PTFE-PFA lined piping
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

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PTFE piping november 2017
Hanwel Netherlands
Hanwel B.V. is established in 1967 and is a part of the Indutrade group. [www.indutrade.se]

We supply valves, expansion joints and pipe supports to all kinds of industries and are a reliable partner for your organization. You can benefit from our knowledge and our experience.

CRP UK: the corrosion expert
CRP is a professional and experienced manufacturer of PTFE lined piping components, based in Littleborough, England. The CRP product range guarantees high quality products with a high lifetime expectancy. The products have been selected to fulfill the highest demands and are divided into the following products:

- PTFE-PFA lined straight pipe spools
- PTFE-PFA lined bended pipe spools
- PTFE-PFA lined elbows
- PTFE-PFA lined (reducing) tees
- PTFE-PFA lined instrument tees
- PTFE-PFA lined reducers
- PTFE-PFA lined crosses
- PTFE-PFA lined instrument crosses
- PTFE-PFA lined spacers
- PTFE-PFA lined reducing flanges
- PTFE-PFA lined blank flanges
- PTFE-PFA lined dip / entry pipes
- PTFE-PFA lined columns
- PTFE-PFA lined valves
- PTFE-PFA lined expansion joints
- PTFE-PFA lined special assemblies
- PTFE-PFA lined sight glasses
- PTFE-PFA lined sampling systems

Both according to DIN-EN (PN10-PN16) and ANSI (#150).

The CRP PTFE-PFA lined pipe system is standard according to:
- DIN 2874 pipes, flanges and mouldings
- DIN 2848 PTFE/PFA
- GKV QA requirements for PTFE

We only use virgin fluor polymers that correspond to the following specifications:
- ASTM D-4895 paste extruded PTFE
- ASTM D-3307 type II PFA

Our steelworks originate from Germany and the UK. Our liner material originates from The Netherlands.

Standard qualification & testing of our piping components are according to:
- ISO 9001:2008 approved production
- In compliance with PED directive 2014/68/EU
- Qualification testing acc. to ASTM F1545
- Full traceability to raw material
- Certificate of compliance EN10204 2.2 (optional: EN10204 3.1 / 3.2)
- Electrostatic spark test 24kV
- Hydrotest at 24barg for three minutes, twice
- Visual inspection

Destructive tests can be carried out upon request.
The lining can be carried out as follows:
- PTFE white
- PTFE black – antistatic
- PFA white
- PFA black – antistatic

The derivation resistance of the effective area of flow (electrode area = 20cm²) may not exceed 108 ohms. The resistance of the pipe part between the connecting tail pieces (flange, screwing, coupling, etc.) must be below or equal to 106 Ω. Resistance measuring is subject to DIN IEC 60093 and DIN IEC 60167.

- PFA natural
- PFA electrically conductive for moulding (Tee-pieces, measuring joints, cross pieces and reduction pieces)

The tolerances of the lined products correspond to DIN 2874 standards.

**Steel pipes are standard according to:**
- DIN EN 10216-1 P235TR2 according to standard specification AD2000-W4
- DIN EN 10216-2 P235GH according to standard specification AD2000-W4

The pipes can be documented according to DIN EN 10204-3.1.

Other pipe qualities and materials (i.e. stainless steel, hastelloy, titanium) are available at request.

**Flanges are standard according to:**
- Welding neck flanges acc. to DIN EN 1092-1-11
- Loose flanges acc. to DIN EN 1092-1-34/04
- Smooth welding flanges acc. to DIN EN 1092-1-1
- Loose flanges acc. To DIN EN 1092-1-32/02

All flanges according to standard specification AD2000-W9 can be documented according to DIN EN 10204-3.1 B

Special flanges are available on request.

In general the following materials are used for flanges:
- S235JR (1.0038)
- P265GH (1.0425)
- P250GH (1.0460)

Other materials materials (i.e. stainless steel, hastelloy, titanium) are available on request.

**Painting:**
The steel parts are standard grind-blasted from the outside acc. to SA 2.5 and coated with corrosion resistant two component low VOC, high solids fast curing epoxy/finish containing zinc phosphate anti-corrosive pigmentation. Colour RAL 5015 blue semi-gloss, typical thickness 80 microns.

There are other possibilities such as:
- Hot dip galvanizing
- Electro galvanizing
- Powder coating
- Zinc phosphate, reddish brown (Other colours are possible.)

**Venting:**
All products (except type 1 spacers) include suitable venting within the metal structure of the item. Typically one or more 5mm diameter holes in spools and PTFE lined fittings and the injection boss of PFA moulded fittings.

We include vent holes on all products because:
- They are early failure indicators in case of liner failure, providing time to shut down before disasters occurring
- They constitute escape ports for permeated media, preventing that the medium gets trapped between the liner and the steelworks.

When Vent extensions are required, a 10mm high G ¼ internally threaded boss is welded to pipe spools. For moulded fittings the injection boss is drilled and tapped with an appropriate female taper thread. A 65mm long vent extension is then supplied to fit to this, to provide a standard 75mm vent extension.
Pressure / temperature performance curve graphs (DIN-EN 2848):

**DIN-EN 2848: vacuum resistance**

For products up to, and including DN200, CRP lined pipe and fittings are rated for full vacuum up to 200°C. Above DN200, please consult Hanwel for vacuum performance.

**DIN 2848 PN 10 lined piping systems**

![Graph](image1)

**DIN 2848 PN 16 lined piping systems**

![Graph](image2)
Pressure and temperature performance curve graphs (ASME 150):

ASM: vacuum resistance

For products up to, and including 8”, CRP lined pipe and fittings are rated for full vacuum up to 200°C
For products between 10” (DN250) and 12” (DN300), CRP lined pipe and fittings are rated for full vacuum up to 150°C
For products above 12” (DN350), CRP lined pipe and fittings are rated for full vacuum up to 50°C

ASME 150 lined piping systems

ASME 300 lined piping systems
PTFE and PFA specifications

Per liner type

<table>
<thead>
<tr>
<th>Liner type</th>
<th>Specification</th>
<th>Properties</th>
</tr>
</thead>
</table>
| Virgin PTFE paste extruded                | ASTM D4895    | Minimum tensile strength: 26 MPa
Minimum elongation at break: 275%
Specific gravity: 2.14 – 2.20 (when tested to ASTM D792 or D1505) |
| Static dissipating PTFE paste extruded    | ASTM D4895    | Minimum tensile strength: 26 MPa
Minimum elongation at break: 275%
Specific gravity: 2.14 – 2.17 (when tested to ASTM D792 or D1505)
Volume resistivity: <107 Ω.cm             |
| Virgin PFA – moulded                      | ASTM D3307    | Minimum tensile strength: 21 MPa
Minimum elongation at break: 300%
Specific gravity: 2.12 – 2.16 (when tested to ASTM D792 or D1505)
Melt flow rate: 1-2.5g/10mins
(when tested to ASTM D3307 at 372°C)      |
| Static dissipating PFA                    | ASTM D3307    | Minimum tensile strength: 21 MPa
Minimum elongation at break: 300%
Specific gravity: 2.11 – 2.16 (when tested to ASTM D792 or D1505)
Melt flow rate: 1-2.5g/10mins
(when tested to ASTM D3307 at 372°C)
Volume resistivity: <107 Ω.cm             |

Machine parts, pipes, expansion joints etc. based on polyfluorethylene have all the advantages of the PTFE base material. These products have an excellent resistance against:

- Acids
- Caustic soda
- Chlorides
- Sulfates
- Oxidants
- A large variety of other corrosive chemicals

Products out of PTFE and PFA have an excellent corrosion resistance due the medium, even at extreme temperatures between -190°C and +220°C.
PTFE properties:
Polymer grade: ASTM D4895

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>2.15 – 2.18g/cm²</td>
<td>DIN 53479</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>≥26N/mm²</td>
<td>DIN 53455</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>≥275%</td>
<td>DIN 53455</td>
</tr>
<tr>
<td>Hardness (shore D)</td>
<td>55-60 shore D</td>
<td>DIN 53455</td>
</tr>
<tr>
<td><strong>Thermal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting point</td>
<td>320 - 340 °C</td>
<td>ISO 12086</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-200 to +200 °C</td>
<td>(for excellent performance)</td>
</tr>
<tr>
<td>Coefficient of linear thermal expansion:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20°C - 100°C</td>
<td>16 x 10⁻⁵ K⁻¹</td>
<td>DIN 52328</td>
</tr>
<tr>
<td>20°C - 200°C</td>
<td>19.5 x 10⁻⁵ K⁻¹</td>
<td></td>
</tr>
<tr>
<td>20°C - 300°C</td>
<td>25 x 10⁻⁵ K⁻¹</td>
<td></td>
</tr>
<tr>
<td>Vicat softening point</td>
<td>110°C</td>
<td>DN 53640</td>
</tr>
<tr>
<td>Conductivity</td>
<td>0.25 - 0.5 W/m K</td>
<td>DIN 52612</td>
</tr>
<tr>
<td>Flammability</td>
<td>Non-flammable</td>
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<tr>
<td>Specific heat at 0°C</td>
<td>0.96 KJ/Kg x K</td>
<td></td>
</tr>
<tr>
<td>Specific heat at 50°C</td>
<td>1.05 KJ/Kg x K</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
<td></td>
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<tr>
<td>Dielectric strength (Film 0.2mm thick)</td>
<td>40 - 80 kV/mm</td>
<td>VDE 0303 part 2</td>
</tr>
<tr>
<td>Dielectric constant from 50 – 10⁷ Hz</td>
<td>2.1</td>
<td>DIN 53483</td>
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<tr>
<td>Volume resistivity</td>
<td>10¹⁸ Ω x cm</td>
<td>DIN 53482</td>
</tr>
<tr>
<td>Surface resistivity</td>
<td>≥10¹⁷ Ω</td>
<td>DIN 53482</td>
</tr>
<tr>
<td>Arc resistance</td>
<td>L4 Degree</td>
<td>VDE 0303 part 5</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water absorption</td>
<td>≤0.01%</td>
<td>DIN 53495</td>
</tr>
<tr>
<td>Coefficient of permeability</td>
<td>2 - 8 x 10⁻⁷</td>
<td></td>
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<tr>
<td>FDA Compliant, UL Listed</td>
<td>Yes</td>
<td>21 CFR 177 1550</td>
</tr>
<tr>
<td>UL Listed</td>
<td>Yes</td>
<td>File 54681 QMFZ2</td>
</tr>
</tbody>
</table>
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

STANDARD RANGE

The PTFE-PFA lined piping product range consists out of several standard parts that are connected by flanges. Smaller pieces and pieces with complicated shapes are executed with a **PFA (injection molded)** inlay. The larger diameters and less complicated shapes are executed with a **PTFE (paste extruded)** inlay.

The standard dimensions are DN15 to DN 500 for DIN EN pipes and ½" to 20" for ANSI pipes.

Upon request we can supply larger dimensions, heavy duty (thicker) liners, super weight liners (halogen services) or special shaped pipe parts.

**PTFE LINED PIPE SPOOL**
One fixed (F) and one loose (L) flange.
**EN 1092-1 PN 10, PN 16**
**ANSI 150lbs, 300lbs**

Also available with two fixed (F) flanges
Also available with two loose (L) flanges
*(Van Stone pipe spool; until 8”)*

Standard length depending on the diameter and maximal 6000mm

**PTFE LINED BENDED PIPE SPOOL**
One fixed (F) and one loose (L) flange.
**EN 1092-1 PN 10, PN 16**
**ANSI 150lbs, 300lbs**

Also available with two fixed (F) flanges

The bended pipe spools are only available in a limited number of diameters and dimensions.
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PTFE LINED BENDS 30°
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with one fixed (F) and one loose (L) flange

PTFE LINED BENDS 45°
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with one fixed (F) and one loose (L) flange

PTFE / PFA LINED BENDS 60°
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with one fixed (F) and one loose (L) flange

PFA LINED BENDS 90°
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with one fixed (F) and one loose (L) flange
Form 1

PTFE LINED BENDS 90°
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with one fixed (F) and one loose (L) flange
Form 2
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PFA LINED EQUAL TEE
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with two loose (L) flanges
PFA lined

PTFE LINED EQUAL TEE
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Also available with two loose (L) flanges
PTFE lined

PFA LINED REDUCED TEE
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined

PTFE LINED REDUCED TEE
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

PFA LINED LATERAL TEE
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PFA LINED EQUAL CROSS
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined

PTFE LINED EQUAL CROSS
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

PFA LINED REDUCED CROSS
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined

PTFE LINED REDUCED CROSS
All flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

PFA LINED INSTRUMENT TEE
To be clamped between flanges.
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined
Style 1
OVERVIEW OF PRODUCTS

PTFE and PFA lined piping

**PFA LINED INSTRUMENT TEE**
To be clamped between flanges.
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

- PFA lined
  - Style 2

**PTFE LINED INSTRUMENT TEE**
To be clamped between flanges.
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

- PTFE lined
  - Style 3

**PFA LINED REDUCER (CONCENTRIC)**
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

- PFA lined
  - Style 1

**PTFE LINED REDUCER (CONCENTRIC)**
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

- PTFE lined
  - Style 2

**PTFE LINED REDUCER (CONCENTRIC)**
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

- PTFE lined
  - Style 3
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PFA LINED REDUCER (ECCENTRIC)
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

PFA lined
Style 1

PTFE LINED REDUCER (ECCENTRIC)
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

PTFE lined
Style 2

PTFE LINED REDUCER (ECCENTRIC)
Both flanges are fixed (F).
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

PTFE lined
Style 3

PFA LINED REDUCING FLANGE
Through going holes and threaded holes
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

PFA lined
Style 1 and 2

PTFE LINED REDUCING FLANGE
Through going holes and threaded holes
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs

PTFE lined
Style 3
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PTFE LINED SPACER – type 1
Solid PTFE spacer – max 25mm
To be clamped between flanges
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
Solid PTFE

PTFE LINED SPACER – type 2
Heavy wall steel tube with PTFE filling
To be clamped between flanges
Maximum length 80mm
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

PTFE LINED SPACER – type 3
2 stub ends and a steel pipe to form the housing with a PTFE liner, flanged
Maximum length 200mm
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined
Style 3

PTFE LINED ANGULAR SPACER
To be clamped between flanges
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined
Style 1

PTFE LINED ANGULAR SPACER
To be clamped between flanges
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined
Style 2
OVERVIEW OF PRODUCTS
PTFE and PFA lined piping

PTFE LINED BLIND FLANGE
With PTFE gasket
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

DN 15 – DN 500

PTFE LINED FLANGE WITH NOZZLE
With PTFE gasket
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

DN 15 – DN 500

PFA LINED SIGHT GLASS
With Borosilicate glasses
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PFA lined

DN 25 – DN 100

PTFE LINED SIGHT GLASS
With Borosilicate glasses
EN 1092-1 PN 10, PN 16
ANSI 150lbs, 300lbs
PTFE lined

DN 125 – DN 400
PTFE lined tube parts are made of seamless PTFE linings which are fitted into (stainless) steel parts.

PTFE expansion joints have a PTFE bellow with turnable backing flanges. Both have a PTFE sealing area at the flange. For safe and reliable operating the following instructions should be followed:

**Receipt:**
Keep the products in the original packing as long as possible. Unprotected storage outside is not allowed.

**Distance bolts:**
The expansion joints are equipped with distance bolts to avoid over stretching during installation and in operation. These bolts should be adjusted to the maximum allowable length after the expansion joint is installed. The distance bolts are not designed to take up the pressure reaction forces! (pressure x effective cross section). The pressure reaction force should be controlled by suitable fix points.

**Flange protection covers:**
The PTFE sealing faces are covered by protection covers. These covers may only be removed prior to the installation. I.e. after inspection the covers should be refitted.

**Gaskets:**
For installation of PTFE on PTFE there are no gaskets required. In case the connecting pipe material is different we advise the use of a 5 mm thick PTFE gasket.

**Welding:**
Welding or burning near the PTFE is not allowed. (The PTFE can be damaged and toxic gasses can develop)

**Pipe supports:**
The pipe must be provided with sufficient supports and fix points.

**Bolt torques:**
For PN 10 flanges the following maximum torques should be applied. At room temperature these torques can be increased by 50% The threads must be clean and well lubricated.

<table>
<thead>
<tr>
<th>DN</th>
<th>Nm</th>
<th>DN</th>
<th>Nm</th>
<th>DN</th>
<th>Nm</th>
<th>DN</th>
<th>Nm</th>
<th>DN</th>
<th>Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>25</td>
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<td>45</td>
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<td>48</td>
<td>150</td>
<td>90</td>
<td>300</td>
<td>115</td>
<td>500</td>
<td>160</td>
</tr>
</tbody>
</table>

To avoid damage to the sealing the parts should only be dismantled below 40°C

**Painting:**
If the PTFE lined pipes are to be painted the ventilation holes may not be plugged by paint or insulation as this might cause the lining to collapse. The vent holes also serve as early warning leakage indicators.
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