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Plastics welding rod

塑料焊条

(English Translation)

(报批稿)

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Foreword

SAC/TC 162 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This standard was proposed by China Petroleum and Chemical Industry Federation.

This standard was prepared by SAC/TC162 National Technical Committee on Non-metallic Chemical Equipment of Standardization Administration of China.

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Plastics welding rod

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1 Scope

This standard specifies the classification, requirements, test methods, inspection rules, and sign, packaging and storage of plastic welding rod.

This standard is applicable to polyvinyl chloride (PVC), polypropylene (PP), polyethylene (PE), acrylonitrile butadiene styrene plastic (ABS) and fluoroplastics welding rod.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 1040.2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics.*

GB/T 1633, *Plastics – Thermoplastic material – Determination of vicat softening temperature (VST).*

GB/T 2918, *Plastic—Standard atmosphere for conditioning and testing.*

GB/T 8170, *Rules of rounding off for numerical values & expression and judgment of limiting values.*

GB/T 11547-2008, *Plastic—Methods of test for the determination of the effects of immersion in liquid chemicals.*

GB/T 21389, *Vernier, dial and digital display calipers.*

QB/T 2443, *Steel measuring tapes.*

3 Classification

3.1 Types of welding rod Materials

The types of welding rod materials are divided by the materials, the types and codes are specified in Table 1.

Table 1 — The material types and code of plastic welding rod.

Types of welding rod	Code	Description
Polyvinyl chloride welding rod	PVC1	General Polyvinyl chloride welding rod
	PVC2	High shock polyvinyl chloride welding rod
Polypropylene welding rod	PP	Polypropylene material welding rod

Table 1 (continued)

Types of welding rod	Code	Description
Polyethylene welding rod	PE1	Medium density polyethylene welding rod
	PE2	High density polyethylene welding rod
Acrylonitrile butadiene styrene plastic welding rod	ABS	ABS welding rod
Fluoroplastics welding rod	PVDF	Polyvinylidene fluoride welding rod
	PFA	Perfluoroalkoxy welding rod

3.2 Shape of welding rod

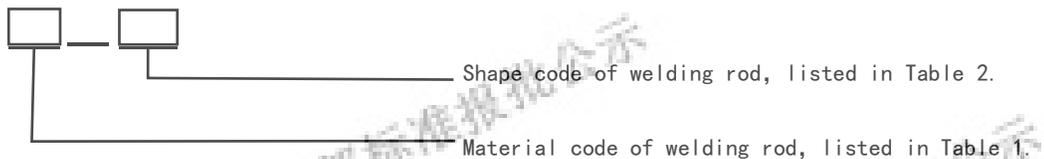
The shape of welding rod is divided according to the cross section. The recommended shape and code see Table 2. Particular shapes shall be agreed upon by the supplier and the demanders.

Table 2 — The shape and code of plastic welding rod

Shape of welding rod	Code of cross-sectional shape for welding rod	Description
Monofilament welding rod	1S	Circle
Double wire welding rod	2S	Two partially overlapping circles
Three wire welding rod	3S	Three partially overlapping circles
Triangle welding rod	SJ	Triangle
Flat welding rod	BP	Flat

3.3 Labeling of welding rod

The welding rod labeling includes the material type and shape code of welding rod, the label is compiled according to the following provisions:



For example:

The type of the double wire Polyvinyl chloride welding rod is shown as follows.

4 Requirements

4.1 Appearance

The surface of the welding rod shall be smooth, and free of damages, air bubbles and foreign materials those may influence the use of welding rod.

4.2 Dimensions

4.2.1 Height and tolerance of welding rod

The section size and tolerances of the welding rod are specified in Table 3.

Table 3 — The section size and tolerances of the welding rod (The unit: mm)

Shape of welding rod	Code of section shape of welding rod	High dimension and tolerance	
Monofilament welding rod	1S	2.0-5.0	+0.2 -0.2
Double wire welding rod	2S	2.0-5.0	+0.3 -0.2
Three wire welding rod	3S	2.0-7.0	+0.4 -0.4
Triangle welding rod	SJ	2.0-6.0	+0.3 -0.3
Flat welding rod	BP	2.0-6.0	+0.3 -0.3
Note 1: The height of welding rod refers to the size measured upward by placing the welding rod on a flat surface. Note 2: Size and tolerance of the height for the other shapes of welding rod should be determined by the agreement between the supplier and demander.			

4.2.2 Length and Tolerance of welding rod

The length and tolerance of welding rod are specified in Table 4.

Table 4 — The length and tolerance of the welding rod (The unit: mm)

Standard values	Tolerance
1 000	0-25
Note: The length and tolerance of the rolled welding rod may be determined by the agreement between the supplier and demander.	

4.3 Characteristics

The characteristics of welding rod are divided into mechanical characteristics and chemical characteristics, and the characteristics of welding rod shall be determined by the data as specified in Table 5.

Table 5 — The characteristic of welding rod

Test Item		Unit	Polyvinyl Chloride		Polypropylene	Polyethylene		Acrylonitrile-butadiene-styrene plastics	Fluoroplastics	
			PVC1	PVC2	PP	PE1	PE2	ABS	PVDF	PFA
Mechanical properties	Tensile strength \geq	MPa	50	36	25	10	20	39	40	30
	Vicat softening temperature \leq	°C	60	55	135	80	90	92		
	Linear heat shrinkage	%	± 2	± 2	± 1	± 1	± 1	± 2	± 2	± 2
Chemical properties (Corrosion resistance)	Distilled water	mg/cm ²	± 0.15	± 0.25	± 0.10	± 0.10		± 0.15	± 0.10	± 0.10
	Sulfuric acid		± 0.10	± 0.20	± 0.12	± 0.12		± 0.15	± 0.12	± 0.12
	Hydrochloric acid		± 0.30	± 0.60	± 0.30	± 0.30		± 0.30	± 0.25	± 0.20
	Nitric acid		± 0.20	± 0.40	± 0.15	± 0.15		± 0.20	± 0.15	± 0.15
	Sodium chloride solution		± 0.15	± 0.20	± 0.10	± 0.10		± 0.15	± 0.10	± 0.10
	Sodium hydroxide solution		± 0.10	± 0.20	± 0.10	± 0.10		± 0.10	± 0.10	± 0.10

5 Test method

5.1 Appearance inspection

The appearance of welding rod shall be visually inspected.

5.2 Dimensional inspection

5.2.1 Height inspection

The height of welding rod shall be measured by the vernier caliper as specified in GB/T 21389 with an accuracy of 0.05 mm.

5.2.2 Length inspection

The length of welding rod shall be measured by the steel tape as specified in QB/T 2443 with an accuracy of Grade 1, during the measurement, the specimen shall be placed on a horizontal plane.

5.3 Mechanical performance test

5.3.1 Specimens and numerical expression

5.3.1.1 Specimen preparation)

The welding rod Specimen used for tensile strength, vicat softening temperature test are cut off firstly, the thickness and size of specimen are 1 mm-6 mm under appropriate molding conditions, the specimen are processed according to the specified size.

5.3.1.2 State adjustment and test of specimen

The test shall be permitted with the standard conditions as specified in GB/T 2918. The state conditioning time of test is specified as follows: polyvinyl chloride shall be kept in standard conditions over 16 h, polypropylene and polyethylene shall be kept in standard conditions over 40 h.

5.3.1.3 Numerical representation of experimental results

The experimental results shall be required to reserve to the one more bit of the performance technical index, the rounding off for numerical values shall be specified in GB/T 8170.

5.3.2 Tensile strength test

Tensile strength test shall be conducted as specified in GB/T 1040.2, the tensile speed is 50 mm/min. The number of specimens is 5.

5.3.3 Vicat softening temperature test

The Vicat softening temperature shall be determined in accordance with GB/T 1633, in which, method B is applicable to polyvinyl chloride, and method A is applicable to polypropylene. The number of specimens is 2.

5.3.4 Linear heat shrinkage test

5.3.4.1 Test device

The following test devices are used:

- a) Heating device: the air oven is required to keep the temperature as specified in Table 6;
- b) Length measuring device: vernier calipers or appliances shall be kept the same or higher accuracy as specified in GB/T 21389.

Table 6 — Test temperature

(The unit: °C)

Species	Temperature
PVC-1	130±2
PVC-2	130±2
PP	150±3
PE-1	80±2
PE-2	120±2
ABS	120±2
PVDF	140±3
PFA	200±5

5.3.4.2 Specimen preparation

Three welding rod specimens with a length of 200 mm are cut off from the welding rods. The marking lines shall be marked on both sides and 50 mm from the center of the specimen.

5.3.4.3 Operation

The experimental specimen shall be put on the board with non-adhesive surface in the heating devices, the heating devices shall keep the temperature determined in Table 6. The experimental specimen is taken out from the heating devices after 30 min, cooled at room temperature for more than 2 h, then the space between the two mark line is measured by using the length measuring device.

5.3.4.4 Calculation

The heat shrinkage rate is determined by the formula (1) and it shall be the average value of 3 experimental specimens.

$$S = \frac{l_2 - l_1}{l_1} \times 100\% \quad (1)$$

Where:

S is linear heat shrinkage;

l_1 is the distance between marking line, in millimeter, before heating;

l_2 is the distance between marking line, in millimeter, after heating.

5.4 Chemical property (Corrosion resistance) test

5.4.1 Equipment

The equipment used in corrosion resistance test shall be as specified in GB/T 11547-2008.

5.4.2 Specimen preparation

The size of the experimental specimen is 50 mm long, 2 mm to 4 mm high. The test reagents are used as specified in Table 7, and two specimens are prepared for each test reagents.

Table 7 — Chemical reagents for testing

Name of test medium	Concentration (Mass fraction) %	Notice
Distilled water		
Hydrochloric acid	35	A+C
Sulfuric acid	30	A
Nitric acid	40	A
Sodium chloride	10	
Sodium hydroxide	40	A

Table 7 (continued)

Note 1: The risks and precautions of the medium which marked symbol A and C see in Table B.1 of GB/T 11547 2008, the following things shall be noted:

Symbol A: with different corrosive degrees, it shall be moved in safety pipette without touching skin and clothing.

Symbol C: the medium produce irritating and poisonous vapors, it shall be operate in an environment with adequate ventilation.

Note 2: the other chemical reagent shall be selected as specified in GB/T 11547 1008, Table B.1 or determined by the agreement between the supplier and demander.

5.4.3 Operation

The mass and surface area of the experimental specimens shall be measured in the standard conditions as specified in GB/T 2918. The specimens are impregnated in the test liquid as specified in Table 7 for 8 h at $60^{\circ}\text{C}\pm 1^{\circ}\text{C}$, then the specimens are washed by running water for 5 s. The specimens are weighed in the weighing bottle after wiping with a dry cloth. The specimens which impregnated in distilled water do not need to be washed.

The mass change results of each specimens impregnated in different test liquid shall be calculated by the average value of 2 specimens which surface area is constant as specified in formula (2).

$$\text{corrosion resistance} = \frac{M_2 - M_1}{A} \dots \dots \dots (2)$$

where

M_1 is the mass, in milligrams, before immersing, the unit is milligram (mg);

M_2 is the mass, in milligrams, after immersing, the unit is milligram (mg);

A is the total surface area, in square centimeter, before testing, the unit is square centimeter (cm^2).

6 Inspection rules

6.1 Inspection classification and items

6.1.1 The inspection of welding rod includes the ex-factory inspection and the type inspection, the product inspection items see Table 8.

Table 8 is the product inspection items which divided into delivery inspection and type inspection.

Table 8 — Ex-factory inspection and type inspection items.

Required clauses and names	Corresponding test method clauses	Ex-factory inspection	Type inspection
4.1 Appearance	5.1 Appearance inspection	√	√
4.2 Dimension	5.2 Dimensional inspection	√	√

Table 8 (continued)

Required clauses and names		Corresponding test method clauses	Ex-factory inspection	Type inspection
4.3 Characteristics	Tensile strength	5.3.2 Tensile strength test		√
	Vicat softening temperature	5.3.3 Vicat softening temperature test		√
	Linear heat shrinkage	5.3.4 Linear heat shrink-age test		√
	Chemical properties (Corrosion resistance)	5.4 Chemical Property (Corrosion Resistance) Test		√

6.1.2 The factory inspection is appearance quality (4.1), dimension and deviation (4.2). The specimens shall be carried out in batches with 2 random test for each batch.

6.1.3 Type inspection items are all inspection items (4.1-4.3).

In case of the following cases, type testing should be conducted:

- a) When a new or an old products manufactured by another factories;
- b) After running normally, under the condition of some factors affecting the performance of the product, such as the structure, material and process;
- c) In regular producing, periodic inspection shall be carried out when the cycle time is reached or the yield accumulated sufficiently, usually once every two years;
- d) A product needs to be recovery after it shut down for a long time;
- e) The State Quality Supervision Authority puts forward the requirements for type inspection;
- f) When the national quality supervision agency puts forward the requirements of type inspection;
- g) User requests a type checking.

6.2 Group rules and judgment

6.2.1 Batches

The division of each bath is based on the same material composition, the same process and the same production of products.

6.2.2 Judgment

The same batch of specimens are qualified if they all meet the requirements.

If one of the items does not meet the requirements, a double quantity shall be random check from the same type of products, and the same inspection shall be

inspected once again, If one item is still unqualified, this batch of product is judged unqualified.

7 Sign, packaging and storage

7.1 Sign

The welding rod packages shall include the following contents:

- a) Type and shape codes;
- b) The name of the manufacturer or its abbreviation;
- c) Production date and batch number.

7.2 Packaging

Soft materials shall be used to prevent welding rod from scratches, and appropriate measures should be used to protect welding rod.

7.3 Storage

The welding rod shall be well kept and stored in a clean room, away from heat source.
