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Types of Waterproofing and Initial Data for its Choice

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ABSTRACT: The mechanism of destruction of waterproofing and roofing materials occurs as a result of the imposition of external and internal influences during the operation of the structure. Hydrogeological conditions, purpose and design features of the structure, crack resistance of structures, types of loads, recommended types of waterproofing for main structures and structures, estimated service life of the main waterproofing coatings

KEYWORDS: Waterproofing, roofing materials, crack resistance, service life, hydrogeological conditions.

I. INTRODUCTION

Waterproofing of artificial structures must be reliable: perform the required functions under operating conditions for a given time while maintaining the main characteristics, have a service life as close as possible to insulated structures [1].

Waterproofing materials in structures and structures are subject to various external and internal influences of ultraviolet rays, variable temperature, oxygen and ozone in the air, wind force, precipitation in the form of rain and snow, microorganisms, aggressive liquid media and gases, polluting mechanical deposits, force stresses and other external factors; heat and mass transfer, humidity gradient, diffusion movements, chemically active reagents, syneresis, shrinkage phenomena and many other internal factors.The mechanism of destruction of waterproofing and roofing materials occurs as a result of the imposition of external and internal influences during the operation of the structure [2-4].

Paint waterproofing - is a multi-layer waterproof coating, performed by painting and having a total thickness of several millimeters. Painting is the most common and cheapest method of waterproofing and anticorrosion protection of surfaces of concrete and metal structures.

Pasting waterproofing - is a waterproof coating of several layers of prefabricated roll, film or sheet materials.

Plaster waterproofing - is a waterproof coating with a thickness of 5 to 50 mm, applied in several layers or bastings by plastering. Depending on the type of material used, cement plasters and shotcrete, asphalt (hot and cold) plasters are distinguished.

Impregnation waterproofing is designed to increase the water resistance of porous products by filling their pores with a waterproof and dense material.

Products made of concrete (pipes, piles, columns, slabs, etc.), ceramics (bricks, pipes), asbestos cement (sheets and pipes) or natural porous stones (limestone-shell rock, chalk, tuffs and flasks) are subjected to impregnation.

Organic binders (bitumen, coal tar and pitches, petrolatum), thermoplastic polymers (low molecular weight polyethylene) and monomers of thermosetting resins (styrene, methyl methacrylate) are used as impregnating materials, and impregnation with thermoplastic substances is carried out when they are heated, and thermosetting - with subsequent polymerization [5].

Waterproofing from piece materials pre-treated by impregnation - tiles, bricks, asbestos slate sheets - or the installation of building structures treated with impregnating materials is used when other waterproofing methods are less effective (for example, isolation of driven piles) and it is required to increase the chemical resistance of individual structures or structures [6].

Waterproofing from impregnated piece materials is arranged on binders that are similar in nature to impregnating materials or are resistant to aggressive waters - acidic, alkaline, carbon dioxide, magnesia, etc.

The impregnating waterproofing should be resistant to washing out by ground and aggressive waters, sufficiently deep and mechanically strong to withstand the loads arising during installation [7-8].

Penetrating waterproofing is a dry mixture of Portland cement, quartz sand and special activating chemical additives.

Representatives of this class of waterproofing materials include, for example, HYDROTEX-B and HYDROTEX-V. Their composition is widely used both to eliminate existing leaks (HYDROTEX-B), and in the construction of new

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facilities as an additional layer during concreting (HYDROTEX-V). When mixed with water and applied as a cementitious coating, the chemicals included in the material cause a catalytic reaction, as a result of which branched filamentous crystalline formations grow in the pores and capillary tracts of the concrete. As a result, the concrete structure is compacted in all directions, preventing the penetration of water or any other liquid.

The material provides watertightness of underground structures under hydrostatic pressure when processed from the inside. Chemicals move with water through the pores and capillary tracts of concrete, even against high hydrostatic pressure, creating crystalline formations. Crystalline formations have pores so small that water cannot penetrate through them. However, they do not interfere with air exchange. Thus, concrete can "breathe" and remains absolutely dry.

Structures treated with these materials withstand most aggressive environments, preventing chemicals, salt water, sewage and other harmful substances from penetrating into insulated objects. Treatment increases the frost resistance of concrete, protects it from weathering and other damage caused by weather conditions; prevents oxidation of the reinforcement.

Injection waterproofing is a waterproof filling of pores or cracks in a structure or its adjuncts, formed as a result of injection of a sealing agent with its subsequent curing. Ways of the device of injection waterproofing: cementation, bitumization, silicification and resinization. All of them involve drilling in the structure or the surrounding soil of holes or wells with the injection of sealant into them.

Cementation is used for injection into cracks or non-density concrete, into the pores of soils with cracks of more than 0.2 mm or water absorption of the soil over 0.05 l / min per 1 m2 of the well.

When using special cement-clay or cement-latex suspensions, it is possible to plug cracks with an opening of more than 0.15 mm, and when using special vibrocolloid suspensions - even up to 0.1 mm (with a specific water absorption of wells up to 0.05 l/min).

To fill large pores and voids with a filtration coefficient of more than 100 m / day, cementing mortars containing additives of sand, bentonites and cement hardening accelerators are used. Cementation is permissible at a filtration rate of not more than 300 m/day in separate-granular soils and not more than 600 m/day in cracks.

Cementation cannot be used when exposed to chemically aggressive groundwater, in permafrost soils and frozen concrete structures.

Cementing slurries are injected with high pressure mortar pumps. Mortar pumps R 100/3, R 200/10, 11-2R develop pressure up to 3 and even 5 MPa, and special cementing plants TsTs-1, TsA-300 and TsA-1, 4/150 - up to 15–30 MPa at maximum solution flow rate up to 1.4 m3/min.

Cast waterproofing is arranged by pouring waterproofing materials into the gap between the insulated surface and the protective (pressure) wall, it is used in cases of possible occurrence of deformation cracks where water leakage is completely unacceptable.

Mounted waterproofing made of sheet polymeric and metal materials is used to isolate structures that are in harsh operating conditions.

When using chemically resistant polymer sheet materials, which practically do not have adhesive ability to known adhesive or binder materials, they are attached to building structures using dowels and studs. Metal sheets can be fixed with anchors.

Backfill waterproofing from hydrophobic bulk materials it has limited use, since to ensure the quality characteristics of the insulation, a constant direction of the heat flow against the direction of the moisture flow is required.

Initial data for the choice of waterproofing: hydrogeological conditions, purpose and features of the structures of the structure, crack resistance of structures, types of loads, recommended types of waterproofing for the main structures and structures, approximate service life of the main waterproofing coatings (table 1).

Table 1
Operating conditions and requirements for waterproofing

Factors that determine waterproofing requirements	Factor characteristic	Indicators to be met by the designed waterproofing
1	**2**	**3**
Hydrogeological conditions		
Depth of laying (structures, foundations, etc.)	Standard soil resistance on the side surface of the pile, foundation, etc.	Shear strength, MPa; crack resistance coefficient, elasticity, mm or %
Water resistance and filtration coefficient	Groundwater level fluctuations relative to the day surface	Taken into account if it is necessary to reduce the impact of external

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		factors on waterproofing (drainage, screens, etc.)
Height of capillary rise	Determined according to geological survey data	Height of the waterproofing device, m
Soil heaving	Vertical movement of soil relative to the structure	Shear strength, Pa; need for drainage
hydrostatic head	Travel speed and duration of pressure	Water resistance
The degree and duration of watering	Planting depth of the structure relative to the groundwater level	Water absorption,%; softening factor
Corrosivity soils	Electrical resistivity and chemical composition	Electrical resistance, Ohm; material grade for acid resistance
Aggressiveness of the aquatic environment	pH, water hardness, sulfate, bicarbonate and magnesia content	Material grade for acid resistance or change in weight (%) and strength (Pa) when exposed to an aggressive environment
Exposure to microorganisms	Destruction of waterproofing due to the vital activity of microorganisms	Use of antiseptic additives
Design features of the structure and its purpose		
Crack resistance of insulated structures	Opening of cracks in the structure	Crack resistance coefficient of waterproofing
Aggressiveness of production fluids	The concentration of aggressive compounds that destroy waterproofing and structures	Material grade for acid resistance
Mechanical influences	Compressive and tensile loads arising from the mass of structures, soil, water pressure, relative displacements, precipitation, etc.	Compressive strength (tensile, bending), Pa
Temperature and other influences	Technological mode of production and climatic conditions (positive and negative temperatures, organic oils, mercury, release of explosive gases, etc.)	Glass transition temperature, °C heat resistance, the use of materials characterized by oil resistance, mercury resistance, spark safety, etc.
Contact with drinking water	Toxicity of waterproofing materials	Maximum Permissible Concentration (MAC)
Estimated service life of the structure or waterproofing	They are installed according to SNiP, and waterproofing and individual materials - according to generalized data	Calculate or take from experimental data

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