Nozzle drop test

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The „levitation" of nozzles in the conduit can occur in cleaning of conduits using HP nozzles. The nozzle can, for example, fall onto the conduit wall when water pressure is suddenly reduced. METROMAX PRC GmbH & Co. KG therefore had tests performed with the IKT in order to determine how metromax polymer-concrete pipes react to loads caused by movements of the HP nozzle body.

For the purpose of the nozzle drop tests, the test objects were exposed to various levels of loading using an HP nozzle as customarily used in practice:

1. Dropping of a levitating HP nozzle
2. Lowering and manipulation of an HP nozzle
3. Dropping of a levitating HP nozzle with great frequency

METROMAX PRC GmbH & Co. KG provided the test apparatus and performed the tests. The test procedure was observed and documented by the IKT. The pipes were visually inspected after completion of three load levels. The overall picture presented by the results obtained did not indicate any material abnormalities which might cause impairment of the tightness, strength or correct functioning of the test objects.

Background

It had been established in the context of the IKT „Conduit cleaning: Nozzles, pressures, high-pressure jets" research project financially supported by the North Rhine-Westphalia Ministry of the Environment [1] that nozzles are capable, in exceptional situations, of migrating upward along the pipe wall, and even of „levitating" within the pipe. It is not always possible for the operating staff to avoid, or even detect, this. Dropping of the nozzle onto the pipe wall is then conceivable in case of a sudden fall in pressure. The effects of an individual descent of the nozzle onto the pipe wall were therefore observed within the framework of the above-mentioned research project for twelve different pipe products (see [1]). In addition, the practical experience gained by system operators also indicates that the nozzle body can impact in case of operating errors by the persons operating cleaning vehicles in case, for example, of lowering of the nozzle into the manhole shaft and its manipulation into the conduit.

Test apparatus and load types

A commercially available omnidirectional nozzle with a weight of 4.5 kg was lifted up to the pipe crown (DN 300) around 50 cm from the pipe joint and then dropped for the purpose of the tests. The nozzle was connected to a rubber DN 32 high-pressure flushing hose, in order to simulate operating practice as authentically as possible. After the descent of the nozzle, the impact surface was examined, and any abnormalities were recorded. Two differing test systems were used, in order to take account of any possible influences exerted by the pipe bedding during the tests.

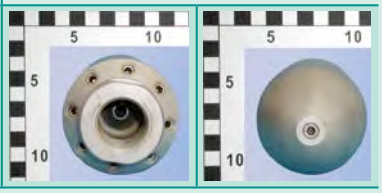
For the first load stage, nozzle drop tests were performed on eight polymer-concrete metromax pipes. The test parameters of nozzle type and pipe bedding were selected with reference to [1]. The nozzle used conformed to the requirements of DIN 19523 (draft version).

The test parameters selected for the „Dropping of a levitating HP nozzle" load situation and the test program are shown in Table 1 (next page).

Bedding 1 Bedding 2

Diagram of system showing bedding of metromax pipes in the nozzle drop test

Nozzle drop test on metromax pipes

PRC metromax DN 300 pipes as per DIN 54815	Bedding 1	Bedding 2
Test Pipe 1	5 x drops / 100 x drops*	5 x Fallen
Test Pipe 2	5 x drops / 100 x drops*	5 x Fallen
Test Pipe 3	5 x drops / 100 x drops*	5 x Fallen
Test Pipe 4	5 x drops	5 x Fallen
Test Pipe 5	5 x drops	5 x Fallen
Test Pipe 6	5 x drops	5 x Fallen
Test Pipe 7	5 x drops	5 x Fallen
Test Pipe 8	5 x drops	5 x Fallen
Test nozzle 4.5 kg 8 nozzle inserts 30° emission angle (as per E DIN 19523)		

* Extreme frequency of a falling HP nozzle as orientational material test, with no relevance to practice

In addition, the loads exerted on a metromax pipe as a result of incorrect insertion of an HP nozzle into the conduit were also simulated in the context of the „Lowering and manipulation of an HP nozzle" load situation. For this purpose, the 4.5 kg HP nozzle was swung energetically into the pipe thirty times from an elevated position.

Incorrect, over-energetic insertion of the HP nozzle into the pipe

No material abnormalities at or around the pipe joint after five-fold dropping of an HP nozzle

The pipes were visually examined for any material abnormalities after application of the above-described loadings, which are authentic and conform with maintenance and cleaning practice.

Results

A pulse-like or surging load exerted on the pipe by the moving nozzle body is conceivable in conduit-cleaning practice. The application of extreme cleaning parameters can also, in principle, result in „levitation" of the nozzle body, followed by its falling to the floor of the pipe (if water pressure is suddenly reduced, for example), particularly in case of irregularities in the pipe floor (socket steps, etc.) and nozzle bodies sensitive to movement. The overall picture presented by the results obtained in the tests on loadings exerted on pipes by nozzle movements did not indicate in the metromax pipes used any material abnormalities which might lead to impairment of the tightness, strength and correct functioning of the test objects.

References

[1] Bosseler, B.; Schlüter, M.: Kanalreinigung - Düsen, Drücke, Hochdruckstrahlen, concluding report by the IKT - Institute for Underground Infrastructure on behalf of the Ministry of the Environment and Conservation, Agriculture and Consumer Protection of the state of North Rhine-Westphalia; 2004. Available for download at: 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.

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