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Data Sheet i-Form® flexible flashing

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Testing document
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Research Testing B.V.

Start Date : 10/10/2010

End date: 23/02/2011

Objective:

To analyse different materials used as lead replacement for their relevant properties according to DIN 7864: sheets of elastomer for waterproofing

Material:

a 3 layer water proofing flashing used for roofing, chimney's, rooflights, ect.

Layers consisting:

- Top layer EPDM, Black
- Middle layer of expanded aluminium mesh, special threaded.
- Bottom layer EPDM – Black
- Adhesive IIR rubber lines (option)
- Protection foil , siliconed PE

Procedure:

All required test pieces were cut from the two rolls of compound or the roll of product.

Cure characteristics were determined on a Rheometer MDR2000E at 80 and 170°C according to ISO 6502:1999. Tensile tests were performed fivefold on a Zwick/Roell Z005 tensile tester according to ISO 37:2005, Cor. 1:2008, type 2. Hot-air ageing of the material was done in a Memmert oven according to ISO 188:2007, method A. Tear resistance was determined fivefold according to ISO 34-1:2010, method C. Density was measured threefold according to ISO 2781:2008/Amd.1:2010.



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Five dumbbells of each compound and a piece of the product were subjected to Xenon lightning and weathering conditions according to ISO 4892-2:2006(E), method B (cycli of 120 minutes of which 102 minutes under dry conditions and 18 minutes spraying with deionised water) in a Q-Sun XE-3/HDS from Q-lab for 1000 hours, after which the change in tensile properties was determined. The piece of product was judged visually.

After immersing pieces of compound and product in water for 14 days at $23\pm 2^{\circ}\text{C}$, the change in mass was determined. Furthermore, these materials were dried for 24 hours at room temperature, after which three test pieces were cut from them. All materials were clamped in the holders for static testing with 20% strain and stored in the dark at $23\pm 2^{\circ}\text{C}$ and $50\pm 5\%$ relative humidity for 72 hours according to ISO 1431-1:2004/A1:2009.

An Argentox ozone cabinet was used to create the appropriate ozone atmosphere.

Test conditions Argentox ozone cabinet	
Extension:	20%
Temperature:	$40\pm 1^{\circ}\text{C}$
Ozone concentration:	200 ± 5 pphm
Time:	200 hrs

For the change in dimension three pieces of the product with the dimensions of app. 200 x 200 mm were cut and placed on a plate, talcum as lubricant was used. The dimensions were measured with an accuracy of 0.1 mm in both directions. Next, the test pieces were stored in a Memmert oven for 24 hours at $100\pm 1^{\circ}\text{C}$ after which the plate was cooled down to $23\pm 2^{\circ}\text{C}$ and conditioned for at least 2 hours. The dimensions were measured and the change was calculated.

For the bending test at low temperature, three test pieces with dimensions of 60x20 mm of every compound were laid at -30°C for 7 days, after which a bending test was performed using a ruler for a rapidly sharp bend.

Results: All test results are shown in Table 1.

It was not possible to determine the tensile strength at $80\pm 1^{\circ}\text{C}$ on all compounds due to a not stable test piece (flowing) caused by a too low or no degree of vulcanization.

The change in dimensions after 24 hours at $100\pm 1^{\circ}\text{C}$ were measured on the product and was app. 0.1 % (<1% required).

The ozone resistance was also measured on the product and no cracks were observed.

The product was also examined for its weathering resistance: no cracking was seen, only slight discolouration, as shown in the microscopic pictures of the samples in Figure 2.

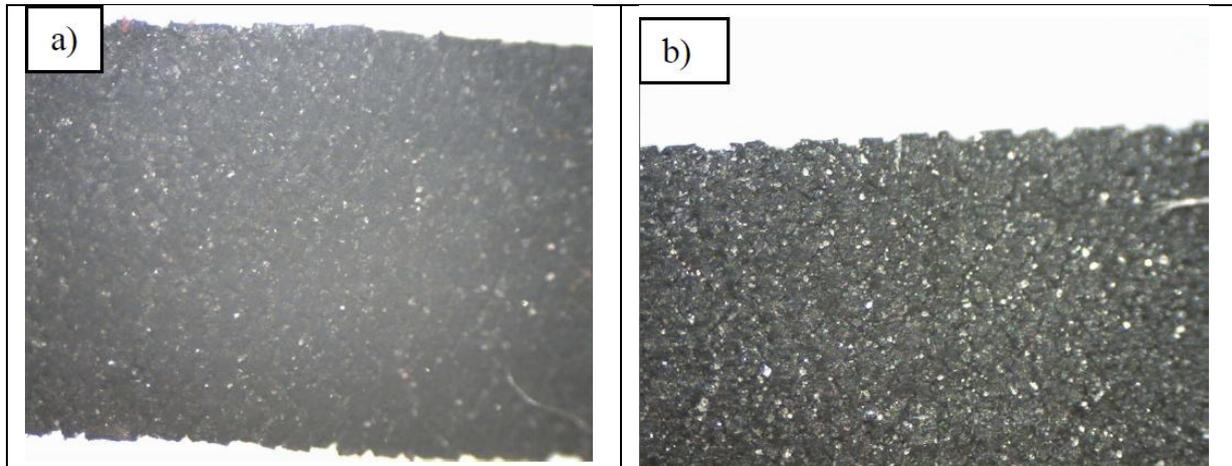


Figure 2: Microscopic pictures (60x magnified) of the materials after weathering ageing and tensile tests: a) EPDM black and b) butyl.

		10244-03C EPDM BLACK		Requirement acc. to DIN 7864
Cure characteristics – ISO 6502 - Rheometer MDR2000E - 170°C, 30 min, 0.5° arc				
t05	[min]	0,28		
t50	[min]	3,46		
t90	[min]	22,5		
ML	[Nm]	0,38		
MH	[Nm]	0,49		
Delta S	[Nm]	0,11		

Cure characteristics – ISO 6502 - Rheometer MDR2000E - 80°C, 900 min, 0.5° arc				
t05	[min]	--	--	
t50	[min]	--	--	
t90	[min]	--	--	
ML	[Nm]	--	--	
MH	[Nm]	--	--	
Delta S	[Nm]	--	--	

Tensile properties, ISO 37, type 2				
Tensile strength at max	[MPa]	7,5		min. 6MPa
Elongation at break	%	730		min. 300%
Mod 25%	[MPa]	1,1		
Mod 50%	[MPa]	1,3		
Mod 100%	[MPa]	1,4		
Mod 200%	[MPa]	1,6		
Mod 300%	[MPa]	1,9		
Mod 500%	[MPa]	3,2		



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Tensile properties, ISO 37, type 2, at 80°C			
Tensile strength at max	Not measurable*		min. 2,5
Change in tensile strength			max. 70

Tensile properties, ISO 37, type 2 , Perpendicular			
Tensile strength at max	[MPa]	6,3	min. 6 MPa
Elongation at break	%	630	min. 300 %
Mod 25%	[MPa]	1,9	
Mod 50%	[MPa]	2,6	
Mod 100%	[MPa]	3,1	
Mod 200%	[MPa]	2,9	
Mod 300%	[MPa]	3,1	
Mod 500%	[MPa]	4,3	

Hot-air ageing for 7 days at 80°C – ISO 188, method A			
Tensile strength at max	[MPa]	6,7	
Change in tensile	%	-11	
Elongation at break	%	700	

Hot-air ageing for 14 days at 80°C – ISO 188, method A			
Tensile strength at max	[MPa]	7,6	
Change in tensile	%	1	
Elongation at break	%	690	

Hot-air ageing for 28 days at 80°C – ISO 188, method A			
Tensile strength at max	[MPa]	6,4	
Change in tensile	%	-14	max. 20%
Elongation at break	%	640	min. 200%

Hot-air ageing for 56 days at 80°C – ISO 188, method A			
Tensile strength at max	[MPa]	7,8	
Change in tensile	%	4	
Elongation at break	%	590	

Hot-air ageing for 91 days at 80°C – ISO 188, method A			
Tensile strength at max	[MPa]	7,8	
Change in tensile	%	4	max. 25%
Elongation at break	%	570	

Xenon test for 1000 hours at 0.51W/m2 – ISO 4892-2, method B			
Tensile strength at max	[MPa]	6,3	
Change in tensile	%	-16	max. 20%
Elongation at break	%	650	max. 40%
Change in elongation	%	-11	



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Tear strength, ISO 34-1, method C (crescent)				
Tear strength	[kN/m]	31		min. 5 kN/m

Ozone resistance, 200 hrs, 200pphm after immersion test pieces for 14 days in water – ISO 1431-1				
cracks		NO		No cracks

Density – ISO 2781				
Density	[kg/l]	1,30		

Bending test at -30 °C				
Cracks		No		No cracks

Mass per surface area				
Mass per surface area	[kg/m ²]	1,67		

Water uptake after 14 days at 23°C				
Water uptake	[%]	6,5		

Discussion:

The cure characteristics and then especially the nihil delta torque (delta S) indicate that the compounds do not contain any curatives.

There are no requirements for the application, i.e. lead replacement, of the tested materials and product. With agreement of the customer, it was decided to test the material for their relevant properties according to DIN 7864: sheets of elastomers for waterproofing.

The elongation at break is allowed to decrease maximum of 70% absolute between 28 and 91 days of hot-air ageing at 80°C. Both materials show an absolute change which is significantly ≤ 70%.

Even though the requirements of DIN 7864 are for sheets of elastomers for roof-sheeting and therefore more demanding than the actual practice of the product, the results of the black coloured EPDM material are above all requirements, except for the tensile strength at 80°C, which could not be measured, due to flowing, caused by a too low or no degree of vulcanization. This may give problems in practical use, because the material may start to flow at elevated temperatures and under load. Although, this will be (partly) covered by the added internal mesh network.

The most important deviation from the stated requirements for the butyl material is the initial strength of the material, which is significantly too low. However, because the material has another function in the application, i.e. a sealing function on the bottom side of the product, it is assumed that the stated requirements do not apply to this material.

Remark: Although all tests were performed according to the specified test standards, this report may be a somewhat condensed version. When specific supplementary data is required, please contact us.