

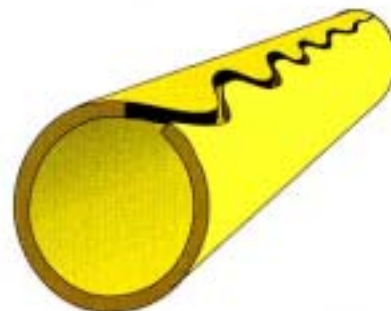
Bodycote Report

RAPID CRACK PROPAGATION - CRITICAL PRESSURE

Rapid crack propagation test (S4) according to ISO 13477 of the PE pipe grade P301EBL from Korea Petrochemical Ind. Co., Ltd.

Final report

Mattias Svedberg



*Rapid crack propagation:
Instable dynamic crack propagation*

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Restricted distribution

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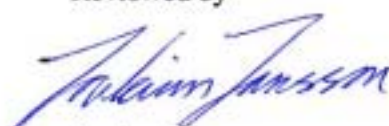
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**RAPID CRACK PROPAGATION
- CRITICAL PRESSURE
Rapid crack propagation test (S4) according to ISO 13477
of the PE pipe grade P301EBL from Korea Petrochemical**

Abstract

A rapid crack propagation testing program has been performed on behalf of Korea Petrochemical Ind. Co., Ltd (herein KPIC). In total 5 pipe specimens of the PE pipe grade P301EBL, 110 x 10 mm, were tested according to the Small-Scale Steady-State test (S4 test), ISO 13477:1997. The testing was performed at 0°C and at different internal pressures. The results show that the critical pressure is >12.0 bar at 0°C.

Reviewed by



Joakim Jansson

Approved by



Jarmo Hassinen

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A	S4-test results, Table A.1
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1 Investigated pipe material

Brand name: P301EBL
Resin manufacturer: KPIC
Lot number: -
Pipe manufacturer: Zhejiang FENGYE, China
Production date: -
Nominal pipe dimension: 110 x 10 mm
Delivery date at Bodycote: 2002-08-01
Bodycote internal code: 2953

2 Experimental procedure

All tests have been performed at the Polymer Laboratory at Bodycote Polymer AB. The pipes were cut into lengths of 790 mm. The pipes were conditioned for at least 16 h at 0°C in air. The internal and external medium was air during the test. The testing followed ISO 13477:1997.

3 Results

A total of 5 pipes have been tested. The results are presented in Appendix A and shown in Appendix B.

In order to have crack propagation the crack length shall be at least 4.7 times the nominal diameter (in this case 517 mm). The test equipment is limited to about 12 bar and because no crack propagation occurred at 12.0 bar the critical pressure for crack propagation at 0°C for the PE pipe grade P301EBL is >12.0 bar.

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Table A.1

S4-testing at 0°C of the PE pipe grade P301EBL from KPIC using air as the internal and external test medium. Bodycote internal code is 2953-.

Test laboratory:	Bodycote Polymer AB
Test method:	ISO 13477:1997
Test medium (internal/external):	Air/air
Conditioning method and time:	Air refrigerator, 16 hours
Nominal pipe diameter (D_n) and SDR:	110 mm, SDR 11
Pipe length (total/free):	790/730 mm
Gauge length:	596 mm
Knife speed:	12-15 m/s
Responsible person for the tests:	Fredrik Hegefors

Specimen ¹⁾ (internal code)	Temp °C	Start	$t^2)$ mm	$D^3)$ mm	$p^4)$ bar	$\sigma^5)$ MPa	Crack length mm	Crack length/ D_n ⁶⁾
2953-3	0	020821	-	110.60	12.0	-	42	0.38 (crack arrest)
2953-5	0	020827	-	110.60	12.0	-	28	0.25 (crack arrest)
2953-2	0	020821	-	110.65	10.0	-	44	0.40 (crack arrest)
2953-1	0	020821	-	110.60	8.0	-	222	2.02 (crack arrest)
2953-4	0	020827	-	110.60	4.0	-	96	0.87 (crack arrest)

1) Internal reference code at Bodycote

2) Minimum wall thickness (not measured)

3) Mean outside diameter

4) Internal over pressure

5) Circumferential stress (hoop stress)

6) If the ratio (crack length/ D_n) is ≤ 4.7 then crack arrests

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Rapid crack propagation diagram

