DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.

Testing of Fused Joints on Liners of Polymer Materials Lap Shear Test

Direction DVS 2226-2

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Contents:

1 Range of Application

The lap shear test is designated to judge fusions on PE liners under short-term tensile strength stress. The quality of a fusion, however, can only be judged sufficiently in connection with other tests. Liners are made of thermoplastics or elastomer and fused by welding, vulcanization or gluing as sealing systems for ground and water construction.

Seal shapes are overlap joint with overlap seams as well as coating seams. The sheets can be set up homogeneous or as multi layer.

The fusion procedures are treated in DVS 2225-1, the on site test in DVS 2225-2.

The requirements are stipulated in section 1 of this guideline.

2 Shape and Number of Samples

Strip shaped Samples are applied for the lap shear test according to fig. 1. They are taken out vertically to the fusion seam of the joint area of the liner the way the fusion seam is situated in the middle. The Samples can be produced by sawing, milling, punching or similar procedures. Notches at the cutting edges should be avoided.

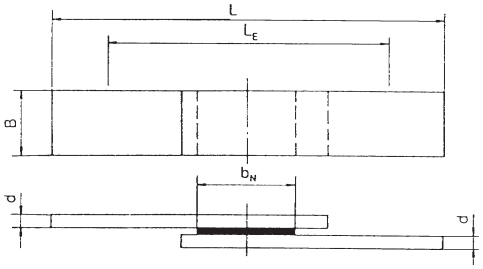

Figure 1. Sample for lap shear test.

b_N Seam width, total width for overlap seams with test channel

d Liner thickness

B Width
15 mm, at least 5-fold sheet thickness for homogeneous sheets
50 mm for reinforced sheets

L_E Clamping length = 100 mm + seam width b_N (in this case corresponding to the clamping distance)

L Length of sample ≥ 50 mm + L_E

At least 5 Samples are checked per test.

3 Procedure

The lap shear test is carried out, if not agreed otherwise, under normal climate 23/50-2 acc. to DIN 50 014 in imitation to DIN 53 455.

The outer texture of the seam (bead, form and evenness) is to be determined visually further to the test. Furthermore, the essential dimensions (sheet thickness, seam thickness and seam width) and the situation of the seam considering the manufacturing direction of the sheets have to be determined (see section 4.3 of DVS 2225-2).

The sample is clamped the way that the seam is situated vertical to the lap direction and in the middle between the clamping levers. The clamping length (clamp distance) has to be respected acc. to fig. 1.

The test speed is

– 50 mm/min for PE;
– 100 mm/min. for smooth elastomer sheets e.g. PVC-P.

During the test the stress-strain diagram (deformation measuring via transverse convey) is registered. It has to get over the fraction resp. distinctly over the segment limit to catch the deformation behavior.

4 Evaluation

The result is mainly designated to judge the deformation and failure behavior of the fusion. Furthermore, the density of the fusion can be determined and the fusion factor "f_k" can be calculated.

4.1 Types of Failure

Essentially the following types of failure may occur:

– Peeling of the seam (e.g. even fraction surface in the fusion level, fraction surface with tough fraction characteristics as white fraction, deeply fissured surface…)

– Elongation and/or fraction in the basic material outside the seam area

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– Elongation and/or fraction in the junction area

– Elongation and/or fraction in the welding filler on coated seams.

4.2 Strength of Fused Joints

The lap shear strength resp. tensile strength is determined in the stress strain diagrams. It results from the max. force (in case of fraction or elongation limit) in relation to the smallest basic cross section of the sample.

Furthermore, the short-term fusion factor f_k can be calculated as quotient from the strength of the fusion σ_s and the strength σ_B of the non-fused sheet. The same testing conditions have to be maintained for testing of the basic material and for the direction to take out Samples.

The fusion layer is comparatively modestly subject to hard wear during lap shear test due to its large seam width. Therefore, the fusion factor determined via density does not dispose of sufficient expressiveness concerning the strength of the fusion layer.

5 Inspection Record

With reference to this guideline the inspection record must include:

– About liner
Type, material, manufacturer and designation (eventually analog for welding filler)

– About fusion
Fusion procedure, seam shape and designation

– About sample
Shape and number, dimensions

– About test conditions
Climate, speed, clamping length

– About result
Visual judgment, seam dimensions, deformation behavior and type of failure, strength, short-term fusion factor

– Conditions differing from this guideline

– Date of inspection and signature

6 Standards, Guidelines and Regulations

DIN 16 726	Plastic roof liners, plastic sealing liners, tests
DIN 50 014	Climates and their technical applications, normal climates
DIN 53 455	Testing of plastics – tensile test
DVS 2225-1	Fusion of PE liners for ground and water construction – welding, vulcanization, gluing
DVS 2225-2	Fusion of PE liners for ground and water construction – on site test
DVS 2226-1	Tests and fusions on PE liners – requirements
DVS 2226-3	Test of fusions on PE liners – peeling test
DVS 2226-4	Test of fusions on PE liners – tensile creep test

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