

## POLYURETHANE ACRYLIC PAINT

### Specification

The CONTEC - Authoring Subcommittee provides guidance on the interpretation of this Standard when questions arise regarding its contents. The Department of PETROBRAS that uses this Standard is responsible for adopting and applying the clauses thereof.

**Technical Requirement:** a provision established as the most adequate and which shall be used strictly in accordance with this Standard. If a decision is taken not to follow the requirement ("non-conformity" to this Standard) it shall be based on well-founded economic and management reasons, and be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by the verb forms "shall," "it is necessary...," "is required to...," "it is required that...," "is to...," "has to...," "only ... is permitted," and other equivalent expressions having an imperative nature.

**Recommended Practice:** a provision that may be adopted under the conditions of this Standard, but which admits (and draws attention to) the possibility of there being a more adequate alternative (not written in this Standard) to the particular application. The alternative adopted shall be approved and registered by the Department of PETROBRAS that uses this Standard. It is characterized by the verbal form "should" and equivalent expressions such as "it is recommended that..." and "ought to..." (verbs of a nonmandatory nature). It is indicated by the expression: **[Recommended Practice]**.

Copies of the registered "non-conformities" to this Standard that may contribute to the improvement thereof shall be submitted to the CONTEC - Authoring Subcommittee.

Proposed revisions to this Standard shall be submitted to the CONTEC - Authoring Subcommittee, indicating the alphanumeric identification and revision of the Standard, the clause(s) to be revised, the proposed text, and technical/economic justification for revision. The proposals are evaluated during the work for alteration of this Standard.

***"The present Standard is the exclusive property of PETRÓLEO BRASILEIRO S.A. - PETROBRAS, for internal use in the Company, and any reproduction for external use or disclosure, without previous and express authorization from the owner, will imply an unlawful act pursuant to the relevant legislation through which the applicable responsibilities shall be imputed. External circulation shall be regulated by a specific clause of Secrecy and Confidentiality pursuant to the terms of intellectual and industrial property law."***

### CONTEC

Comissão de Normalização  
Técnica

### SC - 14

Paintwork and Anticorrosive  
Coatings

### Foreword

*PETROBRAS Technical Standards are prepared by Working Groups - WG (consisting of specialists from PETROBRAS and its Subsidiaries), are commented by PETROBRAS Units and PETROBRAS Subsidiaries, are approved by the Authoring Subcommittees - SCs (consisting of specialists from the same specialty, representing the various PETROBRAS Units and PETROBRAS Subsidiaries), and ratified by the Executive Nucleus (consisting of representatives of the PETROBRAS Units and PETROBRAS Subsidiaries). A PETROBRAS Technical Standard is subject to revision at any time by its Authoring Subcommittee and shall be reviewed every 5 years to be revalidated, revised or cancelled. PETROBRAS Technical Standards are prepared in accordance with PETROBRAS standard N-1. For complete information about PETROBRAS Technical Standards see PETROBRAS Technical Standards Catalog.*

## **FOREWORD**

This Standard is the English version (issued in JULY/2020) of PETROBRAS standard N-2677 REV. B DEC/2017. In case of doubt, the Portuguese version, which is the valid document for all intents and purposes, shall be used.

## **1 SCOPE**

1.1 This Standard establishes the characteristics verifiable in the laboratory, required for aliphatic polyurethane acrylic paint, supplied in 2 containers: one containing the hydroxide acrylic resin (component A) and the other containing the aliphatic polyisocyanate-based curing agent (component B).

Note: The paint can be supplied in aluminum color (code 0170 of PETROBRAS standard [N-1219](#)) in 3 components, where the component C is composed by aluminum paste of leafing type.

1.2 This Standard applies to specifications starting from its issue date.

1.3 This Standard contains Technical Requirements and Recommended Practices.

## **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 applies.

PETROBRAS [N-13](#) - Requisitos Técnicos para Serviços de Pintura;

PETROBRAS [N-1219](#) - Cores;

PETROBRAS [N-2680](#) - Tinta Epóxi, Sem Solventes, Tolerante a Superfícies Molhadas;

ABNT [NBR 8094](#) - Material Metálico Revestido e Não Revestido - Corrosão por Exposição à Névoa Salina;

ABNT [NBR 8096](#) - Material Metálico Revestido e Não-Revestido - Corrosão por Exposição ao Dióxido de Enxofre;

ABNT [NBR 9676](#) - Tintas - Determinação do Poder de Cobertura (Opacidade);

ABNT [NBR 12103](#) - Tintas - Determinação do Descaimento;

ABNT [NBR 15442](#)- Pintura Industrial - Inspeção de Recebimento de Recipientes Fechados;

ABNT [NBR 15742](#) - Tintas e Vernizes - Determinação de Vida Útil;

ABNT [NBR 15877](#) - Pintura Industrial - Ensaio de Aderência por Tração;

ISO [3233-1](#) - Paints and Varnishes - Determination of the Percentage Volume of Non-Volatile Matter - Part 1: Method Using a Coated Test Panel to Determine Non-Volatile Matter and to Determine Dry Film Density by the Archimedes Principle;

ISO [3251](#) - Paints, Varnishes and Plastics - Determination of Non-Volatile-Matter Content;

ISO [8501-1](#) - Preparation of Steel Substrates Before Application of Paints and Related Products;

ISO [16862](#) - Paints and Varnishes - Evaluation of Sag Resistance;

ASTM [D 523](#) - Standard Test Method for Specular Gloss;

ASTM [D 562](#) - Standard Test Method for Consistency of Paints Using the Stormer Viscometer;

ASTM [D 870](#) - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion;

ASTM [D 1210](#) - Standard Test Method for Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage;

ASTM [D 1308](#) - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes;

ASTM [D 1475](#) - Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products;

ASTM [D 1640](#) - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature;

ASTM [D 2247](#) - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity;

ASTM [D 4541](#) - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers;

ASTM [G 154](#) - Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

### **3 GENERAL CONDITIONS**

#### **3.1 Appearance of Components A and B**

Components A and B shall be homogenous and show no skinning and thickening in a freshly-opened can.

#### **3.2 Packaging**

3.2.1 Containers shall be straight circular cylindrical in shape.

3.2.2 For sealing packaging, any material capable of causing degradation or contamination of the paint shall not be used.

### **3.3 Conditions and Filling of Containers**

3.3.1 The containers holding the components of this paint shall be in good conditions and duly labeled or marked on the side, in accordance with the requirements of this Standard and ABNT standard [NBR 15442](#).

3.3.2 The containers shall contain at least the quantity mentioned in the respective indicated information.

### **3.4 Storage Stability**

3.4.1 Components A and B shall demonstrate stability during storage in a closed container at a temperature below 40 °C, ensuring their use for at least 6 months from the date of manufacture.

3.4.2 This period of use should be extended for 2 additional periods of 3 months, through repetition and prior approval of the tests performed at the time of supply, in accordance with PETROBRAS standard [N-13](#).

### **3.5 Dilution**

When necessary, the polyurethane acrylic paint should be diluted according to the manufacturer's instructions in order to facilitate its application. **[Recommended Practice]**

### **3.6 Marking**

The label or body of the containers shall bear at least the following information:

- a) PETROBRAS standard [N-2677](#);
- b) polyurethane acrylic paint;
- c) identification of components: A, B or C;
- d) thinner to be used;
- e) quantity contained in container, in liters and in kg;
- f) manufacturer's name and address;
- g) lot number or identifying signal;
- h) product expiration date;
- i) mixing ratio by mass and volume.

## **4 SPECIFIC CONDITIONS**

### **4.1 Requirements for Components A and B**

Components A and B shall be homogeneous. Should they show any evidence of settling, it shall be capable of being easily homogenized (manually).

## 4.2 Requirements for the Ready-to-Apply Product

4.2.1 The requirements for the ready-to-apply product, with components A and B duly mixed, are set out in TABLE 1.

**TABLE 1 - CHARACTERISTICS OF THE READY-TO-APPLY PRODUCT**

Tests	Dry Film Thickness (µm)	Requirements		Standards to be Used
		Min.	Max.	
Density, g/cm <sup>3</sup>	-	-	1,35	ASTM <a href="#">D 1475</a>
Solids by Mass, %	-	70	-	ISO <a href="#">3251</a>
Solids by Volume, %	-	63	-	ISO <a href="#">3233-1</a>
Solids by Mass of Component B, %	-	75	-	ASTM <a href="#">D 562</a>
Consistency (UK)	-	-	90	ASTM <a href="#">D 562</a>
Sagging, µm (Dry Film)	-	70	-	ABNT <a href="#">NBR 12103</a> and ISO <a href="#">16862</a>
Pot Life, time in h	-	2	-	ABNT <a href="#">NBR 15742</a>
Dry to Touch, time in h	60 to 70	-	4	ASTM <a href="#">D 1640</a>
Tack-Free, time in h	60 to 70	-	8	ASTM <a href="#">D 1640</a>
Dry to Recoat, time in h	60 to 70	8	48	ASTM <a href="#">D 1640</a>
Fineness of grind, µm	-	-	25	ASTM <a href="#">D 1210</a>
Hiding Power	see TABLE A-1			ABNT <a href="#">NBR 9676</a>

4.2.2 To the aluminum color paint (code 0170 of PETROBRAS standard [N-1219](#)), the requirements established in TABLE 2 shall be considered.

**TABLE 2 - CHARACTERISTICS OF THE READY-TO-APPLY PRODUCT IN ALUMINUM COLOR (0170)**

Tests	Dry Film Thickness (µm)	Requirements		Standards to be Used
		Min.	Max.	
Density, g/cm <sup>3</sup>		-	1,15	ASTM D 1475
Solids by Mass, %		55	-	ISO 3251
Solids by Volume, %		50	-	ISO 3233-1
Consistency (UK)		-	70	ASTM D 562
Sagging, µm (Dry Film)		70	-	ABNT NBR 12103 and ISO 16862
Pot Life, time in h		2	-	ABNT NBR 15742
Dry to Touch, time in h	60 to 70	-	4	ASTM D 1640
Tack-Free, time in h	60 to 70	-	8	ASTM D 1640
Dry to Recoat, time in h	60 to 70	8	-	ASTM D 1640
<p><b>NOTE</b> The aluminum pigment in paste can be supplied in a separated container (component C). In the receipt inspection, the paste shall be homogenous and it shall not have any substantial separation between the pigment and the liquid, dryness or hardening.</p>				

4.2.3 The final product, obtained after mixing the paint components, shall has an uniform consistency.

### 4.3 Dry Film Characteristics

4.3.1 The dry film characteristics are established in TABLE 3 and in items 4.3.2 and 4.3.3.

**TABLE 3 - DRY FILM CHARACTERISTICS**

Tests	Dry Film Thickness (μm)	Requirements Minimum	Standards to be Used
Adhesion– Pull off Test (MPa)	See 5.2.2.2	See note 1	ABNT <a href="#">NBR 15877</a> , Annex 2, or ASTM <a href="#">D 4541</a> , Methods D and E - Equipment Type IV or Type V.
Gloss at 60°, UB	120 to 140	85	ASTM <a href="#">D 523</a>
Salt Spray Resistance, h	120 to 140	720	ABNT <a href="#">NBR 8094</a>
Resistance at 100 % Relative Humidity, h	120 to 140	720	ASTM <a href="#">D 2247</a>
SO <sub>2</sub> Resistance, (2.0 L), cycles	120 to 140	5	ABNT <a href="#">NBR 8096</a>
Distilled Water Immersion Resistance, 40 °C, h	120 to 140	720	ASTM <a href="#">D 870</a>
Salt Water Immersion Resistance (3.5 % NaCl), at 40 °C, h	120 to 140	720	ASTM <a href="#">D 1308</a>
UV-A Radiation Resistance and condensation of humidity, h	120 to 140	1440	ASTM <a href="#">G 154</a> ( see Note 2)
<p>NOTE 1: The acceptance criterion for the adhesion test is as follows: For type A / B failures, the result of the adhesion test must be greater than 15 MPa. For type B/C, C , C/Y and Y faults, the result of the adhesion test must be greater than 10 MPa.</p> <p>NOTE 2: In this test, shall be used a cycle of 8 h under UV-A radiation and 4 h under condensation of humidity. After the exposure time, no chalking on the film shall be observed. The gloss decrease shall not be higher than 10 % in comparison with the start value.</p>			

4.3.2 When observing the panels, blisters or corrosion points shall not be found on the surface, neither shall penetration in the notch exceeding 1 mm be observed after 720 h of salt spray testing have elapsed.

4.3.3 There shall be no corrosion points or blistering on the film after the respective time periods established for the following tests have elapsed: resistance to 100 % relative humidity, SO<sub>2</sub> resistance, distilled water immersion resistance and salt water immersion resistance.

## 5 INSPECTION

### 5.1 Visual Inspection

Check if the conditions indicated in items 3.1, 3.2, 3.3 and 3.6 have been fulfilled and reject items supplied in disagreement therewith.

### 5.2 Tests

5.2.1 The tests to be performed are those contained in TABLES 1, 2 and 3.

5.2.2 For the performance of the tests indicated in TABLES 1, 2 and 3, the following conditions shall be observed:

5.2.2.1 The application of polyurethane acrylic paint on the test panels shall be made, at least, 15 min after mixing and homogenizing the components.

5.2.2.2 The following procedure shall be adopted for the Adhesion Test (Pull off Test):

- a) Surface preparation shall be performed by abrasive blasting to near white metal (minimum), grade Sa 2 1/2 of ISO standard 8501-1. The anchor profile shall be 50 µm to 100 µm. Plate dimensions shall be 150 mm x 100 mm and at least 4,0 mm thick
- b) Apply a single coat of PETROBRAS paint N-2680 with minimum dry film thickness of 150 µm.
- c) After 24 hours of applying the background paint, apply a coat of paint.
- d) Let the panel with the applied paint scheme cure for a minimum of 7 days.
- e) Perform the tensile strength test according to ABNT NBR 15877 or ASTM D 4541, using the methods defined in Table 3.

5.2.2.3 For the others tests established in Table 3, the paint shall be applied direct on the carbon steel AISI- 1020 plate. The surface preparation shall be performed by abrasive blasting to near white metal (minimum), grade Sa 2 1/2 of ISO 8501-1. The anchor profile shall be 20 µm to 40 µm. The plate dimensions shall be 150 mm x 100 mm and minimum thickness of 4 mm.

5.2.2.4 The Tests established in Table 3 shall be performed 7 days after the paint application in the panels. During this time, the panels shall be kept at temperature of 25 °C ± 2 °C and relative humidity of 60 % ± 5 %.

5.2.2.5 Panels should be painted by means of a gun. **[Recommended Practice]**



5.2.2.6 For the salt spray resistance test, a single notch shall be made at the center of the specimen, parallel to its largest dimension and 30 mm away from the top and bottom edges.

5.2.2.7 The edges of the test panels shall be suitably protected in order to prevent the premature appearance of a corrosive process at those points.

## INDEX OF REVISIONS

**REV. A**

Affected Parts	Description of Alteration
All	Revised

**REV. B**

Affected Parts	Description of Alteration
All	Revised