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TECHNOLOGIES OF APPLYING ACRYLIC COMPOSITIONS FOR MONOLITHIC JOINTING OF OLD AND NEW CONCRETE WHEN CONSTRUCTING BUILDINGS AND STRUCTURES

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Annotation. *The study examines in detail various methods of applying acrylic adhesives to the surface of already hardened concrete in order to ensure a strong connection with the new concrete mixture. This procedure is critically important in the context of construction, reconstruction and repair works, where it is necessary to integrate old and new concrete elements. Such works are often performed during the construction of large monolithic concrete and reinforced concrete structures, as well as when restoring or changing their size and shape. To effectively perform large volumes of work, especially on vertical surfaces, it is recommended to use mechanized hand tools, such as various sprayers. These tools allow for uniform and rapid application of adhesive, ensuring a high-quality connection between old and new concrete. One of the most widely used methods of applying adhesives and protective coatings to vertical surfaces of concrete and reinforced concrete structures is pneumatic spraying.*

Keywords: *construction, reconstruction, acrylic adhesive, concrete, pneumatic spraying, air spraying, adhesive materials, adhesion.*

Introduction When performing construction work that includes reconstruction or repair, there is often a need to ensure a reliable connection between the existing old concrete and the newly laid new concrete. This is especially important when forming monolithic arrays and adjusting the geometric parameters of structures. To ensure a strong connection between old and new concrete during the reconstruction or repair of buildings, special adhesives are often used. Our research has confirmed that acrylic adhesives are an effective and cost-effective alternative to traditional materials such as epoxy resins. They not only demonstrate similar adhesion and strength indicators, but also surpass them in terms of manufacturability, and are also 16-24% cheaper. Thanks to these advantages, acrylic adhesives are becoming an ideal solution for widespread use in the construction industry [1-3].

Statement and solution of the problem.

During construction, reconstruction and repair of buildings and structures, works are performed to connect old concrete with new concrete. Such works are performed during the erection of monolithic massive concrete and reinforced concrete structures, restoration and change of their dimensions and configurations. In order to improve adhesion and increase the strength of the connection of old concrete with new concrete, various polymer adhesives and compounds have recently been used [1-4]. The authors have developed the technology of such connection using acrylic adhesives [5-10]. Concrete joining with acrylic adhesives has a number of advantages over the use of other polymers for this purpose. They are not inferior to the existing ones (e.g., epoxy) in terms of adhesion and cohesive properties, but have better technological properties and are 18...30% cheaper than the mentioned ones.

Physical and mechanical properties of acrylic adhesives are sufficiently described in [11-12]. The results of determining the strength of joints between old and new concrete depending on various factors are described in [13, 14]. However, no attention has been paid to the study of individual operations of the technology of caulking of old concrete with new concrete using acrylic adhesives.

One of the operations of this technology is the application of acrylic adhesives to the surface of old concrete prepared for bonding. Studies have shown that in the case of small bonding surfaces, the application of glue on them can be carried out manually. Thus, the application of glue on the horizontal surface is carried out with the help of trowels, laths, brushes, watering and other methods. The application of glue on the vertical surface is carried out with the help of skillets, brushes, trowels, rollers and other methods. These methods are characterized by simplicity and do not require special skills and skill.

In case of significant volumes of work for application of adhesives on vertical surfaces it is recommended to use mechanized hand tools - various atomizers. Atomization of adhesive compositions can be pneumatic (air) and hydrodynamic (airless).

The method of pneumatic atomization is one of the most common ways of

applying adhesives and protective coatings on vertical surfaces of concrete and reinforced concrete structures. Its main advantages are versatility, relatively high productivity, simplicity of technical implementation, good enough quality of the obtained coatings.

As shown by the experiments conducted by the method of pneumatic atomization it is possible to apply acrylic adhesives with viscosity up to 100 s according to viscometer VZ-4 on the surfaces of structures of various sizes and configurations.

The main advantages of the pneumatic atomization method are: the possibility of application in various production conditions, as it requires only a source of compressed air with a pressure of 0.2 - 0.6 MPa; the possibility of using acrylic adhesives, provided that their working viscosity is 17-100 sec according to viscometer VZ-3; the possibility of coating the surfaces of structures of various sizes and configurations; obtaining coatings of high quality; simplicity and reliability in the maintenance of spraying devices.

For pneumatic atomization atomizing heads are used, consisting of a material nozzle and air head, fixed coaxially. The adhesive is fed to the material nozzle orifice; compressed air flows into the annular gap formed by the air head orifice and the tip of the material nozzle.

Depending on the design of the spray gun head, the shape of the plume jet or, more precisely, its prints on the concrete surface can be in the form of a circle or a flat strongly elongated oval. Conical jet with the shape of the base in the form of a circle gives the head, which has an air nozzle in the form of a circular hole located around the material nozzle slightly protruding from it. This is the simplest head has a torch of high density and allows you to move the spray gun when applying adhesive material at high speed. Most often these heads can be used when applying adhesive to small and complex embossed surfaces.

A flat torch is formed by a head having two side holes in addition to the central hole. Jets of air coming out of the side holes, compress the atomizing jet of glue and give it a flat shape. Such heads are called heads with air crimping jet. In addition, a flat torch is formed by a head with an air nozzle in the form of a slit. They are called slotted

or heads with mechanical crimping of the jet and are used when the pressure of air atomization does not exceed 0.25 MPa. Usually the heads of spray guns with air-crimped jet are also adapted to produce a round jet.

As studies have shown, the flat jet torch is better to use when applying acrylic adhesive on large flat surfaces. Intermediate between round and flat jet is an oval jet, in this case the side holes in the atomizer head are located at an insignificant angle to the direction of the torch axis and at the exit of the material nozzle. Oval jet is better used where you need a torch with increased density and width of its imprint compared to the round jet.

To obtain a normal flare jet the holes of air and material nozzles should be located strictly concentric. Depending on the purpose of spray guns can be medium pressure 0,25 - 0,55 MPa, and low pressure - up to 0,25 MPa. Spray guns of medium pressure are divided into atomizers of external and internal mixing depending on the place of meeting and mixing of the material with air (at the exit from the head or before the exit). Widely spread in construction are spray guns of medium pressure of external mixing such as KR-20, ZIL, KRV, 0-45, KRM, 0-37A, etc., as well as internal mixing brands KRP-2, C-592, 0-45, C-765.

Application of adhesive materials by air spraying mainly on large surfaces is carried out by spray guns such as SO-71 and KRU-1. For example, the spray gun of KRU-1 brand is designed for application of materials with viscosity not more than 50 s according to VZ-4.

Used in construction hand-held pneumatic spray guns have certain diameters of material nozzle holes and related parameters of atomizers that create a certain type of jet plume. Therefore, their selection should take into account the coarseness of filler grains and viscosity of acrylic adhesive.

The second method of applying adhesive materials to the surface of concrete is hydrodynamic or airless. In this method, adhesive materials are applied under high hydraulic pressure. Compressed air is used only to drive a pump that creates high pressure on the material applied to the surface of the structure.

Compared to the pneumatic method, the hydrodynamic method has a number of

advantages: the losses of the applied material on fogging are reduced (up to 20%); the possibility of spraying more viscous materials; the labor intensity of work is reduced due to the possibility of applying thick layers of coatings; sanitary and hygienic working conditions are improved.

The disadvantages of this method include: the difficulty of applying the method to the treatment of surfaces of structures of complex configuration; increasing losses of applied materials in the treatment of surfaces of complex configuration; limited use of the method for the application of low-viscosity adhesive materials with large easy to precipitate fillers.

In this method, the crushing of material at atomization occurs due to high pressure up to 20 MPa, created by a pump in the internal cavity of the spraying device and displacing the applied material through the nozzle opening. In this case, the potential energy of the material when it enters the atmosphere is converted into kinetic energy. With kinetic energy, the droplets move towards the surface to be coated, attracting a part of the surrounding air. Overcoming the air resistance, the droplets are slowed down and gently layered on the surface, forming a coating of a certain thickness.

Application of adhesive materials by hydrodynamic method is carried out with the help of airless spraying units (ASU). Unlike pneumatic sprayers, they have only one channel for liquid. For example, for application of adhesive materials in the heated state are used atomizers such as KRVD-10fa, and non-heated - KRB-1. The most responsible part of such an installation is the atomizing device, especially its output part - the material nozzle. Nozzles of two geometric shapes are provided at ambient temperature below 0^0C:

1) with cylindrical channel (0.25 - 1.0 cm);

2) with elliptical channel (0,5 - 1,2 cm).

The units are units, the main unit of which is a discharge device - a high-pressure pump of differential or double action with a pneumatic or electric drive, a system of valves and filters, as well as with regulating and control and measuring equipment.

The unit also has a material container and a suction hose with a suction connection, a high-pressure atomizer, and a high-pressure hose connecting the atomizer

to the pump.

Depending on power, capacity and weight, the units are divided into three groups:

1) small-sized portable with a capacity of up to 1.0 kg/min;
2) medium-sized with a capacity of up to 2.0 kg/min, weighing up to 60 kg;
3) large-sized or stationary with a capacity of at least 5 kg/min and a mass of more than 100 kg.

Conclusions: Analytical and experimental studies have shown that for application of acrylic compositions on the surface of old concrete prepared for bonding it is possible to use manual mechanized tools such as spray guns and sprayers UBR used in the practice of construction. To choose the brand of tool it is necessary to know the viscosity of acrylic adhesive by viscometer VZ-4. Therefore, it is necessary to qualify acrylic adhesive formulations not only by their viability and curing time, but also by viscosity.

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