PENETRATING WATERPROOFING FOR CONCRETE TYPE “PENETRON”, ITS ADVANTAGES AND DISADVANTAGES.

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Annotation. Concrete is a structure that is riddled with pores, capillaries and micro cracks. They are formed for a number of reasons: during the setting of concrete, evaporating water leaves voids; when pouring, the concrete may not be sufficiently compacted; due to the shrinkage of concrete during setting, internal stresses arise, which cause the formation of cracks, etc. Measures for waterproofing concrete structures, using the latest technologies and materials, can prevent rapid wear of building structures and in the future do without repair and construction work.

Key words: concrete structure, pores, capillaries and micro cracks in concrete; crack formation; waterproofing materials of penetrating action for concrete; penetrates; water resistance and strength of concrete; adhesion to concrete; frost resistance and corrosion resistance of concrete.

Currently, the construction market has a whole class of materials related to penetrating waterproofing materials. The composition of materials includes: Portland cement, fine quartz sand, fillers and a number of special chemical additives. These are materials such as: Xipex (Canada); Penetron (USA); Aquatron-6 (Russia); Lakhta (Russia); Kalmatron (Russia); Vandex-Super (Switzerland); Aquafin-IS (Germany); Osmosil (Italy) and others. Conventionally, we will call this group of materials “penetrate”.

All firms - manufacturers of "penetrates" describe the same mechanism for increasing the water resistance of concrete, on a well-moistened surface of which they are applied with a brush or by pneumatic spraying (Fig. 1). When applying "Penetrates" on a concrete surface, the material (under the action of osmosis forces) penetrates into the concrete, and its active components enter into a chemical reaction with lime, which is formed during cement hydration. The resulting insoluble crystals clog (fill) pores, capillaries and microcracks without causing internal stresses.

The process proceeds from the surface to the depth of the concrete structure. Crystal growth stops in the absence of water and resumes when it appears, which is typical for cement concretes and mortars.

Fig. 1 Methods for applying Penetron waterproofing material to various surfaces

Properties of "Penetrates".

"Penetrates" are used to improve the water resistance of concrete and reinforced concrete structures based on Portland cement, while it is not recommended to apply it to concrete with water resistance lower than W2 and higher than W8. In the first case, the concrete is too porous, and in the second, the concrete is already quite dense. It is not recommended to use "Penetrates" for waterproofing brickwork, even if lime was used as a masonry mortar. An analytical review of the physical and mechanical properties of "penetrates" from different companies showed the following:

Waterproof.

The penetrating material becomes an integral part of concrete, increasing its water resistance by 2-3 steps. Therefore, if the technical descriptions indicate water resistance: 1 MPa (Osmosil), 1.2 MPa (Xypex and Aquatron-6), 0.8 MPa (Penetron), then the initial water resistance of concrete was (0.2-0.3) MPa below.

Strength.

Materials Osmosil, Aquatron-6 and Aquafin-IS at the age of 28 days have a compressive strength of 44, 30 and 25 MPa, respectively. The increase in concrete strength is usually 6-20%.

Depth of penetration of penetrons into the thickness of concrete.

Usually, for high-quality materials, the penetration depth into concrete reaches 8-10 cm. All advertising statements by some manufacturers that they have materials that penetrate into concrete by 90 cm or more (for example, Penetron material from Hydrocor) do not have any evidence. . Moreover, it largely depends on the condition of the concrete surface and the quality of its preparation. For successful penetration of materials into concrete, its surface must have an open pore structure, which, unfortunately, can be difficult to achieve when repairing concrete structures. An open pore structure can only be obtained by removing cement laitance from the concrete surface, which is ensured by cleaning it with high-pressure water (more than 40 MPa) and “wet” sandblasting. Mechanical cleaning with cutters, metal brushes, dry sandblasting clog and polish the pores and make the impact of materials ineffective.

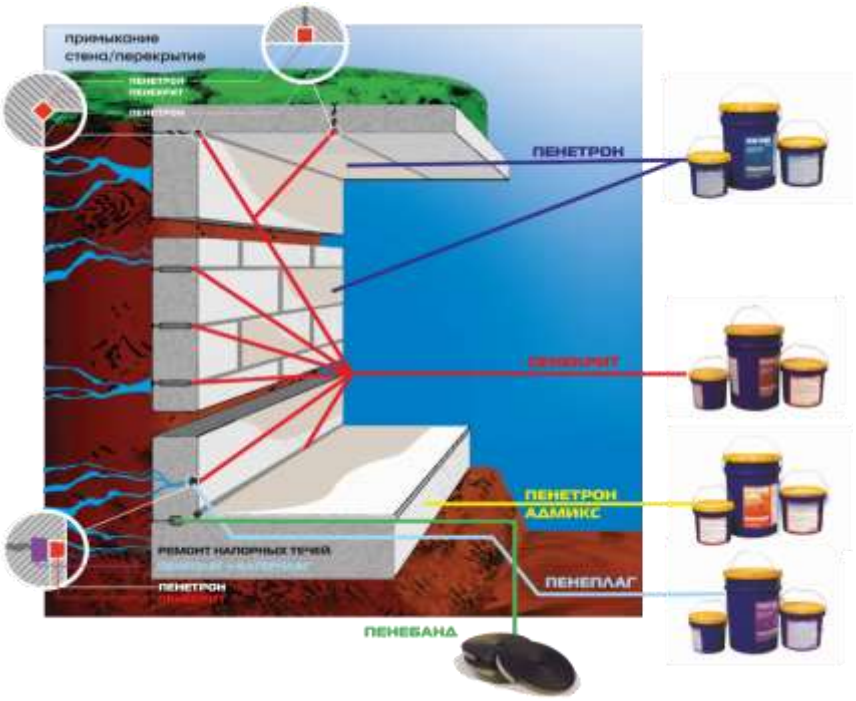

Fig.2 Scheme of places of application on the surface of the waterproofing material "Penetron"

It must be said that "penetrates", due to the specifics of their chemical properties, function exclusively on concrete or on other cement-containing building structures and surfaces. Moreover, when applying "penetrates" on old concrete surfaces, the effect of their use is sharply reduced. This is due to the fact that free lime formed during cement hydration is in a chemically inactive form due to its carbonization under the action of atmospheric carbon dioxide and reacts poorly with the components of "penetrates". Therefore, builders often, in order to improve the action of "penetrates", first arrange a new cement screed on the old concrete, and then apply "penetrates". In some Technical descriptions for these materials, it is indicated that it is rational to treat smooth concrete surfaces (after metal formwork) or old concrete surfaces with a 15% hydrochloric acid solution, and then (after 1.5 hours) rinse with water under pressure. In this case, capillaries are exposed, and lime is activated, which is necessary for chemical interaction with "penetrates".

Self-healing of cracks.

According to various companies, penetrates seal pores and cracks with an opening of up to 0.3-0.4 mm. At the same time, it is necessary to know that the hardly soluble crystalline neoplasms formed rigidly compact the structure of concrete and increase its water resistance, but not crack resistance. Therefore, it is not recommended to use "penetrates" in structures subject to vibration and shrinkage, sedimentary deformations, in expansion joints, at floor/wall junctions. In such cases, it is necessary to apply an elastic coated polymer cement waterproofing.

Adhesion to concrete.

The adhesive strength of the penetrates to concrete is in the range of 1.0-1.2 MPa.

Frost resistance and corrosion resistance.

"Penetrates", compacting the porous structure of concrete, increase the frost resistance and corrosion resistance of concrete in relation to the aggressive effects of the aquatic environment. Some firms write that frost resistance increases by 50 cycles (Kalmatron); other firms write that frost resistance reaches 300 cycles - Aquatron-6; "Xipex" - 500 cycles, and after concrete treatment with "Osmosil" material, it is allowed to operate at temperatures up to -30 0C. Probably, the starting point for the frost resistance of concrete treated with penetrates should be the original brand of concrete in terms of frost resistance, and penetrates should improve it. When using penetrates, it is necessary to request data on frost resistance from manufacturing companies. According to our data, with the water resistance of concrete treated with "penetrates" - W8, the frost resistance of concrete does not exceed 300 cycles, which is in good agreement with the physical and mechanical properties of concrete.

Data on the corrosion resistance of concretes treated with penetrating materials should be treated critically. Almost all technical descriptions (especially for domestic manufacturers) recommend the use of "penetrates" for structures exposed to the aggressive action of acids, alkalis, salts and petroleum products. For example, TU 5745-080-07508005-2000 for the

Aquatron-6 material states that the resistance of concrete to leaching (the first type of corrosion) treated with Aquatron increases to 100 years. Common sense says the following: the compaction of pores and structural defects of concrete treated with "penetrates" undoubtedly leads to an increase in the physical and mechanical properties and corrosion resistance of concrete. But the basis of concrete is cement binder and hardened cement stone. Therefore, all environments that are traditionally aggressive to concrete remain aggressive to concrete as well, in the pores of which calcium compounds, which are sparingly soluble in water, formed as a result of the interaction of lime and chemically active components of "penetrates", are deposited. Statements by individual manufacturers that these materials provide concrete resistance to chlorides, acids, and also reduce radiation exposure are absurd.

Application of plaster coatings on concrete treated with "penetrates".

On concrete treated with "penetrates", it is not recommended to apply plaster coatings. In case of emergency, this is possible only after treating the surface with a weak acid solution and rinsing with water. If this condition is not met, then "penetrates" can begin to "grow" into the alkaline and wet base of the applied coating and tear it off the concrete.

MAIN CONCLUSIONS AND RECOMMENDATIONS:

1. Penetrating materials, like waterproofing materials, have a narrow scope and only for the protection of cement concretes, and not masonry. When choosing them, it is necessary to clearly determine the operating conditions of the structure. Do not use them in structures subject to dynamic loads and operated in aggressive environments in relation to cement concrete. In fact, these materials are designed to create a waterproofing membrane that is below the water level and allows water vapor to pass through. Using them, it is possible to save money by using cheaper concretes, increasing their water resistance to no more than W8.

2. It is more expedient to use penetrating materials to increase the water-tightness of new concrete, if the concreting technology was violated during its laying or the concrete was laid in adverse conditions (low temperatures, poor-quality vibration compaction, poorly organized care during concrete hardening).

3. For waterproofing old concrete structures (during repair), the use of "penetrates" is not effective, since concrete can have a significant crack opening - more than 0.4 mm, and it is difficult to open pores, it does not have the required amount of free oxide calcium. In this case, it is better to use rigid and elastic coating cement and polymer-cement protective coatings, for example, materials from the ALIT company. Their use excludes such activities as sandblasting concrete surfaces or treating them with a hydrochloric acid solution.

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