

WHITE PAPER 2023

MULTI-LAYER PIPEWORK **THE PERFECT ALL-ROUNDER**

PUBLISHER AND EDITOR

Geberit Sales Ltd
Geberit House
Edgehill Drive
CV34 6NH

Printed: March 2023

CONTENTS

Foreword **3**

The challenge of materials selection **4**

A brief history of piping materials **6**

What is a multi-layer pipe? **8**

Overcoming specification challenges **10**

Benefits of multi-layer **12**

Multi-layer pipework in practice **14**

Key takeaways **15**

Plastics are everywhere, whether you love them or hate them. The built environment that we inhabit contains plastic products in every shape and form; both visible and hidden. Technology has developed to utilise different plastics, polymers, elastomers and man-made rubbers in nearly every walk of life. We live with, wear, carry, drive in, fly in, eat with and drink from, shop with, and play sports with plastics.

Some of the most advanced materials in the world are Engineering Plastics which are sometimes used to replace components made from metal or wood. They often have superior properties and can also be formed into complicated shapes. 3D printing has also revolutionised manufacturing techniques and uses plastics to construct complex geometries which would not be able to be formed or cast. However, some commercially driven plastics are deemed unnecessary for modern living, and measures are being taken to develop products which have less of an environmental impact or recycle and reuse as much as is reasonably possible.

Buildings, and the materials used to complete them, have many components which are made from or contain plastics. With every procurement decision comes considerations as to what are the best or most appropriate materials to use. Some plastic based materials are essential when looking at cost effectiveness compared to physical properties and suitability. An example of this would be the necessity of having electrical wires covered in plastic or polymer shroud.

Thoughts around the environment and the use of plastics are at the forefront of everybody's minds and play a role in procurement and decision-making processes of overall construction products. When it comes to material selection for Building Services; drinking water, or heating and air conditioning, for example, the reason for using plastic systems must be correct and considerations must be made compared to their more traditional counterparts. Expansion, corrosion resistance, chemical resistance, surface roughness, and hygiene are all considered. Modern heating systems are evolving to use different product types, moving into lower temperature bands, and becoming more efficient, meaning that plastic and multi-layer systems become an attractive prospect.

Choosing to use multilayer piping systems when considering the variables of corrosion resistance, temperature resistance, pressure loss, expansion, recyclability and responsible sourcing is a great opportunity to use products which cover many, if not all, the modern environmental requirements.

This paper covers the benefits of using multi-layer systems, how the switch to these materials has and is happening; and why companies such as Geberit are embracing the technology to benefit projects, installers and the built environment. It is important now, more than ever, to recognise those technologies created to help with making building projects and the built environment the best it can be.

Antony Corbett MEng (Hons)

Product Manager, Geberit Supply Installation Systems

THE CHALLENGE OF MATERIALS SELECTION

It will come as no surprise to any consultant, building designer, specifier or contractor that appropriate materials selection is critical when designing a supply piping system.

Ensuring a safe, compliant and efficient water supply system, for example, starts with selecting the right products for the right project. It can support building efficiency, help meet applicable regulations, minimise running costs and deliver a better environment for the end user.

On top of this, the value of appropriate materials selection becomes even greater when you understand the risks and potential costs of inappropriate selection; from faulty fittings and pipe bursts, to corrosion and hygiene issues such as limescale build-up or Legionella risk.

Against the wider backdrop of budgetary squeezes and increased client demands, the two biggest costs on any development project are labour costs and remedial costs. Make the wrong choice up front, and it can add significant pressure to project costs.

With development costs still rising (the ONS's construction output price index for all work has increased by around 11% since 2015), it has never been more important to keep costs down where possible.

"THE DURABILITY OF A PLUMBING SYSTEM IS DEPENDENT ON THE QUALITY OF ITS COMPONENT PARTS AND THE ASSEMBLY SKILLS OF THOSE WHO INSTALL IT. NO PLUMBING SYSTEM, HOWEVER WELL DESIGNED, CAN BE EXPECTED TO OPERATE SAFELY OR HYGIENICALLY IF THE PRODUCTS OR MATERIALS USED ARE UNSATISFACTORY."

World Health Organisation, 'Health Aspects of Plumbing' - 2006



↑ FLEXIBLE PLASTIC PIPING INTRODUCED IN THE 1980s

With these challenges in mind, it is vital for anyone working in the design, supply and installation of piping systems to keep an open mind to new materials, products and ways of working. Supported by continued product development, many in the industry have done that to their advantage over many years.

Since the 1940s (and particularly since the 1969 ban on lead piping in UK properties), copper has been widely used due to its inherent stability and strength, together with its resistance to the effects of heat and pressure. In the 1980s and 1990s, flexible plastic piping came to the fore; an inexpensive alternative to metal pipework systems, offering advantages such as flexibility, ease of installation and resistance to freezing.

Both remain popular. **In 2007, 90% of new domestic properties were built using plastic piping for the hot and cold plumbing system**, although copper remains the most commonly specified material for all pipework, particularly in high-rise projects.



→ **There is a third and increasingly viable option for hot and cold potable water systems, which can also deliver benefits across a wide variety of other applications. Driven by key drivers such as cost, reliability and ease of installation, project teams are turning to multi-layer composite pipes – a strong, flexible and added-value option for building services across any project.**

British Plastics Federation Pipes Group

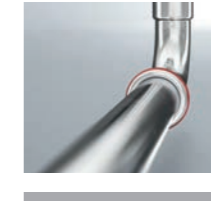
A BRIEF HISTORY OF PIPING MATERIALS



Lead piping



Copper piping



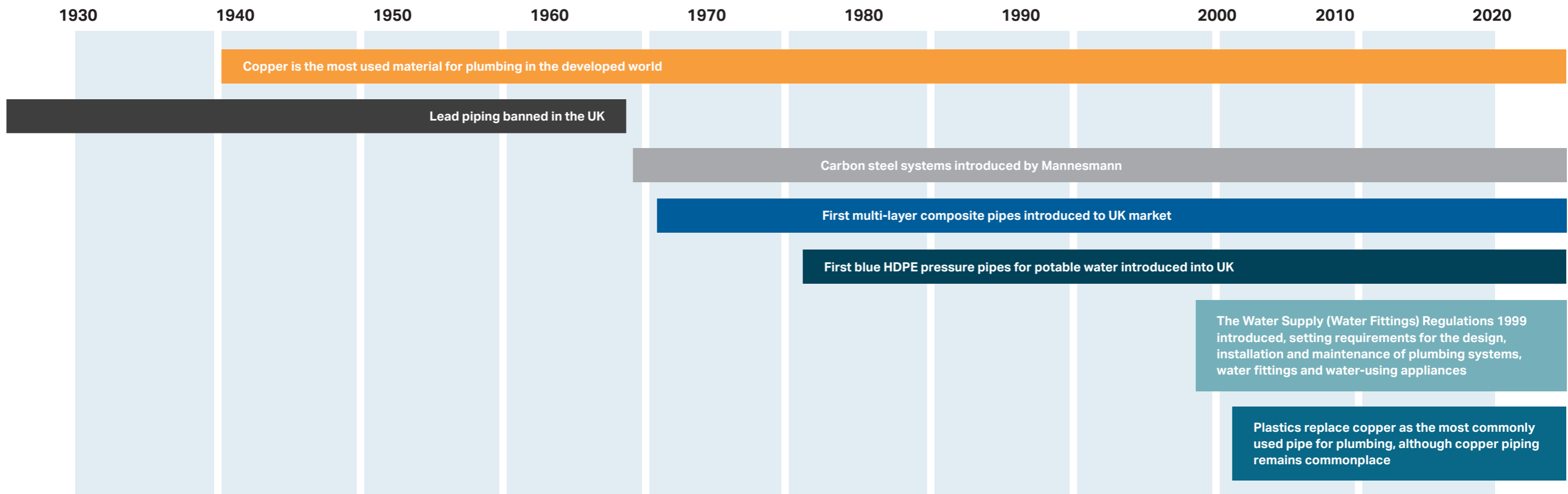
Carbon Steel systems



Multi-layer composite pipes



HDPE pressure pipes



“THESE DAYS WE DON'T JUST HAVE A STRAIGHTFORWARD DOMESTIC WATER SUPPLY, WE HAVE RECLAIMED SYSTEMS, GREYWATER, BLACKWATER, RAINWATER HARVESTING AND SOLAR. THERE ARE MORE AND MORE HIGH-RISE BUILDINGS... WE NEED TO BREATHE SOME SANITY INTO IT SO THAT PEOPLE UNDERSTAND WHAT THE ISSUES ARE AND WHAT THE PITFALLS ARE, TO MAKE SURE THE RIGHT SYSTEMS ARE BEING USED.”

Jonathan Gaunt
Jonathan Gaunt, Associate Director at Cundall and Chair of the Society of Public Health Engineers - speaking at a CIBSE Journal Round Table Event, September 2019.

SOURCES:
www.copper.org/applications/plumbing/water_service/why_copper.html
www.bpf.co.uk/plastipedia/plastics_history/default.aspx
www.plumbase-blog.co.uk/plumbing-with-copper-pipe/features/plumbing
www.south-staffs-water.co.uk/developer/regulations/water-supply-and-fittings-regulations
www.cibsejournal.com/technical/smooth-operator-multi-layer-composite-pipes

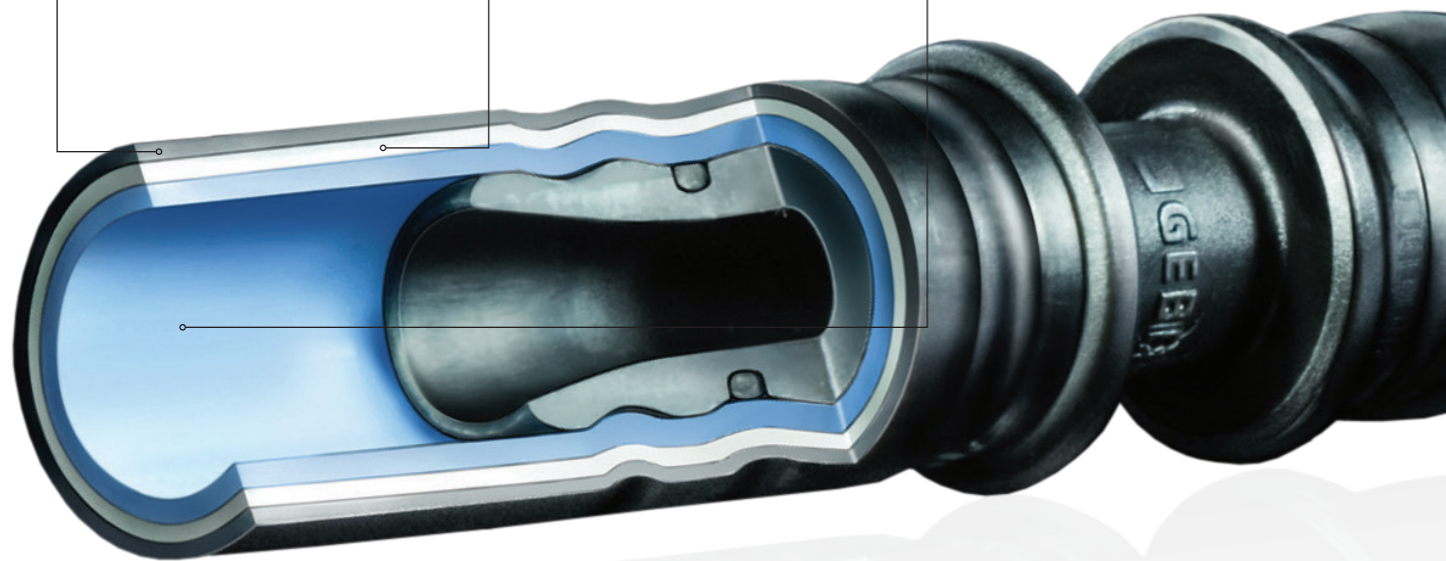
WHAT IS A MULTI-LAYER PIPE?

FLEXIBLE YET DURABLE, MULTI-LAYER PIPING SYSTEMS CONSIST OF THREE LAYERS:

An **outer plastic layer** usually made of polyethylene (PE-RT II) which protects against corrosion and mechanical damage. Non-reactive, fire retardant and flexible. Cross-linked polyethylene (PE-X) and high-density polyethylene (HDPE) can also be used.

A **central aluminium layer** which makes the pipe stable but also bendable. Typically up to 1.25mm thick depending on diameter.

An **inner plastic layer**, which is usually made from the same or similar material to the outside layer.



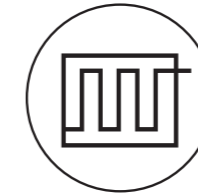
Since it was first introduced to the UK in the 1970s, this technology has often been reserved for industrial applications, including compressed air and process water. However, it is also proving increasingly popular as a single solution for all potable water and heating supplies on both domestic and light commercial projects.

THIS ALL-ROUND SUITABILITY IS JUST ONE OF THE THINGS THAT SETS MULTI-LAYER PIPING APART FROM OTHER MATERIALS.

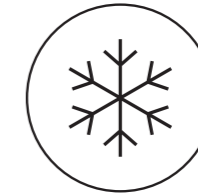
MULTI-LAYER PIPE IS SUITABLE FOR THE FOLLOWING APPLICATIONS:



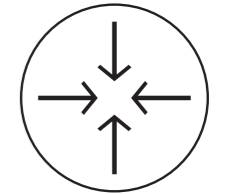
POTABLE WATER



HEATING SYSTEMS



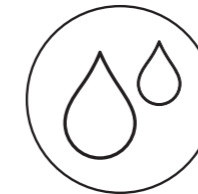
COOLING SYSTEMS (INC WITH ANTIFREEZE)



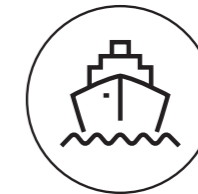
COMPRESSED AIR



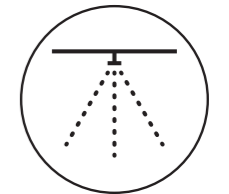
PROCESS WATER



RAINWATER



SEAWATER



EXTINGUISHING WATER



→ GEBERIT FLOWFIT

OVERCOMING SPECIFICATION CHALLENGES

The unique construction of multi-layer composite piping offers a single solution to help consultants, designers and contractors to overcome many of the challenges commonly associated with materials selection, particularly for water supply systems.

CORROSION RESISTANT

Suitable for cold water systems with no need for additional measures to prevent corrosion. The polyethylene inner layer is resistant to cracking, aging and general wear and tear, as well as being non-reactive and corrosion resistant.

HYGIENICALLY PERFECT

The low internal surface roughness (7 μm) means it is difficult for limescale and biofilm to adhere to the smooth surface, enhancing hygiene for potable water applications.

ACOUSTICS

A smoother bore (including fittings) can ensure water passing through the pipework produces less noise than in metal piping.

NO OXYGEN DIFFUSION

The thin aluminium layer prevents the diffusion of oxygen through the pipe wall, which can be the case with plastic pipes over a period of time. This prevents unnecessary damage and corrosion elsewhere in the system.

REDUCED THERMAL EXPANSION

The aluminium layer helps to maintain thermal expansion rate to about 10% of that of a solid PE-RT pipe, with five times less expansion than PE-X and eight times less than polybutylene pipes. **Thermal expansion coefficient = 0.026 mm/(m·K) (0.026 millimetres per metre for every degree increase in temperature)**, compared with 0.0165 per metre (steel) and 0.016 per metre (copper).

POOR HEAT CONDUCTOR

Multi-layer piping is a poor heat conductor, with thermal conductivity of 0.43 W/mK. **This means it loses around 800 times less heat than copper piping.**

SUSTAINABLE

Multi-layer pipe supports sustainable construction because it is **100% recyclable** (excluding systems comprising PE-X) and requires significantly less energy to fabricate, transport and install than comparative systems, according to calculations by the European Plastic Pipe and Fittings Association.

LOW INTRINSIC SCRAP VALUE

Reduces the risk of theft from site, which remains a key challenge throughout the supply chain.

BENEFITS OF MULTI-LAYER

There are direct benefits too. In addition to overcoming project and specification challenges, multi-layer piping offers a number of advantages for those throughout the supply chain. Here we highlight four of the most significant.

SIMPLICITY OF INSTALLATION

Multi-layer piping uses press-fitting, which means no need for hot works on site. The only tools needed to form a reliable, tight and durable connection are a cutter, deburrer and press tool, so joints can be easily made by any installer. In some newer systems, all that is needed is a cutter and press tool.

Press-fitting has been proven to take less time to install than traditional jointing methods, with no need to bring welding or soldering equipment on site too.

As well as a lower insurance premium, the absence of a working flame means less mess on site, fewer health and safety considerations and can minimise the risk of damage to existing fittings and fixtures and the surrounding areas. It also means no need for delays to allow for cool down and there is no need for additional insulation or fire stopping, as with plastic pipes.



"PLASTIC MIGHT BE CHEAPER, BUT BY THE TIME ALL THE EXTRAS, LIKE THE INCORPORATION OF ADDITIONAL INSULATION, FIRE STOPPING AND ACOUSTIC PROPERTIES ARE ADDED, IT WOULD BE INTERESTING TO SEE THE PRICE DIFFERENCE."

Jonathan Gaunt

Associate Director at Cundall and Chair of the Society of Public Health Engineers.
Speaking at a CIBSE Journal Round Table Event, September 2019.



FLEXIBILITY

Thanks to its ability to be easily shaped, multi-layer piping can be adjusted flexibly to the on-site conditions, even manipulated to follow the line of curved architectural features in modern buildings

Installers can bend 16mm and 20mm pipes effortlessly by hand, whilst larger diameters up to 50mm can also be bent without risk of de-lamination or kinking using an appropriate tool.

This can significantly reduce the number of fittings required and thus increase speed of installation, which, in many cases, results in a significantly lower overall project installation cost when compared with copper pipes.

"WE FOUND THAT THE SYSTEM WAS QUICK AND CLEAN TO INSTALL ON SITE, WHICH WAS VERY IMPORTANT FOR US. OUR FITTERS WERE ABLE TO BE TRAINED ON-SITE ON JOINTING THE PRODUCTS WITH THE SIMPLE PRESS-FITTING TOOLS IN JUST ONE HOUR."

Paul Williams

Mechanical Project Manager for NG Williams, the contractor responsible for the M&E services on a £32 million school renovation project at Whitmore High School in Harrow. Geberit Mepla multi-layer piping was specified for the LTHW and water services for the building as it enabled contractors to follow the curvature of the building design.

ENHANCED STRENGTH

Ultimately, multi-layer systems are about improving the strength and durability of the system when compared with plastic piping, without compromising on weight or portability as can be the case with copper.

The central-welded aluminium layer offers mechanical stability to ensure that the pipe remains in its required position yet remains flexible enough to bend. The aluminium layer also provides an oxygen barrier, making it suitable for use in central-heating systems and makes the pipe detectable by electronic devices after installation.



LEAK-PROOF

Multi-layer pipes are typically manufactured to ensure that pressing tools can only be used in the correct way. Jaw guides can be moulded as part of the fitting so that the tool is positioned correctly and does not slip out of place. Depth guides on the fitting also provide visible feedback to help ensure full insertion.

Pressing, when completed correctly, produces a robust connection that is both leakproof and mechanically sound. Fittings that have been left unpressed are typically designed to leak visibly when subjected to low pressure leak tests, so that any pressure test cannot be completed successfully until all the connections have been pressed.

INNOVATIVE MULTI-LAYER SUPPLY SYSTEM CHOSEN FOR DRINKING WATER

SAFE, HYGIENIC AND CONVENIENT

Four storeys, seven flats, seven bathrooms - comfortable, barrier-free living is the focus of a new apartment building in the Huckarde district of Dortmund. One thing was clear from the outset for Robert Wilbrand, managing director of Wilbrand Haustechnik GmbH and builder, planner and installer all in one: "If I ever build, it will be with Geberit products".

In order to be able to optimally master the conditions on site, the focus was on the new Geberit FlowFit supply system. This was the first time that the plumbing contractor had used this system. The demands on FlowFit were correspondingly high: fast installation even in confined spaces, no constant changing of the pressing jaws and hygienically safe working despite dust, dirt and poor visibility.

After construction of the new building was delayed in autumn 2019 due to very damp ground, the shell of the apartment building was finally completed in spring 2021 and Robert Wilbrand was able to start on the extension. As a long-standing user of Geberit solutions, he relied on Geberit products for all the bathrooms as well as for the supply and drainage pipes throughout the building.

USE OF PROVEN INSTALLATION ELEMENTS

Not only were Duofix frames and Sigma concealed cisterns selected for the bathrooms, the experienced planner and installer also chose Geberit Mapress stainless steel for the riser pipes, the basement and the heating system due to its extreme corrosion resistance.

INNOVATIVE SUPPLY SYSTEM FOR SERVICE LINES

Wilbrand opted for a completely new system for the drinking water supply pipes in the bathroom: Geberit FlowFit - a multi-layer press fit system that has been available on the German market since April 2021. "Expectations for new systems are always high, especially when they are supposed to be innovative," says the customer. He wanted to test for himself what Geberit FlowFit promised: easier installation, fast processing in confined spaces, no need to change pressing jaws, safe processing in conditions with poor visibility, and protection against dust and dirt in the pipe system.

GETTING READY TO USE FLOWFIT

In order to get to know the innovative supply system in practice and to be able to carry out the installation, the fitters from Wilbrand Haustechnik GmbH first watched the installation videos provided by Geberit. "It is great that we can access videos about the product via a QR code on the packaging. This gave us a first impression," explains Wilbrand. "On site, we also received a detailed introduction from our Geberit sales representative, who explained and demonstrated the installation of FlowFit in detail. Nothing was left to be desired," he adds.



GEBERIT FLOWFIT SIMPLIFIES WORKFLOWS

The new plumbing system brought many benefits to the installers on site. They only needed one press jaw to install the pipes in the bathroom. "There was no need to change tools for pipes up to 40 millimetres in diameter, so we were able to make rapid progress with the installation," says Wilbrand enthusiastically. Only two jaws are used to process Geberit FlowFit - one for d16 to d40 and another for d50 to d75. This is a time advantage over other pressing systems because it eliminates the need for frequent jaw changes.

Thanks to the innovative lateral pressing system, FlowFit no longer requires the pressing jaw to encircle the entire pipe, but only the pressing indicator. The fitting can be rotated into position as required and the press tool can be used conveniently from any side. "This enabled my staff to press in almost any position without any problems, even in the cramped conditions of the installation system, and to rotate the fittings in such a way that they could comfortably apply the pressing jaw," sums up the managing director of the Dortmund installation company.

This was also noticeable in the time taken for installation: "The installation of the supply system took less than one working day per bathroom. There were significantly fewer steps because, with FlowFit, the pipes no longer had to be deburred and calibrated. Overall, we were able to work faster than with other plumbing systems," says the customer.



SAFETY FIRST

Robert Wilbrand placed particularly high demands on the safety of FlowFit: "We are jointly responsible for the quality of the number one foodstuff, drinking water," he says, explaining the great responsibility he has as a builder, planner and installer. A hygienically flawless system that was easy to store on site and safe to use after installation was therefore a prerequisite for use in the new residential building. To prevent dust and dirt from entering the piping system, all Geberit FlowFit fittings and pipes are fitted with protective caps. The system and all accessories are also lead-free throughout.

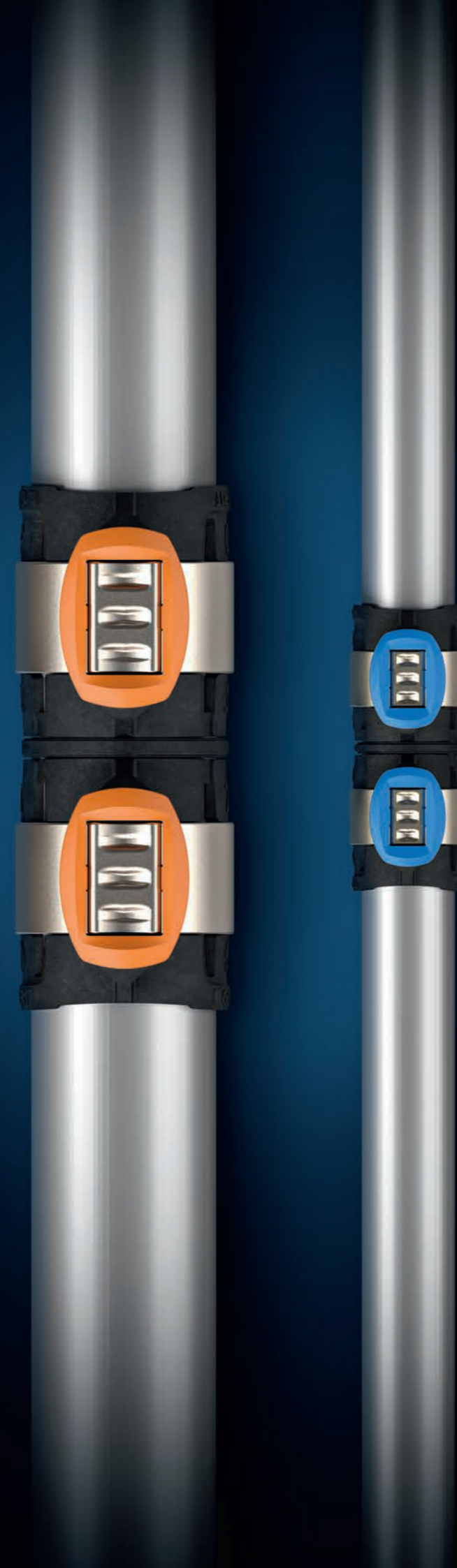
The building owner also makes no compromises when it comes to the tightness of the supply lines. The insertion depth of the pipes can be visually checked through a viewing window on the compression fittings. The pressing indicator only drops away when the pressing process has been successful and the pipe is leakproof: "I was convinced that the pressing indicator gives us a high degree of processing reliability," sums up the managing director of the Dortmund plumbing company. To avoid confusion when selecting the right pressing tool, the pressing jaw and indicator are colour-matched: d16 to d40 are blue, d50 to d75 are orange.

EFFICIENT, SAFE AND ECONOMICAL

Robert Wilbrand has been using Geberit systems for many years: "The quality, user-friendliness and longevity of the products play a decisive role for me - I rely not only on established systems, but also on new developments that simplify planning and installation. When I saw FlowFit for the first time, I was immediately impressed. It leaves nothing to be desired in terms of workflow, hygiene, hydraulics and, above all, safe installation," says Robert Wilbrand, summing up his positive experience: "Geberit has developed a system that is second to none in terms of efficiency and safety. I can recommend it to anyone."

KEY TAKEAWAYS

- Multi-layer composite piping systems offer a viable alternative to copper and plastic piping for water supply systems
- They can help the supply chain to address the typical challenges of materials selection, whilst offering tangible benefits for project teams and contractors
- Multi-layer piping is strong, flexible, easy to install and with added reliability - the perfect all-rounder, suitable for a wide range of applications
- It can help to increase the speed and reduce the cost of installation whilst reducing the risk of pipe failure or corrosion



Geberit Sales Ltd

Geberit House
Edgehill Drive
Warwick
CV34 6NH

T 01926 516 800

F 01926 400 101

In Eire +44 (0) 1926 516800

Literature 0800 007 5133

enquiries@geberit.co.uk

www.geberit.co.uk