Testing laboratory G.L. Electronic

G.L. Electronic
Czech Company for Aerospace Technologies

ilac-MRA

L 1774

G.L. Electronic s.r.o.
Podnikatelská 2902/4
Brno 612 00
Czech Republic

www.glelectronic.space
Ing. Jiří Šmarhák, Ph.D.
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Phone: +420 605 793 525

Testing Laboratory G.L. Electronic

- Is part of a successful company that has been offering complete implementation of Hi-Rel electronics and wiring harnesses for space and other applications since 2008.
- Manufacturing, integration and testing is carried out according to ESA ECSS standards in ISO 8 certified cleanrooms.
- We provide long-term technical and consultancy support in the field of design, manufacturing, testing and integration of flight equipment.

- Cooperation with G.L. Electronic guarantees all customers and partners:
  - the highest quality and precise small batch production,
  - flexibility to customer requirements, tailor-made solutions,
  - the possibility of direct supervision of the manufacturing process,
  - information protection and documentation guaranteeing security and confidentiality,
  - certified manufacturing facilities, processes and operators.

Quality Standards

ČSN EN ISO 17025:2018

EA MLA Signatory
Český institut pro akreditaci, o.p.s.
(Czech Accreditation Institute)
Hájkova 2747/22, Žižkov, 130 00 Praha 3

issues

according to section 16 of Act No. 22/1997 Coll., on technical requirements for products and on changes and amendments to some Acts, as amended

CERTIFICATE OF ACCREDITATION

No. **424/2025**

G.L. Electronic s.r.o.
with registered office Hrázky 804, 768 11 Chropyně
Company Registration No. 28280105

for the Testing Laboratory No. **1774**
G.L. Electronic Testing Laboratory

Scope of accreditation:

Testing of crimped, soldered, and printed circuit connections to the extent as specified in the appendix to this Certificate.

This Certificate of Accreditation is a proof of accreditation issued on the basis of assessment of fulfillment of the accreditation criteria in accordance with

ČSN EN ISO/IEC 17025:2018

In its activities performed within the scope and for the period of validity of this Certificate, the abovementioned Accredited Body is entitled to refer to this Certificate, provided that the accreditation is not suspended and the Accredited Body meets the specified accreditation requirements in accordance with the relevant regulations applicable to the activity of an accredited conformity assessment body.

This Certificate of Accreditation replaces, to the full extent, Certificate No.: 423/2022 of 26/08/2022, and/or any administrative acts building upon it

The Certificate of Accreditation is valid until: **14/08/2030**

Prague: 14/08/2025

Signed in the Czech original:
Zdeňka Drdová on 14/08/2025

Jan Velíšek
Director of the Department
of Testing and Calibration Laboratories
Czech Accreditation Institute

This translation of the Czech original has been issued by: Eliška Frycová

The Appendix is an integral part of
Certificate of Accreditation No: 424/2025 of 14/08/2025

Accredited entity according to ČSN EN ISO/IEC 17025:2018:

G.L. Electronic s.r.o.
CAB number 1774, G.L. Electronic Testing Laboratory
Podnikatelská 2902/4, 612 00 Brno – Královo Pole

Testing laboratory locations:

1. Metallography Facility — Podnikatelská 2902/4, 612 00 Brno – Královo Pole
2. Mechanical Testing Facility — Podnikatelská 2902/4, 612 00 Brno – Královo Pole
3. Electronic Testing Facility — Podnikatelská 2902/4, 612 00 Brno – Královo Pole

The laboratory provides opinions and interpretations of the test results.

1. Metallography Facility

Tests:

Ordinal number [1]	Test procedure/method name	Test procedure/method identification [2]	Tested subject	Degrees of freedom [3]
1	Metallographic test	MMP-01-GLE (ECSS-Q-ST-70-26C Rev.1:3/2017 + Corrigendum 1:6/2017)	Wires and crimped connections	-
2	Metallographic test	MMP-01-GLE (ECSS-Q-ST-70-61C:4/2022)	Soldered electronic components	-
3	Metallographic test	MMP-01-GLE (ECSS-Q-ST-70-60C Rev.1:4/2025)	Printed circuit boards (PCBs)	-

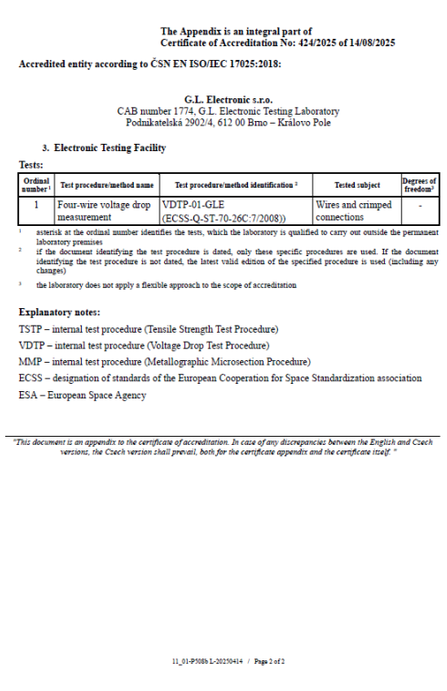
[1] asterisk at the ordinal number identifies the tests, which the laboratory is qualified to carry out outside the permanent laboratory premises
[2] if the document identifying the test procedure is dated, only these specific procedures are used. If the document identifying the test procedure is not dated, the latest valid edition of the specified procedure is used (including any changes)
[3] the laboratory does not apply a flexible approach to the scope of accreditation

2. Mechanical Testing Facility

Tests:

Ordinal number [1]	Test procedure/method name	Test procedure/method identification [2]	Tested subject	Degrees of freedom [3]
1	Test of tensile strength	TSTP-01-GLE (ECSS-Q-ST-70-26C Rev.1:3/2017 + Corrigendum 1:6/2017)	Wires and crimped connections	-

[1] asterisk at the ordinal number identifies the tests, which the laboratory is qualified to carry out outside the permanent laboratory premises
[2] if the document identifying the test procedure is dated, only these specific procedures are used. If the document identifying the test procedure is not dated, the latest valid edition of the specified procedure is used (including any changes)
[3] the laboratory does not apply a flexible approach to the scope of accreditation



The Appendix is an integral part of
Certificate of Accreditation No: 424/2025 of 14/08/2025

Accredited entity according to ČSN EN ISO/IEC 17025:2018:

G.L. Electronic s.r.o.
CAB number 1774, G.L. Electronic Testing Laboratory
Podnikatelská 2902/4, 612 00 Brno – Královo Pole

3. Electronic Testing Facility

Tests:

Ordinal number [1]	Test procedure/method name	Test procedure/method identification [2]	Tested subject	Degrees of freedom [3]
1	Four-wire voltage drop measurement	VDTP-01-GLE (ECSS-Q-ST-70-26C:7/2008))	Wires and crimped connections	-

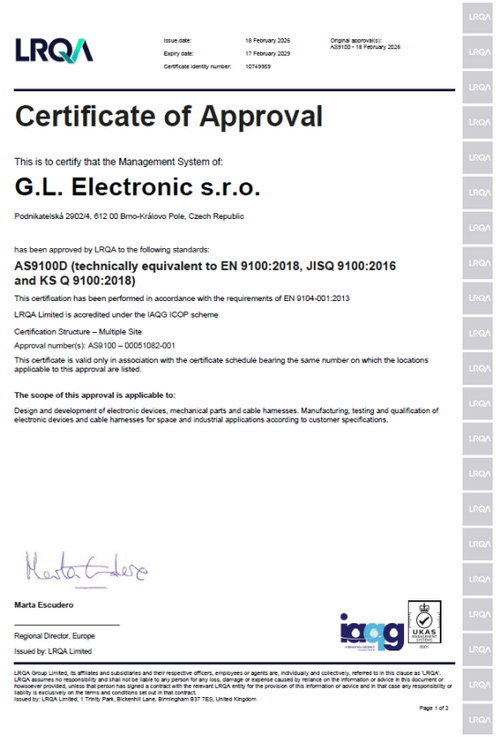
[1] asterisk at the ordinal number identifies the tests, which the laboratory is qualified to carry out outside the permanent laboratory premises
[2] if the document identifying the test procedure is dated, only these specific procedures are used. If the document identifying the test procedure is not dated, the latest valid edition of the specified procedure is used (including any changes)
[3] the laboratory does not apply a flexible approach to the scope of accreditation

Explanatory notes:

TSTP – internal test procedure (Tensile Strength Test Procedure)
VDTP – internal test procedure (Voltage Drop Test Procedure)
MMP – internal test procedure (Metallographic Microsection Procedure)
ECSS – designation of standards of the European Cooperation for Space Standardization association
ESA – European Space Agency

"This document is an appendix to the certificate of accreditation. In case of any discrepancies between the English and Czech versions, the Czech version shall prevail, both for the certificate appendix and the certificate itself. "

AS9100D



LRQA

Issue date: 18 February 2026
Expiry date: 17 February 2029
Certificate identity number: 10749969
Original approval(s): AS9100 - 18 February 2026

Certificate of Approval

This is to certify that the Management System of:

G.L. Electronic s.r.o.

Podnikatelská 2902/4, 612 00 Brno-Královo Pole, Czech Republic

has been approved by LRQA to the following standards:

AS9100D (technically equivalent to EN 9100:2018, JISQ 9100:2016 and KS Q 9100:2018)

This certification has been performed in accordance with the requirements of EN 9104-001:2013

LRQA Limited is accredited under the IAQG ICOP scheme

Certification Structure – Multiple Site

Approval number(s): AS9100 – 00051082-001

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

The scope of this approval is applicable to:

Design and development of electronic devices, mechanical parts and cable harnesses. Manufacturing, testing and qualification of electronic devices and cable harnesses for space and industrial applications according to customer specifications.

Marta Escudero

Regional Director, Europe

Issued by: LRQA Limited

G.L. Electronic
Czech Company for Aerospace Technologies

L 1774

Certifications

- ESA certificates, Cat.2 (inspector) & Cat.3 (operator):
  - ECSS-Q-ST-70-61
  - ECSS-Q-ST-70-18
  - ECSS-Q-ST-70-26
  - ECSS-Q-ST-70-28

- IPC certificates:
  - IPC-A-610
  - IPC J-STD-001
  - IPC/WHMA-A-620

Involvement in Projects

- Hera
  - NASA project - Evaluation of the consequences of the impact of the US DART mission on the Didymos binary asteroid system. Investigation of the physical and dynamic state of the target object and detailed measurement of the outcome of NASA's DART mission kinetic impactor test.
  - Testing the wiring harnesses that connect the functional and control electronic units, sensors, and instruments throughout the satellite.
- Triton-X
  - New Space application (creating space for commercial applications). Modular Triton-X microsatellite platforms allow easy customization for a variety of missions such as Earth observation, telecommunications and SIGINT, or on-orbit services.
  - Participating in the development and testing of the Triton-X Heavy platform, by testing all wiring harnesses, grouping power, signals, communication cables and all necessary sensors.
- ROSE-L
  - ROSE-L is one of the 6 new missions of the Copernicus Sentinel programme, which is sponsored by the European Space Agency.
  - Testing of wiring harnesses between individual antenna panels.

Involvement in Projects

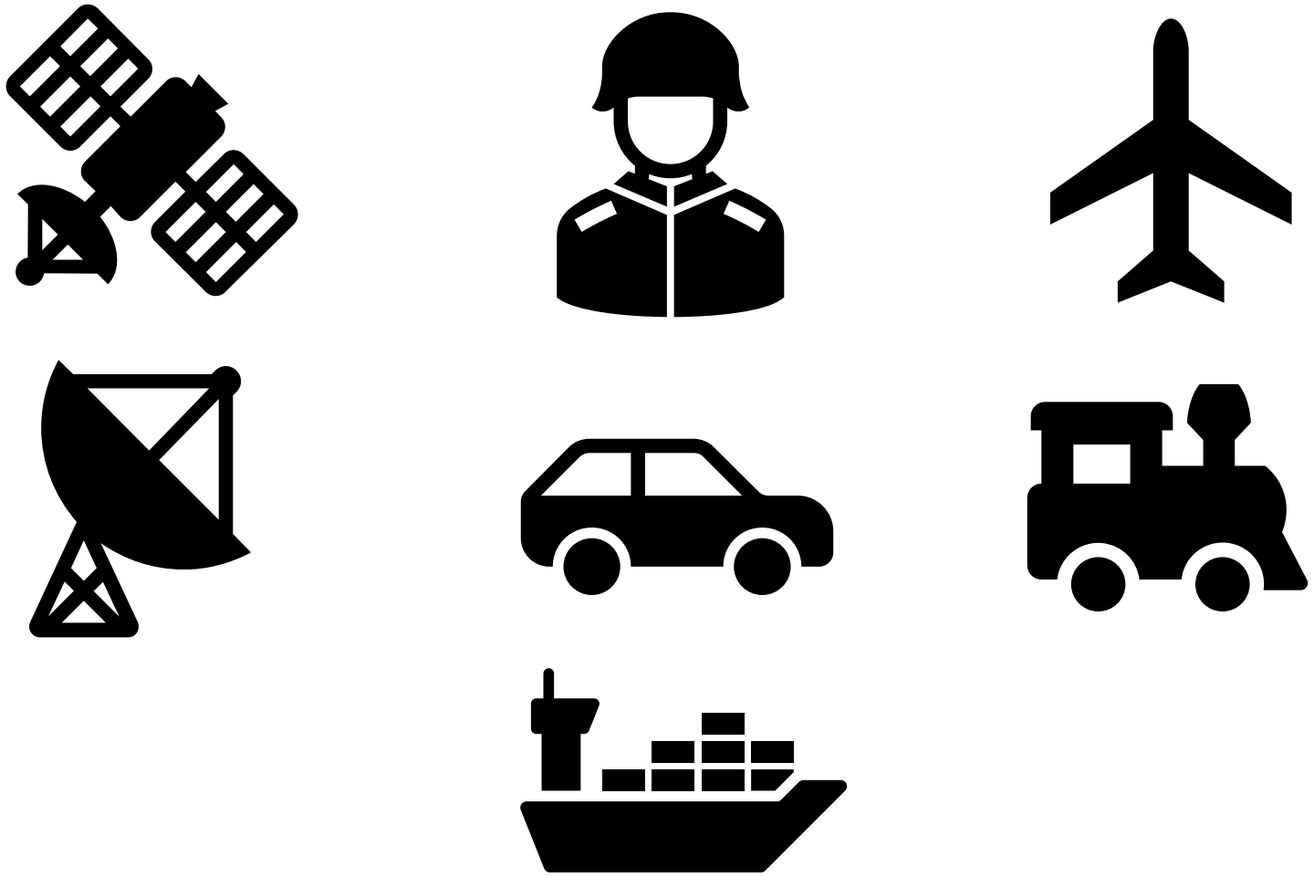
- VPX
  - Development of reusable launch vehicles. The modular control unit will be used in the Themis demonstrator as part of the Future Launchers Preparatory Programme (FLPP), which helps reduce the time, risk and cost of rocket development programmes.
  - Testing the VPX electronic card for a modular control unit.
- Comet Interceptor
  - The Comet Interceptor will be positioned 1.5 million km from Earth, where it will await guidance to a yet unknown target. The mission will investigate a comet or other objects that enter the inner solar system. It will fly past the object under investigation, allowing simultaneous observations.
- CIMR
  - As part of the European Space Agency's programme, we are working together on the manufacturing of the Copernicus Imaging Microwave Radiometer (CIMR) satellite for environmental monitoring. The Copernicus programme enables remote sensing of the Earth, focusing on observations of the atmosphere, land, seas and climate.

Involvement in Projects

- ARIEL
  - ARIEL (Atmospheric Remote-sensing Infrared Exoplanet Large-survey), the space telescope will observe about 1000 known exoplanets around distant stars.
  - We provide the material procurement, manufacturing, assembly and testing of the wiring harnesses - Payload Test Harness, which we are manufacturing in our ISO 8 cleanroom.
- BioMission
  - Design and manufacture of electronics and wiring harnesses.
- Some other projects
  - VEGA SSMS, SALTO, CHIME, ClearSpace.

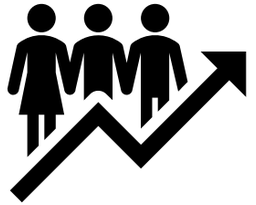
Fields of Application

- Universe,
- military,
- aviation,
- ground support equipment,
- automotive,
- transport technology,
- marine industry.

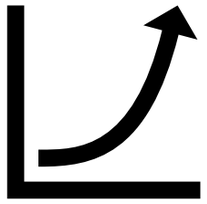


Growth and Vision

- Increase capacity and expansion of services,
- cooperation with academic institutions,
- expanding the scope of certification,
- increasing expertise,
- development projects.



- SpaceWire,
- PCB and electronic component metallography,
- development of ultralight cables,
- development of flexible PCBs,
- lead-free soldering,
- radiation resistance research and more.



Equipment used within Accredited Methods

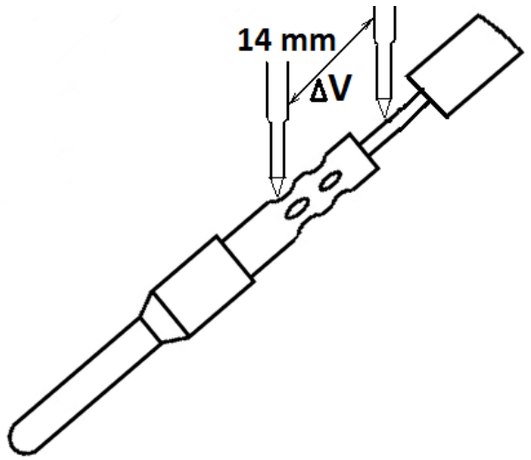
- **Mecmesin AFG Mk4** – Digital force gauge for measuring tension and compression forces.
- **Mecmesin MULTITEST 2.5-dV** – Automatically operated AFG force gauge stand.
- **Struers CitoVac** – Vacuum impregnation equipment for filling of specimens for metallography.
- **Struers Secotom 50** – Table-top equipment for microsectioning and bursting.
- **Struers Tegramin 30** – Automatic metallographic grinder and sample polisher.
- **Carl Zeiss Stemi 508** – Stereomicroscope for optical analysis of samples.
- **UNI-T UT805A** – Digital table-top multimeter for measuring electrical quantities.
- **Manson HCS-3602-000G** – Switching mode power supply.

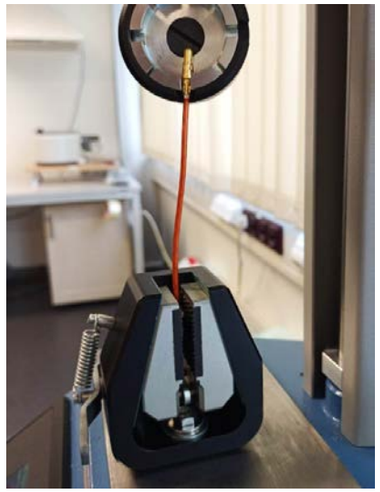
Selected Available Equipment

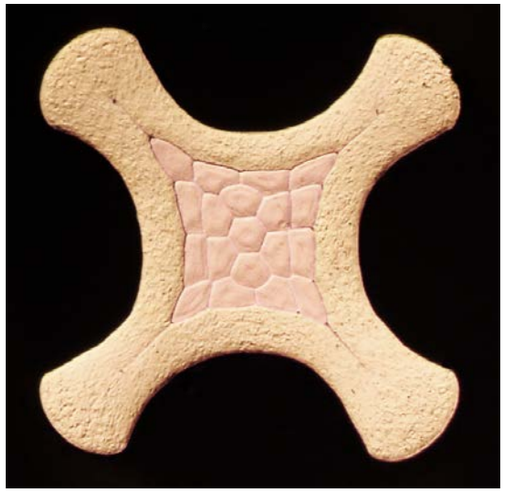
- **NT 600** – Electrical testing of cable harnesses.
- **Endoscopy** – Endoscopic inspections in electronics manufacturing.
- **Weiss Climatic Chamber** – For testing materials.
- **Binder Vacuum Chamber** – For heat treatment of solid or powdered materials using heat.
- **BMT Chamber**– For bakeout.
- **Vibration bench, X-ray, and other equipment in external cooperation with partners.**

Scope of Accredited Testing (ISO 17025)

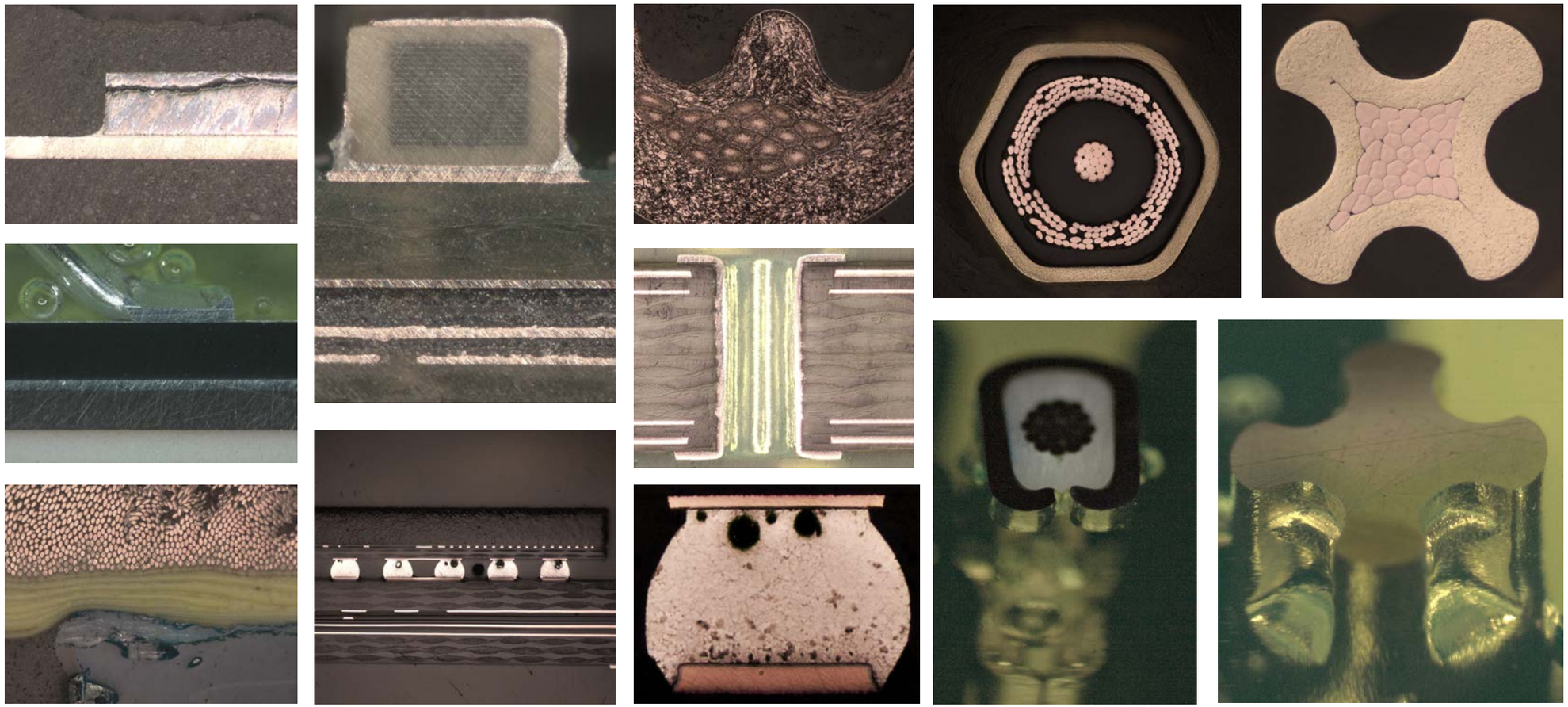
- Tensile test of conductors and crimped joints,
- voltage drop test,
- metallographic cross-sections of conductors, crimped joints, electronic components and PCBs.







Metallographic Cross-Sections



Voltage Drop Test

Switching mode power supply

Manson HCS-3602-00G

- Output voltage 1 – 18 V,
- output current 0 – 20 A.

Multimeter

UNI-T UT805A

- Measurement of electrical quantities,
- range:
  - max. AC voltage: 1000 V,
  - max. DC voltage: 750 V,
  - max. AC current: 10 A,
  - max. DC current: 10 A.

Tensile Test

Digital force gauge

AFG Mk4

- Tension and compression measurement,
- maximum force: 2500 N in tension and compression,
- accuracy ± 0.1 % of range,
- resolution 1:5000,
- memory for up to 500 values.

Automatically operated stand

Multitest 2.5-dV

- Stand-alone force tester,
- maximum load: 2500 N,
- adjustable feed 0.1 – 1200 mm/min,
- display of length, speed and force.

Metallographic Cross-Sections

CitoVac

- Vacuum impregnation unit with vacuum pump for filling and impregnation of sensitive, porous and complex shaped specimens.

Secotom 50

- High performance table-top cut-off machine.
- cutting capacity: 50 x 165 mm,
- size of the cut-off wheel: 75 – 203 mm / 3 - 8” dia.

Tegramin 30

- Grinding and polishing equipment,
- disc size: 300 mm,
- central and individual pressure.

Stemi 508

- Stereo Microscope– zoom with an apochromatic correction,
- magnification: min. 6.3x-50x,
- camera: Axiocam ERc 5s, 5 Mpx,
- image analysis software ZEN Core.

Electrical Test of Cable Harnesses – DC Mode

NT 600

- Electrical testing of cable harnesses,
- easy operation via PC with comprehensive control software via “NT Control”,
- up to 1024 test points in the base unit, expandable to max. 5120 test points,
- two-wire and four-wire continuity measurement, insulation and short-circuit test,
- current: up to 2 ADC,
- voltage: up to 1500 VDC,
- electric strength test: up to 1060 VAC / 1500 VDC.

Electrical Test of Cable Harnesses – DC Mode

W434

- Resistors
  - 1 Ohm to 10 MOhm, accuracy ± (2% + 0.5 Ohms)
  - 10 MOhm to 500 MOhm, accuracy ± 2%
  - 10 mOhms to 100 MOhms, accuracy ± (2%+ 2 mOhms) (Four Terminal Measurement)
- Capacitances
  - 1 µF to 10 mF, accuracy ± (5% 100 nF)
- Diodes and Zener diodes
  - Test of forward, reverse and Zener voltage
- Transistors
- Twisted-Pair and Shield Test
  - from 10 pF to 10 nF ± (5% + 5 pF)
  - Checks pair inversion and shield integrity

Electrical Test of Cables – precision DC Mode

Precision Micro-Ohmmeter TTI BS407

- Range: 1 μΩ - 20 kΩ
- Max. Resolution: 1 μΩ
- Max. Accuracy: ± 0.1 % reading ± 0.1 % scale

Electrical Tests of Cable Harnesses – RF Mode

VNA R&S ZNB8

- Frequency Range: 100 kHz to 20 GHz
- Number of Ports: 4
- Dynamic Range: Up to 140 dB (at 10 Hz IF bandwidth)
- Output Power: Up to +13 dBm, adjustable over a range of more than 95 dB
- Trace Noise: Less than 0.004 dB RMS (at 10 kHz IF bandwidth)
- Sweep Time: 4 ms for 401 points
- Temperature Stability: Typicaly 0.01 dB/°C
- Connectors: 3.5 mm male

Endoscopic Inspections

Flexivision 100

- Endoscopic visual inspection - HD resolution, output: photos and video,
- endoscopic inspections in electronics manufacturing,
- endoscopic inspection of PCB soldering,
- probes in the diameters : 0.7, 1.0, 1.6, 2.0, 2.7 mm.

Testing in the Climatic Chamber

Climatic chamber LabEvent C

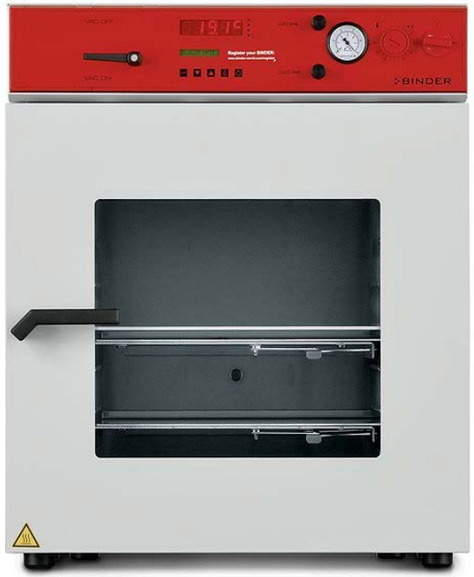
- Wide temperature range from -70 °C to + 180 °C,
- max. temperature changing rate 9 K/min,
- temperature deviation in time: ± 0,3 K to ± 1,0 K,
- flexible, independent and adjustable temperature limiter,
- highly safe for test samples.

https://www.testsysteme.cz/labevent-c

Testing in a Vacuum Chamber

Vacuum chamber Labimex VD115

- For heat treatment of solid or powdered materials,
- controlled temperature and relative humidity regulation,
- temperature range from 10 °C above ambient up to 200 °C,
- volume: 119 l.



Vacuum control box: VCB 521_cv

- Pressure control using a built-in control valve,
- min pressure: 150 mbar.

Bakeout

Climatic chamber Ecocell 111 – ECO line

- Chamber volume 111 litres (4 ft³),
- temperature range +5 °C above ambient up to 250/300 °C,
- high-quality and safe drying, heating and tempering of common laboratory materials,
- wide selection of optional equipment and accessories,
- output for connecting a printer or PC.

https://www.bmt.cz/ecocell-59-ecocell-111---ecoline38

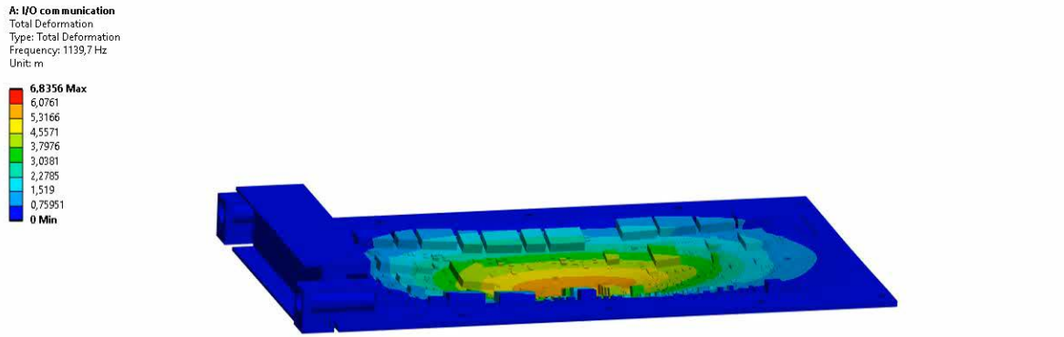
Bakeout

TQCM

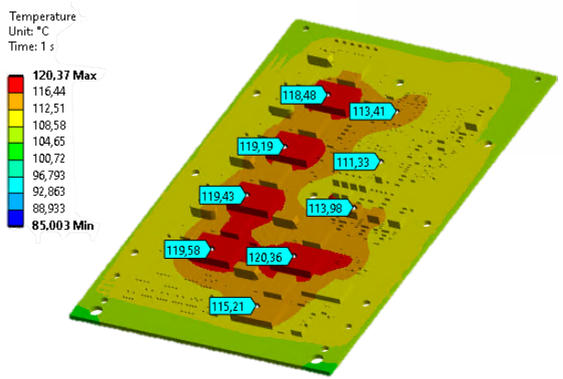
- Thermal-vacuum chamber with TQCM monitoring
- Inner free space: 900 x 730 x 900
- Temperature: -80°C to 250°C
- Pressure: ~ 10-6 mbar
- TQCM monitoring

Computational Analysis

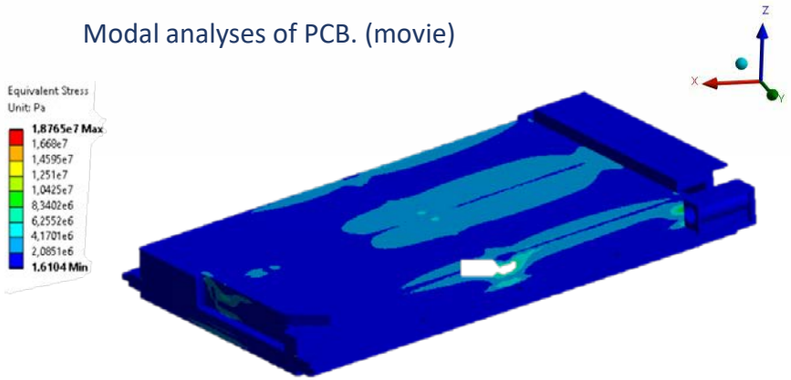
- Engineering simulation software **ANSYS 2023 R2** is used for finite element method (FEM) analyses.
- Analyses types:
  - Strength and fatigue,
  - thermal,
  - computational fluid dynamics (CFD),
  - dynamic:
    - modal,
    - harmonic vibration,
    - random vibration.



Modal analyses of PCB. (movie)



Thermal analysis of PCB.

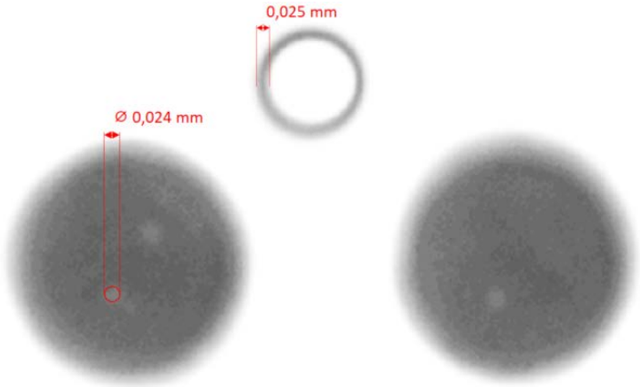


Strength analysis of case.

X-ray Inspection of Voids

GE PHOENIX X-RAY NANOMEX 180T

- Magnification up to 23320x,
- 180kV nanofocus X-ray tube,
- oblique viewing up to 70°.



Test Reports

G.L.Electronic

Wire Intrinsic Tensile Strength Report

Doc. Nr: N/A-GLE-LAB-ITSR-18A
Issue: 01
Date: 18.10.2023
Page: 1 of2

CRIMPING TOOLS QUALIFICATION
Wire Intrinsic Tensile Strength Report

ORDER IDENTIFICATION	
Order Number	N/A
Customer	N/A
Examiner	G.L. Electronic s.r.o., Hrázky 804, 768 11 Chropyně, Czech Republic
Location of Tests	G.L. Electronic s.r.o. Testing Laboratory, Podnikatelská 2902/4, 612 00 Brno, Czech Republic
Project	N/A
Items Incoming Date	17.10.2023

ITEMS IDENTIFICATION	
Received Items	10 Tensile Strength Samples.
Wire Manufacturer	N/A
Wire Manufacturer Part Number	N/A
Wire Type	TP, TP
Wire Combination	2 x 18 AWG
Wire Description	2 stranded Silver Plated Copper conductors, and Polytetrafluoroethylene (PTFE) insulation. This cable has a maximum temperature of 200°C and is rated at 600V.

NOTES

RESULTS SUMMARY		NOTES
Visual Inspection	**N/A**	

DOCUMENT

PREPARED BY		APPROVED BY		AUTHORIZED BY	
Name (Function)	Date and Signature	Name (Function)	Date, Signature and Stamp	Name (Function)	Date and Signature
N/A (Head of Testing)	18.10.2023	N/A (Quality Manager)	18.10.2023	N/A (Director)	18.10.2023
N/A (Test Operator)	18.10.2023				

CHANGE RECORD			
Issue	Date	Change Authority	Reason for Change and Affect Section
01	18.10.2023		Original Document

APPLIED PROCEDURES & REFERENCE STANDARDS		
Document ID	Issue, Revision	Description
ECSS-Q-ST-70-26C	1, 0	Crimping of High-Reliability Electrical Connections
TSTP-01-GLE	1, 0	Tensile Strength Test Procedure

E-mail: info@glelectronic.cz

G.L.Electronic

Wire Intrinsic Tensile Strength Report

Doc. Nr: N/A-GLE-LAB-ITSR-18A
Issue: 01
Date: 18.10.2023
Page: 2 of2

TECHNICAL DATA	
Length [mm]	200,00
End Treatment	Curled wire lugs, both ends.

ENVIRONMENTAL REQUIREMENTS	
Reference Standard	ECSS-Q-ST-70-26C-Rev.1(15March2017)+Corrigendum1(1June2017)
Temperature [°C]	21 ± 3
Relative Humidity [%]	55 ± 10

ENVIRONMENTAL CONDITIONS	
Temperature [°C]	N/A
Relative Humidity [%]	N/A
Atmospheric Pressure [kPa]	N/A

TEST EQUIPMENT REQUIREMENTS	
Visual Inspection	Magnification ×7 to ×40
Tensile Test	Tensile testing machine conforming to ISO 7500 class 1 or better. Axial load applied at a rate of 20 ÷ 50 mm/min ± 2 mm/min.

TEST EQUIPMENT

GLE ID Number	Description	Calibration Valid Until
GLE-MS02	Microscope FX179 - 38MP Kamera, HDMI	N/A
GLE-MEC1	Motorised force tester MecMesin 2.5 dV	N/A
GLE-MEC2	Force meter AFG 2500N	13.03.2024

* the measuring device is subject to regular calibration according to the CIUC-02-GLE and CIUA-02-GLE internal documents.

TEST RESULTS

Visual Inspection according to ECSS-Q-ST-70-26C from §5.2.4 to §5.2.7

Name (Function)	Date, Signature and Stamp	Result Sumary
N/A (Quality Control)	18.10.2023	**N/A**

Tensile Strength Test according to ECSS-Q-ST-70-26C §5.4.3.5

Test Item ID	Tensile Strength [N]
001	N/A
002	N/A
003	N/A
004	N/A
005	N/A
006	N/A
007	N/A
008	N/A
009	N/A
010	N/A
AVERAGE MAX. FORCE [N]	**N/A**

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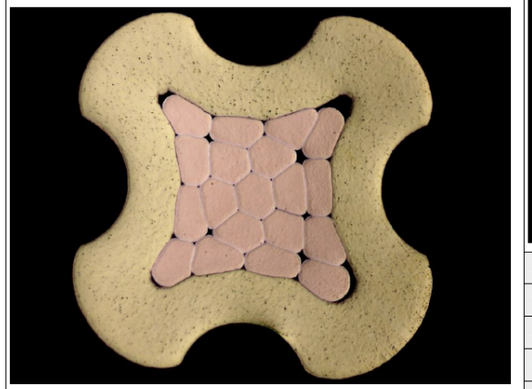
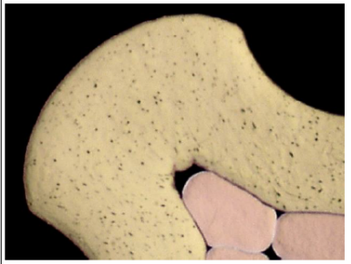
E-mail: info@glelectronic.cz
TEMPLATE NO.: ITSR-GLE-TMP

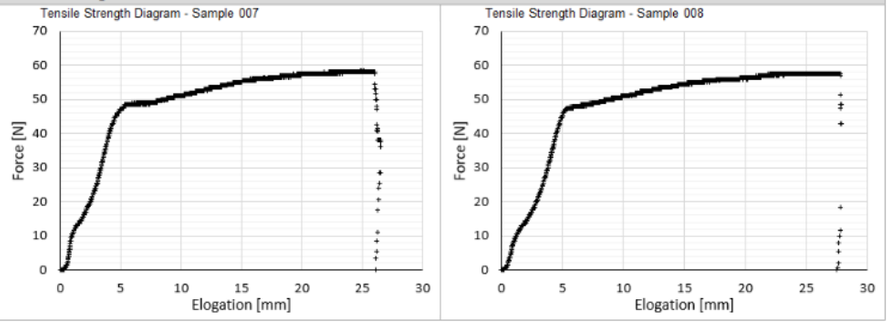
METALLOGRAPHY *acc. to ECSS-ST-Q-70-26C Rev.1 §5.4.4 – i2, i3, i5, i6*





SAMPLE ID.	**AE-8**
VOIDS	3.24 %
STRAND DEFORMATION	All strands
BARREL DEFORMATION	Yes
CRACKS	No evidence

Tensile Strength Test Result



Partnerships

Workplace Photos

Testing laboratory G.L. Electronic

G.L. Electronic

Czech Company for Aerospace Technologies

ilac-MRA

L 1774

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