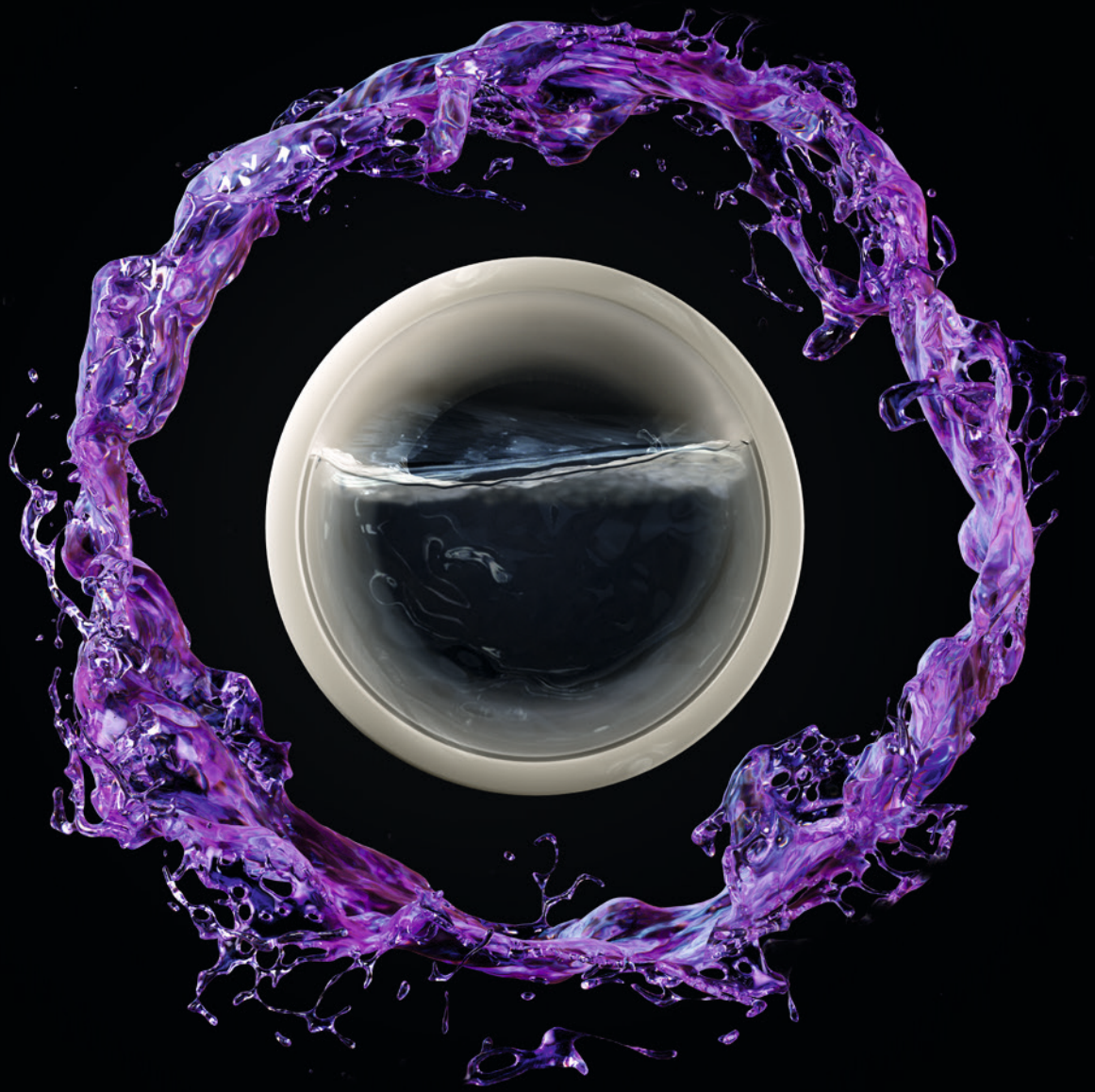
GF Piping Systems

+GF+

Beyond endurance

SYGEF ECTFE



Challenges with harsh chemicals

Extremely aggressive media under high pressure present manufacturers with special challenges.

When aggressive media such as concentrated sulfuric acid (H_2SO_4) or hydrogen peroxide (H_2O_2) is transported under high pressure and temperature conditions, lined steel piping is an often used solution.

PFA or PTFE inliners are used due to their chemical resistance and temperature range. But PFA or PTFE are characterized by a relatively low tensile strength and impact resistance, therefore steel is used as an outer layer to ensure machanical strength.

Lined steel pipes are not an entirely satisfying system solution due to their lengthy assembly times, high weight and exterior corrosion susceptibility.

Corrosion of steel outliners lowers the mechanical properties and can lead to stress cracks in the steel outliner as well as the PFA or PTFE inliners. To ensure the safety of lined steel pipes under harsh conditions frequent inspections, repairs and replacements are necessary.

Therefore, to provide the highest level of safety for people, the environment and the production process in a cost effective way GF Piping Systems' SYGEF ECTFE piping system is a more beneficial solution.

+ Corrosion leads to metal degradation and leakages

+ Contamination of the transported media and the environment

+ High frequency of inspections, repairs, and replacements

+ Heavy weight solutions due to high density of metals

+ **High chemical, pressure and temperature resistance**

+ **Safe and reliable**

+ **Low weight plastic solution**

+ **Economic and efficient operation**

Beyond reliability

The ECTFE system was established as a safe, reliable and cost reducing high-end solution for extremely aggressive media. SYGEF ECTFE is suitable for exceptionally demanding applications in the industrial sector and combines highest chemical, pressure and temperature resistance with economic and efficient operation.

With the SYGEF ECTFE system, GF Piping Systems has expanded its proven solutions with a complete system, which sets new standards for transporting particularly aggressive media such as highly concentrated sulfuric acid. The ECTFE product portfolio includes the complete range of pipes, fitting and innovative jointing technology. This gives users a suitable solution that complements the existing industrial portfolio of PP-, PVC- or PVDF-plastic piping systems.

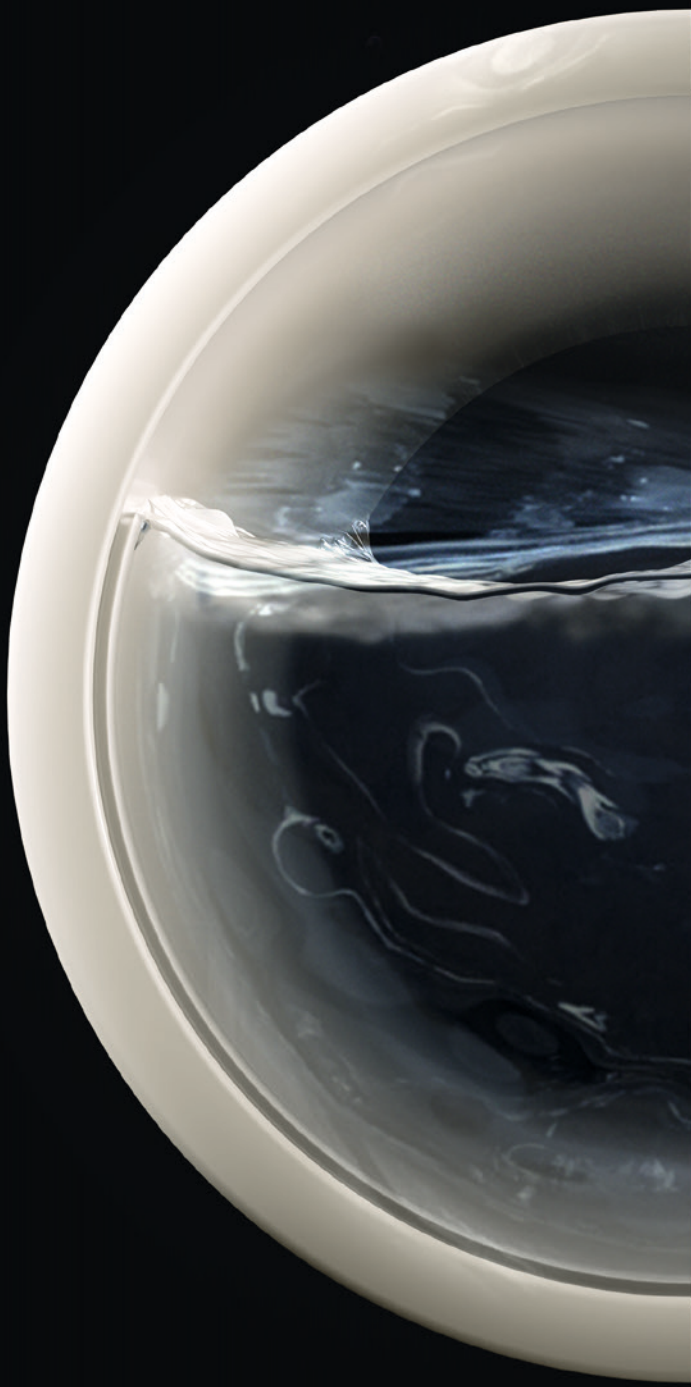
The ECTFE system from GF Piping Systems was designed specifically as a high-end solution for extreme conditions. The piping system has been proven to be extremely resistant and reliable for the transport of bases or highly concentrated acids. At the same time, users benefit from quick assembly, a long system service life, and lower initial costs than welded PFA systems. The combination with the latest IR welding technology from GF Piping Systems provides the highest level of safety for people, the environment and the production process. Similar to all SYGEF system solutions, the particularly robust ECTFE system is produced at the world's largest clean room plant for fluoropolymer products in Ettenheim, Germany. The fully controlled processes coupled with unique quality assurance warranties 100% traceability of each individual product.

The ECTFE fluoropolymer system benefits wherever other plastic piping system solutions reach their limits or metal pipes are chemically attacked. Alternative materials like PFA or PTFE can be quickly, reliably and cost-effectively substituted by ECTFE. Compared to PFA ECTFE enables higher pressure ranges and allows a streamlined and efficient installation design. The ECTFE system is about 50% more cost-effective than IR-welded PFA solutions.

SYGEF ECTFE

Beyond endurance

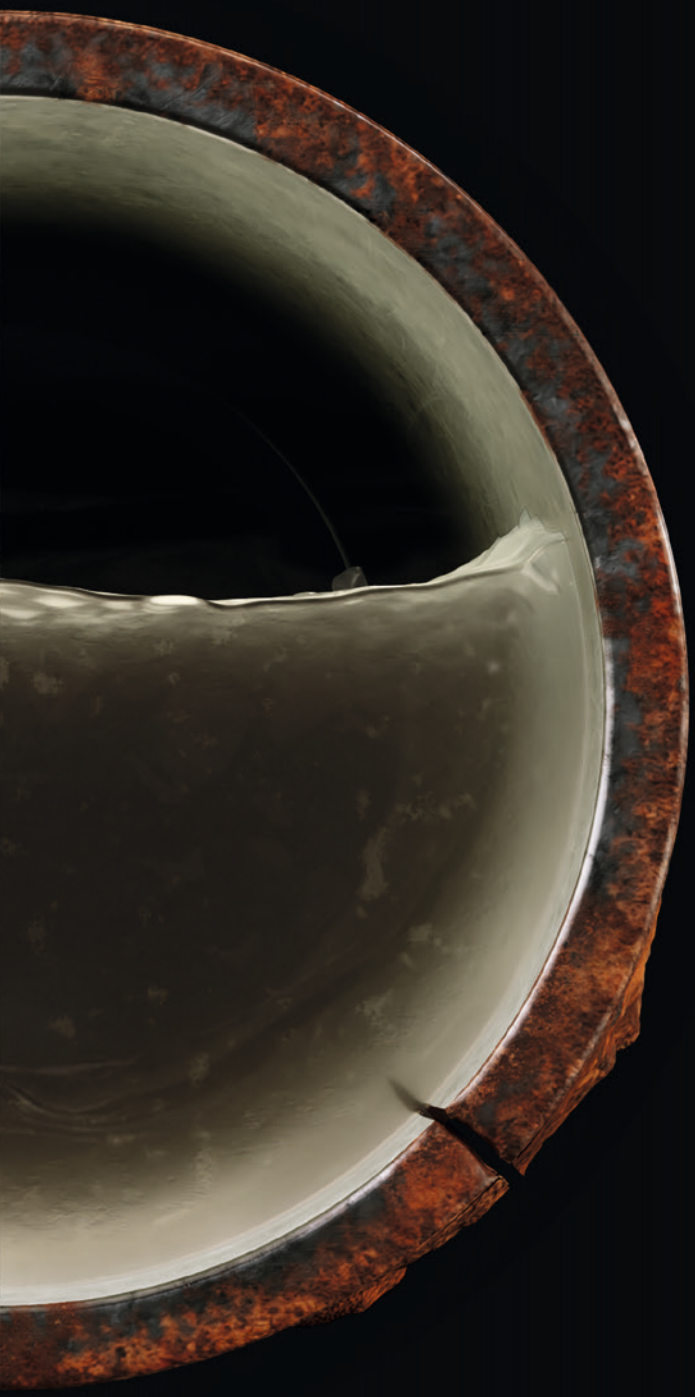
The SYGEF ECTFE piping system shows its advantages when it comes to manufacturing, transport and filling of concentrated chemicals under high temperature and pressure. This property makes ECTFE an ideal addition to the SYGEF fluoropolymer family. Due to faster assembly, lower initial costs and longer service life compared to alternative solutions, an economical transport of particularly aggressive media is achieved. The system is well suited for the chemical process industry, water treatment and microelectronics.



Safe and reliable
The ECTFE system enables safe handling of chemicals including those with a pH value below 2 and above 12. At the same time, the high-end system solution is absolutely reliable thanks to advanced IR welding technologies.

Long system lifetime
Aggressive media often considerably affect the service life of piping systems. Due to its extremely high chemical resistance, ECTFE reduces maintenance costs and eliminates process interruptions.

200% higher pressure range
Due to its excellent mechanical properties, ECFTE allows a 200% higher pressure range than PFA. This provides users with more efficient processes and higher safety standards.



20% more efficient pipe volume
Thanks to its high mechanical stability, the wall thickness of the ECTFE components has an optimal SDR and is 20% more efficient compared to PFA. Thereby the system enables higher flow rates with equal or less space requirements.

Low initial costs
Compared to the widely used PFA solutions, ECTFE is also characterized by significant cost savings and optimum permeation characteristics. The initial costs are 50 % lower than those of IR-welded PFA piping systems.

85% faster assembly
The ECTFE components are securely connected in a few minutes using most advanced IR-welding technology. Compared to pipes made of lined steel, installation time is significantly reduced.

Full solution provider

GF Piping Systems offers a complete portfolio including pipes, fittings and valves from d20 – d110mm.
All components are designed for industrial pressure piping applications with SDR21/ PN10 pressure rating.

All raw material grades used by GF are characterized by excellent behavior in fire tests.

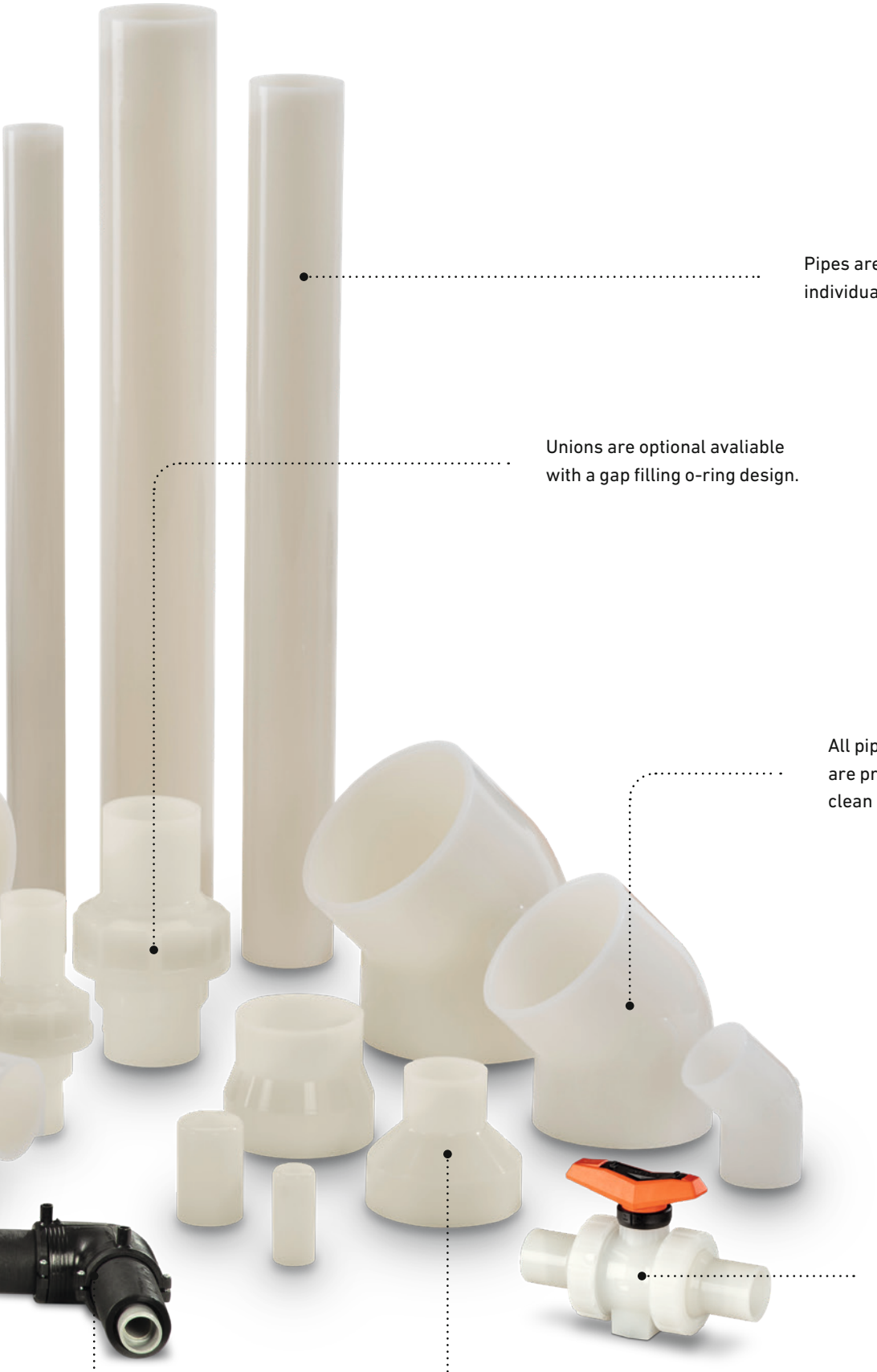
(UL 94 classification: V-0)

The components have been tested to reach the best fire classification that can be reached by thermoplastic polymers.

(EN ISO 13501-1 classification: B-S1, d0)

All components are eligable for IR-welding which guaranties 100% replicable weldings.

The U3000 Clamp-on ultrasonic flow meter ensures accurate and non-contact flow measurement.



Pipes are capped and individually packed in foil.

Unions are optional avaliable with a gap filling o-ring design.

All pipes and fittings are produced under clean room conditions.

PVDF Ball and Diaphragm Valves with ECTFE ends are extending the portfolio.

If required, GF offers a double containment solution with CONTAIN-IT Plus.

All fittings are individually packed in foils.

Ultra system performance

	SYGEF ECTFE
Material	ECTFE Halar
Color	opaque
Density	~1.68 g / cm^3
Thermal expansion coefficient	0.08 – 0.135 mm / mK (DIN 53752 / ASTM D696)
Thermal conductivity at 23°C	0.15 W / mK (ASTM C177)
Tensile stress at 23°C	≥ 30 N / mm^2 (EN ISO 527-1)
E-module at 23°C	≥ 1 600 N / mm^2 (EN ISO 527-1)
Charpy notched impact strength at 23°C	no breaking (EN ISO 179 / 1eA)
Dimensions	d20 – d110 acc. to ISO 10931
Temperature range raw material	–76 °C to 140 °C
Temperature range applied on chemicals	–20 °C to +80 °C
Surface properties	Inner surface Ra < 0.5 µm (20 µin) for injection moulded and extruded components
Internal stress	Pipes: ≤ 2.5 N / mm^2; stress relieved by thermal annealing during manufacturing
Packaging	Pipes are capped and individually packed in foil like the fittings
Marking and labeling	During production, all components are embossed with a permanent identification to ensure full traceability: - Brand name - Lot number - Material - Product description - Dimensions - Article number - Pressure rating - Standards
	Colored labels for differentiation between SYGEF ECTFE and SYGEF Standard PVDF

Safe and reliable

From the characteristics of the raw material to the quality control of the finished part: GF Piping Systems ensures that the warranted properties are met thanks to its unique laboratory expertise.

GF Piping Systems examines the material, jointing technology, and products beyond mandatory standards in detail at its accredited laboratory (OSO/IEC 17025) in Schaffhausen (Switzerland). The guaranteed characteristics of the applied ECTFE raw materials are tested by GF Piping Systems. Despite decades of collaboration with material suppliers, GF Piping Systems strictly adheres to the principle of "trust and verify." SYGEF ECTFE has been and is continuously tested under temperature, also with chemicals, under long-term conditions. So you can be assured that information from our chemical experts is based on decades of experience and various tests. Your medium is tested by GF Piping Systems under application conditions on real components. Additional details are also provided by the microscopic inspection of the parts morphology and the IR-joints. Besides important insights regarding production process and correct fusion parameters, the effect of test and application conditions is also carefully inspected. Has the product been chemically attacked? Extremely experienced staff members examine the samples and products not only visually but also using infrared microscopy.

Chemical resistance

Chemical resistance at 20 °C Detailed evaluation is depending on concentration. Contact ChemRes			Thermoplastics semi-crystalline		amorphous		Steel		
Media group	**Medium**	**Concentration**	**ECTFE**	**PVDF**	**PVC-U**	**PVC-C**	**SS 1.4301 / 304**	**SS 1.4401 / 316**	**Hastelloy C 276**
Acids	**Inorganic oxidizing acids**								
	Nitric acid	> 50 %	+	+	o	o	+	+	+
	Chromic acid	> 30 %	+	+	o	o	+	+	+
	Sulfuric acid	≥ 96 - 98 %	+	o	+	-	o	o	+
	Inorganic non-oxidizing acids								
	Hydrochloric acid	</= 37 %	+	+	+	+	-	-	o
	Hydrofluoric acid	> 40 %	+	+	-	-	-	-	o
	Organic acids								
	Formic acid	> 85 %	+	+	o	-	o	+	+
	Acetic acid	> 85 %	+	+	o	-	o	+	+
Bases	**Inorganic** (caustic soda lye)	</= 50 %	+	-	+	o	+	+	+
Halogens	**Chlorine, bromine, iodine, (no fluorine)**		o	o	o	o	-	-	o
Fuels / oils	**Aliphatic hydrocarbons**		+	+	o	o	+	+	+
	Aromatic hydrocarbons		+	+	-	-	+	+	+
Oxidizing agent	**Hypochlorite, hydrogen peroxide, ...**		+	-	+	o	o	o	+

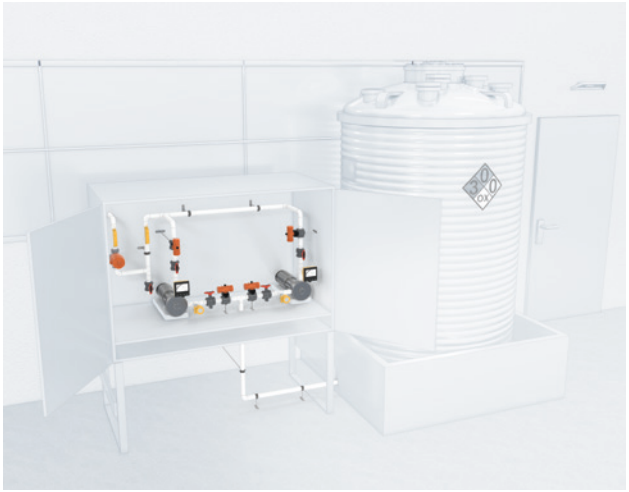
\+ resistant
o conditionally resistant, please consult gss@georgfischer.com
\- not resistant

* Please note: The above list is only intended as a guideline and does not replace an in-depth review of material suitability for the particular application. The information is based on our experience and is state of the art. This data consists only of general indicators. In practice, however, other factors such as concentration, pressure and jointing technology must also be taken into consideration. The technical data is not binding and does not constitute expressly warranted characteristics of the goods. Please contact gss@georgfischer.com for help with selecting the right materials.

Our teams of experts have decades of experience in the chemical resistance of materials. The online tool ChemRes PLUS provides you with the most important basic information. The ChemRes PLUS Online Tool from GF Piping Systems summarizes a large amount of data about materials and media and presents it visually. Choose among all materials and solvent cements of the GF Piping Systems product portfolio and compare them to get a comprehensive overview.

Scan the QR code to visit our chemical resistance online tool.

Ensuring maximum safety under extreme conditions



Dosing sodium hypochlorite

The ECTFE range can also be used effectively for drinking water treatment. In the application example, SYGEF ECTFE is used for a dosing system in water treatment. A sodium hypochlorite solution is dosed into water for disinfection and preparation for drinking water use.

Storage of acid

The transport of aggressive media in particular, such as highly concentrated sulfuric acid, requires an exceptionally reliable piping system to ensure safe handling at all times. The ECTFE assortment is used to fill the tank and subsequently transport such medias. In this case, one of the tanks contains 98% sulfuric acid, a very corrosive liquid.

Your benefits

- Extreme corrosion resistance and reliability when handling aggressive chemicals
- Great permeation and temperature resistance
- Low initial and maintenance costs
- Long system service life
- Low stress installation due to low stress components (pipes and fittings)
- Safe and 100% traceable installation due to the IR welding technology

Customer reference: Merck & Cie

Long-lasting and reliable plastic piping systems for hazardous chemicals

Merck & Cie. is a subsidiary of the German group Merck KGaA and specializes in the Healthcare and Life Science sectors. With several facilities across Switzerland, the company produces high-quality products for the global market. In the field of wastewater treatment, plastic piping systems are used to safely and reliably transport hazardous media. Here, Merck relies on the SYGEF ECTFE system by GF Piping Systems.

Customer benefits

- ECTFE is an exceptionally resistant material for the transport of highly aggressive chemicals and is suitable for high process pressures and temperatures.
- The space-saving components have been designed andtested for especially challenging applications and are particularly suited for tight spaces.
- System components and jointing technology from a single source not only guarantee the best possible welding quality, but also maximum safety.

Scan the QR code to read the full article.

The pioneer in IR fusion

GF Piping systems has been the pioneer and leader for innovative infrared fusion technology since 1992. We have been working closely together with our customers focussing on their real-life needs. As a result we developed the automated IR-A family, which covers the dimension range from d20 up to d400mm and is the completion of the IR-Plus line-up.

The optimized heating process

Non-contact heating (IR) shortens the heating time by more than 50% compared to conventional butt fusion. The entire equalization process is no longer necessary which solves the problem of varying bead formations. The tendency for melted material to stick to the heating element (especially PVDF) is eliminated.

Advantages of IR fusion:

- Short welding time
- Minimal defined bead
- High reproducibility
- High reliability
- Less thermo-stress
- Best for high purity applications

The Weld-Bead Inspection (WBI) Tool

Built to provide peace of mind for piping systems in the microelectronics sector, the Weld-Bead Inspection Tool from GF Piping Systems assesses the quality of infrared-weld beads more reliably than ever.

When an infrared butt fusion process is used to join plastic piping components together, a weld (or fusion) bead is produced. In the past, experienced welders or quality control managers assess the quality of the bead with the naked eye to see whether it is perfectly fused and as uniform as possible. But there are fewer and fewer qualified workers with this expertise, so why take the risk?

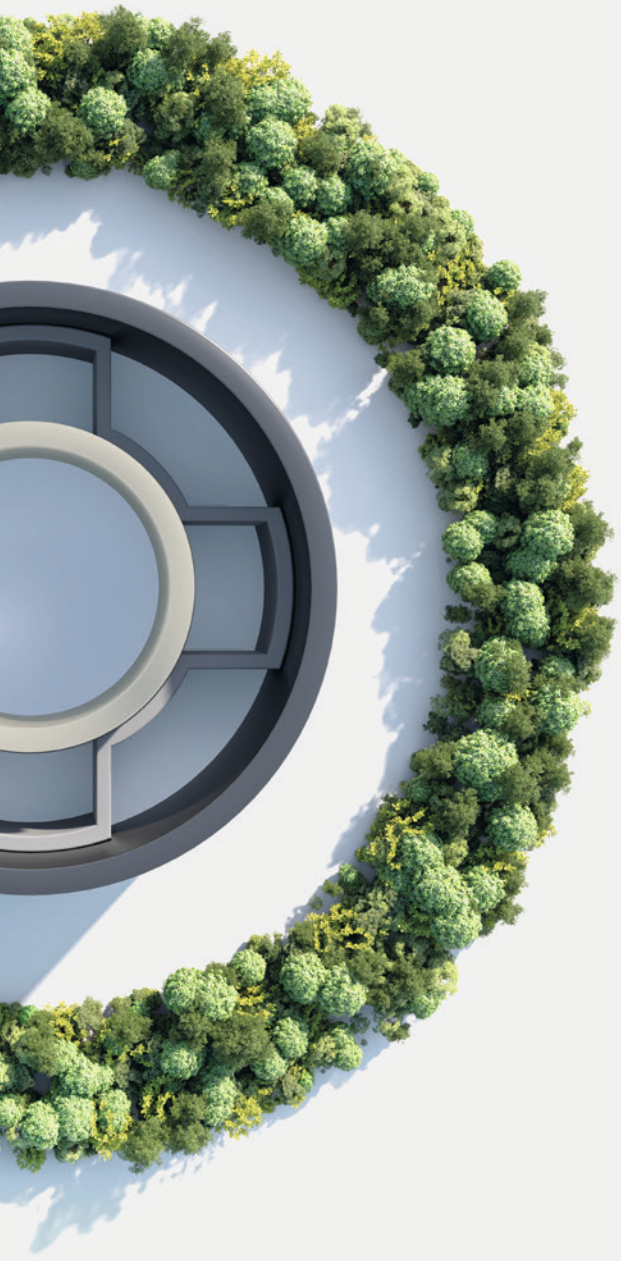
Better to be objective

As small as a computer mouse and packed with state-of-the-art photo-sensory technology: welds for highly demanding applications can now be digitally inspected to ensure potential weaknesses are highlighted objectively, ensuring the risks of leaks resulting in millions of dollars worth of damage are reduced. There has never been a tool like it before that can assess a weld bead and provide a seal of approval as quickly and objectively.

WBI-L assessing the strength of a weld

CONTAIN-IT Plus

Protect and preserve



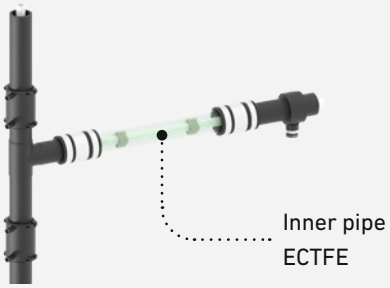
Scan the QR code to know more.

CONTAIN-IT Plus is the ideal solution for the safe transport of hazardous media. When used with SYGEF ECTFE it combines the excellent chemical resistance of ECTFE as an inner pipe with a containment pipe's additional safety. The systems include many features that yield benefits for the plant owner, planner, and installer.

Environmental protection is becoming increasingly important for governments and companies worldwide to ensure good water conditions and sustainable business success. Countries worldwide have defined laws and directives to protect and preserve our water quality, like the Water Framework Directive (2000/60/EC) in the EU and the 40 CFR 280 Requirements in the USA.

All Member States must incorporate these directives into national law and define concrete measures. Nations such as Germany (WHG §62, AwSV §17), the Netherlands (NRB, BRL-K903/08, PGS-31) and the USA (40 CFR 280) have defined double containment systems as a standard for the safe transport of hazardous media.

Outside pipes/fittings	Details
Material	Containment pipe: PE100 & PVC-U (transparent)
Pressure rating	Containment piping system: PE100: PN10/PN16 PVC-U transparent: PN1 Valves: PN6
Operational temperature	-50 °C to +140 °C (depending on inner pipe)
Jointing technology	Containment pipe connection: Electrofusion (PE), EPDM-Coupler (PVC-U)



Together as one

Process automation

We offer a true partnership with a unified vision toward active water conservation. Our solutions for automated flow processes ease the way toward autonomous vessels.

One user experience across the whole control loop

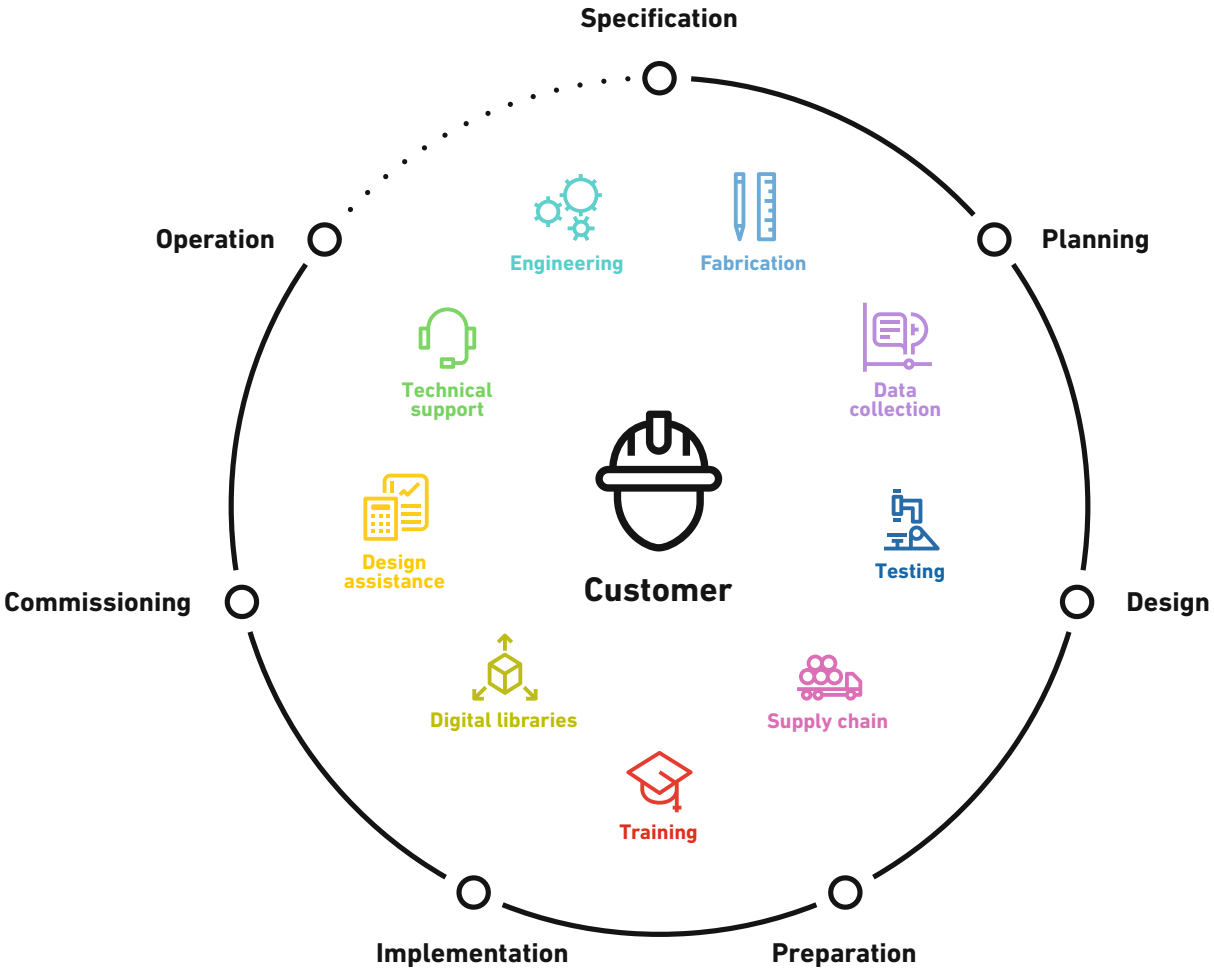
GF Piping Systems is your experienced partner with a full portfolio of measurement, control, and actuation components, which are easy to install and use and have local support through all project phases. We offer the full package with our products and solutions, providing top-quality installation, a highly skilled team of experts standing by our customers' side every step of the way worldwide, and digitalized services ensuring a project is at the forefront of the market.

More information at
www.gfps.com/processautomation

The U3000 Clamp-on ultrasonic flow meter ensures accurate and non-contact flow measurement.

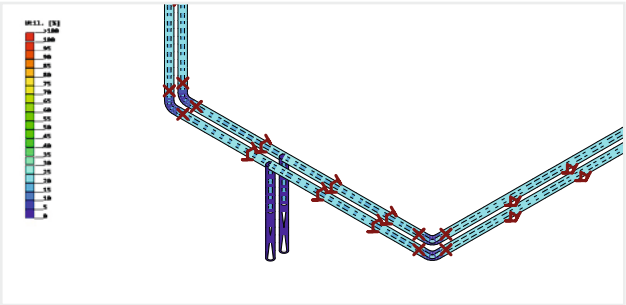
Ready when you are

With Specialized Solutions, the global leader GF Piping Systems provides project support every step of the way to achieve construction excellence. Allowing owners and planners to concentrate on their daily business without interruption.



Pipe stress calculations
To evaluate a piping installation regarding dead load, thermal expansion and additional loads the following evaluations and calculations are offered by GFs Advanced Engineering:

- Flexibility of the pipe system geometry
- Stresses in pipes and fittings
- Pipe displacement
- Pipe deformations
- Loads on components
- Loads on supports



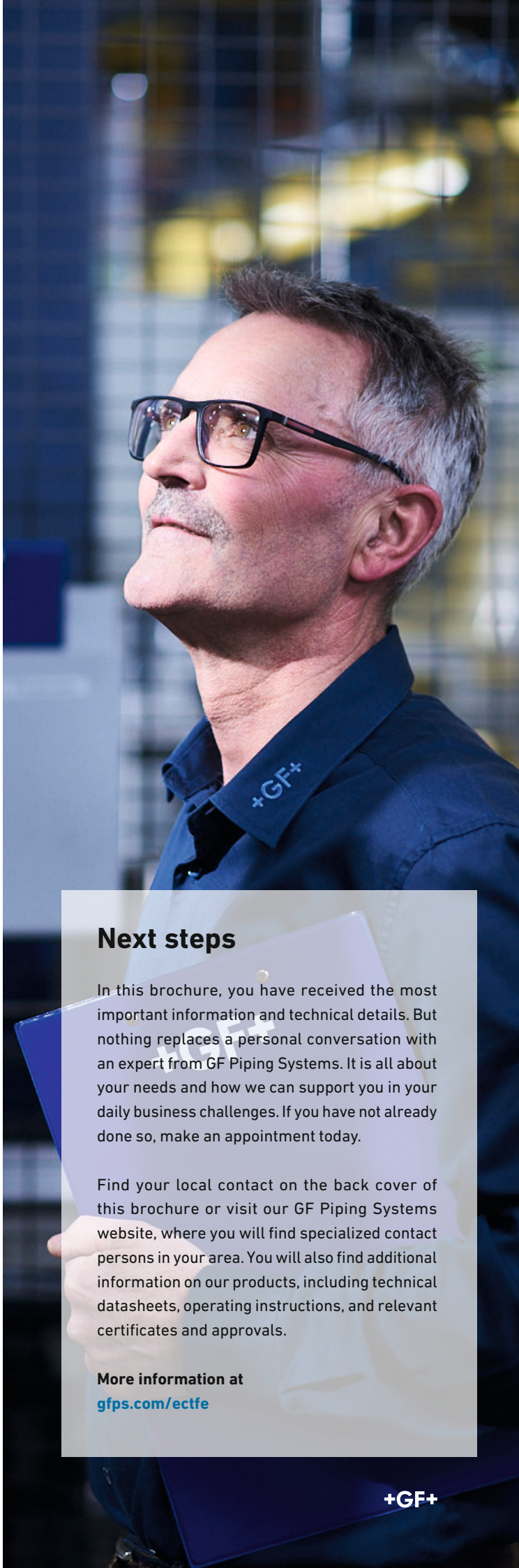
Ultra precise design
Optimize planning and execution phases and avoid failures due to improper design and pipe support.

Ultra training support
Increase quality and safety throughout every phase of your project with industry-leading training programs.

Ultra fast response
Reduce project and operation lead times through off-site prefabrication and advanced stock management.

Ultrasonic analysis
The integrity of a piping system is essential for the semiconductor industry. Our weld-bead inspection tools and ultrasonic NDT (Non-Destructive Testing) provides testing options at the point of installation, while Pipe Condition Assessment can be employed during operation to acquire real data about the state of piping systems.

More information at
gfps.com/specialized-solutions



Next steps

In this brochure, you have received the most important information and technical details. But nothing replaces a personal conversation with an expert from GF Piping Systems. It is all about your needs and how we can support you in your daily business challenges. If you have not already done so, make an appointment today.

Find your local contact on the back cover of this brochure or visit our GF Piping Systems website, where you will find specialized contact persons in your area. You will also find additional information on our products, including technical datasheets, operating instructions, and relevant certificates and approvals.

More information at
gfps.com/ectfe

GF Piping Systems

Local support around the world

Visit our webpage to get in touch with your local specialist:
www.gfps.com/our-locations

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