

## Product Specifications

### PVC-C Metric Piping System Specifications

#### 1. Scope

This specification covers requirements for the +GF+ Georg Fischer (later named only +GF+) PVC-C 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 PVC-C pipe system are in accordance with the following standards.

#### 2. Extract of Material Specification of Chlorinated Polyvinylchloride (PVC-C)

PVC-C pipes, fittings and valves from +GF+ shall be manufactured from chlorinated polyvinylchloride (PVC-C), 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 ISO 15493, as supplied by +GF+.

#### Material characteristics of PVC-C (Standard Values)

Characteristic	Value	Units	Test Standards
Density	1.5	g/cm <sup>3</sup>	ISO 1183-1
Tensile E-modulus	> 25500	N/mm <sup>2</sup>	EN ISO 527-1
Charpy notched impact strength at 23 °C	> 6	kJ/m <sup>2</sup>	EN ISO 179/1eA
Vicat heat distortion temp. B/50N	> 103	°C	ISO 306
Thermal expansion coefficient	0.06-0.07	mm/mK	DIN 53752
Temperature range in °C:	0 °C – 80 °C		
Operating pressure range for pipes, fittings* and two ways ball Valve ≤ O.D. 110 mm with water :	PN 16 at 20 °C		
Colour	7038	RAL	

\* Except for Te 45 degree, unions and transition fittings

For more detailed physical properties please see +GF+ literature reference GMST 5957/4 (planning fundamentals / July 2006), pages 40 and following.

#### 3. PVC-C Pipe

Pipes made of PVC-C; processed according to the quality specifications issued of DIN 8080 and dimensions according to DIN 8079.

Dimensions also comply with ISO, in particular EN ISO 15493 (for metric pipes).

Temperature application range 10-100 °C; colour: agate grey RAL 7038; pipe formulation has been designed for an enhanced chemical resistance and exceptional temperature-stability (Vicat-temperature (B50) =113 +/- 1K).

Processed pipes are straight and show a very low out of roundness. The wall structure is homogeneous and fine.

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OD-tolerances are strongly confined compared to DIN 8079 and harmonized with the fitting programme of GEORG FISCHER to enable an easy pre-assembly and minimized gaps.

For adhesive jointing of the pipes a gap-filling adhesive (Tangit PVC-C, Tangit cleaner of Henkel, Germany) must be used. PVC-C piping intended to be used for conveyance of concentrated and strong oxidizers should be installed using a different adhesive (e.g. DYTEX of Henkel, Germany) certified to be able to match with this kind of chemical load. Any installation should follow the GEORG FISCHER installation guidelines for industrial piping and the guidelines issued by the German association of plastic pipe producers (KRV).

Pipes are certified according to the DVGW (DW-8331 AT 2025 in PN 25 for OD ≤ 63 mm. Application for pipes for the DIBT (German institute for Building Technology)-approval is in progress (# 90433-97HH).

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

Ventilation pipes made of a FM 4910 approved material grade are available upon request.

### 4. PVC-C Fittings

All PVC-C fittings shall be metric sizes d 16 – d 160 mm manufactured by +GF+ or equal and shall be of a type suitable for solvent cementing, with dimensions and tolerances in accordance with EN ISO 15493, EN ISO 15877, Part 1+3, ISO 2045 and ISO 727 Parts 2. 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.

#### 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. PVC-C Valves

All PVC-C valves shall be metric sizes manufactured by +GF+ or equal in accordance with EN ISO 16135 and following, tested according to the same standard.

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### 5.1. Ball Valves

All **PROGEF**<sup>®</sup> ball valves with metric sizes DN 15 - 100 mm in metric, shall be +GF+ Type 546 with true double union design manufactured by +GF+ in accordance with EN ISO 16135. Incorporated into its design shall be a safety stem with a pre-determined breaking point above the bottom O-ring, preventing any media leaking in the event of damage. The valve nut threads shall be buttress type to allow fast and safe radial mounting and dismounting of the valve during installation or maintenance work. Seats shall be PTFE with backing rings creating self-adjusting seals and constant operating torque. Backing rings and seals shall be EPDM or FPM. The handle shall include in its design an integrated tool for removal of the union bush. Union bush shall have fine-pitched left-hand threads to prevent possible unscrewing when threaded end connectors are removed from pipe. Following accessories shall be available:

- A Multi-Functional Model (MFM) in PPGF equipped with internal limit switches for reliable electrical position feedback, is mounted directly between the valve body and the valve handle. This MFM is also the necessary interface for later mounting of actuators.
- Mounting plate in PPGF with integrated inserts for later screw mounting on any support
- Lockable multi-functional handle

#### 5.1.1. Electrically actuated ball valves

Electric actuators shall be Types EA11 (sizes DN 10-50 mm), EA21 (sizes DN 10-50 mm), EA31 (sizes DN 65-100 mm) shall be available manufactured by +GF+ in accordance with EN 61010-1, EC directives 89/336/EEC-EMV and 73/23/EEC, LKD and needs to be **CE** marked. Actuator housing shall be made of PPGF (polypropylene glass fibre reinforced), flame retardant with external stainless steel screws. All electric actuators shall have an integrated emergency manual override and integrated optical position indication. All electric actuator types (with the exception of EA11) shall have the following accessories available:

- Fail-safe unit
- Heating element
- Cycle extension, cycle time monitoring, and cycle counting
- Motor current monitoring
- Position signalisation
- Positioner Type PE25
- Limit switch kits Ag-Ni, Au, NPN, PNP
- AS Interface Control Box

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Electric actuator specifications of the actuators shall be as follows:

Specification	EA11	EA21	EA31	EA42
Nominal torque (Nm)	10	10	60	100
Control time (s/90°)*	5	5	15	25
Cycles at 20°C *	150,000	250,000	100,000	75,000
Duty cycle ED at 25°C	40%	100%	50%	35%
Protection class	IP65 per EN 60529 - IP67 (for vertical cable mounting and wall feed through).			
Voltage	100-230, 50-60 Hz or 24V=/24V, 50/60 Hz versions			

\* = at nominal torque

### 5.1.2. Pneumatically actuated ball valves

Pneumatic actuators shall be +GF+ Types PA11 (for valve sizes DN 15-25 mm) and PA21 (for valve sizes DN 32-50 mm) shall be available manufactured by +GF+. 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 Polypropylene fibre glass reinforced (PPGF) and flame retardant. Actuators shall contain a preloaded spring assembly to ensure safe actuator operation and maintenance. Actuators shall contain integrated Namur interface for the easy mounting of positioners, limit switches and accessories. The Valve shall be equipped with a Multi-functional-module for reliable electric feedback, mounted directly between the valve body and the actuator as manufactured by +GF+.

For valve size DN 65 mm pneumatic actuators shall be Type PA 30 (fail safe to close or open function), Type P35 (double acting function).

For valve size DN 80 mm pneumatic actuators shall be Type PA 35 (fail safe to close or open function), Type P40 (double acting function).

For valve size DN 100 mm pneumatic actuators shall be Type PA 45 (fail safe to close or open function), Type 45 (double acting function)

All actuators shall be manufactured by +GF+. Pneumatic actuators shall have an integrated optical position indication. Actuator housing shall be made of hard anodized aluminium. Actuators shall contain integrated Namur interface for the easy mounting of positioners, limit switches and accessories.

All pneumatically actuated ball valves shall have the following accessories available:

- Pilot valve remote or direct mounted in voltages 24VDC/AC, 110VAC, 240VAC
- Positioner Type DSR 201
- Limit switch kits Ag-Ni, Au, NPN, PNP
- Stroke limiter
- Manual override for all sizes up to d 110 mm
- AS Interface Control Bow with incorporated position feedback and a solenoid pilot valve

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### 5.2. Diaphragm Valves

All **PVC-C** diaphragm valves, metric sized, shall be either:

- Type 314 (true double union design, DN 15-50), or
- Type 315 (spigot design, DN 15-50) or
- Type 317 (flanged design, DN 15-100)

All diaphragm valve shall be manufactured by +GF+ in accordance with

EN ISO 16138. Upper body shall be PPGF (polypropylene glass fibre reinforced) connected to 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 PFM 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 DN15-150 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 or 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

All PVC-C butterfly valves, metric sizes DN 50 (1 1/2") – 200 (8") mm, shall be Type 567 wafer type with a double eccentric disc design manufactured by +GF+ in accordance with EN ISO 16136. Seals shall be available in both EPDM and FPM. The lever handle shall be lockable in increments of 5 degrees. There shall always be six teeth engaged between the ratchet and the index plate to ensure accurate and safe positioning of the lever. There shall be the option of fine adjustment by use of a specific hand lever, allowing the disc to be opened at any angle between 0° and 90°. As an option, the hand lever shall be lockable. The hand lever shall be manufactured of high strength PPGF (polypropylene glass fibre reinforced). The option of an integrated electric position indicator shall be available. The electric

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position indicator shall be integrated into the mounting flange. Butterfly valves shall have low actuation torque to enable easy operation.

### 5.3.1. Electrically actuated butterfly valves

Electric actuators shall be +GF+ Types EA31 or EA 42 depending on valve size shall be manufactured by +GF+ in accordance with EN 61010-1, as per the above specifications. Actuator housing shall be made of PPGF (polypropylene glass fibre reinforced), flame retardant and external stainless steel screws. All electric actuators shall have an integrated emergency manual override and integrated optical position indication. All electric actuator types shall have the following accessories available:

- Fail-safe unit
- Heating element
- Cycle extension, monitoring, and counting
- Motor current monitoring
- Position signalisation
- Positioner Type PE25
- Limit switch kits Ag-Ni, Au, NPN, PNP
- AS Interface Control Box

### 5.3.2. Pneumatically actuated butterfly valves

Pneumatic actuators shall be +GF+ Types PA 30 (metric sizes DN50-65 mm), PA35 (metric size DN 80 mm only), PA40 (metric size DN 100 mm only), PA45 (metric size DN 125 mm only), PA50 (metric size DN 150 mm only) and PA55 (metric size DN 200 mm only) shall be available manufactured by +GF+. 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 hard anodized aluminium. Actuators shall contain integrated Namur interface for the easy mounting of positioners, limit switches and accessories. All pneumatically actuated butterfly valves shall have the following accessories available:

- Pilot valve remote or direct mounted in voltages 24VDC/AC, 110VAC, 240VAC
- Positioner Type DSR 201
- Limit switch kits Ag-Ni, Au, NPN, PNP
- Stroke limiter
- AS Interface Control Bow with incorporated position feedback and a solenoid pilot valve
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### 5.4. Check Valves

Ball check valves, according to EN ISO 16137, metric sizes DN 15-50 mm, shall be Type 360 true double union design. Seals shall be EPDM or FPM. Union bush shall have a left hand thread to prevent possible unscrewing when threaded end connectors are removed from pipe. This valve shall be suitable for mounting in a vertical position.

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### 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	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 **PVC-C** with as supplied by +GF+. Weld-o-let, direct union 1/2", 3/4 " ISO, 3/4" NPT, Submersion kits ...,

These fittings will be socket solvent cemented 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 produces 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

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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  $\mu$ 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

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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.

### 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.

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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 are designed for a maximal operating pressure of 16 bars at 20 °C up to an external dimension of DN 150 mm. (only exceptions are Te 45° and some transition fittings to metal piping). All three way ball valve, diaphragm valve and butterfly valves, as well as some components with a greater external dimension than DN 150 mm, are designed for a maximal operating pressure of 10 bars at 20 °C. 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

### 9. Solvent Cement and Cleaner

Tangit PVC-C solvent cement shall be manufactured by Henkel to EN 1452-3 and must be used subject to the application and operating conditions. Tangit cleaner for PVC-U, shall be manufactured by Henkel, must be used subject to the application and operating conditions.

For chemical concentrations  $\geq 70\%$  sulphuric acid;  $\leq 10\%$  chromic acid,  $\geq 25\%$  hydrochloric acid;  $\geq 20\%$  nitric acid; sodium hypochlorite  $\geq 6\%$  active chlorine,  $\geq 5\%$  hydrogen peroxide and hydrofluoric acid in any concentration, subject to the application and operating conditions, Dytex solvent cement and Dytex Cleaning for PVC-C, manufactured by Henkel, must be used in accordance with Henkel instructions.

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### 10. Pipe Support System

Pipe Support System shall be KLIP-IT, sizes DN10-400, manufactured by +GF+.

### 11. Solvent Cement Jointing and installation

Installation, including support spacing and expansion considerations, shall be in accordance with the +GF+ written recommendations especially regarding thermal expansion precautions and the installation conditions on site.

### 12. Quality

Pipes, fittings, solvent cement, 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.

### 13. Uniformity

Pipes, fittings, valves, solvent cement 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.

### 14. Training, Certification and Installation

Site personnel, involved with **PVC-C** piping installation, shall undergo training and certification from an authorised local institution prior to performing any jointing operations on site. For further information and training please contact +GF+ Georg Fischer support under +41 52 631 11 11 or e-mail to [info.ps@georgfischer.com](mailto:info.ps@georgfischer.com).

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