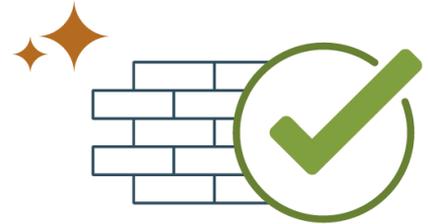


## White paper: Impregnated Vandersanden bricks

In mid-2017, the first production line (Spouwen S3) was fitted with an automated impregnating line, with which the visible side of bricks is given an invisible water-repellent coating. The other plants be will systematically equipped with such a line, starting with Spouwen S5 and followed by Lanklaar. The fourth and last plant will be Hedikhuizen. By the end of the year 2019 all Vandersanden facing bricks, which are susceptible to contamination etc., will be impregnated



### Why does Vandersanden impregnate its bricks?

In recent decades, the brick sector is increasingly faced with stained facades. They are either fouled by salt, soot, algae or other usually innocent substances, or by calcium or gypsum, which are more persistent. While these deposits do not damage the quality of the brick technically speaking, they are not very aesthetically pleasing.

Various studies have been performed over the years to find the cause of persistent calcium or salt fouling, with the most recent doctoral study at KU Leuven demonstrating that it is largely due to the joint mortars used. These mortars have been developed significantly over time with a view to workability, curing time and cost price reduction. The effects that leaching of substances has on quality were not discovered until later and often only become visible after many years.

A highly absorbent brick is more subject to leaching of substances, as it will saturate during rainy weather and draw substances from the mortar. When the brick dries out towards the outside, the substances are carried along and deposited on the outside, resulting in a dirty wall.

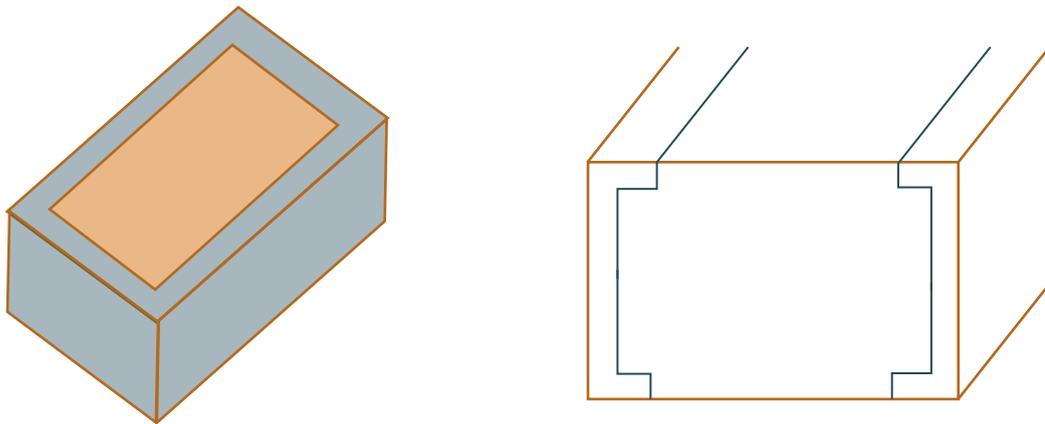
Various studies are being carried out to improve mortars, but the results are long in coming. The phenomenon of calcium and gypsum deposits is a complex issue comprising different influencing parameters.

The Belgium-based company Vandersanden has been confronted with this phenomenon on multiple occasions. It really is a concern for the company, as *sustainability* and *craftsmanship* are among our core values. This is why we decided to put a stop to the issue once and for all by taking action and developing a product that performs independent of the type of mortar and method of processing. That way, Vandersanden can supply products of constant quality that remain aesthetically pleasing for many years.

This entails considerable financial investments that not only seek to realise a commercial objective for Vandersanden but at the same time are intended to proactively protect the brick industry by improving the image of brick. In doing so, Vandersanden also accepts its social responsibility by safeguarding a future role for masons, jointers and bricklayers.

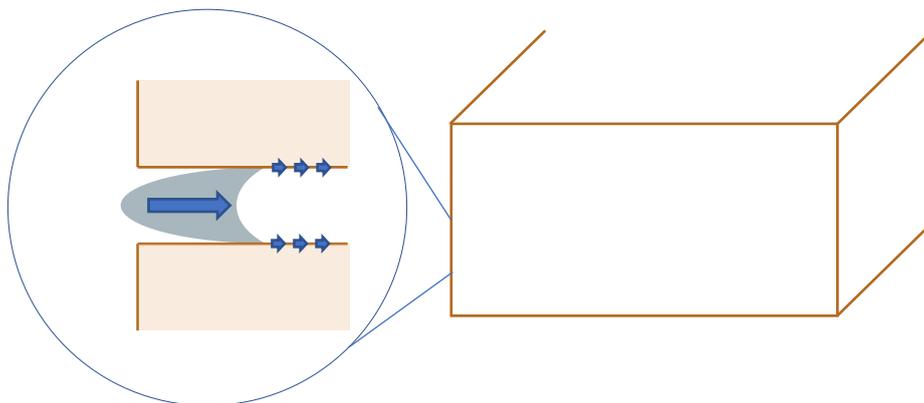
### How are Vandersanden bricks impregnated?

In the automatic process, the four visible sides of the brick are coated with a water-repellent layer. This coating is applied down to approximately 5-10 mm into the brick. The laying surfaces (top and bottom) are not impregnated, so that the bricks can still be laid in the traditional manner, using traditional mortars. However, the laying surfaces do have an impregnated edge, resulting from application of the product to the visible sides. This edge can be some 10-20 mm wide.



### How does water transport in traditional bricks work?

A highly absorbent brick is a product with a lot of pores, both large and small. These bricks act like sponges. The water will be absorbed into the pores as soon as they come into contact with water. This is caused by the capillary action of the pores. Water droplets are attracted by the walls of the pores, creating an absorbent effect.



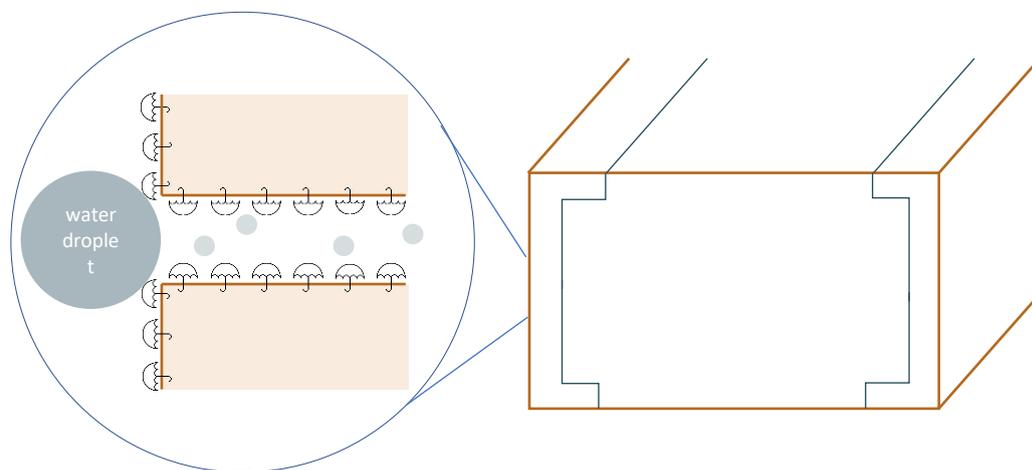
The large pore structure of these bricks ensures that they can never freeze to pieces, even when they are saturated with water, as there is always sufficient space for the water to expand when it turns into ice.

### **How does water transport in impregnated bricks work?**

An impregnated brick has exactly the same pore structure as a non-impregnated brick. The number of pores and their size remain the same. However, the 5-10 mm impregnated layer will not absorb any water, as the walls of the pores are covered with a water-repellent layer and the water droplets are no longer attracted to the walls and can therefore not be absorbed.

As the pores remain open, the bricks retain their resistance to frost.

Moisture in the non-impregnated part of the brick can leave the brick through the non-impregnated laying surfaces or by means of evaporation along the impregnated visible sides. After all, vapour droplets are smaller than water droplets and are perfectly capable of migrating through impregnated pores.



### **Why are impregnated bricks less susceptible to fouling?**

Deposits from the outside, such as soot, dust or algae, cannot attach properly to the water-repellent surface of the bricks. Moreover, the deposits will rinse off more quickly and easily when it rains.

Deposits from the inside, such as substances leaching out of the mortar that are absorbed by the laying surfaces of the brick, will be blocked behind the impregnated layer in the core of the brick. This has the additional effect of causing gypsum efflorescence in the core of the brick, partially clogging the pores. This provides an additional barrier against outward leaching.

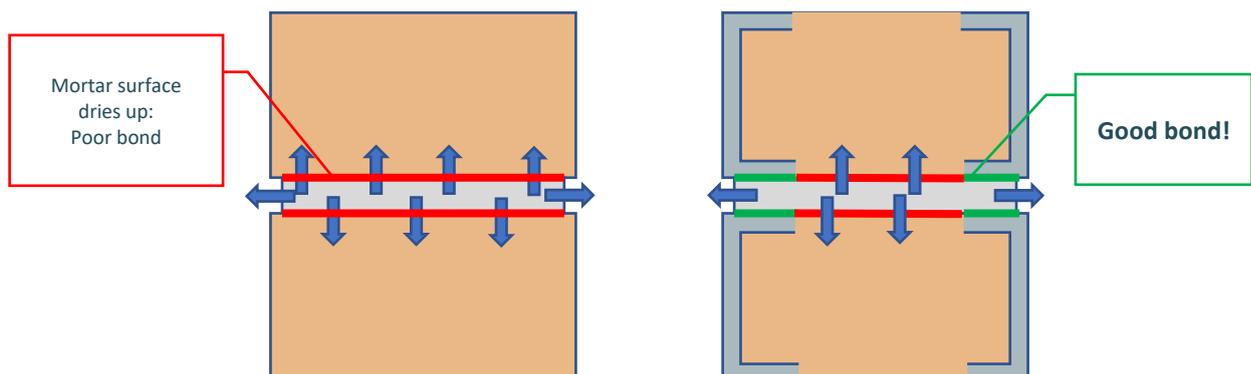
### How are impregnated bricks processed?

As explained above, the laying surfaces of an impregnated brick are not treated, which means that the bricklaying properties of the brick are the same. These surfaces will be sufficiently absorbent.

Despite the fact that a highly absorbent brick gives the idea that it properly attaches to the mortar, tests have shown that this is not always the case. If the quality of the mortar is poor, the brick will absorb the mixing water from the mortar, as a result of which the mortar on the contact face of the brick dries up and cannot cure sufficiently. This is also referred to as "burning" of the mortar.

The mortar on the impregnated part of the laying surface cannot dry up. Tests indicate that the bond on this surface is much stronger. So the Vandersanden impregnated bricks combine the two phenomena referred to above: The core absorbs, so that the brick does not shift during bricklaying. The impregnated edges provide additional bond.

This also applies to the joint mortar. All of the joint mortar is in between 2 impregnated laying surfaces and will not lose moisture to the brick. This increases the quality of the joint and does not have any negative effect on the bond.



### What requirements have to be met when laying impregnated bricks?

A traditional high absorbent brick is a very tolerant product. That means that it can be used in the worst kind of conditions (cold, frost, rain), in the worst possible manner (using far too much mixing water), with the worst possible products (poor mortar quality) and yet have a fairly good end result. But this does not mean that the resultant wall is of a good quality. Because of this great tolerance, highly absorbent bricks are a popular product for bricklayers, but any problems (leaching, gypsum efflorescence) only become visible later.

Impregnated bricks provide an excellent, long-term, guaranteed result, although the processing tolerances are somewhat restricted. The bricks can only be processed in accordance with the generally applicable instructions.

These are known to bricklayers, but they are not always complied with. And that will soon show with the use of impregnated bricks! The following processing requirements are given because they influence the use of impregnated bricks:

1. Impregnated bricks must be stored in a dry and covered place.

If a highly absorbent brick gets wet, they will rapidly lose the water from all sides, which means they are rapidly ready for use. Impregnated bricks can only lose water from the laying surfaces. The water can only be removed through the impregnated sides by means of evaporation. As such, impregnated bricks retain water longer. A wet brick is heavier, which means the wall cannot be built as high, in order to prevent collapse. A wet impregnated brick loses most of its water through the laying surfaces, which makes the fresh mortar even wetter and increases the risk of collapse.



The impregnated bricks can, of course, also be processed while slightly moist. In warm, summery conditions, this is even advisable.

2. The quantity of mixing water for the mortar must be limited.

Bricklayers often tend to up the amount of mixing water to obtain a smooth and sated mortar that is easy to process. While this does not improve the quality of the mortar, it does not cause any problems with traditional high absorption bricks.

But with impregnated bricks, the risks are the same as mentioned under 1. Mortar that is too wet is not as strong. As impregnated bricks absorb less water from the mortar, the mortar will remain wet longer, creating a risk of collapse after only a few courses. This phenomenon does not occur if bricklayers comply with the manufacturer's instructions. These instructions may differ per manufacturer and product and are always available on request. For powdered mortar, the amount of mixing water is always stated on the bag.



For the record: using less mixing water for cement-bound products always has a less negative (or even positive) effect on the final quality of the cement/mortar than using too much mixing water.

3. Water absorption of impregnated bricks

The type of mortar used depends on the initial rate of water absorption (IRA class) of the brick. Traditional hand-moulded bricks have an IRA class of 2 to 4, with class 4 comprising the highest initial rates of water absorption.

The type of mortar used for impregnated bricks requires a dual approach:

- The core of the brick is not treated and has the same water absorption of regular brick.
- The impregnated visible sides of the brick are water-repellent and have an initial rate of water absorption of 0%.

If the initial rate of water absorption is determined using the standard, this produces an average of the above, as a result of which impregnated bricks are 1 class below a similar non-impregnated brick.

The technical information sheet will list the IRA of both the impregnated and the non-impregnated brick. Impregnated products can be recognised by the "C" in the top left of the CE label on the packaging. This will also be stated on the order form.

It is important, therefore, to first verify whether the bricks are impregnated or not and adjust the mortar to the corresponding IRA class, as indicated on the technical information sheet.

Please note: if bricks are used for special purposes and the impregnated bricks are laid on their side, so that an impregnated side becomes the laying surface, the mortar must be adjusted to this water-repellent surface.

#### 4. Extended spread mortar

Processing is the same as described above. Curing of the mortar used for impregnated bricks will be a little slower than with traditional bricks, which absorb the water from the mortar more quickly. This must be taken into account when using extended spread mortar. Curing depends to a large extent on the weather conditions, and no concrete timings can be given. Tests have demonstrated that the difference is slight and does not come with noticeable loss of time.

#### 5. Jointing

The bond of joint mortar was discussed above and there are no adverse effects compared to traditional bricks. However, there is an additional point of attention related to jointing: A freshly impregnated brick will have a water-repellent effect on the visible side during the first few months. As a result, there may be droplets on the visible sides in case of rain or condensation. These droplets will have to be removed before starting the jointing work in order to prevent staining of the brickwork from brushing the joints. The droplets can be removed with a cloth or by means of a blower.



The repellent effect on the visible sides of the bricks will disappear after a few months. Vandersanden advises waiting 4 to 6 months before starting jointing work in order to overcome this problem.

It is also recommended to moisten the fresh jointing in the summer. This also applies to impregnated bricks, although we recommend this be done with care and using less water, as the bricks themselves no longer absorb water and all the water goes to the joints.

According to generally applicable instructions, fresh jointing must always be protected against rain. This is also true for impregnated bricks.

#### **What are additional advantages of impregnated bricks?**

Applying a hydrophobic layer on an existing brick wall costs about €10/m<sup>2</sup>. Vandersanden has made considerable investments to guarantee a future for brickwork without increasing the price of bricks. This also safeguards a future for bricklayers and has benefits for the end user.

By impregnating bricks, they are already mixed in the plants during the production process to some extent. While Vandersanden still recommends mixing bricks from different packages, the risk of colour differences in the wall is minimised.

### What drawbacks exist for the use of impregnated bricks?

When the rules and instructions are complied with, the use of impregnated bricks is not different from that of traditional bricks.

Often, the loss of efficiency is cited as a drawback. And it is true that impregnated bricks are more difficult to lay in rainy weather, which, technically speaking, is positive. After all, the general instructions for traditional brickwork also prescribe covering the brickwork to ensure a good quality.

The same applies to the quantity of mixing water. Bricklayers who are used to make the mortar wetter than prescribed will deliver poorer quality work. Masonry mortar is, of course, perfectly workable when prepared in accordance with the instructions, even though this may run counter to what bricklayer are used to..

Jointing is not possible when it rains or if there is condensation. This is true, the droplets need to be removed before jointing can be resumed. This costs a little extra time and, consequently, money.

However, given the choice, the contractor or bricklayer can wait 4 to 6 months before jointing, when the repellent effect and the related problems have disappeared.

All these issues also apply to the use of extended spread mortar. In this case, too, fresh brickwork must be covered when a rain shower hits the building site to ensure that the wall remains dry and the joints can be applied without soiling the wall. As long as the bricks remain dry and are laid when it is dry, there is little difference in the curing time of joints before they can be raked.



### Overview of generally applicable instructions

Vandersanden recommends complying with the generally applicable instructions, which may differ per country. Compliance with the instructions is particularly important at processing temperatures **below 10°C** in order to obtain quality brickwork.

#### General:

- The facing bricks are always stored and processed under **dry** conditions.
  - Opened packages are properly covered.
  - Stacked bricks must be protected against rain.
- The brickwork must be **protected** against cold, driving rains and wind.
- When laying bricks and during the curing process of the mortar, the ambient temperature may not be lower than 5°C and not higher than 30°C.
- Never work on frozen soil, soil that is thawing out, or when there is a risk of frost within 24 hours.

#### Traditional brickwork with prefab mortar:

- The mortar used must be of good quality and meet the relevant standards for masonry mortars, in accordance with the IRA class for the brick used.
- The masonry mortar must be mixed in accordance with the manufacturer's instructions. **No extra water** must be added to make the mortar smoother. To prevent the impregnated bricks from shifting, **the prescribed quantity of water must be minimised.**
- Improved prefab winter mortars can be used for low absorbent bricks, which cure more rapidly than the traditional M5 masonry mortar. Contact the relevant manufacturer for additional information.

Traditional brickwork with home-made masonry mortar:

- We recommend the following composition to ensure that the home-made mortar will be sufficiently absorbent under wintry conditions:
  - CEM1 52.5 (1 part)
  - Course Rhine sand 0-5 mm (4 parts)
  - Optionally: plasticiser (winter version with accelerant).

Glued brickwork:

- No special requirements compared to traditional brickwork

Extended spread mortar:

- Similar to the recommendations for masonry mortar.
- The amount of mixing water must be minimised, in accordance with the instructions from the extended spread mortar manufacturer.
- During the first curing period of the extended spread mortar, the brickwork must be protected against rain and wind, both before and after application of the mortar.
- The drying period before applying the extended spread mortar may be a little longer than with facing bricks without hydrophobic layer. This difference is not significant.

Joint mortar:

Vandersanden recommends complying with the processing instructions for joint mortar, which may differ per country:

- Belgium: TV208
- The Netherlands: CUR61
- France: DTU20.1
- Germany: Verblendmauerwerk 2012

**The most important points of attention from these instructions are reiterated below:**

Preparation:

- Remove all dust and brick residue from the joints.
- Provide for a joint depth of at least 10-15 mm.
- Any visible water droplets or a water film present on the impregnated visible side must be removed prior to jointing. The droplets can be removed with a cloth or by means of a blower. This phenomenon may occur under damp conditions or when it rains or due to condensation at low temperatures. The repellent effect and the related problems will disappear after a few months.

Processing:

- Impregnated bricks are jointed in the traditional manner using traditional products. These include home-made mortars or prefab joint mortars. Always follow the recommendations for selection of joint mortar and the manufacturers' processing instructions.
- Do not joint in wet conditions or freezing temperatures, or when rain or frost are expected in the first 48 hours after the jointing work.

Post-treatment:

- Protect the jointing against drying out and rain for at least 48 hours.
- Drying out can be prevented by regularly spraying lightly with water. PLEASE NOTE! Impregnated bricks do not absorb water, which puts an added burden on the joints when they are sprayed. First test whether the joint has cured sufficiently to prevent them from eroding, and then spray the wall briefly and multiple times a day.

Vandersanden recommends the use of joint mortars with a hydrophobic coating in order to produce an attractive end result with no deposits.

For questions or advice, contact Vandersanden's Technical support department at [technicalsupport@vandersanden.com](mailto:technicalsupport@vandersanden.com).