GF Piping Systems

SYGEF

Premier Quality with Outstanding Performance

Polyvinylidene fluoride welded system
for industrial applications

The System for Highly Demanding Applications

Superior purity, outstanding chemical and temperature resistance

We are dedicated to designing, manufacturing and marketing piping systems for the safe and secure treatment or conveyance of different qualities of water, liquids and chemicals. Customers rely on our 40+ years experience in Fluoropolymers, our state-of-the-art production technology and our global presence with a worldwide service and training offering. In close collaboration with end-customers and based on their high requirements, GF Piping Systems introduced the SYGEF family – specified PVDF system based on certified raw material. SYGEF is the optimal choice for highly demanding applications on the industrial field.

+ Individuality – From the planning stage to installation

SYGEF Standard (PVDF)

The single-bagged and reliable transport solution for chemical and water applications – even at high temperatures. Defined manufacturing conditions and a high performance raw material ensure the suitability for harsh environments as encountered in disinfection and chemical transport.

SYGEF Plus (PVDF HP)

The double-bagged, high purity (HP) piping system offers additional opportunities for highly demanding applications like conveying hot ultrapure water (HUPW) for microelectronic industries. By manufacturing, cleaning and packing under cleanroom conditions up to ISO class 5 (100), SYGEF Plus achieves an excellent surface finish, superior leach out characteristics and stringent particle control combined with high reliability and product lifetime.

Pipes

Fittings

Valves

Quality control and assurance

SYGEF systems warrant 100 % traceability through our computer aided quality production, packaging and labeling from raw material to the end product.

Temperature and chemical resistance

SYGEF systems are reliable for difficult applications with high temperatures and aggressive chemicals. Through our service team we offer individual support to match your material requirements.

+ Main benefits

Complete system range

- One-stop-shopping
- Including pipes, fittings, valves and automation
- Proven jointing technologies
- Worldwide service: customizing, machine rental pool, training and sales support
- System lifetime warranty*

Total plastic solution

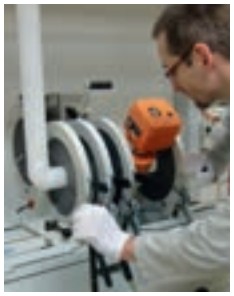
- Outstanding temperature range
- Excellent chemical resistance and purity
- Extremely smooth surface finish
- Rouging- and corrosion-free
- Excellent abrasion resistance
- UV and weather resistant
- No electric conductivity
- Low thermal conductivity

High purity application

- Virgin raw materials
- No additives, stabilizers or pigments
- Outstanding leach-out values
- Fully controlled clean room production
- 100 % traceability and audited by an independent external company

Automation

Jointing technology



Customizing and training

Technical support

For any successful installation a good technical support is the key factor. A team of experts is available for individual assistance all around the world.

Customizing

The focus of our worldwide located customizing teams is manufacturing custom parts for special systems. Standardized processes guarantee the highest level of quality.

Technical documentation

Our extensive expertise of more than 50 years is fully documented in detail in our technical manuals, planning fundamentals and application guides.

Training courses and on-site training

We offer a wide range of training courses that provide participants an excellent opportunity to gain confidence in working with our products and proven jointing technologies.

Online and mobile calculation tools

Our numerous online and mobile calculation tools in many different languages support our customers in configuring and commissioning automation products.

CAD library

The extensive CAD library is the most frequently used planning tool. Our online database comprises over 30 000 drawings as well as technical data for our customers. Many formats are available.

* Detailed information regarding the warranty can be found under: www.gfps.com – Planning Fundamentals

Completely controlled process

The SYGEF High Purity Chain

1 Raw material

SYGEF starts the journey with the highest available quality raw materials. Our suppliers provide analytical proof of compliance with the highest specifications for every shipment. Once the raw materials enter our plant, GF performs extensive incoming goods inspection. This assures that only raw materials fulfilling the strict requirements are released for production.

2 Manufacturing

Manufacturing of the SYGEF Plus products is done in a clean room class 7 (10 000) or better using completely controlled processes. During the complete production process the inner surface area of the pipes, fittings and valves are in contact with air up to class 5 (100).

3 Quality control

A very detailed and unique QS-system has been implemented to ensure the highest level of quality. It is directly linked to the manufacturing of the complete SYGEF range and includes a 100 % inspection of every product to ensure maximum performance including visual inspection, valve packaging and valve seat-tests.

The high purity chain is made up of six links. Each one plays its important role

Manufacturing a product that achieves the lowest possible levels of particle contamination, TOC, anionic and cationic contamination, ultimate surface finish is the result of the relevant links. But it does not stop here. When the product leaves our state-of-the-art warehouse it is delivered to you in protective packaging.

Finally the installation is supported by the most advanced and established welding technology in existence. This technology combined with years of installation training experience make the most of the product when it is installed.

4 Cleaning & packing

Highest purity through consistent cleaning of all SYGEF Plus products is achieved in clean rooms up to class 5 (100), using 18MΩ pure water and special cleaning devices. All products are packaged under selected and strictly monitored process conditions to avoid contamination. Pipes are capped and all SYGEF Plus components are double bagged with a high quality, certified clean bagging material.

5 Logistics

SYGEF products are stored in a separate warehouse for pipes, fittings and valves with distribution centers located worldwide. To avoid damage of SYGEF pipes GF has designed special wooden boxes for storage and transportation. This ensures that the highest possible quality and safety during transportation to the customer is ensured.

6 Installation & services

With broad selection of system specific state-of-the-art welding equipment GF is offering proprietary IR welding technology up to d450mm. Enhanced by industry leading weld bead inspection the highest quality and most reliable system is ensured. Project support including design, installation training and worldwide located service centers completing the high purity chain.

High tech factory Ettenheim / Germany

SYGEF Cleanroom Production

All SYGEF components are manufactured in the world's largest cleanroom factory for fluoropolymer products in Ettenheim

GF Piping Systems played a major role in establishing the relevant standards SEMI F40, F48 and F57 for polymer component testing. Due to long experience and continuous improvements SYGEF Plus pipes, fittings and valves are exceeding these requirements to increase our customers' yield. SYGEF Plus products are strictly fulfilling the strong requirements of the ITRS* roadmap in order to be prepared for upcoming, even more demanding processes in the future.

Fully controlled environment

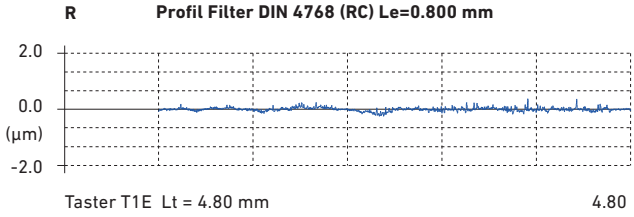
The SYGEF production area includes 5 600m² cleanroom: 4 000m² class 7 (10 000), 1 000m² class 6 (1 000) and 600m² class 5 (100) in operation. All cleanrooms are continuously monitored and audited internally and by external companies. The microbiological and specified particle measurements are fully documented with a unique quality assurance (QA) system.

Ultrapure water plant

Cleaning and rinsing of components with water of impeccable quality assures a constantly high level of cleanliness. SYGEF Plus products are subject to regular leach-out controls. Elementary system impurities like metals, anions and TOC** are constantly monitored to exceed SEMI F57 requirements to warrant the highest possible system performance in use.

Surface quality

Smooth surfaces are achieved due to special equipment design, proper tooling material's selection, mirror finish surface of inner cores and preventive maintenance schedule. Thereby for all SYGEF Plus products the inner surface roughness according SEMI F57 is surpassed.



Inner surface roughness measured at a SYGEF Plus T90° equal d250 SDR33 / PN10

Process expertise

Operating staff has in-depth process knowledge and over 40 years of experience in manufacturing products under strictly controlled cleanroom conditions. With regular internal trainings we ensure that our production team keeps always the highest performance and has the latest insights. All the injection molding machines and extrusion lines are developed by using the latest innovations and technologies.

Quality Assurance

The safe delivery to jobsite and traceability of the finished product back to the raw material batch are ensured through completely controlled processes. All relevant data are archived in an internal QA database and electronically available for statistical researches.

Safe and reliable system

Quality control is an integral part in every step of the high purity chain. Therefore each SYGEF Plus component is 100 % visually inspected, including overall cleanliness, surface appearance and imperfections in accordance to internal specifications.

All mechanical testing takes place in matchless Swiss federally accredited lab facility and external certificated labs. Together with unsurpassed installation equipment GF Piping Systems is superior regarding ovality, internal stress level and warpage. These key factors are able to influence the weld strength which leads to a longer system lifetime and a higher safety.

* ITRS: International Technology Roadmap for Semiconductors

** TOC: Total Organic Carbon

+GF+

More Than a System

With a constant focus on maximum reliability and safety the SYGEF system assures a sustained high level of product quality and outstanding performance for high-end applications. By using certified and completely controlled manufacturing processes the SYGEF products are manufactured according to all relevant specifications and these procedures are regularly audited and evaluated to achieve continuous improvement. Our customers can be assured that their needs are met or exceeded and that the products comply with all necessary standards.

SYGEF Standard and SYGEF Plus system range

Products	SDR	PN	d 16	20	25	32	40	50	63	75	90	110	125	140	160	200	225	250	280	315	355	400	450
			DN 10	15	20	25	32	40	50	65	80	100	100	125	150	200	200	250	250	300	350	400	450
Pipes	21	16																					
	33	10																					
Socket fusion fittings		16																					
Butt fusion fittings (IR and BCF compatible)	21	16																					
	33	10																					
Ball valves		16																					
		10																					
Diaphragm valves		16	upon request																				
		10																					
Butterfly valves		10																					
Check valves		16																					
		10																					
Pressure regulating valves		10																					
Ventilating- and bleed valves		16																					
Automation																							
Flanges																							
Flange seal																							
Pipe clips																							
IR fusion machine																							
BCF fusion machine																							
Butt fusion machine*																							
Socket fusion machine																							

SYGEF Standard SYGEF Plus

* Technically possible but not recommended for SYGEF Standard

System specifications

Standards:

	SYGEF Standard	SYGEF Plus
Material	PVDF	virgin High Purity PVDF (PVDF-HP)
Color	opaque	opaque
Density	~1.78 g / cm³ (EN ISO 1183)	~1.78 g / cm³ (EN ISO 1183)
Thermal expansion coefficient	0.12–0.18 mm / m K (DIN 53752)	0.12–0.18 mm / m K (DIN 53752)
Thermal conductivity at 23 °C	0.19 W / m K (EN 12664)	0.19 W / m K (EN 12664)
Yield stress at 23 °C	≥ 50 N / mm² (EN ISO 527)	≥ 50 N / mm² (EN ISO 527)
Tensile E-modul at 23 °C	≥ 1 700 N / mm² (EN ISO 527/ASTM D790)	≥ 1 700 N / mm² (ISO 527/ASTM D790)
Charpy notched impact strength at 23 °C	≥ 8 kJ / m² (EN ISO 179)	≥ 8 kJ / m² (EN ISO 179)
Dimensions	d16–d315 in accordance to ISO 10931	d20–d450 in accordance to ISO 10931
Temperature rating	from -20 °C to 140 °C (-4 °F to 284 °F)	
Production	- Pipes: extruded - Fittings: injection moulded / machined - Valves: injection moulded (additional oil free treated and paint compatible / silicon free)	- Pipes: extruded - Fittings / Valves: injection moulded / machined - Produced under clean room class 7 (10 000) conditions. Subsequent assembling, quality inspection and cleaning is carried out using 18 MΩ pure water under clean room class 5-6 (100 -1 000) conditions
Surface finish Compliant to Semi F57	Inner surface Ra < 0.5 µm (20µin) for injection moulded and extruded components	Inner surface (PN10/ SDR33): d ≤ 225 Ra ≤ 0.2 µm (8µin) d = 250 Ra ≤ 0.3 µm (12µin) d280–315 Ra ≤ 0.4 µm (16µin) d355–450 Ra ≤ 0.65 µm (26µin) for injection moulded and extruded components
Internal stress	Pipes: ≤ 2.5 N / mm²; stress relieved by thermal annealing during manufacturing	
Material and product approvals	DIBt FM-4910 listed cleanroom material FDA CFR 21 177.2510 USP 25 class VI (physiological non-toxic) ASME BPE	SEMI F57 FM-4910 listed cleanroom material DIBt FDA CFR 21 177.2510 USP 25 class VI (physiological non-toxic) ASME BPE
Packing	Pipes capped and multiple components single bagged in a specified bag	Pipes capped and each component double bagged in a specific inner bag and outer bag under clean room Class 6 (1 000) conditions
Marking and labeling	All components are embossed with a permanent identification during the production process to ensure full traceability: - Brand name - Material - Dimensions - Pressure rating - Lot No. - Product description - Article number - Standard and approvals	

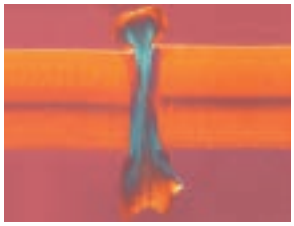
Approvals / Acceptance:

ISPE I ASME BPE I FM-4910

Convincing Welding Technologies

A diverse range of innovative and intelligent welding solutions is enriched with global training and service offerings

As a pioneer in the field, GF Piping Systems has always placed a very high priority on developing innovative jointing techniques to fulfill specific requirements and materials in use. Simplicity in application, chemical resistance, thermal stability and long-term weld strength are the key drivers in our jointing technologies. With a global jointing training program, international machine rental and a worldwide network of service centers, our customers benefit from our expertise and practical experience.

Welding technology	Welding machine	Joint cross-section	Microscopy
Socket fusion – the strong connection The fast and reliable solution to produce heavy-duty connections, in the workshop or the field.			
Butt fusion – the economical connection Economical and flexible fusion especially for larger diameters. From manual machines to full CNC control with traceability.			
IR-Plus (Infrared) fusion – the fast, clean connection Fast, repeatable and clean welds via non-contact heating. Full traceability of the welding process, with user guidance.			
BCF-Plus fusion – the smooth connection Bead and Crevice Free jointing with the highest weld factor, lowest stress and completely smooth fusion zone without any intrusions.			

For more information about training courses from GF Piping Systems please contact our local sales companies.

SYGEF system

Key Products Specially Designed for You

Continuous improvements and new developments assure a maximum level of quality to our customers. The SYGEF Plus system offers very unique key products which are specially designed by GF Piping Systems to fulfill even the highest requirements in segments like Microelectronic, Energy and Chemical Process Industry.

System up to d450

- Completely controlled processes from raw material to installation
- Overall system reliability, purity and safety
- Wide range of pipes, fittings, valves, automation and accessories
- Stress reduced pipes
- SEMI F57 conformity

High purity union

- Special HP design with unique positioning of the sealing
- Defined tightening for optimal deforming of the O-ring
- Crevice and dead space free to avoid bacterial growth
- Full plastic design without metal parts
- In accordance with ASME-BPE

High purity diaphragm valves

- Maintenance free during temperature cycles due to full plastic design
- Maximized purity due to minimized dead legs and manufacturing in clean room class 5 (100)
- Double flow rate compared to other diaphragm valves

Pressure regulating valves (PRV)

- Special HP-version with patented elastomer-free piston – no abrasion
- Valve assembly without metal screws for safer operation
- Compact and intelligent modular design
- Easy maintenance through replaceable cartridge

Automated IR welding machine

- Advanced QA/QC technology and monitored jointing work
- Minimized operator errors by automated welding process
- Full horizontal freedom for complex installation
- State-of-the-art, man-machine interface with user friendly touchscreen display

Ultrasonic flowmeter

- Noninvasive clamp-on design enables contamination free flow measurement
- Easy to retrofit – minimum downtime
- Real time monitoring
- Clean solution – no contact with medium
- Economic solution

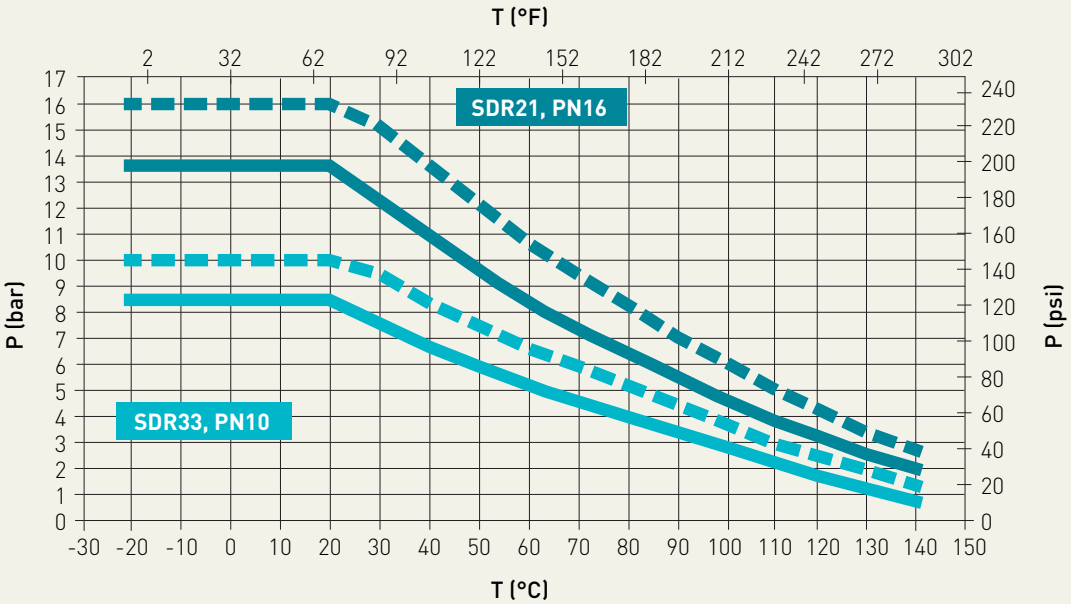
Exceeding Your Standards of Quality

Technical specifications with focus on pressure, temperature and high purity attributes

Excellent pressure/temperature performance
SYGEF PVDF is a thermoplastic fluoropolymer with a melting point above 175 °C and a wide service temperature range from -20 °C to 140 °C. SYGEF systems are ideal for use in aggressive chemical or ultrapure water systems since they are generally considered inert, have high strength and stiffness, and are readily weldable into system components.

Sterilization / sanitization / cleaning
Due to its outstanding material properties, our SYGEF systems are suitable for a broad range of sterilization or cleaning methods using steam, hot water, ozone and chemicals.

Pressure-temperature diagram



P Permissible pressure in bar, psi

T Temperature in °C (Celsius), °F (Fahrenheit)

---- C = 1.6
—— C = 2.0 (recommended by GF)

The pressure/ temperature curve based on medium water, operating temperature of 20°C, valid life time of 25 years and the design factor of C = 2.0 or C = 1.6 respectively

More information regarding technical specifications can be found online in our planning fundamentals: www.gfps.com

For Your Operational Safety

Professional material technology

Polyvinylidene fluoride (PVDF) – a high quality material

Chemical resistance at 20 °C (Applications can be very dependent on the concentration)		**Partially crystalline thermoplastics**			**Amorphous thermoplastics**		**Stainless steel**	
Media	**Chemicals**	**PVDF**	**PE**	**PP**	**PVC-U**	**PVC-C**	**1.4401 316**	**1.4301 304**
Oxidizing acids (HNO_3, H_2CrO_4, H_2SO_4, etc.)	$HNO_3 \leq 25\,\%$	+	o	o	+	+	o	o
	$25\,\% \leq HNO_3 \leq 65\,\%$	+	o	-	o	+	o	o
	H_2CrO_4 aqueous solution	+	o	o	o	o	o	o
	$H_2SO_4 \leq 70\%$	+	+	+	+	+	-	-
	$70\,\% \leq H_2SO_4 \leq 96\,\%$	+	-	-	+	+	-	-
Non oxidizing acids (HCl, HF, etc.)	$HCl \leq 30\,\%$	+	+	+	+	+	o	-
	$HF \leq 40\,\%$	+	+	+	+	-	o	-
	$40\,\% \leq HF \leq 75\,\%$	+	+	+	-	-	-	-
Organic (formic acid, acetic acid, citric acid, etc.)	$HCOOH \leq 25\,\%$	+	+	+	+	+	o	-
	$25\,\% \leq HCOOH \leq$ tech. pure	+	+	+	+	-	o	-
	$CH_3COOH \leq 50\,\%$	+	+	+	+	+	o	-
	$50\,\% \leq CH_3COOH \leq$ tech. pure	+	+	+	o	-	o	-
	$C_3H_4OH(COOH)_3$	+	+	+	+	+	o	-
Bases	Inorganic (NaOH, KOH, etc.)	-	+	+	+	o	+	+
	Organic (amine, imidazole, etc.)	-	+	+	o	-	o	o
Salts	NaCl, $FeCl_2$, $FeCl_3$, $CaCl_2$, etc.	+	+	+	+	+	o	o
Halogens	Chlorine, bromine, iodine, (no fluorine)	o	-	-	o	o	o	-
Fuels / oils	Aliphatic hydrocarbons	+	o	o	+	o	+	+
	Aromatic hydrocarbons	+	-	-	-	-	+	+
Solvents	Chlorinated hydrocarbons	o	-	-	-	-	o	o
	Ketones	o	+	+	-	-	+	+
	Alcohols	+	+	+	o	-	+	+
	Esters	o	o	o	-	-	+	+
	Aldehydes	-	+	+	-	-	+	+
Phenols	Phenol, Cresol, etc.	+	+	+	-	-	+	-

+ resistant o conditionally resistant, please consult us - not resistant

Please note: The above list is only intended as a guideline and does not replace an indepth review of material suitability for the particular application. The information is based on our experience and is state of the art. These data are general indicators only. In practice, however, other factors such as concentration, pressure and jointing technology must also be taken into consideration. The technical data are not binding and are not expressly warranted characteristics of the goods.

Please contact us for help in selecting the right materials.

The smarter way of automation

Automation Made Easy

A unique system-based approach that bundles and integrates competencies, knowledge, best-in-class resources and technologies

With an innovative product portfolio in the field of measurement, control and actuation devices, GF Piping Systems consistently follows its system approach. The complete solution combines measurement, control and actuation technology together with high quality piping systems and represents a unique form of product and competence bundling. The system-integrated devices that measure values such as temperature, pressure and flow delivering accuracy, productivity, reliability and safety to customers in a wide range of industries. Providing the entire range of automation technology from simple instrument panels to complex measurement installations, GF Piping Systems has not only the product resources and the technical expertise, but also the global service and support infrastructure needed to meet the high customer requirements.

As Versatile as Your Applications

Leading applications enabled by safe and reliable systems adapted to fit the needs of highly demanding industries

GF Piping Systems develops customized best-in-class solutions, aligned to the specific requirements of our customers in various sectors of industry, enabling profitable operation. With our system knowledge and product expertise, we support our customers during the planning process, the sustainable realization of the projects and provide valuable added services. Expertise in developing and producing piping systems, combined with profound industry and market knowledge, based on long-standing experience, makes GF Piping Systems an uniquely qualified and professional partner for our customers.

Microelectronics

Ultrapure water (UPW) is the lifeblood of semiconductor wet processing. SYGEF Plus system manufactured out of PVDF high purity material added with latest IR welding technology offers an industrial benchmark solution with excellent leach-out values and no rouging.

Chemical process industry

SYGEF is uniquely equipped to provide a broad and versatile solution for the safe conveyance of aggressive chemicals in extreme conditions. The excellent life span for temperatures up to 140°C including UV- resistance even allows outside installation.

Energy

High voltage direct current (HVDC) transmission is used because of its efficiency with less power loss. Through its thermal resistivity SYGEF systems are well suited to conduct the deionized water in cooling systems to dissipate the generated heat. Custom solutions offered by GF Piping Systems.

Water treatment

With noticeably better water balance compared to steel, SYGEF enables the right water quality for any WT application like drinking water, industrial effluent treatment or filling and emptying of tanks which are required in manufacturing and processing plants to store liquid media.

Food & beverage

Lighter and corrosion-resistant compared to stainless steel SYGEF is ideal for the conveyance of food. With FDA conform BCF-welding a smooth and reliable connection is warranted. Maintenance cycles and lifetime are maximized to achieve highest system efficiency.

Pharmaceutical

Down to the lowest pH values the excellent chemical resistance of SYGEF provides a high-quality and cost-effective alternative even to high-performance stainless steel or Titanium alloys. With BCF welding purest water conveyance, minimal microbiological growth and endotoxin risk is ensured.

GF Piping Systems

Worldwide at Home

Our sales companies and representatives
ensure local customer support in over 100 countries

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GFDO_6217_4 (03.16)