

# TUNGSRAM™

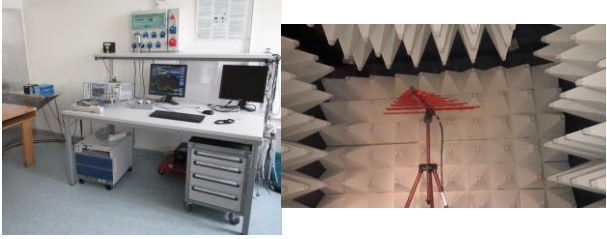


Innovation is our heritage  
EST. 1896

# TUNGSRAM LABORATORIES




October 2019






# EMC & Prod. Testing Laboratory - Overview

Laboratory	Test Method	Description
<p><b>EMC</b></p> 	<p>Conducted disturbances Harmonic currents and flicker Radiated disturbances Immunity test</p>	<p>Up to 16Amps Up to 30 Amps Up to 2GHz emission and up to 1GHz immunity 3m Anechoic chamber 3 axis Large loop antenna system with 2m diameter</p>
<p><b>Safety</b></p> 	<p>Electric strength Insulation resistance Ground continuity Protective conductor's current Touch current tests IK, IP, dust ingress tests</p>	<p>GW Instek KIKUSUI Safety testers Up to 5kV (electric strength) According to IEC60598-1</p>
<p><b>Acoustics &amp; Optics</b></p> 	<p>Noise emission test Light flicker test</p>	<p>5 x 3,5 x 2,5meter anechoic room for acoustics Stabilized ACPSU Mediator 2238 acoustic analyser for basic noise emission tests BTS256-EF light flicker and SVM analyser</p>

# EMC & Prod. Testing Laboratory - Overview

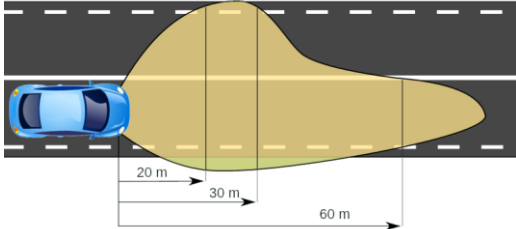

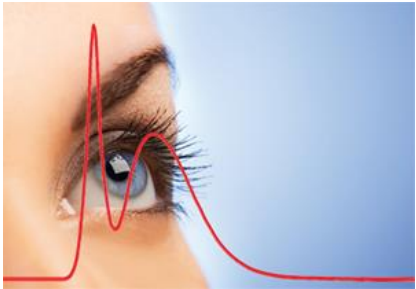
Laboratory	Test Method	Description
<p><b>Salt fog</b></p>  A white salt fog chamber with a blue top and a control panel on the right side.	<p>Endurance test</p>	<p>Salt fog chamber with 1560x740x570mm inside space</p>
<p><b>Vibration</b></p>  A white cylindrical vibration shaker mounted on a blue base with four legs. The text "TIRA vib" is visible on the side.	<p>Vibration test in different orientations, according to various protocols</p>	<p>Horizontal and vertical orientation Sine, random, and shock test Up to 6,3kN vibration exciter</p>
<p><b>Thermal and humidity tests</b></p>  Two thermal and humidity test chambers. The one on the left is blue and white, and the one on the right is white with a red top. Both have their doors open, showing internal components.	<p>Endurance test, thermal shock test, humidity test, thermal test, performance evaluation Thermal test during vibration load High temperature endurance test</p>	<p>Various type of chambers are available with different temperature ranges from -72°C up to 180°C and humidity ranges from 15% up to 100% with different inside dimensions up to 1100x1400x900mm</p>

# Photometry Laboratory - Overview

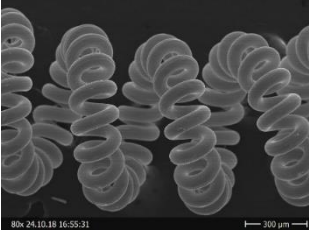

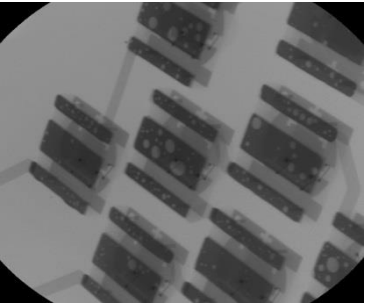
Laboratory	Test Method	Description
<p><b>Sphere Photometry</b></p> 	<p>Integrating sphere photometry and spectroradiometry in different spheres with different reflecting coefficient</p>	<p>For all kind of light sources in 10 different spheres from 0.5m to 3.3m diameter Visible spectral range 380 nm – 780 nm Color evaluation (x, y, CCT, Ri, Ra, Rg, Rf, Duv)</p>
<p><b>Gonio Photometry</b></p> 	<p>Gonio photometry and Gonio-spectroradiometry</p>	<p>2m – 25m optical distance (4pcs), spatial light distribution measurement for indoor, outdoor, automotive luminaires and all kind of light sources Spatial color uniformity measurements (<math>\Delta u'v'</math>) based on spectroradiometry</p>
<p><b>Life tests</b></p> 	<p>Life and reliability testing for all lighting product families</p>	<p>HID, CFL, HAL, LED luminaires, LED modules from 5 W – 3500 W</p>



# Photometry Laboratory - Overview

Laboratory	Test Method	Description
<p><b>Automotive measurements</b></p> 	<p>Automotive optical, electrical and geometrical measurements</p>	<p>25m optical distance, spatial light distribution measurement for automotive luminaires Photometry, Colorimetry, UV, Geometry measurements</p>
<p><b>Energy Star and DOE approval</b></p> 	<p>Measurements for Energy Star and DOE approval</p>	<p>2m – 25m optical distance (4pcs), spatial light distribution measurement for indoor, outdoor, automotive luminaires and all kind of light sources Spatial color uniformity measurements (<math>\Delta u'v'</math>) based on spectroradiometry</p>
<p><b>Photobiological Safety tests</b></p> 	<p>UV, UV-PET, NIR measurements and Blue Light hazard assessment</p>	<p>UV to NIR in the range of 200 nm – 2500 nm Blue-light hazard assessment</p>

# Material Characterization Laboratory - Overview

Laboratory	Test Method	Description
<p><b>Metallography / Microscopy</b></p> 	<p>Stereomicroscopy Optical microscopy for cross sections Scanning Electron Microscopy (SEM) with energy dispersive spectrometer (EDS) Micro Hardness Tester</p>	<p>Surface imaging and analysis of solids Determination of elements, from boron to uranium Cross sections /Grinding and polishing Hardness (HV)</p>
<p><b>Chemical Analysis</b></p> 	<p>FT Infrared Spectroscopy (FTIR)</p>	<p>Determination of structure and composition</p>
	<p>Inductively Coupled Plasma - Optical Emission Spectroscopy (ICP-OES)</p>	<p>Determination of elements in trace concentrations (ppm-ppb levels)</p>
	<p>Mercury Analysis (FIMS)</p>	<p>Mercury measurement (ppb levels)</p>
	<p>Gas analysis (GCA-MS) (GDA-MS)</p>	<p>Gas desorption and gas composition analysis</p>
	<p>Miscellaneous</p>	<p>Corrosion test, Sieve analysis (0,063-2 mm), Laser diffraction particle size analysis (0,01-2000 μm)</p>
<p><b>X-ray Analysis</b></p> 	<p>X-ray Fluorescence (XRF)</p>	<p>Qualitative / quantitative information on the elemental composition (0,01-100 w%)</p>
	<p>X-ray Diffraction (XRD)</p>	<p>Crystal structure analysis</p>
	<p>X-ray radiography (XCT)</p>	<p>Non-visible internal structures</p>

# TEUNGSRAM

*GLASS:*

*Laboratory Tests*

*Production & Engineering*

*Support*



# Glass lab and engineering support service potentials

Testing technical (Soft and Hard) glass physical and chemical properties:

- Test glass compositions ( chemical property measurements)
- Measure, compare glass physical properties
- Test, analyze technical glass compositions for batch and melting corrections
- Glass composition, property validations
- Glass bench mark tests
- Raw material/batch tests for quality assurance purpose
- Glass defect analyses

Glass engineering – melting & processing support service:

- Remote engineering/quality consultations
- Onsite engineering support ( Hot and cold end)
- Consultation to identify glass melting and processing issues
- Support solving glass quality problems



# Glass Laboratory capabilities - 1

Test capabilities	Applications	Method
Glass production inprocess controls	Incomming raw material inspection	Test physical/chemical properties to quality control XRF, XRD, ICP, glass sample preparation Test evaluation Sieve analyses gravimetric density Titration, LOI, Cl measurements
	Test special components in the glass	Chemical properties to quality control Sample preparation for ICP / evaluation
	Test Glass physical properties	Test physical properties to quality control Sample preparation Measurement of glass softening point, Tg, Tk100, Density
	Auxiliary material tests	Filter dust chemical property measurement Sample preparation for XRF tests Test result evaluation

# Glass Laboratory capabilities - 2

Test capability	Applications	Method
Glass production melting controls	Glass property measurement at furnace start or glass composition changes:	Test physical/chemical properties to production control OML, XRF, ICP, glass sample preparation Test result evaluation Corrective action for production control
Measure special glass parameters	Special glass property measurement for quality control.	Water durability / glass weathering Glass Redox state Glass density Tk100 Glass refractive index
Glass defect analyses	Identify glass melting issues, the possible origin of glass defects for quality control.	Identify origin of stones, knots, cords, blisters Sample preparation for ELMI test Test evaluation Identify origin of surface cracks and scratches Identify origin of discoloration, contaminations

# Glass Laboratory capabilities - 3

Test capability	Applications	Method
New raw material qualification	Identify new suppliers for cost control, for glass production and lamp components	Test physical/chemical properties to qualification Test result evaluation Supplier validation Specification for new material for production introduction
Lamp glass component benchmarks	Special glass property measurement to compare glass applicability for lamp production purpose Lamp production glass component issues	Test physical/chemical properties to compare alternative components Identify glass composition, possible supplier Component consultancy for lamp development Identify origin of glass defects
New glass product development	Develop new or modified glass compositions	Benchmarking of alternative glass products Glass composition development Small scale glass test melt

