

Print quality and production reliability in ceramic tile decoration



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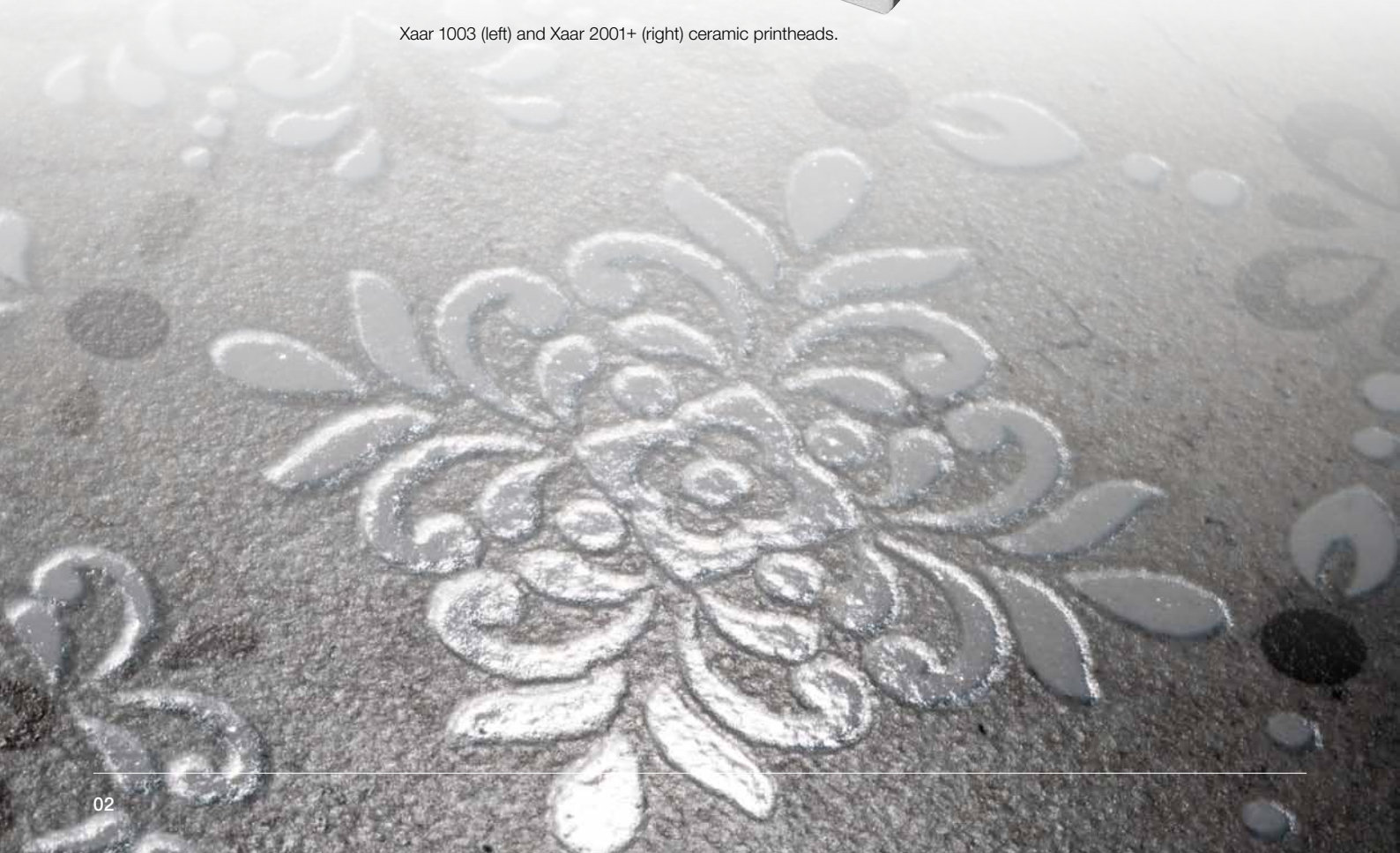
# Print quality and production reliability in ceramic tile decoration

Consistent high print quality and reliable production output are key considerations in ceramic tile decoration – any print defects result in costly waste and reduced factory output, plus unscheduled downtime for equipment maintenance.

Xaar printheads for ceramics are designed with reliability in mind – multiple features ensure stable print quality over time, with minimal maintenance required. The result is extremely robust printheads that can operate in the harsh industrial environment of a ceramic tile factory, running 24 hours a day, 7 days a week, over a period of several years.



Xaar 1003 (left) and Xaar 2001+ (right) ceramic printheads.

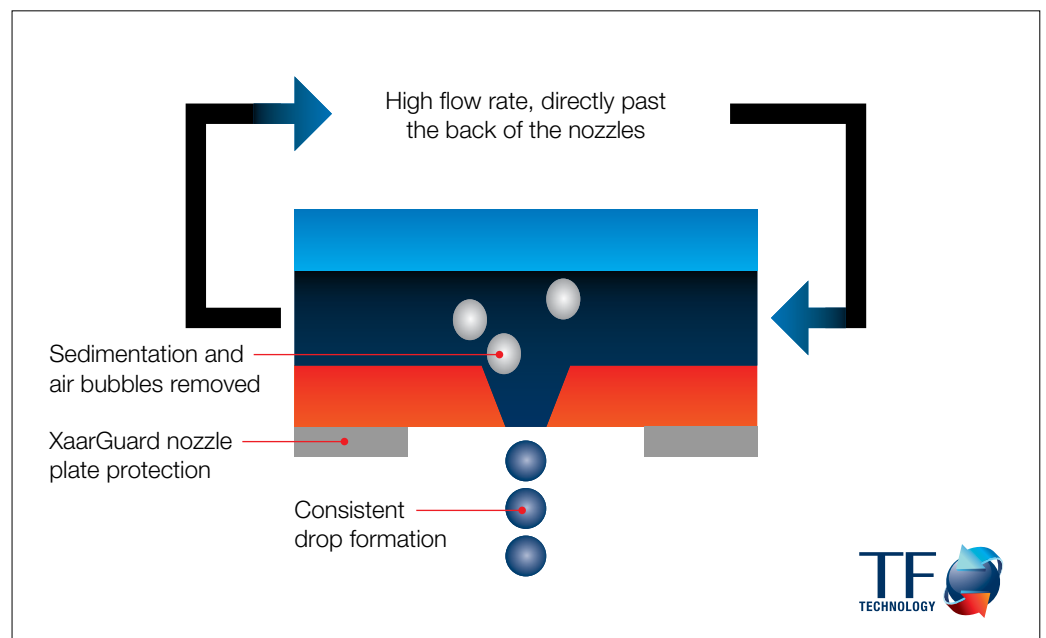


## Xaar TF Technology ink recirculation

With Xaar TF Technology, ink circulates directly past the back of the nozzles during drop ejection at a high flow rate. Many competitor products advertise ink recirculation, but no other achieves the unique combination of high flow rate and circulation directly past the back of the nozzles which is possible with Xaar printheads.

A high flow rate directly past the back of the nozzles ensures that they are continuously primed, keeping the printhead operational and the nozzles firing. The ink is in constant motion which prevents the nozzles from blocking – particularly important with fast-sedimenting heavily pigmented inks. In addition, air bubbles and unwanted particles in the ink are carried away, radically improving reliability even in the harshest industrial environment.

Working in conjunction with this is the XaarGuard nozzle plate protection which minimizes ink build-up on the nozzle plate, reducing maintenance to once per shift or less.



**Figure 1:** With Xaar TF Technology, ink flows directly past the back of the nozzles during drop ejection at a high flow rate, carrying away any unwanted particles or air bubbles.

## Causes of missing jets

Despite ink recirculation in the printhead, nozzles can still become blocked resulting in ‘missing jets’ as illustrated in figure 2. If the causes of this phenomenon are ignored, the printhead can develop an increasing number of missing jets, which negatively impacts print quality and may result in tiles being scrapped, reducing productivity and creating unnecessary costs.

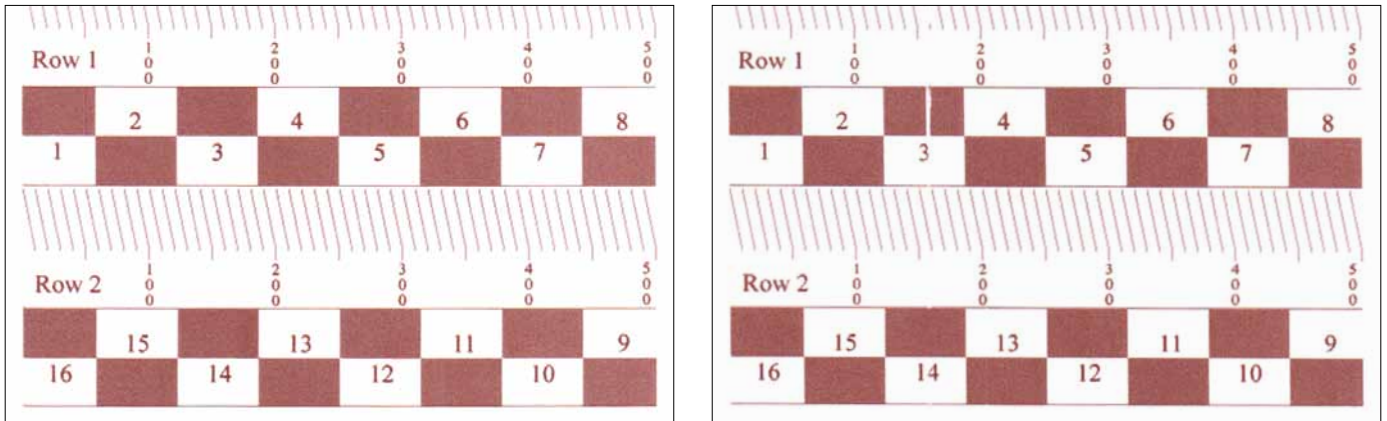


Figure 2: Test prints showing all nozzles firing (left) and a printhead with multiple missing jets in zone 3 (right).

## What causes these missing jets?

The base piezoelectric PZT material used to build Xaar ceramic printheads is extremely robust – testing at Xaar has shown that in lab conditions each actuator operating in Xaar’s shear mode can exceed 10,000 billion cycles – equivalent to 50 years operating at full duty cycle and 24x7!

In fact, the principal cause of missing jets is not the failure of the printhead, but is due to particles of debris from the external environment that get trapped inside the printhead’s internal channel structures. To understand this better, figure 3 shows a microscope view of the printhead nozzle plate. The individual nozzles can be seen in the centre of the image, each one positioned above a narrow channel. The PZT walls on either side of each channel actuate when an electric field is applied, causing a drop to be ejected from the nozzle. Ink is constantly flowing through each channel, from the inlets at the top of the image to the outlets at the bottom.

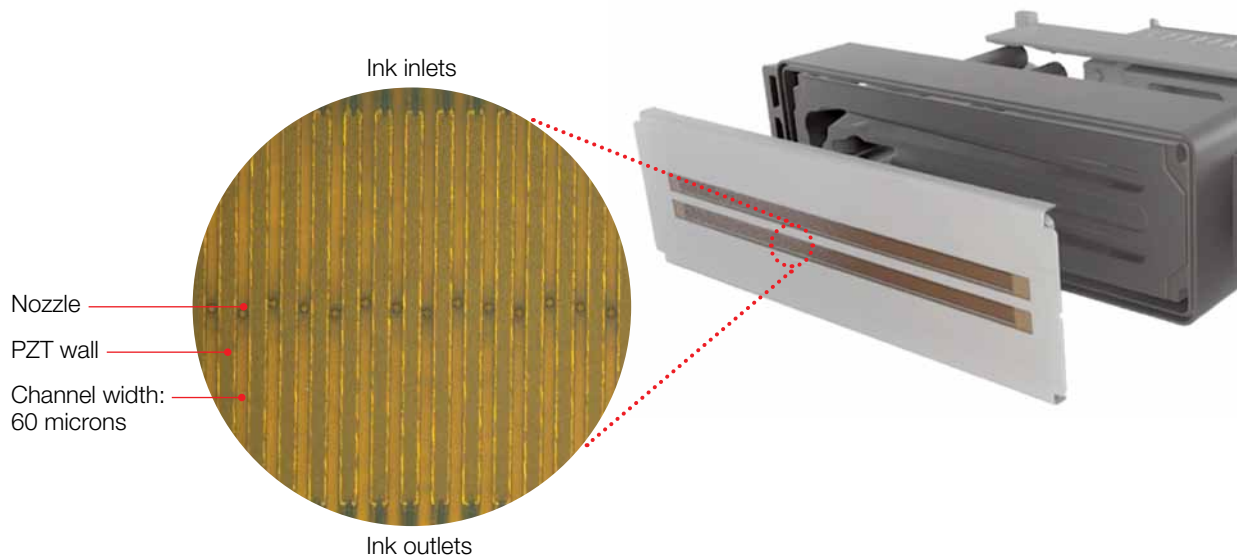
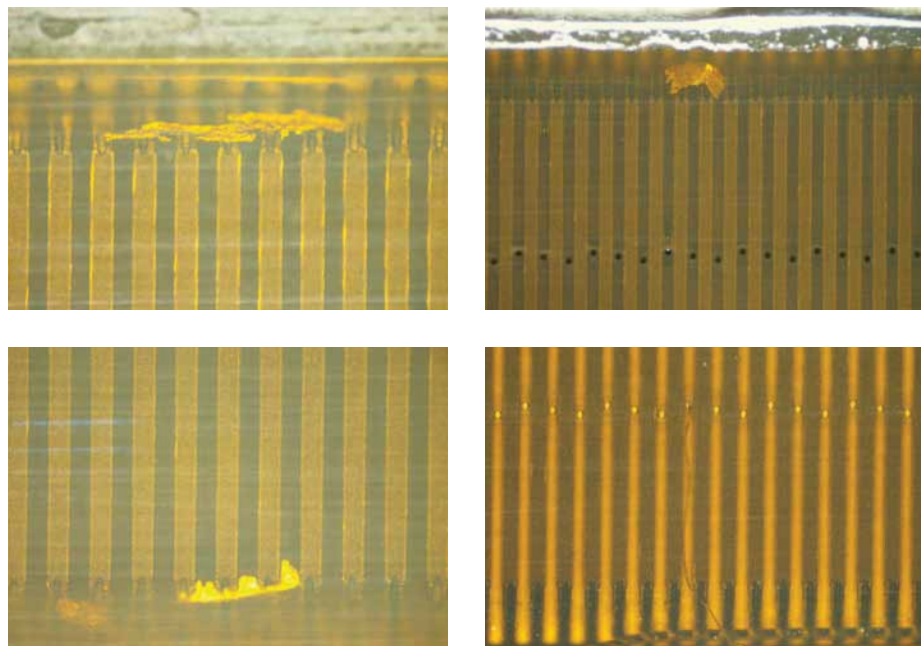


Figure 3: Actuator channels shown through transparent nozzle plate of Xaar 1003 printhead.

These actuator channels are extremely small, approximately 60 microns in width. To put this into perspective, a human hair is typically between 50-150 microns in width. Furthermore, the channels are the narrowest part of the printhead recirculation system, and as a result any debris which enters the printhead from the ink system and which is larger than 60 microns will likely get blocked at the entrance to these channels.

Xaar routinely examines printheads returned by customers. The most common fault reported by customers is missing jets, and in the majority of these cases, microscope analysis identifies particle contamination as the cause. Figure 4 shows examples of debris – metal particles, plastic particles or fibres. None of these particles originated from the printhead itself but were introduced through the ink delivery system.



**Figure 4:** Microscope analysis shows metal, plastic and fibres blocking one or more channels, causing missing jets.

## Sources of debris

The previous images show examples of different types of debris blocking the actuator channels and causing missing jets, but where do these particles come from?

All ceramics printers incorporate a bulk filter situated close to the main ink tank, to filter ink as it initially enters the printer ink delivery system. This bulk filter must be capable of a high flow rate and have a high dirt retaining capacity; it should be renewed at the intervals specified by the printer manufacturer.

Nonetheless the bulk filter will not capture 100% of debris, and any remaining particles will circulate through the ink system and then through the printheads, potentially blocking the printhead channels as explained earlier.

Such debris may result from:

- Debris remaining in the ink system following initial printer installation
- Debris created by wear and tear of components within the ink system
- Debris created by the replacement of the bulk filter itself during regular maintenance cycles
- Small particles that build up into larger debris at weak points in the ink system such as intermediate tank corners and tubing connectors, and which are released during maintenance or ink changes.

## Xaar inline filters

To capture any debris before it enters the printhead, Xaar recommends the use of inline filters – these may also be referred to as ‘last chance filters’ or ‘rock traps’. Xaar inline filters provide the printhead with a final protection, and significantly reduce the occurrence of missing jets caused by debris in the ink system blocking the printheads.

Xaar offers a suitable inline filter via OEM partners (figure 5) – these should be fitted in the inlet tube to each printhead (or both inlet tubes on the Xaar 2001+ printhead) with the directional arrows pointing in the direction of ink flow. The Xaar inline filter has a rating of 50 microns, which is well matched to the dimensions of the printhead channels and intended to retain any debris that would otherwise block them.

Filters are not normally required on the printhead outlets. Note that Xaar does not recommend the use of reverse flushing – if inline filters are fitted to the inlets then there is no reason to use reverse flushing and therefore no need to use a filter on the outlet tube.

In a well maintained printer using approved inks, the inline filters should last the lifetime of the printhead. If they do need to be replaced at some point, then this is likely due to excessive debris in the ink system which would surely have caused blocked channels and missing jets had the filter not been present. It is much easier and cheaper to replace a filter than the printhead itself!



Figure 5: Xaar inline filter (part XP55400006).

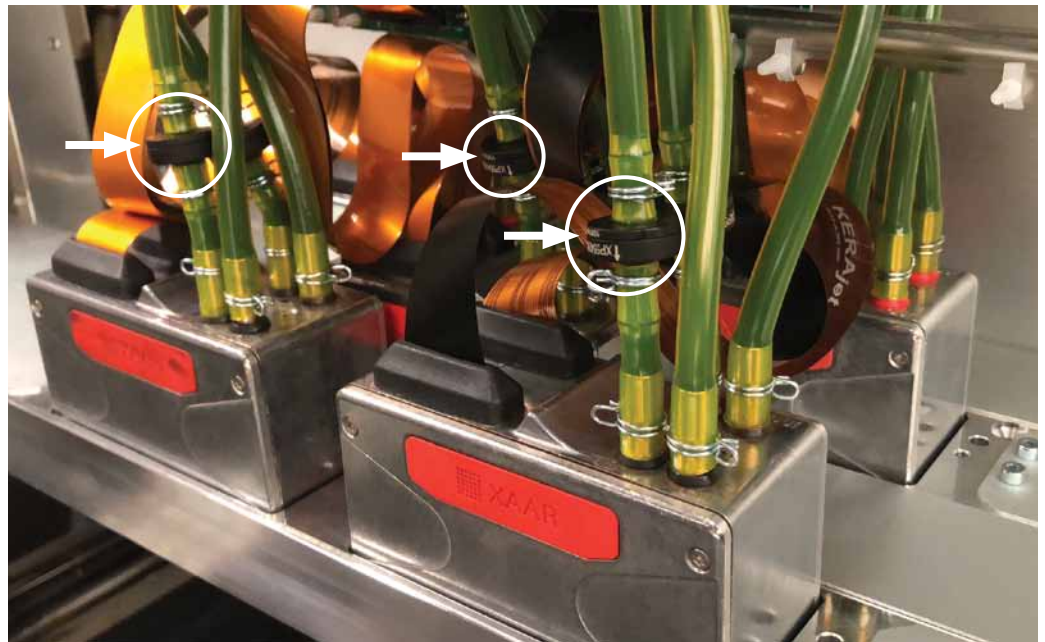


Figure 6: Inline filters installed on Xaar 2001+ printheads.

Photo courtesy of KERAjet

## Printhead maintenance

As explained previously, inline filters offer significant potential to improve print quality and productivity in ceramic tile decoration by reducing the occurrence of missing jets caused by debris in the ink system.

Another cause of missing jets is inappropriate cleaning methods. Printheads are precision products which must be protected and treated with care. All modern ceramics printers incorporate automatic printhead cleaning systems – if these are used as instructed, and the environment is clean, then there is generally no need to manually clean printheads.

If you do need to manually clean a printhead, remember a few basic rules:

### Do

- Wear protective gloves.
- Use clean lint-free wipes, stored in a re-closeable container to prevent contamination by dust.
- Wipe the printhead **ONLY** once and in **ONE** direction.

### Do not

- Wipe the printhead multiple times.
- Re-use wipes, and do not leave wipe containers open.
- Touch the nozzle plate and nozzle guard, especially not with bare fingers.



**Figure 7:** If manual cleaning is required, wipe the printhead **ONCE** and in **ONE** direction with a clean lint-free cloth.



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