

IKT Compare „Short Liner for House Connections“

Test task: Rehabilitation of damaged house connections and subsequent evaluation against groundwater pressure, operational loadings and backed-up water

Supplier		Twinbond Liner	Trelleborg Pipe Seals	Bodenbender	BKP Berolina	Cosmic Engineering	MC-Bauchemie	alocit Chemie	I.S.T.
System		TbL-Verfahren	epros DrainPacker	Point-Liner-System	Berolina Repair System	TopHat System	Konudur LM-Liner	Alocit Short Liner	Spot Repair System
Installer		JT-elektronik GmbH	Trelleborg Pipe Seals	Bodenbender	Casseler-Kanal-Technik	Cosmic Engineering	Sanierungstechnik Dommel	KANAL PLUS	I.S.T.
IKT – Test Result*		VERY GOOD 1.2	VERY GOOD 1.4	GOOD 1.7	GOOD 2.5	GOOD 2.5	GOOD 2.5	SATISFACTORY 2.7	SATISFACTORY 2.9
System tests	85 %	very good 1.2	very good 1.5	good 1.9	good 2.7	satisfactory 2.6	satisfactory 2.8	satisfactory 3.0	satisfactory 3.2
1. Water tightness	60 %	1.0	1.0	2.1	3.1	3.2	3.1	3.5	3.6
... under groundwater pressure and operating loads ¹ - Infiltration I	70 %	1.0	1.0	2.3	3.5	3.8	3.0	3.8	3.5
• Test Setup I	50 %	1.0	1.0	2.5	1.0	3.0	1.0	2.0	1.0
• Test Setup II	50 %	1.0	1.0	2.0	6.0	4.5	5.0	5.5	6.0
... under heavy rain conditions - Infiltration II (backed-up water in pipe, groundwater pressure changes) ²	30 %	1.0	1.0	1.8	2.3	1.8	3.3	3.0	3.8
• Test Setup I	50 %	1.0	1.0	2.5	3.0	2.0	1.5	1.0	1.5
• Test Setup II	50 %	1.0	1.0	1.0	1.5	1.5	5.0	5.0	6.0
2. Operational reliability	20 %	2.2	2.4	2.1	1.9	2.5	2.1	1.9	2.1
Hydraulic performance ³	50 %	2.5	2.6	1.8	2.0	2.6	1.9	2.1	2.3
Cross-section reduction	30 %	1.7	2.6	3.0	2.0	2.4	2.5	1.6	2.1
CCTV inspection ³	20 %	2.3	1.9	1.6	1.7	2.1	1.8	1.9	1.7
3. Structural stability	20 %	1.0	2.1	1.0	2.3	1.0	2.6	2.6	3.2
Short liner stability	70 %	1.0	2.5	1.0	1.5	1.0	2.0	2.0	2.0
Prevention of soil penetration	30 %	1.0	1.0	1.0	4.0	1.0	4.0	4.0	6.0
Quality assurance⁴	15 %	very good 1.0	very good 1.0	very good 1.0	very good 1.0	gut 2.0 no DIBt approval	very good 1.0	very good 1.0	very good 1.0
Additional information (not graded)									
Pressure test after excavation, number of: water tight / leaking / not assessable		8 / 0 / 0	6 / 0 / 2 ⁵	3 / 1 / 4 ⁵	7 / 1 / 0	0 / 0 / 8 ⁶	6 / 1 / 1 ⁵	2 / 1 / 5 ⁵	5 / 1 / 2 ⁵
Adhesive tensile strength Ø / minimum (N/mm ²)		3.1 / 2.9	2.0 / 1.7	not assessable ⁷	1.9 / 0.8	not assessable ⁸	0.5 / 0.3	not assessable ⁷	3.2 / 2.8
Initial inspection / substrate preparation / cleaning		yes / no / yes ⁹	yes / milling / yes ⁹	yes / no / yes ¹⁰	yes / roughening / yes ¹⁰	yes / roughening / yes ⁹	yes / milling / yes	yes / no / yes ¹⁰	yes / milling / yes ⁹
Days on site / Number of staff		2 days / 3 persons	3 days / 3 persons	3 days / 2 persons	2 days / 2 persons	2 days / 2 persons	3 days / 2 persons	3 days / 2 persons	3 days / 2 persons
Time required for preliminary work and installation (ca.)		20 min / 14 h	165 min / 24 h	15 min / 25 h	25 min / 13 h	330 min / 10 h	200 min / 29 h	10 min / 10 h	300 min / 23 h
Costs excl. VAT (ca.)		- ¹¹ EUR	1.900 EUR	3.600 EUR	800 ¹² EUR	- ¹¹ EUR	3.000 EUR	6.500 EUR	4.700 EUR

* Grade calculation is on the basis of unrounded values

1 External water pressure load 85 days (external water pressure: Test Setup I 2 m head, Test Setup II 1 m head).

2 Seven changing groundwater loads and 14 water backing-up events.

3 Evaluation on the basis of video inspections by the steering committee members (weighting: 20% directly after refurbishment; 40% after HD cleaning standard pressure and 40% after HD cleaning max. pressure).

4 Evaluation criteria: manual of procedures, training courses, DIBt approval (German Government's approval body), arrangements for external production monitoring and any special anomalies observed.

5 Not assessable, as no pressure build-up was possible due to unexpected damage to the host pipe.

6 Not assessable due to the design system.

7 Test of adhesive tensile strength not possible due to unexpected cracks in the host pipe.

8 Test of adhesive tensile strength cannot be carried out due to the system, as a full-surface bond between the old pipe and the short liner is not intended.

9 Cleaning of host pipe before renovation with high pressure jetting.

10 Cleaning host pipe before renovation with hose pipe using domestic water supply pressure.

11 No costs charged.

12 Installation costs without material, as material costs were borne by the system provider BKP Berolina.

Grading of results:

Very good	= 1.0 - 1.5	Sufficient	= 3.6 - 4.5
Good	= 1.6 - 2.5	Poor	= 4.6 - 5.0
Satisfactory	= 2.6 - 3.5	Insufficient	= 5.6 - 6.5

TEST SETUP

- Test Setup I:** Vitrified clay pipe DN 150:
- Pattern of cracks
 - Broken out shard (pipe burst/collapse)
 - Offset (radially displaced pipe joint)
 - Angular deflection (pipe joint displaced at an angle)
- Test Setup II:** Pipe with a branch into two pipes (vitrified clay pipe, PVC, cast iron – DN100/125/150):
- Damaged change of material joint
 - Nominal diameter and material change (2x)
 - Broken out shard (pipe burst / collapse) in a 45° bend