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| **Article** |

Schaffhausen

**Infrared welded PVC-U: consistent, safe, and reliable**

**While cemented pipe connections have been a standard across many industries, technological advancements have now brought infrared welding to PVC-U piping systems. Maurice Veldenzer, Product Manager PVC at GF Piping Systems, explains why he believes that IR welding is a groundbreaking solution for the chemical processing and water treatment sectors.**

When asking installers about the typical jointing technique for PVC-U piping systems, the answer would most likely be cementing. This has been the standard for decades, and cemented PVC-U pipes have been implemented in various demanding industries. “Adhesives will always play an important role in PVC-U piping Systems”, explains Maurice Veldenzer. He is Product Manager PVC at GF Piping Systems and joined the Swiss flow solutions provider in 2020. “As a company, we have a long history with adhesives and offer our cements under the Tangit brand in collaboration with Henkel. This includes a THF-free variant suitable for drinking water or an adhesive that is completely solvent-free.” However, in spite of the many specialized types of adhesive available today, cementing can also have drawbacks. “In some scenarios, adhesives are the limiting factor, especially when joints come into contact with highly aggressive media.” This is mainly due to the solvents within the adhesive that can have a minor impact on the PVC piping material. “As we have decades of experience with various types of plastics and jointing technologies, we wanted to create a process that further optimizes the quality of PVC-U connections. The result is infrared welded (IR) PVC-U.”

**Advancements thanks to automation**

This new IR welding process is carried out similarly to infrared welded polyolefins or partially fluorinated plastics. However, PVC-U has some unique demands. Most importantly, the process window is much narrower compared to other materials. For installers, a machine controlled process means that variables such as temperatures, jointing times, and cooling periods are consistent and repeatable. The welding machines are also capable of detecting any deviations from the defined parameters, while an additional printer provides labels that offer full traceability. “The end result is a series of identical welds that remove the risk of human error and ensure an independent quality control.” Nevertheless, the need for welding machines also means that cementing has advantages. “The welding process requires a sufficiently protected area on the building site, which adhesives do not. They are also capable of tighter construction lengths for smaller dimensions.” On the other hand, welding offers the benefit of improved workplace safety as installers do not come into contact with solvents or the fumes associated with adhesives.

**Welding in challenging conditions**

But in order for infrared welded PVC-U to be widely implemented, it first has to prove that it is up to the task. As part of the development phase, the R&D team therefore had to make sure that the welding system could meet the same chemical resistance criteria as cementing. “We conducted a number of creep rupture tests with different media. These tests were based on DIN EN ISO 15493, the standard for industrial plastic pipes made of PVC-U and they surpassed the minimum requirements by a factor of 3.” During the tests, pipes ranging from d20 to d63mm were filled with chemicals and subjected to the specified loads at room temperature as well as 40°C, creating the same test environment as for cemented joints. “As a result, we could show that it is now possible to use PVC-U pipes with media such as sulfuric acid at 96% and run them with an operating pressure of 16 bar”, Veldenzer summarizes. The tests also included Hydrochloric acid (37%) Nitric acid (55%), Sodium hypochlorite (15-17%) and Hydrogen peroxide.

**Industry applications**

How can welded PVC-U pipes be implemented in industries that used to rely on cementing? While cementing remains an indispensable jointing method, Maurice Veldenzer believes that there is a lot of potential for the new system. “IR PVC-U is ground-breaking for the chemical processing sector and water treatment applications. When transporting highly aggressive media, the cemented joints are often the first area to be attacked, as they came into contact with the solvents from the cement. In the case of welding, they are not used in the process, so no solvents can be attacked or leach out into the media.” This additional layer of safety is especially relevant for industries like microelectronics manufacturing where limits for the cleanliness of piping systems are especially strict.

**A future-proof jointing method?**

Looking towards the future, there is an additional consideration to made. As more and more industries need to meet ever stricter sustainability guidelines, they also rely on technologies that reduce their impact on their environment. “This is another area in which PVC-U in general has a lot of potential. We have started adding bio-attributed material to all our PVC metric pressure pipes produced in Europe, Bio-attributed PVC uses resin made of tall oil which is a by-product of the paper industry.” But, as Veldenzer points out, the welding process might prove to be another step towards a more sustainability. “Cements using DOTE stabilizers like DYTEX will become subject to the REACH regulation by the European Union by 2025. These cements need to be used in the most demanding applications, eg. sulphuric acid 96%. IR PVC-U overcomes this challenge.” At the same time, he emphasizes that the welding system is specifically designed as an alternative. “It should not be seen as substitute for cementing but rather as a solution for applications where adhesives are pushed to their limits.”

After working on the development of the IR PVC-U system for 2 years, Maurice Veldenzer is happy with the results. “Ever since joining GF Piping Systems I have enjoyed collaborating with a wonderful team, and I am very proud to have worked on an innovative product that improves safety, reliability, and quality. Thanks to decades of experience with plastic flow solutions, we were able to combine a proven material and jointing technology in a new package.”

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**GF Piping Systems**

As the leading flow solutions provider for the safe and sustainable transport of fluids, GF Piping Systems creates connections for life. The division focuses on industry-leading leak-free piping solutions for numerous demanding end-market segments. Its strong focus on customer-centricity and innovation is reflected by its global sales, service, and manufacturing footprint and its award-winning portfolio, including fittings, valves, pipes, automation, fabrication, and jointing technologies.

GF Piping Systems has its own sales companies in 31 countries, which means it is always by its customers' side. Production sites in 36 locations in America, Europe, and Asia ensure sufficient availability and quick, reliable delivery. In 2022, GF Piping Systems generated sales of CHF 2'160 million and employed 8'085 people. GF Piping Systems is a division of Georg Fischer AG, founded in 1802 and headquartered in Schaffhausen, Switzerland.

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**Pictures**

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| Ein Bild, das Person, Maschine, Forschungsinstrument, Frau enthält.  Automatisch generierte Beschreibung | Infrared welded PVC-U offers a machine controlled process that ensures consistency, a high quality and full traceability. Source: GF Piping Systems  |
| Ein Bild, das Maschine enthält.  Automatisch generierte Beschreibung | IR PVC-U is currently suitable for dimension from d20 to d63mm and an operating pressure of 16 bar. Source: GF Piping Systems  |