SOUTH QUALITY

PROFICIENCY TESTING PROVIDER

REPORT No 11499

Date of issue: *December 12, 2025*

Status: FINAL REPORT

****

ISO 178

DETERMINATION OF FLEXURE PROPERTIES

Program: SQO-PL9 Round 16

****

Prepared by:	Reviewed by:	Approved by:
cn=BERENICE C. FERREL, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=tech@ptsouthquality.com, c=AR 2025.12.12 16:01:27 -03'00'	cn=ESTHER CASAS, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=ecasas@ptsouthquality.com, c=AR 2025.12.15 11:43:03 -03'00'	cn=Emiliano Medina, o=SOUTH QUALITY, ou=PT SOUTH QUALITY SAS, email=quality@ptsouthquality.com, c=ES 2025.12.16 14:10:28 -03'00'
Berenice Ferrel Assistant Technician	**Lic. Esther Casas** Physics expert	**Eng. Emiliano Medina** Quality Assurance Lead

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1. FOREWORD

This report summarizes the results of the **SQO-PL9 Round 16** proficiency testing program on the determination of the flexural properties of rigid and semi-rigid plastics. This program is carried out under a simultaneous participation format, according to the A.3.1 classification of the ISO 17043 standard ("Model 2 - Figure A.1").

South Quality conducted the testing program in October/November 2025. The aim of the program was to assess laboratory ability to competently perform the nominated tests.

2. ORGANIZATION

Program Coordinator:	Lic. Esther Casas
Assistant Technician:	Berenice Ferrel
Statistic:	Lic. Manuel Tozaki
Supervision:	Eng. Emiliano Medina

3. OBJECTIVE

The objective of this proficiency testing program is to determine the flexural stress and flexural strain of plastic materials.

These parameters are verified in accordance with the following standard:

Standard
ISO 178: 2019

To verify this, batches of plastic materials have been chosen.

Participants in this program have not been previously informed of the values or range of values expected from the samples they receive.

4. PARTICIPANTS

In the present round, 18 laboratories have participated, with the following details:

CODE	Country	ISO 17025 accredited	Results delivered
01	Argentina	No	Yes
02	Hong Kong	Yes	No
03	Germany	Yes	Yes
04	Malaysia	Yes	Yes
05	France	Yes	Yes
06	Vietnam	Yes	Yes
07	Portugal	Yes	Yes
08	Spain	Yes	Yes
09	United Kingdom	Yes	Yes
10	Brazil	Yes	Yes
11	Peru	No	Yes
12	South Africa	Yes	Yes
13	Netherlands	Yes	No
14	Mexico	Yes	Yes
15	Germany	Yes	Yes
16	Australia	Yes	Yes
17	Türkiye	No	Yes
18	Brazil	Yes	Yes

5. HOMOGENEITY

Several batches were prepared identically by the staff at South Quality.

Subsequently, a homogeneity study was conducted with an ISO 17025 accredited laboratory.

Control was carried out according to ISO 33405: 2024, clauses 7.4.1.1 / 7.4.1.2. Stratified random sampling was applied. Samples were selected using random number generation software.

The results of this test appear below:

Size of each batch: **50 samples** Tested samples from each batch: **15 samples**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LP3233	BATCH: LP3234	BATCH: LP3235
Flexural strength	YES	YES	YES
Flexural strain	YES	YES	YES

Size of each batch: **50 samples** Tested samples from each batch: **15 samples**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LP3421	BATCH: LP3422	BATCH: LP3423
Flexural strength	YES	NO	YES
Flexural strain	YES	NO	YES

Samples for this program are taken from selected batches identified as LP3234, and LP3421.

The analysis of the test data indicated that the selected samples exhibited sufficient homogeneity for the program. Therefore, the results of participants identified as outliers cannot be attributed to sample variability.

6. SAMPLE INFORMATION

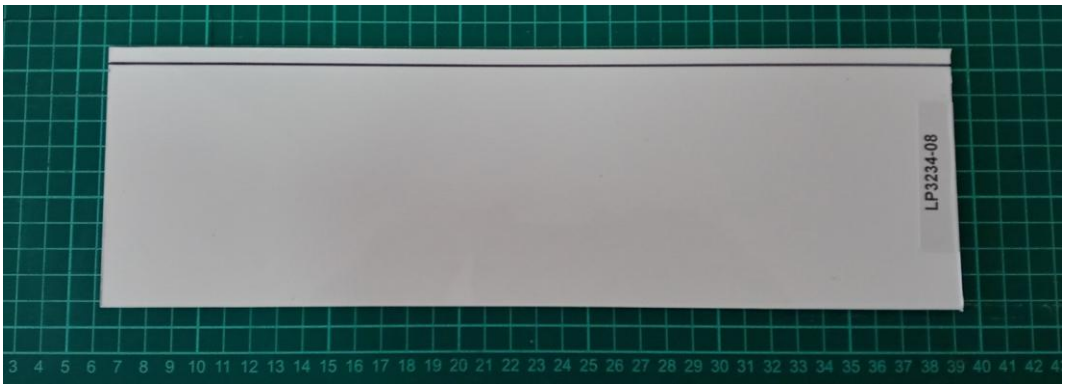
The following samples were sent for testing (Participant **Code 08**):

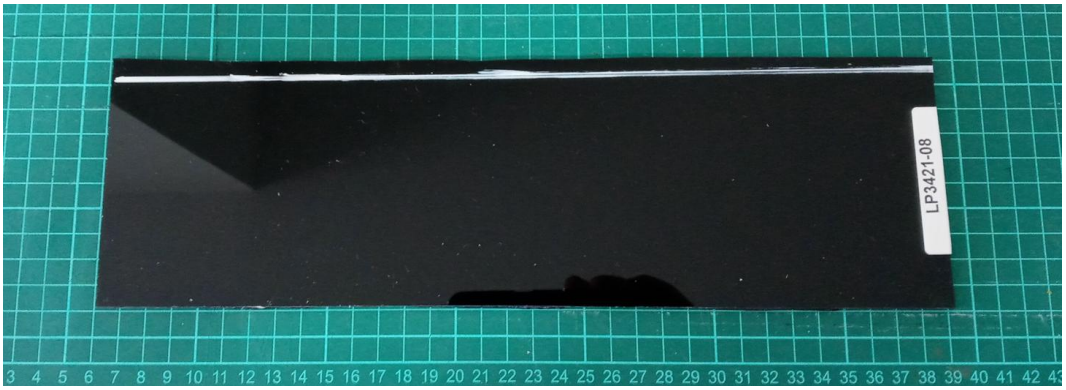
Batch:	LP3234
Sample ID:	08
Characteristics:	White thermoplastic (HIPS) - 330 x 100 x 2 mm

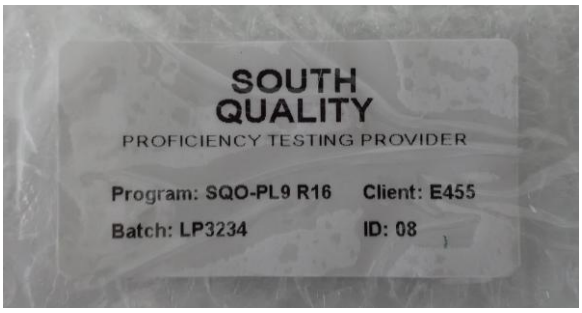
Batch:	LP3421
Sample ID:	18
Characteristics:	Black thermoplastic (Acrylic) - 330 x 100 x 2 mm

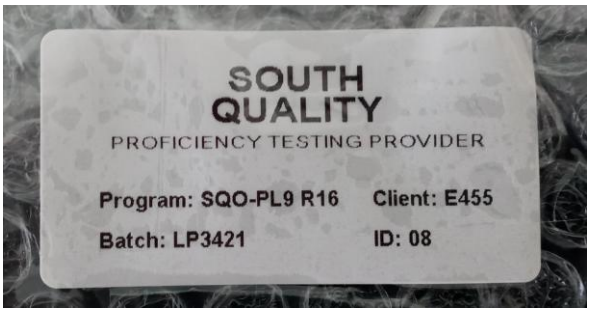
7. IMAGES

SAMPLES









8. ASSIGNED VALUES

The assigned values are obtained from the results reported by all participants (**Consensus values**).

9. PARTICIPANT RESULTS

LABORATORY CODE	BATCH: LP3234			
	LENGTH-WISE		WIDTH-WISE	
	Flexural strength (MPa)	Flexural strain (%)	Flexural strength (MPa)	Flexural strain (%)
01	37.2	5.4	29.5	4.9
03	35.9	4.7	33.3	4.8
04	33.3	4.3	33.5	5.8
05	31.7	4.4	32.6	5.8
06	33.1	5.3	34.7	5.3
07	35.7	4.3	30.4	5.5
08	34.4	4.8	34.1	5.6
09	34.8	5.5	31.0	5.4
10	34.6	4.2	34.1	5.7
11	32.6	5.4	30.2	5.7
12	33.1	5.4	29.2	5.6
14	35.7	5.0	33.3	5.2
15	31.7	4.9	32.4	5.7
16	33.8	4.0	30.5	4.8
17	32.4	5.3	42.6	5.7
18	33.6	3.9	34.6	4.9

ASSIGNED VALUES - BATCH: LP3234							
LENGTH-WISE				WIDTH-WISE			
Flexural strength (MPa)		Flexural strain (%)		Flexural strength (MPa)		Flexural strain (%)	
AVG	SD	AVG	SD	AVG	SD	AVG	SD
34.0	1.60	4.8	0.55	32.2	1.92	5.4	0.37

LABORATORY CODE	BATCH: LP3421			
	LENGTH-WISE		WIDTH-WISE	
	Flexural strength (MPa)	Flexural strain (%)	Flexural strength (MPa)	Flexural strain (%)
01	106.2	5.8	104.6	5.3
03	109.0	5.6	107.1	5.3
04	108.7	5.4	108.4	5.2
05	108.6	5.6	109.0	5.5
06	109.4	5.6	105.1	5.5
07	107.2	5.4	107.1	5.2
08	106.0	5.7	107.0	5.3
09	106.9	5.7	109.1	5.6
10	109.5	5.9	104.0	5.6
11	103.6	5.6	111.5	5.0
12	107.7	5.4	104.9	5.1
14	104.3	6.0	111.7	5.4
15	102.7	5.8	108.7	5.6
16	104.5	5.4	110.5	5.3
17	106.0	5.7	110.9	5.4
18	109.7	5.5	111.5	5.2

ASSIGNED VALUES - BATCH: LP3421							
LENGTH-WISE				WIDTH-WISE			
Flexural strength (MPa)		Flexural strain (%)		Flexural strength (MPa)		Flexural strain (%)	
AVG	SD	AVG	SD	AVG	SD	AVG	SD
106.9	2.24	5.6	0.22	108.2	2.62	5.3	0.18

10. STATISTICS

The results must be treated as quantitative.

According B.3.1.3 of ISO 17043 the appropriate technique is to compare participant results with the assigned values. The results can be compare using ***z*** **score.**

$$z = \frac{x - X}{\hat{\sigma}}$$

x is the participant's result

X is the assigned value

$\hat{\sigma}$ is the standard deviation

The performance evaluation of each sample is carried out with the following criteria:

$|z| \leq 2.0$ indicates "satisfactory" performance and generates no signal;

$2.0 < |z| < 3.0$ indicates "questionable" performance and generates a warning signal;

$|z| \geq 3.0$ indicates "unsatisfactory" performance and generates an action signal;

11. EVALUATION OF PERFORMANCE

LABORATORY CODE	|z score| - BATCH: LP3234			
	LENGTH-WISE		WIDTH-WISE	
	Flexural strength	Flexural strain	Flexural strength	Flexural strain
01	2.02	1.08	1.42	1.36
03	1.21	0.18	0.56	1.63
04	0.42	0.90	0.66	1.08
05	1.43	0.72	0.19	1.08
06	0.55	0.90	1.29	0.27
07	1.08	0.90	0.95	0.27
08	0.27	0	0.98	0.54
09	0.52	1.26	0.64	0
10	0.39	1.08	0.98	0.81
11	0.86	1.08	1.06	0.81
12	0.55	1.08	1.58	0.54
14	1.08	0.36	0.56	0.54
15	1.43	0.18	0.09	0.81
16	0.11	1.44	0.90	1.63
17	0.99	0.90	**5.41** ¤	0.81
18	0.23	1.62	1.24	1.36

LABORATORY CODE	|z score| - BATCH: LP3421			
	LENGTH-WISE		WIDTH-WISE	
	Flexural strength	Flexural strain	Flexural strength	Flexural strain
01	0.30	0.72	1.37	0.24
03	0.95	0.20	0.42	0.24
04	0.81	1.13	0.08	0.79
05	0.77	0.20	0.31	0.86
06	1.13	0.20	1.18	0.86
07	0.15	1.13	0.42	0.79
08	0.39	0.26	0.45	0.24
09	0.01	0.26	0.35	1.41
10	1.17	1.19	1.60	1.41
11	1.46	0.20	1.26	1.89
12	0.37	1.13	1.26	1.34
14	1.15	2.58	1.34	0.31
15	1.86	0.72	0.19	1.41
16	1.06	1.13	0.88	0.24
17	0.39	0.26	1.03	0.31
18	1.26	0.67	1.26	0.79

Laboratory **Code 01**: The laboratory obtained a **QUESTIONABLE** result in the determination of flexural strength on sample batch LP3234 (Length-Wise). However, the laboratory achieved **SATISFACTORY** results for the remaining parameters.

Laboratory **Code 02**: The laboratory has not sent the results before the deadline.

Laboratory **Code 03**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 04**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 05**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 06**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 07**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 08**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 09**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 10**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 11**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 12**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 13**: The laboratory has not sent the results before the deadline.

Laboratory **Code 14**: The laboratory obtained a **QUESTIONABLE** result in the determination of flexural strain on sample batch LP3421 (Length-Wise). However, the laboratory achieved **SATISFACTORY** results for the remaining parameters.

Laboratory **Code 15**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 16**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

Laboratory **Code 17**: The laboratory obtained an **UNSATISFACTORY** result in the determination of flexural strength on sample batch LP3234 (Width-Wise). However, the laboratory achieved **SATISFACTORY** results for the remaining parameters.

Laboratory **Code 18**: The laboratory obtained **SATISFACTORY** results in the determination of all parameters.

GLOBAL PERFORMANCE - SUM OF ABSOLUTE Z SCORE

POSITION	LABORATORY CODE	*z* SCORE
1st	08	3.13
2nd	09	4.45
3rd	03	5.39
4th	05	5.56
5th	07	5.69
6th	04	5.87
7th	06	6.38
8th	15	6.69
9th	16	7.39
10th	12	7.85
11th	14	7.92
12th	18	8.43
13th	01	8.51
14th	11	8.62
15th	10	8.63

12. CONCLUSIONS

The overall performance on this **SQO-PL9 Round 16** program from the participating laboratories, based on expected results, are the following:

- Laboratories Codes **03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 15, 16,** and **18** obtained a **SUFFICIENT** performance according to the expected results and should not take action;

- Laboratories Codes **01,** and **14** obtained an **ALMOST SUFFICIENT** performance according to the expected results and must evaluate if it is necessary to take corrective action.

- Laboratory Code **17** obtained an **INSUFFICIENT** performance in accordance with the expected results and must take corrective action (See Appendix B).

The criteria used for the evaluation of the overall performance is the following:

- **SUFFICIENT** performance: No unsatisfactory/questionable results obtained.

- **ALMOST SUFFICIENT** performance: No unsatisfactory results were obtained, but one questionable result was found.

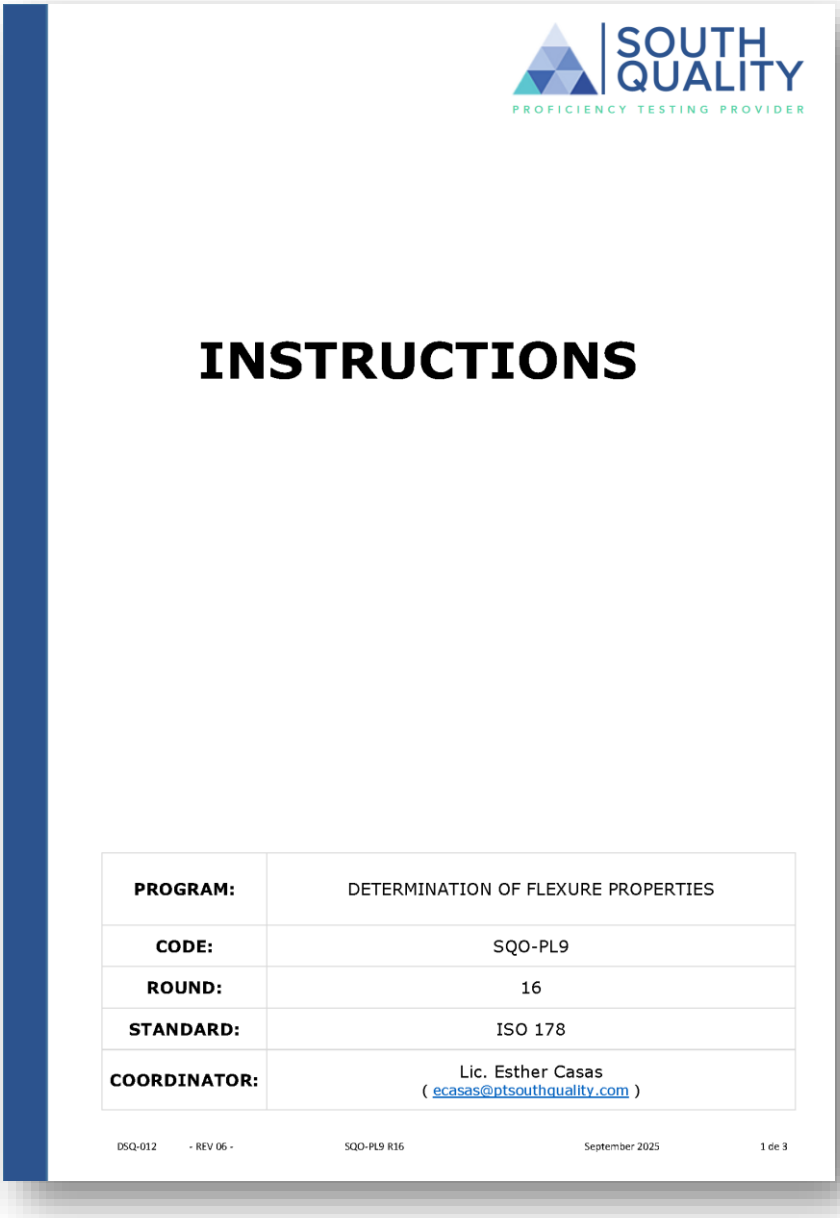
- **INSUFFICIENT** performance: An unsatisfactory result or two questionable results were obtained.

APPENDIX A

A1 - PARTICIPANT DATA

Company:	**Centro de Ensayos, Innovación y Servicios, S.L.**
Laboratory:	**Laboratorio Eléctrico**
Country:	Spain
Client ID:	E455
Contact person:	Rafael Martínez Técnico Dirección de Sistemas de Gestión calidad@ceis.es

A2 - INSTRUCTIONS



INSTRUCTIONS

PROGRAM:	DETERMINATION OF FLEXURE PROPERTIES
CODE:	SQO-PL9
ROUND:	16
STANDARD:	ISO 178
COORDINATOR:	Lic. Esther Casas (ecasas@ptsouthquality.com)

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1 - General

This document is a guide for managing the results of the **SQO-PL9 (Round 16)** program.

2 - Standard

ISO 178: 2019

3 - Participant

CENTRO DE ENSAYOS, INNOVACIÓN Y SERVICIOS, S.L. Laboratorio Eléctrico	**CODE 08**

4 - Tests involved

TEST
Determination of the flexural properties of rigid and semi-rigid plastics (Flexural stress / Flexural strain)

5 - Samples

CODE	SAMPLE	QUANTITY
LP3234-08	Thermoplastic (WHITE) - 330 x 100 x 2 mm	1
LP3421-08	Thermoplastic (BLACK) - 330 x 100 x 2 mm	1

6 - Notes

a) The deadline for the delivery of results is **November 14, 2025**.
b) The participant must submit the results using the usual report employed by their laboratory.
c) The samples are to be handled as routine lab samples, with all testing, documentation, and reporting adhering to **ISO 178**.
d) The specimens are marked with a line indicating the face that must be in contact with the loading edge during the test.
e) Samples must be retained until the end of the program, which concludes with the submission of the final report.
f) To review the results, test images would be appreciated. Images can be attached at the end of this document or sent by email.

PHOTOGRAPHS

A3 - PARTICIPANT RESULTS (TEST REPORT #PLA-0957/25-1)

CEISLAB

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comercial@ceislab.com
www.ceislab.com

Referencia Informe nº: PLA-0957/25-1
Report Reference:
Fecha de emisión: 07/11/2025
Date of issue:

INFORME DE ENSAYOS
TEST REPORT

Datos del solicitante
Requester´s data

Cliente: Client:	CEIS, S.L.
Dirección: Address:	CR VILLAVICIOSA DE ODÓN A MÓSTOLES, Km. 1,5 (28935) MÓSTOLES, MADRID (ESPAÑA)
Referencia Cliente: Reference Client:	
Licenciatario: Licensee:	
Fabricante: Manufacturer:	
Dirección: Address:	
Producto: Product:	OTROS PRODUCTO OTHER PRODUCTS
Recepción muestras: Samples reception:	06/08/2025
Periodo de ensayos: Test Period:	06/11/2025 - 07/11/2025

Este informe es válido únicamente para ensayos de intercomparación

Informe revisado por:
Report revised by:
Gestor de Proyecto
Project Manager

Disposiciones generales:
General dispositions:
Los resultados contenidos en el presente informe se refieren al momento y condiciones en que se realizaron las mediciones y únicamente a la/s muestra/s objeto de estudio.
Test report results apply only to the time and conditions under which the tests were performed and only to the samples tested.
Este informe sólo puede ser reproducido en su totalidad. Está prohibida la reproducción parcial del mismo sin autorización expresa del laboratorio.
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Laboratory is not responsible for information provided by the client.
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This report is secure and protected against changes once signed. To verify the signed and supported version, please click on the electronic signature icon to display the only supported version.
En aquellos casos en los que, en este informe, se expresa la conformidad del resultado de un ensayo con respecto a una especificación se aplica la regla de decisión "Declaración binaria para una regla de aceptación simple (w=0)" con una probabilidad de falsa aceptación (PFA) <50%.
If test result conformity is defined according to a specification, it is applied the decision rule "Binary statement for a simple acceptance rule (w=0)", with a probability of false acceptance (PFA)< 50%.

ENAC
ENSAYO
ISO 17025
Nº1 / LE149

INNOVACCIÓN+

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CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Muestras(1)
Samples(1)

Muestra Sample	Descripción Description
1	Program: SQO-PL9 R 16 Client: E455 Batch: Lp3234 ID: 08
2	Program: SQO-PL9-R16 Client: E455 Batch: LP3421 ID: 08

(1) **Información aportada por el cliente y no amparada por la acreditación.**
(1) Information provided by the client and not covered by accreditation.

Todas las muestras ensayadas CUMPLEN en base a los resultados obtenidos de los ensayos realizados que se desarrollan en el presente informe. Asimismo, los criterios de conformidad respecto a los cuales se declara el cumplimiento de las especificaciones aplicables quedan definidos en el apartado de *Valoración de Cumplimiento* y *Normas Aplicadas*.
All tested samples COMPLY in accordance with this report test results. Therefore, applicable specification conformity criteria, are defined in paragraph *Stating Compliance and Applied Standard*.

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Ensayos realizados
Tests performed

Descripción Description	Muestras Samples
Determinación de las Propiedades de flexión - UNE-EN ISO 178:2020 Determination of flexural properties - UNE-EN ISO 178:2020	1, 2

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Valoración de Cumplimiento y Normas aplicadas
Conformity assessment and Standards applied

Según producto

En el presente Informe, cuando se evalúa la conformidad del resultado con los requisitos de la/s norma/s aplicada/s, los tres posibles casos son:

- *CUMPLE: Los valores medidos cumplen con los requisitos de las especificaciones de las normas aplicadas.*
- *NO CUMPLE: Los valores medidos no cumplen con los requisitos de las especificaciones de las normas aplicadas.*
- *NO APLICA: No aplica realizar evaluación de conformidad. Ensayo/Requisito no aplicable a la muestra.*

In this report, when assessing the conformity of the result with the requirements of the applied standard(s), the three possible cases are:

- *COMPLY: The measured values comply with the requirements of the specifications of the applied standard(s).*
- *NOT COMPLY: The measured values do not comply with the requirements of the specifications of the applied standard(s).*
- *NOT APPLICABLE: Conformity assessment is not applicable. Test/Requirement not applicable to the sample.*

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Resultados de los ensayos
Test results

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Determinación de las Propiedades de flexión

Determination of flexural properties

Norma de Ensayo: UNE-EN ISO 178:2020
Test Standard:

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Nº muestra Sample nº	1						
Fecha del ensayo Test date	06/11/2025						
Forma y dimensiones de las probetas Shape and dimensions of the test speciments	Recomendada (punto 6.1.2. ISO 178) Preferred (Part 6.1.2. ISO 178)				80x10x4 mm		
Método de preparación de las probetas Method of preparing speciments	Moldeo por Compresión Compression mouilding						
Condiciones de ensayo Test conditions	**T(ºC)**	23					
	Hr(%)	50					
Nº de probetas ensayadas Number of speciments tested	5						
Longitud nominal de Distancia entre apoyos (mm) Nominal Span (mm)	64±4						
Método Test method	A	**Velocidad 1 (mm/min)** Speed 1 (mm/min)	2				
		Velocidad 2 (mm/min) Speed 2 (mm/min)	n/a				
Grado exactitud del equipo Accuracy prading of the test machine	Tipo IV (tabla 2 UNE-EN ISO 178)						
Sistema de medición de la flecha Instrument for measuring the deflection	Deflectómetro Deflectometer						
Superficie de aplicación de la fuerza Surface on wich the force was applied	No aplica Not applicable						

	Ef (Mpa)	**σfc (Mpa)**	**σfM (Mpa)**	**εfM (%)**	**σfB (Mpa)**	**εfB (%)**	**σf5% (Mpa)**
Probeta 1 Test piece 1	1400	32,9	33,2	4,5			33,1
Probeta 2 Test piece 2	1440	34,9	35,1	4,4			34,9
Probeta 3 Test piece 3	1130	34,0	34,8	5,7			34,7
Probeta 4 Test piece 4	1360	33,6	34,5	5,3			34,3
Probeta 5 Test piece 5	1320	34,1	34,2	4,1			33,8
Valor medio Average	1330	33,9	34,4	4,8			34,2
Desviación estándar Standard desviation	120	0,7	0,7	0,7			0,7
Intervalo de confianza (95%) Confidence interval	9,0	2,2	2,1	13,7			2,1

Ef - Módulo de elasticidad en flexión/Flexural modulus
σfc - Esfuerzo para flecha 1,5 veces el espesor de la probeta/Flexural stress at deflection equal 1,5 times the thickness
σfM - Esfuerzo máximo de flexión/Maximum flexural stress
εfM - Deformación de flexión en el punto de esfuerzo máximo/Flexural strain at máximum flexural stress
σfB - Esfuerzo de flexión en la rotura/flexural stress at break
εfB - Deformación en flexión en la rotura/flexural strain at break
σf5% - Esfuerzo de flexión en 5% deformación /flexural stress at 5% flexural strain

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Nº muestra Sample nº	1						
Fecha del ensayo Test date	06/11/2025						
Forma y dimensiones de las probetas Shape and dimensions of the test speciments	Recomendada (punto 6.1.2. ISO 178) Preferred (Part 6.1.2. ISO 178)				80x10x4 mm		
Método de preparación de las probetas Method of preparing speciments	Moldeo por Compresión Compression mouilding						
Condiciones de ensayo Test conditions	**T(ºC)**	23					
	Hr(%)	50					
Nº de probetas ensayadas Number of speciments tested	5						
Longitud nominal de Distancia entre apoyos (mm) Nominal Span (mm)	64±4						
Método Test method	A	**Velocidad 1 (mm/min)** Speed 1 (mm/min)	2				
		Velocidad 2 (mm/min) Speed 2 (mm/min)	n/a				
Grado exactitud del equipo Accuracy prading of the test machine	Tipo IV (tabla 2 UNE-EN ISO 178)						
Sistema de medición de la flecha Instrument for measuring the deflection	Deflectómetro Deflectometer						
Superficie de aplicación de la fuerza Surface on wich the force was applied	No aplica Not applicable						

	Ef (Mpa)	**σfc (Mpa)**	**σfM (Mpa)**	**εfM (%)**	**σfB (Mpa)**	**εfB (%)**	**σf5% (Mpa)**
Probeta 1 Test piece 1	1210	32,5	33,4	5,5			33,3
Probeta 2 Test piece 2	1050	33,7	34,7	5,6			34,6
Probeta 3 Test piece 3	1200	32,6	33,5	5,6			33,3
Probeta 4 Test piece 4	1240	33,2	34,1	5,7			33,9
Probeta 5 Test piece 5	1330	33,7	34,6	5,6			34,5
Valor medio Average	1210	33,1	34,1	5,6			33,9
Desviación estándar Standard desviation	104	0,6	0,6	0,1			0,6
Intervalo de confianza (95%) Confidence interval	9,0	1,8	1,7	0,9			1,8

Ef - Módulo de elasticidad en flexión/Flexural modulus
σfc - Esfuerzo para flecha 1,5 veces el espesor de la probeta/Flexural stress at deflection equal 1,5 times the thickness
σfM - Esfuerzo máximo de flexión/Maximum flexural stress
εfM - Deformación de flexión en el punto de esfuerzo máximo/Flexural strain at máximum flexural stress
σfB - Esfuerzo de flexión en la rotura/flexural stress at break
εfB - Deformación en flexión en la rotura/flexural strain at break
σf5% - Esfuerzo de flexión en 5% deformación /flexural stress at 5% flexural strain

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Ref. Informe nº: PLA-0957/25-1
Report Ref:

Nº muestra Sample nº	2						
Fecha del ensayo Test date	06/11/2025						
Forma y dimensiones de las probetas Shape and dimensions of the test speciments	Recomendada (punto 6.1.2. ISO 178) Preferred (Part 6.1.2. ISO 178)				80x10x4 mm		
Método de preparación de las probetas Method of preparing speciments	Moldeo por Compresión Compression mouilding						
Condiciones de ensayo Test conditions	**T(ºC)**	23					
	Hr(%)	50					
Nº de probetas ensayadas Number of speciments tested	5						
Longitud nominal de Distancia entre apoyos (mm) Nominal Span (mm)	64±4						
Método Test method	A	**Velocidad 1 (mm/min)** Speed 1 (mm/min)	2				
		Velocidad 2 (mm/min) Speed 2 (mm/min)	n/a				
Grado exactitud del equipo Accuracy prading of the test machine	Tipo IV (tabla 2 UNE-EN ISO 178)						
Sistema de medición de la flecha Instrument for measuring the deflection	Deflectómetro Deflectometer						
Superficie de aplicación de la fuerza Surface on wich the force was applied	No aplica Not applicable						

	Ef (Mpa)	**σfc (Mpa)**	**σfM (Mpa)**	**εfM (%)**	**σfB (Mpa)**	**εfB (%)**	**σf5% (Mpa)**
Probeta 1 Test piece 1	2740	94,5	106,0	5,7			104,9
Probeta 2 Test piece 2	3120	87,9	104,0	5,3	104,0	5,3	103,5
Probeta 3 Test piece 3	3050	86,1	102,0	5,5			100,8
Probeta 4 Test piece 4	2870	84,6	99,0	5,5	95,4	6,9	98,4
Probeta 5 Test piece 5	3260	93,4	108,0	5,4			107,2
Valor medio Average	2740	94,5	106,0	5,7	99,6	6,1	104,9
Desviación estándar Standard desviation	3120	87,9	87,9	5,3	104,0	5,3	
Intervalo de confianza (95%) Confidence interval							

Ef - Módulo de elasticidad en flexión/Flexural modulus
σfc - Esfuerzo para flecha 1,5 veces el espesor de la probeta/Flexural stress at deflection equal 1,5 times the thickness
σfM - Esfuerzo máximo de flexión/Maximum flexural stress
εfM - Deformación de flexión en el punto de esfuerzo máximo/Flexural strain at máximum flexural stress
σfB - Esfuerzo de flexión en la rotura/flexural stress at break
εfB - Deformación en flexión en la rotura/flexural strain at break
σf5% - Esfuerzo de flexión en 5% deformación /flexural stress at 5% flexural strain

CEISLAB

Ref. Informe nº: PLA-0957/25-1
Report Ref:

Nº muestra Sample nº	2						
Fecha del ensayo Test date	06/11/2025						
Forma y dimensiones de las probetas Shape and dimensions of the test speciments	Recomendada (punto 6.1.2. ISO 178) Preferred (Part 6.1.2. ISO 178)				80x10x4 mm		
Método de preparación de las probetas Method of preparing speciments	Moldeo por Compresión Compression mouilding						
Condiciones de ensayo Test conditions	**T(ºC)**	23					
	Hr(%)	50					
Nº de probetas ensayadas Number of speciments tested	5						
Longitud nominal de Distancia entre apoyos (mm) Nominal Span (mm)	64±4						
Método Test method	A	**Velocidad 1 (mm/min)** Speed 1 (mm/min)	2				
		Velocidad 2 (mm/min) Speed 2 (mm/min)	n/a				
Grado exactitud del equipo Accuracy prading of the test machine	Tipo IV (tabla 2 UNE-EN ISO 178)						
Sistema de medición de la flecha Instrument for measuring the deflection	Deflectómetro Deflectometer						
Superficie de aplicación de la fuerza Surface on wich the force was applied	No aplica Not applicable						

	Ef (Mpa)	**σfc (Mpa)**	**σfM (Mpa)**	**εfM (%)**	**σfB (Mpa)**	**εfB (%)**	**σf5% (Mpa)**
Probeta 1 Test piece 1	2790	91,8	101,0	4,4	101,0	4,4	
Probeta 2 Test piece 2	3030	97,0	109,0	5,5	102,0	7,7	108,2
Probeta 3 Test piece 3	2820	94,9	106,0	5,6	106,0	5,6	104,7
Probeta 4 Test piece 4	3130	90,8	106,0	5,4	103,0	6,5	105,4
Probeta 5 Test piece 5	3090	99,2	111,0	5,4			110,5
Valor medio Average	2970	94,7	107,0	5,3	103,0	6,0	
Desviación estándar Standard desviation							
Intervalo de confianza (95%) Confidence interval							

Ef - Módulo de elasticidad en flexión/Flexural modulus
σfc - Esfuerzo para flecha 1,5 veces el espesor de la probeta/Flexural stress at deflection equal 1,5 times the thickness
σfM - Esfuerzo máximo de flexión/Maximum flexural stress
εfM - Deformación de flexión en el punto de esfuerzo máximo/Flexural strain at máximum flexural stress
σfB - Esfuerzo de flexión en la rotura/flexural stress at break
εfB - Deformación en flexión en la rotura/flexural strain at break
σf5% - Esfuerzo de flexión en 5% deformación /flexural stress at 5% flexural strain

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Incertidumbres
Uncertainties

Ensayo Test	Parámetro Parameter	Valor Value
Determinación de las Propiedades de flexión UNE-EN ISO 178:2020 Determination of flexural properties UNE-EN ISO 178:2020	Deformación en flexión Flexural strain	±0,2 %
Determinación de las Propiedades de flexión UNE-EN ISO 178:2020 Determination of flexural properties UNE-EN ISO 178:2020	Esfuerzo de flexión Flexural stress	±1,1 Mpa
Determinación de las Propiedades de flexión UNE-EN ISO 178:2020 Determination of flexural properties UNE-EN ISO 178:2020	Módulo de flexión Flexural modulus	±199 Mpa

APPENDIX B

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