LGAI Technological Center, S.A. (APPLUS)
Campus UAB
Ronda de la Font del Carme S/N
08193 Bellaterra (Spain)
www.appluslaboratories.com

Date Ed.6: 23-05-2024

Test Report

Customer:	**Pivema S.A.** C/de Sentmenat, 77, 08184 – Palau-Solità i Plegamans, Barcelona	**Version:** 0
Att. Mr.:	Eduardo Puig	**Date:** 09/01/2024
Report Number:	24/36601248 M1	
Elaborated by:	Alejandro Belmez	
PO number:	5810209430_12_615908	

It's the petitioner's responsibility to substitute the original and copies.

Record of changes

Edition	Modification	Date	Editor
0	Original	26/09/2024	Alejandro Belmez
1	Removal of watermark	09/01/2024	Alejandro Belmez

ALEJANDRO BELMEZ LLEDO 2025.01.09 15:49:47 +01'00'

Alejandro Belmez
Technical responsable LE1332
Mechanical Labs
LGAI Technological Center, S.A.

ETIENNE PASCAL JEAN CAMINADE 2025.01.09 16:16:25 +01'00'

Etienne Caminade
Technical Responsible LE1680
Mechanical Labs
LGAI Technological Center, S.A.

The reproduction of this document is authorized only if it's carried out fully.
Reports will be legally valid with original signatures or certified copies.
This document contains **5** pages and this is the **1st** page.

The results refer exclusively to the sample, product or materials received in the laboratory, as indicated in the section pertaining to the description of the material received, and tested in the conditions described in this test report

The laboratory is responsible for all the information provided in the report, except when information is provided by the customer. The laboratory is not responsible when the information is supplied by the customer and can affect the validity of results

Quality Assurance Service

Applus+, guarantees that this work has been made in accordance with our Quality and Sustainability System, fulfilling the contractual conditions and legal norms.
Within our improvement program we would be grateful if you would send us any commentary that you consider opportune, to the person in charge who signs this document, or to the Quality Manager of Applus+, in the following e-mail address: satisfaccion.cliente@applus.com.

(*) activities or results marked with (*) are not covered by ENAC accreditation

1 Issue requested

The main objective of this project was to determine the following properties to a paint sheet referenced by the petitioner as "Imperpol 251":

- Tensile properties UNE-EN ISO 527-3:2019
- Flexibility at low temperatura UNE-EN 495-5:2013[*]
- Watertightness UNE-EN 1928:2000
- UV aging UNE-EN 1297:2006[*]
    - Tensile properties UNE-EN ISO 527-3:2019 after aging

2 Material received

Applus received the material ready to be tested. All specimens were kept at a temperature of 23ºC and relative humidity of 50% before the tests.

The following shows the specimen identification by Applus and the customer:

Table 1. Specimen identification

Applus Reference	Customer reference	Date of reception
24350-00001	*Imperpol 251*	03/04/2024

3 Equipment used

The Table 2 summarizes the equipment used to perform the test.

Table 2. Equipment used

Inventory number	Equipment description
108259	Electromechanical 5kN INSTRON 3365
118275	Thermohygrometer 174H (Mat) TESTO 174H
170195	Verification scale extensometer - Instron
104120	Micrometer Mitutoyo
06-GI-042	Calliper digital 150 mm (IPE) MITUTOYO 500-311
119124	UV aging chamber – ATLAS UV Test
118428	UV radiometer – ATLAS UV test
118737	Freezer
108288	Bending apparatus
119148	Thermometer
108287	Watertighness apparatus
108301	Digital manometer

4 Test results

4.1 Tensile test UNE-EN ISO 527-3:2019

The specimens have the dimensions shown in Table 3, they are designed following the type 5 of the referenced standard. 5 specimens are prepared in each direction.

Table 3. Tensile test specimen dimensions

Reference	Thickness (mm)	Width (mm)	Area (mm^2)	Length (mm)
Lengthwise - 1	1,73	6,34	11,0	120
Lengthwise – 2	1,57	6,32	9,9	120
Lengthwise – 3	1,96	6,34	12,4	120

Reference	Thickness (mm)	Width (mm)	Area (mm^2)	Length (mm)
Lengthwise – 4	2,02	6,33	12,8	120
Lengthwise – 5	1,74	6,34	11,0	120
Crosswise - 1	1,83	6,34	11,6	120
Crosswise – 2	1,95	6,30	12,3	120
Crosswise – 3	1,99	6,36	12,7	120
Crosswise – 4	1,67	6,33	10,6	120
Crosswise – 5	1,66	6,37	10,6	120

Table 4 shows the test parameters.

Table 4. Tensile test parameters

Control mode	Initial grip separation (mm)	Crosshead speed (mm/min)	Extensometer gage length (mm)	Temperature (ºC)	Humidity (%)	Type of grips used
Displacement	80	100	25	25,5	63,0	Pneumatic

Table 5 to Table 6 show the test results.

Table 5. Tensile test results – Lengthwise specimens

Customer reference	Test date	Tensile strength σ_m (MPa)	Strain at break (%)
Lengthwise - 1	02/05/2024	5,4	50
Lengthwise – 2	02/05/2024	5,5	128
Lengthwise – 3	02/05/2024	5,5	50
Lengthwise – 4	02/05/2024	5,3	55
Lengthwise – 5	02/05/2024	6,2	111
	Mean	**5,6**	**79**
	Std Dev.	**0,3**	**38**

Table 6. Tensile test results – Crosswise specimens

Customer reference	Test date	Tensile strength σ_m (MPa)	Strain at break (%)
Lengthwise - 1	02/05/2024	5,4	154
Lengthwise – 2	02/05/2024	5,2	168
Lengthwise – 3	02/05/2024	5,3	177
Lengthwise – 4	02/05/2024	5,3	95
Lengthwise – 5	02/05/2024	5,5	45
	Mean	**5,3**	**128**
	Std Dev.	**0,1**	**56**

4.2 Flexibility at low temperatura UNE-EN 495-5:2013[*]

Table 7. Parameters of flexibility at low temperature according to UNE-EN 495-5:2013

Nº specimens	Temperature (ºC)	Time (h)	Date of test
2 crosswise + 2 lengthwise	-45	1	03/06/2024

2 specimens per direction (crosswise and lengthwise) were tested. For each direction, 1 specimen was folded upwards and the other downwards.

Table 8. Results of flexibility

Specimen	Direction	Result
1	Lengthwise	No cracks
2	Lengthwise	No cracks
3	Crosswise	No cracks
4	Crosswise	No cracks

4.3 Watertightness UNE-EN 1928:2000

All specimens are conditioned at 23ºC at least 6h prior to the testing.

Table 9. Watertighness test parameter

Nº specimens	Method	Pressure (kPa)	Duration (h)	Specimen diameter (mm)
3	B	60	24 ± 1	~130

The specimen is considered watertight if there is not a sudden decrease of the pressure or if there is not any indication of water on the not exposed surface.

Table 10. Watertighness results

Specimen	Start test	End test	Result (watertight/not watertight)
1	04/06/2024	05/06/2024	Watertight
2	05/06/2024	06/06/2024	Watertight
3	06/06/2024	07/06/2024	Watertight

4.4 UV aging UNE-EN 1297:2006[*]

Samples are introduced in the UV chamber already cut for the tensile test. UV aging conditions are shown in .

Table 11. Tensile test parameters

Phase	Phase duration (h)	Irradiance (W/m²) @ 340nm	BPT (ºC)	Total duration (h)	Test date
UV	5	0,83	50	1.000	30/05/2024 until 11/07/2024
Water spray	1	Light off	NA		

After the aging, no apparent defects are detected on sample specimens. Some of them, were attached to the sample holder after the aging.

4.4.1 Tensile test after aging

After the aging, the tensile properties are checked. The parameters for tensile test are indicated in Table 4.

Table 12. Tensile test after UV aging specimen dimensions

Reference	Thickness (mm)	Width (mm)	Area (mm^2)	Length (mm)
Lengthwise - 1	1,93	6,18	11,95	120
Lengthwise – 2	1,87	6,17	11,52	120
Lengthwise – 3	1,65	6,24	10,31	120
Lengthwise – 4	1,90	6,20	11,79	120
Lengthwise – 5	1,88	6,23	11,72	120
Crosswise - 1	1,80	6,22	11,18	120
Crosswise – 2	1,82	6,22	11,35	120
Crosswise – 3	1,97	6,18	12,15	120
Crosswise – 4	1,91	6,24	11,90	120
Crosswise – 5	1,83	6,26	11,48	120

Test results are shown in Table 13 and Table 14.

Table 13. Tensile test results – Lengthwise specimens

Customer reference	Test date	Tensile strength σ_m (MPa)	Strain at break (%)
Lengthwise - 1	15/07/2024	6,9	189
Lengthwise – 2	15/07/2024	7,3	224
Lengthwise – 3[1]	-	-	-
Lengthwise – 4	15/07/2024	7,5	270
Lengthwise – 5	15/07/2024	7,6	248
	Mean	**7,3**	**233**
	Std Dev.	**0,3**	**35**

Table 14. Tensile test results – Crosswise specimens

Customer reference	Test date	Tensile strength σ_m (MPa)	Strain at break (%)
Lengthwise - 1	02/05/2024	7,4	280
Lengthwise – 2	02/05/2024	7,5	269
Lengthwise – 3	02/05/2024	6,9	219
Lengthwise – 4	02/05/2024	6,3	188
Lengthwise – 5	02/05/2024	7,3	285
	Mean	**7,1**	**248**
	Std Dev.	**0,5**	**43**

Test Technician: Alejandro Belmez / Marc Garcia / Elisa Oller

[1] Specimen 3 (lengthwise) broke during handling. It is not considered in final results