Product Specifications

PE 100 Metric Piping System Specifications

1. Scope

This specification covers requirements for the +GF+ Georg Fischer (later named only +GF+) **PE 100** Piping System intended for a wide range of applications including water, wastewater and effluent treatment as well as a wide range of chemical applications. The components of the PE 100 pipe system are in accordance with the following standards.

2. Extract of the Material Specification for Polyethylene High Density (PE 100)

PE 100 pipes and fittings from +GF+ are manufactured from High Density Polyethylene 100 (MRS 10 MPa) either with SDR 11 or SDR 17,6 version, of which pipes and fittings are designed for 25 years for industrial operation. 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 15494, as supplied by +GF+.

Extract of Material characteristics of PE 100 (Standard Values)

Characteristic	Value	Units	Test Standards
Density	0.95	g/cm3	ISO 1183
Charpy notched impact strength at 23 °C	83/p	kJ/m2	EN ISO 179/1eA
Charpy notched impact strength at -40 °C	13	kJ/m2	EN ISO 179/1eA
Crystallite melting point	130	°C	ISO 306
Thermal expansion coefficient	0.15-.020	mm/mK	DIN 53752
Colour	9005	-	RAL
Temperature range in °C:	-50 - + 60 in °C		
Operating pressure range for Pipes, Fittings up to d 400 mm: - S 5 / SDR 11 - S 8.3 / SDR 17,6			 PN 16 at 20 °C PN 10 at 20 °C

For more detailed physical properties please see +GF+ literature reference GMST 5957/4 (planning fundamentals / 2006), page 31 and following.

3. Pipes

Pipes are made of PE100; processed according to the quality specifications issued by DIN 8075 and dimensions according to DIN 8074. Temperature application range -50°C to 60°C; colour black.

The PE100 formulation has been designed to match with the requirements of applications in chemical industry; pipes made of raw material with DIBT-listing (DIBT = German institute for building technology) and therefore complying with the corresponding DIBT media list are available upon request.

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The raw material matches with the “PE100+ association” quality standards.

Processed pipes are straight and show a very low out of roundness. The wall structure is homogeneous, fine and shows no voids or inclusions.
Pipes do show no axial grooves and pipes show a very smooth inner surface; GF DEKA is ready to deliver pipes with an r_a-value < 2 µm upon request.

Rheological properties of the pipe material with regard to welding complies with the DVS 2207 standards.

Axial heat reversion (110°C/ 1h (for wall thickness < 8 mm) or 2h (for wall thickness 8-16 mm) never exceeds 2%.

Pipes are fabricated in a stress-relieving process.

Pipes comply with the ship building approval according to GL, LR, BV, RINA, DNV, CCS and RMRS

4. Fittings

All **PE 100** fittings shall be metric sizes d 20 – d 630 mm butt fusion or electro-fusion type manufactured by +GF, which dimensions are in tolerances with EN ISO 15494 and ISO 7279. 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. Electro-fusion fitting in PE will contain in the fitting wall the heat conductive wire, avoiding any possible contact with the later transported media. All butt fusion spigot fittings shall be manufactured with laying lengths designed for use with the polyfusion machine IR-63 Plus and IR-225 Plus from +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. These flanges are manufactured in a seamless technology injection moulding process by +GF+. 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

As no valves in **PE 100** are supplied by +GF+, valves in the material **PVC-U** or **ß-PP-H** shall be installed with pre-mounted butt fusion end connectors in **PE 100**. These valves shall be metric sizes manufactured by +GF+ or equal in accordance with EN ISO 16135 and following and ISO 8242, tested according to the same standard. Please refer to the adequate material specifications template.

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5.1. Pressure regulating valves

All **PROGEF®** pressure regulating valves as supplied by +GF+ shall have the following characteristics:

Pressure ranges for all pressure regulating valves are the following:
DN 10 – 50 from 0 up to max 10 bar
DN 65-80 from 0 up to max 6 bars
DN 100 – from 0 up to max. 4 bars

The pressure regulating valves supplied by +GF+ are available in PVC-U, PP or PVDF materials. Please refer to the material section you choose for your application.

6. Instrumentation

The following parameters can be measured (Sensors), indicated and/ or transmitted (Transmitters) to PLC, PC and other Data Acquisition Systems.
All products comply with the CE standard

Parameter	Technology	Compatible liquids (*)
Flow	Paddlelwheel	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 **PROGEF PP-H** with end connectors in PE 100 as supplied by +GF+. Weld-o-let, direct union ½", ¾ " ISO, ¾" NPT, Submersion kits are available. These fittings shall be a butt fusion version.

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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.

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 µS or greater) as it moves across the magnetic

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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.

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.
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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

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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 version allows to build his own customised transmitter by mixing and matching In- and Output as supplied by +GF+.
Following selection are possible:
- 2,4 or 6 sensor input (Flow, Level, pH-ORP, Conductivity, Pressure Temperature)
- 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 in PE 100 in SDR 11 are designed for a maximal operating pressure of 16 bars at 20 °C up to an external dimension of DN 400 mm. All components in PE 100 in SDR 17.6 are designed for a maximal operating pressure of 10 bars at 20 °C from DN 50-400 mm. Binding is continuously updated product information available on our homepage.

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

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9. Welding and assembly

All PE 100 pipes and butt fusion fittings shall also be manufactured with laying lengths designed for use with polyfusion machine IR-63 Plus and IR-225 Plus from +GF+, allowing smaller welds beats with increased mechanical and chemical stability than conventional welding methods. +GF+ Electrofusion fitting will be welded with the +GF+ MSA Electrofusion machine to ensure best welding quality. Only authorised welder by +GF+ are allowed to perform fusion on these machines.

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 standard butt fusion or electrofusion machine please contact Georg Fischer support under +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, manufactured 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 and cleaner 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 **PE 100** 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.