

CONTEC

Comissão de Normalização
Técnica

SC-14

Painting and Anticorrosive
Coatings

**PAINT OF ETHYL – SILICATE OF ZINC -
ALUMINUM**

Revalidation

Revalidated em 12/2022.

CONTECComissão de Normalização
Técnica**SC-14**Painting and Anticorrosive
Coatings**PAINT OF ETHYL-SILICATE OF ZINC -
ALUMINUM****1st Amendment**

This is the 1st Amendment to PETROBRAS N-2231 REV. E and it is used to alter the text of the Standard in the part(s) indicated below:

NOTE 1 The new(s) page(s) with the performed amendment(s) is (are) placed in its corresponding position(s).

NOTE 2 The amended pages, indicated the date of the amendment, are placed at the end of this standard, in chronological order, and shall not be used.

CONTENTS OF THE 1st AMENDMENT - 10/2020

- Section 2

-Replace ISO 3251 by ASTM D2369.

- Table 1

Alteration of the table.

PAINT OF ETHYL - SILICATE OF ZINC - ALUMINUM

Specification

This Standard replaces and cancels its previous revision.

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.

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Foreword

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CONTEC

Comissão de Normalização
Técnica

SC - 14

Anticorrosive Painting and
Coatings

FOREWORD

This Standard is the English version (issued in JULY/2020) of PETROBRAS standard N-2231 REV. E MARCH/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 defines the characteristics that can be verified in laboratory and are required for the supply of ethyl-silicate of zinc-aluminum paint shipped in 2 cans: 1 containing zinc and aluminum (component A) and the other one the solution of ethyl-silicate (component B).

1.2 The paint is intended for the anticorrosive protection of surfaces that are subject to temperatures up to 500 °C.

1.3 This Standard is applicable to procedures started as from the date of issuance.

1.4 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;

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

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

ABNT [NBR 15742](#) - Tintas e Vernizes - Avaliação do Tempo de Vida Útil da Mistura ("Pot-Life");

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

ISO [4628-8](#) - Paints and Varnishes - Evaluation of Degradation of Coatings - Designation of Quantity and Size of Defects, and of Intensity of Uniform Changes in Appearance - Part 8: Assessment of Degree of Delamination and Corrosion around a Scribe or other Artificial Defect;

ISO [8501-1](#) - Preparation of Steel Substrates before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates after Overall Removal of Previous Coatings;

ASTM [D562](#) - Standard Test Methods for Consistency of Paints Measuring Kreg Uni (KU) Viscosity Using a Stormer-Type Viscometer;

ASTM [D1475](#) - Standard Test Method for Density of Liquid Coatings, Inks and Related Products;

ASTM [D1640](#) - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature;

ASTM [D2247](#) - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity;

ASTM [D2369](#) - Standard test Method for Volatile Content of Coatings;

ASTM [D2371](#) - Standard Test Method for Pigment Content of Solvent-Reducible Paints;

ASTM [D4541](#) - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

3 GENERAL CONDITIONS

3.1 Appearance of Component A

Zinc and aluminum (component A) shall have the appearance of a dispersion, free of agglomerates and presented in the form of a paste.

3.2 Packing

3.2.1 The form of the can (component A) shall be straight circular cylindrical.

3.2.2 The packing of component B (ethyl-silicate solution) shall be appropriate to maintain the characteristics of the product unchanged during storage.

3.2.3 Material that can cause the degradation or contamination of the paint should not be used for the sealing of the packing.

3.3 Condition and Filling of the Containers

3.3.1 The recipients that contain the components of this paint shall be in good conditions of conservation and be properly labeled or marked on the side surface according to the requirements of this Standard and standard ABNT [NBR 15442](#).

3.3.2 The recipients shall contain, at least, the quantity cited in the respective indication.

3.4 Stability in Storage

3.4.1 Components A and B shall present stability to storage in a closed recipient in a temperature below 40 °C and assures its use for at least 6 months after the manufacturing date.

3.4.2 It is allowed to revalidate this term of use for 2 additional periods of 3 months, through repetition and prior approval of the tests performed at the time of supply, according to PETROBRAS [N-13](#) standard.

3.5 Dilution

When necessary and in order to make the application easier, this paint can be diluted according to the instructions of the manufacturer. **[Recommended Practice]**

3.6 Marking

The label or the body of the recipients shall give, at least, the following information that can not be written on the lid:

- a) PETROBRAS standard [N-2231](#);
- b) ethyl-silicate of zinc aluminum paint;
- c) identification of the components: A or B;
- d) diluting agent to be used;
- e) quantity contained in the recipient, in liters and kg;
- f) name and address of the manufacturer;
- g) identifying number or signal of the manufactured lot;
- h) expiration date of the product;
- i) proportion of the mixture in mass and volume.

4 SPECIFIC CONDITIONS

4.1 Requirements of Components A and B

4.1.1 When component A, is analyzed regarding retention in mesh of 45 µm, the contents of coarse particles can not exceed 3 %.

4.1.2 The components A and B, when examined regarding sedimentations, at most, may present an easily homogenized bottom (manually).

4.2 Requirements Regarding the Product Ready to Use

4.2.1 The requirements regarding the product ready to use after the mixture of components A and B are contained in TABLE 1.

TABLE 1 - REQUIREMENTS REGARDING THE PRODUCT READY TO USE

Tests	Thickness of the Dry Film (µm)	Requirements		Standards to Use
		Min.	Max.	
Specific Mass, g/cm ³	-	1.90	-	ASTM D 1475
Solids per Mass, %	-	65	-	ASTM D 2369
Touch Dry Time, min.	65 to 75	-	20	ASTM D 1640
Pressure Drying Time, h	65 to 75	-	2	ASTM D 1640
Contents of Pigments, %	-	60	-	ASTM D 2371
Pot Life of the Mixture, h	-	2	-	ABNT NBR 15742
Consistence, UK	-	60	70	ASTM D 562
<p>NOTA 1 O teor de pigmentos na mistura deve ser calculado pela fórmula a seguir:</p> $\% P_m = \frac{m_a \times P_a}{m_a + m_b}$ <p>Onde:</p> <p>P_a = % de pigmentos no componente A; m_a = massa de componente A; m_b = massa de componente B indicada na proporção de mistura.</p> <p>NOTA 2 Para efeito de cálculo do rendimento teórico, com base nos valores estabelecidos para sólidos por massa e teor de zinco na película seca, considerar um teor de sólidos por volume de 50 %.</p>				

4.2.2 The final product to be obtained after the mixture of the 2 components of the paint shall have a uniform consistence.

4.2.3 For the performance of the tests for determination of solids by mass, the times and temperatures for drying and curing the paint must be 24 hours at 25 (± 2) °C and more 180 minutes at 105 (± 1) °C.

4.3 Characteristics of the Dry Film

The characteristics of the dry film are established in TABLE 2 and the requirements about tests are established in 5.2

TABLE 2 - CHARACTERISTICS OF THE DRY FILM

Tests	Thickness of the Dry Film (µm)	Minimum Requirements	Standards to Use
Adhesion, MPa	200 to 240	10	- ABNT NBR 15877 , Anexo2; or - ASTM D4541 , Método D - Equipamento Tipo IV, or - ASTM D4541 , Método E Equipment Type V
Resistance to Saline Mist, h	65 to 75	480	ABNT NBR 8094
Resistance to 100 % of Relative Humidity, h	65 to 75	480	ASTM D 2247
% Metallic Zn in the Dry Film, in Mass	-	75	(see Note)
Thermal shock	100 to 140	See itens 5.2.2.6 and 5.2.2.7	
<p>Note: The contents of metallic zinc in the dry film shall be calculated based on the following ratio:</p> $Zn^1 = \frac{m_a \times Zn^0 \times P_a}{NVM (m_a + m_b)}$ <p>Where:</p> <p>Zn^1 = % of metallic zinc in the dry film; Zn^0 = % of metallic zinc in the pigment; P_a = % of pigments in component A (according to ASTM standard D 2371); NVM = % of non-volatile components per mass in the paint (solid components per mass, according to standard ISO 3251); m_a = mass of component A; m_b = mass of component B indicated in the proportion of the mixture.</p>			

5 INSPECTION

5.1 Visual Inspection

It shall be verified if the conditions defined in items 3.1, 3.2, 3.3 and 3.6 are met, and if the supplied products do not attend these conditions they shall be refused.

5.2 Tests

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

5.2.2 The tests defined in TABLES 1 and 2 shall be performed observing the conditions described in items 5.2.2.1 to 5.2.2.15.

5.2.2.1 The paint shall be applied directly on the AISI-1020 carbon steel plate. The preparation of the surface shall be carried out by means of blasting to white metal, grade Sa-3 of ISO 8501-1. The anchor profile shall be 50 μm to 70 μm . The dimensions of the plate shall be 150 mm x 100 mm, and minimum thickness of 4 mm.

5.2.2.2 For each test to be performed, shall be prepared at least three panels of test.

5.2.2.3 The dry film thickness that is necessary for the performance of each tests is specified in Table 2.

5.2.2.4 The tests contained in TABLE 2 shall be carried out 7 days after the application of the paint on the panels. During this period the panels shall be kept in a temperature of $(25 \pm 2) ^\circ\text{C}$ and relative humidity of $(60 \pm 5) \%$.

5.2.2.5 The panels shall be painted preferentially by spray gun. **[Recommended Practice]**

5.2.2.6 The thermal shock test must be carried out by placing specimens, prepared with Ethyl Paint - Zinc Silicate - Aluminum, as described in 5.2.2.1 to 5.2.2.4, in an oven whose temperature should be gradually increased to the level of $500 ^\circ\text{C}$, according to the following thermal cycle:

- a) $200 ^\circ\text{C}$ during 8 h (minimum);
- b) $300 ^\circ\text{C}$ during 8 h (minimum);
- c) $400 ^\circ\text{C}$ during 8 h (minimum);
- d) $500 ^\circ\text{C}$ during 16 h (minimum).

5.2.2.7 The panels shall be visually inspected after the exposure to each level of temperature, verifying the existence or lack of the following imperfections: peeling, cracking, blisters, irregular discolor and loss of adherence. After the end of the high temperature exposure, the panels of the stove shall be removed and cooled down abruptly by placing them under water jet at room temperature. The visual inspection shall be repeated with the purpose of verifying the quoted defects. If during both tests the panels do not present any of the quoted defects, they shall be submitted to the saline mist test during a period of 24 hours according to the procedure described in ABNT standard [NBR 8094](#). The panels can not show any evidence of corrosive attack of the steel. The defects found in a strip of 6 mm from the edges of the test panels shall be ignored.

5.2.2.8 For the test of resistance to saline mist a single notch shall be made in the middle of the test body, parallel to its largest dimension, in a distance of 30 mm from the upper and lower edges.

5.2.2.9 The calculation of the corrosion advance shall be carried out in the manner described in ISO [4628-8](#).

5.2.2.10 The edges of the test panels shall be adequately protected during the saline mist and relative humidity tests with the purpose of avoiding the premature appearance of corrosive process in these places.

NOTE As long as it is resistant to the test conditions, the paint to be used to protect the edges and back of the specimens may be different from the one being evaluated.

5.2.2.11 The Pull Off Test shall be performed in two points by panel of test and, at least, in 2 different panels.

5.2.2.12 In the Pull Off Test, the coatings that present type A / B failure, in any proportion, at stress values below 15 MPa.

5.2.2.13 When observing the panels, the presence of bubbles or contact points should not be noted corrosion on the surface, nor penetration into the notch after 480 hours of testing, under salt spray.

5.2.2.14 There shall be no points of corrosion of the steel or formation of bubbles in the film after time established for the resistance test to 100% relative humidity.

5.2.2.15 For the verification of the resistance of the dry film to thermal shock, it shall be performed test according to 5.2.2.6 and 5.2.2.7 after 7 days of applying the paint on the panels.

REV. A and B

There is no index of revisions.

REV. C

Affected Parts	Description of Alteration
	Revalidation

REV. D

Affected Parts	Description of Alteration
	Revalidation

REV. E

[illegible]