

Bodycote Report

RAPID CRACK PROPAGATION –CRITICAL PRESSURE

Evaluation of the critical pressure according to ISO 13477 of the pipe grade P502YE from Korea Petrochemical Ind. Co., Ltd.

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**RAPID CRACK PROPAGATION –CRITICAL PRESSURE
Evaluation of the critical pressure according to ISO 13477 for the
pipe grade P502YE from Korea Petrochemical Ind. Co., Ltd.**

Summary

An evaluation of the critical pressure for rapid crack propagation according to ISO 13477 for the pipe grade P502YE has been performed on behalf of Korea Petrochemical Ind. Co., Ltd.

Five pipe specimens, 110 mm SDR 11, of the pipe grade were tested according to the Small-Scale Steady-State test (S4 test), ISO 13477. The testing was performed at 0°C and at different internal pressures.

Material	Bodycote code	Critical pressure at 0°C
P502YE	3685	≥12 bar

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Appendices

- A Investigated pipe material
- B Test results
- C Diagram

Reviewed by

Approved by

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1 Investigated pipe material

The characteristics and code of the investigated material is presented in Appendix A, Table A.1.

2 Experimental procedure

All tests have been performed at Bodycote Polymer. The pipes were cut into 840 mm sections and conditioned for at least 16 h at -1 ± 1 °C in air. The internal and external medium was air during the test. The testing followed ISO 13477:1997.

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In order to have crack arrest the crack length shall be ≤ 4.7 times D_n^1 . For the result to be valid the initiated crack length must be at least equal to D_n .

3 Results

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

As no initiated crack propagated longer than 4.7 times D_n at 12 bar, the critical pressure for crack propagation at 0°C, p_{cS4} , for the PE pipe grade P502YE is ≥ 12 bar.

¹ Nominal outer diameter of the pipe

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Table A.1, Investigated pipe material

Trade name:	P502YE
Material:	PE
Colour	Yellow
Resin producer:	Korea Petrochemical Ind. Co., Ltd.
Pipe producer:	Korea Petrochemical Ind. Co., Ltd.
Pipe production date:	n/a
Lot number:	n/a
Pipe dimension:	110 mm, SDR 11
Pipe marking:	n/a
Consignor:	Korea Petrochemical Ind. Co., Ltd.
Arrival date at Bodycote:	2006-01-10
Amount of pipes:	21 x 1.4 m
Bodycote code:	3685

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Table B.1

S4-testing at 0°C of the pipe grade P502YE from Korea Petrochemical Ind. Co., Ltd. using air as the internal and external test medium. Bodycote internal code is 3685.

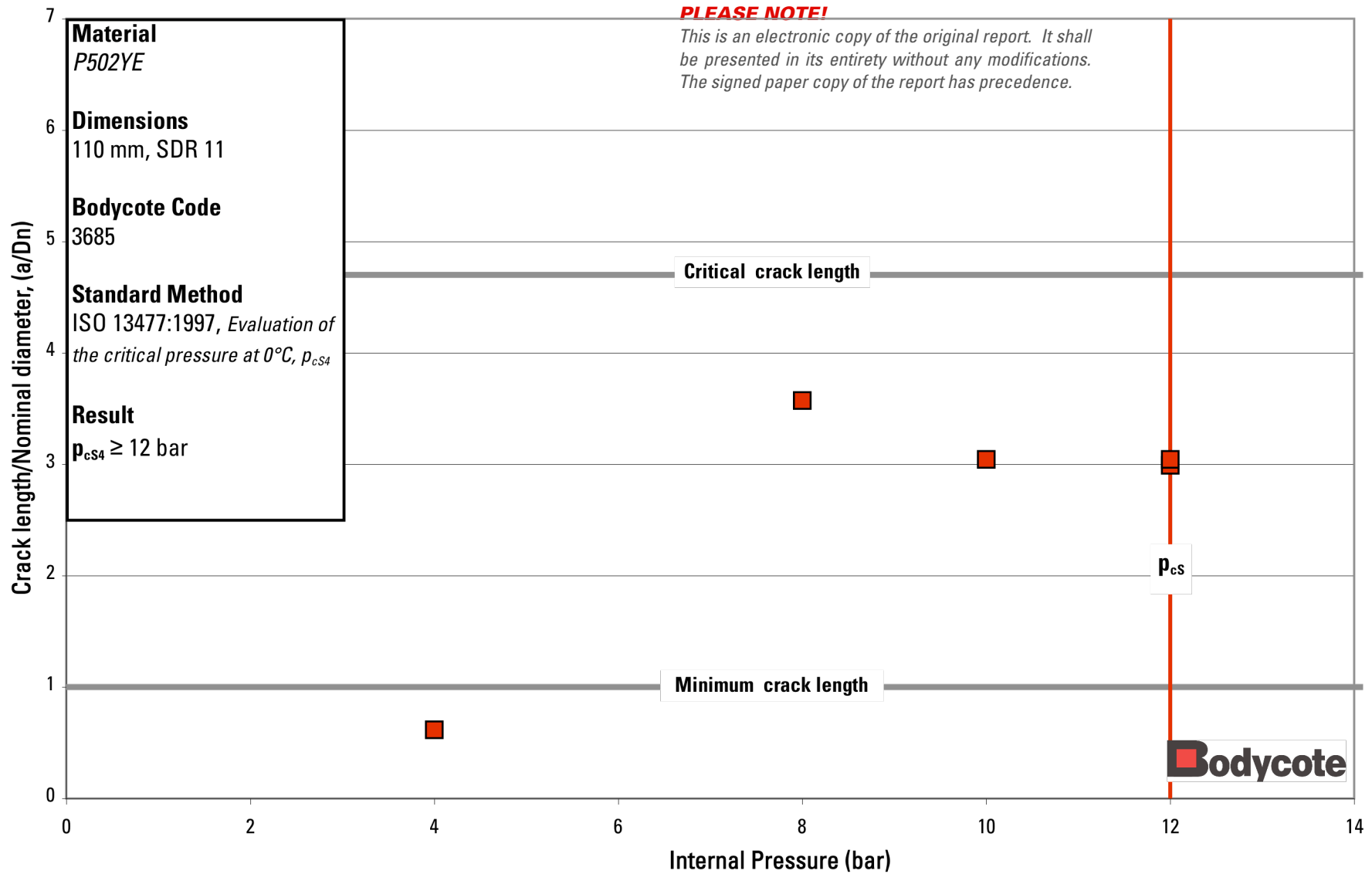
Test laboratory: Bodycote Polymer
 Test method: ISO 13477:1997
 Test medium (internal/external): Air/air
 Conditioning method and time: Air refrigerator, 16 hours
 Nominal pipe diameter (D_n), SDR: 110 mm, SDR 11
 Pipe length (total): 840 mm
 Gauge length: 606 mm
 Responsible for the tests: Fredrik Hegefors

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Specimen ¹⁾ (internal code)	Temp °C	Start	t ²⁾ mm	D ³⁾ mm	p ⁴⁾ bar	v ⁵⁾ m/s	Crack ⁶⁾ length mm	Crack length/D _n ⁷⁾
3685-6	0	060120	-	110.65	4.0	14.9	68	0.62 (not valid)
3685-4	0	060120	-	110.70	8.0	14.9	393	3.57 (crack arrest)
3685-8	0	060120	-	110.40	10.0	15.0	335	3.05 (crack arrest)
3685-7	0	060120	-	110.15	12.0	15.0	329	2.99 (crack arrest)
3685-5	0	060120	-	110.00	12.0	15.0	335	3.05 (crack arrest)

- 1) Internal reference code at Bodycote
- 2) Minimum wall thickness (not measured)
- 3) Mean outside diameter
- 4) Internal pressure
- 5) Knife speed at impact
- 6) A valid crack is defined to be one time the nominal outside diameter (110 mm)
- 7) If the ratio (crack length/D_n) is ≤4.7 then crack arrest. If the ratio is <1.0 the test is not valid.

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