



Structural analysis

Project:	Structural analysis of an AMEX-10-Sleeve DN 2400
Description:	<p>Under the terms of the conceptual formulation, a structural analysis of an AMEX-10-Manchette DN 2400 for an outer water load of 3 meter over liner crown had to be done according to the rules and standards. A draft is attached in Annex 1, in which steel rings of 50 mm width, 10 mm thickness and a clearance of 45 mm were applied.</p> <p>Three load cases were observed:</p> <p>Load case 1: Calibration of bedding and pre-stressing A tangential force of 45.200 kN is induced to the ring by a locking pressure of 400 bar and kept by the insertion of the fitting piece. The result for an ideal circular ring is a normal force of -45200 N per ring or -904 N/mm in relation to 1 mm width of the ring. From this results a constant compressive stress of 90.4 N/mm² Under consideration of the sealing, which has a thickness of 10 mm in this phase and with a diameter of 2400 mm, a radial contact force of $904/1190 = 0.76$ N/mm² is created. According to the load deformation test (s. Annex 3) the comprised sealing has a bedding modulus of about 0.5 N/mm³ in this stress range. The result is a theoretical compression of $0.76/0.5 = 1.52$ mm. The pre-stress of the steel ring (s. Annex 2) is created by an internally programmed heating process. Accordingly, the heating and bedding of the steel ring needs to be chosen for the calibration load case in a way to achieve a compressive stress of 90.4 N/mm² and a radial displacement of 1.52 mm at the same time.</p> <p>Load case 2: State of stress after installation (without water pressure) For the load case 2 the locking pressure is applied in accordance with load case 1. In addition the imperfections were considered according to the ATV-Merkblatt M 127, Part 2 (January 2000) and the DWA-Arbeitsblatt A 143, Part 2 (yellow print November 2012) respectively. The joint ring deformation (ovalisation) is assumed with a standard value of 3 %. The local deformation is reduced to 1 % as small irregularities in thickness could be balanced by the sealing and uneven places could be avoided.</p> <p>Load case 3: State of stress under water pressure (3 m over liner crown) For this load case there is an additional force as a result of 3 m water load over liner crown. In order to measure the water load that is induced to the steel ring via the elastomer, the specific gravity of water is mathematically raised from 10 to 19 kN/m³.</p>
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