



## 1 Introduction

This report describes the assessment of the characteristics for the intended use of the plastics piping kits for the transport system of hot and cold water, made of PE-RT Type II, introduced by Westfälische Rohrwerke GmbH.

These tests for the assessment were carried out in accordance with the verification methods in of the CUAP No. 07.01/04 "Plastics piping kits for the transport system of hot and cold water, made of PE-RT Type II". This report contains the results of the tests that have been carried out and the use of those results in order to verify that the product characteristics meet the declared values as those in the corresponding ETA-07/0058.

## 2 Available test reports

The available data were taken from the test reports listed below:

- a) Test report WRW FPC test report FB-Wareneingang dated 14-08-2006  
Including: - melt mass flow rate of the PE-RT material (ETA clause 2.3.1.1)  
- melt mass flow rate of the extruded pipe (ETA clause 2.4.6)
- b) Test report Dow 2866688 dated 26-20-2006  
Including: - oxidation induction time of the PE-RT material (ETA clause 2.3.1.2)
- c) Test report WRW FPC test report FB dated 22-11-2006  
Including: - density of the PE-RT material (ETA clause 2.3.1.3)
- d) Test report Bodycote P02-195 dated 02-12-2002  
Including: - conformance to the reference curves (ETA clause 2.3.1.4)
- e) Test report Novelis 81406452 dated 13-12-2006  
Including: - minimum tensile strength of the aluminium functional layer material (ETA clause 2.3.2)  
- minimum percentage elongation after fracture of the aluminium functional layer material (ETA clause 2.3.2)  
- minimum permanent set strength at 0,2% of the aluminium functional layer material (ETA clause 2.3.2)  
- layer thickness of the aluminium strip (ETA clause 2.4.2)
- f) Test report SKZ 67689/05-II dated 11-07-2006  
Including: - peak melting temperature of the adhesive material (ETA clause 2.3.3)  
- longitudinal reversion of the pipe (ETA clause 2.4.3)  
- hydrostatic strength of the pipe (ETA clause 2.4.7)
- g) Test report WRW FPC test report FB-Dimensionskontrolle dated 17-01-2007  
Including: - geometrical characteristics of the pipe (ETA clause 2.4.2)
- h) Test report WRW FPC test report FB-Aluminiumprüfung dated 15-12-2006  
Including: - layer thickness of the aluminium strip (ETA clause 2.4.2)
- i) Test report WRW FPC FB dated 20-12-2006  
Including: - longitudinal reversion (ETA clause 2.4.3)
- j) Test report Kiwa KL4357 dated 29-11-2006  
Including: - elongation at break of the PE-RT pipe (ETA clause 2.4.4)
- k) Test report Kiwa KL3620 dated 24-08-2006  
Including: - thermal stability of the PE-RT pipe (ETA clause 2.4.5)

- l) Test report Kiwa KL3847 dated 28-03-2006  
Including: - hydrostatic strength of the pipe (ETA clause 2.4.7)
- m) Test report SKZ 67690/05-I dated 17-07-2006 (Multicapas fittings)  
Including: - pressure test fittings (ETA clause 2.5.1.1)  
- internal pressure test on the piping system (ETA clause 2.7.1)  
- bending test on the piping system (ETA clause 2.7.2)  
- pull-out test on the piping system (ETA clause 2.7.3)  
- thermal cycling test on the piping system (ETA clause 2.7.4)  
- pressure cycling test on the piping system (ETA clause 2.7.5)  
- leaktightness under vacuum (ETA clause 2.7.6)
- n) Test report SKZ 67690/05-II dated 13-02-2006 (IPA fittings)  
Including: - pressure test fittings (ETA clause 2.5.1.1)  
- internal pressure test on the piping system (ETA clause 2.7.1)  
- bending test on the piping system (ETA clause 2.7.2)  
- pull-out test on the piping system (ETA clause 2.7.3)  
- thermal cycling test on the piping system (ETA clause 2.7.4)  
- pressure cycling test on the piping system (ETA clause 2.7.5)  
- leaktightness under vacuum (ETA clause 2.7.6)
- o) Test report SKZ 67690/05-III dated 17-07-2006 (APE fittings)  
Including: - pressure test fittings (ETA clause 2.5.1.1)  
- internal pressure test on the piping system (ETA clause 2.7.1)  
- bending test on the piping system (ETA clause 2.7.2)  
- pull-out test on the piping system (ETA clause 2.7.3)  
- thermal cycling test on the piping system (ETA clause 2.7.4)  
- pressure cycling test on the piping system (ETA clause 2.7.5)  
- leaktightness under vacuum (ETA clause 2.7.6)
- p) Test report Diehl Metall 898037843 dated 17-06-2005  
Including: - dezincification resistance (ETA clause 2.5.1.2)
- q) Test report MPA NRW 22 0003602 dated 04-05-2005 (Multicapas fittings)  
Including: - mechanical characteristics on elastomeric sealing elements  
(ETA clause 2.5.2)
- r) Test report MPA NRW 22 0003060 dated 24-02-2004 (IPA fittings)  
Including: - mechanical characteristics on elastomeric sealing elements  
(ETA clause 2.5.2)
- s) Test report EBI 05/194/5114/01 dated 26-09-2005 (APE fittings)  
Including: - mechanical characteristics on elastomeric sealing elements  
(ETA clause 2.5.2)
- t) Test report Kiwa 060900179 dated 19-10-2006 (Multicapas fittings)  
Including: - geometrical characteristics on fittings (ETA clause 2.6.1)
- u) Test report inspection Kiwa K11610 dated 17-08-2006 (IPA fittings)  
Including: - geometrical characteristics on fittings (ETA clause 2.6.1)
- v) Test report inspection Kiwa K25301 dated 27-11-2006 (APE fittings)  
Including: - geometrical characteristics on fittings (ETA clause 2.6.1)
- w) Test report Kiwa KL3967 dated 23-05-2006 (IPA fittings)  
Including: - internal pressure test on the piping system (ETA clause 2.7.1)

### 3 Evaluation of the available data

The piping system is evaluated according to the following groups in accordance with prEN 15015:

- pressure group: 1 and 2 (design pressure, 1-  $p_D \leq 6$  bar; 2-  $p_D > 6$  bar);
- size group: 1 (range of nominal diameters,  $d_n \leq 63$  mm);
- fitting groups: 1, 2 and 3 (1-elbows and tees; 2-reducers, couplers, end caps; 3-adapters).

#### 3.1 Raw materials of the pipe

##### 3.1.1 PE-RT material of the stress bearing layer

###### 3.1.1.1 Melt mass flow rate

The melt mass flow rate was determined according to EN ISO 1133 with the test conditions according to clause 2.3.1.1 of the ETA.

The test result was 0,809 g/10 min, the declaration in the ETA is between 0,6 g/10 min and 1,0 g/10 min.

###### 3.1.1.2 Oxidation induction time

The oxidation induction time (OIT) was determined in accordance with clause 2.3.1.2 of the ETA. The test result was 63 min, the declared value in the ETA is greater than 40 minutes.

###### 3.1.1.3 Density

The density of the PE-RT material was determined in accordance with clause 2.3.1.3 of the ETA. The test result was 0,9417 kg/m<sup>3</sup>, the declared value in the ETA is between 0,940 kg/m<sup>3</sup> and 0,942 kg/m<sup>3</sup>.

###### 3.1.1.4 Demonstrating conformance to the reference curves

The tested PE-RT Type II material shows conformance to the reference curves of annex A in CUAP 07.01/04 according to clause 2.3.1.4 of the ETA.

##### 3.1.2 Aluminium functional layer

The characteristics of the aluminium functional layer are determined in accordance with clause 2.3.2 of the ETA and EN 10002-1 with a test speed of 10mm/min up till an elongation of 0,2% and a test speed of 20mm/min after this 0,2% elongation percentage.

- The minimum tensile strength ( $R_m$ ) is 128 MPa, the declared value in the ETA is greater than 95 MPa.

- The minimum percentage elongation after fracture ( $A_{50}$ ) is 26%, the declared value in the ETA is greater than 15%.

- The minimum permanent set strength at 0,2% ( $R_{r,0,2}$ ) is 55 MPa, the declared value in the ETA is greater than 35 MPa.

##### 3.1.3 Peak melting temperature of the adhesive layer(s)

The peak melting temperature of the adhesive layer is determined in accordance with clause 2.3.3 of the ETA. The test result was 127°C, the declared value in the ETA is greater than 120°C.

##### 3.1.4 Outer protective layer

The outer layer is made of the same PE-RT as used for the inner stress bearing layer and therefore covered by clause 3.1.1 of this evaluation report.

#### 3.2 Extruded pipe, inclusive functional barrier layer

##### 3.2.1 Build up of the pipe

The drawings for the build up of the pipes and the used colours of the pipes are deposited at Kiwa N.V.

**3.2.2 Geometrical characteristics**

The geometrical characteristics are determined in accordance with clause 2.4.2 of the ETA.

dn	d <sub>em</sub> (mm)	ovality (mm)	e <sub>min</sub> (mm)	e <sub>max</sub> (mm)	e <sub>aluminium</sub> (mm)
16	16,16	0,03	2,03	2,36	0,20
20	20,26	0,32	2,27	2,49	0,24
25	25,21	0,43	2,48	2,82	0,30
26	26,04	0,18	2,97	3,26	0,30
32	32,28	0,41	3,00	3,33	0,35

**3.2.3 Longitudinal reversion**

The longitudinal reversion is determined in accordance with clause 2.4.3 of the ETA. The maximum test result was 0,22%, the declared value in the ETA is smaller than 2%.

**3.2.4 Elongation at break (PE-RT)**

The elongation at break is determined in accordance with clause 2.4.4 of the ETA. The minimum test result was 504%, the declared value in the ETA is greater than 350%.

**3.2.5 Thermal stability (PE-RT)**

The thermal stability is determined in accordance with clause 2.4.5 of the ETA. The test was voluntary stopped at 8760h, the declared value in the ETA is greater than 8760h.

**3.2.6 Melt mass flow rate (PE-RT)**

The melt mass flow rate of the extruded pipe is determined in accordance with clause 2.4.6 of the ETA. The test result was 0,798g/10min, the resulting deviation of this melt flow rate with the melt flow rate of the raw material is 0,01 g/10 min. The declared value in the ETA is smaller than 30% deviation of the initial MFR value.

**3.2.7 Hydrostatic strength**

The hydrostatic strength of the extruded pipe is determined in accordance with clause 2.4.7 of the ETA at a temperature of 95°C. For composite pipes, not the hoop stress (4,0 MPa) is used but the actual test pressure (in MPa or bar), see table below. The tests were voluntary stopped at 1000h, the declared value in the ETA is greater than 1000h.

dimensions (mm)	Test pressure (bar)
16x2,0	20,3
20x2,25	17,8
25x2,5	14,8
26x3,0	15,5
32x3,0	15,4

**3.2.8 Release of dangerous substances**

For the release of dangerous substances of the products a reference is made to clause 3.6 of this evaluation report.

**3.3 Raw material of the fittings**

**3.3.1 Metal fittings**

**3.3.1.1 Pressure test**

The resistance to pressure of the metal fittings is determined in accordance with clause 2.5.1.1 of the ETA.

The test results were no leakage during testing at minimum 15,4 bar at 95°C for 1000 hours.

**3.3.2 Elastomeric sealing elements**

The requirement values of the properties of the elastomeric sealing elements are determined in accordance with clause 2.5.2 of the ETA and EN 681-1 and EN 681-1/A1 for EPDM rubber with hardness IRHD 70 (Multicapas and APE) or IRHD 80 (APE), type WB.

### 3.3.3 Release of dangerous substances

For the release of dangerous substances of the products a reference is made to clause 3.6 of this evaluation report.

## 3.4 Fitting characteristics

### 3.4.1 Geometrical characteristics

The geometrical characteristics are determined in accordance with clause 2.6.1 of the ETA. The drawings with accompanying tolerances on the relevant geometrical characteristics are deposited at Kiwa N.V., all measurements were within the given tolerances of clause 4.3 of EN 1254-3.

## 3.5 Tightness of the jointing

### 3.5.1 Internal pressure test

The resistance to internal hydrostatic pressure of the piping system is determined in accordance with clause 2.7.1 of the ETA. The test results were:

- for the piping system with Multicapas fittings: no leakage during the testing time of 1000 hour at 95°C/15,5bar, declared is a testing time without leakage greater than 1000 hour;
- for the piping system with IPA fittings: no leakage during the testing time of 1000 hour at 95°C/13,9bar, declared is a testing time without leakage greater than 1000 hour;
- for the piping system with APE fittings: no leakage during the testing time of 1000 hour at 95°C/15,5bar, declared is a testing time without leakage greater than 1000 hour.

### 3.5.2 Bending test

The leaktightness under bending of the piping system is determined in accordance with clause 2.7.3 of the ETA. The test results were:

- for the piping system with Multicapas fittings: no leakage during the testing time of 1 hour, declared is a testing time without leakage greater than 1 hour;
- for the piping system with IPA fittings: no leakage during the testing time of 1 hour, declared is a testing time without leakage greater than 1 hour;
- for the piping system with APE fittings: no leakage during the testing time of 1 hour, declared is a testing time without leakage greater than 1 hour.

### 3.5.3 Pull-out test

The resistance to pull-out of the piping system is determined in accordance with clause 2.7.3 of the ETA. The test results were:

- for the piping system with Multicapas fittings: a pull-out force of 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) were measured without failure during testing, declared is a pull-out force greater than 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) without failures;
- for the piping system with IPA fittings: a pull-out force of 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) were measured without failure during testing, declared is a pull-out force greater than 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) without failures;
- for the piping system with APE fittings: a pull-out force of 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) were measured without failure during testing, declared is a pull-out force greater than 500N (16mm), 800N (20mm), 1250N (25mm and 26mm) and 2000N (32mm) without failures.

### 3.5.4 Thermal cycling test

The resistance to temperature cycling of the piping system is determined in accordance with clause 2.7.4 of the ETA. The test results were:

- for the piping system with Multicapas fittings: voluntary stopped at 5000 cycles without failures observed, declared in the ETA is greater than 5000 cycles without failures;
- for the piping system with IPA fittings: voluntary stopped at 5000 cycles without failures observed, declared in the ETA is greater than 5000 cycles without failures;
- for the piping system with APE fittings: voluntary stopped at 5000 cycles without failures observed, declared in the ETA is greater than 5000 cycles without failures.

### 3.5.5 Pressure cycling test

The resistance to pressure cycling of the piping system is determined in accordance with clause 2.7.5 of the ETA. The test results were:

- for the piping system with Multicapas fittings: voluntary stopped at 10000 cycles without failures observed, declared in the ETA is greater than 10000 cycles without failures;
- for the piping system with IPA fittings: voluntary stopped at 10000 cycles without failures observed, declared in the ETA is greater than 10000 cycles without failures;
- for the piping system with APE fittings: voluntary stopped at 10000 cycles without failures observed, declared in the ETA is greater than 10000 cycles without failures.

### 3.5.6 Leak tightness under vacuum

The resistance to vacuum of the piping system is determined in accordance with clause 2.7.6 of the ETA. The test results were:

- for the piping system with Multicapas fittings: the test was voluntary stopped at 1 hour without failure and change in vacuum smaller than 0,05 bar, declared is a vacuum change less than 0,05 bar;
- for the piping system with IPA fittings: the test was voluntary stopped at 1 hour without failure and change in vacuum smaller than 0,05 bar, declared is a vacuum change less than 0,05 bar;
- for the piping system with APE fittings: the test was voluntary stopped at 1 hour without failure and change in vacuum smaller than 0,05 bar, declared is a vacuum change less than 0,05 bar.

### 3.6 Release of dangerous substances

The products in regard to the release of dangerous substances have been assessed with the procedures detailed in guidance paper H.

The manufacturers and his raw material suppliers have made declarations that the product Smartpipe system does not contain dangerous substances according to European regulations. The composition is deposited at Kiwa N.V..