

Report No.: R16 01 2589_PLT+

Subject: Accelerated Point Loading Tests (PLT+) on
2-layer gas pipes 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,
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recognition will be provided on written request.



Date: 25.02.2016

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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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Preliminary Remarks

The objective of the investigation is the testing of polyethylene pipes under internal pressure and additional external point load following PAS 1075 to prove the applicability for alternative installation methods. The tests have been performed for pipe approval testing.

Basics of the Investigation

- Hessel, J The creep behaviour of polyethylene under the influence of local stress concentrations, 3R international 34 (1995) 10/11, pages 573-579, Vulkan-Verlag GmbH, Essen, Germany
- Hessel, J. Minimum service-life of buried polyethylene pipes without sand-embedding, 3R international 40 (2001) Special Plastics Pipes, pages 4-12, Vulkan-Verlag GmbH, Essen, Germany
- PAS 1075
(2009-04) Pipes made from Polyethylene for alternative installation techniques - Dimensions, technical requirements and testing, Beuth Verlag GmbH, Berlin, Germany
- PA PLP+ 2.2-4
(2013-09) Accelerated internal pressure tests of thermoplastic pipes with additional locally concentrated external load (point load, linear load) following to PAS 1075, Annex A3, internal instruction for testing of HESSEL Ingenieurtechnik GmbH, Roetgen, Germany

Test sample

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

Principle and Limiting Conditions of the Tests

The maximum stress that the pipe material will experience from a point load is the yield stress. Therefore in this test it was ensured that the displacement of the point load into the pipe wall was sufficient to cause yielding of the material at the inside of the pipe. Since the additional stress in the pipe wall far from the point of load will be zero all possible stresses that might occur in the field due to a point load are represented in this test.

There are two scenarios which are not covered:

- 1) The penetration of a sharp object through the pipe wall and
- 2) the complete crushing of the pipe, e.g. by a large rock.

Specimen preparation and testing conditions

The pipe ends were closed by using end-caps. One of the end caps was equipped with a pressure connection.

The required surface elongation at the inner pipe wall (i.e. the above yield elongation) was produced by a tool displacement from the outer surface along the radius of the pipe with a tool tip radius of 5 mm (figure 1). The tool loading was carried out at room temperature with no internal pressure in the pipe.

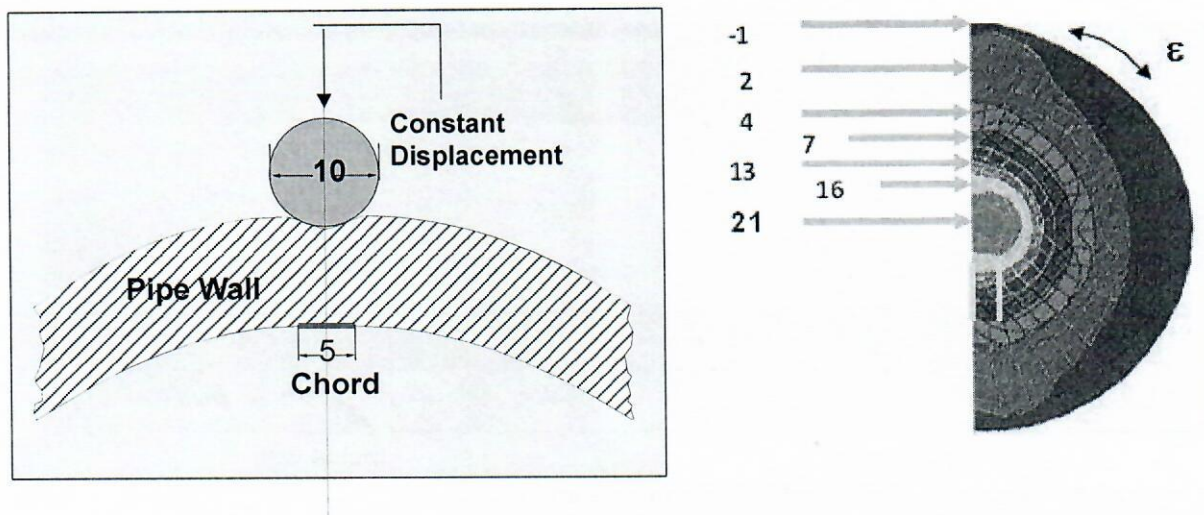


Figure 1: External point load at the pipe wall and finite element analysis of the elongation at the inside pipe wall

The point loading tests have been performed on 3 specimens following to PAS 1075 and the test instruction PA PLP+ 2.2-4 using a solution of NM5¹ in demineralised water (2/100, w/w) at 90 °C.

The internal pressure of the pipe was selected according to a circumferential stress of 4 N/mm². The testing times have been recorded.

1 Mixture of anionic and cationic detergents

Test Results

The results of the point loaded pipes under internal pressure are summarised in table 1. Specimen B1 and B3 were removed from test after fracture of specimen B2. The requirement of the pipe approval testing at the applied test conditions is > 450 hours.

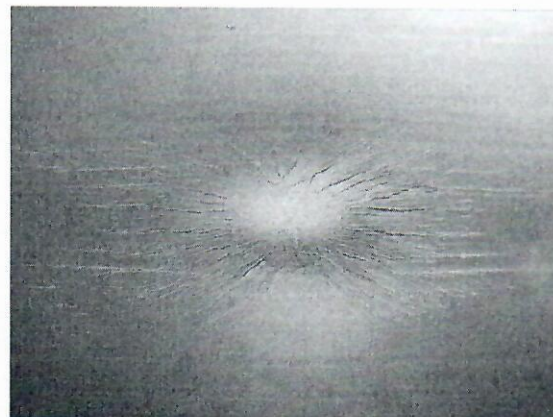
Specimen-designation	Testing time [h]	Remark
B1	>751	Starting cracks at the point load area
B2	751.0	Failure at the point load area
B3	>751	Starting cracks at the point load area

Table 1: Results in the point loading tests under internal pressure at 90 °C in an aqueous solution of NM5

The appearance of the pipe walls at the point load locations are shown in figures 2 to 4.

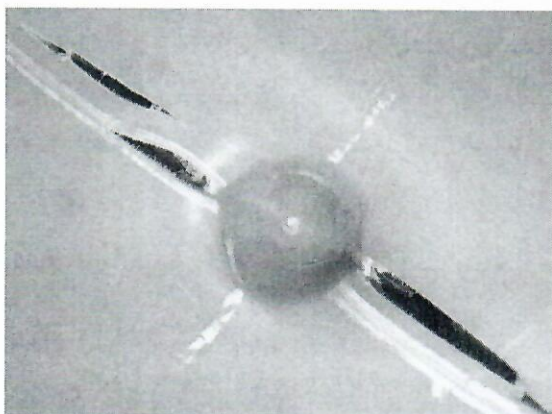


Outside wall

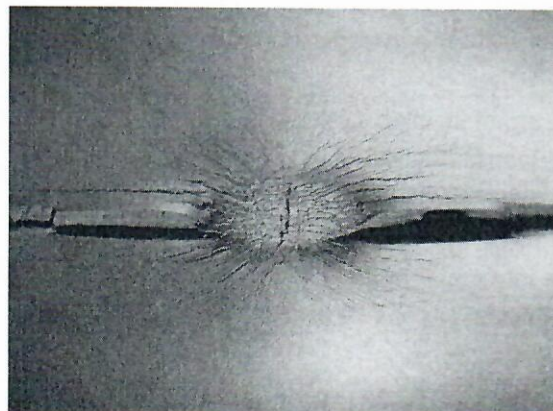


Inside wall

Figure 2: Figure 2: Pointload location of specimen B1

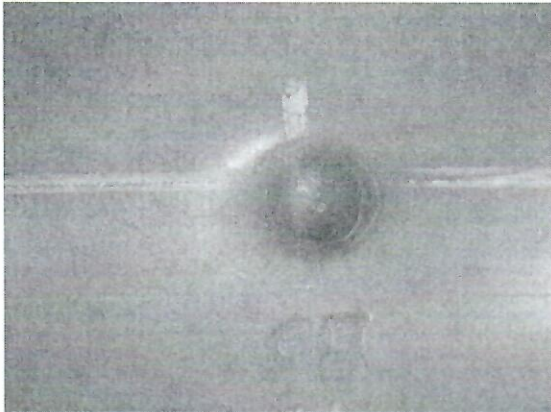


Outside wall

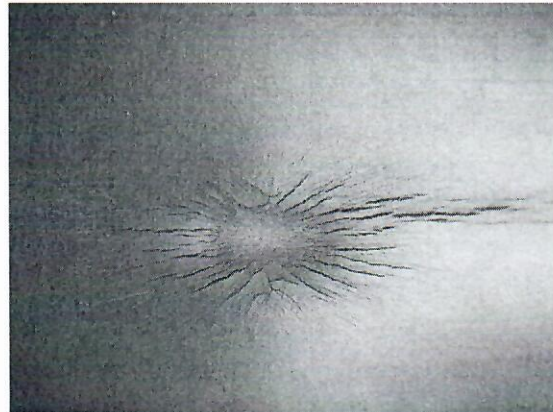


Inside wall

Figure 3: Pointload location of specimen B2 (failure)



Outside wall



Inside wall

Figure 4: Pointload location of specimen B3

Conclusion

The 2-layer gas pipes OD110 x 10 mm meet the requirement in the accelerated Point Loading Test according to ZP 14.23.39 and following PAS 1075.

