

Inspection-Systems for Domestic Sewer Networks

The objective of IKT-Product-Tests is to provide network operators with reliable and independent information on the properties of products of the pipe technology. Such information has been almost completely missing for the pipeline construction and rehabilitation area until now. The clients obtain information on product characteristics almost exclusively from advertisements and the offerers' brochures, who try to convince potential customers of the alleged quality of a product. The aim is, to assess the quality of products available on the market, to indicate potentials for improvement and simultaneously to develop an appropriate market pressure so that product suppliers will indeed exploit these potentials.

A central aspect of the IKT-Product-Test is the practical product quality evaluation, e. g. under operating conditions. The focus of the examinations is not the compliance with individual standards or bodies of rules and regulations, but the reliable fulfilment of network operator requirements during construction and operation. The service life under the expected conditions and loads, such as e. g. groundwater, earth pressures, volume of traffic or high-pressure cleaning, are the focus of attention. As a result the network operators are provided with independent, practice-related, and technically well-founded information concerning the strengths and weaknesses as well as areas of application and limits of the tested products.

The main focus during IKT-Product-Tests is on three examinations: Process offerer quality assurance, system tests and building site investigations. At the end of IKT-Product-Tests a score card with a comparative evaluation of the products is developed on the basis of the test

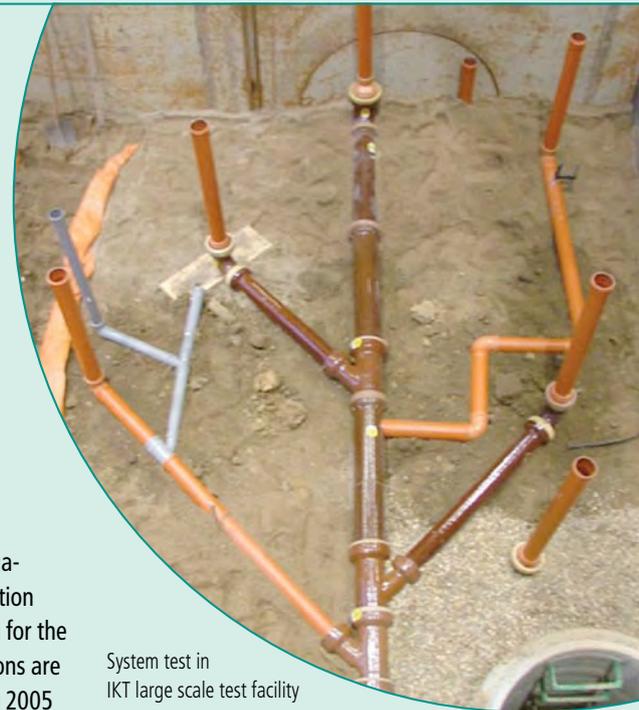
results. Test marks are formulated using the quality assurance of the process offerers and system tests as investigation priorities. The building site investigation results were not taken into consideration for the test marks, because building site conditions are not comparable. In this way IKT tested in 2005 special, new-developed devices for the inspection of domestic sewer networks.

From "Aaligator" to "Worm"

In North-Rhine-Westphalia, Section 45 of the Regional Building Regulations [1] specify that the owner of a piece of land must have older laterals and base lines in water protection areas checked for leaks by 31st December 2005. Newer laterals and base lines, and those outside water protection areas, must be inspected by 31st December 2015. In recent years the industry has reacted and developed special inspection systems for the use in domestic sewer networks. These remarkably small and manoeuvrable cameras are particularly suitable for the inspection of the narrow and highly branched networks out of the main sewer or demarcation chamber/ manhole. But what can these systems do? This question was answered in the IKT-Product-Test. The following inspection systems were closely examined:

The "Aaligator" is a hydraulically driven camera system. The drive unit has a collar of hydraulic nozzles. The optical unit consists of an axial camera and incorporates nozzles aimed laterally, so that the system can move sideways. Manually turning the high-pressure hose at the same time makes it possible to turn to other lateral/base line branches.

The hydraulically driven "Göttinger ZK-Kanalwurm 70/500" (Göttingen ZK Drain Worm) in-



System test in IKT large scale test facility

cludes a carriage unit with an axial camera mounted in the head of the carriage. The system can be turned up to 90° to the side, and if the "worm" is advanced at the same time, it can be made to turn into lateral/ base line branches. In addition to its function as an inspection unit, the "worm" can be used as a blocking unit for leak tests.



Aaligator, Schwarz Umweltservice GmbH



Göttinger ZK-Kanalwurm 70/500, IMS Robotics GmbH

The successor model of the "Göttinger ZK-Kanalwurm 70/500" with rotary/pivoting head offers the features of the "old" worm model, while the camera's pan/tilt head also makes it possible, for instance, to pivot over a damage. This model is also fitted with a front rinsing unit, with which the camera lens can be cleaned.



Göttinger ZK-Kanalwurm 70/500 with rotary/pivoting head, IMS Robotics GmbH



Göttinger-ZK-Kanalwurm 50/300 (mini), IMS Robotics GmbH

The "Göttinger ZK-Kanalwurm 50/300" is a smaller version of the "Göttinger ZK-Kanalwurm 70/500". The small worm was specially developed to inspect laterals/ base lines with very narrow nominal widths. The short carriage unit is fitted with an axial camera. The worm can be turned smoothly in four directions by up to 90°. It is not possible to pivot over a damage. The small worm has not been designed as a blocking unit for leak tests.



Lindauer Schere, JT elektronik GmbH

The "Lindauer Schere (mini)" (Lindauer shear) consists of a camera on a pan/tilt head onto which an extendable mechanical scissors unit has been mounted. When examining a branching lateral/base line, the camera head is turned in the direction of the branch that is to be



ORION L (Kieler Stäbchen), IBAK Helmut Hunger GmbH & Co. KG

recorded, and the scissors are extended. The system is therefore turned into the branch when it is further advanced. The scissors are then withdraw again.

The "Orion L (Kieler Stäbchen)" (Kiel bars) consists of camera on a pan/tilt

head to which a guide bar has been fastened. This is not telescopic. The Orion L is turned into the branching lateral/base line with the aid of the glass fibre rod and enters as it is advanced further. The guide bar always remains in the camera's view during optical inspection. To test the inspection-systems IKT built a test bed in its industrial size test rig (18 m x 6 m x 6 m), corresponding to real domestic sewer networks. Six different inspection-systems had been examined during these system tests. The tasks for the companies who submitted their systems for test purposes, were to find out the structure of the networks and to localize damages which had been created in the pipes. For the technicians who carried out the inspections was not visible that the three networks which had been built were identical. This circumstance had consequences with interesting results. Furthermore the quality assurance of the companies for their

inspection systems was investigated and the application of the inspection-systems in present domestic sewer networks was accompanied in the cities of Gelsenkirchen, Göttingen and Würzburg.

Because of the test results all the tested inspection systems were evaluated with the test mark "GOOD" in the finally developed score card. Nevertheless they have all these advantages and disadvantages for the use in domestic sewer networks.

Final conclusion

The IKT-Product-Test "Inspection-Systems for Domestic Sewer Networks" is the third IKT-Product-Test (cf. IKT-Product-Tests "Lateral connections" [2] and "Repair methods for lateral connections" [3]). The eager participation of sewer network operators in the IKT-Product-Tests underlines their practical significance. The way the test results are accepted in the trade also shows what a demand there is for comparative product tests in sewer technology. The IKT product tests support the "circle of product improvement" (cf. [4]) and the development of improved or even new products (cf. [5]). The overall aim in future will remain that of improving the quality of the offered products in the interests of the sewer network operators.

References

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- [2] Bosseler, B; Kaltenhäuser, G; Puhl, R: IKT-Warentest "Hausanschluss-Stutzen", IKT - Institut für Unterirdische Infrastruktur; Gelsenkirchen, 06/2002.
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- [4] Homann, D.; Kaltenhäuser, G.: IKT-Warentest „Flexoset-Anschlusselement B" – Nachttest zum IKT-Warentest „Hausanschluss-Stutzen"; IKT - Institut für Unterirdische Infrastruktur; Gelsenkirchen, 06/2003.
- [5] Kaltenhäuser, G.: IKT-Warentest „Janssen-Verpresssystem mit Mörtel" - Nachttest zum IKT-Warentest „Reparaturverfahren für Anschlussstutzen"; IKT - Institut für Unterirdische Infrastruktur;

IKT Product Test „Inspection systems for domestic drainage/sewerage systems“

System supplier	IBAK Helmut Hunger GmbH & Co. KG	IMS Robotics GmbH	IMS Robotics GmbH	IMS Robotics GmbH	IMS Robotics GmbH	IMS Robotics GmbH	Schwarz Umweltservice GmbH
Inspection system	ORION L (Krieler Stäbchen)	Lindauer Schere (mini)	Gottinger-ZK-Kanalwurm 70/500 with rotary/pivoting head	Gottinger-ZK-Kanalwurm 70/500	Gottinger-ZK-Kanalwurm 70/500	Gottinger Kanalwurm 50/300	Aaligator
							
Inspection period in the test systems	approx. 7 h	approx. 7.5 h	approx. 4.5 h	approx. 5.5 h	approx. 3 h	approx. 5 h	approx. 5 h
IKT test mark	GOOD (2.0)	GOOD (2.1)	GOOD (2.1)	GOOD (2.2)	GOOD (2.3)	GOOD (2.3)	GOOD (2.5)
System test (weighting 70 %)	good (2.1)	good (2.3)	satisfactory (2.6)	satisfactory (2.6)	good (2.5)	good (2.5)	satisfactory (2.8)
Usability*	2.5	2.7	2.8	3.3	2.7	2.7	2.3
Degree of registration**	1.6	1.6	1.5	1.4	1.3	1.3	2.0
Quality of registration***	2.2	2.7	3.6****	3.3	3.6****	3.6****	4.1
System suppliers' quality assurance (weighting 30 %)	good (1.7)	good (1.7)	very good (1.0)	very good (1.0)	good (1.7)	good (1.7)	good (1.7)
Process manual****	yes	no	yes	yes	yes	yes	no
Training available****	yes	yes	yes	yes	yes	yes	yes
Service and maintenance available****	yes	yes	yes	yes	yes	yes	yes
Software****	yes	yes	yes	yes	yes	yes	yes
Radio locator****	yes	yes	yes	yes	yes	no	yes
Cleaning from inspection opening****	yes	yes	yes	yes	yes	yes	yes
Cleaning from main sewer****	no	yes	yes	yes	yes	yes	yes
In-situ test							
Basic suitability	+	+	+	+	+	+	+
Reach, bend + branch accessing	+	+	-	-	-	-	0
Damage registration	+	+	+	+	+	+	+
Additional information			No documentation supplied			No documentation supplied	
Costs (smallest deployable unit) (net, in €)	approx. 18 400 from stock	approx. 20 000	approx. 50 000	approx. 50 000	approx. 50 000	22 870	20 800
Delivery time	from stock	approx. 3 - 4 weeks	approx. 6 - 10 weeks	approx. 6 - 10 weeks	approx. 6 - 10 weeks	approx. 12 weeks	approx. 12 weeks
Dimension range(s)	DN 100 - DN 200	DN 100 - DN 200; 45° bends in DN 100; 90° sockets as from DN 125	DN 100 - DN 200; 45° bends in DN 100 with SIDAAL system in DN 200 to DN 600	DN 100 - DN 200; 45° bends in DN 100 with SIDAAL system in DN 200 to DN 600	DN 100 - DN 200; 45° bends in DN 100 with SIDAAL system in DN 200 to DN 600	DN 70 - DN 150; 90° bends in DN 100 with SIDAAL system in DN 200 to DN 600	Lines as from DN 100, bends up to 90° up to DN 500, without tractor 200 m
Cable length/reach	60 m, 33 m with tractor	Installation of a cleaning nozzle, with ready-to-use unit when used from main sewer	Cleaning nozzle, shut-off bellows	Cleaning nozzle, shut-off bellows	Cleaning nozzle, shut-off bellows	Cleaning nozzle	Cleaning nozzle
Additional functions	Filling of a cleaning nozzle, not possible with LSY tractor Installation of front flushing system	Installation of a cleaning nozzle, with ready-to-use unit when used from main sewer	Cleaning nozzle, shut-off bellows Reduce physical burden for advance and retreat Increase image stabilization**** Install rotary pivoting head camera**** Install front flushing system****	Cleaning nozzle, shut-off bellows Reduce physical burden for advance and retreat Increase image stabilization**** Install rotary pivoting head camera**** Install front flushing system****	Cleaning nozzle, shut-off bellows Reduce physical burden for advance and retreat Increase image stabilization**** Install rotary pivoting head camera**** Install front flushing system****	Cleaning nozzle Use without shut-off entry should be possible Reduce physical burden for advance and retreat Increase image stabilization**** Install rotary pivoting head camera**** Install front flushing system****	Improve footage quality Reduce physical burden for advance and retreat Install rotary pivoting head camera Reduce physical burden for hose operation
Recommended improvements	Inspection system with high registration quality (system records, pipe diagrams and firmware quality)	Inspection system with freely movable rotary/pivoting head (positioning of sockets possible)	Inspection system with freely movable rotary/pivoting head and shut-off system (pivoting of sockets and shut-off of side inlets possible)	Inspection system with shut-off system (shut-off of side inlets possible)	Inspection system specifically for extremely small diameters (up to DN 70 in size)	Inspection system with powerful cleaning function (additional side-emitting nozzle spouts are integrated)	
IKT conclusions							

The test marks and recommended improvements relate to the applications examined in the test under the selected boundary conditions.

*Evaluation: 1 = 0 % of systems entered = 1.0 to 0 % entered = 6.0; depiction of grades using linear function

**Evaluation: 1 = 0 % of systems entered = 1.0 to 0 % entered = 6.0; depiction of grades using linear function

***Evaluation: 100 points = 1.0 to 0 points = 6.0; depiction of grades using linear function

****Evaluation: in place = yes; not in place = no; depiction of grades using linear function.

*****System diagrams not submitted

*****This has already been implemented in the development of the Gottinger ZK drain worm 70/500 with rotary/pivoting-head camera.

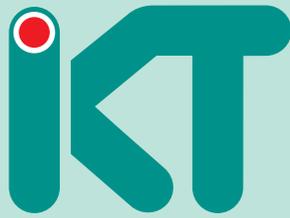
Evaluation key for test results: Very good = 1.0 to 1.5, Good = 1.6 to 2.5, Satisfactory = 2.6 to 3.5, Adequate = 3.6 to 4.5, Poor = 4.6 - 5.5, Unsatisfactory = 5.6 to 6.0.

Test report available for download from: www.ikt.de

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IKT - Institute for Underground Infrastructure

ABOUT IKT



IKT - Institute for Underground Infrastructure is a research, consultancy and testing institute specialized in the field of sewers. It is neutral and independent and operates on a non-profit basis. It is oriented towards practical applications and works on issues surrounding underground pipe construction. Its key focus is centred on sewage systems. IKT provides scientifically backed analysis and advice.

IKT has been established in 1994 as a spin-off from Bochum University, Germany.

The initial funding for setting up the institute has been provided by the Ministry for the Environment of the State of North-Rhine Westphalia, Germany's largest federal state.

However, IKT is not owned by the Government. Its owners are two associations which are again non-profit organizations of their own:

a) IKT-Association of Network Operators: Members are about 100 cities, among them Berlin, Hamburg, Cologne and London (Thames Water). They hold together 66.6% of IKT.

b) IKT-Association of Industry and Service Providers: Members are about 60 companies. They hold together 33.3% of IKT.

You can find information on projects and services at:

www.ikt.de



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