SOUTH QUALITY

PROFICIENCY TESTING PROVIDER

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IEC 60811-404

ELECTRIC AND OPTICAL FIBRE CABLES
MINERAL OIL IMMERSION TESTS FOR SHEATHS

Program: SQ-2597.V1

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Prepared by:	Reviewed by:	Approved by:
cn=VALENTYN E. KRAVCHENKO, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=tech@ptsouthquality.com, c=AR 2025.09.08 10:51:31 -03'00'	cn=ESTEBAN DI MARCO, o=PT SOUTH QUALITY SAS, ou=SOUTH QUALITY, email=edimarco@ptsouthquality.com, c=AR 2025.09.08 16:14:08 -03'00'	cn=Emiliano Medina, o=SOUTH QUALITY, ou=PT SOUTH QUALITY SAS, email=quality@ptsouthquality.com, c=ES 2025.09.09 11:59:39 -03'00'
Valentyn Kravchenko Assistant Technician	**Eng. Esteban Di Marco** Electromechanical expert	**Eng. Emiliano Medina** Quality Assurance Lead

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1. FOREWORD

This report summarizes the results of the **SQ-2597.V1** proficiency testing program on the determination of the mechanical properties of sheaths before and after ageing by oil immersion. This program is conducted in a bilateral format, following the A.3.3 classification of the ISO 17043 standard ("Split-sample testing schemes").

South Quality conducted the testing program in July 2025 with the aim of assessing the laboratory's ability to competently perform the designated tests.

2. ORGANIZATION

Program Coordinator:	Eng. Esteban Di Marco
Assistant Technician:	Valentyn Kravchenko
Statistic:	Lic. Manuel Tozaki
Supervision:	Eng. Emiliano Medina

3. OBJECTIVE

The objective of this proficiency testing program is to determine the tensile strength and elongation at brake before and after ageing in oil immersion, using the following standard.

Standard
IEC 60811-404: 2012

To verify this, batches of cables have been selected.

Participants in this program have not been previously informed about the expected values or value ranges of the samples they receive.

4. PARTICIPANT

Company:	**U.I. LAPP GmbH**
Laboratory:	**Laboratory Germany Cables (LGC)**
Country:	Germany
Client ID:	E480
Contact person:	Laura Marie Erdmann Quality Management Representative laura.marie.erdmann@lapp.com

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.

The control process followed ISO Guide 35: 2017, clause 7.4.1.2. Stratified random sampling was employed, and samples were chosen using random number generation software.

The results of this test are presented below:

Size of each batch: **50 samples** Tested samples from each batch: **10 (100 units)**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM2261	BATCH: LM2262	BATCH: LM2263
T_E	YES	NO	YES
T_U	YES	NO	YES
E_E	YES	NO	NO
E_U	YES	NO	YES

Size of each batch: **50 samples** Tested samples from each batch: **10 (100 units)**

DETERMINATION	HOMOGENEITY OF RESULTS IN THE ANALYZED SAMPLES		
	BATCH: LM2421	BATCH: LM2422	BATCH: LM2423
T_E	YES	YES	YES
T_U	YES	YES	YES
E_E	NO	YES	YES
E_U	NO	YES	YES

Samples for this program are taken from the selected batches identified as **LEM2261** and **LEM2422**.

For the indicated batches, the values determined in the homogeneity study are utilized as the assigned values.

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

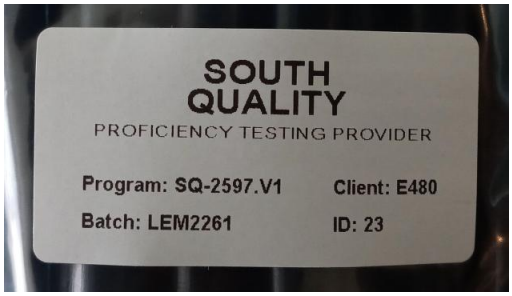
The following samples were sent to be tested:

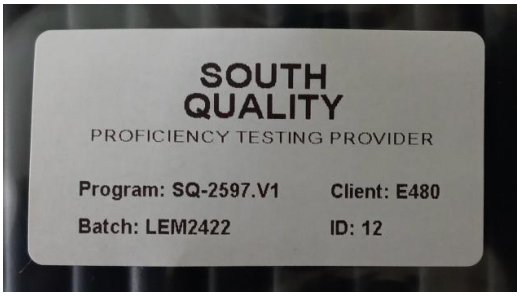
Batch:	LEM2261
Sample ID:	23
Characteristics:	Concentric electric cable (Aluminium /XLPE) - 16 + 16 mm2 - 12 cm - 10 units

Batch:	LEM2422
Sample ID:	12
Characteristics:	Concentric electric cable (Aluminium/XLPE) - 6 + 6 mm2 - 12 cm - 10 units

7. IMAGES

SAMPLES





8. ASSIGNED VALUES

	BATCH: LEM2261			
	T_E (N/mm²)	T_U (N/mm²)	E_E (%)	E_U (%)
AVG	21.38	15.92	616	535
SD	0.52	0.58	11.5	12.8

	BATCH: LEM2422			
	T_E (N/mm²)	T_U (N/mm²)	E_E (%)	E_U (%)
AVG	27.45	17.62	785	645
SD	0.48	0.72	10.3	12.4

9. PARTICIPANT RESULTS (SEE APPENDIX)

	T_E (N/mm²)	T_U (N/mm²)	E_E (%)	E_U (%)
LEM2261-23 (GENI1) AVG	21.47	16.56	606	542
LEM2261-23 (ENYM1) AVG	22.09	15.38	638	523
LEM2422-12 (GENI1) AVG	27.82	18.00	791	653

10. STATISTICS

The results must be treated as quantitative.

The comparison is made according B.3.1.3 of ISO 17043 and the appropriate technique is to compare participant results with the assigned values. The results can be compare using percent difference ***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

BATCH	PARAMETER	PROCESSOR	AVERAGE		| z score |	PERFORMANCE RESULT
			PARTICIPANT RESULT	ASSIGNED VALUE		
LEM2261	T_E (N/mm^2)	GENI1	21.47	21.38	**0.17**	**SATISFACTORY**
		ENYM1	22.09	21.38	**1.37**	**SATISFACTORY**
	T_U (N/mm^2)	GENI1	16.56	15.92	**1.10**	**SATISFACTORY**
		ENYM1	15.38	15.92	**0.93**	**SATISFACTORY**
	E_E (%)	GENI1	609	616	**0.87**	**SATISFACTORY**
		ENYM1	638	616	**1.91**	**SATISFACTORY**
	E_U (%)	GENI1	542	535	**0.55**	**SATISFACTORY**
		ENYM1	523	535	**0.94**	**SATISFACTORY**
LEM2422	T_E (N/mm^2)	GENI1	27.82	27.45	**0.77**	**SATISFACTORY**
	T_U (N/mm^2)	GENI1	18.00	17.62	**0.53**	**SATISFACTORY**
	E_E (%)	GENI1	791	785	**0.58**	**SATISFACTORY**
	E_U (%)	GENI1	653	645	**0.65**	**SATISFACTORY**

12. CONCLUSIONS

The overall performance on this **SQ-2597.V1** program from the participant laboratory **U.I. LAPP GmbH - Laboratory Germany Cables (LGC)**, is **SUFFICIENT** based on expected results.

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

- **SUFFICIENT** performance: No unsatisfactory/questionable results were obtained.
- **ALMOST SUFFICIENT** performance: No unsatisfactory and one questionable result were obtained.
- **INSUFFICIENT** performance: An unsatisfactory result was obtained or two questionable results were obtained.

APPENDIX

PARTICIPANT RESULTS

(Results form)

INSTRUCTIONS
&
RESULTS FORM

PROGRAM:	Electric and optical fibre cables Mineral oil immersion tests for sheaths
CODE:	SQ-2597
VERSION:	1
STANDARD:	IEC 60811-404
COORDINATOR:	Eng. Esteban Di Marco (edimarco@ptsouthquality.com)

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1 - **General**

This document serves as a guide for managing the results of the **SQ-2597.V1** program.

Results must be typed, not handwritten.

2 - **Standard**

IEC 60811-404: 2012

3 - **Tests involved**

TEST
Determination of mechanical properties before and after ageing by oil immersion

4 - **Samples**

CODE	SAMPLE	QUANTITY
LEM2261-23	Concentric electric cable (Aluminium /XLPE) - 16 + 16 mm^2 - 12 cm	10
LEM2422-12	Concentric electric cable (Aluminium/XLPE) - 6 + 6 mm^2 - 12 cm	10

5 - **Notes**

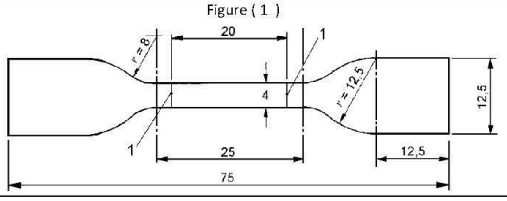
a) Being a bilateral program, there is no deadline for submitting results.
b) The tables in this document may be modified by the participant, if desired, to include data or observations.
c) The samples are to be handled as routine lab samples, with all testing, documentation, and reporting adhering to **IEC 60811-404**.
d) Samples must be retained until the end of the program, which concludes with the submission of the final report.
e) To review the results, test images would be appreciated. Images can be attached at the end of this document or sent by email.
f) Once this document is completed, it must be converted into a PDF file and sent to the program coordinator.

6 - **Test results**

Method:	According to standard

TEST CONDITIONS	
Oil:	IRM902
Temperature (°C):	100°C
Duration (h):	24

Test date:	29.07-31.07.2025

Dumb bell test pieces:	Figure (1) 
Distance between grips (mm):	20
Rate of separation (mm/min):	25

UNTREATED TEST SAMPLES					
CODE	PROCESSOR	SAMPLE	Cross-sectional area (mm^2)	Tensile strength (N/mm^2)	Elongation at break (%)
LEM2261-23	GENI1	1	4,84	20,90	590,3
		2	4,96	20,82	597,9
		3	4,96	26,04	653,9
		4	4,88	21,47	605,8
		5	4,84	22,31	621,2
LEM2261-23	ENYM1	1	3,88	23,65	637,8
		2	4,04	22,09	641,8
		3	4,92	20,95	624,4
		4	4,16	23,33	638,0
		5	4,92	17,34	533,2
LEM2422-12	GENI1	1	5,40	27,92	767,3
		2	5,00	28,35	802,9
		3	5,56	27,25	790,5
		4	5,24	26,79	769,1
		5	5,56	27,82	811,7

AGED TEST SAMPLES					
CODE	PROCESSOR	SAMPLE	Cross-sectional area (mm^2)	Tensile strength (N/mm^2)	Elongation at break (%)
LEM2261-23	GENI1	6	4,20	16,84	550,6
		7	4,88	22,29	629,6
		8	4,84	16,27	533,1
		9	4,44	15,84	528,4
		10	Invalid*	Invalid*	Invalid*
LEM2261-23	ENYM1	6	Invalid*	Invalid*	Invalid*
		7	4,80	14,83	503,9
		8	4,76	15,94	542,3
		9	4,76	13,89	489,2
		10	4,32	21,05	590,0
LEM2422-12	GENI1	6	5,04	16,85	639,1
		7	5,08	22,24	698,8
		8	4,88	18,95	658,4
		9	5,40	17,06	647,4
		10	Invalid*	Invalid*	Invalid*

BATCH	PROCESSOR	T_E (N/mm^2)	T_U (N/mm^2)	V_T (%)
LEM2261-23	GENI1	21,47	16,56	**-23**
LEM2261-23	ENYM1	22,09	15,38	**-30**
LEM2422-12	GENI1	27,82	18,00	**-35**

BATCH	PROCESSOR	E_E (%)	E_U (%)	V_E (%)
LEM2261-23	GENI1	606	542	**-11**
LEM2261-23	ENYM1	638	523	**-18**
LEM2422-12	GENI1	791	653	**-17**

OBSERVATIONS & PHOTOGRAPHS

General

*The extensometer has slipped, therefore the sample is invalid.

Temperature and humidity in the test room

Tensile tester

----- END OF REPORT -----