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Near future testing requirements for joints in modern district heating networks

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Abstract

Due to manual installation of joints, the connection of the single pipe segments is one major influence for the performance of the whole network system. For granting joint quality, minimum requirements have to be proven in a standardized European test. Recommendations for the improvement of the test procedure are given. Furthermore expected operational loads in modern district heating networks are discussed. Since flexible operation of combined heat and power plants is necessary due to peak loads from feeding in of renewable energy sources, a different load spectrum is expected for the district heating network in the future. Possible amendments for the testing may be derived and a first step for understanding the load spectrum of joints in modern district heating networks is discussed.

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Keywords: district heating networks; joints; sand box; load spectrum

1. Introduction

For reliable modern district heating (DH) networks, sustainable solutions for their construction is needed. The joint technology is a key factor for quality and serviceability.

Due to manual installation of the joints, the connection of the single pipe segments is one major influence for the performance of the whole network system. For granting supply to the customer and low heat losses in the system, high requirements are necessary for the quality of joints [1]. Since there are several joint systems on the market, quality

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testing in a sand box was established and standardized in the European Standard EN 489 [2]. The boundary conditions for the tests were chosen close to the estimated operational load for district heating pipes during a lifetime of 30 years. However, a longer lifetime for the pipe system was suggested according to investigations of other authors [3]. On the other hand, the future load spectrum for pipe systems is assumed to imply more repeated temperature loads and an overall lower temperature level. These reverse acting effects are not well understood today. An accurate life-cycle-analysis seems to be difficult for the district heating networks and their joints because of unsolved uncertainties. The meaning of the results according to EN 489 should be reviewed.

Nomenclature

C_U	uniformity index
D_r	relative density
e	void ratio

Due to manual installation of the joints, the connection of the single pipe segments is one major influence for the performance of the whole network system. For granting supply to the customer and low heat losses in the system, high requirements are necessary for the quality of joints [1]. Since there are several joint systems on the market, quality testing in a sand box was established and standardized in the European Standard EN 489 [2]. The boundary conditions for the tests were chosen close to the estimated operational load for district heating pipes during a lifetime of 30 years. However, a longer lifetime for the pipe system was suggested according to investigations of other authors [3]. On the other hand, the future load spectrum for pipe systems is assumed to imply more repeated temperature loads and an overall lower temperature level. These reverse acting effects are not well understood today. An accurate life-cycle-analysis seems to be difficult for the district heating networks and their joints because of unsolved uncertainties. The meaning of the results according to EN 489 should be reviewed.

2. Sandbox testing according to EN 489

2.1. Testing methodology

The testing methodology for joints according to EN 489 was introduced in terms of a maximum load test. A sand box test was selected to represent *in situ* trench conditions and a load spectrum for an estimated lifetime of 30 years was chosen. For the joint system the following general requirements are defined according to EN 489 [2]:

- Resistance against axial forces due to axial displacement of the test specimen;
- Resistance against radial forces and bending moment (not tested in the sand box);
- Resistance against temperature influence and temperature changes;
- Water tightness.

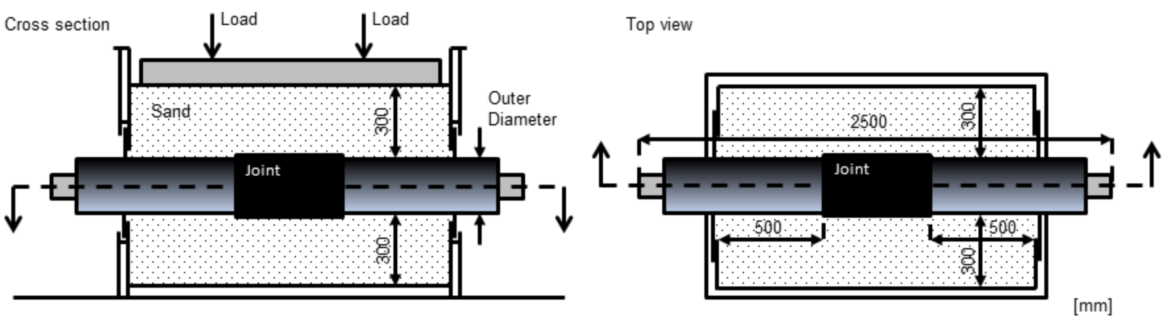

Fig. 1. Scheme of the sand box according to [2], cross section (left), top view (right).