SYGEF® PVDF

Product Range Export 1.11.2006

+GF+

GEORG FISCHER
PIPING SYSTEMS

List of Abbreviations

AL	Number of bolt holes
ANSI	American National Standard Institute
d	Pipe outside diameter
DIN	Deutsche Industrie-Normen
DN	Nominal bore
e	Wall thickness
EPDM	Ethylene Propylene Rubber
FPM	Fluorine Rubber, e.g. Viton®
g	Weight in grams
G	Pipe thread, not pressure tight in the thread to ISO 288
HP	High Purity
HTR	High Temperature Resistant
ISO	International Standardization Organisation
NBR	Nitrile Rubber
NPT	Taper male thread pressure tight in the thread to ANSI B 1.20.1
PBTP	Polybutylene therephthalate
PN	Nominal pressure at 20°C, water
PP	Polypropylene, heat stabilised
PTFE	Polytetrafluorethylene, e.g. Teflon®
PVDF	Polyvinylidene fluoride
R	Taper male thread, pressure tight in the thread to ISO 7
Rp	Parallel female thread, pressure tight in the thread to ISO 7
®	Registered trade-mark
s	A/F
SC	Size of hexagon bolts
SDR	Standard Dimension Ratio
SP	Standard pack. The figure given indicates the quantity of fittings contained in a standard pack
St	Steel
™	Trade-mark
Tr	Trapezoid thread

General Information

Dimensions
All dimensions are given in mm and are intended as nominal or average sizes. Subject to alteration resulting from modifications in design.

Orders

Always quote the Georg Fischer code number when placing orders.

Ordering example

Pipe	d32	PVDF HP	175 481 669
Elbow 45°	d140	PVDF Standard	735 158 516

SYGEF® is a registered trade-mark for Georg Fischer plastic piping systems as well as the system-oriented fusion machines.

Detailed technical information is given in our handbook «Planning Fundamentals» and also available under www. piping.georgfischer.com

Content – Fluoropolymers Product Range 2007

GF Piping Systems quality is no coincidence!

GF Piping systems has not only taken a pioneering role in the past for the range of PVC fittings and equipment, but also in the sector of fusible plastics.
GF Piping Systems developed the socket fusion jointing process 30 years ago, and in later years also the BCF® and IR-Plus® fusion methods. More than 9 million IR & BCF fusion joints in the past 15 years world-wide has proven GF Piping Systems performance in jointing technology.

GF Piping Systems jointing technology for fluoropolymers

Jointing Method	SYGEF-Plus	SYGEF-Standard	SYGEF-Exhaust	SYGEF-PFA	FUSEAL 25/50
Heated Element Socket Fusion	-	X	-	-	-
Heated Element Butt Fusion	X[1]	X	-	-	X[2]
Infrared (IR-Plus®) Fusion	X	X	-	X[2]	-
Bead-and-Crevice-Free (BCF®) Fusion	X	X	-	-	-
Electrofusion with Integral Heating	-	-	-	-	X
Hot Air / Hot Gas Manual Fusion	X	X	X	X	X
Mechanical Jointing	X	X	X	X	X

X = Standard range X[1] = Technically possible, but not recommended
X[2] = On request only - = Not available

Hot Air / Hot Gas Manual Fusion is the standard jointing method for SYGEF-Exhaust, however it can be implemented on other systems as a repair method &/or for the processing of semifinished materials.

Component selection basis

SYGEF-Plus and SYGEF-Standard are system products, pipes and fittings are matched to each other, when selecting SYGEF PVDF fusion components to produce a system; the only consideration needs to be the fusion dimension; PN16 or PN10.

Mechanical joints such as flanges & threaded components are available in various industry standards:

- Flange connections to EN ISO 1092 or ANSI B16.5 #150 (JIS available on request)
- Threaded connections to ISO 7/1 & 228/1 (BSP) or NPT (JIS Rc available on request)
- Sanitary clamp connections to all standards worldwide
- Union connections to GF specification

Design Factors and derived operating pressures

In various standards for PVDF we find design factors (formerly called safety factors) stated, these are for water.
They are lower than the design factors recommended by GF Piping Systems for industrial applications. In order to protect human beings and the environment, those safety factors cannot be applied for industrial applications. We therefore recommend to use safety factors for SYGEF® piping systems as published in the following graph, for the calculation of piping system pressures for industrial applications.
For chemical applications, special considerations must be taken in determining appropriate safety factors, please consult GF for further information.

Size comparison – SS Tube to PVDF Pipe

DN, d, inch, nominal bore, o.d. – which is which?

Plastic piping in Inch sizes is typically sized on the nominal bore (DN) which is designated in inches. The outside diameter is fixed but is not mentioned.

Metric piping systems are sized on their outside diameter, with occasional mention of the DN size, when referring to valves or flanges.

Existing comparisons of metric sized pipes to Inch sizes pipes are well known, and generally the variation between Inch and Metric sizes (OD & ID) for the same DN is only a few millimetres.

e.g. The closest size to 1" Sch80 is d32 Metric, with both pipes being "DN25"

However, the sizing for SS tubes is often based on the outside diameter, and this does lead to some confusion. The table below demonstrates which PVDF size pipe is the closest match to SS Tubes in Inch & DIN, and to IPS / BS Inch pipe.

SS Tube Inch	SS Tube ISO/DIN	PVDF Pipe	IPS / BS Pipe
¾"	DN20	d20	½"
1"	DN25	d25	¾"
1½"[A]	DN32	d32	1"
1½"	DN40	d40	1¼"
2"	DN50	d50	1½"
2½"	DN65	d63	2"
3"	DN80	d75	2½"
4"[B]	DN100[B]	d90	3"
		d110	4"
5"	DN125	d125[C] / d140[C]	5"
6"	DN150	d160	6"
8"	-	d200	-
-	DN200	d200 or d225	8"

A = There is no 1¼" SS Tube Size in Inch dimensions; 3A, ASME-BPE or BS
B = 4" & DN100 SS Tube could transitioned to either d110 or d90 PVDF
C = 5" & DN125 Tube is closest to d125 PVDF, 5" IPS/BS is closest to d140 PVDF

8" SS tube is equivalent to d200 PVDF – DN200 SS Tube could be transitioned to either d200 or d225 PVDF

Further examples of this size comparison can be seen in the SYGEF-Plus Sanitary Clamp adaptors for transition to SS Tubes. As a "rule of thumb", the DN value of SS tube should be matched to the d value of PVDF pipe, but there are some exceptions depending upon which standard of SS Tube is employed.

→ In short, DN value is often not a clear indication of the required dimension.

SYGEF® PVDF General Information

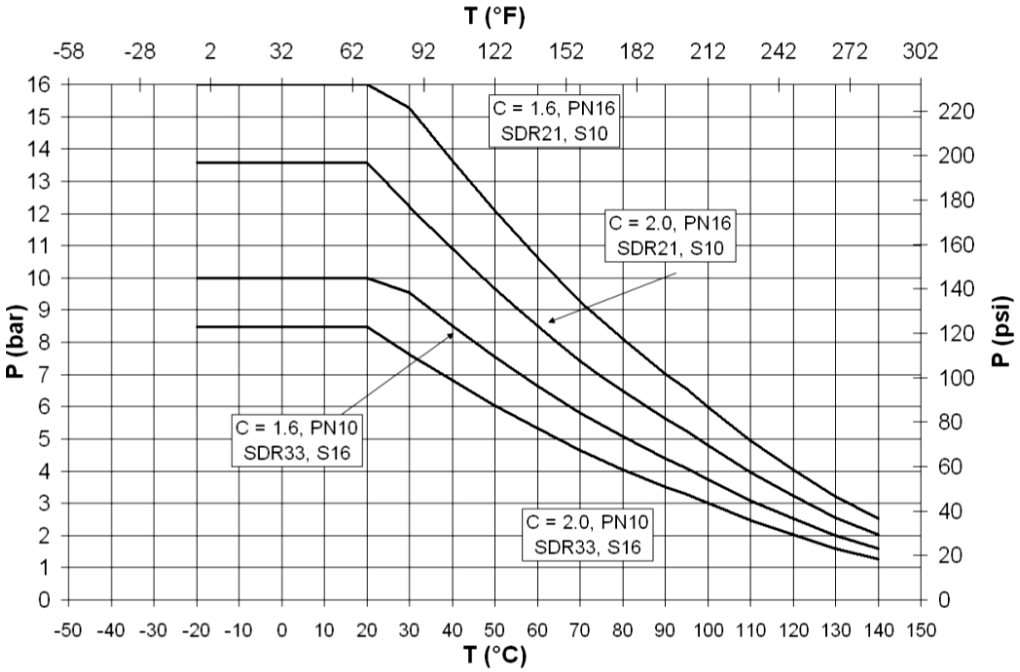
- **Standard and High-Purity Pipes**
- **Socket Fusion System**
- **Butt Fusion (IR/BCF) System**
- **High-Purity Butt Fusion (IR/BCF) System**

SYGEF® Polyvinylidenefluoride (PVDF) virgin fluoropolymer

PVDF is a thermoplastic fluoropolymer with a melt point of 178°C and a wide service temperature range from –40°C to 140°C. The PVDF polymer chain is very linear and similar to PTFE Teflon® except it is not fully fluorinated and contains 3% hydrogen by weight. PVDF materials are ideal for use in aggressive chemical or ultrapure water systems since they are basically inert, have hard high strength, and are readily weldable into system components. PVDF raw material is commonly available under the trade names Kynar®, supplied by Arkema Chemicals, and Solef®, supplied by Solvay Fluoropolymers.

Application limit of SYGEF pipes and fittings

(25-year values with design factor C included in the calculation = 2.0 & 1.6)



P Pressure in Bar, PSI
T Temperature in °C, °F

Dedicated Fluoropolymer Production

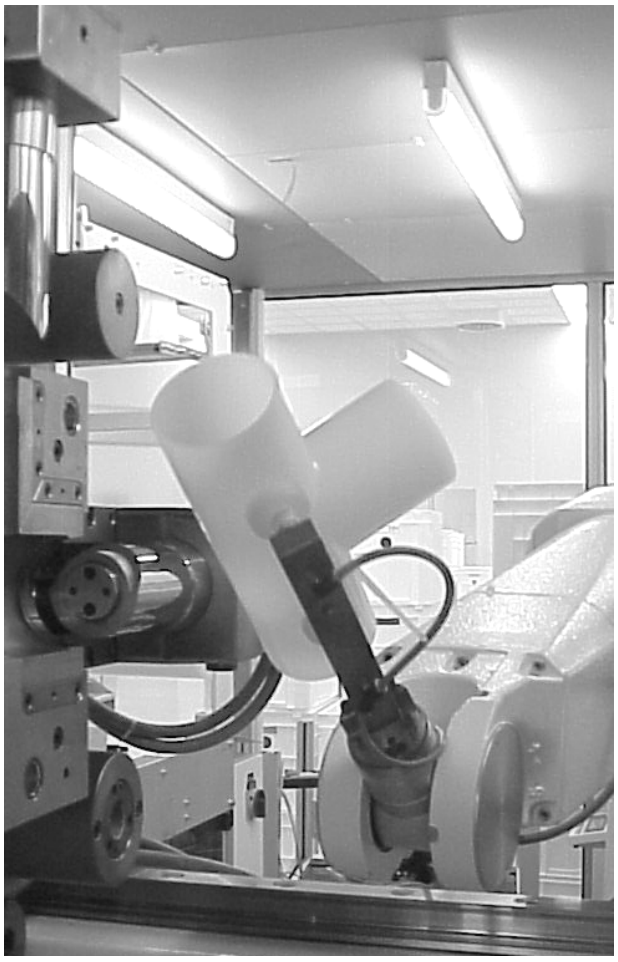
GF Piping Systems produces SYGEF® PVDF piping system components under cleanroom conditions in our state of the art high purity manufacturing facilities in Switzerland and Germany. The entire production process is designed, dedicated and operated to produce high quality PVDF components in both Standard and High-Purity grades. GF IR-Plus™ & BCF®Plus fusion technologies are substantial improvements over existing jointing methods such as contact butt fusion and socket fusion.

Completing the system are SYGEF® PVDF butt fusion fittings and valves specifically designed for use with IR-63 Plus, IR-225 Plus and IR-315 Plus fusion machines, and the BCF-Plus "Bead-&-Crevice-Free" Fusion machine.

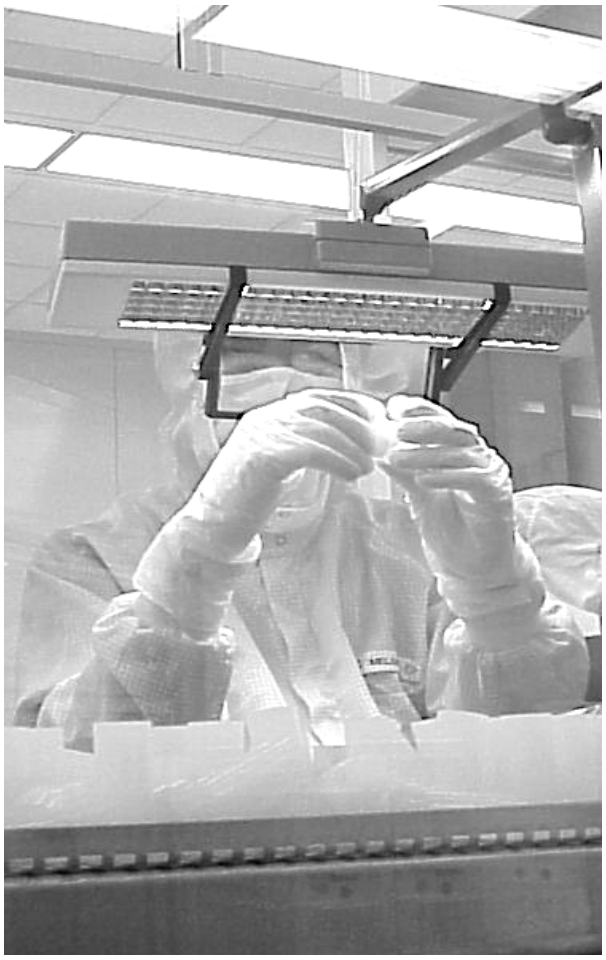
For less demanding applications, GF also offers a comprehensive range of Fittings and Valves for Socket Fusion jointing up to the dimension d63.

GF Piping Systems Fluoropolymer Production – Ettenheim, Germany

Extrusion of Pipes & Tubes d16 – d400



Injection Moulding



100% Visual Inspection

SYGEF® Standard

SYGEF® Standard – Product Specification

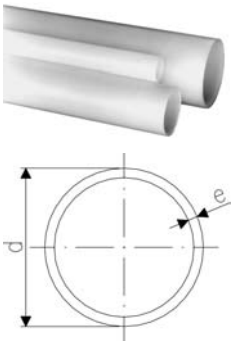
Material Colour Density Surface tension Linear expansion coefficient E-module (tensile strength) Thermal conductivity Surface resistivity	Polyvinylidene fluoride (PVDF) translucent ~1.78 g/cm^3 (ISO 1183 / ASTM D 792) 30–35 mJ/m^2 0.12–0.18 mm/mK (DIN 53752) 2100 N/mm^2 (ISO 527/ASTM D 790) 0.19 W/mK (DIN 52612) 5 x 10^{14} Ωcm (IEC 60093)
Dimension	d 20 (½")–d 225 (8") in accordance to ISO 10931
Pressure rating	Pipes/fittings: PN 16 (d 20–d 225), PN 10 (d 90–d 225) Valves: separate specification
Temperature rating	from –20 °C to 140 °C (-4 °F–284 °F)
Production	Fittings/valves: injection moulded Pipes: extruded Valves: injection moulded (additional available oil free treated and paint compatible / silicon free)
Surface finish	Inner surface Ra ≤ 0.5 µm (20 µin) for injection moulded and extruded components
Marking	All components are embossed with a permanent identification during the production process to ensure full traceability. Lot No Material Dimension Pressure Rating
Testing and inspection (ISO 10931)	Inclusions Visual inspection Surface finish Dimension tolerance Pressure testing
Approvals/conformance[1]	ASME BPE FDA CFR 21 177.2510 USP 25 class VI (physiological non-toxic)
Welding technology	BCF® Plus, bead and crevice free fusion, size d 20 (½")–d 110 (4") IR® Plus, infrared fusion (DVS 2207-6), size d 20 (½")–d 225 (8") BF, butt fusion (DVS 2207-15)
Documentation[2]	Certificate of Conformance with FDA, USP EN 10204 2.2 EN 10204 3.1b
Packing[3]	Multiple components single bagged in specified bag
Labeling	Brand Name Product Description Code Number Material Dimension CE-labeling
Main applications	Uses include delivery of pharmaceutical grade purified water (PW) and DI water, using hot water, steam chemical or ozone sanitisation. Due to its excellent chemical resistance it is widely used in chemical distribution systems.

[1] For thermoplastic material only
[2] on request
[3] not for socket fusion products

Pipes

75 48 02 Pipe, PN 16, PVDF-Standard

H

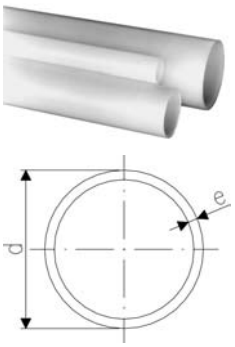


PF 2 35 188

d [mm]	PN	Code	e [mm]	Weight [kg/m]	Length [m]
16	16	**175 480 202**	1.9	0.171	5.00
20	16	**175 480 203**	1.9	0.209	5.00
25	16	**175 480 204**	1.9	0.278	5.00
32	16	**175 480 205**	2.4	0.425	5.00
40	16	**175 480 206**	2.4	0.550	5.00
50	16	**175 480 207**	3.0	0.835	5.00
63	16	**175 480 208**	3.0	1.080	5.00
75	16	**175 480 209**	3.6	1.519	5.00
90	16	**175 480 210**	4.3	2.232	5.00
110	16	**175 480 211**	5.3	3.336	5.00
140	16	**175 480 213**	6.7	5.310	5.00
160	16	**175 480 214**	7.7	6.960	5.00
200	16	**175 480 216**	9.6	10.800	5.00
225	16	**175 480 217**	10.8	13.700	5.00

75 48 06 Pipe, PN 10, PVDF-Standard

H



PF 2 35 188

d [mm]	PN	Code	e [mm]	Weight [kg/m]	Length [m]
90	10	**175 480 665**	2.8	1.565	5.00
110	10	**175 480 666**	3.4	2.140	5.00
125	10	**175 480 667**	3.9	2.800	5.00
140	10	**175 480 673**	4.3	3.710	5.00
160	10	**175 480 668**	4.9	4.657	5.00
200	10	**175 480 669**	6.2	6.916	5.00
225	10	**175 480 670**	6.9	9.162	5.00
250	10	**175 480 671**	7.7	11.100	5.00
280	10	**175 480 656**	8.6	13.900	5.00
315	10	**175 480 674**	9.7	17.600	5.00