

Contents:

- 1 Scope and purpose
 - 1.1 Scope
- 1.2 Quality assurance
- 2 Test centres and examiners for plastics welders
- 3 Admission to the tests
- 4 Scope of the test
- 5 Proof of skills and knowledge
 - 5.1 Practical test
 - 5.2 Theoretical test
- 6 Welding and testing of the test specimens by the test participant
 - 6.1 Welding supervision
 - 6.2 Test specimen preparation
 - 6.3 Substitute test specimens
 - 6.4 Testing for tightness
 - 6.5 Testing the seam dimensions and weld strength
- 7 Testing and assessment of the test specimens by the examiner
 - 7.1 Test contents
 - 7.2 Production of the test specimens
 - 7.3 Visual inspection
 - 7.4 Testing the tightness
 - 7.5 Testing the seam strength
 - 7.6 Testing the seam dimensions
- 8 Test result, substitute test specimens, Test Certificate
 - 8.1 Practical test
 - 8.2 Substitute test specimens
 - 8.3 Theoretical test
 - 8.4 Overall result

- 8.5 Test Certificate
- 8.6 Failing the test
- 9 Repeat test
 - 9.1 Duration of test validity
 - 9.2 Deadline extension through routine monitoring
 - 9.3 Special rules
 - 9.4 Test procedures
- 10 Standards, Directives, Regulations
 - Enclosures 1 to 7

1 Scope and purpose

1.1 Scope

This Directive applies to testing the knowledge and skills of welders who are to weld original and repair welds on plastic lining membranes in the fields of geotechnical and hydraulic engineering.

It is to be used in all situations where clients, or the agencies responsible for this field of application, require the work of certified plastics welders.

This part of Directive DVS 2212 covers hot-gas extrusion (HE), hotgas lap (HL) and heated wedge (HW) welding processes of lining membranes made of PE-HD, ECB and PVC-P according to Table 1. If necessary, the practical skills in Sub-Group III-4 and III-5, or III-6 and III-7, are to be demonstrated on work.

If lining membranes made of other materials is to be included, a corresponding, representative test specimen must be produced and tested accordingly. Test specimen and requirements are determined by the plastics welder examiner in accordance with

Table 1. Breakdown and scope of the plastics welder examination, examination Group III.

Sub-Group No	Test specimens Semi-finished products (quality requirements, dimensions: Section 10)	Scope		Welding process
		Lining membrane thickness ^{*)} (mm)	Seam types in lap joint	
III-1	PE-HD	2 ... 5	Lap seam with filler material – w/o testing channel (single seam) – with testing channel (double seam) – with surfacing weld	Hot-gas extrusion welding ^{**) (HE) or light beam extrusion welding (LE)}
III-2	PE-HD	2 ... 5	Lap seam without filler material – w/o testing channel (single seam) – with testing channel (double seam)	Hot-gas lap welding (HL)
III-3	PE-HD	2 ... 5	Same as III-2	Heated wedge welding (HW)
III-4	ECB	1 ... 4	Same as III-2	Hot-gas lap welding (HL)
III-5	ECB	1 ... 4	Same as III-2	Heated wedge welding (HW)
III-6	PVC-P	1 ... 4	Same as III-2	Hot-gas lap welding (HL)
III-7	PVC-P	1 ... 4	Same as III-2	Heated wedge welding (HW)

^{*)} If other lining membranes thickness are to be included, an additional test specimen of representative thickness is to be produced and tested according to the corresponding aspects. Test specimens and requirements are determined by the plastics welder examiner in accordance with DVS 2225, Parts 1 and 2. The test specimens and the scope of the test are to be entered on the blank lines on the back of the Test Certificate (Enclosure 4).
^{**) Similar filler materials of the same compound type are to be used.}

This publication has been prepared by a group of experienced specialists working in a honorary capacity and approved by the Working Group "Training and Examination". It is binding for DVS Training Centres. The applicant must check in each case whether the version in his possession is still valid.

DVS, Technical Committee, Working Group "Plastics, Welding and Adhesive Bonding"
DVS, Committee for Education System, Working Group "Training and Examination"

this Directive. The test specimens and the scope of the test are to be entered on the blank lines on the back of the Test Certificate (Enclosure 4).

Part 1 of Directive DVS 2212 covers hot-gas welding with torch separate from filler rod (HT), hot-gas string bead welding (HS) and heated tool butt welding (HB) processes on tubes and sheets made of the materials PVC-U, PE-HD, PP-H, PP-B, PP-R and PVDF. Part 2 of Directive DVS 2212 covers the hot-gas extrusion welding (HE) process on tubes and sheets made of the materials PE, PP-H, PP-B and PP-R.

1.2 Quality assurance

The quality of welding work essentially depends on the skills and knowledge of the welder. Thus, knowledge and skills must be demonstrated in a test in order to ensure the quality of welding work.

They only remain up-to-date if the welder is exposed to a sufficient amount of welding work. For these reasons, it is also necessary for welding supervisors¹⁾ to monitor the welder during welding work.

The use of this Directive ensures that this test is conducted in accordance with a uniform test specification on uniform test specimens and under uniform conditions.

A welding test properly completed in accordance with this Directive guarantees that the plastics welder in question has demonstrated the minimum degree of skill and knowledge required in the tested fields according to the state of the art.

Thus, this Directive provides the technical prerequisite for the mutual recognition of this plastics welder test by the responsible agencies.

2 Test centres and examiners for plastics welders

The test is to be conducted at a test centre by an examiner for plastics welders²⁾. The test centre must have the facilities required to conduct the tests. If the test is conducted following a preparatory training course, no test participant may have the same instructor and examiner.

3 Admission to the tests

Only those welders whose training and previous practical experience indicate that they possess sufficient professional

knowledge and skills to pass the test, are permitted to take the test. This is generally the case if one of the following conditions is fulfilled:

- Completed vocational training as a plastics fitter with experience in welding lining membranes made of plastic and sufficient technical knowledge of materials and process relationships.
- Several years of experience as a welder of plastic lining membranes and sufficient knowledge of materials and process relationships based on DVS Directives, generally through participation in special training courses adapted to the experience and technical knowledge of the participant.
- At least one year of experience in welding plastic lining membranes and participation in a two-week preparatory training course for the welding test for plastic lining membranes. The preparatory training course includes the manufacture of test specimens and the test of specialist knowledge.
- At least one year of experience in installing lining membranes in geotechnical and hydraulic engineering, successful participation in a one-week basic training course and a two-week preparatory training course for the welding test for plastic lining membranes. The preparatory training course includes the manufacture of test specimens and the test of specialist knowledge.

Vocational training must be proven by certificates and practical experience by company references. In case of doubt, the test centre may conduct an admission test.

4 Scope of the test

The test in Examination Group III includes Sub-Group III-1 to III-7 (Table 2). It is possible to limit the test to individual Sub-Groups in accordance with the experience level and field of knowledge of the test participant.

¹⁾ For example, welding experts as per DVS 2211 (currently being drafted) or experts with corresponding competence who are commissioned by company management.

²⁾ In accordance with the Test Centre and Examiner Requirements for Plastics Welders and Plastics Bonnets (DVS 2212/TUV agreement). The test centre addresses can be obtained from the offices of the DVS in Düsseldorf and the VdTUV in Essen.

Table 2. Test specimens and test type.

Sub-Group No.	Material type	Thick-ness mm	Welding		Type of lap seam	Test specimen to Fig. No.	Test specimen dimensions		Visual inspection	Check of seam dimensions	Peeling test	Compressed air test	Vacuum test
			Welding process	Welding method			Length m	Width m					
III-1	PE-HD	2.5	HE	Manual welding	Surfacing weld	2	Patch 2.5	0.5	+	+	+	-	+
III-2	PE-HD	2.5	HL	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-
III-3	PE-HD	2.5	HW	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-
III-4	ECB	2	HL	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-
III-5	ECB	2	HW	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-
III-6	PVC-P ¹⁾	2	HL	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-
III-7	PVC-P ¹⁾	2	HW	Mech. welding	Double seam	3	4	1.5	+	+	+	+	-

¹⁾ In the case of test specimens made of fibre-reinforced lining membranes, the membrane edges must be protected with a paste of similar type after welding.