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## **СПОСОБЫ УСКОРЕНИЯ ПРОЦЕССА ТВЕРДЕНИЯ БЕТОНА В ТЕРМОФОРМАХ И С ПОМОЩЬЮ ЭЛЕКТРИЧЕСТВА**

**Аннотация:** *Рекомендуется повышение температуры легковесных стеновых панелей в термоформах в течение 2-3 часов, изотермическая выдержка при 90-95°C в течение 3-5 часов. Формы для обогрева крупнопанельных конструкций изготавливаются в передвижных горизонтальных термоформовочных машинах. Для приготовления термоформы используется специальное формовочное устройство*

**Ключевые слова:** *кассетный метод, твердение бетона, электрообработка, пар, нагрев, термоформование, процесс твердения в термоформах, нагрев.*

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## **AERABLE CONCRETE AND MODERN FACING MATERIALS AND PRODUCTS BASED ON THEM**

**Annotation:** *It is recommended to increase the temperature of lightweight concrete wall panels in thermoforms for 2-3 hours, isothermal exposure at 90-95°C for 3-5 hours. Forms for heating large-panel structures are made in mobile horizontal thermoforming machines. For the preparation of thermoforms, a special molding device is used.*

The cassette method is a type of stand technology, and products are made in vertical mold-cassettes. Mold-cassettes consist of molds located

side by side, separated from each other by metal plates. Reinforced concrete products are molded and heat treated in the cassette plant.

The concrete mixture poured into form-cassettes is compacted with the help of suspension or depth compactors (Fig. 1). They have special devices adapted to heat the item with steam or electricity. In cassettes, the product is heat treated at a temperature of 85-95 °C for 6-10 hours.

Heat-treated and sufficiently hardened products are removed from slightly loosened molds by means of a bridge crane. The product is transported to the warehouse of finished products using a special transport or bridge crane. In the cassette method, external and internal wall panels and plates, cover panels, stair marches and landings, balcony plates and similar thin reinforced concrete structures with a flat surface are made. Compared to other methods, this method is distinguished by high labor productivity, small production area, energy efficiency, and does not require a strict rhythm.[1]



**Figure 1 Cassette method**

Cassette technology used in the production of reinforced concrete products has a number of advantages and disadvantages. When the product is prepared in cassettes, the precision of the assembled details is achieved, and the concrete surface is flat. As a result of contact heating of concrete, its strength is 10-20%

higher than in open formwork. Due to the small open surface of the concrete in the cassette, the temperature rises quickly (60-70°C). The item in the cassette can be heated without pre-holding, and the temperature of concrete reaches 100°C in cassette devices, and this indicator does not exceed 85-90°C in deep-shaped chambers. However, the strength of the concrete prepared in the cassette is different at different heights. This is especially true when the heating process is short.

Light concrete wall panels made on the basis of porous fillers are recommended to be heated in thermoforms for 2-3 hours, isothermal holding at 90-95°C for 3-5 hours. Molds for heating large panel constructions are made in movable horizontal thermoformers. A special molding device is used to prepare the thermoform.

During heat treatment, the heating environment in the mold is brought to a rational level for each item. At the start of heating, the required pressure is present, the relative humidity at the beginning of heating is 50-60% and during heating is 90-95%. When the product is heated in molds, the heat is supplied from both sides. The strength of products heated in the mold increases by 20-25% compared to those processed at atmospheric pressure, and its other properties also increase. This method is used in conveyors and mainly in the preparation of items for large panel constructions. The technological line includes thermoforming molders, mold cleaning and lubrication stations, and molding stations. [2]

391 is used in structures where fiber electrodes are longer than wide. Examples of these are columns, procons, piles and other hokozas. External wall panels made of lightweight and cellular concrete are recommended to be heated in horizontal forms. As one electrode, the mold plate is used, and for the other, the reinforcement mesh located closer to the surface of the object is used. Internal walls and roof slabs are usually heated in cassette devices, where the separation walls and outer barrier are used as electrodes.

Electric heating stations are marked in specially designated areas. In order to reduce heat loss and electricity consumption, the molds containing the product are placed layer by layer on non-conductive materials. If steel boards or pallets are used as electrodes, other elements of the formwork should be covered with a non-conductive layer or they should not touch the heated concrete. In cassette devices, when heated by an electrode, internal steam chambers are used to mold the product. Separating walls - electrodes are surrounded by insulating material, bushings and other materials from the frame of the cassette device and from each other. For electric heating of objects, a sufficiently gentle mode is usually chosen, and the rate of heating and cooling should not exceed 20°C per hour. Isothermal holding is at 80-90°C, and when using fast-hardening portland cement, it should not exceed 60-70°C. Before heating with electricity, the item should stand in the mold for at least 2-3 hours. In cassettes, the product is heated in a faster mode: the temperature rises to 90°C at a rate of 30°C per hour, and the cooling mode is also carried out for 3-5 hours.

In contrast to electric heating, electric heating of the concrete surface is carried out with high-temperature infrared heaters or low-temperature heaters. Heat enters the product mainly due to thermal conductivity. The main advantage of electric heating is that this method can be implemented regardless of the number of fittings in the product and the way they are located. Unlike electric heating, this method consumes a lot of electricity. Because the main part of the released heat is spent on the environment, heating of the heat-protecting element and heating of the mold elements. High-temperature heaters with infrared heaters include heaters that raise the temperature above 250°C, radiant lamps, spirals, TENS. Low-temperature heaters include flexible mesh, wire, Ugolok-stergen, heaters, heater cords, etc. When choosing electric heaters, it is necessary to pay attention to their characteristics. For example, 394 heaters made of non-ferrous metals, while they conduct heat well, are less durable, are made of rare materials, are expensive and fail quickly. Compared to them, electric heaters

made of ferrous metals are more durable, simple, cover a wider range and cost less. [3]

The use of mirror fabric heaters for heating concrete in cassettes and heating molds is one of the promising directions. They are light in weight and consume less electricity. The widespread use of such heaters is limited due to their low industrial production. The type of heater to use depends on the appearance, size, structure of the mold and the power of the electric power of the object to be heated..

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