In February 1970 the Podol'sk Refractories Plant introduced a high-temperature tunnel kiln for firing alumina refractories.

The structure of the kiln was made from firebrick and alumina refractories, and the kiln was housed in a metal hood and built on a concrete floor without foundations. The equipment was made by the departments in the factory.

The length of the kiln is 15 m, width 2 m, and height 3.1 m. The width of the tunnel is 0.55 m, and its height from the bottom of the car 0.6 m. The choice of the kiln dimensions was limited by the dimensions of the existing building housing the kiln section.

The structure made of alumina refractories was located at positions Nos. 7, 8, and 9. The alumina refractories were also laid in the three upper rows of the car linings. The properties of the corundum products were as follows: \( \text{Al}_2\text{O}_3 \) content 98.5\%, \( \text{TiO}_2 \) 0.4\%, \( \text{Fe}_2\text{O}_3 \) 0.2\%, porosity 21\%, compressive strength 200 \( \text{kg/cm}^2 \), and after-contraction at 1750°C 0.1\%. The firebrick corresponded to the requirements of GOST for class-A products. The heat insulation in the kiln was made from lightweight brick ShLB-0.9 and ShLB-0.4.

The welded tunnel kiln cars were made from steel St. 3. A hydraulic pushing device with a force of 1.5 ton was provided for pushing the cars through the kiln channel.

The furnace was heated with natural gas. The air for the combustion is fed with fan No. 4 type TS9-57, and the flue gases are extracted with fans No. 5 type TS9-57. The air is fed into the cooling zone with a fan No. 3 type TS9-57.

![Fig. 1. Plan of the kiln for firing alumina refractories.](image-url)
The main plan of the kiln is shown in Fig. 1. The kiln car with the products is fed every 4 h with a bogie on the bypass to the kiln and is pushed every hour with the hydraulic pusher over a distance of one quarter of the length of the car. Natural gas is fed through the regulators 1 into the mixers 2 and 3, and blended with the air which is delivered by the fan 1V. The gas–air mixture passes through two collectors into the burner at positions Nos. 7, 8, and 9.

The flue gases are extracted through the channel into the structure at positions Nos. 2 and 3 from the furnace with a flue pump 1D. Since the temperature in the kiln is 1000°C at the site of extraction of the flue gases, they are diluted to guarantee normal working conditions in the flue pump with external air transmitted through the connecting pipe 4 with a gate valve at 90°C.

The cold gas–air mixture, warmed up in front of the burners by mixing it with hot air at a temperature of 650°C is injected at positions Nos. 11 and 12 through the channels in the walls of the kiln.

At position No. 10 the air from the impeller fan 1V passes through the injector device 5 and sucks up hot air which is fed through the outside pipeline with a diaphragm 6, and through the channels in the structure of the walls at position No. 1 for preheating the products and creating an air curtain at the entry to the kiln.

The fan 2V is used to force cold air from the workshop through the channels into the walls of the structure at positions Nos. 13–15, and this replaces the deficiency of air required for burning the gas, and creates an air curtain at the exit from the kiln.

The air curtains facilitate operations without doors at the entrance and exit to the kiln.

The products are set onto the kiln cars in alumina saggars or staging made from alumina bricks of different dimensions (Fig. 2).

The heat cycle of the kiln is controlled with thermocouples at positions Nos. 2, 5, 7, 9, 10, and 14. The temperature at position No. 9 is also determined by an optical pyrometer and pyroscopes. The hydraulic cycle is controlled at position No. 2 and at the faces of the kiln. The pressure at positions Nos. 1 and 15 is 0.2 mm water.

The pressure of the gas–air mixture and the oxygen concentration in it are also controlled. The prescribed quantity of oxygen is 18.5%.

The firing curve is shown in Fig. 3. The gas consumption is 25 m³/h, the gas pressure 500 mm water, and the air pressure 800 mm water, the gas–air mixture has a pressure of 200 mm water, and the pressure on the right and left injectors is 650 mm water.

The pyroscope measurements show that the drop in temperature between the top and bottom of the setting does not exceed 10°C. The pyrosopes fix the temperature of firing at 1650°C.

Depending on the configuration of the products, the capacity of the car varies from 10 kg when crucibles and thermocouple sheaths are being set, to 550 kg for the setting of alumina brick of standard dimensions.

The properties of the products made by casting in plaster molds from water slips are: alumina content 98.5%, TiO₂ 0.8%, Fe₂O₃ 0.3%, apparent density 2.7 g/cm³, and apparent porosity 1–3%.