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Testing of welded joints between panels and pipes made of thermoplastics – Tensile impact test

DVS
Technical Code DVS 2203-3

Contents:

1 Scope of application

In order to assess the welding execution, reference can be made to the tensile impact test in conjunction with other tests. The short-time welding factor and the fracture pattern give an indication of the ductility of the joint and thus of the quality of the execution. The results cannot be readily transferred to just any welded structures since the values are dependent on the shape of the mouldings and on their manufacturing conditions.

2 Type and structure

The tensile impact test is performed with reference to DIN EN ISO 8256. It should be utilised predominantly for specimens with a thickness < 4 mm. Welded joints are tested according to the actual execution, i.e. with or without a welding bead. The test is conducted on at least ten welded specimens and ten reference specimens. The shapes and dimensions of the test specimens are described in DIN EN ISO 8256.

Before the test, it is necessary to visually detect and to document the appearance of the test specimens and, in particular, the welding execution.

In order to obtain a fracture failure in the weld and thus better differentiation for assessing the weld quality, the joining weld in the specimen can be weakened by a central hole notch with a diameter of (for example) 3 mm. For assessment purposes, the tests with a hole notch must be carried out with the corresponding reference specimens as well. This special test is recommendable particularly whenever no fracture in the region of the joining weld is obtained during the normal test.

3 Brief description

The test is performed by subjecting the test specimen to impact-like loads once at the low point of the pendulum movement of the tensile impact machine. The test specimen is located in a horizontal position at the time when the fracture occurs.

4 Execution

Unless anything else has been agreed upon or specified in the technical terms of delivery for the product to be tested, the test is carried out in a standard atmosphere according to ISO 554-23/50 (normal tolerances).

The test specimens are tested on a pendulum impact testing machine in Class 1 according to DIN 51222 which is additionally equipped with a facility for the execution of tensile impact tests. The tensile impact test is carried out according to DIN EN ISO 8256. The decision about which of the pendulum impact testing machines and which pendulum hammer should be used is geared to the type of the product to be tested and to the thickness of the test specimen. The test conditions should always be chosen in such a way that the corrected impact energy is min. 20 % and max. 80 % of the greatest impact energy of the pendulum hammer. If more than one pendulum satisifies these requirements, the pendulum with the higher energy capacity must be utilised.

5 Evaluation

The corrected impact energies W_{ZV} and W_{ZB} are established from the mean values of the consumed impact energies of the joined specimens W_{SV} and of the reference specimens W_{SB} using the centrifugal energy correction curves according to DIN EN ISO 8256 for the pendulum hammer in question. The short-time welding factor is then calculated as follows:

$$f_{SZ} = W_{ZV}/W_{ZB}$$

In the case of test specimens with different thicknesses and widths, the impact energy should be related to the product b · h (b = specimen width and h = specimen thickness) in the centre of the specimen or immediately next to the joint. The short-time welding factor is then calculated according to the formula:

$$f_{SZ} = \frac{W_{ZV}}{b_V \cdot h_V} \cdot \frac{b_B \cdot h_B}{W_{ZB}} = \frac{W_{ZV}}{W_{ZB}} \cdot \frac{b_B}{b_V} \cdot \frac{h_B}{h_V}$$

In addition to the impact energy it is recommended to establish the permanent elongation at fracture too. The level of the permanent elongation at fracture also provides a good assessment criterion for the quality of the joint. The permanent elongation at fracture ε_{bl} is established from:

$$\varepsilon_{bl} = \frac{l_{bl} - l_0}{l_0} \cdot 100$$

l_0 original measuring length

l_{bl} measuring length of the test specimen brought together after the test

and specified in percent.

The appearance of the test specimens after the test must be detected and, in particular, the fracture type and the fracture pattern must be assessed.

DVS, Technical Committee, Working Group "Joining of Plastics"

Orders to: DVS Media GmbH, P. O. Box 10 19 65, 40010 Düsseldorf, Germany, Phone: +49(0)211/1591-0, Telefax: +49(0)211/1591-150

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
- hole notch diameter (if present)
- position of the test specimens in the product
- thickness of the test specimens in mm
- width of the test specimens in mm
- number of the test specimens
- pretreatment of the test specimens
- utilised pendulum hammer as well as mass of the utilised cross-beam in g
- testing atmosphere (in so far as it deviates from this technical code)
- corrected impact energies of the joined specimens W_{ZV} and of the reference specimens W_{ZB} in mJ/mm² or kJ/m², rounded to three value-displaying figures
- short-time welding factor f_{SZ}
- permanent elongation at fracture of the joined specimens $\varepsilon_{bl\,V}$ and of the reference specimens $\varepsilon_{bl\,B}$ in % to ± 5 %
- appearance of the test specimens after the test
- visual assessment of the fracture pattern
- testing date

7 Literature

DIN EN ISO 8256	Plastics – Determination of the tensile impact strength
DIN EN ISO 13802	Plastics – Verification of pendulum impact testing machines – Charpy, Izod and tensile impact tests
ISO 554	Standard atmospheres for conditioning and/or testing; requirements
DIN 51222	Testing of metallic materials – Notched-bar bend impact test – Particular requirements on pendulum impact testing machines with a nominal energy capacity ≤ 50 J and their verification