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

Testing of welded joints of thermoplastics materials: Tensile test

Direction DVS 2203-2

(July 1985)

Dimensions in mm

Contents:

1 Scope

A tensile test may be used in conjunction with other tests to assess the performance of welded assemblies, made from thermoplastics materials. The welded specimen will be tested with the same test speed which is used to determine the yield point of the parent material.

The short term welding factor and the fracture appearance when the test is terminated provide a guide to the ductility of a welded joint and hence the weld quality. The results derived from the tensile tests can not be used to assess the long term behaviour of welded joints

2 Normative references

DIN 50014 Climates and their technical application; standard atmospheres

DIN 53455 Testing of plastics; Tensile test

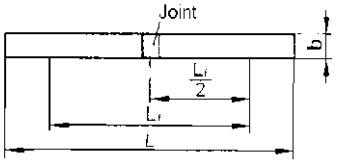

Figure 1.
Tensile specimen, form 1.

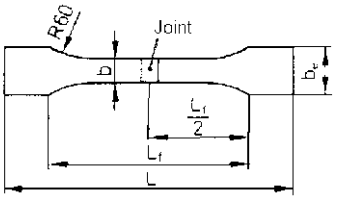

Figure 2.
Tensile specimen, form 2.

3 Method and design

The tensile test shall be carried out in accordance with DIN 53 455. Where the beads are left intact in service, they shall be left intact for the test. Where the beads are removed in service, they shall be removed prior to testing. At least five test specimens shall be tested for each welded and unwelded (reference specimens) test piece. If the test specimens as shown in fig 1 consistently fail in the clamps then test specimens of form 2 as shown in fig. 2 shall be used. The dimensions of the test specimens are given in table 1.

Table 1. Dimensions of test specimens.

Thick-ness h	Specimen form 1			Specimen form 2			
	b	L_f	L	b	L_f	L	b_e
≤ 10	15	120	≥ 170	10	115	≥ 170	20
> 10	30	120	≥ 300	30	115	≥ 300	40
> 20	1.5 · h	200	≥ 400	1.5 · h	200	≥ 400	80

The appearance of the test pieces esp. the welded joint shall be visually inspected prior testing.

Note: In order to get a better assessment of the weld quality the specimen can be weakened in the joint by a hole of e. g. 3 mm. This special test is recommended when the specimen in the "normal" tensile test shows failure outside the joint. The results shall be evaluated in relation to specimens with the same hole of the parent material.

4 Performance

Unless otherwise specified or fixed by technical specifications the test shall be carried out according to DIN 50014-23/50-2. In order to determine the strength the specimen shall be elongated with constant test speed according to table 2. The test speed is defined by the velocity of the displacement of the clamps.

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Table 2. Standard test speeds.

Test speed	mm/min	According to ISO 527-1976
I	1 ± 50 %	Speed A
Ia	2 ± 20 %	Speed A1
II	5 ± 20 %	Speed B
III	10 ± 10 %	Speed C
IV	20 ± 10 %	Speed D
V	50 ± 10 %	Speed E
VI	100 ± 10 %	Speed F
VII	200 ± 10 %	Speed G
VIII	500 ± 10 %	Speed H

The test speed to be applied shall be taken from the relevant standards for the product or shall be agreed between the contracting parties. The preferable test speed should be chosen in this way that the yield strength is obtained in approximately one minute. If necessary the test speed should be determined by a pre-test. The test speeds for some plastics are given as an index in table 3.

Table 3. Test speeds for some thermoplastics.

Material	Test speed mm/min
PE-HD	50
PP, PVDF	20
PVC	10

When rupture occurs the measured force is to be recorded. If yielding occurs the force at yield is to be recorded and the test is finished. If necessary the load sustained by the test specimen is measured and the graph of load versus displacement is to be recorded. Test specimens with failure in the area of the clamps shall be disregarded.

5 Evaluation

The short term tensile welding factor is determined from the arithmetic mean values of the fracture loads of the welded test specimens (F_v) and the unwelded test specimens (F_B). If the test specimens yield prior to fracture, the yield load shall be used instead of fracture load.

$$f_z = F_v / F_s$$

If specimens with different widths and thickness are used the load shall be related to the product of b x h (b: Width of the specimen; h: Thickness of the specimen) measured close to the joint. The short term welding factor is calculated according to the formula:

$$f_z = \frac{F_v}{b_v \cdot h_v} \cdot \frac{b_B \cdot h_B}{F_B} = \frac{F_v}{F_a} \cdot \frac{b_B}{b_v} \cdot \frac{h_B}{h_v}$$

The appearance of the test pieces after the test shall be recorded. The type of failure and the crack surface shall be assessed.

6 Test report

The test report shall refer to this guideline and it shall include the following information :

- description and identification of the sample
- date and procedure of preparation of the test specimens
- position of the test specimens in the sample

  type of test specimen
- thickness of test specimens in mm (mean value)
- width of test specimens in mm (mean value)
- number of test specimens

  pre-treatment of test specimens
- test conditions (if deviating from this guideline)
- test speed
- load at fracture or load at yield resp. corresponding stress values

  short term welding factor f_z
- if available, graph of load vs displacement

  appearance of the test pieces after the test; visual examination of the crack surface

  date of test