January 2003

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

Testing of welded joints of thermoplastic sheets and pipes
Test methods – Requirements

DVS
Directive DVS 2203-

Contents:

1 Scope

This directive provides the processor of semifinished products of thermoplastics and the user of the products with instructions for testing welded joints. The requirements of the tests which are treated in detail in part 2 – 5 of this directive are mentioned in the corresponding supplements of part 1.

The useful test procedure has to be chosen according to the corresponding execution and application. Here it has to be considered that the test results depend on the manufacturing conditions for the test specimens and on the test conditions. For this reason they are only transferable to the behaviour of a product or to the design calculation if the arising practical requirements correspond to manufacturing and test conditions or if the influence of form and stress is considered.

2 Materials and characteristics

This directive covers the plastics listed in table 1 which are mainly used in the apparatus and piping engineering.

These plastics have specific characteristics regarding processing and application technology due to their molecular structure. These material properties have to be considered for applications of thermoplastic semifinished products, mainly for load-bearing components, especially when they are at the same time subjected to mechanical, thermal and chemical stress.

The characteristics of the semifinished products – pipes, sheets, profiles, fittings – with the relevant tests are described in DVS 2201-1. The characteristic values of the semifinished products can be taken from the pertinent DIN standards or the specifications according to EN. The welding fillers are treated in DVS 2211 or DIN EN 12943. The characteristic values of the most common thermoplastics for design calculation can be found in DVS 2205-1 or DIN EN 1778.

Table 1. Materials and letter symbols.

Letter symbol	Description of material
PE-HD	High density polyethylene
PE 63	(Subdivision of PE into strength classes)
PE 80	(Subdivision of PE into strength classes)
PE 100	(Subdivision of PE into strength classes)
PE Xa	Peroxide-crosslinked polyethylene
PP	Polypropylene
PP-H	Polypropylene homopolymer (type 1)
PP-B	Polypropylene block copolymer (type 2)
PP-R	Polypropylene random copolymer (type 3)
PVC-U	Polyvinyl chloride unplasticized
PVC-NI	Polyvinyl chloride normal impact
PVC-RI	Polyvinyl chloride raised impact
PVC-HI	Polyvinyl chloride high impact
PVC-C	Polyvinyl chloride chlorinated
PVDF	Polyvinylidene fluoride

Footnote 1):

– PE-HD is subdivided into strength classes with the names PE 63 (MRS ≥ 6,3 N/mm^2), PE 80 (MRS ≥ 8,3 N/mm^2), PE 100 (MRS ≥ 10,0 N/mm^2).

– PVC-U: Name for PVC unplasticized, until now also used for normal impact PVC. New name: PVC-NI (normal impact).

– PVC-HI: Name for all impact-resistant modified PVC types. New name: PVC-RI (raised impact); PVC-HI (high impact).

3 Tests

Different kinds of tests can be used for testing welded joints with regard to the set requirements or the desired results and the given possibilities.

Besides the measures described in DVS 2201-2 welding trials subjected to testings conforming to the practice are necessary for testing the weldability of a given combination of basic material and filler material.

DVS, Technical Committee, Working Group “Joining of Plastics”

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

3.1 Non-destructive tests

The non-destructive tests such as dimensional inspection, visual inspection, leak test, ultrasonic test, high-voltage test as well as radiographic test are described in the directive DVS 2206 and can be applied by analogy for the welded joints.

3.2 Destructive tests

Scope, set-up as well as carrying-out of the test and interpretation of the indivual test results are described in the parts of this directive mentioned in table 2.

Table 2. Tests and requirements for welded joints.

Test method	Directive	Requirements
Tensile test	DVS 2203-2	2203-1 supplement 1
Impact tensile test	DVS 2203-3	None
Tensile creep test	DVS 2203-4	2203-1 supplement 2
Technological bend test	DVS 2203-5	2203-1 supplement 3

4 Requirements

The plastics/semifinished products used for the welded joints have to comply with the standards and directives mentioned in section 5. The directive DVS 2201-1 has furthermore to be considered.

4.1 Non-destructive tests

The requirements are to be taken from DIN 32502 Detection of defects, Directive DVS 2202 and Directive DVS 2206.

4.2 Destructive tests

The requirements on the welded joints are to be taken from the supplements of this directive. The values of requirement represent minimum values.

5 Relevant Standards and Directives

Paperback: DVS instruction sheets and directives “Joining of plastics”, 10th edition 2003, series of reference books: welding technique, volume 68/IV

CD-ROM: DVS-Guidelines and -Worksheets, Plastics Welding and Adhesive Bonding, German and English, Edition 2002, DVS-Verlag GmbH, Düsseldorf.

DIN EN ISO 15013 (1999-05)	Extruded sheets of polypropylene (PP) – Requirements and test methods
DIN EN ISO 14632 (1999-05)	Extruded sheets of polyethylene (PE) – Requirements and test methods
ISO 11833-1 (1998)	Plastics – Unplasticized poly(vinyl chloride) sheets – Types, dimensions and characteristics – Part 1: Sheets of thickness not less than 1 mm
DIN 16927 (1988)	Unplasticized polyvinyl chloride sheets – Technical delivery conditions
(E) DIN EN ISO 15014 (1999-05)	Extruded sheets of polyvinylidene fluoride (PVDF) – Requirements and test methods
DIN 16972 (1995)	Compression moulded plates made of polyethylene high-density (PE-UHMW), (PE-HMW), (PE-HD) – Technical specifications
(E) DIN EN ISO 15527 (1999-05)	Compression moulded plates made of polyethylene high-density (PE-UHMW), (PE-HMW), (PE-HD) – Requirements and test methods
DIN 16835 (1989)	Semi-finished thermoplastics products – Technical delivery conditions
DIN EN 12473 (1999-12)	Filler materials for thermoplastics, scope, designation, requirements, testing
prEN 12814-8	Testing of welded joints of thermoplastics semi-finished products – Part 8: Requirements