



Ever wondered  
how bricks  
are made?





# How they're made

**Bricks are made by shaping clay and water which is then hardened by drying and firing.**

As our simplest and most ancient building material, bricks have enjoyed widespread and ongoing popularity, due largely to their decorative and loadbearing properties, exceptional durability and economy. This is enhanced by the fact that bricks do not require any surface treatment such as paint to maintain their appearance or durability. Under most conditions a well-fired brick will last almost indefinitely. Clay pavers are also widely appreciated for their aesthetics, flexibility and durability and are produced using the same method.

Most Australian bricks are standardised at 230 x 110 x 76 mm (nominal size) and weigh about 3 to 4 kilograms.

Bricks are made from a wide range of clays and shales with an extremely fine particle size. These clays contain many different minerals that influence the final colour of the fired brick. For example clays with a 3 per cent iron content give white to cream or buff colours which change to pink and red as the iron content rises to 8 to 10 per cent. By adding 1 to 4 per cent manganese dioxide, a range of grey and brown colours can be produced.

## **Natural variation**

Because they are made from naturally occurring minerals, bricks will vary from one production run to the next. The firing conditions may also influence the end product.

Even within a specific 'burn', the colour will change according to the location of the unit within the kiln and its proximity to the fire. This natural variation is part of the charm and character of fired clay bricks.

# Preparation

## **Extraction**

Heavy earthmoving equipment such as bulldozers, scrapers and mechanical shovels are used to extract ('win') clays and shales. Because the amount of raw material extracted is small, clay quarries are relatively unobtrusive and readily rehabilitated. Some Australian clay pits have operated for more than a century and others have been re-developed to become parks and public space.

## **Crushing and proportioning**

Raw materials are transported from the pit by scraper, truck or conveyor, stockpiled by type, and fed into primary crushers to reduce the particle size to about 10cm. Various clays are then mixed, depending upon the properties required in the brick.

## **Grinding and screening**

Conveyors carry the material for secondary crushing, usually by a pan mill with two heavy steel wheels that crush the clay against a perforated base.

Dry clay shatters into brittle pieces that fall through the perforations. Wet clay is squeezed through the perforations and falls between high-speed rollers to complete the grinding process. The crushed clay is screened and oversize pieces returned for further crushing.

## **Did you know**

Because bricks are made only of clay and shale, they have no emissions like man-made materials and therefore create healthier living and working environments.

# Shaping

The shaped unit prior to firing is called a 'green brick'. There are two basic shaping methods: pressing and extruding.

## **Semi-dry pressed bricks**

Semi-dry pressed bricks are made from clay with about 10 to 12 percent water content. The powder is dry enough to fall under its own weight into the steel mould (or die box) in which it is then compressed into the finished brick shape. The resulting brick is smooth and straight with sharp arrises (edges) and a frog (shallow depression) in the top surface.

## **Extruded bricks**

Extruded bricks (also known as wire-cut bricks) are the most common brick type, using clay with 18 to 25 per cent water, forced by auger into a horizontal cone-shaped tube which tapers down to a die (something like a pasta machine). A continuous column of clay, a little larger than the size of a brick in plan, is forced through the die and onto a conveyor.

The clay column is cut into bricks by a wire, like a cheese cutter. Although inherently smooth, extruded bricks may be patterned or textured mechanically or have selected minerals sprinkled on the brick face before firing.

## **Did you know**

1.6 billion bricks  
are made in  
Australia each year?

# Drying

Most extruded bricks are perforated to increase the surface area and decrease drying, firing and cooling times. These perforations also relieve internal stresses in the brick and reduce distortions during firing.

Before bricks are fired the free water must be removed by forced drying as air drying takes up to three months and is impractical with modern production volumes.

## **Pressed bricks**

Pressed bricks are usually set (stacked) directly in the kiln and dried by a small fire or by hot exhaust gases from an adjacent kiln.

## **Extruded bricks**

Extruded bricks with a low moisture content are set directly on kiln cars (large trolleys) that pass through drying and firing without additional handling or resetting. Green perforated bricks with a higher water content cannot be stacked and are placed to dry in racks on special cars or frames. After drying they are offloaded and set onto kiln cars ready for firing.

## **Did you know**

Waste bricks are crushed and added back into the clay mix and are also recycled into mulch or asphalt.

# Firing

Bricks are fired (baked) at temperatures between 1000°C and 1200°C depending on the clay. Light colours are usually fired at the lower temperature and darker colours at the higher.

Although there are many different kiln types, three basic types are widely used in Australia, mostly fuelled by natural gas.

## **Down-draught kiln**

A down-draught kiln consists of a rectangular space with a barrel-arch roof and a slotted or perforated floor leading to flues below. Green bricks are stacked in the kiln and fires lit along the sides, causing hot gases to pass up to the curved roof and down through the stacked bricks and on to the chimney stack. When firing is complete, the fire is extinguished, the kiln cooled and bricks removed.

## **Hoffman kiln**

By contrast a Hoffman kiln fires bricks continuously with the hot gases travelling around the periphery of the kiln and up the central chimney. Each day green bricks are placed in front of the fire and fired bricks removed from behind it through side entrances known as wickets. Closing fire holes at the front of the fire and opening those behind it moves the fire forward. Hot gases from the firing zone preheat and dry green bricks while the fired bricks are cooled by the incoming airflow.

## **Tunnel kiln**

A tunnel kiln is also continuous, with the bricks moving on kiln cars past stationary fires (similar to a conveyor pizza oven). Spent combustion gases preheat unfired bricks and airflow over cooling bricks is used to dry green bricks.

**Did you know**  
Bricks come in  
over 800 different  
colours?

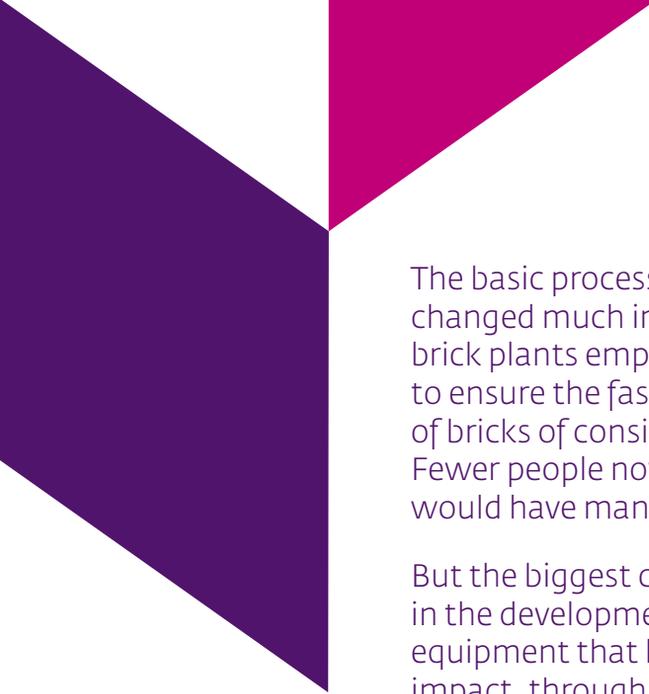
# Blending, packing and delivery

In most brick plants the manual work of unloading fired bricks, blending (to mix or separate various colours) and packaging have largely been automated.

A vertical layer of 50 to 60 bricks may be strapped (banded) into a 'leaf' that is strapped with three or four other leaves into a 'pack' for transport. Alternatively bricks may be packed onto wooden pallets.

Most commonly, delivery to the building site is made by a truck carrying a crane or a special-purpose fork-lift vehicle that can enter difficult sites and place bricks or pavers strategically around the site.





The basic process of making bricks hasn't changed much in 3,000 years, yet today's brick plants employ the latest technology to ensure the fast and efficient production of bricks of consistently high quality. Fewer people now achieve what dozens would have managed only decades ago.

But the biggest changes are occurring in the development of processes and equipment that lessen environmental impact, through the reduction of pollutants, energy consumption, noise pollution, wastage and the upgrading of water management systems.

Think Brick Australia is proud of the commitment its members have undertaken to continually improve the manufacturing process to protect our environment. Go to [www.thinkbrick.com.au](http://www.thinkbrick.com.au)



**Above** Heavy earthmoving machines are used to extract and stockpile clay.

**Below** The raw clays and shales are transported by conveyor for crushing.





**Above** A typical brick production line showing the 'green' (unfired) units travelling at high speed down a conveyor system.

**Right** The green bricks are stacked automatically onto kiln cars (large trolleys) that transport the units for drying and through a kiln to be fired.





**Above** Looking inside a tunnel kiln where the green bricks are transported stacked on kiln cars past stationary heat sources.

**Below** A typical tunnel kiln.



**Right** Most bricks are packaged using automatic equipment. In this case the bricks have been banded with metal straps, leaving two entry points for fork lifts.



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