REPORT
issued by an Accredited Testing Laboratory

Contact person
Sven-Erik Sällberg
SP Structural and Solid Mechanics
+46 10 516 58 18
sven-erik.sallberg@sp.se

Date 2015-12-15
Reference 4P05616

Accred. No. 1002
Testing
ISO/IEC 17025

Chalmers University of Technology
Att. Dr Bijan Adl-Zarrabi
Building Technology
412 96 Göteborg

Mechanical tests on samples from district heating pipes

Object

Samples from district heating pipes DN150/280 mm.

Delivered

2015-09-01

The Client delivered to SP 10 samples from district heating pipes of size DN150/280 mm. 6 of the samples were of length 200 mm and 4 of the samples of length 150 mm. The samples consisted of a service pipe made from steel, heat insulation made from polyurethane (PUR) and a casing pipe made from polyethylene (PE).

The samples with length 200 mm were marked:
PP2A, PP2B, PP1C, SH1A, SH1B and SH2C.
The samples with length 150 mm were marked:
PP1E, PP2D, SH1D and SH2E.

TEST RESULTS

Measurement uncertainty

Reported uncertainty corresponds to an approximate 95 % confidence interval around the measured value. The interval has been calculated in accordance with EA-4/16 (EA guidelines on the expression of uncertainty in quantitative testing), which is normally accomplished by quadratic addition of the actual standard uncertainties, and multiplication of the resulting combined standard uncertainty by the coverage factor $k = 2$. The results apply only to the tested objects.

Compressive strength – Insulation

Sample	Measured value, MPa	Requirement, MPa
PP1E-1	0.42	
PP1E-2	0.44	
PP1E-3	0.43	
Mean value	0.43	≥0.30
PP2D-1	0.38	
PP2D-2	0.37	
PP2D-3	0.35	
Mean value	0.37	≥0.30
SH1D-1	0.64	
SH1D-2	0.66	
SH1D-3	0.69	
Mean value	0.66	≥0.30
SH2E-1	0.57	
SH2E-2	0.56	
SH2E-3	0.64	
Mean value	0.59	≥0.30

Test method: *EN 253:2009 clause 5.3.3*
The total calculated uncertainty is <2 %.
Date of test: *2015-12-15*

Voids and bubbles – Insulation – DN150/280

Sample	Measured value, %	Requirement, %
PP2D	0.72	≤ 5
PP1E	1.76	
PP2A	0.35	
PP2B	0.89	
PP1C	0.16	
SH1D	0.06	≤ 5
SH2E	0.34	
SH1A	0.00	
SH1B	0.05	
SH2C	0.58	

No single void was bigger than 2/3 of the insulation thickness.

Test method: *EN 253:2009 clause 5.3.2*
Date of test: *2015-09-15*

Axial shear strength – Pipe assembly – DN150/280 mm

Sample No	Axial shear strength at +23°C MPa	Displacement at break, mm	Location of rupture
PP2A	0.20	4.8	Service pipe
PP2B	0.16	3.8	Service pipe
PP1C	0.16	4.2	Service pipe
Mean value:	0.17		
Requirement:	≥0.12		
SH1A	0.21	4.3	Service pipe
SH1B	0.22	5.5	Casing pipe
SH2C	***0.01***	3.7	Casing pipe
Mean value:	0.15		
Requirement:	≥0.12		

Test method: *Axial shear strength at +23°C EN 253:2009 clause 5.4.1.4*
The total calculated uncertainty at determination of axial shear strength is <2%.
Date of test: *2015-12-15*

Closed cell content – Insulation

Sample	Measured value, %	Requirement, %
PP1E-1	92.5	
PP1E-2	90.5	
PP1E-3	90.9	
Mean value	91.3	≥88
PP2D-1	94.6	
PP2D-2	91.6	
PP2D-3	88.3	
Mean value	91.5	≥88
SH1D-1	95.1	
SH1D-2	92.4	
SH1D-3	92.5	
Mean value	92.3	≥88
SH2E-1	93.3	
SH2E-2	92.5	
SH2E-3	91.8	
Mean value	92.5	≥88

Test method: *Closed cell content EN 489 clause 5.4.5.2*
Date of test: *2015-12-03*

SP Technical Research Institute of Sweden
SP Structural and Solid Mechanics - Pipe Centre

Performed by

Signed by: Sven-Erik Sällberg
Date & Time: 2015-12-18 13:57:34 +01:00

Sven-Erik Sällberg

Examined by

Signed by: Jan Henrik Sällström
Date & Time: 2015-12-18 13:00:52 +01:00

Jan Henrik Sällström