

**Report No.:** R16 01 2589\_ACT

**Subject:** Full Notch Creep Tests (FNCT) under ACT test conditions on specimens from a 2-layer gas pipe OD110 x 10.0 mm (SDR 11) according to ZP 14.23.39 and following PAS 1075

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Information regarding accreditation, certification, recognition as testing laboratory and further official recognition will be provided on written request.



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The test results in this report relate only to the items tested.  
Further test specifications can be found in the documentation of testing.  
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## 1 Preliminary Remarks

The objective of the investigation is the determination of the resistance to slow crack growth of pipes using the Full Notch Creep Test (FNCT) under ACT-conditions according to PAS 1075.

The FNCT represents an accelerated test method which allows the assessment of polymeric materials with respect to their stress-crack behaviour.

The tests are performed on notched specimens according to the test methods described in EN 12814-3, Annex A and the test instruction PA ACT 2.1-9 of HESSEL Ingenieurtechnik.

## 2 Basics of the Investigation

PAS 1075 (2009-04)	Pipes made from Polyethylene for alternative installation techniques - Dimensions, technical requirements and testing, Beuth Verlag GmbH, Berlin, Germany
EN 12814-3 (2014-07)	Testing of welded joints in thermoplastics semi-finished products — Part 3: Tensile creep test, Annex A: Resistance to slow crack growth, Beuth Verlag GmbH, Berlin, Germany
PA ACT 2.1-9 (2013-09)	Accelerated Creep Test (ACT) - Accelerated test method to verify the creep rupture strength of polyolefins (validation included), internal instruction for testing of HESSEL Ingenieurtechnik GmbH, Roetgen, Germany
DVS 2203-4 Supplement 3 2015-03	Testing of welded joints of thermoplastic sheets and pipes - Tensile creep test – Verification of the required long-term welding factor and the minimum service life of welded joints made from polyethylene (PE 80 und PE 100), DVS Media GmbH, Düsseldorf, Germany

## 3 Test sample

Black pipes (Type 2) with orange outside layer OD 110 x 10 mm (SDR11) arrived at HESSEL Ingenieurtechnik on 25.03.2014.



#### 4 Specimen Preparation and Testing Conditions

Specimens with parallel sides and square cross-sections (10 mm x 10 mm) were machined in axial direction from the pipe. Each specimen was notched perpendicular to the parallel sides' in middle of the test specimen (figure 1).

The tensile creep rupture tests were performed on 3 notched specimens following EN 12814-3 Annex A and the test instruction and PA ACT 2.1-9 using a solution of NM5<sup>1</sup> in demineralised water (2/100, w/w) at (90 ± 0.5) °C. The specimens were loaded by a constant tensile stress of (4.00 ± 0.02) N/mm<sup>2</sup> related to the remaining un-notched cross-sections (ligament-area). The creep rupture times were recorded.

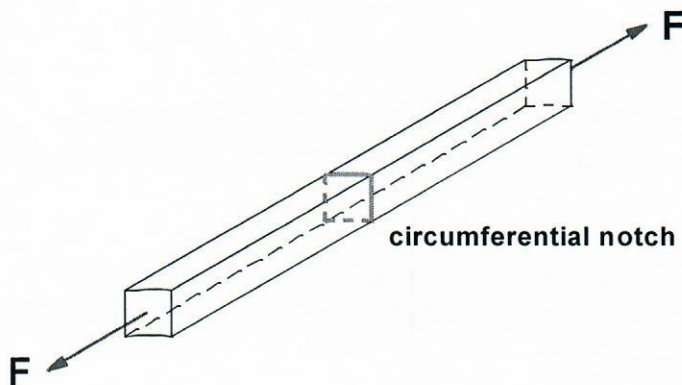


Figure 1: FNCT-specimen under constant load

#### 5 Test Results

The results of the tested specimens are given in table 2. The creep rupture times were statistically evaluated according to DVS 2203-4 supplement sheet 3.

Specimen-designation	Rupture time [h]	Geometric mean value [h]	Scattering-factor	Remark
A1	824.2	<b>844.2</b>	1.03 (3 %)	Percentage of brittle fracture surface related to the ligament-area > 30 %
A2	842.5			
A3	866.5			

Table 2: Results of tensile creep tests on notched specimens (ACT) in an aqueous solution of 2 % NM5 at 90 °C and 4 N/mm<sup>2</sup>

1 Mixture of anionic and cationic detergents

The geometric mean value of the rupture times is below the requirement of 160 hours for PE 100-RC pipes at 90 °C and 4 N/mm<sup>2</sup> in an aqueous solution of 2 % NM5 (ACT conditions) according to the pipe stress cracking test in PAS 1075.

## **6 Conclusion**

**The tested 2-layer pipe (OD110 x 10 mm) meets the PAS 1075 requirement of 160 hours in the pipe stress cracking test.**

