Execution of connections to pipelines in operation (1996 N3.3)

Introduction
The expansion of district heat supply to areas with low heat demand requires a consistent use of all possibilities to cut costs, in the pipeline construction too. One of the possibilities examined in this work is the forceful application of drilling-in techniques on pipelines in operation.

The essential use of this technology is the production of additional connections. First shall be revealed with an example that the drilling-in technique in principle offers a cost cutting potential. This allows already for a reduction of the building costs at the planning of the distribution network where at larger dimensions a variety of shut-off armatures requires considerable investments.

A reduction of the construction costs is possible because by this approach one can do without installing connection support nozzles for all potential customers along a main distribution line. Many nozzles appear to be abundant later on. Construction costs can be limited this way too because the time needed to realise connections with the drilling-in techniques is very limited. It is even possible to create open works which can be operated with simple safety measures.

Operation costs can be reduced by this drilling technique while the distribution company has no losses of revenue due to longer fall outs of operations. No costs appear for emptying and filling of additional parts of the network.

The drilling-in technique is not used as often as possible. Goal of this examination is to present and to compare in function and handling all common drilling-in techniques on the European market. Next to the description of the technology are presented the limits of use, opportunities and matters of security on the job. A comparison of costs of the available drilling-in techniques is in the conclusion.

Summary
The execution of connections to pipelines in operation is a proven technology for long time in the field of gas and water and is used more and more in applications in the field of district heating. The advantages are clear:
- No more emptying the pipeline.
- Heat distribution is not interrupted.
- Construction of networks is possible without a variety of shut-off devices and inspection chambers. Drilling-in is a fast and inexpensive technology.
- Repair of damaged pipelines possible by drilling-in without interrupting the service.

Welding the drilling support at the filled-up pipeline was seen for long time as the critical point for the application of the drilling-in technique. In a detailed essay of the Technische Werke Stuttgart (TWS), in co-operation with the TUV, welding to water-filled pipes was examined and the conclusion was that with certain requirements, e.g. the use of specific electrodes, a sufficient welding seam quality is obtained. From a welding point of view nothing opposes drilling-in.

Five manufacturers altogether are present on the market with equipment to create connections to filled pipelines without interruption. At this time two principally different procedures are offered:
- The drilling-in and milling procedure.
- The shear-off procedure (firing-off).

The drilling-in and milling procedure is offered by four manufacturers and uses a milling drill in combination with a centre drill for milling the pipe wall. The procedure requires a drain armature which is either connected directly with the drilling-in machine (a so called drain-drill-machine) or is separated from the actual drilling-in machine and connected to it. The drilling-in machines are on the market for several years partially and have proved themselves at a variety of drillings.

At the shear-off procedure the pipe wall is separated by means of a cutting club . The ripped off pipe wall is caught in the system-unit cover. The cutting club is accelerated by a priming mechanism, therefore it is called ”Anschießen”, firing off. The firing-off is a new development and has been on the market only for a short time.

The limitations of the drilling systems are enclosed by:

- Max. Temperature Approx. 130 °C
- Max. Pressure Approx. 16 - 25 bar
- Max. Drill size DN 400

Therefore all are applicable in normal district heating installations.

For firing-off an especially dimensioned piece of equipment is required for every combination of drill size and main pipeline size. The connecting dimension is limited to DN 25/32 and the main pipeline to DN 80.

A comparison of the costs points out that prices for purchasing a drilling machine with appliances differ greatly and are hard to compare while the machines do cover different dimensions. Prices vary from DM 6.000,- to DM 40.000,-.

A comparison of the costs for producing a connection has shown that the drilling-in machine of TONISCO is the most economic one and that shearing-off is the most expensive. It should be considered though that a drilling-in closure with a closing disc is used at the TONISCO system as drain armature which is very inexpensive compared to other armatures. Safety reconsiderations oppose this system since a total closeness at drilling cannot be guaranteed.
The shear-off system however is more advantageously compared to drilling-in only than if a distribution company practises only a few drillings per annum out or if narrow working space excludes the use of a drilling-in machine.
Doubts on grounds of technical safety are further argument against the drilling-in technique. Demands of trade organisations led to requirements for a construction admittance for drilling-in machines in which the equipment is checked for technical safety and a clearance certificate is emitted.
Exact checking guidelines are in process but not yet formulated.

To sum up

Drilling-in is starting to become a frequently used technology in district heating.
It facilitates the production of an additional connection without interruption of service.
The equipment offered on the market has partly proved it self already for years and there are dedicated machines and procedures for almost every case in district heating.
Technical safety risks have to be classified low under consideration of specific requirements.