DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E.V.	Testing of welded joints between panels and pipes made of thermoplastics – Low-temperature tensile test	DVS Technical Code DVS 2203-2 Supplement 1

Contents:

1   Scope of application

In order to assess the welding execution, reference can be made to the low-temperature tensile test in conjunction with other tests. In particular, this applies to materials with which the tensile test at the room temperature does not allow any differentiation.

The low-temperature short-time tensile welding factor f_{zT} and the fracture pattern give an indication of the ductility of the joint and thus of the quality of the execution. The results are not transferable to the creep behaviour of the welded structure subjected to tensile stresses.

2   Removal and number of the test specimens, type and structure

The tensile test is performed with reference to DIN EN ISO 527. Welded joints are tested according to the actual execution, i.e. with or without a welding bead.

The test specimens may only be removed eight hours after the welding. Each test specimen must be marked in such a way that its original position in the test piece is comprehensible.

The specimens must be neither heat-treated nor subjected to mechanical stresses.

The test is carried out on at least six welded test specimens and six unwelded reference test specimens which were removed as uniformly distributed as possible around the circumference or over the length. In the case of pipes with a diameter of ≤ 63 mm, the number of the test specimens can be reduced to four.

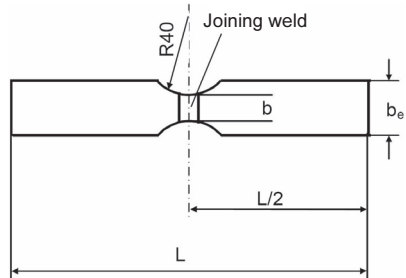The dimensions of the test specimen are included in Table 1.

3   Shape and manufacture of the test specimens

Figure 1.   Test specimen shape.

Table 1.   Dimensions of the test specimens from panels.

Thickness s (nominal dimension) mm	L mm	b_e mm	b = mm
≤ 10	160	14	7
$10 < s \leq 20$	180	18	
> 20	180	28	14

Table 2.   Dimensions of the test specimens from pipes.

Diameter d (nominal dimension) mm	L mm	b_e mm	b = b_e/2 mm
$25 - 63$	160	12	6
$75 - 110$	160		7
$125 - 160$		16	8
200	180	18	9
$225 - 250$	180	20	10
$280 - 315$	180	22	11
355		24	12
400		26	13
450	180	28	14

the surfaces of the test specimens must be free from visible imperfections, notches or other defects. Any heating caused by the machining must be kept at a low level. Before the test, it is necessary to visually detect the appearance of the test specimens and, in particular, the welding execution.

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4 Execution

The testing speeds and the testing temperatures are listed in Table 3 for selected materials. For other materials, the temperatures must be chosen in such a way that a brittle fracture arises. For this purpose, the testing temperature concerned must be well below the glass transition temperature of the material in question.

It must be ensured that the entire test specimen has taken on the testing temperature before the test.

Table 3. Testing speeds and testing temperatures for a few plastics.

Material	Testing speed mm/min	Testing temperature range * °C
PVDF	50 ± 10 %	- 40 to - 50
PP-H	50 ± 10 %	- 40 to - 50
PP-R	100 ± 10 %	- 40 to - 50
PE 80 and PE 100	200 ± 10 %	- 80 to - 90
PA12	200 ± 10 %	- 80 to - 90

* In each case, ± 2°C

The force at the moment of the fracture must be recorded.

5 Evaluation

The low-temperature short-time tensile welding factor is determined from the arithmetic mean values of the fracture stress of the welded test specimens (σ_{wT}) and of the reference test specimens (σ_{rT}):

$f_{zT} = \sigma_{wT}/\sigma_{rT}$

If the test specimen is stretched, the result must not be assessed and the testing parameters must be adjusted with regard to a brittle fracture to be obtained.

The fracture type and the fracture pattern must be detected visually and documented.

6 Test report

The following items must be specified in the test report with an indication of this technical code:

– type, supply form and designation of the product
– manufacturing date and process of the test specimens
– appearance of the test specimens before the test
– visual assessment of the welding execution
– position of the test specimens in the product
– shape of the test specimens
– thickness of the test specimens in mm
– width of the test specimens in mm
– number of the test specimens
– testing temperature
– testing speed
– low-temperature short-time tensile welding factor f_{zT} (arithmetic mean values)
– visual assessment of the fracture pattern and the fracture type
– testing date, testing agency and name of the tester

7 Literature

DIN EN ISO 527-1 Plastics – Determination of the tensile properties – Part 1: General principles

DIN EN ISO 527-2 Plastics – Determination of the tensile properties – Part 2: Testing conditions for moulding and extrusion materials