TECHNONICOL

PREMIUM

Guide on the application of LOGICBASE INJECT injection materials for waterproofing and protection of building structures

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Contents

1.General information

1.1. Provisions of this guide should be considered when developing project documentation

on waterproofing and protection of building structures with the application of LOGICBASE INJECT injection materials.

1.2. Provisions of this guide should be considered when developing any operating procedures, programs of works, as well as technological flow charts regulating works on waterproofing and protection of building structures with the application of LOGICBASE INJECT injection materials.

1.3. This guide is recommended for the application by employees of specialized building organizations engaged in waterproofing, repair and protection of concrete structures.

1.4. This manual shall not be used instead of design or regulatory documents. When designing waterproofing systems and installing waterproofing coverings, the requirements of national and territorial regulations on design of insulating coatings and safety precautions in construction, as well as current regulations on occupational health and fire safety in construction, must be observed.

2. General provisions

2.1. This guide has been developed for specialists of the professional construction community in order to improve the quality of design and installation of waterproofing systems.

2.2. The guide is intended for the use during development and implementation of projects on repair, protection and waterproofing of building structures with the application of LOGICBASE INJECT injection materials. It determines the procedure of selection and the rules of applying materials for injection.

2.3. It also determines the requirements for injection materials, establishes the order of performing works and the control of their quality, as well as specifies the requirements for equipment being applied, surfaces being insulated and environment.

2.4. Works on development of projects on repair and protection of building structures must be performed by specialized organizations authorized for performing such works.

3. Normative references

3.1. All the works on waterproofing, protection and repair must be performed in strict adherence to a specific project of performing works, this guide and the requirements of the following regulatory documents*:

GOST 33762-2016 "Materials and systems for protection and repair of concrete structures. Requirements for injection compounds and seals of cracks, cavities and crevices";

GOST 56378-2015 «Materials and systems for protection and repair of concrete structures. Requirements for repair mixtures and adhesive joints in a contact zone when restoring structures»;

GOST 12.1.004-91 SSBT. Fire safety. General requirements;

GOST 12.4.011-89 SSBT. Occupational safety standards system (OSSS). Safety equipment for workers. General requirements and classification

GOST 12.1.005-88 OSSS «General sanitary and hygienic requirements for the air in the working area»;

GOST 12730.5-84 Concrete types. Methods for determining water resistance;

GOST 17624-78 Concrete types. Ultrasonic method for determining strength;

SNiP 12-03-2001 Construction safety requirements. Part 1. General requirements;

SNiP 12-04-2002 Construction safety requirements. Part 2. Construction operations;

SR 03-428-02 Safety rules for the construction of underground structures;

FSR 01-03 Fire safety rules in the Russian Federation.

* During the use of this Technological flow chart, it is advisable to check the effect of reference standards and classifiers in a public information system, i.e. on the official website of the national body of the Russian Federation for standardization on the Internet or according to the annually published information index "National Standards", which was published as of January 1 of the current year, and according to the corresponding monthly published reference indexes published this year.
If a reference document was replaced (changed), then during the use of this standard, you should be guided by to the replaced (changed) document. If a reference document was cancelled without changing, then the provision in which it is referred to should be applied in a part that does not touch upon this reference.

3.2. The following reference literature was used in the development of this Guide:

3.2.1. Guide for repairing concrete and reinforced concrete structures of transportation facilities with taking into account the compatibility of materials. OAO TsNIIS.

4. Terms and definitions

4.1. **Crack** – a concrete structure defect that may occur during construction or may result from a structural failure or damage.

4.2. **Active crack** - a crack that changes its opening during application of temporary or temperature loads.

4.3. **Filtering crack** - a crack that has traces of water presence or demonstrates water filtration presence.

4.4. **Technological (working) joint -** a joint at the point of contact of concrete of different ages that results from the technology of concrete works.

4.5. **Deformation joint** - a moving joint in concrete and reinforced concrete structures, which is a special gap between two mating elements that allows to compensate various kinds of deformations (thermal, sedimentary, etc.).

4.6. **Waterproofing membrane** - an insulation system element designed to protect underground parts of buildings, structures or their elements from groundwater and surface water, atmospheric precipitation and aggressive effects of surrounding soils.

4.7. **Defect** - a separate discrepancy between structures, including building materials, to some parameter set by the project or a regulatory document.

5. General requirements

5.1. Repair of reinforced concrete structures is carried out both at the construction stage and during their operation. At the construction stage, defects are usually eliminated and cracks are treated. At the operation stage, various types of repair works are carried out, including repairs for eliminating water penetration through cracks and working joints of concreting.

5.2. For effective repairing reinforced concrete structures at the operation stage, It is necessary to develop a step-by-step plan based on the results of on-site surveys, the operating conditions of the facility and data on the properties of materials that can be used for repairs.

5.3. Performing the injection works is allowed at base and ambient temperatures from +5°C to +30°C. If necessary, concrete should be heated using hot air blowers and infrared heaters.

5.4. If necessary, before starting injection, the working area must be protected from dust and water, for example, using a PE film, access to cracks must be prepared and connections for equipment and power tools, as well as lighting must be provided.

5.5. Visible defects on the concrete surface (cavities, porous areas) must be repaired prior to starting injection works using repair compounds.

5.6. In case of a strong pressure of water flow in a joint cavity, water suppression should be carried out by arranging a cutoff wall before starting repair works.

5.7. For preparing the work area, the following equipment and tools shall be used: chisel, hammer, pick, sledgehammer, scrapers, pitching chisel, crowbar, metal and lint brushes, vibration drill, angle grinder, apparatus for water jetting and sandblasting, industrial vacuum cleaner, discs for cutting and grinding concrete.

5.8. In order to prepare compounds for performing works, the following equipment and tools shall be used: construction mixer, mixing containers, measuring containers, weigh-scales. During injection works, the following equipment and tools shall be used: brushes with hard bristles, spatulas, trowels, rules, floats, sealant gun with closed tube, hot air gun. injection pumps of various types, air compressor for pneumatic pumps.

6. Materials used

6.1. LOGICBASE INJECT injection materials shall be applied as the main materials for waterproofing and protecting building structures.

6.2. Compounds for protection and repair of concrete structures are divided into two groups:

— Adhesive-sealing closure group (AS) - materials that seal crack cavities, are adhesively bonded to the concrete surface after polymerization and capable of taking up impacts from movements during movement of cracks;

— Compression-sealing closure group (CS) - materials that seal crack cavities due to their own swelling when absorbing moisture, are compressively connected to structure concrete and capable of taking up impacts from movements during movement of cracks and water pressure.

6.3. Classification of compounds according to a closure attribute is shown in Table 1.1

Table 1.1. «Classification of compounds according to a closure attribute»

Material type	Remark
Adhesive-sealing closure group	
LOGICBASE INJECT PU 300 1K injection resin based on a hydroactive polyurethane with a short foaming time.	Applied for quickly bridging and sealing cracks with active water leaks under pressure. When contacting with water for a short time, the material repeatedly increases in volume, forming a foam with small closed pores. To ensure long-term water resistance and reliability upon the application of a hydroactive foam, it is necessary to conduct an additional injection stage using a polyurethane resin, which does not form foam and gives the compound strength and durability.
Two-component polyurethane injection resins LOGICBASE INJECT PU 305 2K	A product based on a polyurethane resin with low viscosity and without solvent content. Upon the reaction with water, the substance forms a dense, waterproof, hard-elastic foam with a fine-porous structure. On contact with water, an approximately 30-fold increase in volume is achieved in a free space.
Two-component polyurethane injection resins LOGICBASE INJECT PU 310 2K	They have a low viscosity and do not contain solvents. They are characterized by high elasticity figures and excellent adhesion to most surfaces. This type of resins is used to bridge moving cracks (from 0.2 mm), which provides strong sealing and protection against re-opening even under conditions of drops in temperature and frequent changes in loads.
Compression-sealing closure group	
Acrylate-based injection gels LOGICBASE INJECT ACRYL 500 F, S	The main feature of injection gels is their very low viscosity, which allows the material to penetrate into the smallest water-bearing cracks. Such gels are able to absorb moisture, increasing in volume and, as a result, filling possible voids that may appear during deformations of structures. After polymerization, the damaged waterproofing is completely restored. Solutions based on acrylate gels are best suited for arranging injection anti-filtering curtains in underground parts of buildings, waterproofing large volumes of masonry, restoring waterproofing and sealing deformation joints.
Plasticizer for acrylate injection gels LOGICBASE INJECT ACRYL FLEX	

6.4. The list of injection materials used is presented in Table 1.2.

Table 1.2. List of injection materials used, their parameters and brief description.

LOGICBASE INJECT PU 300 1K

Hydroactive highly elastic polyurethane resin	
Quantity of components	1
Base type	Polyurethane
Application	• Elimination of active water leaks; sealing of joints, cracks or voids in building structures subject to dynamic loads. • For filling voids in soils behind tunnel lining. • For eliminating filtration and infiltration of water through building structures, including those under significant pressure. • For eliminating active water leaks under pressure in cracks and joints prior to injection of the LOGICBASE INJECT PU 310 2K polyurethane resin.
Packaging	The product is supplied in 25-kg buckets.

LOGICBASE INJECT PU 305 2K

Two-component hydroactive polyurethane foaming resin	
Quantity of components	2
Base type	Polyurethane
Application	• For eliminating active water leaks under pressure in cracks and joints prior to injection of the LOGICBASE INJECT PU 310 2K polyurethane resin. • For waterproofing and sealing damp joints, cracks or voids in building structures. • For filling voids in soils behind tunnel lining. • For eliminating filtration and infiltration of water through building structures, including those under significant pressure.
Packaging	Supplied in a 44-kg set: Component A – 20 kg Component B – 24 kg

LOGICBASE INJECT PU 310 2K

Hydroactive highly elastic polyurethane resin with low viscosity	
Quantity of components	1
Base type	Polyurethane
Application	• For elastic sealing and filling of dry or damp cracks, joints and connections. In the presence of water, the material is used in combination with LOGICBASE INJECT PU 305 2K after active filtration has stopped. • For creating a cutoff waterproofing that would prevent rise of capillary moisture along brick and stone walls.
Packaging	Supplied in a 44-kg set: Component A – 20 kg Component B – 24 kg

LOGICBASE INJECT PU CLEANER

Solvent for polyurethane resins	
Quantity of components	1
Base type	Multicomponent transparent organic
Application	It is most effectively used for cleaning equipment from polyurethane compositions, both film-forming and foaming. In most cases, cleaning is possible even from solid polymerization products. It is an effective solvent for cleaning from most polymer film-forming agents, resins, and oligomers. Can be applied to remove old paint coatings. Can be effectively applied for cleaning parts of machines (including vehicles) and mechanisms from various POL.
Packaging	The product is supplied in 5-, 10- and 20-kg canisters.

LOGICBASE INJECT ACRYL 500 F

Highly-elastic acrylate gel for injection	
Quantity of components	3
Base type	Polymer composition based on polyacrylates
Application	• For elastic sealing of deformation and structural joints, as well as micro-cracks in concrete and stone structures. • For restoring the integrity of waterproofing made of polymer membranes. • For sealing of working concrete joints through a system of hoses. For creating a cutoff waterproofing that would prevent rise of capillary moisture along brick and stone walls. • For arrangement of grout cutoffs behind a structure. • For filling of cavities, voids and communication inputs. • For soil consolidation.
Packaging	Supplied in a 21.5-kg set: Component A1 – 20 kg Component A2 – 0.5 kg Component B – 1 kg

LOGICBASE INJECT ACRYL 500 S

Highly-elastic acrylate gel for injection	
Quantity of components	3
Base type	Polymer composition based on polyacrylates
Application	• For elastic sealing of deformation and structural joints, as well as micro-cracks in concrete and stone structures. • For sealing of working concrete joints through the Injpipe hose system. • For creating a cutoff waterproofing that would prevent rise of capillary moisture along brick and stone walls. • For arrangement of grout cutoffs behind a structure. • For filling of cavities, voids and communication inputs. • For soil consolidation.
Packaging	Supplied in a 21.3-kg set: Component A1 – 20 kg Component A2 – 1.0 kg Component B – 0.3 kg* * – if a larger amount of Component B is required, it is additionally supplied in packages weighing 0.3 kg, 0.5 kg or 1 kg.

LOGICBASE INJECT ACRYL FLEX

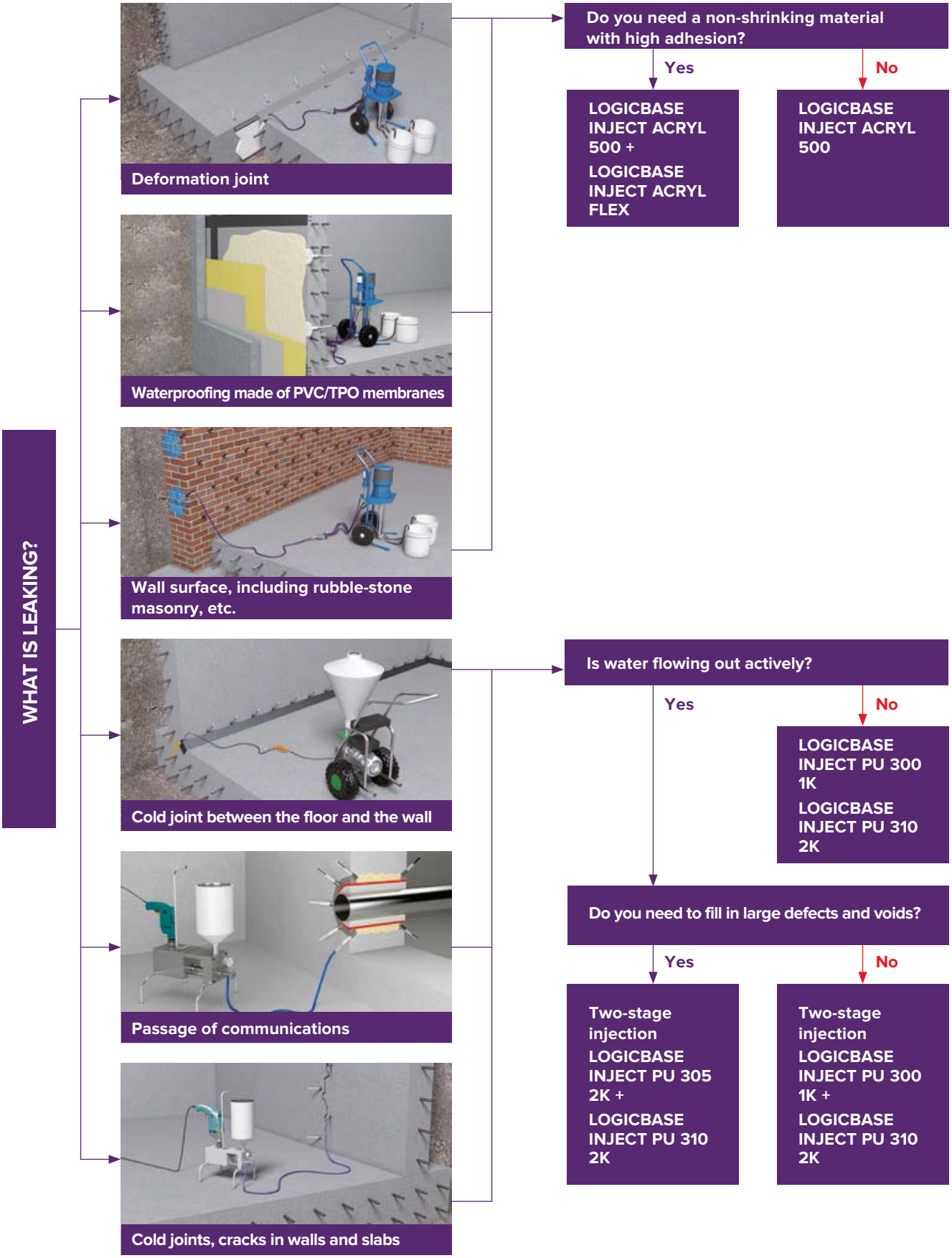
Plasticizer for acrylate gels LOGICBASE INJECT ACRYL 500 F,S	
Quantity of components	1
Base type	Polymer composition based on polyacrylates
Application	• Recommended for the use to increase the mechanical strength and adhesion of acrylate gels • To reduce shrinkage of acrylate gels • Instead of water to dissolve Component B when preparing acrylate gels in the following cases: – When injecting in areas with hydrostatic pressure of more than 0.6 bar; – When injecting in areas with high alkalinity (pH 13-14).
Packaging	The product is supplied in 20-kg canisters.

LOGICBASE INJECT ACRYL CLEANER

Solvent for acrylate injection gels	
Quantity of components	1
Base type	Epoxy-based polymer composition
Application	• Restoration of structures made of concrete, brick, natural stone, glass, ceramic tiles and metal. • Filling and sealing dry and wet cracks and voids where structural strength is required. • Repair of joints and cracks. • Restoration and leveling of damaged concrete and plaster. Filling voids, potholes, etc. • Restoring edges and corners of structural elements. • When adding mineral fillers, it can be used as a puttying mass.
Packaging	The product is supplied in 20-kg canisters.

The matrix for selection of injection compounds is shown in Fig. 1.1

MATRIX FOR SELECTION OF INJECTION COMPOUNDS



7. Works organization

7.1. Before performing the works, it is necessary:

- to appoint persons responsible for safe performing the works;
- to issue to the executive in charge an act of admission and an order of admission for performing the works;
- to instruct the executive in charge to conduct a targeted instruction of employees on the matters of labor protection, electrical and fire safety, and also environmental protection under the signature in the journal of labour protection briefings;
- to familiarize the operating personnel with the technology of performing works, project documentation, CMP, working plan and this technological flow chart;
- to allocate areas for storage and stock-keeping of materials;
- to deliver to the site and carry out incoming quality control of building materials in the prescribed manner;
- to deliver the necessary tools, accessories, inventory, etc. to the site.
- to provide employees with the necessary tools, fittings, fixtures, harness, work wear and other personal protective equipment;
- to check functionality of mechanisms, harness and tools;
- to accept the spread of activities according to the acceptance certificate for completed works.

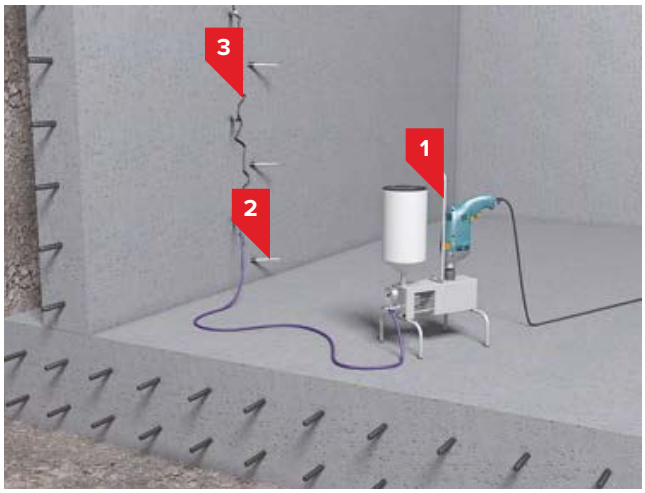
7.2. The works on the waterproofing of technological joints of concreting and cracks are performed by a team consisting of:

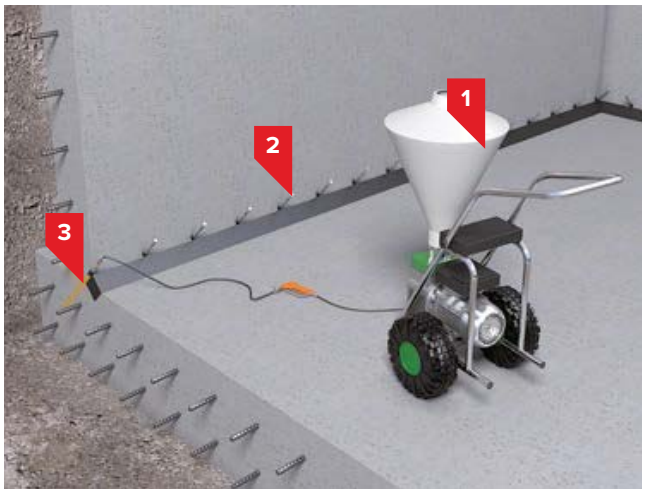
- insulation worker - 2 persons.

7.3. Repair works, upon their completion, are documented with appropriate acts for covered-up works.

8. Technology of performing works

8.1. Arrangement of waterproofing of technological joints and cracks in foundation structures, transport tunnels, exploited roofs, intermediate floors of underground parking lots made of monolithic reinforced concrete, including joints between FBS blocks in prefabricated foundation structures.





1. Electrical piston pump; 2. Injection packers; 3. Crack or technological joint of concreting.

8.1.1. The following materials are applied to seal technological joints and cracks: LOGICBASE INJECT PU 300 1K; LOGICBASE INJECT PU 305 2K; LOGICBASE INJECT PU 310 2K.

8.1.2. Specifications of injection compounds are presented in Appendix B

8.1.3. The final sealing of technological joints and cracks with active water flow is carried out only after eliminating the possibility of water filtration into them and formation of streaks on these cracks by injection with highly elastic polyurethane resins INJECT PU 300 1K and LOGICBASE INJECT PU 305 2K. Products based on a polyurethane resin with low viscosity and without solvent content. Afte polymerization, the products remain highly elastic.

8.1.4. To seal technological joints and cracks with an opening of 0.3 mm or more, it is recommended to inject them with elastic injection compounds LOGICBASE INJECT PU 310 2K. A low-viscosity, solvent-free product based on polyurethane resin for injection into dry cracks and joints. After polymerization, the product has constant elasticity and allows you to seal moving cracks.

8.1.5. Technological joints and cracks that change the opening width by more than 0.3 mm are recommended to be sealed with elastic compounds LOGICBASE INJECT ACRYL 500 F,S that have a significant relative elongation. Acrylate-based products with very low viscosity, solvent-free, with fast curing time. They increase in volume during polymerization. After polymerization, the gel has a high elasticity and is able to withstand dynamic loads.

8.1.6. Sealing of filtering cracks and technological joints with weak or moderate water pressure is carried out by one- or two-stage injection with polyurethane compounds INJECT PU 300 1K, LOGICBASE INJECT PU 305 2K and LOGICBASE INJECT PU 310, which provide sealing and reliable adhesion to concrete in the presence of water. Or by one-step injection using LOGICBASE INJECT ACRYL 500 F,S. The application of LOGICBASE INJECT ACRYL 500 F,S compositions is advisable for active cracks with low water pressure.

8.1.7. The compositions of injection solutions, as well as the technology of their injection, can change for each structural element based on data from on-site surveys, the type of cracks, the temperature of concrete and the environment during performance of works.

THE WORKS ARE PERFORMED IN SEVERAL STAGES:

8.1.8. At the first stage, pointing of the mouth of the defect (technological joint, crack) should be performed, for which it is necessary:

— make a chase to a depth and width of at least 15x15 mm, with trapezoidal or rectangular cross-section, along the crack mouth (the optimal shape of chase when pointing cracks is a trapezoidal shape). A chase can be made manually using a wall-chaser or mechanically using a vibration drill with a blade or using an angle grinder with a diamond blade;

— clean the prepared chase from dust and pieces of concrete with a metal brush or rinse with water at a pressure of up to 15 atm using a pump set.

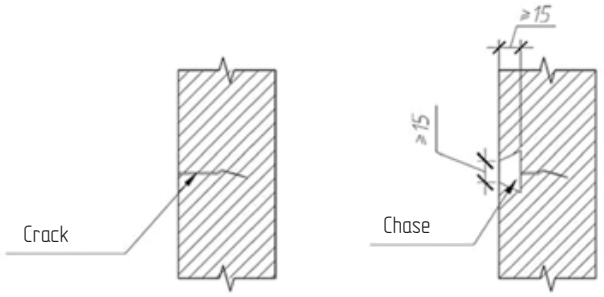


Figure 8.1 - Chase making diagram

8.1.9. At the second stage, drilling of injection holes (boreholes) and installation of packers should be performed;

— a borehole for a packer should be drilled at an angle not exceeding 30-45° to the plane of the concrete surface;

— drilling injection holes for installing packers must be performed with a borer of the appropriate diameter;

— drilling boreholes should be performed as close as possible to the mouth of the crack, without breaking off its edges;

— the distance between adjacent boreholes must be 150...500 mm, the distance of the holes from the defect must correspond to half the thickness of the structure, the length of the holes must be 0.5...0.7 of the thickness of the structure. If necessary, the pitch and depth of the boreholes can be changed depending on the situation on the site. The pitch of the boreholes, in any case, must be at least 150 mm and not more than 500 mm. For identifying the most optimal drilling site, it is recommended to conduct a trial pumping of the crack with water from the pioneer packer with determining the most remote point of water outlet to the crack surface, which will determine the installation location of the next packer. Injecting a packer with water also allows you to determine the permeability of the crack in this particular area. If the crack has good permeability, the distance between packers in the longitudinal direction may be increased to 500 mm.

— the boreholes shall be cleaned of dust and dirt with compressed air or water, and the packers shall be installed in the injection holes;

— while installing the packers, they must be firmly secured in the boreholes. The top of the expanding part of a packer in a borehole must be at least 10 mm below the concrete surface, and its body must not overlap the plane of the crack;

— in this case, a drilling depth may reach 20-40 cm.

8.1.10. At the third stage, to reduce the consumption of the solution, it is recommended to fill the mouth of the defect, for which the following works should be performed:

— the prepared chase should be filled with a suitable (depending on the grade of concrete) repair compound;

— filling the chase with a repair compound should be done layer-by-layer by hand onto a prepared base (the minimum and maximum allowable thicknesses of a single-layer application of the compounds is 5...30 mm);

— compacting the applied solution with a trowel, squeezing out the entrained air;

— giving the necessary shape to the laid repair compound as soon as it begins to set (it is forbidden to use water to wet the tool while giving the desired shape to the surface of the repair compound);

— applying a notch with a trowel on the laid layer, as soon as it begins to set, if necessary, laying subsequent layers of the repair compound after the technological break specified in the technical description of a specific repair compound.

8.1.11. The final stage is performing injection works:

— injection is performed only after a technological break for hardening the applied repair compound in case of its application;

— preparation and application of an injection compound should be performed according to the relevant technical description of the injection material;

— before preparing a mixture of resin components, it is necessary to perform a trial mixing in a small container to assess their viability under the conditions of the object and the ambient temperature, since the viscosity of a mixture increases with a decrease in temperature, and with an increase in temperature, the viability of a mixture of resin components decreases;

— injection works should be performed sequentially. row by row, from the lower left to the upper right packer (for defects on vertical surfaces) or sequentially from the edge (for defects on horizontal surfaces);

— on the second packer it is necessary to unscrew the reverse-flow valve and connect the pump hose to the first packer. Injection must be conducted until excess injection compound begins to flow out of the second packer, after which the reverse-flow valve must be returned to the second packer and injection must be continued. The above steps must be repeated for each subsequent packer;

— discharge pressure should be increased gradually. It must not exceed the following empirical dependence:

$$P_{max} = 10 \text{ atm} \cdot \frac{(\text{Grade of concrete})}{3}$$

— In case of a sharp increase in pressure or its constant retention for 30...60 seconds, injection should be stopped and the injection equipment should be flushed with a suitable flushing compound. The flushing method is determined by the design of the injection pump.

— after every 40 minutes of conducting the injection works with the use of polyurethane materials, it is also required to conduct equipment cleaning using a wash-off solution (detergent, cleaner);

— Upon completion of injection, the equipment must be flushed in the same way.

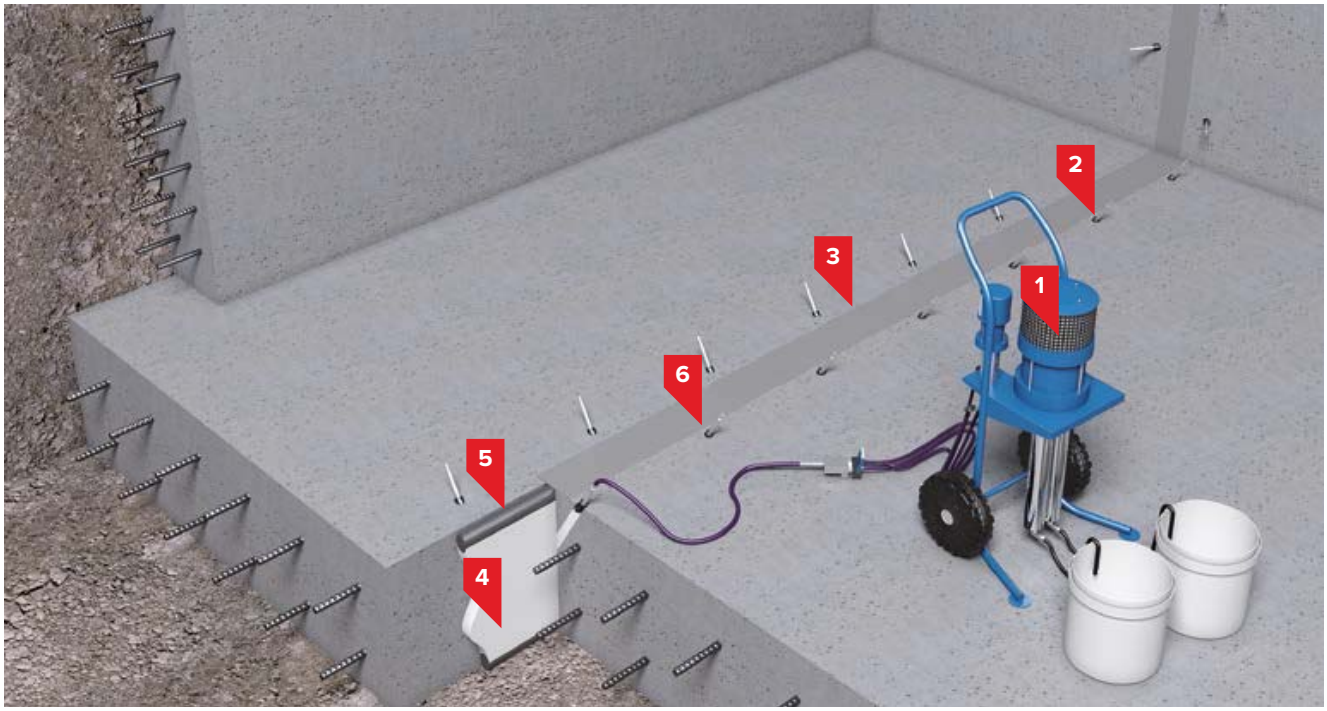
Then injection pumps for polyurethane compounds should be flushed and preserved with clean hydraulic oil;

— when conducting two-stage injection, polyurethane elastic resin INJECT PU 310 2K should be injected into the same packers 25...40 minutes after injection of hydroactive foaming resin INJECT PU 300 1K or LOGICBASE INJECT PU 305 2K;

— 24 hours after completion of injection works, packers should be dismantled. Their dismantling shall be performed either by knocking off using a hammer or by shearing off using an angle grinder flush with the concrete surface. Upon dismantling, packers must be disposed of.

— injection holes must be filled with a repair compound.

8.2. Restoring the tightness of deformation joints



1. Two-component injection pump for acrylate gels with a mixing ratio of 1 to 1
2. Injection packers
3. Deformation joint
4. LOGICBASE INJECT ACRYL 500 F, S
5. Joint limiter
6. Joint packing

For restoring the tightness of deformation joints, materials LOGICBASE INJECT ACRYL 500 F, S and LOGICBASE INJECT ACRYL FLEX are used.

8.2.1. Specifications of injection compounds are presented in Appendix B.

THE WORKS ARE PERFORMED IN SEVERAL STAGES:

8.2.2. At the first stage, you should perform pointing of the joint cavity, for which you must:

— clean the joint cavity to a depth of at least 3 (three) times the width of the joint opening by machining using hand and power tools, followed by additional cleaning from dust and dirt with compressed air;

— install a lower restrictive profile made of foamed polyethylene having circular cross-section with a diameter 20% greater than the width of the joint opening to a depth of at least 3 (three) times the width of the joint opening;

— install an upper restrictive profile made of foamed polyethylene having circular cross-section with a diameter 20% greater than the width of the joint opening in a way that the distance between the lower and upper restrictive profiles is at least 50 mm.

8.2.3. At the second stage, drilling of injection holes (boreholes) and installation of packers should be performed;

— drilling boreholes for packers into a limited joint cavity must be done on both sides of the joint, alternating their placement in a checkerboard pattern at an angle of 45° and a step of 150...300 mm with the location of the borehole mouth in the joint cavity;

— drilling injection holes for installing packers must be performed with a borer of the appropriate diameter;

— the boreholes shall be cleaned of dust and dirt with compressed air or water, and the packers shall be installed in the injection holes;

— while installing the packers, they must be firmly secured in the boreholes. The top of the expanding part of a packer in a borehole must be at least 10 mm below the concrete surface. It is recommended to use packers with the ability to dismantle the reverse-flow valve to control the quality of works.

8.2.4. At the third stage, to reduce the consumption of the solution, it is recommended to fill the joint, for which the following works should be performed:

— filling the upper limited cavity of the joint with a suitable (depending on the concrete grade) repair compound;

— filling the joint with a repair compound should be done layer-by-layer by hand onto a prepared base (the minimum and maximum allowable thicknesses of a single-layer application of the compounds is 5...30 mm);

— compacting the applied solution with a trowel, squeezing out the entrained air;

— giving the necessary shape to the laid repair compound as soon as it begins to set (it is forbidden to use water to wet the tool while giving the desired shape to the surface of the repair compound);

— applying a notch with a trowel on the laid layer, as soon as it begins to set, if necessary, laying subsequent layers of the repair compound after the technological break specified in the technical description of a specific repair compound.

8.2.5. The final stage is performing injection works:

— injection shall be performed after a technological break for setting the applied repair compound if used;

— for reducing the consumption of the injection compound, it is recommended to pre-inject the joint with water. The rate of gel consumption depends on the configuration of the joint and the structure of the surrounding soil.

— preparation of injection compound LOGICBASE INJECT ACRYL 500 F, S should be performed in the following sequence:

— Mix components A1 and A2, which are supplied in a packaging ready for mixing in a ratio of 40 to 1 by weight (A1 to A2)

— For this end, it is necessary to completely pour out component A2 from a small container into a large container with component A1. Then mix the components using a drill with an attachment for 3 minutes. Finished component A is sensitive to light, so it must be stored in an opaque container. Upon mixing components A1 and A2, the time of using the mixture is 4 hours. To mix component B, you will need a container with the same volume as for the mixture of components A1 and A2. Fill the container with water or plasticizer LOGICBASE INJECT ACRYL FLEX and add component B. Mix using a drill with an attachment for 3 minutes. The volume of water or the plasticizer with component B must be equal to the volume of the mixture of components A1 and A2. For component B with water or the plasticizer, the time of using the mixture is 5 hours. The time of reaction start and, accordingly, of increase in viscosity depends on the concentration of component B (catalyst) and on the temperature of components during injection. Nevertheless, the amount of the catalyst must be not less than 40 g and not more than 1000 g per 20 liters of the mixture of components A1 and A2. The duration of polymerization time for LOGICBASE INJECT ACRYL 500 F,S depending on the ambient temperature and the amount of catalyst is shown in Appendix B.

NOTE:

— If the presumed injection zone is under a hydrostatic pressure of more than 0.6 bar, then the LOGICBASE INJECT ACRYL FLEX additive should be used instead of water for mixing component B. This material retains waterproofing at pressures of up to 7 bar.

— If it is necessary to provide high adhesion of the gel to the base (under conditions of large tensile or bending deformations), then LOGICBASE INJECT ACRYL FLEX thixotropic additive should be used instead of water for mixing component B.

— If there is an active water inflow in the injection zone, it must first be stopped with a one- or two-component foaming polyurethane injection compound (e.g., INJECT PU 300 1 K), and then an acrylate gel must be injected (preferably LOGICBASE INJECT ACRYL 500 F) with plasticizing agent LOGICBASE INJECT ACRYL FLEX.

— If a highly alkaline environment (pH 13-14) is expected in the injection area, an acrylate gel with plasticizing additive LOGICBASE INJECT ACRYL FLEX should be used to prevent migration of aggressive substances into the gel structure.

— before preparing a mixture of components, it is necessary to perform a trial mixing in a small container to assess their viability under the conditions of the site and the ambient temperature, since the viscosity of a mixture increases with a decrease in temperature, and with an increase in temperature the viability of a mixture of components decreases;

— injection works should be performed sequentially in a closed loop along the entire length of the joint - along the plate, wall parts and the upper floor. Injection should be performed row by row, from the lower left to the upper right packer (for defects on vertical surfaces) or sequentially from the edge (for defects on horizontal surfaces);

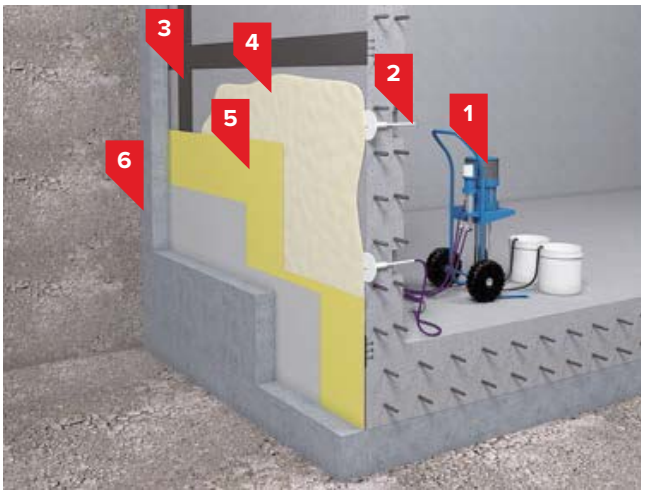
— on the second packer it is necessary to unscrew the reverse-flow valve and connect the pump hose to the first packer. Injection must be conducted until excess injection compound begins to flow out of the second packer, after which the reverse-flow valve must be returned to the second packer and injection must be continued. The above steps must be repeated for each subsequent packer;

— working pressure, its control and actions due to its change should be carried out as described in 7.1.10;

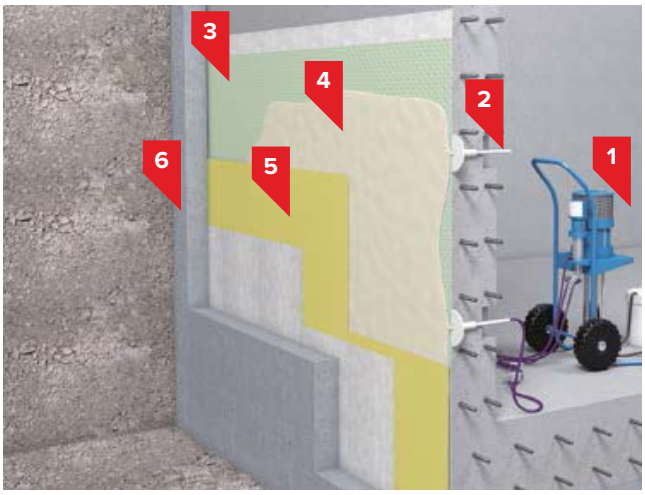
— 24 hours after completion of injection works, packers should be dismantled. Their dismantling shall be performed either by knocking off using a hammer or by shearing off using an angle grinder flush with the concrete surface. Upon dismantling, packers must be disposed of.

— injection holes must be filled with a repair compound.

8.3. Restoration of repairable waterproofing made of PVC, TPO membranes.



A.) Injection of a single-layer waterproofing system



B.) Injection of a two-layer waterproofing system

1. Two-component injection pump for acrylate gels with a mixing ratio of 1 to 1
2. Injection tubes and connecting branches
3. (A) External waterstop for sectioning PVC membranes; (B) PVC membrane LOGIBASE V-ST
4. LOGICBASE INJECT ACRYL 500 F, S
5. PVC membrane LOGIBASE V-SL
6. Shoring of excavation or backfill soil

Waterproofing membranes made of polymer roll materials are provided at the installation stage with a system for restoring their water resistance, which includes:

— waterstops for sectioning the entire waterproofing coating into sealed sections isolated from each other (area: no more than 150 m^2);

— injection tubes for supplying the injection compound to connecting branches;

— injection connecting branches for spreading the injection compound over the membrane surface. In case of damage to a waterproofing membrane of this type, the penetrated water is localized within sealed sections and manifests itself through injection tubes.

8.3.1. To restore repairable waterproofing from PVC, TPO membranes, by injection, three-component injection composition LOGICBASE INJECT ACRYL 500 F,S is used. The material can also be used in combination with additive LOGICBASE INJECT ACRYL FLEX, which is a plasticizer for acrylate injection gels, increases their strength and reduces shrinkage.

THE WORKS ARE PERFORMEDIN SEVERAL STAGES:

8.3.2. At the first stage, it should be determined by the presence of water manifestations from injection tubes which of the sealed sections is damaged, for which it is necessary:

— to provide access to injection tubes (as a rule, they are embedded in wall structures or foundation slabs);

— at the location of injection tubes, most often in the concrete body (at the stage of monolithic works), special plastic boxes are installed in which tubes from each or several sections are placed. If there are no plastic boxes for placement of injection tubes, access to them should be ensured by dismantling the finish and then restoring it;

— to connect the injection pump to the tubes of the injection system, for which special packers with a herringbone adapter or other types of connections can be used to ensure the tightness of the pump connection to the tubes.

8.3.3. At the second stage, injection should be performed:

8.3.4. Preparation of LOGICBASE INJECT ACRYL 500 F, S and LOG1C BASEINJECT ACRYL FLEX materials should be performed similarly to clause 8.2.5.

— on the second packer it is necessary to unscrew the reverse-flow valve and connect the pump hose to the first packer. Injection must be conducted until excess injection compound begins to flow out of the second packer, after which the reverse-flow valve must be returned to the second packer and injection must be continued. Injection is conducted from left to right or from the lower to the upper packer. Transition to the next packer is performed when an excess of the injection compound begins to flow out of it. The check valve is returned to it and injection is continued, as is done with each subsequent packer. The injection material spreads evenly between the concrete structure and the membrane, sealing the damaged area and the structure as a whole. The above steps must be repeated for each subsequent packer;

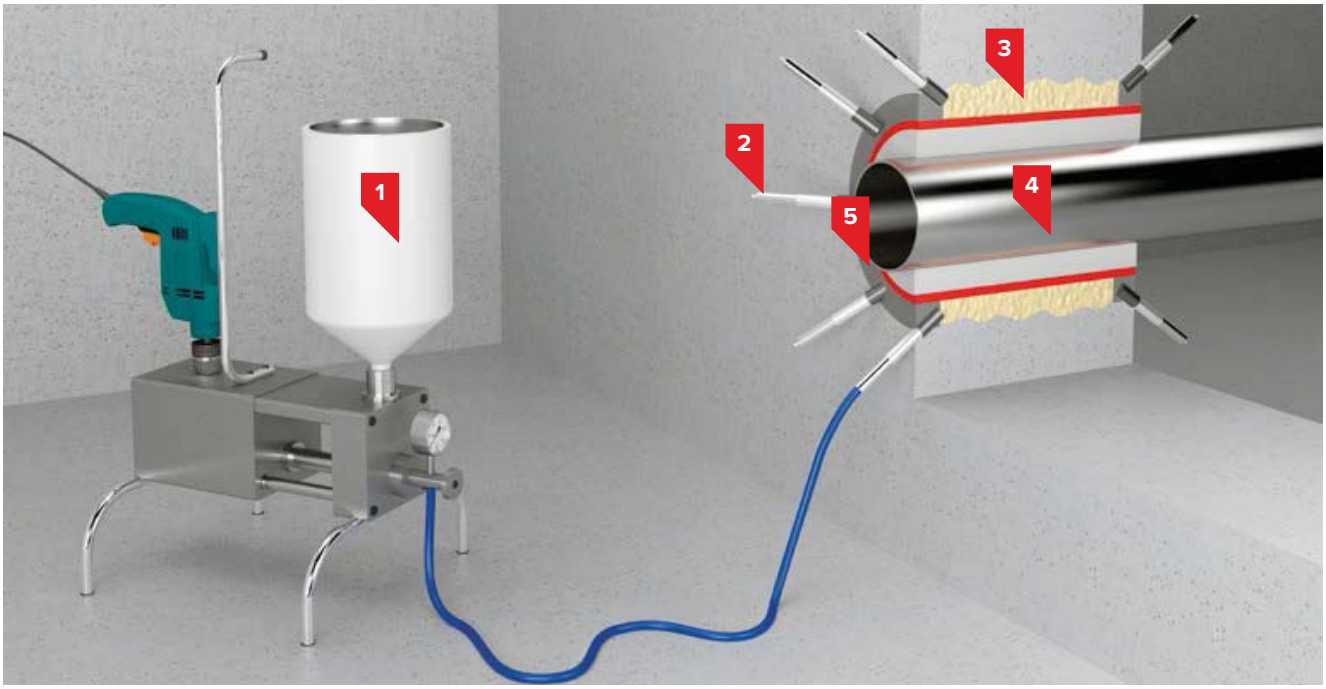
— on the second packer it is necessary to unscrew the reverse-flow valve and connect the pump hose to the first packer. Injection must be conducted until excess injection compound begins to flow out of the second packer, after which the reverse-flow valve must be returned to the second packer and injection must be continued. The above steps must be repeated for each subsequent packer;

8.3.5. working pressure, its control and actions due to its change should be carried out as described in 8.1.12;

8.3.6. upon completion of injection, the equipment must be flushed with a flushing compound.

8.3.7. 24 hours after completion of injection works, packers should be dismantled.

8.4. Sealing of passageways of engineering communications



1. Electrical piston pump
2. Injection packers
3. Injection compound
4. Embedded sleeve
5. Repair compound for packing

8.4.1. For sealing the passage points of engineering communications, materials LOGIC BASED INJECT ACRYL 500 F,S, LOGICBASE INJECT ACRYL FLEX, INJECT PU 310 2K, INJECT PU 300 1K and LOGICBASE INJECT PU 305 2K are used;

8.4.2. Specifications of injection compounds are presented in Appendix B

THE WORKS ARE PERFORMED IN SEVERAL STAGES:

8.4.3. At the first stage you should:

- perform pointing of concrete around the embedded sleeve; to do this, perform a chase to a depth and width of at least 30x30 mm; rectangular section along the mouth of the crack. A chase can be performed manually using a wall-chaser or mechanically using a vibration drill with a blade or using an angle grinder with a diamond blade;
- clean the prepared chase from dust and pieces of concrete with a metal brush or rinse with water at a pressure of up to 15 atm using a pump set.
- pack the space between the embedded sleeve in concrete and the communication pipe (cable) using polyurethane foam and polymer sealant.

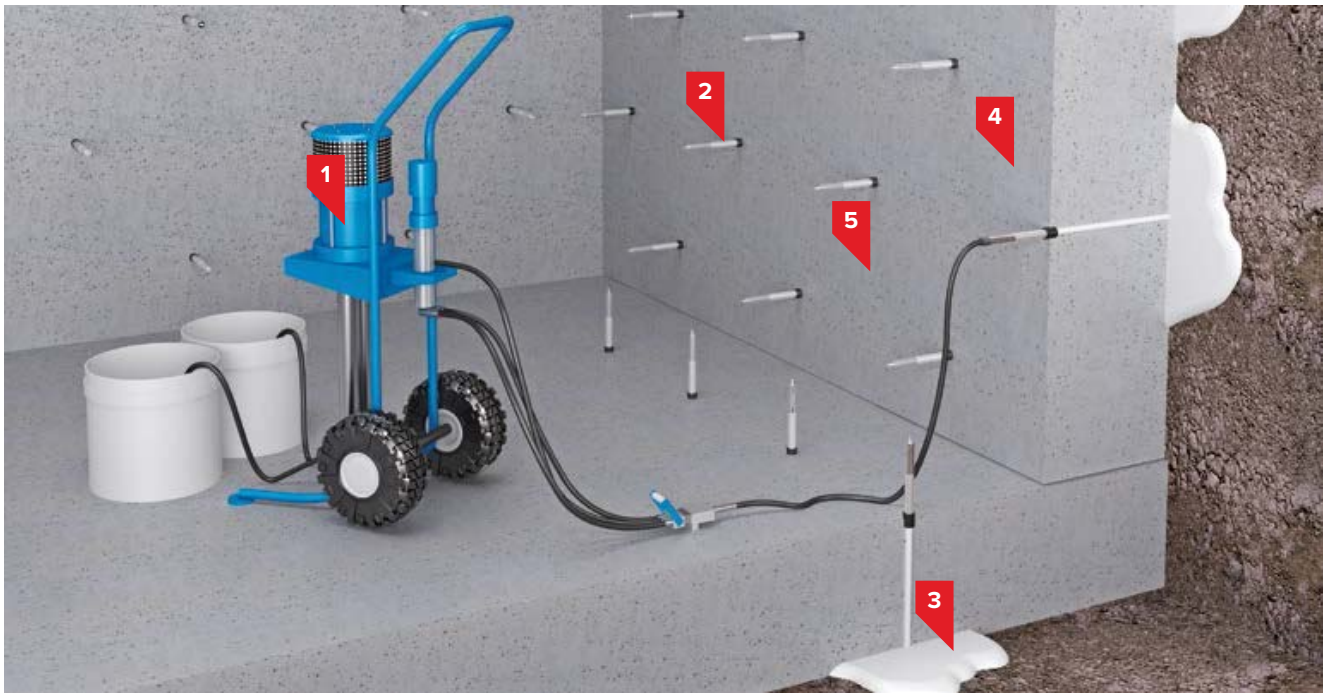
8.4.4. At the second stage, drilling of injection holes (boreholes) and installation of packers should be performed. Boreholes for injection packers should be drilled around the circumference, so that the hole passes through the concrete all the way to the sleeve. Distance from the sleeve: 50 mm, distance between boreholes: 150-500 mm, drilling angle: 45° to the concrete surface.

8.4.5. At the third stage, to reduce the consumption of the solution, it is recommended to fill the chase in the same way as described in 8.1.9.

8.4.6. The final stage is performing injection works:

- clean boreholes from cement dust, dirt and foreign elements, place injection packers into them and tighten the O-ring on each of the packers.
- unscrew the reverse-flow valve on one of the packers and connect the pump hose to the first packer. After that, you can start injecting, which should be performed sequentially from the lower packer to the upper one. Transition to the next packer should be performed when an excess of the injection compound begins to flow out of it. Install the reverse-flow valve onto it and continue injecting. Remove injection packers and close boreholes with a repair compound.

8.5. Arrangement of grout cutoffs and soil consolidation



1. Two-component injection pump for acrylate gels with a mixing ratio of 1 to 1
2. Injection tubes and connecting branches
3. LOGICBASE INJECT ACRYL 500 F,S
4. Reinforced concrete structure

8.5.1. For grout cutoffs and soil consolidation, three-component injection compound LOGICBASE INJECT ACRYL 500 F,S, LOGICBASE INJECT ACRYL FLEX is used

8.5.2. Specifications of injection compounds are presented in Appendix B

THE WORKS ARE PERFORMED IN SEVERAL STAGES:

8.5.3. At the first stage you should:

— eliminate concrete defects using a repair compound based on polymer-modified cement The surface should become uniform and stable.

8.5.4. At the second stage, drilling of injection holes (boreholes) and installation of packers should be performed. Boreholes for injection packers should be placed in a checkerboard pattern over the entire wall area. Distance between adjacent boreholes: 15-30 cm, full depth drilling without tilting. The hole diameter depends on the diameter of packers. For controlling the works while arranging a grout cutoff, it is necessary to use packers with a de-mountable valve. Thus, you can observe the release of material from an adjacent packer.

8.5.5. The final stage is performing injection works:

8.5.6. Clean boreholes from cement dust, dirt and foreign elements, place injection packers into them and tighten the o-ring on each of the packers.

8.5.7. Unscrew the reverse-flow valve on one of the packers and connect the pump hose to the first packer. Before injection, it is recommended to supersaturate the soil with water to reduce the consumption of the injection compound.

8.5.8. Upon that, you may begin injection, which should be done sequentially from bottom to top or from left to right. This will allow you to achieve an even distribution of the material behind the structure and create a waterproof membrane. Transition to the next packer should be performed when an excess of the injection compound begins to flow out of it. Install the reverse-flow valve onto it and continue injecting. Remove injection packers and close boreholes with a repair compound.

8.5.9. For this type of works you will need a minimum of 10 kg of LOGICBASE INJECT ACRYL 500 F,S, LOGICBASE INJECT ACRYL FLEX per 1 m^2. The consumption rate shall be determined based on soil analysis and also depends on the structure of the base.

9. Work quality requirements

9.1. Structural repair works should be conducted in accordance with the technological regulations included in the work project, the instructions of the material manufacturer and this technological flow chart.

9.2. Ensuring the requirements for the quality of works performed is the responsibility of the shift foreman (site engineer) and the work producer.

9.3. Quality control of concrete, as well as repair and injection compounds in terms of strength should be carried out by making and testing control samples.

9.4. The construction company must ensure compliance with the sequence of injection works set out in this technological flow chart.

9.5. If necessary, the strength of repair and injection sealing compounds should be controlled in accordance with the requirements of GOST 56378-2015 “Materials and systems for protection and repair of concrete structures. Requirements for repair mixtures and adhesive connections of the contact zone when restoring structures” and GOST 33762-2016 “Materials and systems for the protection and repair of concrete structures. Requirements for injection compounds and seals of cracks, cavities and crevices”.

9.6. Quality control of joint repairs based on the degree of filling is conducted using three main methods: ultrasonic (GOST 17624-78), by determining the surface gas permeability of concrete (GOST 12730.5-84) or by drilling cores.

9.7. Upon completion of the works, the absence of water manifestations in the structure and the absence of blowholes, cavities and other defects on the concrete surface should be checked.

10. Acceptance and storage of construction materials

10.1. When accepting construction materials, you must:

- check the condition of the packaging (container) and the presence of tags (labels) that allow you to identify the material being received;
- check the container for external damage;
- check the delivery completeness;
- if necessary, request a quality certificate (its copy) from the manufacturer for this batch of material.

10.2. Materials must be stored in places protected from atmospheric precipitation and mechanical impact.

10.3. All materials and equipment must be stored in a warm warehouse at a temperature of +15 to +20 °C.

11. Occupational health and safety

11.1. Repair works on concrete and reinforced concrete structures must be conducted in compliance with safety requirements regulated by the following standards:

- SNiP 12-03-2001 “Labor safety in construction. Part 1. General requirements”;
- SNiP 12-04-2002 “Labor safety in construction. Part 2. Construction operations»;
- SR 03-428-02 “Safety rules during construction of underground structures;
- FSR 01-03 “Fire safety rules in the Russian Federation;
- GOST 12.1.005-88 OSSS “General sanitary and hygienic requirements for the air in the working area”;
- GOST 12.1.004-91 OSSS “Fire safety. General requirements”;
- Rules of safety and industrial sanitation during performing works for reconstruction and overhaul of man-made facilities;
- Rules of safety and industrial sanitation during performing handling operations.

11.2. When using repair compounds, personal protective equipment as per GOST 12.4.011-89 should be used.

12. Protection of environment

12.1. No damage to the environment should be caused during repair works.

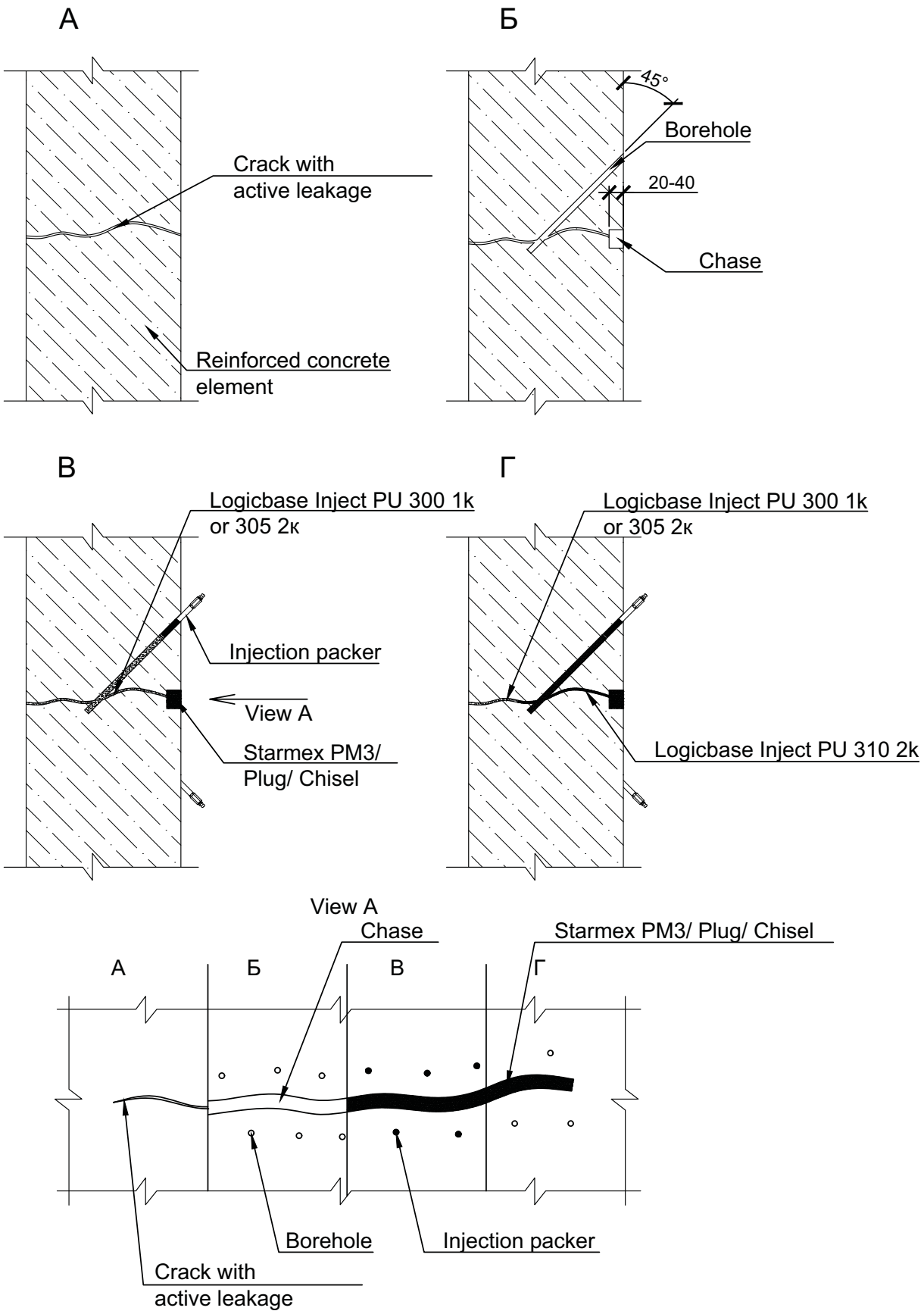
12.2. In accordance with the law of the Russian Federation “On Environmental Protection”, release and discharge of harmful substances, as well as disposal of waste, are allowed on the basis of a permit issued by state bodies of the Russian Federation. Construction debris should be removed using chutes or containers directly into vehicles. It is not allowed to bury unnecessary construction materials in the ground or burn them on the construction site.

12.3. It is strictly forbidden to discharge fuel and lubricants onto the ground on or outside the construction site when operating construction machines and mechanisms or refueling them. In case of leakage of fuels and lubricants, the place of leakage must be localized by sanding up. Then the soil impregnated with fuels and lubricants must be collected and removed to specially designated areas where it is processed.

Appendix A Recommended.

Album of technical solutions on the application of LOGICBASE INJECT injection materials for waterproofing, repair and protection of building structures.

Waterproofing cracks with polyurethane compound



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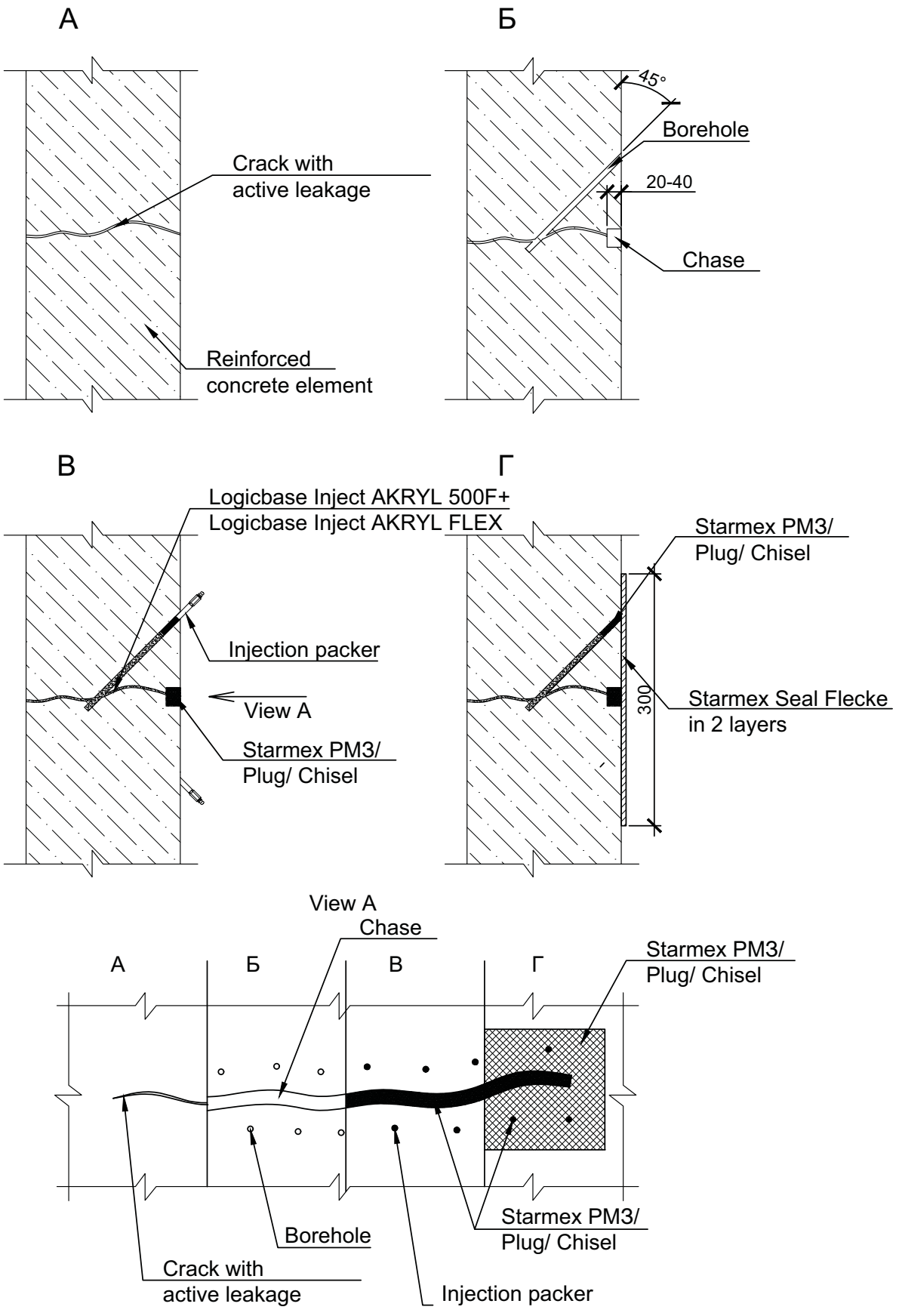
Page 1

Waterproofing of crack with acrylate gel



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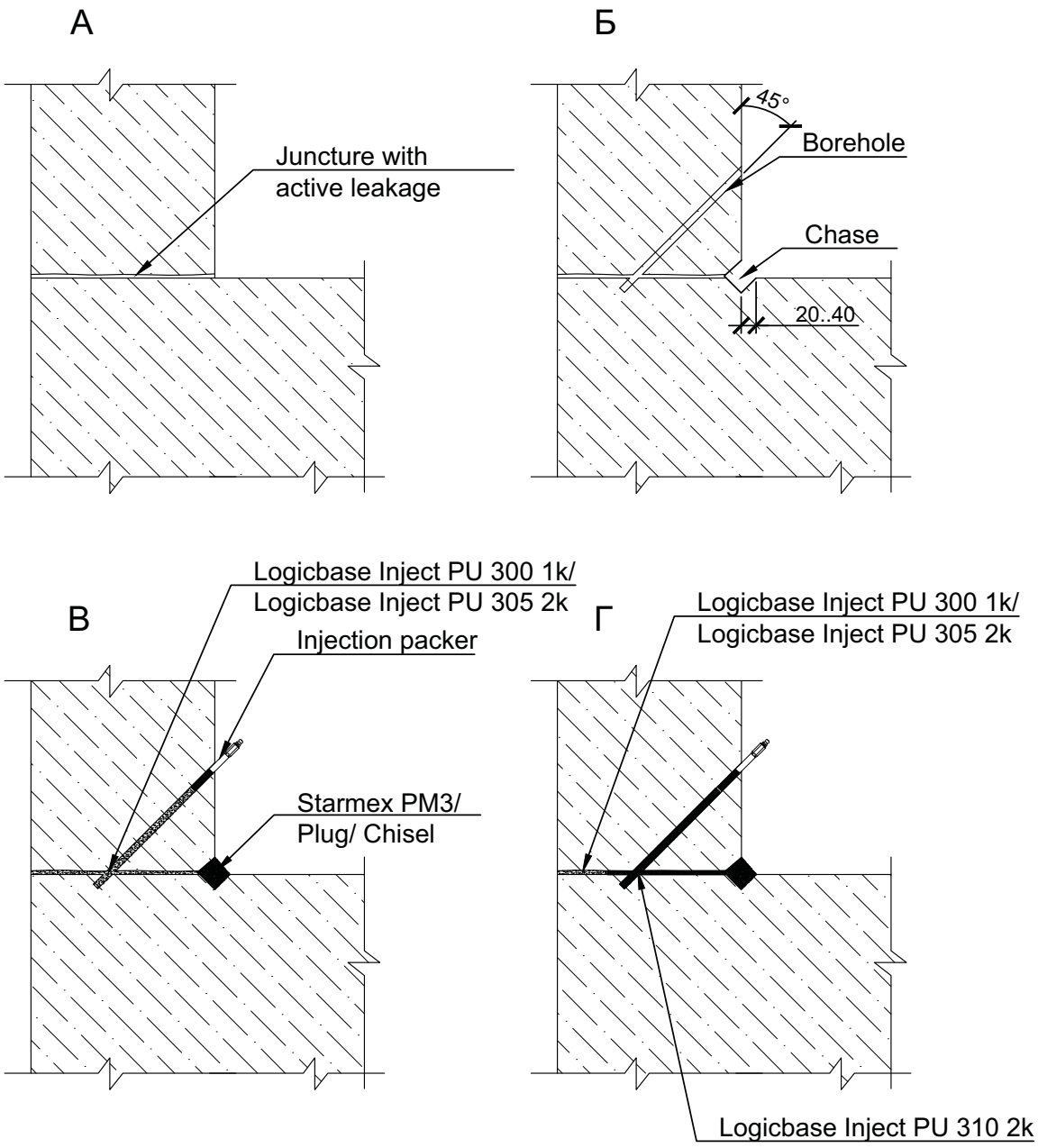
Page 2

Waterproofing of cold joint of juncture with polyurethane compound



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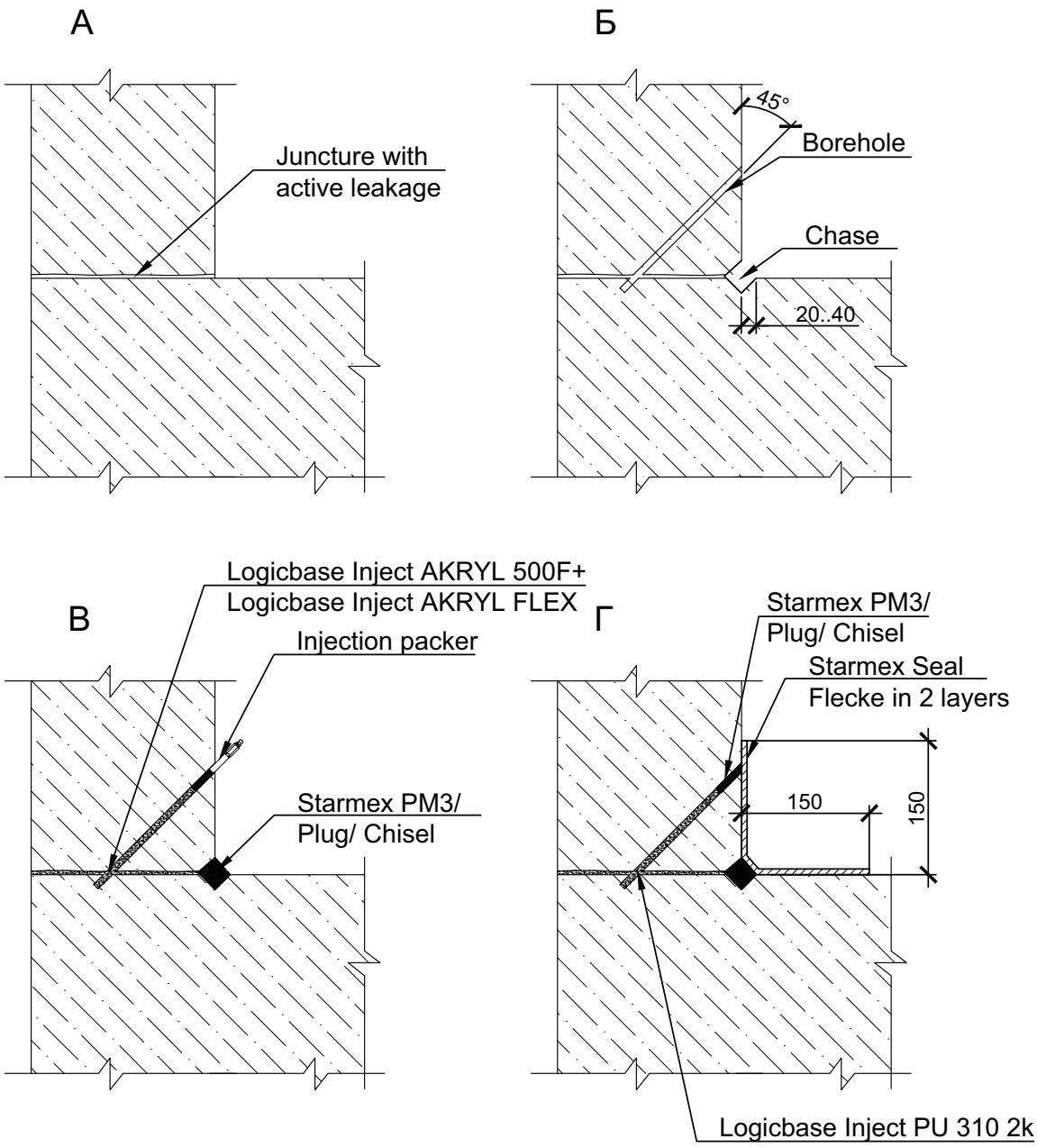
Page 3

Waterproofing of cold joint of juncture with acrylate gel



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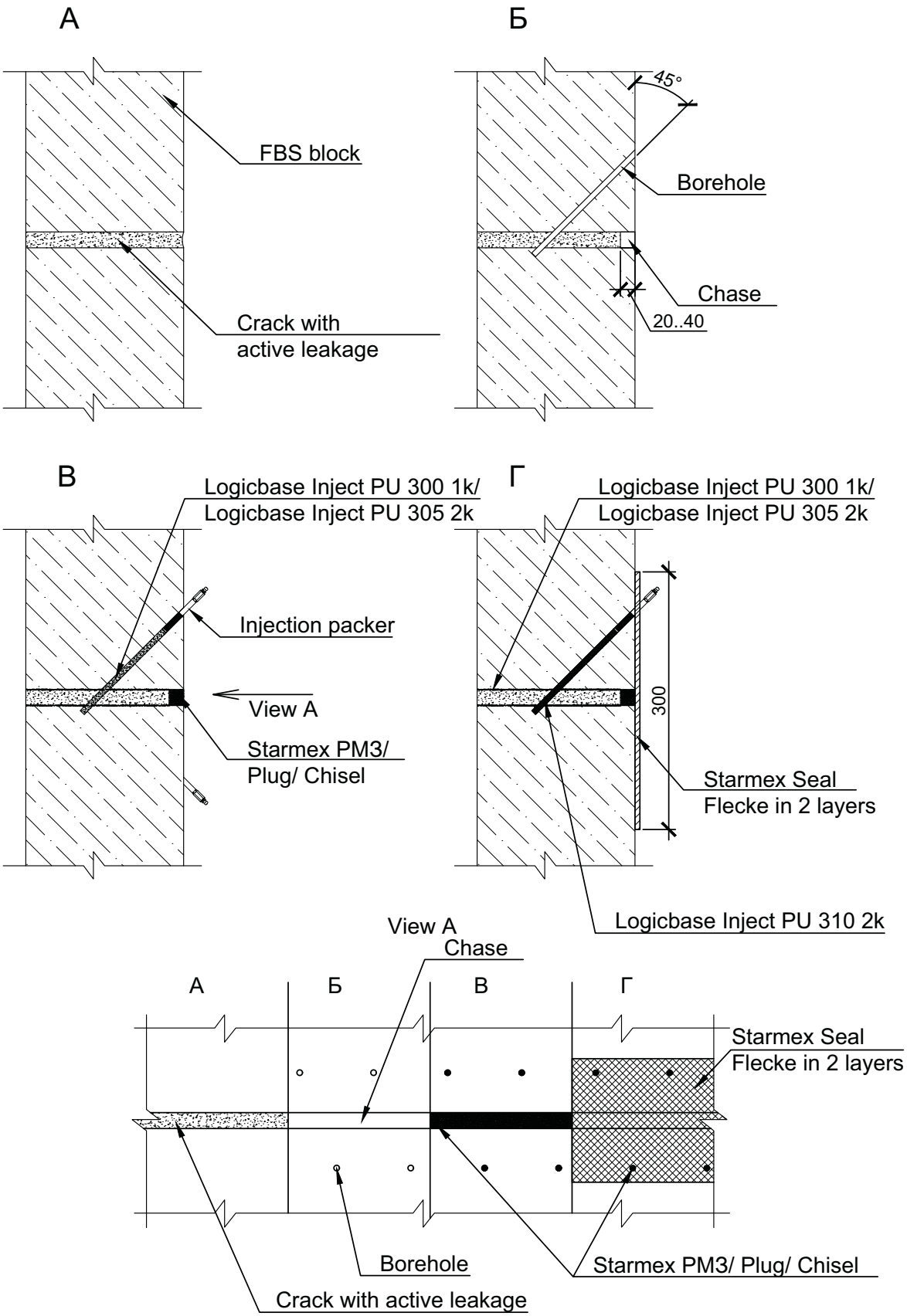
Waterproofing of joints between FBS blocks with polyurethane compound



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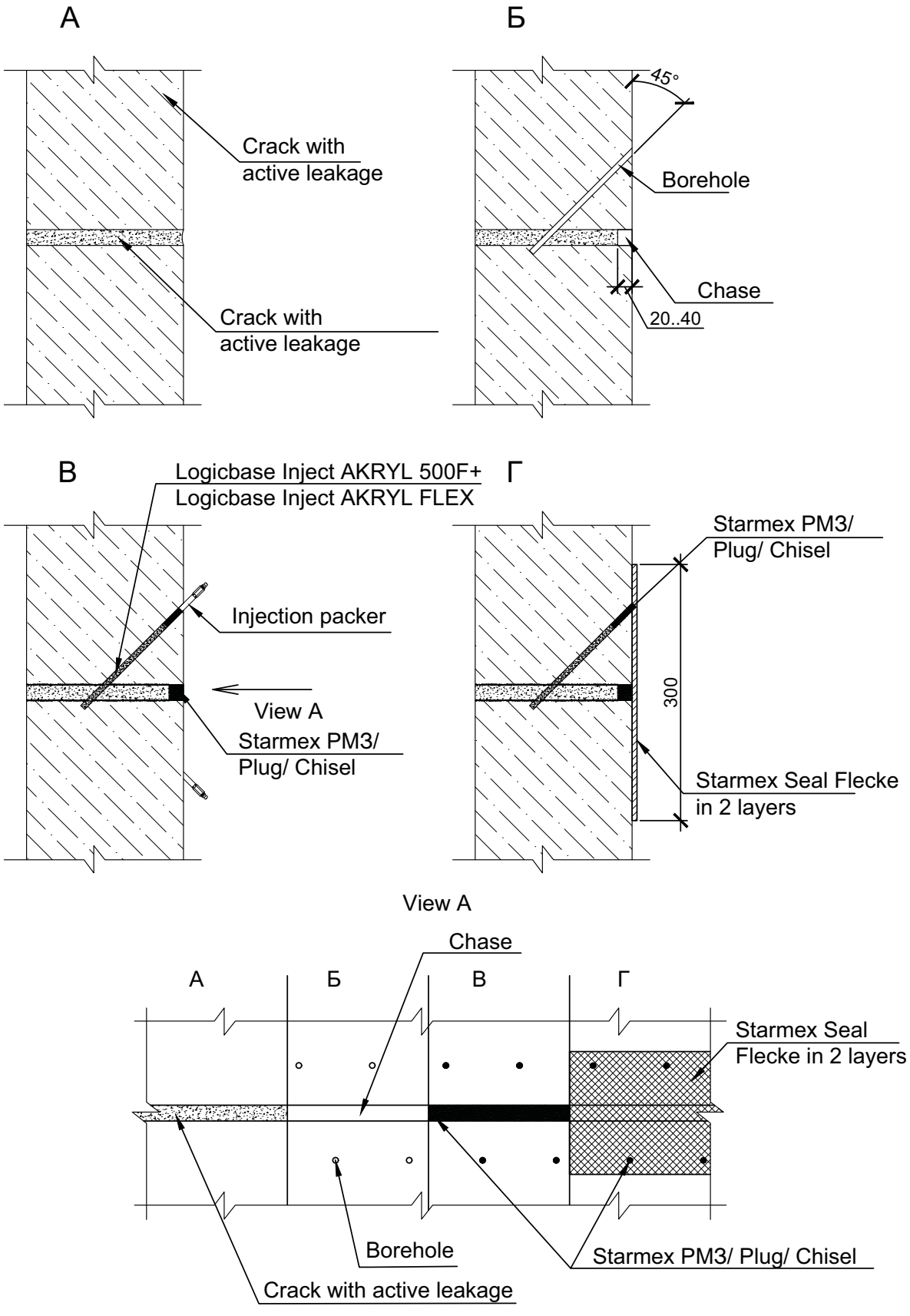
Waterproofing of joints between FBS blocks with acrylate gel



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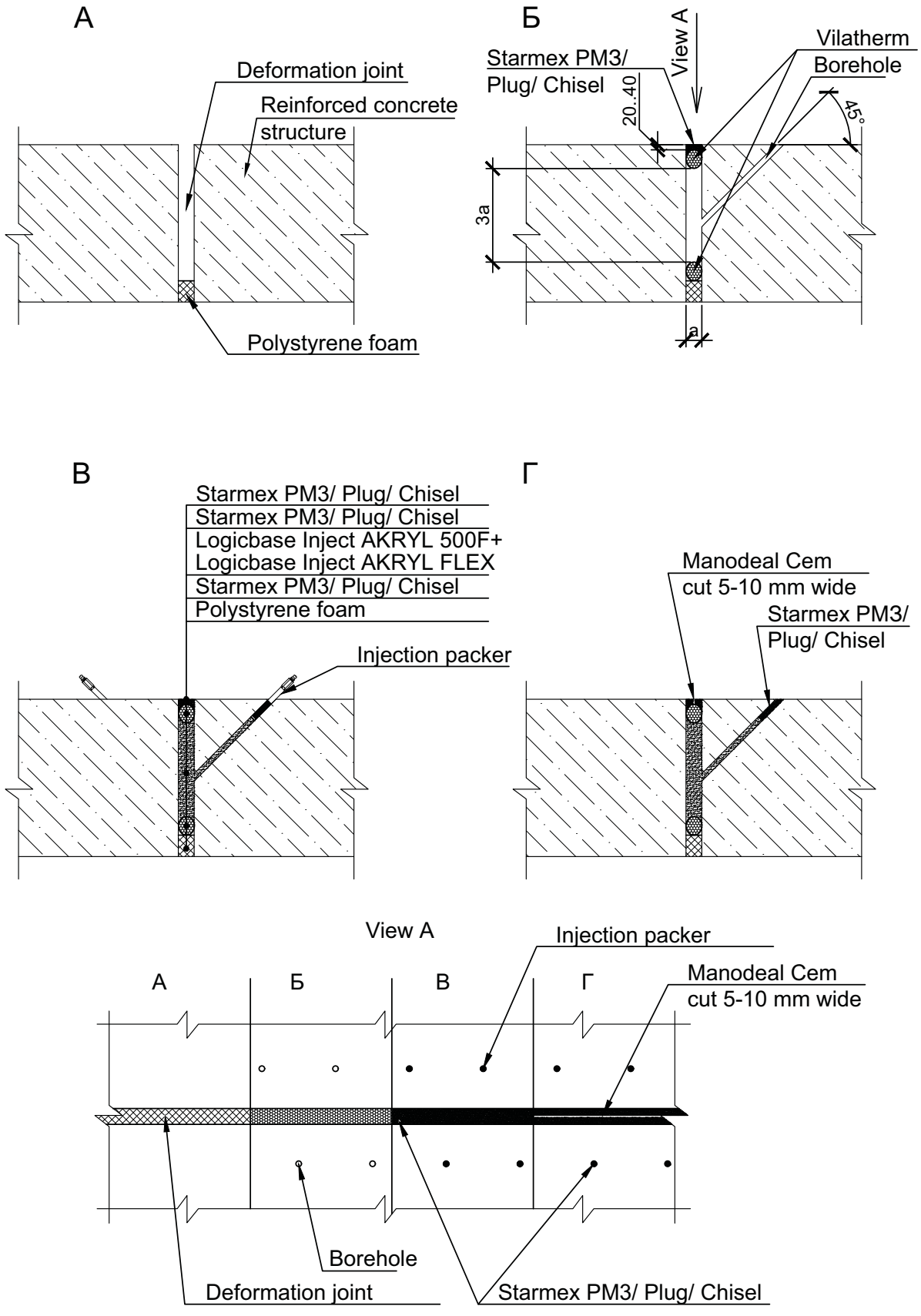
Page 6

Deformation joint waterproofing



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Page 7

Repair of two-layer waterproofing made of LOGICBASE polymer membranes by injecting acrylate gel

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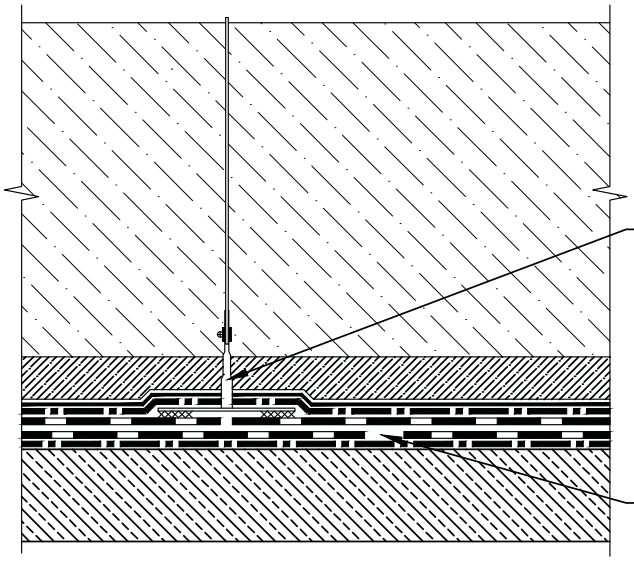

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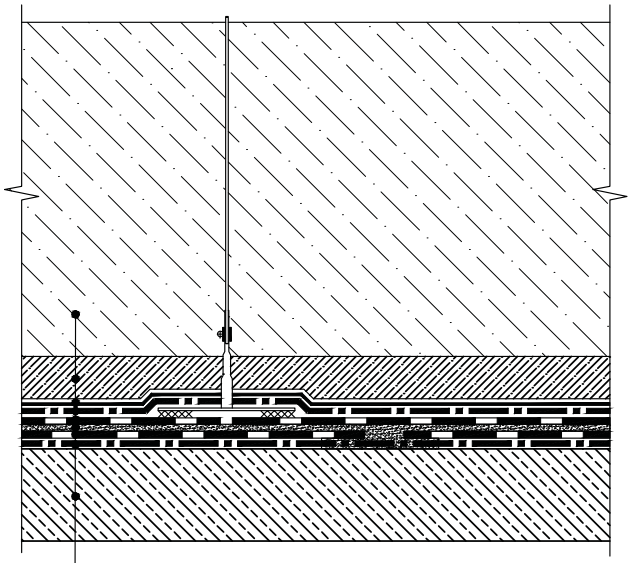

Monolithic reinforced concrete slab
Protective cement-sand screed
Polyethylene film 200 microns thick
Geotextile, 500 g/m^2
Textured membrane LOGICBASE V-ST
Logicbase Inject AKRYL 500F+ Logicbase Inject AKRYL FLEX
Waterproofing membrane LOGICBASE V-SL
Geotextile, 500 g/m^2
Concrete bedding

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Page 8

Repair of single-layer waterproofing made of a LOGICBASE polymer membrane by injecting acrylate gel

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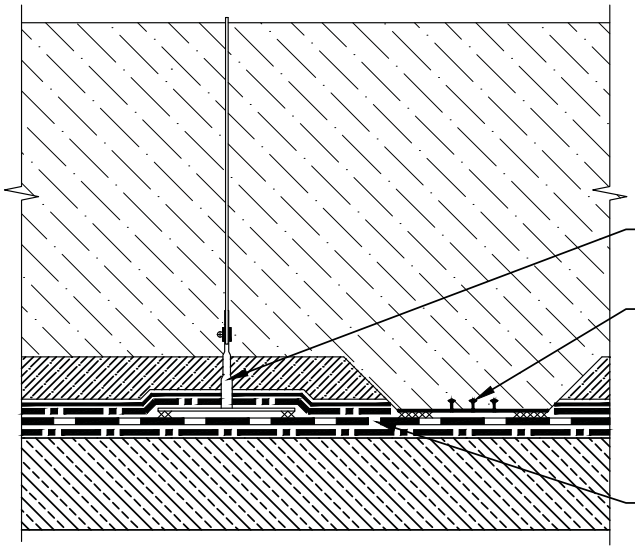

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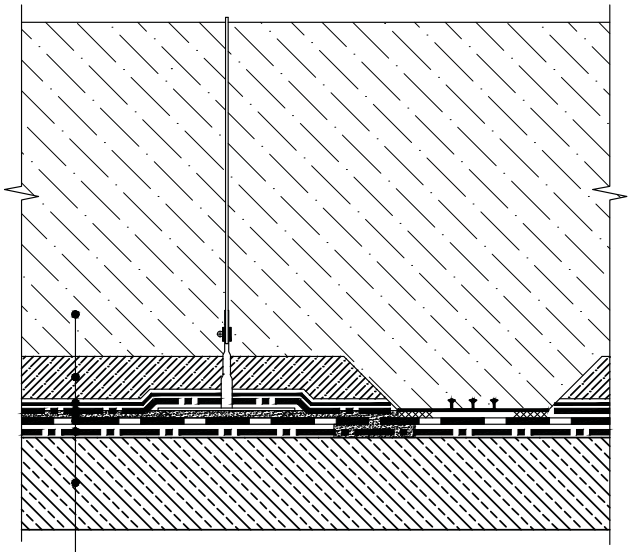

Monolithic reinforced concrete slab
Protective cement-sand screed
Polyethylene film 200 μm
Geotextile fabric 500 g/m^2
Logicbase Inject AKRYL 500F+ Logicbase Inject AKRYL FLEX
Waterproofing membrane LOGICBASE V-SL
Geotextile, 500 g/m^2
Concrete bedding

Repl. inv. No.							Repair of single-layer waterproofing made of a LOGICBASE polymer membrane by injecting acrylate gel	Page 9
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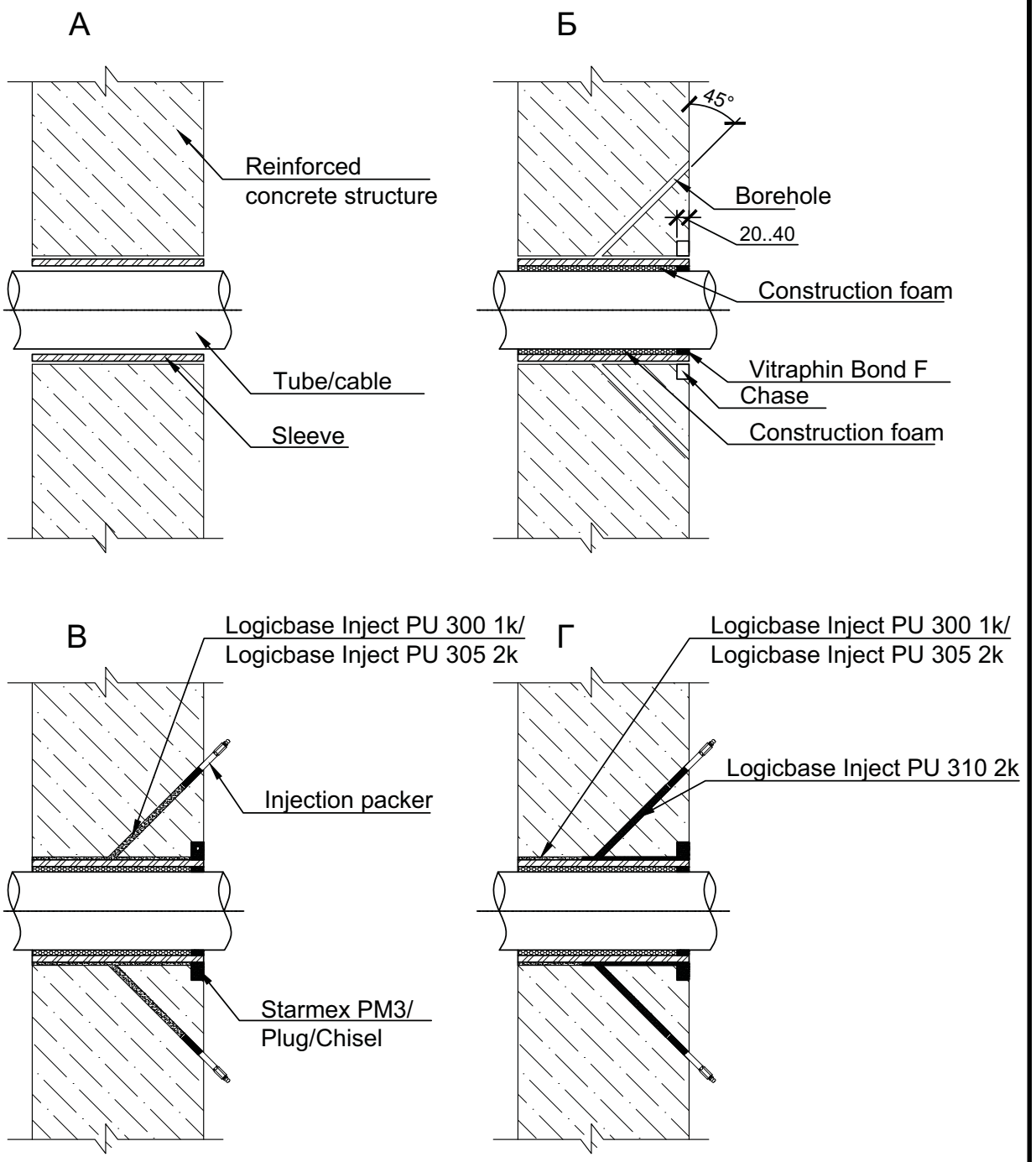
Waterproofing of communication inputs with polyurethane compound



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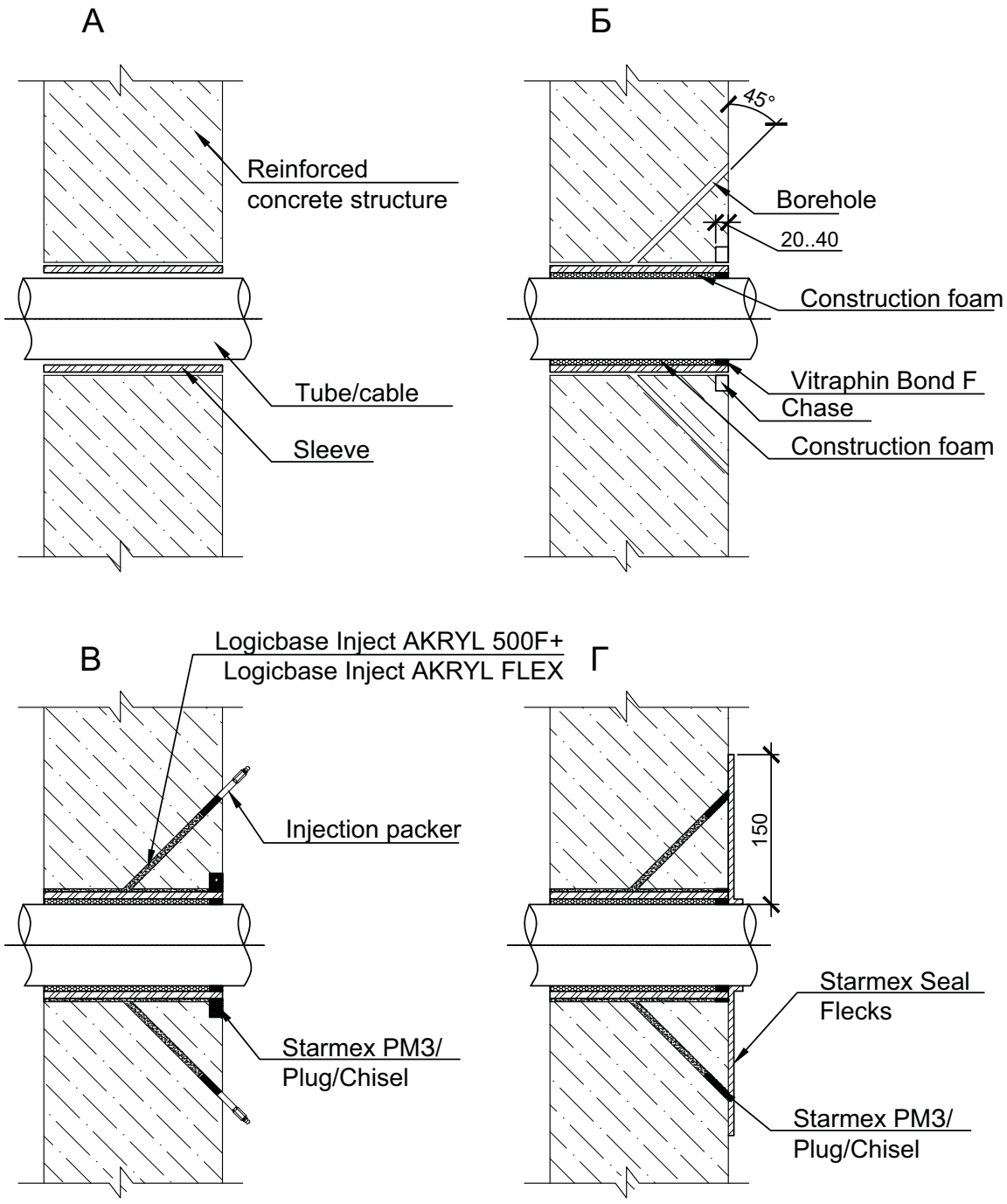
Page 10

Waterproofing of communications input with acrylate gel



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Appendix B.

Specifications of materials used for injection.

Specifications of LOGICBASE INJECT ACRYL 500 S

Parameters	A1	A2	B
Appearance	Liquid	Liquid	Powder
Color	Colorless	Colorless	White
Density at 20 °C, approx.	1.05 g/cm^3	0.93 g/cm^3	1.1 g/cm^3
Mixture density (A1 + A2) + (B + water), approx.	2.6 mPa-s		
Reaction time, approx.	2-30 min		
Full cure	10-40 min		

After polymerization	
Consistence	Elastic rubber
Color	White
Density at 20 °C	1.03 g/cm^3
Tensile strength	0.08 MPa
Relative extension at fracture	290%
Elasticity modulus	0.13 MPa
Adhesion to concrete	0.12 N/mm2
Swelling ratio	20%
Waterproofing (with LOGICBASE INJECT ACRYL FLEX)	7 bar
Durability	At least 30 years

Specifications of LOGICBASE INJECT PU 300 1K

Parameters	Values
Density at 25 °C	900 mPa-s
Foaming ratio, max	1:16
Density at 20 °C	1.2 kg/l
Reaction start time on contact with water	20-25 s
Reaction continuation time	120 s
Drying until residual tack	2 min.
Application equipment	One-piece pump

Specifications of LOGICBASE INJECT ACRYL 500 F

Parameters	A1	A2	B
Appearance	Liquid	Liquid	Powder
Color	Colorless	Colorless	White
Density at 20 °C, approx.	1.22 g/cm^3	0.93 g/cm^3	1.1 g/cm^3
Mixture density (A1 + A2) + (B + water), approx.	4.5 mPa-s		
Reaction time, approx.	15 s - 4 min.		
Full cure	1-10 min.		

After polymerization	
Consistence	Softly elastic
Color	White
Extension at fracture	970%
Swelling ratio	100%
Adhesion to concrete	
with LOGICBASE INJECT ACRYL FLEX	0.26 MPa
with LOGICBASE INJECT ACRYL FLEX PLUS	0,42 MPa
Waterproofing (with LOGICBASE INJECT ACRYL FLEX)	7 bar
Durability	At least 30 years

Specifications of LOGICBASE PU 310 2K

Parameters	Values
Viscosity of blend at 20 °C	100 ±20 mPa-s
Density at 20 °C	1100 ±20 kg/m^3
Mixing ratio of components A:B by volume	1:01
Mixing ratio of components A:B by weight	100:112
Working life of blend A+B at 20 °C	90 min.
Polymerization time at 20 °C	12-24 hrs
Polymerization time at 8 °C	up to 36 hrs
Minimum base and environment temperature during application	+5 °C
Application equipment	one-piece pump

Specifications of LOGICBASE INJECT PU 305 2K

Parameters	Values
Viscosity of blend at 20 °C	180 mPa-s
Maximum foaming ratio	1:30
Working life of blend at 20 °C, not less than	25 min.
Application temperature	> 3 °C
Density of blend at 20 °C	1.1 kg/l
Density of foam at 20 °C	0.1 g/cm^3
Reaction start time on contact with water	15-25 s
Polymerization time	2-3 min.
Mixing ratio of components A:B by weight	1:1.2
Mixing ratio of components A:B by volume	1:1
Application equipment	one-piece pump

Specifications of LOGICBASE INJECT ACRYL FLEX

Parameters	Values
Aggregate state	Liquid
Color	White
Density at 20 °C	1.01-1.02 g/cm^3
Dynamic viscosity at 20 °C	8-15 mPa-s

Specifications of INJECT ACRYL CLEANER

Parameters	Values
Aggregate state	Liquid
Color	Transparent
Smell	Distinct
Specific density at 20 °C, approx.	0.8 g/cm^3
Water solubility	An emulsion is formed

Version: February 2024

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