

**PROCESS CHART**

**FOR MONOLITHIC AND PRE-CAST CONCRETE STRUCTURES WATERPROOFING WITH  
POLYMER LINING SHEETS WITH ANCHORING RIBS**

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## 1. AREA OF APPLICATION

This "Guideline" applies to performance of works related to waterproofing and paving of newly manufactured or operated monolithic and pre-cast concrete structures using polymer (polyethylene or polypropylene) lining sheets.

Polymer lining sheets can be used as waterproofing, as well as protective coating in the course of construction of newly constructed and operated reinforced concrete structures

## 2. DESIGN SOLUTIONS

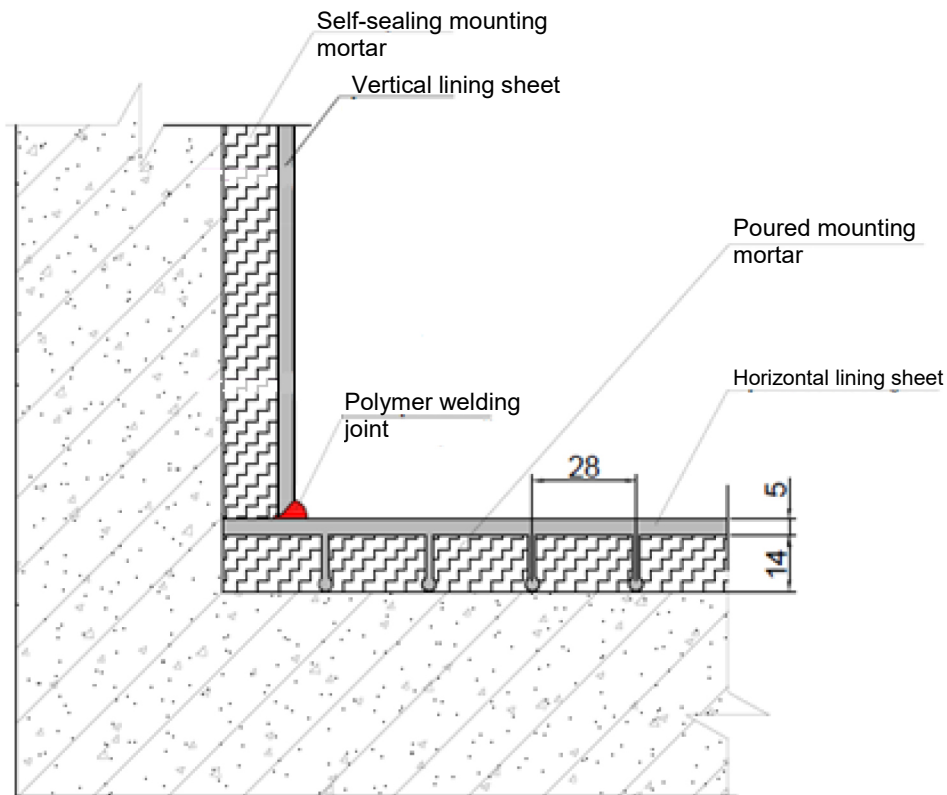
2.1. In the course of waterproofing or protective coatings installation on the inner and outer surfaces of vertical reinforced concrete structures, the anchoring ribs of the lining sheets must be positioned vertically.

2.2. For waterproofing of horizontal reinforced concrete structures (bottoms and floors), the lining sheet is mounted with anchor ribs on the surface of the structure using special sand-cement mortars.

2.3. Mortar (concrete) protective screed (if required) on a polymer lining sheet shall be at least M150 with 30-50 mm thickness. In case of requirement to ensure movement of mechanisms or vehicles on the surface of the screed, wall thickness and its structure shall be taken according to the calculation as per **SP 29.13330.2011 "Floors"**.

2.4. An option of reinforced concrete structure bottom polymer waterproofing joining to the walls is given in Fig.1

### Walls waterproofing and bottom joint



**Fig. 1.**

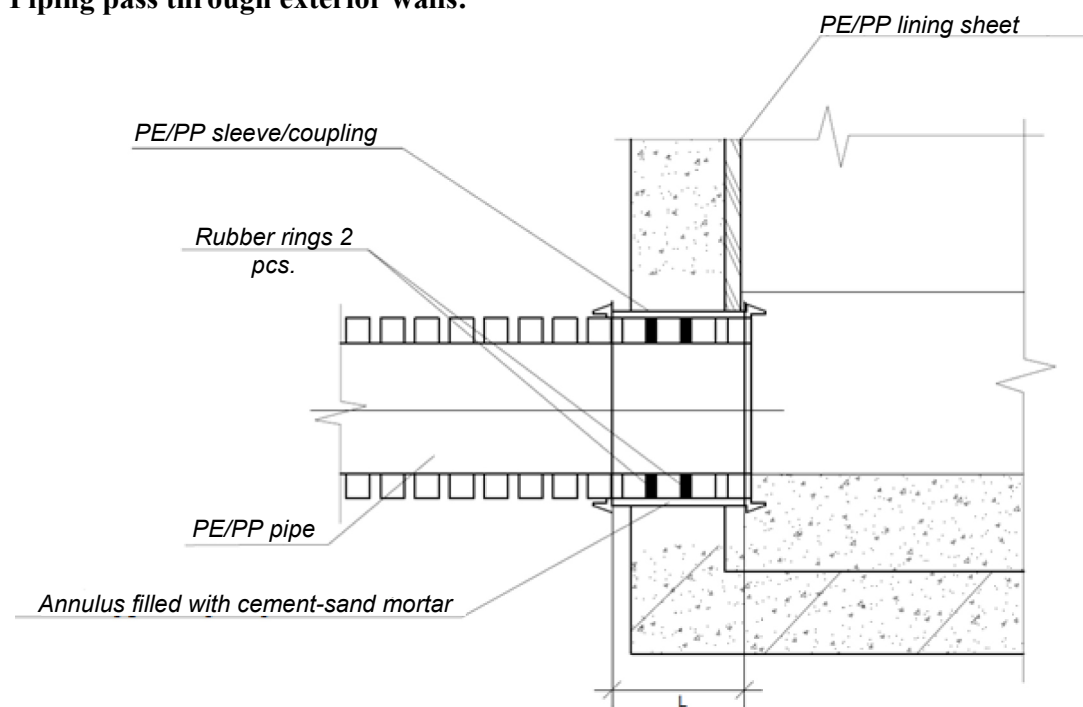
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2.5. Nodes for pipes passing through structures with polymer lining should be performed in accordance with Fig. 2.

**Piping pass through exterior walls:**



**Fig. 2.**

**3. ACCEPTANCE OF POLYETHYLENE SHEETS AT CONSTRUCTION SITE, THEIR STORAGE AND TRANSPORTATION**

3.1. Polymer lining sheets designed for waterproofing and protective coatings of vertical and horizontal reinforced concrete structures and waterproofing joints junction corners shall meet requirements of TU 22 4600-9-001-11146988-2015.

3.2. Polymer lining sheets shall be supplied complete with welding filler material: a bar of circular section with 3-4 mm diameter or pellets made of polymer material of the same brand as the lining sheets.

3.3. The sheets shall not contain technological and mechanical defects in the form of: through cuts, notches, bald spots, key drawing indistinctness, defects with depth exceeding sheet thickness negative allowance, as well as foreign inclusions.

3.4. The front side of the sheets shall be flat and smooth, bubbles, notches, shells and cracks are not allowed.

3.5. Lining sheets length shall be at least 300 mm, width 750 ±5 mm, 1,000 ±5 mm, 1,500 ±5 mm.

3.6. Polymer lining sheets can be transported by any type of transport providing material protection against mechanical damage and contamination. In the course of transportation, packages can be placed both vertically (on butt end) and horizontally (several rows in height). In order to protect the polymer lining sheet from damage during transportation, packages must be secured or placed close to each other.

3.7. Lining sheets and filler material (welding rod or pellets) should be stored in closed area, in conditions excluding the effects of organic solvents, oils, and direct sunlight.

3.8. In the course of transportation and storage sheets at temperature below 0°C, it is not allowed to throw or expose packed products to impacts.

**4. PRACTICES RELATED TO WATERPROOFING OF CONCRETE STRUCTURES USING**

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## POLYMER LINING SHEETS

Prior to commencement of works on the waterproofing of reinforced concrete structures, the surfaces of the waterproofing reinforced concrete structure, the storage area, and the formwork must be prepared.

### 4.1. Works execution flow

4.1.1. Works on waterproofing or protective coatings application on reinforced concrete structures, using polymer lining sheets shall be performed in the following technological sequence:

- inspection of technical condition of structural elements subject to waterproofing;
- preparation of surfaces of reinforced concrete structures subject to waterproofing;
- cleaning the reinforcement, installation of additional reinforcement, if required;
- reinforcement processing with anti-corrosion materials;
- preparation of working solution of cement-sand repair mortar;
- repair and leveling of surface of the reinforced concrete structure subject to waterproofing;
- cutting polymer lining sheets to cut-to-length sections;
- installation and fastening of the polymer lining sheet in the design position to the surface of the reinforced concrete structure subject to waterproofing (for horizontal reinforced concrete structures, special cement-sand adhesive mortar of the self-leveling type shall be applied to the surface prior to lining sheets installation);
- form works;
- welding of polymer lining sheets blanks;
- preparation of working solution of special cement-sand mortar;
- pouring the working solution of the cement-sand mixture into the interfin space of the lining sheet;

### 4.2. Inspection of technical condition of structural elements of reinforced concrete structures subject to waterproofing

4.2.1. Prior to commencement of waterproofing of structural elements using polymer lining sheets, survey of their technical condition should be carried out. The main objectives of the technical condition survey are:

- establishment of actual values of technical characteristics of reinforced concrete structures subject to waterproofing;
- identification and elimination of the causes of defects existing in reinforced concrete structures;
- setting the boundaries of reinforced concrete structural element damaged area, specified in the course of works execution;
- assessment of repair and waterproofing works with drawing up defect diagrams, determining their depth and area;
- determination of required volume and thickness of the layer (protective layer) of the repair mix.

4.2.2. Technical condition of the reinforced concrete structure is evaluated visually.

### 4.3. Surface preparation of repaired structural elements

4.3.1. Surface preparation of reinforced concrete structural elements is one of the main technological operations in the course of their repair and waterproofing using polymer lining sheets, which provides the required adhesion of repairing materials with the prepared surface and resistance to destruction of the waterproofed concrete surface when exposed to operational loads

4.3.2. To ensure reliable adhesion of concrete and reinforcement of waterproofed reinforced concrete structures with repair mixtures, it is required to prepare the concrete surface and reinforcement in accordance with the requirements of this "Guideline" and technological documentation provided along with repair mixtures.

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4.3.3. The surface of the concrete is cleaned of dirt, efflorescence, layers of old paint coatings and primers, as well as layers of previously applied repair materials. Layers of solidified "cement grout", layers of porous, thawed, flaky concrete with mandatory sinking into "healthy" concrete shall be removed from the surface of the structures.

4.3.4. Reinforced concrete structure surface preparation methods depend on its condition - the degree of destruction, type and volume of damage and can be performed in the following ways:

- manual surface cleaning by means of metal brushes, scrapers, picks, and pitching chisels, etc.;
- surface cleaning and preparation using a variety of electric (knock-boring machines, buchards, needle hammers, rotary cutters, discs, abrasive stones) and pneumatic (jackhammers) tools;
- surface cleaning using particles impact - sandblasting and shot blasting.

4.3.5. If the surface of reinforced concrete structures subject to waterproofing is contaminated with oils, fats, and asphalt, they must be removed before mechanical cleaning with organic solvents or detergents.

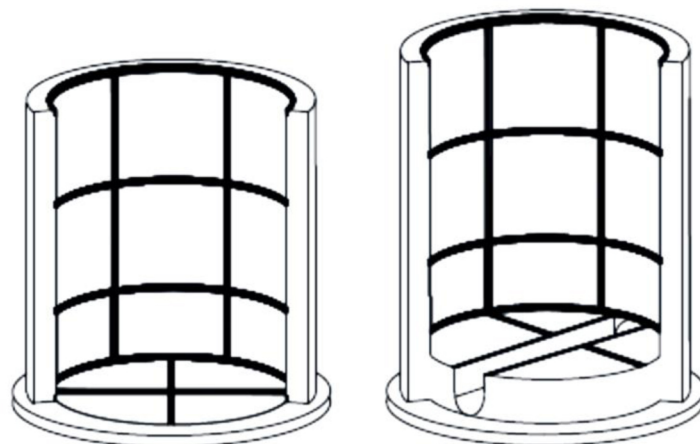
4.3.6. The damaged surface (fractured, porous and flaking layers, as well as shells and chips) of reinforced concrete structures shall be cut to a structurally integral material, freeing it from easily removed, weathered, thawed low-strength concrete. Soft material areas are reinforced with primer.

4.3.7. Surface pre-repair is executed using repair compounds that must be applied on moist rough surface of healthy concrete, the strength of which should not be below the minimum specified in the repair work project . In case the main mass of the structure consists of concrete, the strength of which is lower than the minimum value set in the project, repair compositions should be applied on the reinforcement grid fixed to the array using anchors.

#### 4.4. Installation of the lining sheet with anchoring ribs

In case of welding, it is required to select sheets by delivery batches. Welding of sheets made of various polymer materials is not allowed.

Install the lining sheets in the well. Weld the resulting weld joints between the lining sheets. When welding, immediately before heating, the welded surfaces of the lining sheets must be machined to remove possible contamination and oxide film. If more than 20 minutes have passed after preparing the edges of the sheet, clean the surfaces and start welding immediately.



The edges of the sheets are cleaned mechanically at a distance of at least 2 mm from the edge.

After mechanical treatment the welded surfaces of the sheets are neutralized by wiping with compositions specially recommended for this purpose.

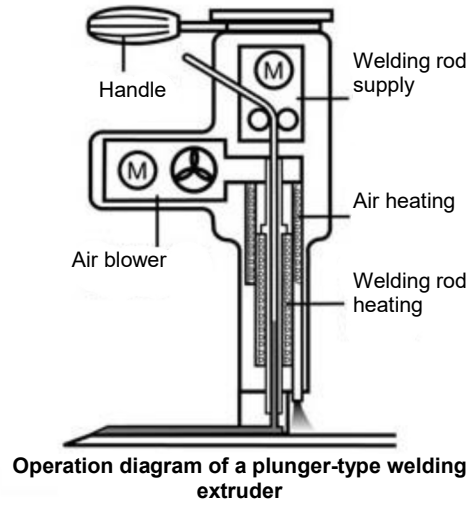
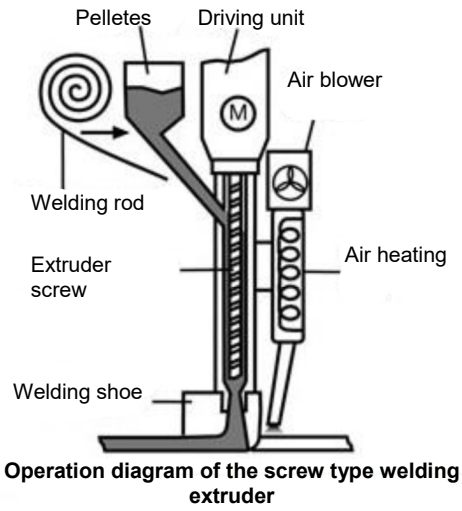
It is strictly forbidden to clean the welding surface with solvent.

The main control parameters of the butt welding process are: temperature of the working surfaces of the heater, heating duration, melting depth, contact pressures value during melting and precipitation.

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Welding of joints is carried out using a welding extruder.



When welding, it is necessary to maintain the compliance of melting temperature of the lining sheet with the weld rod.

An extrusion weld is usually performed in a single pass.

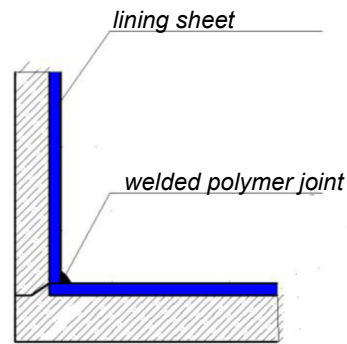
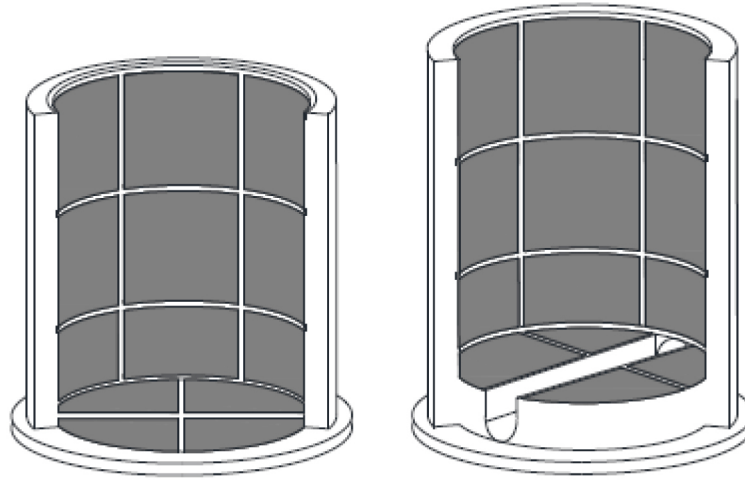
Mount the tray, if required.

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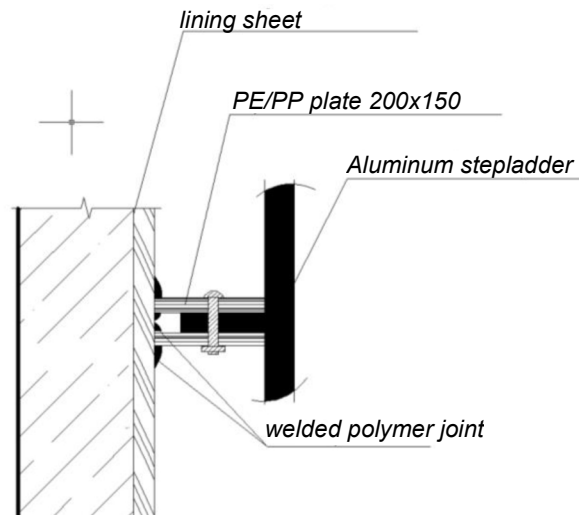
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To attach an aluminum stepladder, use a welding extruder to weld 200x150mm polyethylene / polypropylene plates to the surface.



Install the formwork to provide tight fit of the lining structures to the cleaned concrete.

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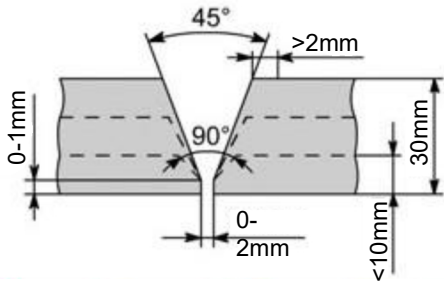
Methods of welding of lining sheets with anchor ribs.

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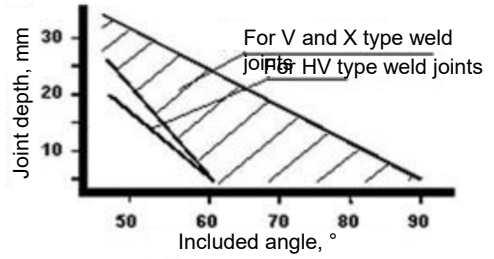
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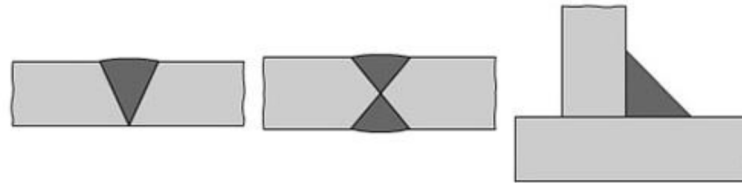
**V type weld joint**



**Preparation of welding groove prior to welding with V type weld joint**



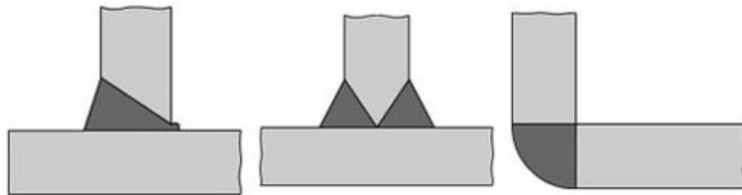
**Included angle vs its depth**



**V type weld joint**

**X type weld joint**

**K type weld joint**

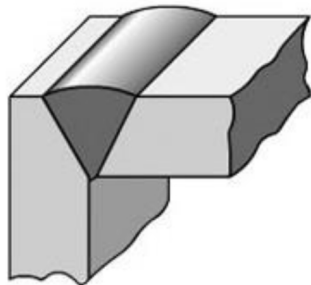


**HV type weld joint**

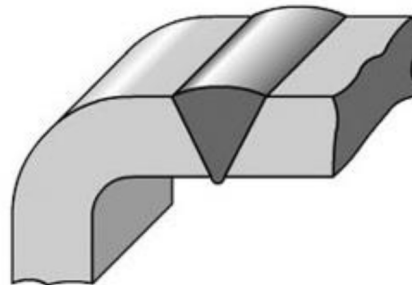
**Double HV type weld joint**

**E**

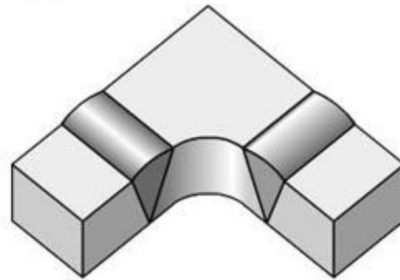
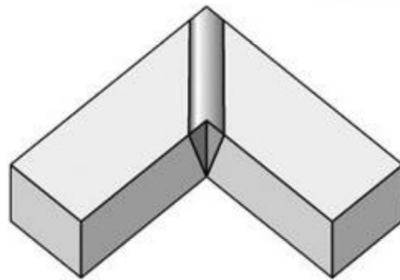
**F type weld joint**



**Not recommended**



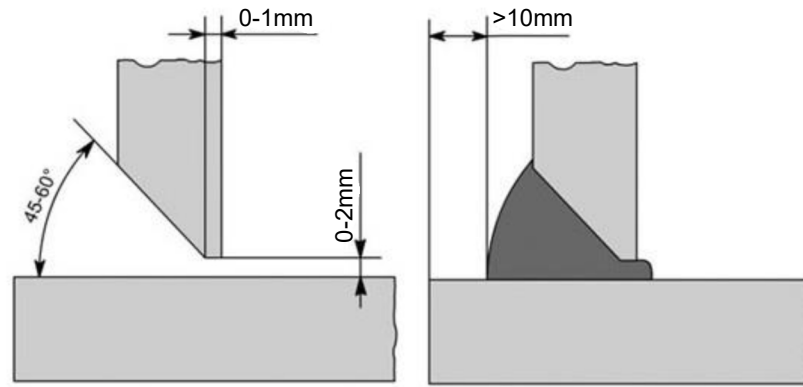
**Preferable**



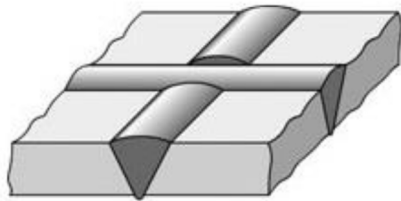
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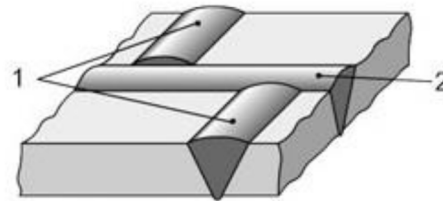
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Preparation for welding of HV type joint Complete HV type weld joint



Not recommended



Preferable

**Extrusion butt welding of sheets**

**4.5. Application of cement-sand mixture**

After installing the lining sheet with anchor ribs in a reinforced concrete structure, it is necessary to apply cement-sand mixture to the base of the pre-prepared surface of the well.

The mixture has a wide range of applications. In existing reinforced concrete structures, it allows you to eliminate defects, restore the protective layer, fill in cracks, and prepare the reinforced concrete structure for attaching the lining sheet. The mixture has different specifications and has the following properties:

- easy to apply, quickly gaining strength, thereby minimizing the time spent on the restoration of reinforced concrete structures;
- quickly forms strong, waterproof and wear-resistant coating that is durable even in highly aggressive environments.

The composition shall be poured in the interfin space of the lining sheet. The process should be carried out on one side, to prevent air lock. The adhesive composition should be laid from the corners, gradually moving to the center.

It is recommended to apply the mixture without vibration, evenly distributing over the entire area of the treated surface in order to prevent cold joints formation.

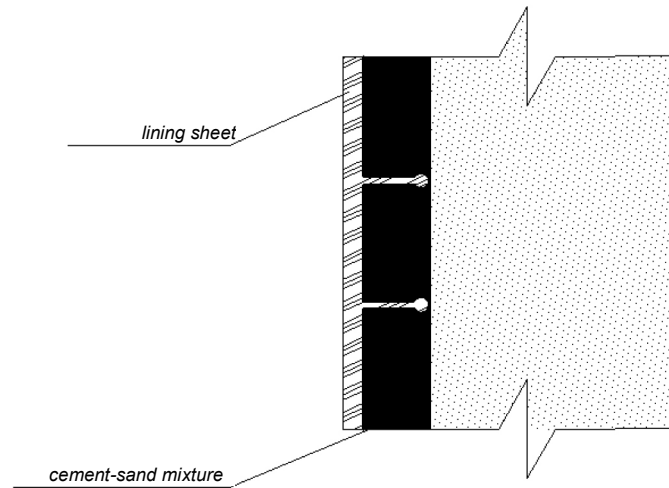
Special requirement when applying: at low temperatures, do not apply the mixture on frozen surfaces.

The surface on which the composition is laid should be strong, rough and moistened to saturation, but not wet.

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After application on reinforced concrete structure and installation of lining sheet with anchoring ribs, to prevent shrinkage cracks in the interfin space it is required to cover the product with plastic film for one day to prevent fast evaporation of water.

After setting the cement-sand mixture, it is necessary to remove the formwork and install an aluminum stepladder in the well in the prepared plates, securing it with embedded bolts.

### 5. SAFETY REQUIREMENTS

General safety requirements are specified in SNIIP 12-03-2001 "Construction safety requirements", in addition, it is necessary to comply with the requirements of this section.

#### 5.1. Safety requirements for the preparation of surfaces of reinforced concrete structures and installation of protective lining polymer sheets.

5.1.1. Dry repair and adhesive cement-sand mixtures are fire - and explosion-proof, non-radioactive. According to GOST 12.1.007-76, they are classified as substances of hazard class IV.

5.1.2. When performing repair and installation works using repair and adhesive mixtures, follow the instructions of SNIIP 12-03-2001, this "Guideline...", as well as the safety rules set out in the operating instructions for the relevant mechanisms and equipment

5.1.3. Repair works may be performed by persons not younger than 18 years of age, having:

- received special training;
- passed medical examination and admitted for health reasons to work;
- passed the safety induction and initial briefing on labor protection at workplace;
- 1st qualification group for electrical safety when working with power tools.

5.1.4. Application of repair and adhesive compositions should be carried out in accordance with the requirements of GOST 12.3.002-75\*. When working with repair and adhesive compositions for respiratory protection, it is necessary to use "Lepestok" ShB-1 type respirator per GOST 12.4.028, or other dust masks. To protect the skin, it is required to use special clothing, footwear and personal protective equipment in accordance with GOST 12.4.011, GOST 12.4.041-89 and GOST 12.4.103.

Installations, devices and tools used during operation shall be tested in accordance with the standards and terms stipulated by Rostekhnadzor safety rules for operation of electrical installations.

5.1.5. It is forbidden to:

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