GEBERIT

WHITE PAPER 2020

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

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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.

A BRIEF HISTORY OF PIPING MATERIALS

1930 1940 1950 1960 1970 1980 1990 2000 2010 2020

Copper is the most used material for plumbing in the developed world

Lead piping banned in the UK

Carbon steel systems introduced by Mannesmann

First multi-layer composite pipes introduced to UK market

First blue HDPE pressure pipes for potable water introduced into UK

The Water Supply (Water Fittings) Regulations 1999 introduced, setting requirements for the design, installation and maintenance of plumbing systems, water fittings and water-using appliances

Plastics replace copper as the most commonly used pipe for plumbing, although copper piping remains commonplace

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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.

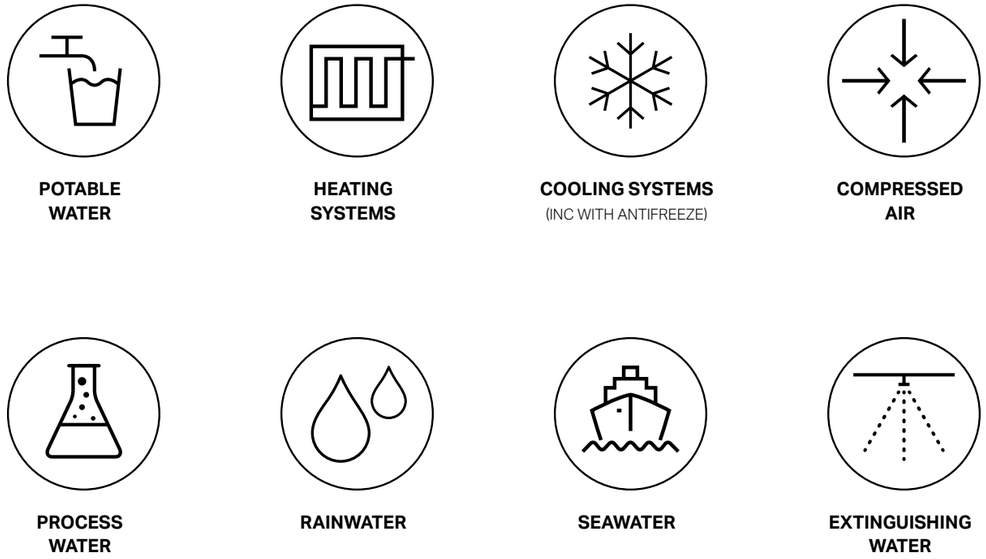
A **central aluminium layer** which makes the pipe stable yet bendable. Typically 0.2 – 0.7mm thick.

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 ground-breaking 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:



→ GEBERIT MEPLA

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 – similar to that of copper piping and significantly lower than steel piping) means it is more 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 0.9mm per metre (steel) and 1.4mm 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

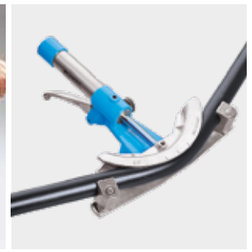
Multi-layer piping uses press-fitting, which means no need for hot works on site. The only tools needed to form a reliable, tight and durable connection are a cutter, deburrer and press tool, so joints can be easily made by any installer.

Press-fitting has been proven to take 30% less time to install than traditional jointing methods according to a BSRIA report, 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 (despite the fact that copper is typically 5-10% cheaper for the initial pipe cost).

"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.

MULTI-LAYER PIPEWORK IN PRACTICE

PROJECT OVERVIEW

Red Queen student accommodation in Coventry is a development of high quality, purpose-built accommodation serving students at the University of Warwick and being built by main contractor Torsion Group. Located on the A45, the development will consist of 210 bedrooms upon its completion in August 2020.

Mechanical contractor, Torsion Engineering Services Ltd, specified Geberit Mepla's multi-layered piping system for the building's supply of hot and cold water.

CONTRACTORS

Torsion Engineering Services Ltd
Green Frog Mechanical Services

CHOOSING GEBERIT MEPLA

In the first instance, Torsion Engineering Services Ltd was looking for a product that was reliable with proven durability. Also important was that it worked with a manufacturer that was able to provide strong support both throughout the project and after completion.

Another consideration for the Torsion Engineering team was the selection of material for the system. Situated on a busy main road, the risk of copper theft from the building was a very real risk and so the contractor was keen to look to alternative solutions when specifying the piping system - yet one that still offered the same stability as copper.

Opting for Geberit Mepla's multi-layered system meant that Torsion Engineering had a solution that brought together the strength of copper with the flexibility and corrosion resistance of plastic.

Bendable yet durable, multi-layer piping systems like Geberit Mepla consist of three layers: an outer plastic layer made of polyethylene (PE-RT of the second generation) which protects against corrosion and mechanical damage, a central aluminium layer which makes the pipe stable yet flexible, plus an inner layer, which is also made of PE-RT, for internal corrosion resistance.

The one advantage that multi-layer systems have over other systems is improved stability compared to purely plastic piping – but, importantly, without compromising on transportability or weight as is often the case with metals.

Meanwhile, the Torsion Engineering Services site team also had a dedicated member of the Geberit team to advise them during the installation process – something it was looking for from the outset as it had a requirement for expansion on the pipework and wanted to ensure that it had expert technical advice on hand throughout.

SPECIFYING THE SOLUTION

Mechanical Contracts Manager Leon Grant at Torsion Engineering Services explains why the engineering team opted for Geberit Mepla. "The support we received from Geberit has been very good from pre-construction right through to installation on site. We had a dedicated contact throughout who helped monitor the project, offering advice and guidance. This was particularly important given we had complexities around expansion of the pipework and was a huge factor in ensuring that the installation process went as quickly and smoothly as it did.

"We've had issues with copper theft in the past so were keen to find a solution that was not copper but still offered the same durability. Geberit Mepla combined this with flexibility and ease of transportation too so it really was the most obvious solution and the perfect system for a project like this."

Lee Place at Green Frog Mechanical Services worked on the installation of Mepla. He said: "We've used Mepla on many projects now. What I like about it is that installation is so fast and simple. It's also a very clean process, with minimal flushing and no hot works. The characteristics of the material and the press-fit system means that we can have complete peace of mind in the system."

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

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