for PVC-U Metric Piping Systems

1. Scope

This specification covers requirements for the GF **PVC-U** 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-U** piping systems are in accordance with the following standards.

2. Basic System Data

2.1 Material Specification for Unplasticised Polyvinylchloride (PVC-U)

PVC-U pipes, fittings and valves from GF Piping Systems shall be manufactured from unplasticised polyvinylchloride, of which pipes and fittings are designed for 25 years of operation with water as medium (20°C). **PVC-U** has also an optimal chemical resistance against many mineral acids, bases and salt solutions. For detailed information, please refer to the list of chemical resistance provided by GF Piping Systems. 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 15493, as supplied by GF Piping Systems.

2.1 Characteristics of PVC-U Material

Characteristic	Value	Test Standards
Density	1.38 g/cm^3	ISO 1183-1
Tensile E-modules	>2400 N/mm^2	EN ISO 527-1
Charpy notched impact strength at 23 °C	6 kJ/m^2	EN ISO 179/1eA
Charpy notched impact strength at 0°C	3 kJ/m^2	EN ISO 179/1eA
Vicat heat distortion temp. B/50N	≥76 °C	ISO 306
Chemical resistance	DIBT agreement	based on the medium list 40.1.4
Thermal expansion coefficient	0.07 - 0.08 mm/mK	DIN 53752
Temperature range in °C	0°C - 60°C	
Colour	dark grey; 7011 -RAL	

2.2 PVC-U Dimensional Range & Pressure** (at 20 °C)

Products	d / bar	6	8	10	12	16	20	25	32	40	50	63	75	90	110	125	140	160	180	200	225	250	280	300	315	355	400
Pipe	16	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
	10							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				
	6										■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Fittings	16	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■									
	10																			■	■	■	■				
	6																								■	■	■
ball valve*	10					■	■						■	■	■												
	16			■	■	■	■	■	■	■	■	■	■	■													
butterfly valve*	10											■	■	■	■	■	■	■	■	■							
cone check valve*	6								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
	16					■	■	■	■	■	■	■	■	■	■												
diaphragm valve*	10						■	■	■	■	■	■	■	■	■			■									***
Flange*	16						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■		
	10																									■	■
Gaskets & Pipe Clips	16	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Sensors & Controllers	--	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

*** for detailed information please consult the GF Piping Systems online catalog**
**** values in table at the max. pressure in units of bar, at 20°C**
***** metal butterfly valves**

For more detailed physical properties and product pressure – temperature curves, please consult the GF Piping Systems Planning Fundamentals on the GF Piping Systems website.

2.3 Approvals

This material specification for **PVC-U** is met by GF Piping Systems. Therefore GF Piping Systems is approved according to different categories all over the world. For more information please consult our approvals database on the GF Piping Systems website.

Approvals	DVGW	DIBT	GOST-R	DGS (ACS)	KIWA	CSTB	IIP	ABS	BV	CCS	DNV	GL	LR	RINA	RMROS
								ship building							
Raw Material	■			■	■										
Pipe	■	■	■					■	■	■	■	■	■	■	■
Fittings		■	■		■	■	■	■	■	■	■	■	■	■	■
Valves*		■	■	■				■	■	■	■	■	■	■	■
Flange		■													
gaskets	■		■	■	■										

**** For details on which valve (ball, butterfly, diaphragm etc. …) please contact GF database**

3. Pipes

Pipes are made of **PVC-U** and processed according to the quality specifications and dimensions according to EN ISO 15493. Pipe formulation has been designed for an

enhanced chemical resistance (content of $CaCO_3$ < 3%), enhanced thermo stabilizer package etc.

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

OD-tolerances surpass the requirements of ISO 15493 and are compatible with the fitting programme of GF Piping Systems for easy pre-assembly and minimized gaps.

For highly demanding applications in the chemical industry, the application of pressure rating SDR 9 pipes and PN 16 fittings is strongly recommended for OD ≤ 110 mm.

Any installation should follow the GF Piping Systems installation guidelines for industrial piping and the guidelines issued by the DVS.

Approved pipes comply with the corresponding quality specifications of DIN Certco ZP 1.1.1.

4. Fittings

All **PVC-U** fittings shall be metric sizes manufactured by GF Piping Systems, and shall be of a type suitable for solvent cementing, with dimensions and tolerances in accordance with EN 1452-1 & 3 and EN ISO 15493. All the requirements of those standards must be fulfilled. All threaded connections shall have pipe threads in accordance with the requirements of ISO 7-1.

4.1 PRO-FIT Fittings in PVC-U

All PRO-FIT fittings (elbows 45 ° and 90 °, tee equal, reducing bushes, and unions) shall be metric sizes from d 20-63 mm in **PVC-U** as manufactured by GF Piping Systems. The PRO-FIT fittings shall have a 45° marking as well as integrated marking for vertical mounting and a spigot-socket design, reducing bushes shall offer the possibility of a spigot and cemented socket connection on each side of the fitting as manufactured by GF Piping Systems.

4.2 Packaging and Labelling

The packaging must ensure that the fittings are not damaged during transportation.

Packaging and labelling must meet the following requirements:

- Identification of the content, in type, quantity and product details
- Information about standards and approvals covered by the product
- Content of the label has to accomplish legal requirements
- Labels must be EAN coded for automatic identification
- Comply to GF standards as well as to international standards such as ISPM 15

5. Accessories

5.2.1 Flanges

Backing flanges in metric sizes DN 15-400 mm shall be designed according to EN ISO 15493, 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 Piping Systems. 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; Bolt circle diameter PN 10; Inch: ANSI B 16.5, BS 1560; class 150.
Alternatively the backing flanges in metric sizes can be from or unplasticised polyvinyl chloride, **PVC-U** designed according to EN ISO 15493, in a thermo plastic-oriented design. The backing flanges shall be marked with dimension, PN-value, standards, brand and lot number. Connecting dimensions metric according to ISO 7005, EN 1092; Bolt circle diameter PN 10; Inch: ANSI B 16.5, BS 1560; class 150.

5.2.2 Gaskets

Gaskets in metric sizes DN10 – 300 shall consist of elastomeric material according to EN681, designed with or without metal reinforcement for use with solvent cementable flange adaptors according to EN ISO 15493. Gaskets with reinforcement shall be designed to be centred by the outer diameter. Gaskets with reinforcement shall provide fixation aids to fit on the flange bolts.

5.2.3 Pipe Support System

Pipe Support System shall be KLIP-IT, sizes d10-400 mm, supplied by GF Piping Systems. The product range includes two different types of pipe clamps, type 060 and type 061. Type 60 is available for d90 – d400 and shall be made of PP. Type 061 is available for d10 – d160 and shall be made of PP or PE. Pipe clamps bigger than d40 shall be equipped with a security bow to secure the pipe.

6. Valves

All **PVC-U** valves shall be metric sizes manufactured by GF Piping Systems or equal in accordance with EN ISO 16135, 16136 (butterfly valves), 16137 (check valves), 16138, tested according to the same standard.

6.1. Ball Valves

All **PVC-U** ball valves with metric sizes DN 10 - 100 mm, shall be GF Piping Systems Type 546 with true double union design manufactured by GF Piping Systems in accordance with EN ISO 16135 (16136 butterfly valves, 16137 check valves etc). Incorporated into its design shall be a safety stem with a predetermined breaking point above the upper 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 bushes shall have 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

6.1.1. Electrically Actuated Ball Valves

Electric actuators shall be Types EA11 (sizes DN 10-50 mm), EA21 (sizes DN10-50 mm), EA31 (sizes DN 65-100 mm) shall be available manufactured by GF Piping Systems in accordance with EN 61010-1, EC directives 2004/108/EC (EMC) and 2006/95/EC, LVD 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, NAMUR
- AS Interface Plug Module

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 cycles ED at 20°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

6.1.2. Pneumatically Actuated Ball Valves

Pneumatic actuators shall be GF Piping Systems Types PA11 (for valve sizes DN 15-25 mm) and PA21 (for valve sizes DN 32-50 mm). They shall be manufactured by GF Piping Systems. 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 Piping Systems.

- For valve size DN 65 mm pneumatic actuators shall be Type PA 30 (fail safe to close or open function), Type PA35 (double acting function).
- For valve size DN 80 mm pneumatic actuators shall be Type PA 40 (fail safe to close or open function), Type PA40 (double acting function).
- For valve size DN 100 mm pneumatic actuators shall be Type PA 45 (fail safe to close or open function), Type PA45 (double acting function)

Pneumatic actuators shall have an integrated optical position indicator. Actuator housing shall be made of hardened 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, 230VAC
- Positioner Type DSR 500-3
- Limit switch kits Ag-Ni, Au, NPN, PNP
- Stroke limiter
- Manual override for all sizes up to d 110 mm
- AS Interface control module with incorporated position feedback and a solenoid pilot valve

6.2 Diaphragm Valves

6.2.1 Manual Diaphragm Valves

6.2.1.1 Diaphragm Valves d20 to d63

All **PVC-U** diaphragm Valves, metric sized from d20 to d63, shall be either:

- Type 514 (true double union design, DN15 to 50), or
- Type 515 (spigot design, DN15 to 50), or
- Type 517 (flange design, DN15 to 50)

All diaphragm Valves shall be manufactured by GF Piping Systems in accordance with EN ISO 16138. The upper body shall be PPGF (polypropylene glass fibre reinforced) connected to the lower body with a central union avoiding exposed screws.
A two colored position indicator integrated into the hand wheel must be present to determine diaphragm position. The hand wheel shall have an integrated locking mechanism.

Diaphragms are to be EPDM, FPM, NBR, PTFE with EPDM or FOM supporting diaphragm. Following options shall be available:

- PN16 pressure rating
- Electrical feedback unit with either AgNi or AU contacts
- Pressure proof housing

The diaphragm valve shall have following KV values:

d [mm]	DN [mm]	KV [l/min @ ΔP=1 bar]
20	15	125
25	20	271
32	25	481
40	32	759
50	40	1263
63	50	1728

6.2.1.2 Diaphragm Valves d75 to d160

All **PVC-U** diaphragm valves, metric sized, shall be Type 317 (flanged design, DN 65-150). All diaphragm valves shall be manufactured by GF Piping Systems in accordance with EN ISO 16138. The 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, or PTFE with EPDM or FPM supporting diaphragm.

6.2.2 Pneumatic Diaphragm Valves

6.2.2.1 Pneumatic Diaphragm Valves d20 to d63

All **PVC-U** diaphragm Valves, metric sized from d20 to d63, shall be either:

- true double union design, DN15 to 50, or
- spigot design, DN15 to 50, or
- flange design, DN15 to 50

All diaphragm Valves shall be manufactured by GF Piping Systems in accordance with EN ISO 16138. The upper body shall be connected to the lower body with a central union avoiding exposed screws.
Diaphragms are to be EPDM, FPM, NBR, PTFE with EPDM or FOM supporting diaphragm. Following options shall be available:

The diaphragm valve shall have following KV values:

d [mm]	DN [mm]	KV [l/min @ ΔP=1 bar]
20	15	125
25	20	271
32	25	481
40	32	759
50	40	1263 (960*)
63	50	1728 (1181*)

*DIASTAR Six

Pneumatic actuators shall be GF Piping Systems Type DIASTAR and shall be available as

- DIASTAR Six for PN up to 6 bar,
- DIASTAR Ten for PN up to 10 bar,
- DIATARR TenPlus of PN up to 10 bar both sides,
- DIASTAR Sixteen for PN up to 16 bar

The mode of operation shall be fail safe close (FC), fail safe open (FO) and double acting (DA). The valves shall have an integrated optical position indicator. Actuator housing shall be made of PPGF (polypropylene glass fibre reinforced). Actuators with FC mode shall contain a preloaded galvanised steel spring assembly to ensure safe actuator operation and maintenance. The actuator DIASTAR Ten, DIASTAR TenPlus and DIASTAR Sixteen shall have following accessories available:

- Solenoid pilot valve remote or direct mounted in voltages 24VDC/AC, 110VAC, 230VAC
- Positioner Type DSR 500-1
- Feedback with following limit switches Ag-Ni, Au, NPN, PNP, NAMUR
- Stroke limiter & emergency manual override
- ASI controller

6.2.2 pneumatic Diaphragm Valves d75 to d160

All **PVC-U** diaphragm valves, metric sized, shall be flanged design, DN 65-150
All diaphragm valves shall be manufactured by GF Piping Systems in accordance with EN ISO 16138. The upper body shall be connected to the lower body with exposed stainless steel bolts. Diaphragms are to be EPDM, FPM, NBR, or PTFE with EPDM or FPM supporting diaphragm.
Pneumatic diaphragm actuators shall be GF Piping Systems Type DIASTAR Type 025. The mode of operation shall be fail safe close (FC), fail safe open (FO) and double acting (DA). The valves shall have an integrated optical position indicator. Actuator housing shall be made of PPGF (polypropylene glass fibre reinforced). Actuators with FC mode shall contain a preloaded galvanised steel spring assembly to ensure safe actuator operation and maintenance. The actuator DIASTAR 025 shall have following accessories available:

- Solenoid pilot valve remote or direct mounted in voltages 24VDC/AC, 110VAC, 230VAC
- Positioner Type DSR 500-2
- Feedback with following limit switches Ag-Ni, Au, NPN, PNP, NAMUR
- Stroke limiter & emergency manual override
- ASI Controller

6.3. Butterfly Valves

All **PVC-U** butterfly valves, metric sizes DN 50 (2") – 400 (16") mm, shall be GF Piping Systems Type 567/568 wafer/lug type with a double eccentric disc design manufactured by GF Piping Systems 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 exposed at any angle between 0° und 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. Optional the valves can be actuated by gear box with hand wheel. The electric position indicator shall be integrated into the mounting flange. Butterfly valves shall have low actuation torque to enable easy operation. All butterfly valves Type 567 manufactured by GF Piping Systems are designed for a nominal pressure rate of 10 bar. All butterfly valves Type 563 are designed for a nominal pressure rate of 4 bar.

6.3.1. Electrically Actuated Butterfly Valves

Electric actuators shall be GF Piping Systems Types EA31 or EA 42 dependent on valve size. They shall be manufactured by GF Piping Systems 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 feature 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
- Manual override
- AS-Interface Plug Modul

6.3.2. Pneumatically Actuated Butterfly Valves

Pneumatic actuators shall be GF Piping Systems Types PA 35 (metric sizes DN 50-65 mm), PA40 (metric size DN 80 mm only), PA45 (metric size DN 100 -125 mm), PA55 (metric size DN 150-200 mm), PA60 (metric sizes DN 200mm FC), PA65 (metric sizes DN 250 mm FC) PA70 (metric sizes DN 300 mm FC). They shall be supplied by GF Piping Systems. 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 hardened anodized aluminium. Actuators shall contain integrated Namur interfaces for the easy mounting of positioners, limit switches and accessories. All pneumatically actuated butterfly valves shall have the following accessories available:

- Solenoid pilot valve remote or direct mounted in voltages 24VDC/AC, 110VAC, 230VAC
- Positioner Type DSR 100/101
- Feedback with following limit switches Ag-Ni, Au, NPN, PNP, NAMUR
- Stroke limiter & emergency manual override
- ASI-controller

6.4 Angle Seat Valves

All **PVC-U** Angle Seat Valves, Type 300 shall be manufactured by GF Piping Systems according to EN ISO 21787 and overall length according to EN 558, available in metric sizes DN10-80 mm, with an internal piston cone end in PE or PTFE, and solvent cement spigots. The Angle Seat valves manufactured by GF Piping Systems are designed for a nominal pressure rate of 10 bar.

6.5. Check Valves

All **PVC-U** Cone check valves, according to EN ISO 16137, metric sizes DN 10-100 mm metric, shall be Type 561/562 true double union design. Seals shall be EPDM or FPM. Union bushes 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 and horizontal position. Type 562 shall be equipped with a spring made of stainless steel (V2A) to allow position independent installation. The valves are designed for a nominal pressure of 16 bar.

6.5.1. Angle Seat Check Valves

All **PVC-U** Angle Seat Check Valves, Type 303 shall be manufactured by GF Piping Systems according to EN ISO 16137 and overall length according to EN 558-1, available in metric sizes DN 10-80 mm with EPDM or FPM seals and with solvent cement spigots. The Angle Seat Check Valves shall be leakproof from a water column of 2 m for EPDM and 3 m for FPM seals as supplied by GF Piping Systems. The Angle Seat Check valves manufactured by GF Piping Systems are designed for a nominal pressure rate of 10 bar.

6.5.2. Wafer Check Valves

All **PVC-U** Wafer Check Valves shall be GF Piping Systems Type 369, metric size DN 32-300 mm. The minimum water column of 2 m is required for sealing. They have to be equipped with a spring (either in 316 stainless steel or Hasteloy C) guaranteeing closing in all installation positions. Attention: A stabilizing pipe zone of at least 5 times nominal diameter (DN) (recommended 10 times nominal diameter) before and after the wafer check valve should be provided.

6.6. Pressure Regulating Valves

All **PVC-U** pressure regulating valves as supplied by GF Piping Systems 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 bar
- DN 100 from 0 up to max. 4 bar

6.6.1. The Pressure Reducing Valve

as supplied by GF Piping Systems reduces the pressure within the system to a pre-set value. By using the differential pressure, the pressure reducing valve adjusts itself to the set working pressure. The outlet pressure (working pressure) is not directly related to the inlet pressure. If the outlet pressure increases above the set value, the diaphragm is lifted against the spring force. If the outlet pressure falls below the set value, the diaphragm is pressed down by the spring force. The pressure reducing valve begins to close/open until a state of equilibrium is re-established; in other words, the outlet pressure remains constant irrespective of an increasing or decreasing inlet pressure. Following types and sizes are available:

- Type V82, compact Pressure Reducing Valve with an integrated manometer, sizes DN 10 -100 mm
- Type V182, compact Pressure Reducing Valve offering easy adjustment and real time visual control of the actual pressure reduction on the integrated manometer, sizes DN 10-40 mm
- Type V782, compact Pressure Reducing Valve, offering an easy adjustment, excellent flow rate and very low hysteresis, sizes DN 10-40 mm

6.6.2. Pressure Relief Valve

as supplied by GF Piping Systems serves to keep the working or system pressures constant, to balance out pressure pulsation, and to reduce pressure peaks in process systems. The third pipe spigot fitted on the valve body means the valve can be installed directly in the main pipeline. If the inlet pressure rises above the set value, the pressurized valve piston is lifted against the spring force. Consequently, the valve opens and there is a reduction of pressure in the outlet pipe. The excess pressure can exhaust or be redirected via the third outlet. The valve closes as soon as the inlet

pressure sinks below the pre-set spring tension. Following types and sizes are available:

- Type V185, Pressure Relief Valve, sizes DN 10-50 mm
- Type V85, Pressure Relief Valve, sizes DN 65 -100 mm

6.6.3. The Pressure Retaining Valve

as supplied by GF Piping Systems serves to keep the working or system related pressures constant, to balance out pressure pulsation, and to reduce pressure peaks in chemical process systems. If the inlet pressure rises above the set value, the pressurized valve piston is lifted against the spring force. Consequently, the valve opens and there is a reduction of pressure through the outlet pipe. The valve closes as soon as the inlet pressure sinks below the pre-set spring tension. Following types and sizes are available:

- Type V186, Pressure Retaining Valve, sizes DN 10-50 mm
- Type V86, Pressure Retaining Valve, sizes DN 65-100 mm
- Type V786, Pressure Retaining Valve, sizes DN 10-40 mm

6.7 Direct-acting Solenoid Valves

Supplied by GF Piping Systems serves to regulate and control fluids, if no compressed air is available or not wanted. They are used for diverse functions, e.g. opening, shutting, dosing, distribute and mixing. The medium flow is switched directly by the armature moved by the magnetic force.

- Safety position shall be available

Following type and sizes are available:

- Type 157, sizes DN4-8
- Type 160/161, sizes DN10-20

6.8 Servo-assisted Solenoid Valves

Supplied by GF Piping Systems serves to regulate and control fluids, if no compressed air is available or not wanted. They are used for diverse functions, e.g. opening, shutting, dosing, distribute and mixing. Opening large orifices using the direct-acting method would require enormous and expensive coils. Servo assisted valves use the power of the fluid to open the flow channel by controlling a small pilot channel to alter the forces on a larger main seal. A Δp 0.5 bar is mandatory with servo-assisted valves.

- Type 165, sizes DN10-50

6.9 Ventilating- and Bleed Valves

All **PVC-U** Ventilating- and Bleed valves shall be GF Piping System type 591. Dimensions DN10-100 are with pressure rating PN16. They shall be equipped with a PP-H floater with density of 0,91 g/cm³.

6.10 Ventilating Valves

All **PVC-U** Ventilating Valves shall be GF Piping System type 595. Dimensions DN10-100 are with pressure rating PN16. They shall be equipped with plastic coated stainless steel spring with minimal opening pressure (10-80 mbar).

7. Solvent Cement & Cleaner

For adhesive jointings, **PVC-U** cement with gap-filling adhesives must be used for solvent cementing. GF recommends the Henkel cement system TANGIT **PVC-U** for all **PVC-U** solvent cement joints. All specifications are based on using TANGIT **PVC-U**, including strength and chemical resistance. For all other cements please refer to the manufacturers' instructions.

PVC-U TANGIT contains app. 20% **PVC-U**, dissolved in a blend of solvents. The solvents soften and macerate the edges of the surfaces they are applied to. Once the solvents have evaporated, they leave a homogenous joint with the same mechanical, thermic and chemical properties as of the **PVC-U** pipe system.

The jointing surfaces of pipe and fitting must be clean and free of grease. They must be cleaned with TANGIT cleaner.

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

8. Measurement & Control / 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	Tochnology	Compatible liquids (*)
Flow	Paddlewheel	clean liquids
	Rotameter	clean 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 in material, pressure and temperature (data sheet) and chemical resistance list

8.1 Sensors

The sensors listed hereafter will transfer the measured value to a GF Signet transmitter, to indicate the measured value and allowing simple calibration and maintenance of the devices. Alternatively the measured values of the sensors can be sent directly to a PLC, PC or other local made electronics using either an analogue signal (4-20 mA, open collector or sinusoidal voltage) or a digital signal called S3L (GF Signet proprietary serial signal).

8.1.1 Installation Fittings

Depending on the sensor type, special installation fittings shall be used for connection to the pipeline: Installation T-Fitting sizes d20-63 mm with double true union, Wafer fittings sizes d75 – 315 mm and weld on fittings (weld-o-let) sizes d75 – 630mm. Sensor thread connection for flow- and pH-sensors shall be 1 1/4 “ NPSM. For all further sensors standard adaptor sockets or nipples with ½", ¾" ISO, oder ¾" NPT thread shall be used.

8.1.2 Flow sensors

8.1.2.1 Paddlewheel sensors

515 and 525 sensors:

All sensors of this family are equipped with a frequency output. The signal shape is sinusoidal. This sensors require no external power source to produce a signal. Internal to the body of the sensor is a wire coil which when excited 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 each of the four paddles produces a sine wave signal as it passes the centre of the body (two paddles of the rotor produces a full AC sine wave). The sensors produce a signal output which is proportional to the flow velocity. A K-factor (number of pulses generated by the sensor per 1 liter or 1 gallon) is used to calculate the flow volume.

3-2536 and 3-2537 sensors:

All sensors of this family detect the movement of the paddlewheel with a Hall Effect element. They are equipped with an open collector frequency output, which generates a square-wave signal. The sensor is supplied with a voltage from the 3-8550 transmitters or an external power supply ranging from 5 to 24 volts. The sensor's rotor assembly has four paddles. Inserted in two of the paddles is a magnet. As the paddles pass the centre of the sensors body, the magnetic field switches the open collector output. Two pulses indicate a complete rotation (on/off cycle) of the paddle wheel. The pulse output is directly proportional to the fluid velocity. A K-factor (number of pulses generated by the sensor per 1 liter or 1 gallon) is used to calculate the flow volume.

8.1.2.2 Variable Area Flowmeters

Variable area flowmeters are radially installed dismountable meters for flow rate measuring in industrial piping applications. If needed, minimum or maximum flow can also be monitored via limit switches. Additionally, analogue flow measurement with a 4-20 mA Signal is possible.
The working principle of the variable area flowmeter is based in gravity and equilibrium of forces. If a medium flows upwards at a sufficient flow rate through the vertically mounted taper tube, the float is raised to the point at which a state of equilibrium sets in between the lifting force of the medium and the weight of the float. Since the mean rate of flow is proportional to the quantity flowing through per unit of time, this state of equilibrium corresponds to the measurement of the instantaneous flow rate.

Following types and sizes are available:

- Type SK, DN 10 – 65 mm
- Type 335, DN 25 – 65 mm
- Type 350, DN 25 – 65 mm

8.1.2.3 Magnetic Inductive Flowmeter (Magmeter)

The Magmeter of GF SIGNET consists of two metallic pins that produce a small magnetic field across the inside of the pipe. It measures the velocity of a conductive liquid (20 µS or greater) as it moves across the magnetic field. A voltage occurs on the sensor tips, which is directly proportional to the flow rate of the fluid. The magnetic signal is conditioned and translated in to a pulse signal. A K-factor (number of pulses generated by the sensor per 1 liter or 1 gallon) is used to calculate the flow volume. The Magmeter is offered as a blind output (frequency, 4-20 mA or digital S3L signal), or with integral display and control relays.

8.1.3 Level Sensor (hydrostatic)

Hydrostatic pressure is the pressure exerted by the weight of a column of fluid. Internal to the PVDF sensor body is a ceramic diaphragm sensor and capillary tube led to the ambient atmosphere. The ceramic diaphragm sensor exposed to the fluid senses the hydrostatic pressure of the fluid and compares the pressure to the

atmospheric pressure. As the hydrostatic level sensor senses the hydrostatic pressure of the fluid, are signal fluctuations reduced to a minimum. The level sensors are offered as a blind output 4-20 mA version, or with digital S3L output connected to the GF Signet transmitter unit.

8.1.4 pH Sensors

All GF Signet pH sensors are constructed commonly called combination electrodes. 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 value of the fluid. The reference cell is used to provide a stable reference signal. The pH signal is measured against a stable reference signal. The measured signals are conditioned and sent as a blind 4-20mA or as a digital S3L signal to a GF Signet Transmitter unit. All sensors are equipped with an integrated temperature compensation.

8.1.5 ORP Sensors

All ORP sensors from GF Signet are constructed similar to the pH sensors, except that a noble metal like platinum or gold replaces the silver chloride element of the measuring and reference cell of the pH electrode. Temperature compensation is not used in ORP measurements.

ORP is an abbreviation for Oxidation-Reduction Potential. Oxidation is a term used to denote the occurrence of a molecule losing an electron. Reduction occurs as a molecule gains an electron. The “potential” is simply an indication of a solution’s propensity to contribute or accept electrons. ORP reactions (sometimes referred to as REDOX) always take place simultaneously. There is never oxidation without reduction, and ORP electrodes are used to detect electrons exchanged by molecules as these reactions occur.
The measured signals are conditioned and sent as a blind 4-20mA or as a digital S3L signal to the GF Signet transmitter unit.

8.1.6 Conductivity Sensors

All Conductivity sensors from GF Signet are manufactured using two stainless steel electrodes. Alternative materials are available in case of chemical incompatibility. Conductivity sensors measure the ability of a fluid to conduct an electrical current between two electrodes.

Most conductivity electrodes consist of two measuring half-cells. Depending on the measuring range the electrodes vary in length and area, to provide highly accurate measurements over a specific conductivity range. Cell constants help to describe electrode geometry for the purpose of selecting the appropriate electrode for a given application. A cell constant is defined as the distance between the two half cells divided by the area of the cells. All conductivity sensors have a temperature compensation circuits in order to increase the sensors accuracy.
The measured signals are conditioned and sent as a blind 4-20 mA or as a digital S3L signal to the GF Signet Transmitter unit.

8.2 Transmitters

The GF Signet 9900 Transmitter provides a single channel interface for many different parameters including Flow, pH/ORP, Conductivity, Resistivity, Salinity, Pressure, Temperature, Level and other sensors that are equipped with an 4-20 mA signal output. The display shows separate lines for units, main and secondary measurements. A dial-type digital bar graph indicates values even from distance clearly visible.

The 9900 transmitter is offered in both panel or field mount versions. Both configurations can run on 12 to 32 VDC power (24 VDC nominal). The 9900 can also be loop powered with compatible sensors.

Designed for complete flexibility, plug-in modules allow to adapt the unit easily to meet changing customer needs. Optional modules include relay, direct Conductivity/Resistivity, HART- as well as a PC communication interface.

- 1 sensor input (Flow, pH/ORP, Conductivity/Resistivity, Salinity, Pressure, Temperature, Level and other sensors that output a 4-20mA signal, Signet 8058 i-Go™ Signal Converter required)
- 1 analogue output (4-20mA)
- 1 Open Collector output
- Optional relay module with 2 Dry Contact Relay SPDT
- Power supply 12-32 VDC

8.3 Multi-Parameter Controller

The GF Signet 8900 Multi-Parameter Controller takes the concept of modularity. Each 8900 is field commissioned with the users specified combination of inputs and outputs using simple-to-install modular boards into the base unit. Configure the system by selecting either two, four or six input channels which accept any of the GF Signet sensors listed below, and/or other manufacturer's sensors via 4-20 mA signal converter (Model 8058). To complete the unit, power modules with a universal AC line voltage or 12 to 24 VDC are available.

Derived measurements include difference, sum, ratio, percent recovery (reverse osmois), percent rejection (reverse osmois), percent passage (reverse osmois) and BTU (thermal energy). The menu can be displayed the languages Englisch, German, French, Spanish, Italian and Portuguese.

- 2, 4 or 6 sensor inputs (Flow, Level, pH-ORP, Conductivity, Pressure, Temperature)
- 0, 2 or 4 analog outputs (4-20 mA or 0-10 Volts)
- 0, 2, 4, 6 or 8 relay outputs
- Power supply 12-30 VDC or 110-230 VAC

8.4 Batch Controller

The GF Signet 5600 Batch Controller allows batching a pre-selected quantity of liquid. After selection of the quantity to be dosed, the batching process may be started via

integrated keys or via remote cable connection. The batch controller will energize a valve and/or switch on a pump. The batch controller count the pulses coming from any flow sensor with frequency output and stop the batch process as the pre-selected quantity is reached. Advanced features include a user-set security code, an automatic calibration option and overrun compensation.

9. Quality

9.1 Production Conditions

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

9.2 Marking

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

- Manufacturer's name or trade mark
- Production lot number
- Material
- Dimension
- Pressure rating

9.3 Uniformity

Pipes, fittings, valves, solvent cement and cleaner shall be supplied from one manufacturer, namely GF Piping Systems, to ensure correct and proper jointing between components and uniform chemical and physical properties of the piping system.

9.4 CAD Library

All components shall be available in an online CAD Library.

9.5 Training, Certification and Installation

Site personnel, involved with **PVC-U** 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 Piping Systems support under

Phone: +41 52 631 11 11 or
e-mail: info.ps@georgfischer.com
www.piping.georgfischer.com.