# Life Science
# Water Cycles

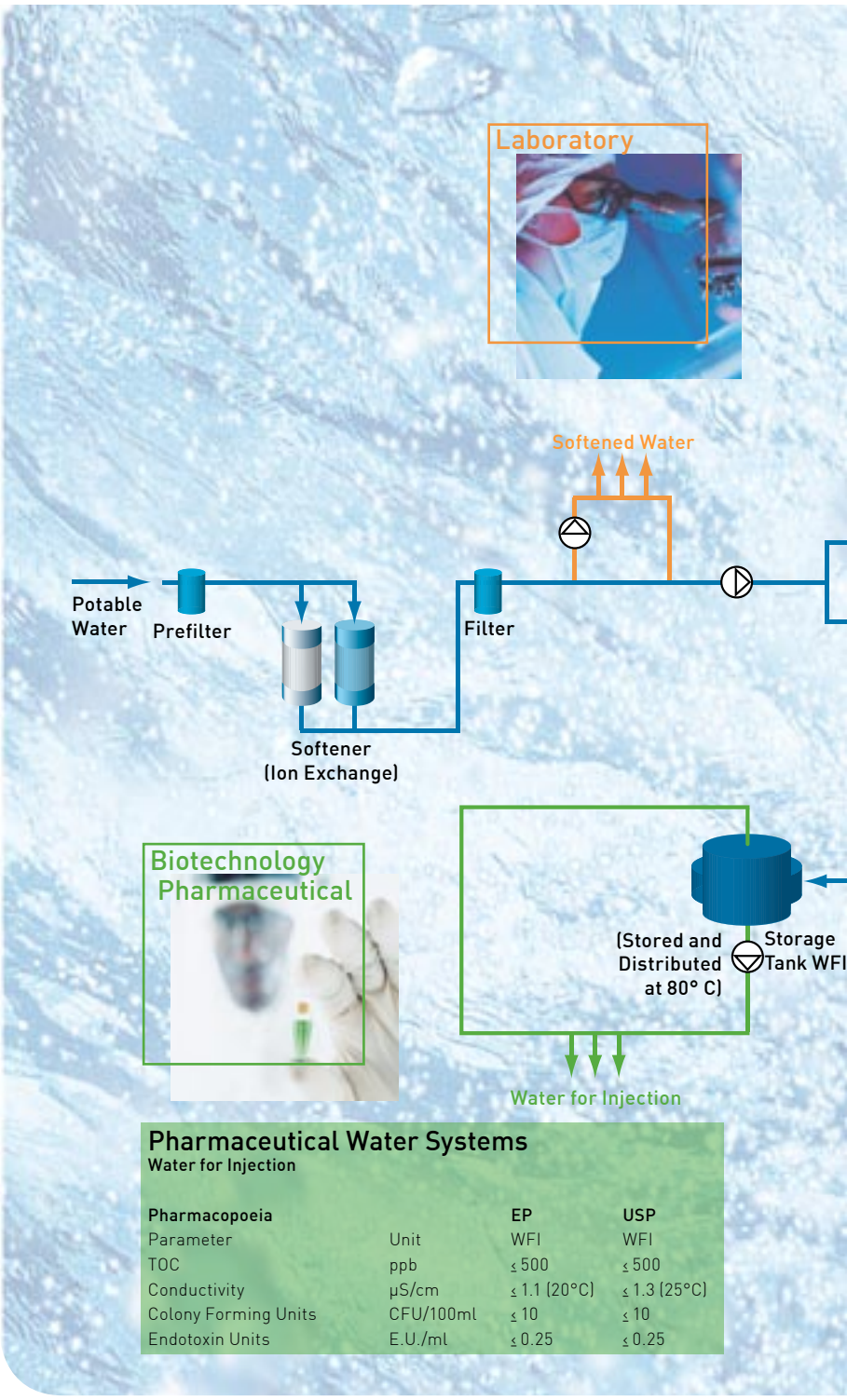
## Your applications
## → our systems

+GF+

GEORG FISCHER
PIPING SYSTEMS

Your benefits at a glance

- Better water quality
  Corrosion problems, as found with metal, are not an issue with our solutions.
- Fast and easy installation
  Perfectly adapted components and jointing technologies reduce installation time.
- Sanitary pipelines
  The smooth, hydrophobic surfaces in our pipes and joints minimize biofilm growth.
  TOC, bacteria and endotoxins are kept to a minimum in your water.
- Complete solutions from one source
  Our large selection of materials, fittings, valves, sensors and jointing technologies provide the ideal and economical solution for your water system.




**Pharmaceutical Water Systems**
**Water for Injection**

| Pharmacopoeia | | EP | USP |
|---|---|---|---|
| Parameter | Unit | WFI | WFI |
| TOC | ppb | ≤ 500 | ≤ 500 |
| Conductivity | µS/cm | ≤ 1.1 (20°C) | ≤ 1.3 (25°C) |
| Colony Forming Units | CFU/100ml | ≤ 10 | ≤ 10 |
| Endotoxin Units | E.U./ml | ≤ 0.25 | ≤ 0.25 |

# The Life Science Water Cycle

## System solutions for all water qualities

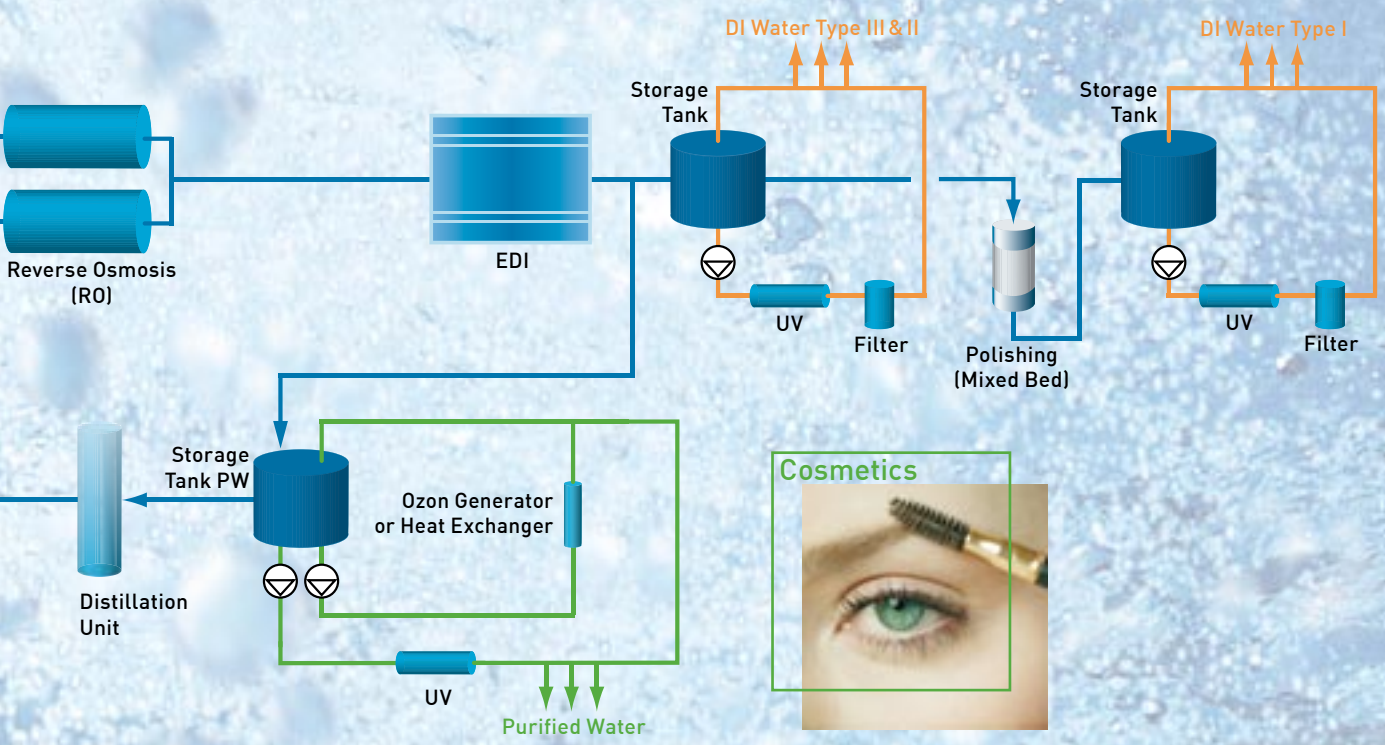
GF Piping Systems provides a solution for every quality of water on offer, which are easily adapted to your requirements. We supply the ideal piping material, component concepts and the best jointing technology for your water quality.

### Laboratory Water Systems

Reagent-Grade Water ASTM DI Water Type III & II DI Water Type I

| Parameter | Unit | Type III | Type II | Type I |
|---|---|---|---|---|
| Resistivity | MΩ/cm, 25°C | ≤ 4.0 | ≤ 1.0 | ≤ 18 |
| TOC | µg/l | ≤ 200 | ≤ 50 | ≤ 50 |
| Silica ($SiO_2$) | µg/l | ≤ 500 | ≤ 3 | ≤ 3 |
| Sodium | µg/l | ≤ 10 | ≤ 5 | ≤ 1 |
| Chloride | µg/l | ≤ 10 | ≤ 5 | ≤ 1 |

| Parameter | Unit | Type C | Type B | Type A | |
|---|---|---|---|---|---|
| Colony Forming Units | CFU/100ml | | ≤ 1000 | ≤ 10 | ≤ 1 |
| Endotoxin Units | EU/ml | | - | ≤ 0.25 | ≤ 0.03 |







### Pharmaceutical Water Systems

**Purified Water / Aqua Purificata**

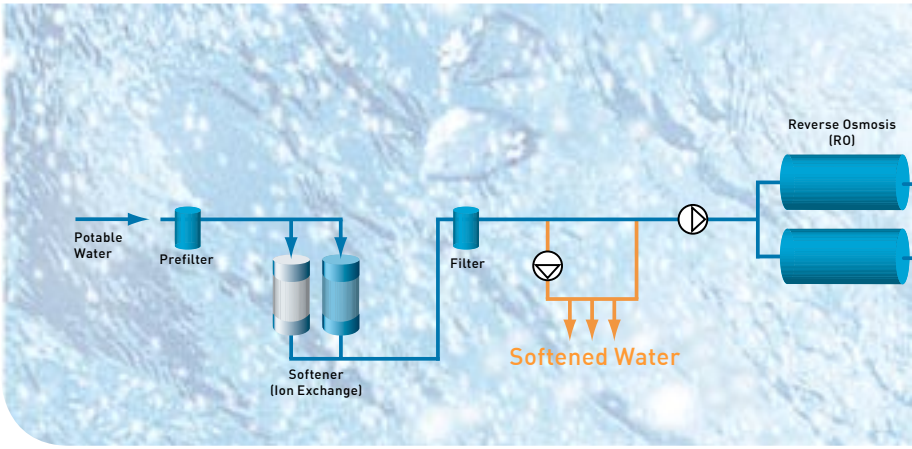
| **Pharmacopoeia** | | **EP** | **USP** | **EP** |
|---|---|---|---|---|
| Parameter | Unit | PW | PW | hPW |
| TOC | ppb | ≤ 500 | ≤ 500 | ≤ 500 |
| Conductivity | µS/cm | ≤ 4.3 (20°C) | ≤ 1.3 (25°C) | ≤ 1.1 (20°C) |
| Colony Forming Units | CFU/100ml | ≤ 10000 | ≤ 10000 | ≤ 10 |
| Endotoxin Units | E.U./ml | - | - | ≤ 0.25 |

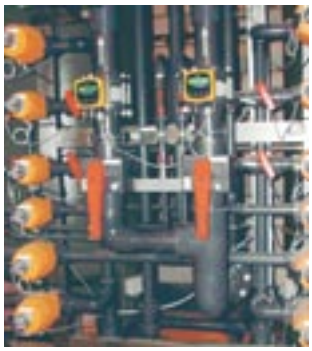
Glossary

| | | |
|---|---|---|
| PW | = | Purified Water |
| hPW | = | highly Purified Water |
| WFI | = | Water for Injection |
| EP | = | European Pharmacopeia |
| USP | = | United States Pharmacopeia |
| ASTM | = | American Society for Testing and Materials |
| TOC | = | Total Organic Carbon |
| UV | = | Ultraviolet Light |

## Your benefits at a glance

- Complete system solution available from one source
- Wide range of valves and measurement and instrumentations
- Adapted system components permit compact design
- Jointing technologies, as required for every water quality
- Lightweight for a more economical installation
- Solutions for wide range of pressures and temperatures
- Best conductivity is supported
- Low leach-out values for metal ions and organic compounds
- Minimal maintenance
- Long service life
- Proven in hundreds of different water systems



Water treatment
Softened water

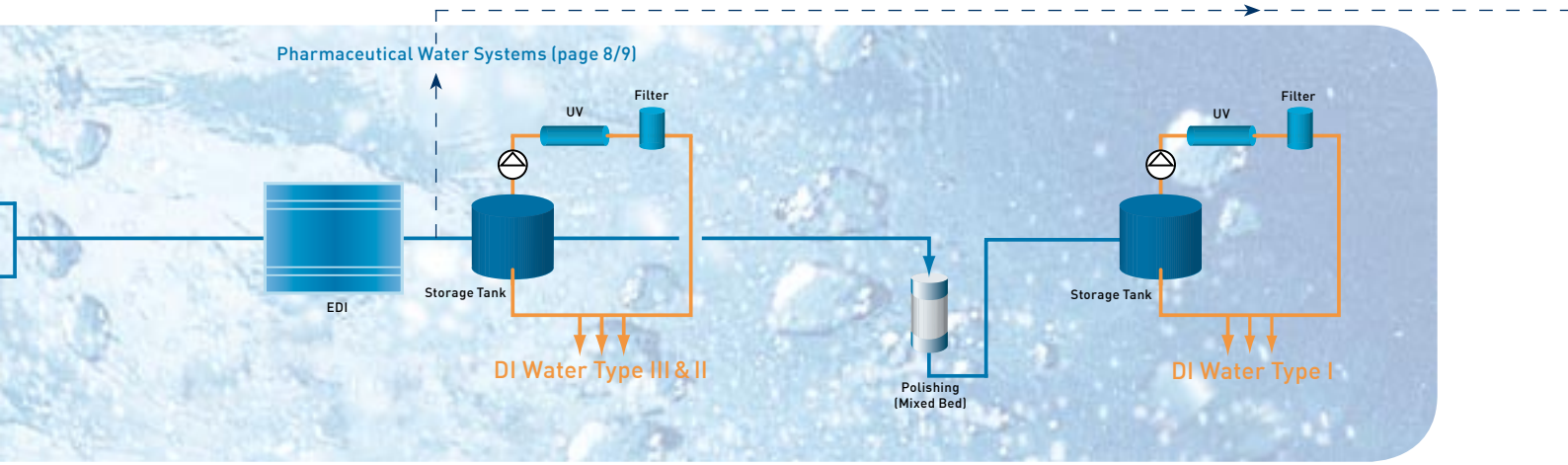
Perfectly functioning water treatment is crucial for a good water quality.
To prevent precipitation of calcium and magnesium, softened water is frequently used for cleaning and for hot water.
GF Piping Systems' selection of PVC-U/-C, ABS, state-of-the-art Polypropylene and PE 100 offer comprehensive solutions that are ideal for this application. Pipes, valves, measurement devices and the suitable jointing technology create an ideal package for diverse treatment process steps.

| Our Systems | Solvent cemented solutions | Fusion solutions |
|---|---|---|
| | PVC-U<br>PVC-C<br>ABS | PROGEF® (Polypropylene)<br>PE 100 |

# The Water Cycle in the Laboratory

## Laboratory water systems

Specifications for piping systems vary greatly depending on the water and the application. Washing and dilution processes or extremely sensitive analytical measurement devices demand individual solutions. Selecting the right piping system is essential and has a major effect on the required purity. That is why GF Piping Systems has developed solutions which are perfectly adapted to a variety of applications.




Deionized water
Types III & II

These two water qualities are used in many laboratories where conductivity and TOC are the most important considerations.
The PROGEF® materials (state-of-the-art Polypropylene) and PROGEF® Natural (PP-n) are best suited for these water qualities.

As jointing technology for less stringent requirements, we offer the highly efficient socket fusion (PROGEF® Standard), or for cleaner applications, the IR (infrared) fusion technology (PROGEF® Natural, Standard and Plus).

| Our Systems | Best | Best | Good |
|---|---|---|---|
| **Piping Material** | PROGEF® (Polypropylene) | PROGEF®Natural (PP-n) | PROGEF® (Polypropylene) |
| **Fusion** | IR Plus® d20–225 | IR Plus® d20-63 | Socket Fusion |
| **Sanitisation** | Hot Water, Chemicals | Chemicals | Hot Water, Chemicals |

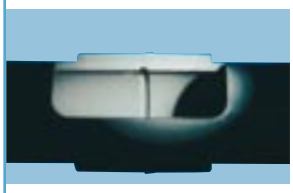
Deionized water
Type I

Top quality laboratory water is required for analytical instruments, for a minimum of interference and ultimate precision.
To achieve this ultrapure water, we have developed our high purity system solution SYGEF® Plus (PVDF HP).

In conjunction with our bead and crevice-free fusion technology (BCF®), this demanding water quality is transported reliably to the point of use.

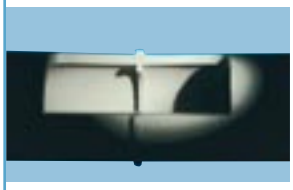
| Our Systems | Best |
|---|---|
| **Piping Material** | SYGEF® Plus (PVDF HP) |
| **Fusion** | BCF® Plus d20-110 |
| **Sanitisation** | Hot Water, Ozone Chemicals |

## Jointing technologies by GF Piping Systems



Solvent Cemented
– the fast connection

Socket fusion
– the connection for smaller dimensions



Butt fusion
– the connection for larger dimensions

IR Plus® fusion
– for clean connections

BCF® Plus fusion
– the smooth connection

## Solvent cemented plastics

PVC-U / PVC-C
Polyvinyl chloride

The fast solution for your water treatment system.

- → good chemical resistance
- → non-toxic
- → easy and fast connections
- → fast installation
- → no tools required
- → complete system in global standards (metric, BS, ASTM, JIS)
- → proven in millions of applications over 50 years

ABS
Acrylonitrile-Butadiene-Styrene

Ideal for low temperature applications in the treatment and distribution of softened water.

- → high impact strength even at low temperatures to -40 °C
- → easy handling thanks to solvent cemented jointing
- → biologically inert
- → recyclable

# System Solutions for Water Treatment and for General Laboratory Applications

## Fusion plastics

PROGEF® Standard
state-of-the-art Polypropylene

The strong solution for average water qualities with hot water or chemically sanitized processes.

- → socket, butt or IR fusion technology
- → high impact strength
- → temperature resistant up to 95 °C
- → good long-term performance
- → excellent resilience to cleaning agents

PE 100
Polyethylene

The economical solution for cold water applications.

- → excellent flexibility
- → good chemical resistance
- → easily fused
- → good ductile characteristics
- → superior price-performance ratio
- → UV-resistant

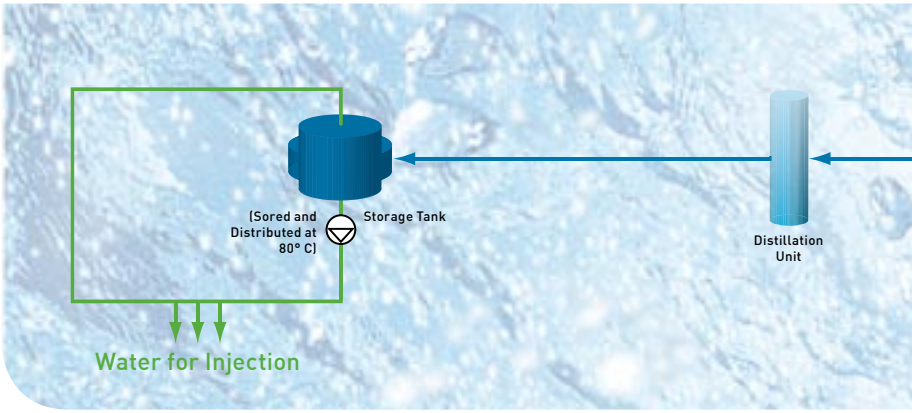
## Measurement and control components

GF Piping Systems offers integrated solutions for control and regulation of flow, pressure, temperature and analytical tasks (measurement) in diverse water applications.

- → high process reliability and long service life thanks to sophisticated system components
- → user-friendly and low maintenance systems that generate measurable added value
- → the systems are coordinated and time-tested
- → total system and solution responsibility from one source
- → ISO 9001 certified production ensures quality and customer satisfaction
- → worldwide local support by specialists

Your benefits at a glance

- Active ingredients are not affected by the materials
- Minimal temperature loss thanks to ca. 500x lower thermal conductivity compared to stainless steel
- No corrosion or rouging problems
- Reliable media quality without passivation or post-treatment
- Complete system solutions in compliance with FDA, USP, ASME BPE, ISPE
- Solutions for conventional sterilization and sanitization methods
- Less biofilm thanks to unsurpassed surface quality in the entire piping system (incl. BCF fusion welds)
- Easy documentation and qualification concept




Water for Injection (WFI)

The top-end water quality WFI according to USP/EP/JP is used for parenteral substances. These sterile products absolutely require purified water quality to minimize the risk of microbes and endotoxins. The piping systems are operated constantly at 80 °C. The GF Piping Systems high-end solution SYGEF® Plus (PVDF HP) lends itself in particular to high temperature applications. Due to the very low heat conductivity, the temperature loss is kept to a minimum. Rouging problems, which occur with stainless steel, do not exist with PVDF. The excellent smooth surface in the piping systems (0.2 µm) and the fusion joints guarantee minimal biofilm growth.

| Our Systems | Best |
|---|---|
| **Piping Material** | SYGEF® Plus (PVDF HP) |
| **Fusion** | BCF® Plus d20-110 |
| **Sanitisation** | Hot Water, Steam |

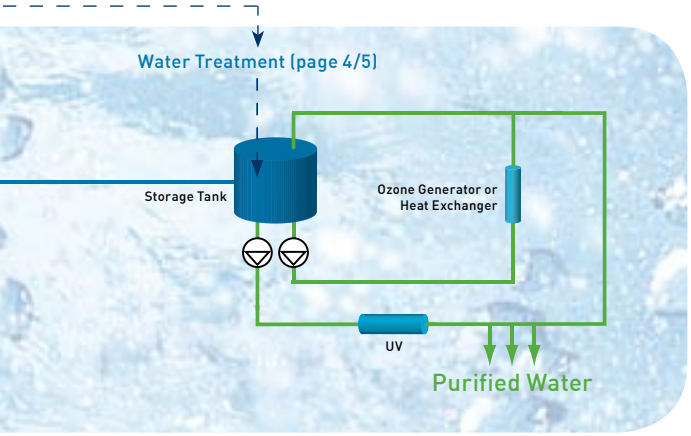
Glossary

| | | |
|---|---|---|
| ASME BPE | = | The American Society of Mechanical Engineers Bioprocessing Equipment |
| FDA | = | Food and Drug Administration |
| ISPE | = | International Society for Pharmaceutical Engineering |
| USP | = | United States Pharmacopeia |
| EP | = | European Pharmacopeia |
| JP | = | Japanese Pharmacopeia |

# The Water Cycle in Biotechnology, Pharmaceutics and Cosmetics

## Pharmaceutical water systems

Pharmaceutical grade water is the lifeblood of the biotechnology, pharmaceutical and cosmetic industries. Whether used as an ingredient, for experimental purposes or for rinsing, a high quality of pharmaceutical water is crucial for the end product. Biofilm growth in piping systems and the resulting microbiological and endotoxin contamination are risks that must be avoided.




Purified Water (PW)
(Aqua Purificata)
Purified water according to USP/EP/JP is used as an ingredient in non-sterile products or for cleaning. Apart from preventing microbiological contamination, it is essential that no other substances enter the water. The GF Piping Systems solutions SYGEF® Standard (PVDF) for hot water and ozone or PROGEF® Natural (PP-n) for chemically sanitized systems guarantee superior product purity. And there isn't the additional worry of corrosion and leach-out. The bead and crevice-free fusion technology creates an unsurpassed smooth joint surface without passivation.

Highly Purified Water (hPW)

Highly purified water is a new water quality according to EP with more stringent requirements in terms of microbiological and endotoxin control. For such applications, we recommend our high-end solution SYGEF® Plus (PVDF HP). This system guarantees a superior quality of water.

| Our Systems | Best | Good |
|---|---|---|
| **Piping Material** | SYGEF® Standard (PVDF) | PROGEF® Natural (PP-n) |
| **Fusion** | BCF® Plus d20-110 | BCF® Plus d20-63 |
| **Sanitisation** | Hot Water, Ozone | Chemicals |

| Best |
|---|
| SYGEF® Plus (PVDF HP) |
| BCF® Plus d20-110 |
| Hot Water, Ozone |

## BCF® Plus Fusion Technology

The BCF® Plus fusion machine guarantees high reproducibility of fusion weld quality even for on-site fusion.

A bladder positioned in the fusion zone produces a bead and crevice-free fusion weld.

Easy, fast and foolproof inspection of the weld with a torch.

Smooth inner fusion zone for optimal cleaning and minimal microbiological contamination.

PROGEF® natural
(Polypropylene natural; PP-n)

The pure and economical solution, specially for use in chemically sanitized processes.

- → unpigmented translucent raw material
- → surface roughnes Ra ≤ 1.0 µm
- → temperature resistant up to 80 °C
- → excellent resistance to cleaning agents
- → hydrophobic surface for easier cleaning
- → defined manufacturing conditions
- → single bagged
- → material conforms to FDA and ASME BPE
- → tested according to USP Class VI
- → little metallic contamination
- → traceability per EN 10204 3.1

# System Solutions for Pharmaceutical Water and Laboratory Water Type I

SYGEF® Standard
(Polyvinylidene Fluoride Standard; PVDF)

The reliable transport solution for high temperatures or ozonized pharmaceutical water applications.

→ surface roughness Ra ≤ 0.5 µm
→ defined manufacturing conditions
→ single bagged

SYGEF® Plus
(Polyvinylidene Fluoride High Purity; PVDF HP)

The proven high-end solution for transporting ultrapure media.

→ excellent surface roughness Ra ≤ 0.2 µm
→ manufactured and cleaned under cleanroom conditions
→ double bagged

→ free of additives and pigments
→ physiologically inert, so it doesn't react with the medium
→ extremely low «leach out» for organic and inorganic substances
→ temperature resistance up to 140 °C
→ sanitisation possible with hot water, steam, ozone, UV and chemicals
→ good mechanical resistance
→ neither rouging nor corrosion
→ material conforms to FDA, cGMP, ASME BPE, ISPE, etc.
→ tested according to USP Class VI
→ traceability per EN 10204 3.1

# www.piping.georgfischer.com → Solutions → Life Science

For more information about GF Piping Systems Life Science Solutions: www.piping.georgfischer.com → Solutions → Life Science

The technical data is not binding and not an expressly warranted characteristic of the goods. It is subject to change. Our General Conditions of Sale apply.


**Australia**
George Fischer Pty Ltd
Riverwood NSW 2210 Australia
Phone +61(0)2 9502 8000
australia.ps@georgfischer.com
www.georgefischer.com.au

**Austria**
Georg Fischer
Rohrleitungssysteme GmbH
3130 Herzogenburg
Phone +43(0)2782 856 43-0
austria.ps@georgfischer.com
www.georgfischer.at

**Belgium / Luxembourg**
Georg Fischer NV/SA
1070 Bruxelles/Brüssel
Phone +32(0)2 556 40 20
be.ps@georgfischer.com
www.georgfischer.be

**Brazil**
George Fischer Ltda
04795-100 São Paulo
Phone +55(0)11 5525 1311
br.ps@georgfischer.com

**China**
Georg Fischer
Piping Systems Ltd Shanghai
Pudong, Shanghai 201319
Phone +86(0)21 58 13 33 33
china.ps@georgfischer.com
www.cn.piping.georgfischer.com

**Denmark / Iceland**
Georg Fischer A/S
2630 Taastrup
Phone +45 (0)70 22 19 75
info.dk.ps@georgfischer.com
www.georgfischer.dk

**France**
Georg Fischer SAS
95932 Roissy Charles de Gaulle Cedex
Phone +33(0)1 41 84 68 84
fr.ps@georgfischer.com
www.georgefischer.fr

**Germany**
Georg Fischer GmbH
73095 Albershausen
Phone +49(0)7161 302-0
info.de.ps@georgfischer.com
www.georgfischer.de

**India**
Georg Fischer Piping Systems Ltd
400 076 Mumbai
Phone +91 224007 2001
in.ps@georgfischer.com
www.georgfischer.in

**Italy**
Georg Fischer S.p.A.
20063 Cernusco S/N (MI)
Phone +3902 921 861
it.ps@georgfischer.com
www.georgfischer.it

**Japan**
Georg Fischer Ltd
556-0011 Osaka,
Phone +81(0)6 6635 2691
jp.ps@georgfischer.com
www.georgfischer.jp

**Korea**
Georg Fischer Piping Systems
Guro-3 dong, Guro-gu, Seoul, Korea
Phone +82(0)2 2081 1450
Fax +82(0)2 2081 1453
kor.ps@georgfischer.com

**Malaysia**
George Fischer (M) Sdn. Bhd.
40460 Shah Alam, Selangor Darul Ehsan
Phone +60 (0)3 5122 5585
my.ps@georgfischer.com

**Mexico**
Georg Fischer S.A. de C.V.
Apodaca, Nuevo Leon
CP66636 Mexico
Phone +52 (81)1340 8586
Fax +52 (81)1522 8906

**Middle East**
George Fischer Piping Systems
Dubai, United Arab Emirates
Phone +971 4 289 49 60
info.export@georgfischer.com
www.export.georgfischer.com

**Netherlands**
Georg Fischer N.V.
8161 PA Epe
Phone +31(0)578 678 222
nl.ps@georgfischer.com
www.georgfischer.nl

**Norway**
Georg Fischer AS
1351 Rud
Phone +47(0)67 18 29 00
no.ps@georgfischer.com
www.georgfischer.no

**Poland**
Georg Fischer Sp. z o.o.
05-090 Sekocin Nowy
Phone +48(0)22 31 31 0 50
poland.ps@georgfischer.com
www.georgfischer.pl

**Romania**
Georg Fischer
Piping Systems Ltd
020257 Bucharest - Sector 2
Phone +40(0)21 230 53 80
ro.ps@georgfischer.com
www.export.georgfischer.com

**Russia**
Georg Fischer Piping Systems
Moscow 125047
Tel. +7 495 258 60 80
ru.ps@georgfischer.com
www.georgfischer.ru

**Singapore**
George Fischer Pte Ltd
528 872 Singapore
Phone +65(0)67 47 06 11
sgp.ps@georgfischer.com
www.georgefischer.com.sg

**Spain / Portugal**
Georg Fischer S.A.
28046 Madrid
Phone +34(0)91 781 98 90
es.ps@georgfischer.com
www.georgfischer.es

**Sweden / Finland**
Georg Fischer AB
117 43 Stockholm
Phone +46(0)8 506 775 00
info.se.ps@georgfischer.com
www.georgfischer.se

**Switzerland**
Georg Fischer
Rohrleitungssysteme (Schweiz) AG
8201 Schaffhausen
Phone +41(0)52 631 30 26
ch.ps@georgfischer.com
www.piping.georgfischer.ch

**Taiwan**
Georg Fischer Piping Systems
San Chung City, Taipei Hsien
Phone +886 2 8512 2822
Fax +886 2 8512 2823

**United Kingdom / Ireland**
George Fischer Sales Limited
Coventry, CV2 2ST
Phone +44(0)2476 535 535
uk.ps@georgfischer.com
www.georgefischer.co.uk

**USA / Canada / Latin America / Caribbean**
Georg Fischer LLC
Tustin, CA 92780-7258
Phone +1(714) 731 88 00
Toll Free 800 854 40 90
us.ps@georgfischer.com
www.us.piping.georgefischer.com

**International**
Georg Fischer
Piping Systems (Switzerland) Ltd.
8201 Schaffhausen/Switzerland
Phone +41(0)52 631 30 03
Fax +41(0)52 631 28 93
info.export@georgfischer.com
www.export.georgfischer.com



700.671.054
**GFDO_5844_4a (12.09)**



+GF+

GEORG FISCHER
PIPING SYSTEMS