

# *Polski Rejestr Statków*

## **PRZEPISY**

PUBLICATION NO. 108/P

### **QUALIFICATION AND CERTIFICATION OF PLASTICS' WELDERS**

**2015**

Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków complete or extend the Rules and are mandatory where applicable.



GDAŃSK

*Publication No. 108/P – Qualification and Certification of Plastics' Welders*, based on the Polish Standard PN-EN 13067:2013: *Plastics welding personnel. Qualification testing of welders. Thermoplastics welding assemblies*, was approved by the PRS S.A. Board on 12 June 2015 and enters into force on 1 July 2015. .

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# 1 GENERAL

## 1.1 Application

**1.1.1** The present *Publication* specifies the principles for examining and certifying personnel welding (bonding) plastics for granting PRS qualification certificates.

**1.1.2** *The Publication* applies to the following thermoplastics welding processes:

- hot gas welding:
  - round nozzle,
  - high speed nozzle,
- extrusion welding,
- heated tool welding,
- hot gas pressure welding:
  - by machine,
  - manual,
- heated wedge pressure welding,
- heated tool pressure welding:
  - butt,
  - socket,
  - saddle,
- electrofusion pressure welding,

**1.1.3** This *Publication* applies to the joining of sheets, pipes, fittings and lining membranes manufactured of appropriate plastics of material groups 1 to 9.

**Table 1.1.4**  
**Division of plastics into material groups**

SHEETS, PIPES AND FITTINGS	GROUP 1	<b>PVC</b> (PVCU, ABS, PC)	PVC – polyvinyl chloride, poly(vinyl chloride) PVC-U – PCV hard
	GROUP 2	<b>PP</b>	PP – polypropylene
	GROUP 3	<b>PE</b> (PE, PB)	PE – polyethylene PB – polybutylene
	GROUP 4	<b>PVDF</b>	PVDF – polyvinylidene fluoride, poly(vinylidene fluoride)
	GROUP 5	<b>ECTFE</b> PFA, FEP	ECTFE – ethylene chlorotrifluoroethylene copolymer ethylene/ chlorotrifluoroethylene PFA –perfluoroalkoxy polymer FEP – tetrafluoroethylene / hexafluoropropylene co- polymer
LINING MEMBRANES	GROUP 6	<b>PVP-P</b>	PVP-P – cross linked polyvinyl N-pyrrolidone
	GROUP 7	<b>PE</b>	PE – polyethylene
	GROUP 8	<b>ECB</b>	ECB – ethylene copolymer bitumen
	GROUP 9	<b>PP</b>	PP – polypropylene

**1.1.4** Non-metallic materials and products of organic origin and from plastics shall comply with the requirements specified in *Publication No. 40/P – Non-metallic Materials* and in *Publication No. 53/P – Plastic Pipelines on Ships*.

## 1.2 Terms and Definitions

For the purpose of the *Publication*, the definitions given in current revisions of Standards PN-EN 13067, PN-EN 14728 and PN-EN ISO/IEC 17024, as well as in the *PRS Rules, Part IX – Materials and Welding* and in *Publication 51/P – Procedural Requirements for Service Suppliers* apply and additionally:

**Certificate Issuing Authority (CIA)** – the institution approving competences and qualifications of plastics welding examiner and of the test invigilator.

**Competences** – an ability to use ones knowledge and skills in order to achieve demanded results.

**Electrofusion welding** – a welding process used for joining the electrofusion socket or saddle fitting with a pipe or a fitting ended with a muff; electrofusion fittings are heated applying the Joule phenomenon, exposed heating elements are joined, which results in softening the material and pressure welding of pipe and fitting surfaces.

**Examiner** – a person having competences to perform the test and report its result, when a professional judgment is required within the test.

**Extrusion welding** – a welding process in which an extruder unit with a melting chamber gives the extruded material required by the thickness and shape of the joint. Hot air or inert gas heats simultaneously the parent material.

**Heated tool welding** – welding process in which the joint surfaces are adequately heated by exposure, through direct contact with heated elements or without contact and are welded under pressure.

**Hot gas welding** – welding process in which materials to be unified are softened by hot air or inert gas and are pressed together.

**Invigilator** – a person having appropriate qualifications for supervising practical and theoretical tests, approved by certificate issuing authority. In accordance with PN – EN ISO/IEC 17024, the person who administrates or supervises the test, however, does not assess the candidate competences (proctor, test administrator, observer).

**Plastics welding examiner (PWE)** – suitably qualified person, approved by certificate issuing authority and accepted by the parties to the contract, who verifies compliance with the PN-EN 13067 Standard.

**Qualification test** – theoretical and/or practical test performed in order to grant PRS competences to a welder for the first time or to extend the scope of possessed PRS competences.

**Range of qualification** – welding/pressure welding processes, types of joint, materials, thicknesses and diameters for which a welder/pressure welder is qualified.

**Revision test** – test carried out at the request of PRS' Surveyor, e.g. where the quality of the welds performed by welder has decreased significantly, to check the welder's current skills.

**Test** – activities being part of the assessment which serve the evaluation of candidate competences by one or more methods, such as a written, oral, practical examination and observation.

**Test piece** – welded joint made during the welder's test.

**Welding procedure specification (WPS)** – a document providing in detail the variable parameters required for a specified welding process, to ensure its repeatability.

**Welding process** – a technique characterized by the method of softening to obtain permanent assembly, which covers both welding and bonding processes.

**Welder's qualification prolongation test** – test carried out to prolong the validity of the welder's qualification, granted by PRS.

**Welding record sheet** – a document recording in detail the variable parameters applied at the practical test.

**Welder** – a person making a welded assembly by any process, whose manual skill and knowledge are two of the determining factors influencing the quality of the welded joint, or a person performing a welding operation by means of mechanical or automatic equipment.

### **1.3 Standards referred to in the *Publication***

PN-EN 12814-1 – Testing of welded joints of thermoplastics semi-finished products. Bend test..

PN-EN 12814-2 – Testing of welded joints of thermoplastics semi-finished products. Tensile test.

PN-EN 12814-3 – Testing of welded joints in thermoplastics semi-finished products. Tensile creep test.

PN-EN 12814-4 – Testing of welded joints of thermoplastics semi-finished products. Peel test

PN-EN 12814-5 – Testing of welded joints of thermoplastics semi-finished products. Macroscopic examination.

PN-EN 12814-6 – Testing of welded joints of thermoplastics semi-finished products. Low temperature tensile test.

PN-EN 12814-7 – Testing of welded joints of thermoplastics semi-finished products. Tensile test with waisted test specimens.

PN-EN 12814-8 – Testing of welded joints of thermoplastic semi-finished products. Requirements.

PN-EN 13100-1 – Non destructive testing of welded joints of thermoplastics semi-finished products. Visual examination.

PN-EN 13100-2 – Non destructive testing of welded joints of thermoplastics semi-finished products. X-ray radiographic testing.

PN-EN 13100-3 – Non-destructive testing of welded joints in thermoplastics semi-finished products. Ultrasonic testing.

PN-EN 13705 – Welding of thermoplastics. Machines and equipment for hot gas welding (including extrusion welding).

PN-EN 14728 – Imperfections in thermoplastic welds. Classification.

PN-EN 16296 Imperfections in thermoplastics welded joints — Quality levels.

PN-EN ISO/IEC 17024 – Conformity assessment – General requirements for bodies operating certification of persons.

PN-EN ISO/IEC 17025 – General requirements for the competence of testing and calibration laboratories.

## **2 QUALIFICATION TESTS OF WELDERS**

### **2.1 General**

**2.1.1** The firm holding the qualification test of plastics welding personnel to achieve PRS qualifications shall request its direct supervision from the relevant PRS Branch Office. The list of welders, together with their application forms as shown in Annex 1, shall be enclosed with the request.

**2.1.2** The purpose of the qualification test is to grant competences of plastics welder. The welder's qualification test certificate conforming to Annex 5 format is a document confirming the qualifications.

**2.1.3** The qualification test shall be surveyed and evaluated by the examining body. The examining body shall include:

- the plastics welding examiner (PWE), which at once is the chairman of the examining body,
- the invigilator,
- the representative of the firm holding the test.

**2.1.4** The same surveyor may fulfil the role both PWE and the invigilator.

**2.1.5** Prior to the test, PWE shall check candidate's identity, materials, WPS, machines, instruments, qualifications of the training centre and of the certifying body, where applicable.

**2.1.6** PWE shall supervise welding of the test piece.

**2.1.7** PWE may not perform tests of own trained candidates for plastics welders.

**2.1.8** Training courses which the plastics welder has passed, as well as the hand-on experience in welding shall be documented, by appropriate certificates, etc.

**2.1.9** The firm holding the test is responsible for providing such practical test conditions, which will allow PRS' Surveyor to monitor the test welding processes carried out by particular plastics welders during the test.

**2.1.10** Examination of the test pieces shall be performed by laboratories approved by PRS, and/or shall be surveyed directly by the PRS Surveyor. The approved laboratories shall operate in accordance with the guidelines of current revision of the *Standard EN ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories*.

## **2.2 Admission to the Qualification Test**

**2.2.1** Only candidates who comply with, and document compliance with, at least one of the below conditions (in accordance with 2.1.8) may be admitted to the test:

- completed apprenticeship as plastics fabricator;
- at least two years experience as a plastics welder confirmed by manufacturer's declaration;
- completion of both a theoretical and practical training courses in preparation for the plastics welder qualification test;

## **2.3 Theoretical Test**

**2.3.1** PWE is responsible for correct conducting of the theoretical test.

**2.3.2** During the qualification test, the candidate for a plastics welder shall answer a minimum of 20 questions. It is recommended that the test time shall not exceed 1 hour, be continuous without access to teaching aids.

**2.3.3** The theoretical test shall be restricted to verification of plastics welder knowledge of the practical rules for skilful and safe working.

Knowledge of the following subjects shall be verified:

- markings and rules for welding and pressure welding of thermoplastics to which the test is designed to apply, meaning of the welding signs and symbols of the range of work.
- operation and control of the welding equipment;
- welding processes;
- knowledge concerning on-site welding;
- correct preparation of the work pieces for welding and pressure welding;
- knowledge concerning the characteristics of thermoplastics within the sub-groups;
- knowledge concerning the characteristics of fillers within the relevant sub-group of thermoplastics;
- preventing and correcting faults when making welds;
- knowledge concerning the types of imperfections for the applied welding process(es);
- knowledge concerning the WPS and welding record sheet;
- awareness of the consequences of misapplying welding parameters and/or procedures;
- knowledge concerning non-destructive examinations necessary for the applied welding process(es);
- awareness of health and safety requirements for the above work.

## **2.4 Practical Test**

**2.4.1** During the practical test, the plastics welder shall perform the test piece to prove the welding skill necessary to obtain a relevant qualification certificate.

**2.4.2** Parent materials and plastics welding consumables used for welding the test piece shall be properly selected in accordance with the requirements of appropriate standard and their group and quality shall be confirmed with *Materials Certificate* (3.2) or *Type Approval Certificate*.



**2.4.3** The shapes and dimensions of test pieces shall be in accordance with the requirements of the proper Standard (Annex 2) and the requirements for the sub-group as given in Table 1 or Table 2 (Annex 3). The test piece shall be performed in accordance with appropriate welding procedure specification (WPS).

**2.4.4** All welding equipment, materials and documents necessary to complete the test piece shall be available to the welder.

**2.4.5** The procedure of welding the test piece shall comply with the welding procedure specification WPS, which shall be available at the practical test welding stand. The welding time for the test piece shall correspond to the working time under usual production conditions.

**2.4.6** Each test piece shall be identified with a durable mark. The plastic welding examiner (PWE) is responsible for durability and correctness of marking.

**2.4.7** The welder shall complete the *Welding Record (Annex 4)*. The record shall be controlled and confirmed by PWE or the invigilator.

**2.4.8** Replacement of the initiated test piece by a new one is possible only in the case where, according to examining body, difficulties, not associated with the welder's qualifications, have occurred and the consequential defects cannot be removed without worsening the quality of the test piece.

**2.4.9** The examining body may stop the test if the welding conditions are not as required or if it appears that the welder does not have the skill to complete correctly the test welding process.

**2.4.10** PWE shall visually check the test piece immediately after it has been performed by the welder.

## **2.5 Test Piece Examination**

**2.5.1** Prior to any examination, the test piece shall be cleaned and the weld profile and dimensions shall be checked to confirm compliance with Annex 2. The number of test specimens cut from the test piece shall be in accordance with the guidelines given for particular material sub-groups (under Annex 2).

**2.5.2** Shapes, dimensions and conditioning of test specimens shall be in accordance with valid standards. The examinations shall be performed by an approved laboratory, which shall also be responsible for cutting the test specimens. The specimens shall be taken possibly without damage to welds and heat affected zones. The representative of the company holding the test is responsible for sending the specimens to an approved laboratory.

**2.5.3** The results of the examination of the test piece shall be documented. It is recommended that the examination methods and scope the test pieces shall be subjected to, shall be in accordance with the requirements of the Standard the test is based on.

## **2.6 Assessment of Qualification Test Results and Issue of *Welder's Qualification Test Certificate***

**2.6.1** *Welder's Qualification Test Certificate* may be issued only when the overall result of the qualification test is considered satisfactory, and if the results of both the theoretical and practical parts of the qualification test are considered satisfactory.

**2.6.2** The assessment is considered positive if during the practical part all the requirements of each of the evaluation section are fulfilled and the test has been performed in accordance with the guidelines of 2.4 and at least 80% of the candidate's answers given during theoretical part were correct.

**2.6.3** PWE performs visual assessment of test pieces, test specimens and the results achieved by the approved laboratory.

**2.6.4** The following designation for the test evaluation applies: „c” indicates „conforming” and „nc”: „non-conforming”. The results and the evaluation shall be presented by PWE in the relevant evaluation record form – *Evaluation sheet for practical test* (Annex 6).

**2.6.5** Visual evaluation of test piece performed in accordance with WPS applies to all stages of practical and destructive tests, in accordance with PN-EN 13100-1.

**2.6.6** The destructive tests shall be carried out in accordance with 2.5.2, as well as Annex 2 and Tables 1 and 2 of Annex 3.

**2.6.6.1** The bend test shall be carried out in accordance with PN-EN 12814-1, except that the test specimen width shall be 20 mm. In accordance with Table 1 (Annex 3), where in column “Verification and test” „B f + r” are given, half of the test specimens shall be tested as „B f” (face bending) and half as „B r” (root bending).

**2.6.6.2** The tensile test shall be carried out in accordance with PN-EN 12814-2. For PE pipes covering subgroups 3.4 and 3.5 in Table 1 (Annex 3), the test specimens shall be tested in accordance with Annex B to EN 12814-2.

**2.6.6.3** The peel test shall be carried out in accordance with PN-EN 12814-4, by the method conforming to the below Table.

**Table 2.6.6.3**  
**Peel test methods depending on material subgroups**

Material group	Subgroup	Peel test method
PP	2.6	crush test
	2.7	
PE	3.6	decohesion test
	3.7	
	3.8	
	3.9	crush test
	3.10	
PVDV	4.4	
PVC-P	6.1 to 6.4	T-peel test
PE	7.1 to 7.5	
ECB	8.1 to 8.4	
PP	9.1 to 9.5	T-peel test

**2.6.7** The test results and other decisions shall be covered in a collective record.

**2.6.8** A complete set of documents of performed test shall include:

- welder’s application (in accordance with Annex 1),
- WPS list for test pieces,
- copies of acceptance certificates for base materials and welding consumables used during the test,
- records of all performed examinations of test pieces,
- collective record.

## **2.7 Qualification Test Certificate for Plastics Welder**

**2.7.1** After the plastics welder has passed theoretical and practical part of the qualification test and received positive evaluation, the certifying body issues a certificate in accordance with PN-EN ISO/IEC 13067 and on form contained in Annex 5.

**2.7.2** *The Certificate* is issued in two languages, in Polish and the language previously agreed by both parties and it includes the below information:

- plastics welder full name;
- date and place (town, country) of birth;
- clear photograph;
- the number of the Standard being the base for the test, the number of material group and subgroup, in accordance with Table 1 and 2 of Annex 3;
- date of qualification test passed/qualifications granted;
- date of certificate issue;
- period of qualifications validity;
- PWE signature;
- full name and address of certifying authority,
- individual identification number of the certificate.

## **2.8 Re-test**

The welder who failed to pass the qualification test shall undergo further education and practical training prior to taking a new qualification test.

## **3 SCOPE OF QUALIFICATIONS**

### **3.1 Scope of Qualifications**

**3.1.1** The plastics welder receives qualifications to perform welds within the scope of the test scope, test group and subgroup of materials and other qualifications specified in the application (Annex 1), in accordance with Tables 1 and 2 (Annex 3).

### **3.2 Qualifications Validity**

**3.2.1** The qualification test certificate is issued to a welder for a period of 2 years commencing with the date of the practical test. The date of test and certificate issue may differ. Welder's qualification can be prolonged for further 2 years after he has passed the revision test, within the scope of the granted qualification or at the compliance of conditions specified in 4.1. In the case of prolongation of qualification in accordance with 4.1, i.e. without passing the practical test, the qualification test certificate will be valid from the day following the date of qualification prolongation.

**3.2.2** The *Welder's Qualification Test Certificate* is valid for a period of 2 years, provided that:

- the welder is employed at welding works. Breaks in employment longer than 6 months are not acceptable;
- no particular reasons for questioning skills and knowledge of the welder occurred;
- the employer verifies, at annual basis, that the welder's qualifications conform to the technical conditions being the basis for the qualification test certificate.

**3.2.3** The welder's qualification expires where he has not performed any welding operations within the scope of granted qualifications for a period longer than 6 months.

**3.2.4** The welder's qualification may be withdrawn at the request of PRS' Surveyor who supervises the welding operations if the welder has failed to comply with the good welding practice or where the quality of the welds has decreased significantly.

**3.2.5** A manufacturer (or welder itself in the case of other form of employment) is responsible for control of welder's qualification, the welders' training and their continuous work to allow them to maintain their qualifications.

## **4 PROLONGATION OF QUALIFICATION VALIDITY**

### **4.1 Prolongation of Qualification Validity**

**4.1.1** Prolongation of plastics welder's qualification for further 2 years without the necessity to weld the test pieces can be made at the request of the manufacturer's welding supervisor, after submitting and accepting by the certificate issuing authority of welding quality evidences. All records which constitute the basis for the request shall allow to identify the welder and the welding procedure (the WPS) used in the production.

**4.1.2** The request shall be submitted to PRS before the expiry date of the welder's qualification to enable verification of the submitted documents regarding welder's qualification prolongation in due time.

**4.1.3** If conditions, referred to in 4.1, are not satisfied, in order to prolong the welder's qualification, the welder shall take and pass a test which should be held in accordance with the general principles applicable to welder's qualification tests.

5 ANNEXES

ANNEX 1

**Application to Polish Register of Shipping S.A. for plastics welder’s qualification test**

PLASTICS WELDER FULL NAME: .....

WELDER’S NATIONAL IDENTIFICATION NUMBER (PESEL NO./PASSPORT): .....

BIRTH DATE AND PLACE: .....

EMPLOYER: .....

STANDARD NO.: .....

TYPE OF QUALIFICATION TEST: QUALIFICATION, PROLONGATION, REVISION<sup>1</sup>

WELDING PROCEDURE SPECIFICATION (WPS) NO. ....

PREVIOUS QUALIFICATION: .....

Scope of qualification test			No. of test record / Welder’s qualification No.
Qualification test details	Proposed	Carried out <sup>2</sup>	
Welding process			Date of test piece welding
Welding procedures			
Material group			Test piece designation acc. to WPS
Product type			
Wall thickness / pipe diameter			Parent material group
Test piece shape			
Equipment			Welding consumable
Type of joint			
Bend test			Visual examination results root:
Tensile test			face:
Peel test			Theoretical test results
Visual examination			
Specimen check			Initials and signature of Surveyor
Conformity to drawing (Annex 2)			

....., the .....

.....  
Signature and stamp of the applicant

With the act of 29.08.1997 on personal data protection (Journal of Laws 2002, No. 101, item 926 as further amended) I agree to processing personal data by the Polish Register of Shipping S.A. through entering them in the list of persons granted PRS S.A. qualifications, published in Internet

.....  
Date and signature of welder

<sup>1</sup> – Delete as appropriate.  
<sup>2</sup> – To be completed by PRS Surveyor  
<sup>3</sup> – For joint welding processes, thickness to be given for particular processes

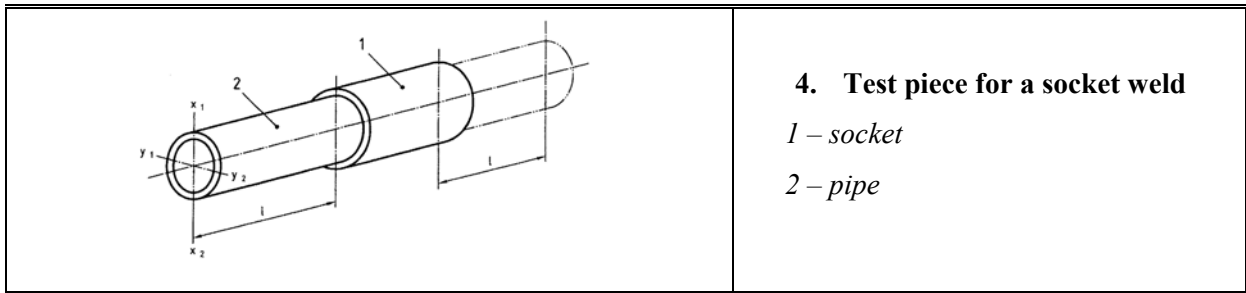
I hereby oblige myself:

- to abstain from such using the certificate that could jeopardize a good name of PRS and from submitting declarations which could be considered by PRS as misleading or not authorized.
- after suspending or withdrawing the certificate, stop using it and referring to it,
- to use the certificate only for documenting the scope of granted qualifications,
- to ensure that no certificate or report, or any part thereof is used in a misleading manner. .

.....  
Date and signature of welder

**Test pieces**  
[minimum dimensions in mm]

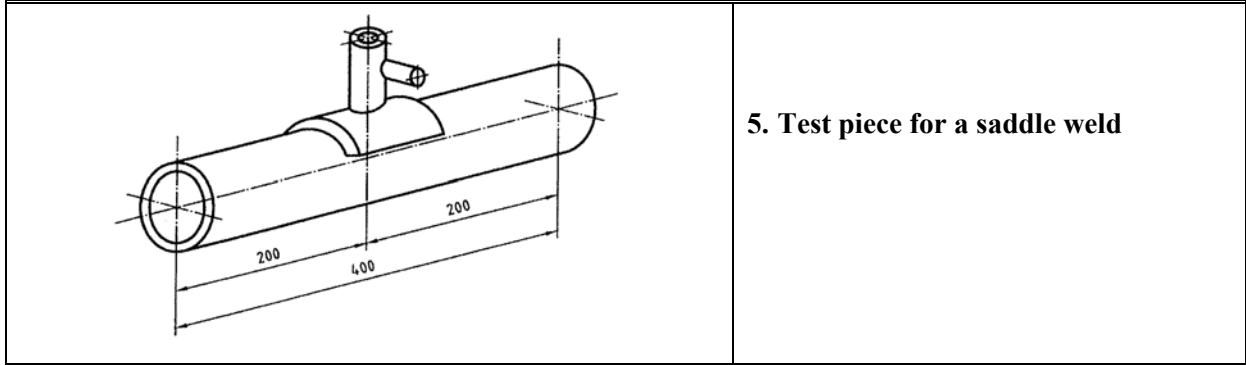
<p><b>1. Test piece for a butt weld on sheet (for bend test specimens)</b></p>	
	<p>Key:</p> <p>1 – discard</p> <p>2 – 6 bend test specimens, cut as directed by PWE</p>
<p><b>2. Test piece for a butt weld on pipe (for bend or tensile test specimens)</b></p>	
	<p>Key:</p> <p>1 – 4 test specimens, 1 in each location (<math>x_1, x_2, y_1, y_2</math>) cut as directed by PWE</p> <p><math>l \geq 350</math> or <math>2 d_n</math> whichever is longer</p>
<p><b>3. Test piece for a butt weld on sheet (for tensile test specimens)</b></p>	
	<p>Key</p> <p>1 – discard</p> <p>2 – 5 tensile test specimens, cut as directed by PWE</p> <p>3 – 3 tensile test specimens (for reference), cut as directed by PWE</p>



**4. Test piece for a socket weld**

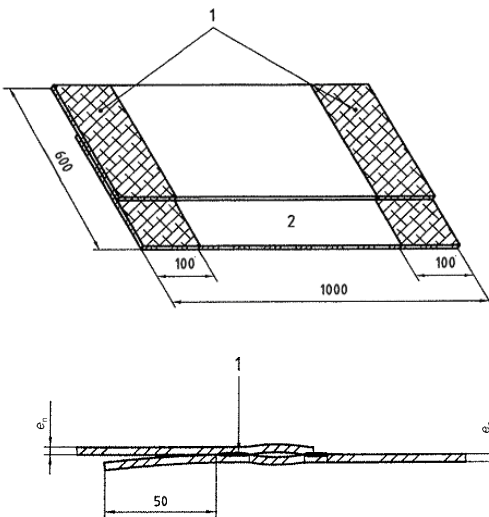
*1 – socket*

*2 – pipe*



**5. Test piece for a saddle weld**

**6. Test piece for lining membranes – lap seam without testing channel**



Key:

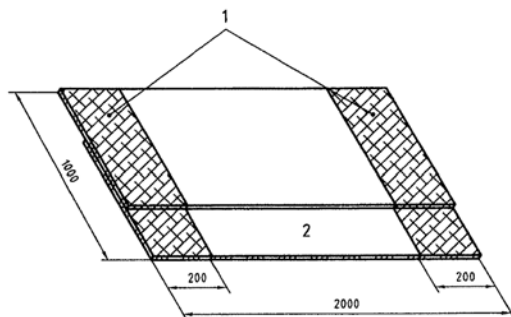
*1 – discard*

*2 – 5 peel test specimens,  
cut as directed by PWE*

Key:

*1 – welding zone*

**7. Test piece for lining membranes – lap seam with testing channel**

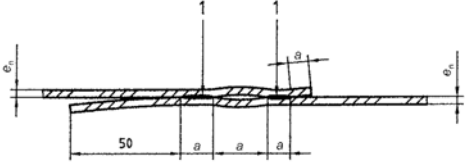


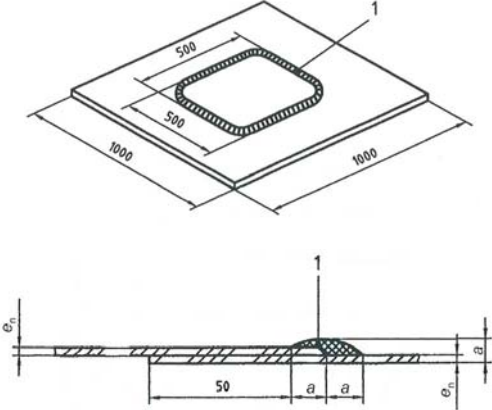
Key:

*1 – discard*

*2 – 5 peel test specimens,  
cut as directed by PWE*



	<p>Key:</p> <p>1 – welding zone</p> <p>2 – the dimensions are dictated by the machine, WPS employed</p>
---	---

<p><b>8. Test piece for lining membranes – lap seam extrusion welded</b></p>	
	<p>Key:</p> <p>1 – 5 test specimens, cut as directed by PWE</p> <p>Key:</p> <p>1 – welding zone</p> <p>A – the dimensions are dictated by the applied WPS</p>

**Table 1**  
**Sheets, pipes and fitting details of tests** *acc. to PN-EN 13067:2013*  
 [all dimensions in millimeters]

Group of material	Subgroup	Type of product S = sheet, P = pipe	Welding process	Weld form	Position	Examination and testing	Test piece acc. to Annex 2 Figure ...	Range of qualification		
								Dimensions	Type of joint	
1	2	$e_n$ = nominal wall thickness $d_n$ = nominal pipe outside diam.	4	5	6	7 Type of test	8	9	10	
1 PVC	1.1	S SDR = $5d_n / e_n$	Hot gas round nozzle	∇	Flat	V/B f+r	1	All $e_n$	V, ∇ X, ⊥	
	1.2	S $e_n = 5$	Hot gas high speed nozzle	∇	Flat	V/B f+r	1	All $e_n$	V, ∇ X, ⊥	
	1.3	S $e_n = 5$	Heated tool butt weld	∏	By machine	V/B	1	$e_n \geq 3$	∏	
				Solvent welding			V/Vis	4	$d_n < 160$	
				Solvent welding			V/VIs	4	$d_n \geq 160$	
2 PP	2.1	S $e_n = 9$ or $10$	Hot gas high speed nozzle	X	Flat	V/B f+r	1	All $e_n$	V, ∇ X, ⊥	
	2.2	S $e_n = 9$ or $10$	Extrusion continuous	∇	Flat	V/B f+r	1	$e_n \geq 3$	∇ X, ⊥	
	2.3	S $e_n = 9$ or $10$	Heated tool butt weld	∏	By machine	V/B	1	$e_n \geq 3$	∏	
	2.4	P $d_n = 110$ SDR = 17.6	Heated tool butt weld	∏	By machine	V/B r	2	$e_n \geq 3$	∏	
	2.5	P $d_n \geq 400$ SDR $\leq 17.6$	Heated tool butt weld	∏	By machine	V/B f s	2	$e_n \geq 3$ $\alpha_n \leq 315$	∏	
	2.6	P $\alpha_n = 63$ SDR = 11	Heated tool butt weld		By machine	V/P c	4	All $d_n$		
	2.7	P $\alpha_n = 63$ SDR = 11	Electrofusion		By machine	V/P c	4	All $d_n$		

1	2	3		4	5	6	7	8	9	10
3 PE	3.1	S	$e_n = 10$	Hot gas high speed nozzle	×	Flat	V/B f+r	1	All $e_n$	V, V, X, I
	3.2	S	$e_n = 10$	Extrusion continuous	V	Flat	V/B f+r	1	$e_n \geq 3$	V, X, I
	3.3	S	$e_n = 10$	Heated tool butt weld	II	By machine	V/B	1	$e_n \geq 3$	II
	3.4	P	$\alpha_n = 110$ or $\alpha_n = 180$ SDR = 11 or SDR = 17.6	Heated tool butt weld	II	By machine	V/T	2	$d_n \leq 315$	II
	3.5	P	$d_n \geq 400$ SDR $\leq 17.6$	Heated tool butt weld	II	By machine	V/T	2	$d_n > 315$	II
	3.6	P	$d_n = 90$ SDR = 11	Electrofusion	I	By machine	V/Pd	4	$d_n \leq 225$	I
	3.7	P	$d_n = 315$ SDR = 17.6	Electrofusion	I	By machine	V/Pd	4	$d_n > 180$	I
	3.8	P	$d_n = 32$ or $d_n = 90$ SDR = 11	Electrofusion	.†.	By machine	V/Pd	5	All $d_n$	.†.
	3.9	P	$d_n = 63$ SDR = 11	Heated tool socket	I	By machine	V/Pc	4	All $d_n$	I
	3.10	P	$d_n = 32$ or $d_n = 90$ SDR = 11	Heated tool saddle	.†.	By machine	V/Pc	5	All $d_n$	.†.
4 PVDF	4.1	S	$e_n = 4$	Hot gas high speed nozzle	V	Flat	V/B f+r	1	$e_n \geq 2$	X, I
	4.2	S	$e_n = 4$	Heated tool butt weld	II	By machine	V/B	1	$e_n \geq 2$	II
	4.3	P	$d_n = 110$ $e_n = 5.3$	Heated tool butt weld	II	By machine	V/B r	2	All $d_n$ $e_n \geq 1.9$	II
	4.4	P	$d_n = 63$ $e_n = 3$	Heated tool socket	I	By machine	V/B c	4	All $d_n$	I
5 ECTFE or FEP or PFA	5.1	S	$e_n = 2.3$	Hot gas high speed nozzle	V	Flat	V/T	3	$e_n \geq 1.6$	V, V, X, I
	5.2	P	$d_n = 110$ $e_n = 3$	Heated tool butt weld	II	By machine	V/T	2	All $d_n$ All $e_n$	II
	5.2	P	$d_n = 110$ $e_n = 3$	Heated tool butt weld	II	By machine	V/T	2	All $d_n$ All $e_n$	II

∇	V preparation	∩	butt weld
X	double V preparation	⊥	fillet weld
.†.	saddle		socket

**Table 2**  
**Lining membranes – details of tests acc. to PN-EN 13067:2013**

Group of material	Subgroup	Type of product M = membrane		Welding process	Weld form	Position	Examination and testing Type of test	Test piece acc. to Annex 2 figure ...	Range of qualification	
									Dimensions	Type of joint
6 PVC-P	6.1	$e_n$	nominal wall thickness	Hot gas manual		Flat	V/Pt	6	$1 \leq e_n \leq 4$	All lap
	6.2	M	$e_n = 2$	Hot gas by machine		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
	6.3	M	$e_n = 2$	Heated wedge by hot gas		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
	6.4	M	$e_n = 2$	Heated wedge electric		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
7 PE	7.1	M	$e_n = 2.5$	Hot gas manual		Flat	V/Pt	6	$1 \leq e_n \leq 5$	All lap
	7.2	M	$e_n = 2.5$	Hot gas by machine		Flat	V/Pt	7	$1 \leq e_n \leq 5$	
	7.3	M	$e_n = 2.5$	Heated wedge by hot gas		Flat	V/Pt	7	$1 \leq e_n \leq 5$	
	7.4	M	$e_n = 2.5$	Heated wedge electric		Flat	V/Pt	7	$1 \leq e_n \leq 5$	
	7.5	M	$e_n = 2.5$	Extrusion manual		Flat	V/Pt	8	$1 \leq e_n \leq 5$	
8 ECB	8.1	M	$e_n = 2$	Hot gas manual		Flat	V/Pt	6	$1 \leq e_n \leq 4$	All lap
	8.2	M	$e_n = 2$	Hot gas by machine		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
	8.3	M	$e_n = 2$	Heated wedge by hot gas		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
	8.4	M	$e_n = 2$	Heated wedge electric		Flat	V/Pt	7	$1 \leq e_n \leq 4$	
9 PP	9.1	M	$1 \leq e_n \leq 2$	Hot gas manual			V/Pt	6	$0.7 \leq e_n \leq 3$	All lap
	9.2	M	$1 \leq e_n \leq 2$	Hot gas by machine			V/Pt	7	$0.7 \leq e_n \leq 3$	
	9.3	M	$1 \leq e_n \leq 2$	Heated wedge by hot gas			V/Pt	7	$0.7 \leq e_n \leq 3$	
	9.4	M	$1 \leq e_n \leq 2$	Heated wedge electric			V/Pt	7	$0.7 \leq e_n \leq 3$	
	9.5	M	$1 \leq e_n \leq 2$	Extrusion manual			V/Pt	8	$0.7 \leq e_n \leq 3$	

Pt = Peel test (type test – T)  
Pc = Peel test (crush test)  
Pd = Peel test (decohesion test)  
V = Visual examination  
B = Bend test (f: face crush; r: root crush; s: lateral crush (for thick materials))

**Welding record acc. to PN-EN 13067:2013**

Manufacturer's WPS .....

Material: Type .....

Reference No. ....

Reference trade designation .....

Origin: .....		Lot No. ....		Works .....			
Sketch of edge preparation		Sketch of completed weld					
Edge preparation* ..... / Machining, Manual machining, Solvent cleaning .....							
Interrun cleaning*: Scraping, Surface dressing, Other .....							
Finishing*: ..... Weld flush machined ....., Outside, Inside							
* – underline as appropriate							
Marking of runs							
Welding process							
Welding rod or granules	Size in mm Material ref. Origin Cleaning Scraping, Solvent Lot No.						
Equipment used	Nozzle (round or high speed) Torch Extruder: – Reference – Trade name – No.						
Welding parameters	Gas type Air = A, Nitrogen = N Gas flow rate, l/min Gas pressure, bar Temperature, °C Speed, cm/min Force on filler material, daN						
Type of heated tool	Flat	Bushes	Welding wedges				
Equipment used	Mechanical guiding Pressure regulated by spring rating (lever) Regulated hydraulic pressure Automation by pre-adjustments						
Machine used	Reference: ..... Trade name ..... No. .... Equalization pressure (force): ..... MPa (daN)						

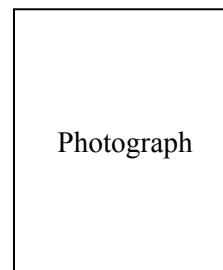
Pressure welding	Temperature regulated adjusted at: .....°C		
	Heating time .....min		
	Heating pressure (force) .....MPa (daN)		
	Change-over time ..... sec		
Parameters	Welding time ..... sec		
	Total joining time ..... min		
	Welding pressure (force) ..... MPa (daN)		
Manufacturer	Date	Prepared by	Signed

**Welders qualification test certificate form**  
*acc. to PN-EN 13067:2013*

Welder's full name:

Date, place and country of birth:

Testing standard: EN 13067



Group of material and subgroup(s)  
(according to Table 1 and Table 2):

Date of overall assessment pass:

Date of issue:

Validity of qualification until:

Certificate Issuing Authority

Signature of PWE:

- full name
- full address
- individual certificate identification number



PWE evaluation sheet for practical test

**C.1 Welding process: Hot gas round nozzle  
Hot gas high speed nozzle**

Type of product: Sheet Pipe  
 Dimensions:  $e_n = \dots\dots\dots$  mm  $d_n = \dots\dots\dots$  mm  
 $e_n = \dots\dots\dots$  mm  
 SDR  $\dots\dots\dots$

Welder's name:  $\dots\dots\dots$  Control No. / Code  $\dots\dots\dots$

		Subgroup									
		1.1	1.2	2.1	3.1	4.1	5.1				
<b>1</b>	Welding of test pieces										
	– base material (type, conditions)										
	– weld edge preparation										
	– component alignment										
	– welding rod (type, conditions, pre-treatment)										
	– choice of welding parameters										
	– welding equipment (conditions, setting)										
	– control and measuring equipment										
	• gas flow rate										
	• gas temperature										
	– welding equipment handling										
	– welding record										
	<b>Evaluation</b>										
<b>2</b>	Visual examination										
	– double weld seam										
	– notches										
	– color of metals										
	– heat effects										
	– start faults, irregular weld surface										
	– stretching/punching of filler rod										
	– linearity of weld seam										
	– weld penetration										
	– misalignment										
	– reinforcement										
		<b>Evaluation</b>									
<b>3</b>	Mechanical-technological examination										
	– tensile test (reference specimen) N/mm <sup>2</sup>										
	– tensile test (weld specimen) N/mm <sup>2</sup>										
	– short term tensile welding factor $f_s$ (required)										
	– short term tensile welding factor $f_s$ (actual)										
		<b>Evaluation of welding factor*</b>									
	– minimum bending angle (required)										
	– bending angle (actual value)										
	<b>Evaluation of bend test*</b>										
<b>Result</b>											

\* if required

Enter:

c = conform

nc = not conform

Date:

PWE signature:

**C.2 Welding process: Extrusion welding**

Type of product: Sheet

Dimensions:  $e_n = \dots\dots\dots$  mm

Welder's name: ..... Control No. / Code .....

		Subgroup							
		2.2	3.2						
<b>1</b>	Welding of test pieces								
	– weld edge preparation								
	– component alignment								
	– welding rod (type, conditions, pre-treatment								
	– welding equipment (conditions, setting)								
	– control and measuring equipment								
	• temperature of extruded material								
	• gas flow rate								
	• gas temperature								
	• extruded material output								
	• welding speed								
	– welding equipment handling								
	– welding record								
	<b>Evaluation</b>								
<b>2</b>	Visual examination								
	– poor fusion (notches, cavities)								
	– homogeneity: shape, evenness of weld								
	– lateral breakout / welding shoe guidance								
	– joint coverage / edge welding								
	– heat effect/ heating width / overheating								
<b>Evaluation</b>									
<b>3</b>	Mechanical-technological examination								
	– minimum bending angle (required value)								
	– bending angle (actual value)								
<b>Evaluation of bend test*</b>									
<b>Result</b>									

\* if required

Enter:

c = conform

nc = not conform

Date:

PWE signature:

**C.3 Welding process: Heated tool butt welding**

Type of product: Sheet Pipe  
 Dimensions:  $e_n = \dots\dots\dots$  mm  $d_n = \dots\dots\dots$  mm  
 $e_n = \dots\dots\dots$  mm  
 SDR  $\dots\dots\dots$

Welder's name:  $\dots\dots\dots$  Control No. / Code  $\dots\dots\dots$

		Subgroup									
		1.3	2.3	2.4	2.5	3.3	3.5	4.2	4.3	5.2	
<b>1</b>	Welding of test pieces										
	– base material (type, conditions)										
	– weld edge preparation										
	– component alignment										
	– ovality										
	– choice of weld parameters										
	– welding equipment (conditions, setting, control and measuring equipment)										
	– welding equipment handling										
	– welding record										
	<b>Evaluation</b>										
<b>2</b>	Visual examination										
	Weld beads										
	– shape										
	– height/width										
	– surface										
	– notches between weld beads										
	– misalignment										
	– evenness of weld										
	– defect in cross-section										
	<b>Evaluation</b>										
<b>3</b>	Mechanical-technological examination										
	– tensile test										
	– short term tensile welding factor $f_s$ (required)										
	– short term tensile welding factor $f_s$ (actual)										
	<b>Evaluation of welding factor*</b>										
	– minimum bending angle (required)										
	– bending angle (actual value)										
<b>Evaluation of bend test*</b>											
<b>Result</b>											

\* if required

Enter:

c = conform

nc = not conform

Date:

PWE signature:

C.4 Welding process: **Heated tool socket welding**  
**Heated tool saddle welding**

Type of product: Pipe Socket Saddle  
Dimensions:  $d_n = \dots\dots\dots$  mm  $d_n = \dots\dots\dots$  mm  $d_n = \dots\dots\dots$  mm  
 $d_n = \dots\dots\dots$  mm  
SDR  $\dots\dots\dots$  SDR  $\dots\dots\dots$  SDR  $\dots\dots\dots$

Welder’s name:  $\dots\dots\dots$  Control No. / Code  $\dots\dots\dots$

		Subgroup					
		2.6	3.9	3.10	4.4		
1	Welding of test pieces						
	– base material (type, conditions)						
	– preparation of weld area on pipe						
	– ovality						
	– alignment						
	– welding equipment (conditions)						
	– choice and control of weld parameters						
	– welding record						
	<b>Evaluation</b>						
2	Visual examination						
	–						
	–						
	–						
	<b>Evaluation</b>						
3	Peel test						
	–						
	–						
	–						
	<b>Evaluation</b>						
<b>Result</b>							

Enter:  
c = conform                              nc = not conform

Date:    PWE signature:



**C.6 Welding of lining membranes**

**Welding process:**

**Type of seam/weld:**

Hot gas manual

Single seam

Hot gas by machine

Double seams

Electrofusion saddle welding

Double seams

Heated wedge by hot gas

Double seams

Heated wedge electric

Single seam

Extrusion welding

Surfacing weld

Welder's name: ..... Control No. / Code .....

		Subgroup								
		6.1	to	6.4	7.1	to	7.5	8.1	to	8.4
<b>1</b>	Welding of test pieces									
	Seam/weld preparation: cleaning, drying, mechanical bevelling of top edges									
	Welded material: weldability, pre-treatment									
	Welding equipment: setting, control and measurement, handling									
	Test weld/seam: seam/weld assessment, peel test									
	Welding record									
	<b>Evaluation</b>									
<b>2</b>	Visual examination of the test pieces, seam/weld dimensions									
	Seam/weld profile: shape and uniformity, defects, centricity, surface									
	Beading: at front of seam/weld edge, lateral flow									
	Notching and scoring									
	Seam/weld dimensions requirements conform to Rating Sheet									
	<b>Evaluation</b>									
<b>3</b>	Seam/weld strength									
	Peel test: requirements conform to Rating Sheet									
<b>Result</b>										

Enter:

c = conform

nc = not conform

Date: PWE signature:

## Rating Sheets for lap seams with testing channel

Welder's name: ..... Control No. / Code .....

### 1. Seam dimensions

	Subgroup	Width of the seam sections ( $b_{N1}$ , $b_{N2}$ ), mm	Width of the testing channel ( $b_p$ ), mm
Specifications			

Measurements results	Subgroup: Specimen No.			Subgroup: Specimen No		
Measurements points	1	2	3	1	2	3
$d_o$ (mm) $d_u$ (mm) Sum: $d_o + d_u$ (mm)						
$d_{N1}$ (mm) $d_{N2}$ (mm) Difference: $d_o + d_u - d_{N1}$ (mm) $d_o + d_u - d_{N2}$ (mm)						
<b>Evaluation:</b>						
$b_{N1}$ (mm) $b_{N2}$ (mm)						
Difference      0 mm Required value $b_{N1}$ + 3 mm <hr/> 0 $b_{N2}$ + 3 mm						
<b>Evaluation:</b>						
$b_p$ (mm)						
Difference      + 0 Required value $b_p$ - 6 mm						
<b>Evaluation:</b>						

### 2. Seam strength – peel test

Subgroup	Specimen No..	Specimen width (mm)	Peeling resistance		Deformation and failure type	Evaluation
			Total force (N)	Force / Specimen width (N/mm)		
	1					
	2					
	3					
	4					
	5					

Date:

PWE signature:

**Rating sheets for surfacing weld (subgroup 7.5)**

Welder's name: ..... Control No. / Code .....

**1. Weld dimensions**

Specifications

Weld thickness (d)

$(d_o + d_u) \times 1.25$  to 1.75

Weld width (b)

$\geq 30\text{mm}$  welded in the middle  $\pm 5$  mm

Measurements results:

Specimen No.	d <sub>o</sub> mm	d <sub>u</sub> mm	S thickness d mm	sum d <sub>o</sub> + d <sub>u</sub> mm	Evaluation	Weld width b mm	Evaluation
1							
2							
3							
4							
5							

**2. Weld strength – peel test**

Specimen No.	Specimen width (mm)	Peeling resistance		Deformation and failure type	Evaluation
		Total force (N)	Force / Specimen width (N/mm)		
1					
2					
3					
4					
5					

Date:

PWE signature:

\_\_\_\_\_