting the outer surface of the walls from water or snow due to its hydrophobization. God forbid to be freshly applied and after long enough operation. The cost of materials to achieve this goal depends on the water absorption capacity and other characteristics of the substrate, the type of organosilicon liquids and a number of other factors, but do not exceed the costs shown in the previous case.

These technical guidelines apply to waterproofing aqueous solutions designed to create a horizontal compartment from the action of capillary moisture by injection into the drilled holes of the walls or under pressure. It is possible to use solutions of silicone liquids for re-waterproofing basements or other damp walls from the middle by the method of silicizing layers with subsequent coating (plastering, seamless floors, slabs), as well as for hydrophobic treatment of wall surfaces in wet rooms, in wet rooms concrete.

Conclusions

1. On the basis of technological peculiarities of the use of waterproofing liquids the technological regulation of the use of materials 1 K, 2 K, 1 H and 2 N. was developed.

2. The algorithm for using materials 1 K, 2 K, 1 H and 2 H depends on the specific condition of the walls, their moisture, thickness and so on.

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В. В. Ілів, Я. В. Ілів, М. В. Гоголь
Національний університет "Львівська політехніка",
кафедра будівельного виробництва

ТЕХНОЛОГІЧНІ ОСОБЛИВОСТІ ВИКОРИСТАННЯ КРЕМНІЙОРГАНІЧНИХ РІДИН ДЛЯ ОТРИМАННЯ ЧИ ВІДНОВЛЕННЯ ГОРИЗОНТАЛЬНОЇ ГІДРОІЗОЛЯЦІЇ СТІН

Як встановлено, водорозчинні рідини ГКЖ-11Н та ГКЖ-11К як основні імпрегнуючі матеріали ДП "Кремнійполімер" не витримують надлишкового тиску води понад 0,02 МПа при дослідженні за методикою, розробленою на основі визначення водонепроникності бетонів. Розроблено експериментальні гідроізолюючі рідини 1 К, 2 К, 1 Н та 2 Н, що базуються на основі ГКЖ-11Н і ГКЖ-11К і володіють необхідними технічними властивостями. Ці рідини є готовими до застосування розчинами для гідрофобізації і силікатизації на основі гідрофобних кремнієвих сполук. Вони гідрофобізують і звужують або перекривають капілярну структуру в бетоні, цегляній і кам'яній кладці. Перекриття капілярної структури зумовлено взаємодією з вапном з утворенням нерозчинних хімічних сполук, які припиняють капілярне всмоктування. Вони не спричиняють корозії арматурної сталі. Рідини застосовують там, де необхідно домогтися припинення капілярного підсосу води за допомогою створення внутрішнього гідрофобного ефекту і звуження або перекриття капілярів. Вживають ці рідини для створення горизонтального гідроізоляційного заслону під час ремонту старих будівель за наявності вапна в складі кладки. Горизонтальний заслін матеріалами 1 К, 2 К, 1 Н та 2 Н може застосуватися лише при відсутності водяного навантаження, тобто там, де немає виходу води. Для гідроізоляції в умовах гідростатичного напору необхідно використовувати гідроізоляційні покриття із полімерцементних матеріалів. Витрату рідин розраховують, враховуючи всмоктувальну здатність стіни за даними обробки пробного шпура – наприклад, не менше 15 кг/м^2 площі поперечного перерізу стіни за однорідної цегляної кладки, із нормальною всмоктувальною здатністю. Для цих рідин розроблено технічні рекомендації, що поширюються на експериментальні гідроізолюючі водні кремнійорганічні розчини, призначені для створення чи відновлення горизонтальної гідроізоляції від дії капілярної вологи методом ін'єкції самоналивом у попередньо розсвердлені отвори стін чи під дією тиску. Можливо використовувати рідини для повторної гідроізоляції підвалів чи інших вологих стін із середини методом силікатизуючих шарів з подальшим личкуванням (нанесенням тиньку, безшовних підлог, плит) та для гідрофобної обробки поверхонь стін у вологих приміщеннях по свіжонанесених тиньках, цегляних кладках чи бетонах.

Ключові слова: гідроізолюючі рідини, гідрофобізація, силікатизація, гідростатичний напір, капілярний підсос, гідроізоляційні покриття, ін'єкція самоналивом, гідрофобна обробка.