GF Piping Systems
MAB PE4710 mechanical products for HDPE pipes

Rick van Kesteren - GF WAGA
MAB PE4710 mechanical products for HDPE pipes / presentation outline

1. Overview of available Products for use on PE4710 (Products = mechanical products)
   a) Split in 2 sections per C901-17 (3/4” to 3” CTS and IPS- PE4710 DR9) and C906-15 (4” – 12” DIPS and IPS PE4710 only). Future work will consider 14” and greater sizes.
   b) When should your products be used for potable water HDPE systems?
   c) Provide sample flow chart / decision tree analysis
   d) Identify type(s) of Products: Repairs, connections (to other materials too), tapping, Restraints
   e) Pressure Classes of Products
   f) All Products fully restrained and fully pressure rated for PE4710?
   g) All Products are resistant to axial pullout
   h) Available sizes of Products, including CTS, IPS and DIPS.
   i) Are Products universal for use on other piping materials?
   j) Do you require modification or special installation and special training for use on HDPE?
   k) Do you require a max. HDPE DR?
   l) Ongoing work to make gaskets compliant with new AWWA requirements re disinfectants
   m) Large diameter hot tapping: solutions with 4” to 8”; tapping equipment used? Any special tooling the local water company may not have?

2. Design features that make the Products compatible with properties of HDPE

3. Testing done with HDPE pipe (tensile/restraint, pressure, cyclic, seismic, others, …)

4. Installation recommendations (stiffener, bolt torque, spring washers, special tooling, special support for weight of fitting, lifting lugs, anode connection, how to repair a scratch on coating?, alignment, etc.).

5. Manufacturing Standards (ISO, ASTM, others …) and Model Specs for Products and installation procedures

6. Projected Design life
   o Are repair methods considered temporary or permanent (permanent ≥ 50 years)?
   o Corrosion protection methods

7. History of use with HDPE/ case studies/ operating conditions

8. Other issues and concerns
1. Overview of available products recommended for use on HDPE
1.a. C901-17 (3/4” to 3” CTS and IPS- PE4710 DR9)

Product range of MULTI/JOINT
Starts with 2” (actual 1,811”)

Couplers
Reduced couplings

Flange adaptors
Reduced flange adaptors

End caps
End caps with thread

And many more specific models
1.a. C906-15 (4” – 12” DIPS and IPS PE4710 only). Future work will consider 14” and greater sizes.

Full product range of MULTI/JOINT
Starting from 4” up to 12”

For future work we are prepared!

The product line goes up to 24”

All suitable for PE connections.
1.b. When should your products be used for potable water HDPE systems?

Repair and emergency repairs

Planned maintenance work in distribution and transport networks

Renovation works

Transitions old to new pipes / different materials

Pressure tests (end caps)

Network extensions

Re lining applications
1.c. flow chart/decision tree

Not available at the moment. Should be defined in later stage.

➔ Many local solutions and methods.
➔ If possible -> weld it. If not -> mechanical solutions are preferred
1.d. Identify type(s) of mechanical products for HDPE (Split PP in 4 sections: repairs, couplings, transitions and tapping)

Our core competence: repair and transitions, all types are suitable.

Repair: Valves: Old to new:
1.e. Pressure Classes of Products

Water applications
Restraint pressure  232 PSI Wp. (from 2”-12”)

Max. Allowable testing pressures in the trench:  PSI Wp. x 1.5 = 350 Psi

In company laboratory testing facilities for certifications PSI Wp x 1.5 + 72.5 PSI = 420.5 PSI tested with internal pressure. (water pressurized)
1.f. fully restrained pressure rated for PE4710 – 12” HDPE

The MULTI/JOINT 3000plus series is fully equipped to withstand the axial pullout force. Fits and Grips all pipe materials.
1.g. Resistant to axial pull out PE – 24”. At 420 Psi.
1.4. All products are resistant to axial pullout. Restraint pressure overview water applications

<table>
<thead>
<tr>
<th>DN (mm)</th>
<th>Size (inch)</th>
<th>Range (mm)</th>
<th>Range (inch)</th>
<th>Working pressure**</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN50</td>
<td>2&quot;</td>
<td>46 - 71</td>
<td>1.811 - 2.795</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN65</td>
<td>2 ½&quot;</td>
<td>63 - 90</td>
<td>2.480 - 3.543</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN80</td>
<td>3&quot;</td>
<td>84 - 105</td>
<td>3.307 - 4.133</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN100</td>
<td>4&quot;</td>
<td>104 - 132</td>
<td>4.094 - 5.196</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN125</td>
<td>5&quot;</td>
<td>132 - 155</td>
<td>5.196 - 6.102</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN150</td>
<td>6&quot;</td>
<td>154 - 192</td>
<td>6.062 - 7.559</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN200</td>
<td>8&quot;</td>
<td>192 - 232</td>
<td>7.559 - 9.133</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN225</td>
<td>9&quot;</td>
<td>230 - 268</td>
<td>9.050 - 10.551</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN250</td>
<td>10&quot;</td>
<td>267 - 310</td>
<td>10.500 - 12.204</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN300</td>
<td>12&quot;</td>
<td>315 - 356</td>
<td>12.401 - 14.015</td>
<td>232 psi</td>
</tr>
<tr>
<td>DN350</td>
<td>14&quot;</td>
<td>352 - 393</td>
<td>13.858 - 15.472</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN400</td>
<td>16&quot;</td>
<td>392 - 433</td>
<td>15.433 - 17.047</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN425</td>
<td>17&quot;</td>
<td>432 - 464</td>
<td>17.000 - 18.267</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN450</td>
<td>18&quot;</td>
<td>450 - 482</td>
<td>17.716 - 18.976</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN475</td>
<td>19&quot;</td>
<td>481 - 513</td>
<td>18.937 - 20.196</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN500</td>
<td>20&quot;</td>
<td>500 - 532</td>
<td>19.685 - 20.944</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN550</td>
<td>22&quot;</td>
<td>548 - 580</td>
<td>21.574 - 22.834</td>
<td>150 psi</td>
</tr>
<tr>
<td>DN600</td>
<td>24&quot;</td>
<td>605 - 637</td>
<td>23.818 - 25.078</td>
<td>150 psi</td>
</tr>
</tbody>
</table>

**restraint
1. h. Available IPS, DIPS and CTS sizes up to 24”

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>MULTI/JOINT® coupling overview *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>mm</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>2 ½</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>125</td>
</tr>
<tr>
<td>6</td>
<td>150</td>
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<tr>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>9</td>
<td>225</td>
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<tr>
<td>10</td>
<td>250</td>
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<tr>
<td>12</td>
<td>300</td>
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<tr>
<td>14</td>
<td>350</td>
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<tr>
<td>16</td>
<td>400</td>
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<tr>
<td>17</td>
<td>425</td>
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<tr>
<td>18</td>
<td>450</td>
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<tr>
<td>19</td>
<td>475</td>
</tr>
<tr>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>22</td>
<td>550</td>
</tr>
<tr>
<td>24</td>
<td>600</td>
</tr>
</tbody>
</table>
1.i. Are products universal for use on other pipe materials? YES!
1.j. Do you require modification or special installation and special training for use on HDPE?

No modification is needed for the MULTI/JOINT, **one piece stab fit.**

Always take care of PE pipe surface conditions! especially scratches etc. In gas applications we advice the use of grease on our rubber seal system and peeling (Always: do create a scratch free sealing zone).

Always use insert stiffeners when working with PE pipes.
1.j. Do you require modification or special installation and special training for use on HDPE?

Standard tools are needed on site. Such as pipe preparations tools.

Ratchets
Torque keys.
Gas application example. Cast iron to PE branch off with welded PE T-section
Water application
1.k. Do you require a max. HDPE DR?

We do not require a max. or min. DR → as long as the pipe outside diameter will be covered by the fitting range.

We have gained experience with mechanical jointing with PE piping starting in the 1960’s. Density experience materials PE 63 PE 80, PE 100. (3 Generations)

**Pressure Rating:**
- DR 32.5 (65psi)
- DR 26 (80psi)
- DR 21 (100psi)
- DR 17 (130psi)
- DR 13.5 (160psi)
- DR 11 (200psi)
- DR 9 (250psi) take in consideration pressure class of fitting.
- DR 7 (335 psi) take in consideration pressure class of fitting.
1.1. Ongoing work to make gaskets compliant with new AWWA requirements re disinfectants

- Typically, the disinfectant is 3ppm chlorine - and chlorimines (and in some few cases, chlorine dioxide).

- Chloramines in concentrations up to 5 ppm will have no aging effect on pipe gasket performance, use EPDM seals

- Our product is fully NSF61 certified by NSF
1.1. Large diameter hot tapping: solutions with 4” to 8”; tapping equipment used? Any special tooling the local water company may not have?

Max. cupdrill size is 3.3 “
2. Design features that makes products compatible with properties of HDPE

The uniqueness of the system lies in the sealing which consists of a flexible ring which consists of plastic segments and a rubber sealing ring (EPDM or NBR). The Restraint version is supplied with stainless steel metal grippers which makes the MULTI/JOINT® 3000 Plus restraint on all types of pipe materials.

Horizontal design
For PE piping gripping elements
3. Testing done with HDPE pipe (tensile/restraint, pressure, cyclic, others, ...)  

- The MULTI/JOINT undergoes all described tests acc. to EN14525  
- Tensile  
- Restraint  
- Pressure  
- Cyclic testing
### 3. Tests in acc. with the EN 14525

**Table 4 – Performance testing of the joints: requirements and test conditions**

<table>
<thead>
<tr>
<th>Test</th>
<th>Tests requirements</th>
<th>Pipe section</th>
<th>Test conditions</th>
</tr>
</thead>
</table>
| Positive internal pressure  | - test pressure (bar): 1.5PFA + 5  
- test duration: 2 h  
- no leakage               | Stiff pipe of maximum OD       | Joint deflected                            |
|                             |                     |                                | Joint aligned and withdrawn, with shear load |
| Positive internal pressure  | - test pressure (bar): 1.5PFA + 5  
- test duration: 2 h  
- no leakage               | Stiff pipe of minimum OD       | Joint of maximum annulus, deflected         |
| (if applicable)             |                     |                                | Joint of maximum annulus, aligned and        |
|                             |                     |                                | withdrawn, with shear load                  |
| Positive internal pressure  | - test pressure (bar): 1.5PFA + 5  
- test duration: 2 h  
- no leakage               | PFA 6 bar PVC pipe ²          | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn, with shear load                  |
|                             |                     |                                | Joint of maximum annulus, aligned and        |
|                             |                     |                                | withdrawn, with shear load                  |
| Negative internal pressure  | - test pressure: - 0.8 bar  
- test duration: 2 h  
- max pressure change: 0,08 bar | Stiff pipe of minimum OD       | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn, with shear load                  |
|                             |                     |                                | Joint of maximum annulus, aligned and        |
|                             |                     |                                | withdrawn, with shear load                  |
| Negative internal pressure  | - test pressure: - 0.8 bar  
- test duration: 2 h  
- max pressure change: 0,08 bar | PFA 6 bar PVC pipe ²          | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn, with shear load                  |
|                             |                     |                                | Joint of maximum annulus, aligned and        |
|                             |                     |                                | withdrawn, with shear load                  |
| Negative internal pressure  | - test pressure: - 0.8 bar  
- test duration: 2 h  
- max pressure change: 0,08 bar | PFA 6 bar PE pipe ²           | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn.                                  |
|                             |                     |                                |                                              |
| Dynamic internal pressure   | - test pressure: 24 000 cycles between 0,5 PMA or PMA - 5 bar and PMA  
- no leakage               | Stiff pipe of minimum OD       | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn.                                  |
|                             |                     |                                |                                              |
| Dynamic internal pressure   | - test pressure: 24 000 cycles between 0,5 PMA or PMA - 5 bar and PMA  
- no leakage               | PFA 6 bar PVC pipe ²           | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn.                                  |
|                             |                     |                                |                                              |
| Dynamic internal pressure   | - test pressure: 24 000 cycles between 0,5 PMA or PMA - 5 bar and PMA  
- no leakage               | PFA 6 bar PE pipe ²           | Joint of maximum annulus, aligned and        |
| (if applicable)             |                     |                                | withdrawn.                                  |

² The PFA 5 and PFA 16 PVC and / or PE pipes may be replaced by the lowest and the highest PVC and / or PE pipe series declared by the coupling/range adaptor manufacturer.

²b Whichever pressure range is the greater.
3. PE Testing in Japan, seismic
3. PE testing
3. Internal pressure test.

7 Performance tests

7.1 Leak tightness of joints to positive internal pressure

7.1.1 Coupling

The test shall be carried out on an assembled joint comprising a ductile iron coupling and two pipe sections (see figure 3).

The test apparatus shall be capable of providing suitable end and lateral restraints whether the joint is in the aligned position, deflected or subjected to a shear load. It shall be equipped with a pressure gauge with an error limit of ± 3%.

![Diagram of the test setup](image)

**Key**

1. Pipe section
2. Ductile iron coupling
3. Negative internal pressure test.

7.2 Leak tightness of joints to negative internal pressure

The test assembly shall be as given in 7.1.1 or 7.1.2 with the pipe section(s) axially restrained to prevent them from moving towards each other.

The test assembly shall be empty of water and shall be evacuated to a negative internal pressure of 0.8 bar (see Table 4) and then isolated from the vacuum pump. The test assembly shall be left under vacuum for at least 2 h during which the pressure shall not have changed by more than 0.08 bar. The test shall be at a temperature between 10 °C and 25 °C. The temperature of the test assembly shall not vary by more than 10 °C for the duration of the test.
3. Dynamic internal testing
24 000 cycle test.

7.3 Leak tightness of joints to dynamic internal pressure

The test assembly shall be as given in 7.1.1 or 7.1.2. The test assembly shall be filled with water and suitably vented of air.

The pressure shall be steadily increased up to PMA, the allowable maximum operating pressure of the joint, then automatically monitored according to the following pressure cycle:

a) steady pressure reduction to 0,5 PMA or PMA -5 (as applicable);

b) maintain 0,5 PMA or PMA -5 (as applicable) for at least 5 s;

c) steady pressure increase to PMA;

d) maintain PMA for at least 5 s.

The number of cycles shall be recorded and the test stopped automatically in the occurrence of a failure of the joint.

For a restrained joint, the test assembly, the test apparatus and the test procedure shall be identical, except that there shall be no end restraint, so that the axial thrust is taken by the restrained joint under test. In addition, possible axial movement of the spigot shall be measured every 15 min.

All necessary safety precautions should be taken for the duration of the pressure test.
4. Installation recommendations (stiffener, bolt torque, spring washers, special tooling, etc.).

- Every product is supplied with a full installation manual
- Torque figures are listed in the manual
- Before installing the product pay attention to the manual

### 5. Manufacturing Standards

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body</strong></td>
<td>Ductile iron GGG45 in accordance with EN-GJS-450-10.</td>
</tr>
<tr>
<td><strong>Clamp ring</strong></td>
<td>Ductile iron GGG45 in accordance with EN-GJS-450-10.</td>
</tr>
<tr>
<td><strong>Coating</strong></td>
<td>Resicoat® epoxy powder coating, type RT 9000 R4, meets the requirements of NSF Standard 61. Colour red (RAL 3003). Minimum layer thickness 250 micron, in accordance with the GSK-register.</td>
</tr>
<tr>
<td><strong>Varionoseal rubber gasket</strong></td>
<td>Potable water: EPDM, NSF 61 approved. Non potable water and gas: NBR.</td>
</tr>
<tr>
<td><strong>Uni/Fiks and Uni/Fleks ring</strong></td>
<td>POM (polyoxymethylene) and/or glass fibre filled Polyamide.</td>
</tr>
<tr>
<td><strong>Uni/Fiksers</strong></td>
<td>Stainless steel AISI 316.</td>
</tr>
<tr>
<td><strong>Bolts and nuts</strong></td>
<td>Stainless steel AISI 304 or stainless steel AISI 316. Bolts are PTFE coated, nuts are galvanised and passivated to prevent galling.</td>
</tr>
<tr>
<td><strong>Washers</strong></td>
<td>Stainless steel AISI 304 or stainless steel AISI 316.</td>
</tr>
<tr>
<td><strong>Flanges</strong></td>
<td>Drilling pattern in accordance with AWWA C-110 or patterns PN16/PN10 in accordance with EN1092-2.</td>
</tr>
<tr>
<td><strong>Working temperature</strong></td>
<td>-5°C to +50°C / 23°F to 122°F</td>
</tr>
<tr>
<td><strong>Working pressure [PFA]</strong></td>
<td>Non restraint: up to 362 psi water and up to 116 psi gas. Restraint: up to 232 psi water and up to 116 psi gas. * For details see user manual or contact your supplier.</td>
</tr>
<tr>
<td><strong>Certificates</strong></td>
<td>NSF, ACS (France), Belgaqua (Belgium), WRc (United Kingdom), ÖVGW (Austria), SVGW Switzerland), DVGW (Germany) and KIWA (The Netherlands). EN 14525: ÖVGW, SVGW and KIWA.</td>
</tr>
<tr>
<td><strong>Standards</strong></td>
<td>AWWA C219-11, AWWA C111/A21.11-12, AWWA C153/A21.53-11, RMDCS 02511, ASTM F1476-07(2013), AWWA C227-11</td>
</tr>
</tbody>
</table>
5. Model Specs

Available upon request

Word files with all detailed information
6. Projected Design life

50 years technical lifetime design. We consider the repairs as permanent.

Tested and proofed by internal testing methods (sensor tests).
6. Corrosion protection methods

- Epoxy powder coating
- Minimum layer thickness of 250 micron
- Impact resistant, thanks to the elasticity of the coating
- Perfect adhesion to the body (ISO 4624)
- No toxic substances
- No pores (3kV direct Volt test GSK)
- Chemical resistance of pH 2 - pH 13
- No bacteriological growth
- NSF approved

Resicoat is NSF approved

### NSF International

**OFFICIAL LISTING**

NSF International certifies that the products appearing on this listing conform to the requirements of NSF/ANSI Standard 61 - Drinking Water System Components – Health Effects.

This is the official listing recorded on April 12, 2017.

<table>
<thead>
<tr>
<th>Ahsco Hubal Powder Coatings GmbH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marktkassenstr. 50</td>
</tr>
<tr>
<td>D-72770 Raublingen</td>
</tr>
<tr>
<td>Germany</td>
</tr>
<tr>
<td>49 714 181 918</td>
</tr>
</tbody>
</table>

**Facility:** Raublingen, Germany

**Joining and Sealing Materials**

<table>
<thead>
<tr>
<th>Size</th>
<th>Sealsante</th>
<th>Resicoat Slim Master</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Protective (Barrier) Materials**

<table>
<thead>
<tr>
<th>Trade Designation</th>
<th>Water Contact Temp</th>
<th>Water Contact Material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Additions shall not be made to this document without prior evaluation and acceptance by NSF International.

1 of 3
7. History of use with HDPE/ case studies/ operating conditions
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7. History of use with HDPE/ case studies/ operating conditions
7. History of use with HDPE/ case studies/ operating conditions
7. Canada reference
7. Canada valve chamber
7. Canada
7. Canada bridge crossing isolated PE pipes
8. Other issues and concerns

**Nominal* angularity**
- Restraint connection: 8° per coupling side
- Non-restraint connection: 8° per coupling side

*Based on the middle of the coupling range*
8. Other issues and concerns

- One stab one piece fitting
- No need for adjusting the product on site
- High grade materials used. Stainless steel and ductile iron
- No steel parts in the system. Preventing corrosion risks.
- 25 Years of track record with PE - up to 24 inch.
- PE Restraint / pull out resistance
Thank you for your attention!

Q&A

"Didn’t I tell you to use MULTI/JOINT® fittings!"