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Non-destructive tests on tanks, apparatus and piping made of thermoplastics – Dimensional checking and visual inspection

DVS
Technical Code DVS 2206-1

Replaces DVS 2206 dated November 1975

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1 Scope of application

This technical code applies to dimensional checks and visual inspections on thermoplastic tanks, apparatus and piping. They must meet the corresponding stipulations, e.g. in the Pressure Device Directive, the Water Resources Act or the specially agreed technical terms of delivery / specifications.

2 Requirements

2.1 Requirements on thermoplastic components

The requirements relate to:

- dimensions (e.g. lengths, diameters and wall thicknesses)
- angular deviations depending on the component size
- out-of-roundness of the component (ovality)
- surfaces (e.g. roughness, scratches and grooves)
- limiting dimensions (tolerances)
- type of joining technology (e.g. welding, adhesive bonding and bolting processes)
- external appearance of the manufactured joint (e.g. uniformity and shape)
- assessment of the joint, inside and outside (e.g. non-destructive defect evaluation according to the DVS 2202-1 technical code)

Tables 1 and 2 apply to limiting dimensions which are directly influenced by the fabrication of the component (e.g. by welding), unless they are stipulated in other sets of rules (e.g. in the DVS 2205 technical code). For example, this does not apply to thickness or diameter deviations in so far as they are covered by standard sheets for semi-finished products.

Table 1. Limiting dimensions ΔL for lengths L.

Accuracy class	Area of application		Dimensions* in mm							
		L	> 315 up to 1,000	> 1,000 up to 2,000	> 2,000 up to 3,000	> 3,000 up to 5,000	> 5,000 up to 8,000	> 8,000 up to 12,000	> 12,000 up to 20,000	> 20,000
A	e.g. structures with little heat input by welding	ΔL	± 2	± 3	± 4	± 5	± 6	± 7	± 8	± 9
B	e.g. structures with a lot of heat input by welding		± 4	± 6	± 8	± 10	± 12	± 14	± 15	± 16
C	e.g. structures with which a greater deviation can be permitted		± 8	± 12	± 15	± 18	± 21	± 23	± 25	± 27

* The dimensions apply to 23 ± 2°C.

If no information about permissible limiting dimensions for length and angular dimensions is provided on the drawings, an accuracy class appropriate for the application in question must be taken as the basis.

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Table 2. Limiting dimensions for angles.

		Dimensions in mm			
Accuracy class	L*	bis 315	> 315 up to 1,000	> 1,000 up to 2,000	> 2,000 up to 3,000
A	e*	± 1	± 2	± 3	± 7
B		± 3	± 6	± 9	± 12
C		± 7	± 10	± 14	± 20

* The length L of the shorter leg is regarded as the reference for the limiting dimension e of the angles (see Fig. 1). This must always be related to the apex. The lengths of the limiting dimensions (e) for angular dimensions are measured at the outermost point of the reference leg. The limiting dimensions apply to 23 ± 2°C.

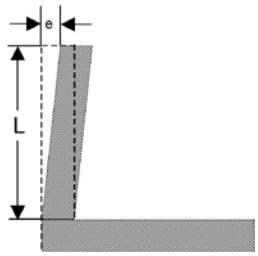

Figure 1. Limiting dimension (e) of the angle.

2.2 Requirements on testers/inspectors and testing/inspection materials

The people commissioned for dimensional checks and visual inspections must possess the plastics technology expertise and experience necessary for this purpose.

The testing/inspection materials must satisfy the requirements in the relevant standards.

Examples:

– calliper gauge according to DIN 862
– graduated rule according to DIN 866
– tape measure according to DIN 6403
– steel try square according to DIN 875-1
– inclination measuring facilities according to DIN 2276

All the testing/inspection materials must be marked as testing/inspection materials and must be subjected to regular calibration.

3 Tests and inspections

3.1 Visual inspections

3.1.1 Examination of the execution

During the visual inspections, it is necessary to examine the complete and correct execution of the components/installation according to the design stipulations.

3.1.2 Surface inspections

With good illumination, the component surfaces are visually inspected with regard to grooves, notches, inhomogeneities (e.g. smears), sink marks and miscellaneous damage or manufacturing defects. In cases of doubt, it is necessary to use an illuminated magnifying glass with an adequate magnifying power (e.g. up to approx. ten times).

3.1.3 Dimensional check

During the dimensional check, all the main dimensions (e.g. the external dimensions, the geometrical arrangement of the nozzles, flanges and miscellaneous attachments) are examined first of all. Furthermore, all the limiting dimensions are examined. For example, these are out-of-roundness, wall thicknesses, angles and the parallel faces of the flanges.

3.2 Testing and inspection of the joints

It must be checked whether the execution of the joints complies with the agreements or coincides with the design drawing. In principle, the weld execution must be evaluated according to the DVS 2202-1 technical code and the adhesive-bonded seam execution according to the DVS 2221 guideline.

In the case of joints which are no longer accessible during the final acceptance, an intermediate acceptance must be carried out during the fabrication.

4 Testing and inspection report and evaluation

It is necessary to draw up a testing and inspection report. An example is specified in Appendix 1.

5 Bibliography

DIN EN ISO 13920	Welding – General tolerances for welded structures – Length and angular dimensions; shape and position
DIN 862	Calliper gauges; requirements, testing and inspection
DIN 866	Geometrical product specifications (GPS) – Graduated rules and rules for working purposes – Executions and requirements
DIN 875-1	Geometrical product specifications (GPS) – Try squares – Part 1: 90° steel try squares
DIN 2276-1	Inclination measuring facilities; level tubes; dimensions and requirements
DIN 2276-2	Inclination measuring facilities; electronic inclination measuring facilities; shape and requirements
DIN 6403	Tape measures made of steel with a winder frame or a winder
Technical code DVS 2202-1	Defects in welded joints between thermoplastics – Characteristics, description and assessment
Technical code DVS 2205-1	Calculation of tanks and apparatus made of thermoplastics – Characteristic values
Technical code DVS 2205-2	Calculation of tanks and apparatus made of thermoplastics – Vertical round, non-pressurised tanks
Technical code DVS 2205-3	Calculation of tanks and apparatus made of thermoplastics – Welded joints
Technical code DVS 2205-4	Calculation of tanks and apparatus made of thermoplastics – Flanged joints
Technical code DVS 2205-5	Calculation of tanks and apparatus made of thermoplastics – Rectangular tanks
Technical code DVS 2210-1 Supplement 3	Industrial piping made of thermoplastics – Designing and execution – Above-ground pipe systems – Flanged joints: Description, requirements and assembly
Guideline DVS 2221	Qualification testing of plastics adhesive bonders – Pipe joints between PVC-U, PVC-C and ABS with solvent adhesives