

Product Specifications

SYGEF[®] Plus PVDF HP Metric Piping System Specification

1. Scope

This specification covers requirements for the +GF+ Georg Fischer (later named only +GF+) **SYGEF[®] Plus PVDF HP** Piping System intended for a wide range of applications including water, pure water and effluent treatment as well as a wide range of chemical applications. The components of the **SYGEF[®] Plus PVDF HP** piping system are in accordance with the following standards.

2. Extract of Material Specification of SYGEF[®] Plus PVDF HP (Polyvinylidenfluoride) **SYGEF[®] Plus PVDF HP** pipes, fittings and valves from +GF+ shall be manufactured from Polyvinylidenfluoride, of which pipes and fittings are designed for 25 years of operation and an optimal chemical resistance. The raw material used shall be material designed for use with pressure bearing piping systems with long term hydrostatic properties in accordance with EN ISO 10931, and FM 4910 as supplied by +GF+.

Extract of Material characteristics of SYGEF[®] Plus PVDF HP (Standard Values)

Characteristic	Value	Units	Test Standards
Density	1.78	g/cm ³	ISO 1183
Charpy notched impact strength at 23 °C	> 9	kJ/m ²	EN ISO 179/1eA
Charpy notched impact strength at 0 °C	> 8	kJ/m ²	EN ISO 179/1eA
Final inner surface finish For injection moulded and extruded components	< 0.5 µm r _a -value		
Thermal expansion coefficient	0.12 - 0.18	mm/mK	DIN 53752
Temperature range :	Degree Celsius -20 °C – 140 °C		
Chemical resistance	DIBT agreement based on the Medium list		
	40.1.4		
Operating pressure for Pipes, Fittings and ball valves ≤ O.D. 63 mm	d 20 – 225 mm		PN 16 at 20 °C
all other components are executed in	d 90 – 225 mm		PN 10 at 20 °C
Colour	opaque	-	

For more detailed product properties please see +GF+ literature reference planning fundamentals / 2006.

3. Pipes

All **SYGEF[®] Plus PVDF HP** pipes shall be metric sizes from DN 15 (1/2") – DN 300 (8"), manufactured in accordance with the requirements of ISO 4433-4 and EN ISO 10931, as supplied by +GF+. Furthermore the pipes are manufactured stress free, without any voids and inclusions, allowing a high grade of roundness, high degree of straightness

Product Specifications

and an extreme smooth surface (r_a -value $< 0,2 \mu\text{m}$ for all dimensions up to $d 225 \text{ mm}$ and r_a -value $< 0,3 \mu\text{m}$ for all dimensions up to $d 225 \text{ mm}$) as supplied by +GF+.

4. Fittings

All **SYGEF[®] Plus PVDF HP** fittings shall be metric sizes DN 15 (1/2") – DN 300 (8") as socket or butt fusion type and manufactured by +GF+, which dimensions are in tolerances with EN ISO 10931. They need to be tested according to EN 10204. All threaded connections shall have pipe threads in accordance with the requirements of ISO 7-1. All butt fusion fittings shall be manufactured with laying lengths designed for use with the polyfusion machine IR-63 Plus[®], IR-225 Plus[®] or the BCF (Bead and Crevice Free) Plus[®] welding machine supplied by +GF+.

4.1 Fitting Accessories

Backing flange metric sizes DN 15-225 mm shall be designed according to EN ISO 15494-1, in a thermo plastic-oriented design, consisting of 100% glass fibre reinforced polypropylene, PP-GF30, graphite black and UV stabilized as manufactured by +GF+. These flanges are manufactured in a seamless technology injection moulding process. The flange shall be optimised with a V-groove in the inner diameter to ensure an evenly distributed force on the thermo plastic flange adapter. Connecting dimensions metric according to ISO 7005, EN 1092, DIN 2501; Bolt Circle Diameter PN 10; Inch: ANSI B 16.5, BS 1560; class 150

5. Valves

All **SYGEF[®] Plus PVDF HP** valves shall be metric sizes manufactured by +GF+ or equal in accordance with EN ISO 16135 and following, tested according to the same standard. All butt fusion valves shall also be manufactured with laying lengths designed for use with the polyfusion machine IR-63 Plus[®], IR-225 Plus[®] or the BCF Plus[®] welding machine supplied by +GF+.

5.1. Ball Valves

Ball valves are not offered in **SYGEF[®] Plus PVDF HP**, but they are available in **SYGEF[®] Standard PVDF**. Please refer to this specification template.

5.2. Diaphragm Valves

All **SYGEF[®] Plus PVDF HP** diaphragm valves, metric sized, shall be either:

- Type 314 (true double union design with BCF ends, DN 15-50), or
- Type 315 (butt fusion ends, DN 15-50) or
- Type 317 (fixed flange design, DN 15-150)
- Type 319 (T-valve design with butt fusion ends, DN 20 – 20 - 100)
- Type 319 HTR (identical to Type 319, but with a high temperature resistance)

They shall be manufactured by +GF+ in accordance with EN ISO 16138. The upper body shall be in PPGF (polypropylene glass fibre reinforced) connected to

Product Specifications

the lower body with exposed stainless steel bolts. A position indicator integrated into the hand wheel must be present to determine diaphragm position. Diaphragms are to be EPDM, FPM, NBR, CSM or PTFE with EPDM or FPM supporting diaphragm.

Following Option shall be available:

- Handwheel with build-in locking mechanism

5.2.1. Pneumatically actuated diaphragm valves

Pneumatic diaphragm actuators shall be +GF+ Type DIASTAR® sizes DN 15-150 mm. Pneumatic actuators shall be available as fail safe close, fail safe open and double acting and have an integrated optical position indication. Actuator housing shall be made of PPGF (polypropylene glass fibre reinforced), flame retardant and NEMA 4X or IP 65 corrosion resistance. Actuators shall contain a preloaded galvanised steel spring assembly to ensure safe actuator operation and maintenance. All pneumatically actuated diaphragm valves shall have the following accessories available:

- Pilot valve remote and direct mounted in voltages 24VDC/AC, 110VAC, 240VAC
- Positioner Type DSR 100/101
- Limit switch kits Ag-Ni, Au, NPN, PNP
- Stroke limiter & emergency manual override
- AS Interface Control Bow with incorporated position feedback and a solenoid pilot valve

5.3. Butterfly Valves

Butterfly valves are only available in SYGEF® Standard PVDF. Please refer to this specification template.

5.4. Check Valves

Check valves are only available in SYGEF® Standard PVDF. Please refer to this specification template.

5.5. Wafer Check Valves

Wafer Check Valves are only available in SYGEF® Standard PVDF. Please refer to this specification template.

5.6. Pressure regulating valves

Pressure regulating valves are only available in SYGEF® Standard PVDF. Please refer to this specification template.

6. Instrumentation

The following parameters can be measured (Sensors), indicated and/ or

Product Specifications

transmitted (Transmitters) to PLC, PC and other Data Acquisition Systems.
All products comply with the CE standard

Parameter	Technology	Compatible liquids (*)
Flow	Paddlewheel	Clean liquids
	Vortex	Ultra pure liquids
	Magmeter	Contaminated liquids
Level	Hydrostatic	All liquids
pH-ORP	Glas electrodes	All liquids
Conductivity	Contact	All liquids
Pressure	Piezoresistive	All liquids
Temperature	Pt1000	All liquids

(*) Please check first the sensors limitations (Data sheet) and chemical resistance list

6.1 Sensors

The sensors listed here after will transfer the measured value to a +GF+ Transmitter, allowing simple calibration and maintenance of the devices. Alternatively the measured values of the sensors could be send directly to a PLC, PC or other local made electronics using either an analogue signal (mA, open collector or sinusoidal voltage) or a digital signal called S3L (+GF+ Signet serial signal).

Depending on the sensors type, special installation fittings shall be used to connect it into the pipeline: Installation T-Fitting (DN15-50 mm) with double true union in **SYGEF[®] Plus PVDF HP** as supplied by +GF+. Following connection shall be available: Weld-o-let, direct union 1/2", 3/4" ISO, 3/4" NPT and submersion kits. These fittings are offered in IR Plus Butt fusion version.

6.1.2 Flow sensors

6.1.2.1 Paddlewheel sensors

515 and 525 sensors:

All the sensor of this family are considered as a "sinusoidal" sensor. This sensor from +GF+ SIGNET requires no external power source to produce a signal. Internal to the body of the sensor is a wire coil which when excite by the rotor assembly produces a small sinusoidal signal. The rotor assembly consists of four paddles; inserted into each of the paddles of the rotor are magnets. As liquid flows past the rotor assembly it rotates, as each of the four paddles pass the center of the body a sine wave signal is produced (two paddles of the rotor produces a full AC sine wave). The sensors as manufactured by +GF+ SIGNET produce a signal output which is proportional to the flow rate. A K-factor (number of pulses generated by the sensor per 1 liter or 1 gallon of fluid that passes the sensor) is used to define the size of the pipe that the sensor is inserted into.

Product Specifications

3-2536 and 3-2537 sensors:

All sensors of this family of sensors are considered as a “Hall Effect” sensor. Internal to the +GF+ SIGNET sensors body is an open collector relay. The sensor is supplied with a voltage from the 3-8550 transmitters or an external power supply ranging from 5 to 24 volts. This voltage is switched through the open collector relay as the paddlewheel (rotor) of the sensor rotates.

The sensor’s rotor assembly has four paddles. Inserted in to each of the paddles is a magnet. As the paddles pass the center of the sensors body, the magnetic field switches the open collector relay on and off which generates a square wave pulse as manufactured by +GF+ SIGNET. A pulse is a complete cycle of on and off of the open collector relay.

The sensors pulse output is directly proportional to the fluids velocity. A K-factor (number of pulses generated by the sensor per 1 liter or 1 gallon of fluid that passes the sensor) is used to define the size of the pipe that the sensor is inserted into.

6.1.2.2 Vortex sensors:

Located inside the body of the +GF+ SIGNET Type 7000 and 7001 Vortex sensor is a “Bluff Body and a Piezoelectric sensor. As fluids passed the bluff body, the fluid creates small swirls called Vortices. As the vortices pass the piezoelectric sensor, the sensor vibrates. As the flow velocity increases the vibration on the surfaces of the piezoelectric sensor increases. This vibration or movement of the piezoelectric sensor is translated into electrical signals. The electrical signals are then conditioned and translated into pulse signal (K-factor), which will be send to a +GF+ SIGNET Transmitter unit.

6.1.2.3 Magmeter

The Magmeter sensor of +GF+ SIGNET consists of two metallic pins that produce a small magnetic field across the inside of the pipe. The Magmeter measure the velocity of a conductive liquid (20 μ S or greater) as it moves across the magnetic field produced by the Magmeter. The magnetic field produced by the sensor is directly proportionally to the flow rate of the fluid. The magnetic signal is conditioned and translated in to a pulse signal (K-factor). The Magmeter of +GF+ SIGNET is offered as a blind output (frequency or 4-20 mA), or with a integral display and control relays.

6.1.3 Level sensor (hydrostatic level)

Hydrostatic pressure is the pressure exerted on a column of fluid by the weight of the fluid above it. Internal to the +GF+ SINGET PVDF sensor body is a ceramic diaphragm sensor and capillary tube/cable assembly. The ceramic diaphragm sensor exposed to the fluid senses the hydrostatic pressure of the fluid and compares the pressure to the atmosphere pressure that is sensed by the capillary tube/cable assembly. Because the hydrostatic level sensor from +GF+ SIGNET only senses the pressure of the fluid, interference and inaccuracies of the signal are dramatically reduced. The measured signals are then conditioned send to a +GF+ SIGNET Transmitter unit.

Product Specifications

6.1.4 pH sensors

All pH sensors from +GF+ SIGNET are constructed of three key elements, measuring cell, reference cell and the reference junction. The measuring cell is constructed of hydrogen sensitive glass that can detect the concentration of hydrogen ions (+H) in a solution. The concentration of +H ions directly determines the pH of the fluid. The reference cell is used to provide a stable reference mV-signal that the measuring cell compares its signal to. The reference junction allows the reference cell to come in contact with the fluid being measured. The measured signal are then conditioned and send to a +GF+ SIGNET Transmitter unit.

6.1.5 ORP sensors

All ORP sensors from +GF+ SIGNET are constructed similar to the pH sensor with one exception. The hydrogen sensitive glass is replaced with a noble metal such as platinum or gold.

The noble metal measures the activity of oxidizing or reducing chemicals agents. The electrical signals are then conditioned and translated into pulse signal (K-factor), which will be send to a +GF+ SIGNET Transmitter unit.

6.1.6 Conductivity sensors

All Conductivity sensors from +GF+ SIGNET are manufactured using two electrodes made of stainless steel (other material available if there is a chemical compatibility issue). Conductivity sensors measure the ability of a fluid to conduct an electrical current between the two electrodes. The conductivity monitor/transmitter sends a signal into one the electrode and depending on the fluids availability to conduct a charge (concentration of ions) measures the amount of current required to sense the signal on the second electrode. Other important fact to consider, select a sensor that has the proper cell constant (depends on the conductivity level). All conductivity sensors from +GF+ SIGNET have a temperature compensation circuits in order to increase the sensors accuracy.

6.2 Transmitters

The analogue data transfer with or without display as well as optional relays contacts will be provided by a +GF+ Transmitter. This transmitter can be built:

- Directly inline on the sensor (INTEGRAL Version)
- On a wall, pipe, frame etc... by using a universal mounting kit (UNIVERSAL Version)
- On the door of a cabinet or a panel (PANEL Version)

The analogue or digital display version will allow to set up all process parameters like the measuring range, relay set points and to calibrate the piping system.

A Multi parameter (Multi channel) version in panel execution allows building the own customised transmitter by mixing and matching In- and Output as supplied by +GF+.

Following selection is possible:

- 2,4 or 6 sensor input (Flow, Level, pH-ORP, Conductivity, Pressure Temperature)

Product Specifications

- 0,2 or 4 analogue output (4-20 mA or 0-10 Volts)
- 0,2,4,6 or 8 relay output
- Power supply 12-30 VDC or 110-230 VAC

6.3 Batch control

A Batch controller manufactured by +GF Signet Type 5600 allow dosing a pre-selected quantity of liquid. After a start signal (local or remote), the 5600 will close a contact to open an automatic valve and/or switch on a pump, count up pulses coming from a flow sensor (Paddlewheel, Vortex or Magmeter) and open the contact again as soon as the pre-selected quantity is reached. This batch process is repeatable and the +GF+ Batch Transmitter is designed for intensive industrial applications.

7. Piping System Pressure Rating

All components are designed for a maximal operating pressure of the entire system DN 15 (1/2") – 200 mm (8") of 16 bars at 20 °C or with the system from DN 80 (3") – 300 mm (8") of 10 bars at 20 °C up to an external dimension (d) of DN 200 mm. All diaphragm, butterfly and three way ball valves are designed for a maximal operating pressure of 10 bars at 20 °C. Binding is the continuously updated product information available on our homepage: www.piping.georgfischer.com.

8. Marking

All components are embossed with a permanent identification during the production process to ensure full traceability. The following information will be mentioned:

- Production lot number
- Material
- Dimension
- Pressure rating

9. Welding and assembly

All butt fusion fittings and valves in **SYGEF[®] Plus PVDF HP** shall be manufactured with laying lengths designed for use with polyfusion machine IR-63 Plus[®] and IR-225 Plus[®] from +GF+, allowing welds with increased mechanical and chemical stability than conventional welding methods. The IR Plus fusion technology uses the material temperature of the welding zone to determine the end of the fusion process. As soon as the welding zone temperature of the fitting is below the defined unclamping temperature, the fusion process (cooling time) is being finished. The cooling time for the IR-Plus fusion machines is calculated on the basis of the ambient temperature and the bead surface temperature. To increase the cooling capacity, additional ventilation is included in the IR-225 Plus. Only authorised welder by +GF+ are allowed to perform polyfusion on these machines.

Product Specifications

The BCF fusion technology welds **SYGEF[®] Plus PVDF HP** piping components from dimensions d20 to d110 without any irregularities, beads or crevices. The extremely compact fusion machine, which is also ideal for on-site fusion, is very reliable, easy to handle and creates reproducible and very strong fusion welds. Only authorised welder by +GF+ are allowed to perform fusion on the BCF Plus machines manufactured by +GF+.

The welding and the installation should be in accordance with +GF+ Piping Systems Guide to the Installation and Use of Plastic Pipeline. For further information and training regarding the polyfusion technique and machines IR Plus[®] and BCF Plus[®] please contact Georg Fischer support under Tel.: +41 52 631 11 11 or e-mail to info.ps@georgfischer.com.

10. Pipe Support System

Pipe Support System shall be KLIP-IT, sizes d10-400 mm, as supplied by +GF+.

11. Quality

Pipes, fittings, cleaner, valves and accessories shall be manufactured in an environment operating a Quality Assurance System to ISO 9001 and a Environmental Management System conform to ISO 14001.

12. Uniformity

Pipes, fittings, valves, cleaner and Polyfusion IR Plus machines shall be supplied from one manufacturer, namely +GF+, to ensure correct and proper jointing between components and uniform chemical and physical properties of the piping system.

13. Training, Certification and Installation

Site personnel, involved with **SYGEF[®] Plus PVDF HP** piping installation, shall undergo training and certification from an authorised +GF+ representative prior to performing any jointing operations on site. Installation, including support spacing and expansion considerations, shall be in accordance with the +GF+ written recommendations.

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