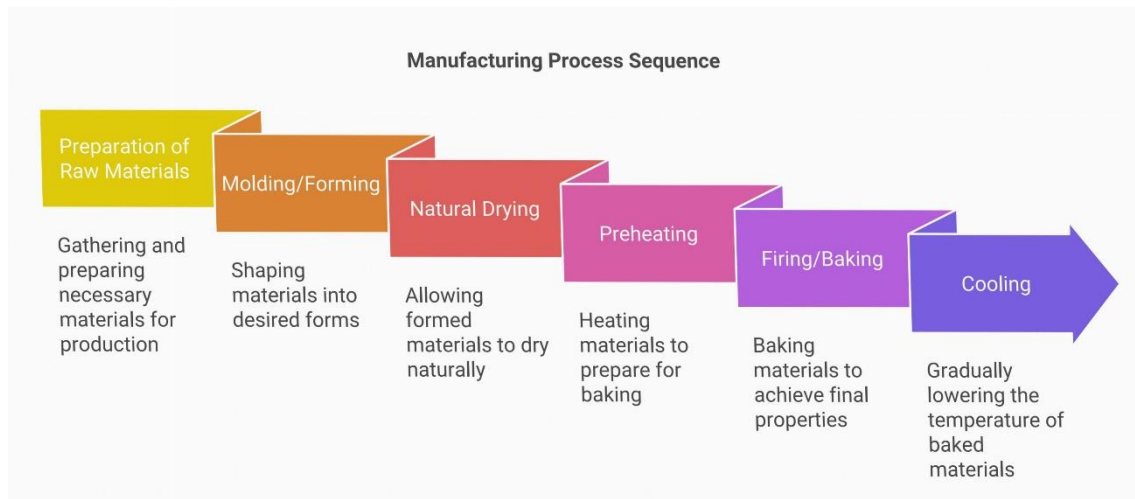


Overview of the Brick Kiln

The Hoffmann kiln, or Hoffmann ring kiln, is an industrial kiln invented by German engineer Friedrich Hoffmann in the mid-19th century. This kiln introduced an innovative technique that allowed for efficient firing of bricks and tiles. The kiln has a circular or oval tunnel structure divided into multiple chambers, where the processes of loading, firing, preheating, and cooling occur continuously in each chamber. By reusing heat from adjacent chambers, the kiln conserves fuel, making it possible to operate continuously for mass production. The Hoffmann kiln was adopted in factories across Europe and worldwide, contributing significantly to the development of the construction and civil engineering industries during the Industrial Revolution.

In Japan, the only Hoffmann brick kiln was constructed in 1890 in Nogi Town, Tochigi Prefecture, supplying bricks to the Kanto region and even used for the construction of Tokyo Station. In 1979, it was designated an National Important Cultural Property by the Japanese government. Now open to the public, it stands as a symbol of Nogi Town and as part of “Modern Industrial Heritage”, showcasing the historical significance of this kiln in the modernization of Japanese architecture and infrastructure.

Manufacturing process



Nogi Town’s Hoffmann brick kiln, multiple processes were carried out in a cycle to efficiently and continuously fire bricks. The main steps of the Hoffmann kiln process are as follows.

1. Preparation of Raw Materials

Bricks are made from clay and sand. High-quality clay was available in this area due to the nearby

Watarase basin was then added to the clay and sand mixture, which was kneaded until a uniform consistency was achieved. This process made the clay easier to mold and ensured stable quality after firing.

This brick kiln has two staircases. Workers used these stairs to carry pulverized coal, placed in shallow baskets called "Baisuke," which they lifted onto their shoulders with a balance pole and transported to the second-floor carts. Each Baisuke held 30 kilograms of pulverized coal at the front and back (a total of 60 kilograms), and workers transported around 1,500 kilograms each day.

The transported pulverized coal was placed in carts on both sides of the kiln and then fed into the firing chamber through feed holes every 15 minutes. There are 25 feed holes per kiln, totaling 400 for the entire chamber. When not in use, the feed holes were covered with iron lids.

2. Molding

The molding process shapes the prepared clayed sand into bricks. Common methods include pressing the clay into specialized molds or using machines like roller presses. The dimensions and shape of the bricks are determined at this stage.

3. Natural Drying

After molding, the bricks contain a significant amount of moisture, so they must be dried before firing. If moisture remains during firing, the heat causes expansion, which can crack or distort the bricks. To prevent this, the molded bricks are lined up in outdoor drying areas, where they undergo natural drying for several days to weeks. This drying process removes moisture from the clay and improves the stability of the bricks.

4. Preheating

After drying, the bricks are transported into the Hoffmann kiln and first placed in the "preheating chamber." The preheating section is prepared by opening and closing dampers around the chimney, which directs the movement of heat to preheat the firing chamber. In the preheating chamber, hot air from the adjacent firing chamber flows in, naturally warming the bricks. By gradually raising the temperature during this preheating stage, sudden temperature changes that could cause cracking are avoided, while also conserving energy.

5. Firing

Once the bricks are thoroughly preheated, they are moved to the "firing chamber." In the Hoffmann kiln's "continuous firing system," each chamber is fired in sequence, maintaining efficient overall production. During firing, pulverized coal fuel is dropped through the holes,

while smoke exits through holes on the ground that connect to the chimney. The temperature in the firing chamber reaches approximately 1050°C (1922°F). The bricks are piled up to near the ceiling, with each chamber producing around 14,000 bricks, and the entire kiln producing about 220,000 bricks per cycle.

6. Cooling

After firing, the bricks are moved to the "cooling chamber," located after the firing chamber, where their temperature is gradually reduced. This circulation system optimizes fuel efficiency by using heat energy without waste.

7. Inspection and Finishing

Once the cooling process is complete, the bricks are removed from the kiln for final inspection and finishing. During this inspection process, the strength and dimensions of the bricks are checked to ensure they meet the required standards, and any cracks or chips on the surface are examined. Bricks that meet the standards are designated as quality products and are shipped out, while any defective bricks are discarded.

8. Shipping

Bricks that pass the final inspection are packaged and shipped as needed. The bricks produced in this manner were used for a wide range of applications, including construction and civil engineering projects in the Kanto region. This continuous cycle process enables the Hoffmann brick kiln to maintain an uninterrupted and efficient system for brick production. In particular, the Hoffmann kiln in Nogi Town played a significant role as a production base for bricks that supported Japan's modernization.