

MATERIAL TESTING

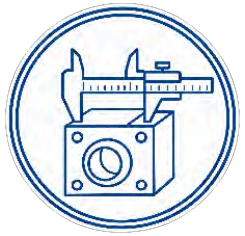


COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL Research & development



DESIGN AND
ENGINEERING SUPPORT



ENGINEERING
SERVICES

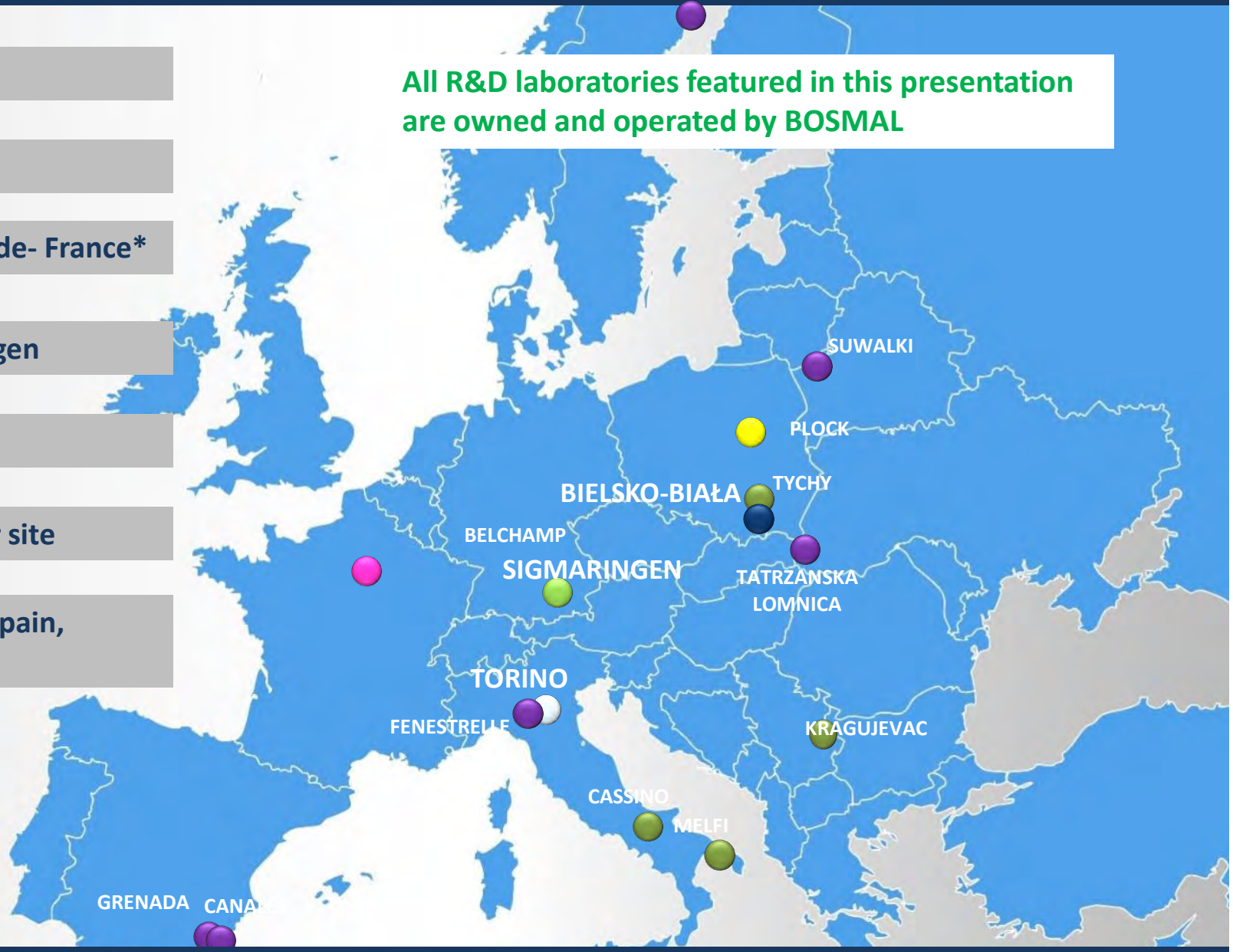


HOMOLOGATION
TYPE APPROVAL

- The headquarter: Poland, Bielsko-Biała
- Subsidiary: BOSMAL Italia s.r.l. – Italy, Torino
- Temporary test site : BELCHAMP – France, Île-de- France*
- Customer representation: Germany, Sigmaringen
- BOSMAL Branch/ Customer site – Płock
- BOSMAL Customer site / temporary Customer site
- Other BOSMAL's temporary test sites – Italy, Spain, Sweden and other European countries

* - available soon

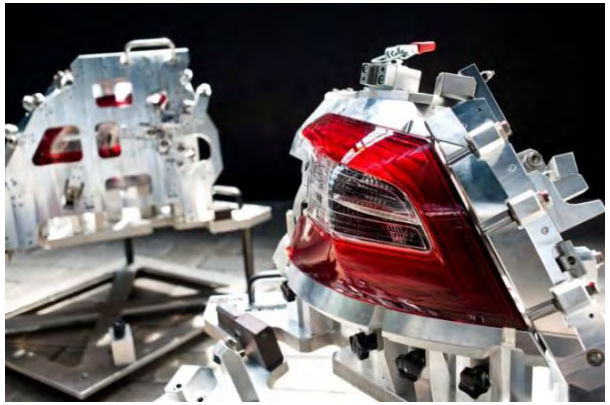
All R&D laboratories featured in this presentation are owned and operated by BOSMAL



BOSMAL RESEARCH & DEVELOPMENT

- **Research and Development Center (with that legal status)**
- **Testing laboratory accredited by the Polish Centre for Accreditation (PCA), accreditation No. AB 128, with more than 600 accredited test methods**
- **Authorised to conduct type-approval testing of vehicles, systems, components and equipment, including internal combustion engines, electric motors and batteries, within the scope of the applicable authorisations.**
- **Certified, integrated management system (PN-EN ISO 9001:2015-10, PN-ISO 45001:2024-02 and PN-EN ISO 14001:2015-09)**
- **Certificate AQAP 2110:2016 - confirming compliance with NATO quality requirements in design, development and manufacture**
- **License of the Ministry of Interior and Administration No. B-138/2023 to conduct business activities in the field of production and trade in explosives, weapons, ammunition and products and technology for military or police purposes**
- **TISAX label. Results of Institute are available at https://enx.com/tisax**
- **Research, testing and engineering services, mechanical tooling design and manufacture, and engineering support for customers' production processes.**
- **Personnel: 340 employees, including 230 engineers**











MATERIAL TESTING

1. **material composition analysis** (metals, metal alloys)
2. **non-metallic materials constitution and composition analysis** (rubber, plastics, solvents, paints, fuels, and lubricants)
3. **chemical and physicochemical tests**
4. **examination of galvanized and organic coatings (paints):** corrosion tests, thickness measurement, scratch and adhesion testing
5. **material resistance to light and climatic environment (ageing tests)**
6. **cleanliness analysis of parts and components,** including inclusions and contamination, with a focus on their composition and constitution

















7. **materials VOC** (Volatile Organic Compounds) **analyses**
8. **emission testing of hydrocarbons and halocarbons**
9. **tests of petroleum products: fuels, oils, lubricants, coolants for radiators, brake fluids, anaerobic adhesives, sealing compounds, and other materialst**
10. **thermal analysis**
11. **aging, heat cycles, environmental trials, low and high temperature resistance testing** of materials and components

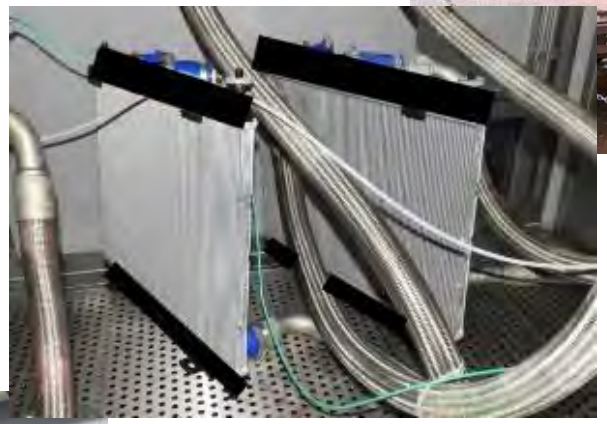
55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

COMPONENT & ASSEMBLY TESTING

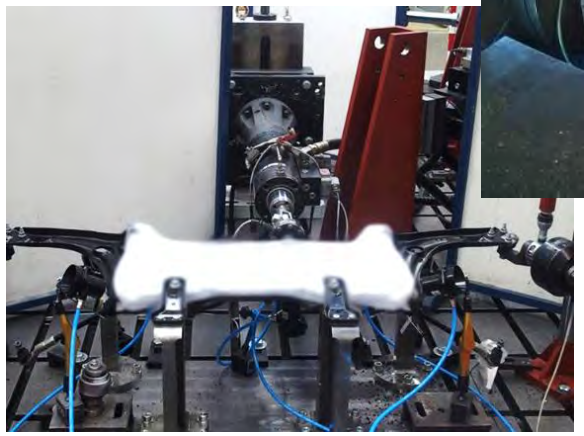
Tests of:

1. engines and exhaust aftertreatment systems
2. transmissions and gearboxes
3. braking systems
4. hydraulic hoses
5. heat exchangers
6. suspension systems
7. windows
8. automotive parts and assemblies
9. chassis and body components









Vibration system dedicated for EV large battery testing





Tests:

10. resistance, durability, material, functionality
11. vibration, vibroacoustic (NVH) and tensometric
12. static and dynamic twist tests
13. aging, climatic, temperature, corrosion resistance
14. resistance to water
15. dust resistance
16. pressure
17. thermovision
18. photometric
19. electrotechnical and electronic
20. photobiological safety assessment

ROAD TESTING, EMISSION TESTING & ENGINE/POWERTRAIN TESTING

2 x Emissions Testing Laboratories (including 4x4 and climatic chamber)

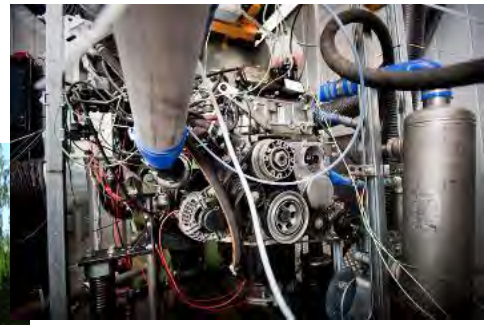
1. **road tests**
2. **hybrid and electric vehicles/parts testing**
3. **static tests** of vehicles, machines, equipment and parts
4. **engine and exhaust aftertreatment** system tests
5. **exhaust emission and fuel consumption tests:** RDE – Real Driving Emissions (PEMS – Portable Emission Measurement System)
6. **exhaust emission and fuel consumption tests:** at engine test cells (at temperatures of -35˚C to 60˚C, on various road surfaces, different climate conditions and route profiles
7. **dynamic vehicle tests** on 2WD and 4WD chassis dynos

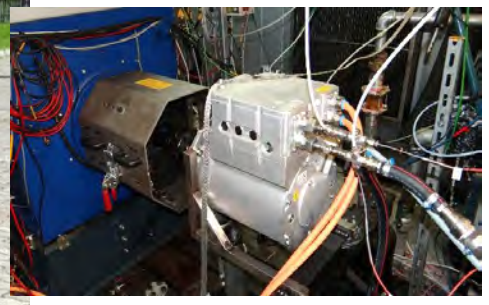












8. **vehicles, machinery and devices testing** in large chambers under high and low temperatures (ranging from -45°C to 75°C or -35˚C to 60˚C)
9. **vehicle functionality testing**
10. **engine durability testing**
11. **engine development testing**
12. **calibration work**
13. **testing engine oils and liquids**
14. **testing for type approval**
15. **Conformity of Production**
16. **ISC** (In-Service Conformity)
17. **MS** (Market Surveillance)

DESIGN AND ENGINEERING SUPPORT

Mechanical design and engineering

- Development of design requirements and technical specifications.
- CAD modelling and preparation of technical drawings.
- Engineering calculations and finite element analysis.
- Design modifications and optimisation.

Mechanical tooling

- Design and manufacture of bases, holders, locating fixtures, checking fixtures and templates.
- Models and prototypes of mechanical tooling.
- CNC machining and CAD/CAM programming.

Verification and customer support

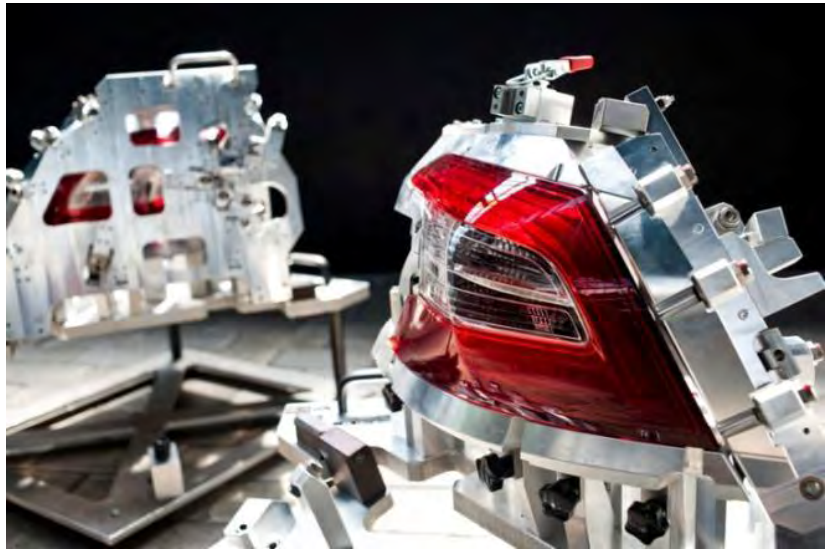
- Dimensional inspection and measurement reports.
- Functional verification of tooling against agreed requirements.
- Engineering support for implementation at customers' facilities.

Mechanical design

- 3D CAD modelling
- Preparation of 2D technical drawings
- Conversion of CAD drawings and models between file formats

Engineering calculations and simulation

- Linear static analysis
- Nonlinear static analysis
- Dynamic analysis
- Modal analysis — natural frequencies and mode shapes
- Coupled-field analysis



One-off and small-batch manufacture of mechanical tooling

- Bases and holders
- Mounting fixtures for vibration testing
- Checking fixtures and templates
- Locating and clamping fixtures
- Workshop aids

Precision machining

- Milling
- Turning
- Grinding
- Wire electrical discharge machining (WEDM)

Dimensional inspection and measurement reports

- Coordinate measurements using CMMs
- Verification of tooling dimensions against technical drawings
- Preparation of measurement reports

ENGINEERING SERVICES

Engineering support and manufacturing through external partners

Staff augmentation (Body/ team leasing):

1. **Engineering staff augmentation (including residents)**
2. **Auditors/ experts outsourcing**
    1. System audits
    2. Product/ service audit
    3. Process audit
    4. Interim Management

Special production

1. 3D Printing
2. Precision parts
3. Surface coating
4. Parts Machining – technologies
5. Injection Moulding

Individual design

1. Body Systems
2. Exterior trim systems
3. Interior Trim Systems
4. New Product Development (NPD)
5. Modeling and engineering calculations
6. Draughting and Markup
7. Product analysis and optimization
8. 3D scanning and reverse engineering
9. Assembly design
10. Data Management
11. Materials

Opinions, analyzes, trainings and workshops

1. Technical analyses and opinions
2. Opinions on innovativeness
3. Root cause analysis (RCA) of non-conformances of components and subassemblies
4. Verifications of the conformity of vehicle production with the producer's requirements,
5. Trainings on type-approval regulations and requirements
6. Workshops on material testing





Development and optimization of processes in the company

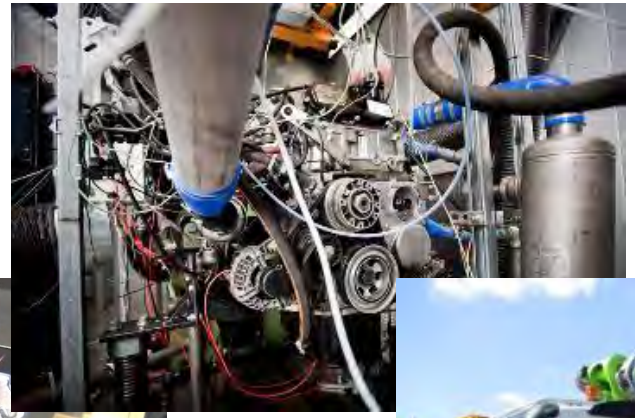
1. Production processes simulation
2. Organization of purchases
3. Implementation and improvement of management systems
4. ERP/CAD/CAM/PLM systems
5. Production planning
6. Organization of the supply chain (logistics and warehouses)
7. Total Productive Maintenance (TPM)
8. Analysis and verification of manufacturing technology
9. Energy audits
10. Analysis and optimization of production and/or management processes

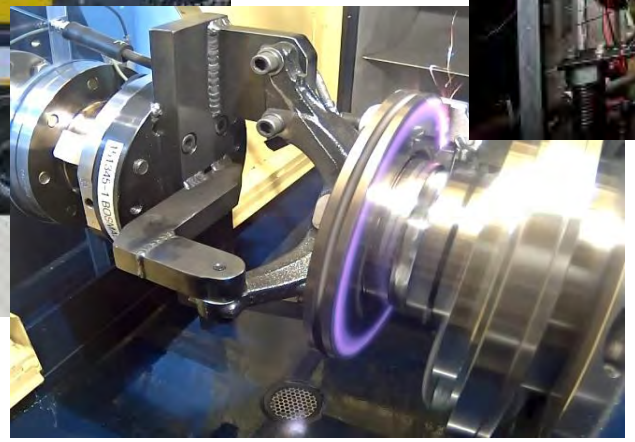
HOMOLOGATION - TYPE APPROVAL

1. **Type-approval tests for vehicles or vehicle** types for the following vehicle categories: M, N, O, L, T, R, C, S;
2. **Type-approval tests for equipment or parts** for the following vehicle categories: M, N, O, L, T, R, C, S;
3. **Type-approval tests for the installation of additional gas supply** systems in vehicles for the following categories: M and N;
4. **Conformity of production (COP) inspections** for vehicles, equipment, or parts (M, N, O, L, T, R, C, S), as well as conformity inspections for the installation of additional gas supply systems (M, N);
5. **Tests to confirm compliance with the relevant conditions or technical** requirements for national individual vehicle approval for the following categories: M, N, O, L, T, R, C, S;
6. **Tests to confirm compliance with the relevant conditions or technical requirements** for EU individual vehicle approval for the following categories: M1, N1, and special vehicles M, N, O.







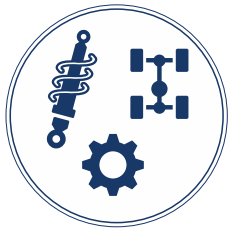








MATERIAL TESTING



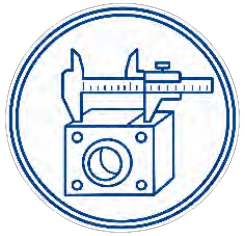
COMPONENT
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BOSMAL

material testing



DESIGN AND
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ENGINEERING
SERVICES

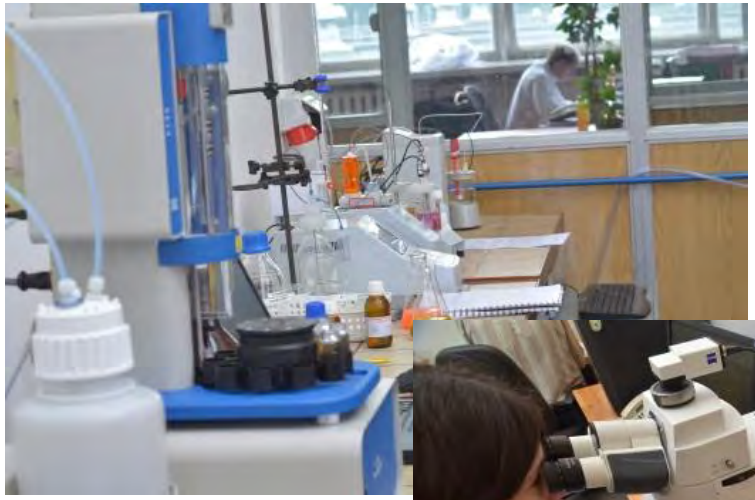


HOMOLOGATION
TYPE APPROVAL

MATERIAL TESTING - SELECTED AREAS

Chemical Laboratory:

- Identification
- Chemical composition
- Emissions
- Cleanliness



Metallographic Laboratory:

- Mechanical properties
- Microscopic analyses
- Failure analyses



Plastic, Rubber and Coatings Laboratory

- Environmental resistance (temperature, humidity, light …)
- Corrosion resistance
- Mechanical properties
- Physico-chemical properties (flammability, abrasion, impact resistance …)



MATERIAL TESTING

- Material identification
- Chemical composition
- Emissions from materials
- Internal and external cleanliness of products
- Metallographic analyses
- Scanning electron microscopy (SEM)
- Environmental resistance
- Corrosion testing
- Physico-chemical properties
- Component & assembly testing
- Exemplary research equipment
- Accreditation
- Certificates
- Customers' recommendations and accreditations



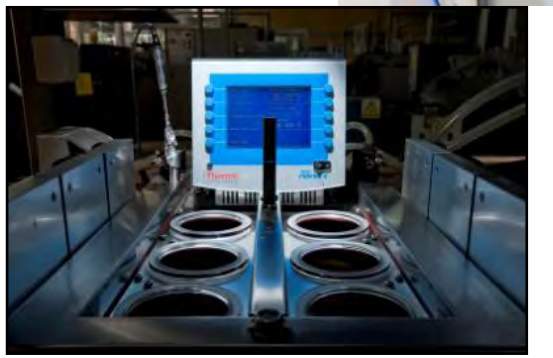
















55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

MATERIAL TESTING - OVERVIEW

Materials development:

- support in the development and implementation of new materials, components and composites used in the automotive industry
- material tests, functional and durability tests as well as integration tests of materials and components



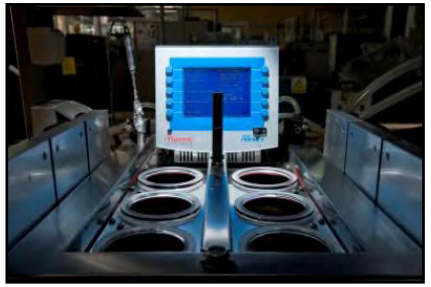


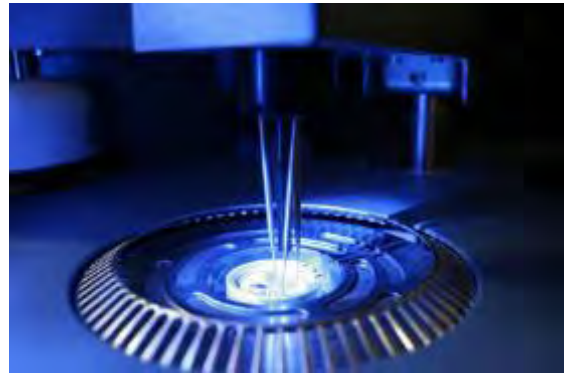












- material composition analysis (metals, alloys of metals)
- non metallic materials constitution and composition analysis (rubber, plastics, solvents, paints, fuels and lubricants)
- chemical and physicochemical tests
- galvanized and organic (paints), coatings examination (corrosion tests), thickness, scratch (adhesion)
- material resistance to light and climatic environment (ageing tests)
- cleanliness of parts and components inclusions and contamination analysis regarding its compositions and constitutions
- materials VOC (Volatile Organic Compounds) analyses
- emission testing of hydrocarbons and halocarbons
- tests of petroleum products: fuels, oils, lubricants, coolants for radiators, brake fluids, anaerobic adhesives, sealing compounds, other materials
- thermal analysis
- tests of ageing, heat cycles, enviromental trials, low and high temperature resistance of materials and components

MATERIAL IDENTIFICATION

Materials identification is very important in quality assurance and analysis of failures and their causes.
The knowledge and experience of our staff and the wide, continuously expanding analytical facilities allow identification of: plastic, rubber and petroleum products; metals and their alloys

In case of **metal and their alloys** is usually based on:

- by optical emission spectrometry with inductively coupled plasma (ICP-OES)
- X-ray fluorescence with wavelength dispersion (WD-XRF)

In case of **plastic materials** is usually based on:

- Fourier transformation infrared spectroscopy (FTIR)
- Differential scanning calorimetry (DSC)
- Thermogravimetry (TGA) also with infrared spectroscopy (TGA-FTIR)







CHEMICAL COMPOSITION

We conduct **chemical composition tests** (determining the content of main and trace elements) of different type and sample origin, among others:

- metals, metal alloys and sinters, among others: iron alloys, cast iron, aluminium and aluminium alloys, copper and copper alloys, zinc and zinc alloys, nickel and nickel alloys and others
- dusts, sediments, residues, liquid and solid samples of various origin, water
- petroleum products, including fuels (gasoline, diesel, biodiesel and others), biocomponents, engine oils, transmission oils, lubricants, cooling fluids and others
- plastic, rubber, fabrics, textiles, foams, etc.
- anti-corrosion coatings









EMISSIONS FROM MATERIALS

We conduct tests of products and materials in terms of **emissions of volatile substances** and **emitted odours**. Organic substances emitted from tested products and materials, after being absorbed on suitable solid adsorbents or directly from the sample are analysed using gas and liquid chromatography methods. Volatile and semi-volatile organic compounds, carbonyl compounds (including aldehydes), phthalates, amines and nitrosamines are quantitatively and qualitatively analysed.







Examples:

- **Determination of volatile, semi-volatile and heavy organic compounds (VOC, SVOC, FOG) by direct thermal desorption and chromatographic analysis**

  Standards: VDA278, GMW15634 …

- **Total volatile organic compounds emission (TVOC) and detrmination of specific substances using a headspace sampler**

  Standards: VDA 277, PV3341, VCS 1027,2749 ….

- **Determination of organic compound emission using a microchamber**

  Standards: ISO 12219-3, TPJLR.52.104 …

EMISSIONS FROM MATERIALS

Examples:

Determination of formaldehyde and carbonyl compounds emission

Standards: VDA 275, PV3925, VCS 1027,2739….

Volatile substances emissions in a 1 m3 emission testing chamber

Standards: GS 97014 (-2,3,4), VDA 276, PV3942, ISO 12219-4 ….

This test method is dedicated for assemblies and large components and allows on-line monitoring of hydrocarbons emission during the test and determination of VOC,SVOC, carbonyl compounds, amines and nitrsoamines by chromatographich analyses (GC-FID/MS, HPLC, GC-NPD) and odor





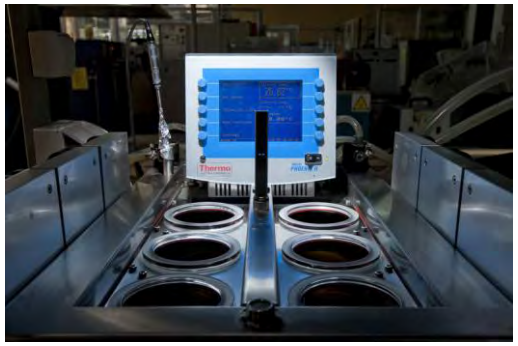


Fogging tests

Standards: DIN 75201, SAE J1756, PV3015 …

These tests consist of condensation of evaporated, volatile components from interior equipment on vehicular window glass, the front windscreen in particular and are also important in case of modern headlights testing.





Odor testing

Standards: VDA 270, PV3900, MS 300-34, TSM 0505G …

This tests are conducted directly in laboratory glassware by a trained odor panel. Both the intensity of the smell (on a suitable scale), the type of smell (description) and subjective feelings (pleasant, unpleasant) are evaluated.

Additionally, we conduct tests of material and product smell after emission tests in a 1m3 chamber, as well as evaluation of the smell and air quality in vehicle cabins. Samples are collected into inert bags and evaluated using an olfactometer.





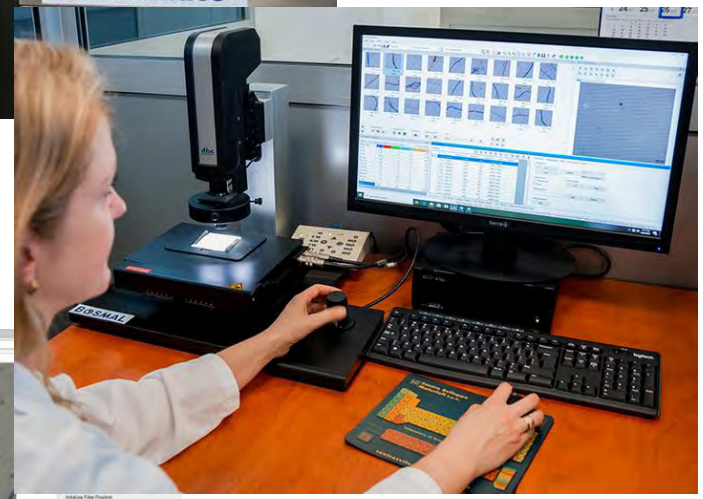
INTERNAL AND EXTERNAL CLEANLINESS OF PRODUCTS

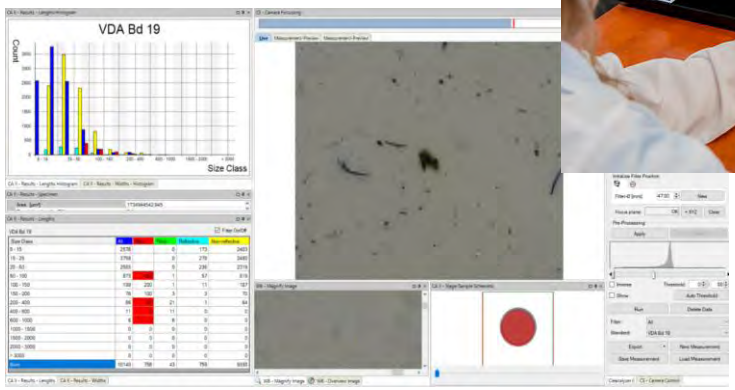
Product cleanliness testing is a very important element in the quality assessment of many components, especially those having contact with operating fluid. Such tests are carried out in a clean room of ISO 6 cleanliness class (according to ISO 14644).

The basic factors determining the purity of the tested object are: mass of insoluble impurities, mass of soluble impurities, amount of insoluble impurities of a certain size and type of contamination. In the case of insoluble (solid) impurities, it is possible to divide them according to their nature: metallic, non-metallic and fibers, as well as by chemical composition.

The choice of the extraction method depends on the characteristics of the tested object and on the specified properties: internal/external/overall purity.







Extracted pollutants are analyzed by the following methods:

- gravimetric – the mass of contaminants
- microscopic – the quantity and size of the contaminants
- scanning electron microscopy (SEM)– the chemical composition of the impurities
- infrared spectroscopy – the chemical composition of organic impurities

METALLOGRAPHIC ANALYSES

- **Mechanical properties**

  Standards: ISO 6892-1, ISO 2739, ISO 8492 …

- **Non-destructive tests – material discontinuites**

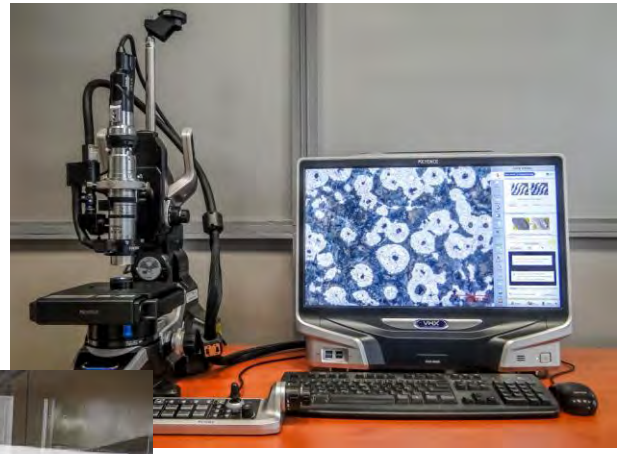
  Standards: EN 26157-1, ISO 6157-2 …

- **Metallographic examination:**
  - Microstructure assessment.
  - Graphite classification
  - Determination of decarburisation depth
  - Grain size assessment.
  - Non-metallic inclusion assessment.
  - Layer thickness measurement.

- **Hardness**

  Standards: ISO 945-1, ISO 3887, ASTM E45, ASTM E112 …











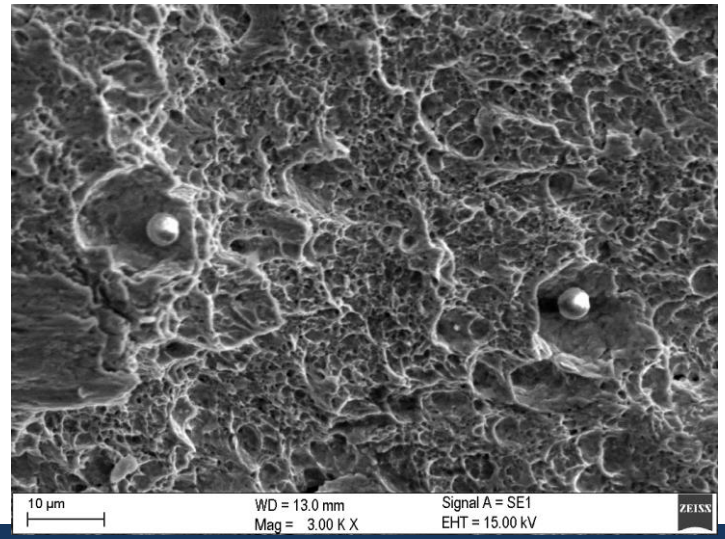
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SCANNING ELECTRON MICROSCOPY (SEM)

Scanning electron microscope with the ability to work in both high and low vacuum mode, which allows analysis of both conductive and nonconductive samples. It has the ability to image SE (secondary electron) and BSE (backscattered electron), it is also equipped with EDS analyzers (energy dispersive X-ray spectroscopy) and EBSD (electron backscatter diffraction) from Bruker.



- Qualitative and quantitative analysis and mapping of elemental composition of samples.
- Evaluation of fractography of the fracture surface to determine the nature of the crack, material discontinuities and, for example, hydrogen embrittlement.
- Analysis of the size and type of non-metallic inclusions.
- Linear microanalysis of coatings and diffusion layers.
- Classification of pollutants on the filters – cleanliness tests.
- Possibility to test samples with larger dimensions (300x200x200 mm) due to the large chamber.



ENVIRONMENTAL RESISTANCE

External conditions like temperature, humidity or light may have effect on materials properties (mechanical, visual, aesthetic, haptic…). BOSMAL have broad possibilities to check the effect of various conditions on tested materials:

- Temperature: -70 … 210 oC
- Humidity: 0- 98 %RH also 100 %RH (condensation)

- **Ozone resistance**

A rubber or thermoplastic rubber's resistance to cracking when subjected to static or dynamic stretching strains is assessed in air at a specified temperature, humidity and concentration of ozone, with the direct action of light being eliminated.

The ozone chamber with a working volume of 310 litres also permits tests on non-rubber materials to be carried out, at a wide range of ozone concentrations: from 25 to 1000 pphm.

- Resistance to various fluids and substances (fuels, oils, windshield fluid, hand cream, lotion …)







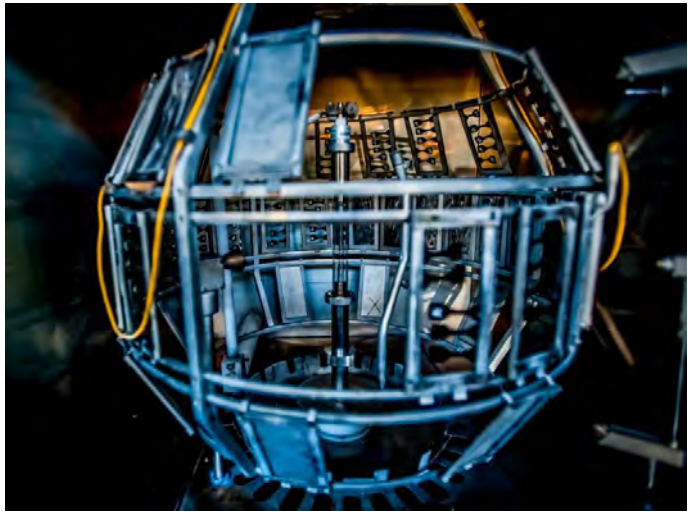
ENVIRONMENTAL RESISTANCE

Resistance to weather conditions – Xenon-arc lamps

The test method consists of exposing working samples to artificial weather conditions (filtered xenon lamp, temperature, humidity and precipitation) in order to simulate ageing processes that occur as a result of natural weather conditions, in the laboratory.

Standards: ISO 4892-2 (met. A), ISO 16474-2 (met. A), ISO 105-B04 …





Resistance to light

The test method consists of determining the colour fastness and ageing characteristics of the products in response to artificial light simulating natural daylight passing through window glass with the unmistakable action of heat. The working sample of the tested product is subjected to artificial light under defined conditions. Colour fastness is assessed by comparing the colour change of the test specimen to a non-exposed specimen

Standards: ISO 4892-2 (met. B), ISO 16474-2 (met. B), ISO 105-B02 …



CORROSION TESTING

Objects are tested in **artificial corrosive atmospheres** (e.g. salt spray, immersion in corrosive solutions, sulfur dioxide environment, specific climatic conditions, condensation of water vapor, etc).

The surfaces of the objects and their base material are evaluated. Tests can be performed on reference samples (e.g. coated and/or galvanized vehicle body parts) or on finished objects (e.g. LPG tanks, bumpers, wipers, heat exchangers, rocker arms, brackets, covers, etc.). The laboratory also has the ability to test items not related to the automotive industry.

Standards: ASTM B117, ASTM G85, ISO 9227, ISO 6988

So-called **internal corrosion** tests are also performed in the laboratory, where test objects (mainly heat exchangers) are subjected to simulated operation with fluids causing accelerated corrosion, or exhaust gas condensate.









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Noxious Gases Test

The test in flowing mixed gas corrosion test allows to determine the corrosive effect of the working and storage environment on electrotechnical components, especially contacts, terminals and connections (considered both separately and as integrated into a component or assembled as a complete equipment).

Tested samples are placed in the AirEvent Gas/600/0 chamber under various temperature and humidity conditions, in the atmosphere of single corrosive gas or their mixture: Cl2, SO2, NO2, H2S

Gases are mixed with together depending on the test method and/or Customer requirements. The working range of gases concentration is from 10 to 500 ppb.

Gases concentration are monitored with the use of SPM Flex analyser

Preferred test duration is 4, 7, 10, 14 or 21 days.

Standards: IEC 60068-2-60, EN 60512-11-14, ASTM B845-97 …





New investment
Launch date: Q4/2026

Cyclic Corrosion & Aggressive-Climate Resistance of Coatings and Vehicle Components (Walk-In Chamber)

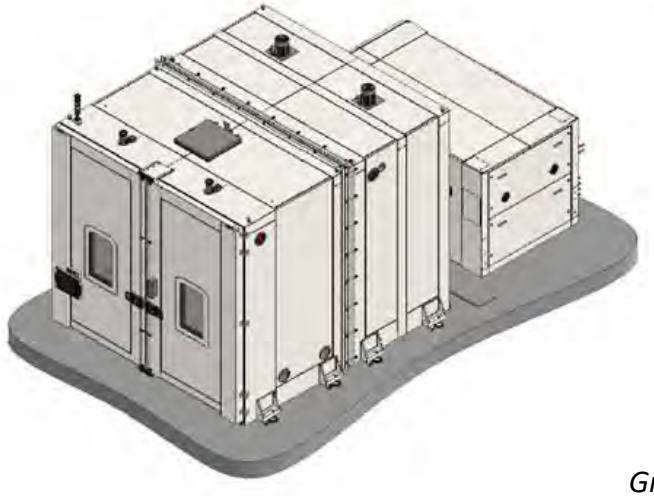


The chamber reproduces salt-mist exposure, condensation, temperature and humidity cycling, and drying phases to assess corrosion resistance and durability of coatings, parts and assembled modules under accelerated, repeatable conditions.

Parameters / key information

- Supported modes: salt mist, condensation, temperature/humidity cycling, drying.
- Operating envelope and rates: see table:

Parameters	value
Workspace (H x L x W)	2 x 4 x 2,5
Cooling rate	5 K/min (max 10 K/min)
Heating rate	5 K/min (max 10 K/min)
Temperature range	−50 °C to +180 °C (up to +200 °C)
Humidity range	10 % RH – 98 % RH



Conformance:

- VDA 233-102:2013-06,
- PV 1210:2016-02,
- PV 1209:2023,
- PN-EN IEC 60068-2-52:2018-05 (Test Kb),
- DIN 55635:2019-05 and EN ISO 11997-3:2023-10.

Graphics and photos - illustrative

PHYSICO-CHEMICAL PROPERTIES

- **Melting temperature, crystlization, glas transition, deg crystalinity**
  - Standards: ASTM D3418, ISO 11357 (-1,-2,-3), ASTM E1356 …
- **Impact testing acc. to Charpy and Izod**
  - Standards: ISO 179-1, ISO 180
- **Flammability - horizontal and vertical**
  - Reference documents include ISO 3795, UN Regulation No. 118, DIN 75200 and FMVSS 302, as applicable to the selected test method.
- **Density**
  - Standards: ISO 1183-1, ISO 2781 …
- **Coating gloss (20°, 60°, 85°)**
  - Standards: ISO 2813
- **Hardnes**
  - scales / methods: Sh A, Sh AM, IRHD-M
- **Wear resistance - abrasion**
  - Standards: ISO 15082, ISO 7784-2, ISO 105-12 …
- **And many others….**

















Aging tests, climatic and temperature tests, corrosion resistance

The Institute offers a wide range of tests in climatic, temperature, pressure and salt chambers



























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EXEMPLARY TESTING EQUIPMENT

Agilent 7890A gas chromatograph



Emission of hydrocarbons and freons



Chemical composition of materials



Tests of volatile compounds



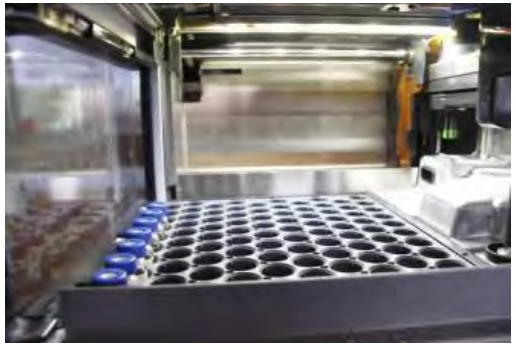
Odour testing



Microstructure of metals and metal alloys



Liquid chromatography



Internal and external cleanliness of products



Product light and weather conditions resistance tests



Color spectrophotometric measurements



Aging tests, environmental tests, pressure cycles, resistance to low and high temperatures



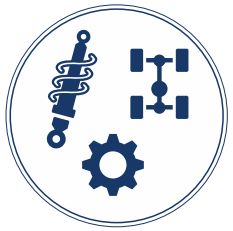
Materials, coatings, components corrosion resistance tests



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MATERIAL TESTING

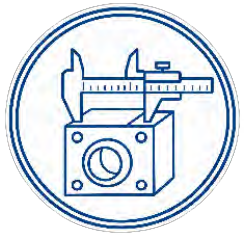


COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL component & assembly testing



DESIGN AND
ENGINEERING SUPPORT



ENGINEERING
SERVICES



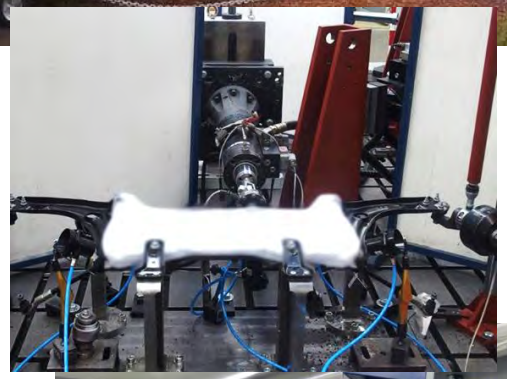
HOMOLOGATION
TYPE APPROVAL

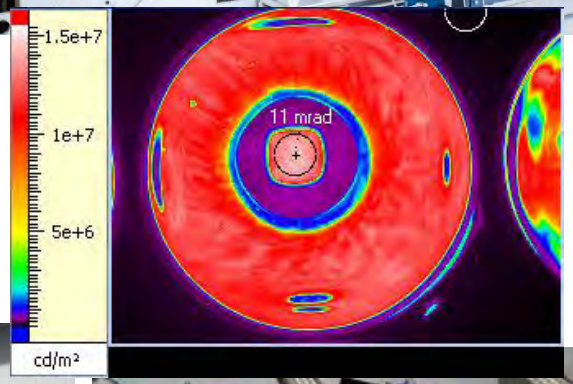
DURABILITY AND FATIGUE TESTS OF AUTOMOTIVE PARTS AND ASSEMBLIES

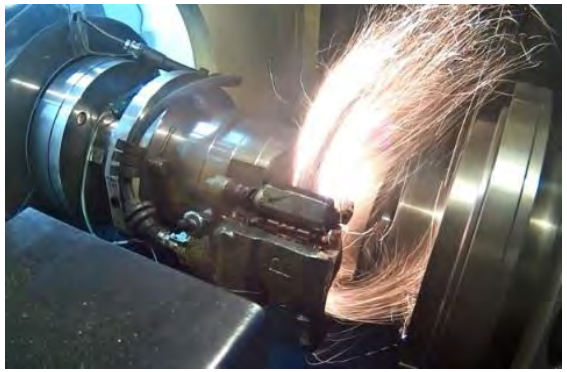
- Durability and fatigue tests of automotive parts and assemblies
- Heat exchangers testing
- Transmission testing
- Braking systems testing
- Vibration tests
- Vibration, vibroacoustic (NVH)
- High pressure tests
- Water & dust resistance
- Aging, climate, temperature, corrosion tests
- Photometric and photobiological measurements, thermovision
- Electric/ electronic automotive components testing
- Battery tests
- Electromobility
- Metrological measurements
- Accreditation
- Certificates
- Customers' recommendations and accreditations





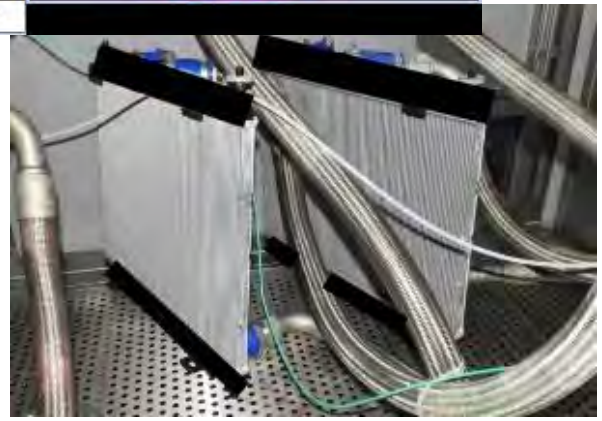












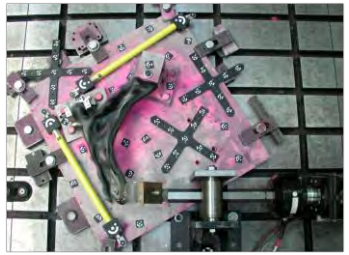
55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

DURABILITY AND FATIGUE TESTS OF AUTOMOTIVE PARTS AND ASSEMBLIES

Durability and fatigue tests

- Durability tests of various parts and assemblies, e.g. two-dimensional loads - rotation and force control
- Fatigue tests of assemblies, e.g. radiators, cooling fans, fuel tanks
- Fatigue test of the shock absorbers
- Squeak and rattles tests
- Fatigue testing of components and systems using random excitation defined by a Power Spectral Density (PSD) profile.
- Static and dynamic torsion tests of various parts



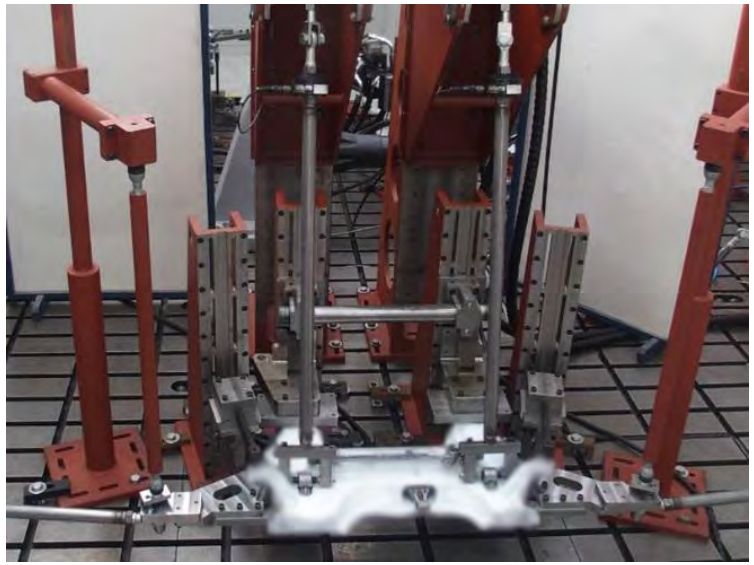


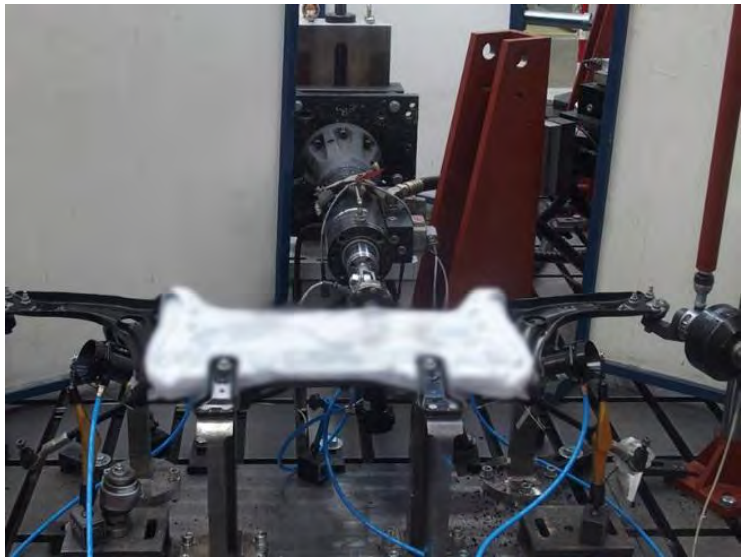




Durability test – multiaxial load

MTS and INOVA multiaxial test stands







HEAT EXCHANGERS TESTING

The scope of heat exchangers tests:

- pressure cycles
- thermal efficiency
- thermal shocks
- thermovision measurements
- ageing
- internal / external corrosion / erosion
- freon emission
- helium tightness – product tightness tests
- vacuum resistance - product tightness tests
- water resistance
- metallographic
- cleanness
- vibration
- durability tests of electric fans
- acoustic measurements in an anechoic chamber
- burst tests
- strain gauge measurements
- fatigue and durability

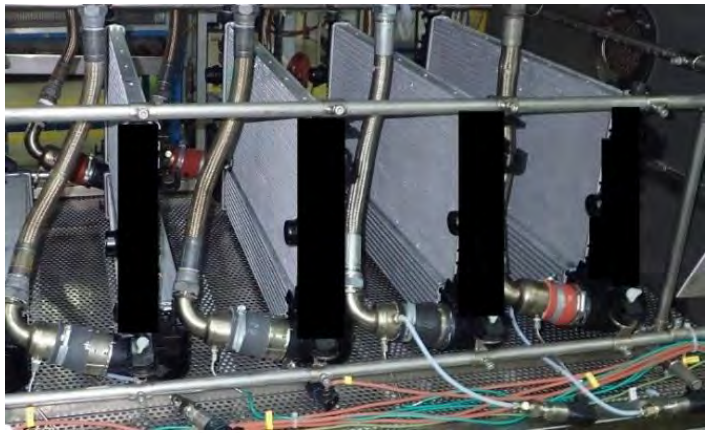
Tests of:

- Coolers
- Heater cores
- Intercoolers
- Condensers
- Fans + shrouds

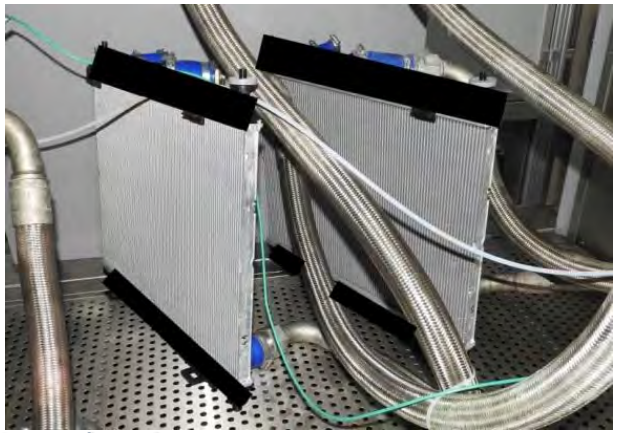




Tests according to the standards of:
BMW, FIAT, Ford, GM, Jaguar, Mazda, Mercedes, Nissan, PSA, Renault, Volvo, VW, Toyota i innych.



Pressure cycles (ait)



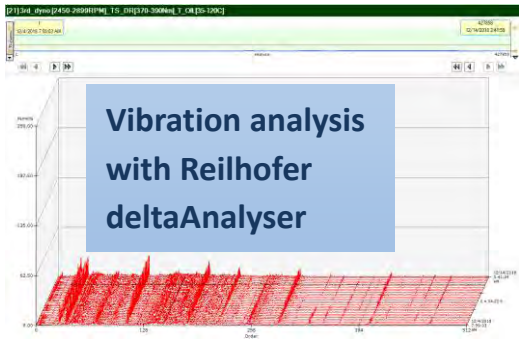
Internal erosion test

Dynamic transmission test bed for both manual, automatic transmissions and eDrive – drivetrain testing

- Suitable for both manual, automatic transmission and eDrive – drivetrain testing activity
- Durability and dynamic tests of transverse 4x2 drive systems
- Simulation of road load, vehicle, engine, driver, vehicle brake and starter
- Control of vehicle speed via accelerator pedal and vehicle brake (acceleration and deceleration)
- Simulation of various driving behavior (sporty, economic behavior, ...)
- Simulation of various driving situations (starting from rest, acceleration, deceleration, hill driving, coast down)
- Vibration spectrum analysis with **Reilhofer deltaAnalyser**



eDrive gearbox testing



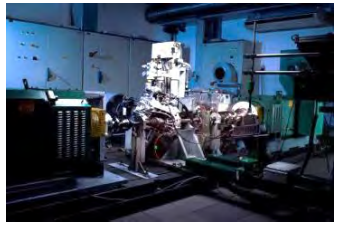


eDrive drivetrain testing with 250kW emulator



Steady state transmission test bed for manual transmissions

- Suitable for manual transmissions testing
- Steady state durability tests of transverse 4x2 drive systems
- Vibration spectrum analysis with Reilhofer delta Analyser





BRAKING SYSTEMS TESTING

Capabilities:

- Performance testing
- Effectiveness / friction characteristics / friction coefficient testing
- Fade / mountain descend
- Friction material wear simulation
- Thermal fatigue / cracking tests
- High load / strength tests
- NVH – Noise & Vibration measurements (AK-Noise ABC Sections)
- DTV – Disc Thickness Variation measurements
- Static torque simulation
- Parking brake system
- Water spray system
- SAE, ISO, JASO, UNECE and OE, OES & OEM test specification

Functional and durability tests of disc and drum brakes on a real scale of :

- friction linings: brake pads and shoes
- brake drums
- full and ventilated brake discs of each type and made of each material

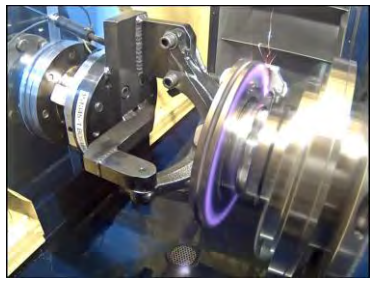
Technical specification	
DC Drive Motor	186 kW
Speed range	0 - 2800 rpm
Braking torque	0 - 8000 Nm
Inertia	5 - 250 kgm^2
Pressure	0 - 205 bar
NVH	Class 1 - Noise & Vibration
DTV	4 capacitive sensors
Static torque	0 – 18 rpm / 5650 Nm
Parking brake system	3,3 kN / 2600N/s
Cooling air	-10°C - 40°C / up to 100kph



Dynamometer LINK Model M300







Standards:

- UN ECE R90
- SAE-J2521 – „AK-Noise”
- SAE-J2522 – „AK-Master”
- ISO 26867
- ECE R13
- ECE R13-H
- ECE-R78
- SAE-J2707
- SAE-J2784
- SAE-J2928
- JASO C406
- JASO C419
- JASO C427
- JASO C443
- ISO 11157
- ISO 15484

and many more

New investment
Launch date: Q1/2027

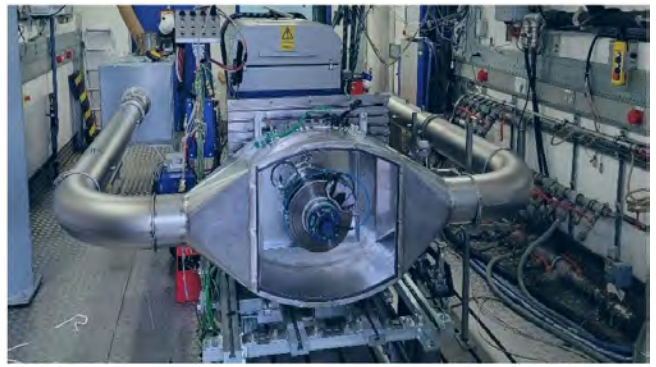
Brake Particle Emissions & Wear Characterisation (UN GTR No. 24 / EURO 7-aligned)

The stand reproduces controlled braking events to quantify brake wear, particulate mass (PM) and particle number (PN) emissions in line with UN GTR 24, supporting EURO 7 compliance demonstrations for light-duty applications.

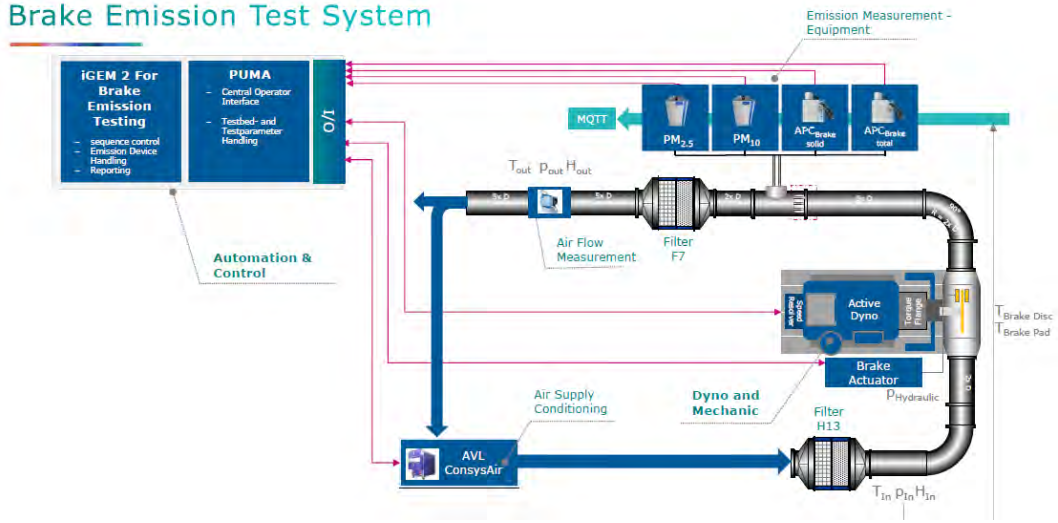
Parameters / key information

- Scope: **Light-Duty Vehicles cat. 1-1 (M1) & 2 (N1)**, fully laden mass **< 3,500 kg**.
- Metrics: **brake wear**, **PM**, **PN** during defined braking sequences.
- Conditions: controlled **thermal** and **dynamic** profiles representative of real-world operation.
- Output: repeatable emission and wear datasets for conformity assessment and development benchmarking.

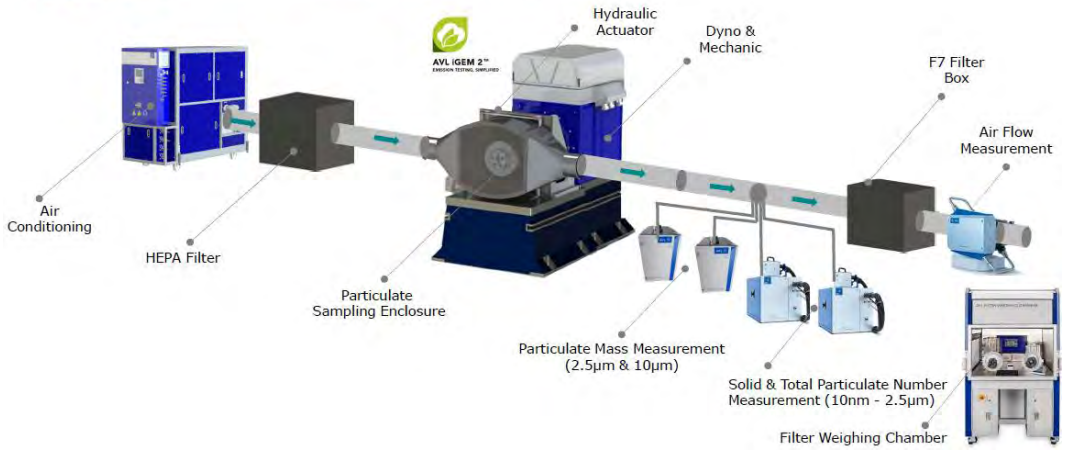
Conformance:
UN GTR No. 24 (Brake Emissions); aligned with **EURO 7** brake emission provisions (as referenced in the regulation).



Brake Emission Test System



Brake Emission Test System Equipment



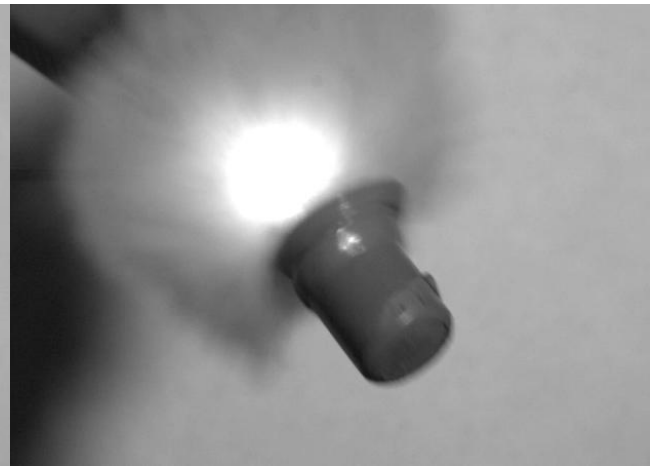
Phantom VEO 710S high-speed camera

The Phantom VEO 710S high-speed camera enables precise recording and analysis of ultra-fast mechanical and physical phenomena, including projectile motion, impact events, airbag deployment, material deformation and short-duration dynamic processes.

- **High Frame Rates:** Over 7,500 frames per second (fps) at full resolution (1280 x 800 pixels) and up to 1,000,000 fps at reduced resolution (throughput of 7.5 Gpx/s).
- **High-Capacity Memory:** 36 GB of RAM, ensuring a relatively long recording time for high-speed sequences for this class of equipment.
- **Versatile Optics:** Equipped with lenses that allow for the recording of phenomena from distances ranging from a few tens of centimeters up to several meters, depending on the object's dimensions and the event being recorded.
- **Advanced Triggering:** The system features both hardware and software triggers. The buffering function allows the camera to retain up to a few seconds of footage prior to the moment the measurement is triggered (pre-trigger).
- **Monochrome Sensor (Mono):** Guarantees maximum light sensitivity and edge sharpness. This is crucial for precise measurements at ultra-short exposure times, reaching as low as 1 us.







Vibration tests



Parameters of Vibration System 36kN

- frequency range: 4…3000 Hz
- maximum displacement: 76 mm
- maximum acceleration: 100 g (sinus/random) 260 g (mechanical shocks)
- maximum load up to 600 kg
- head-expander dimension: 600 x 600 mm
- slip table dimension: 900 x 900 mm

Parameters of Climats Climatic chamber

- internal dimension: 1500x1500x1500 mm
- temprature range: -70…180 st.C (10K/min)
- humidity: 10…98 % RH



Parameters of Vibration System 80kN

- frequency range: 4…2000 Hz
- maximum displacement: 76 mm
- maximum acceleration: 100 g (sinus/random) 260 g (mechanical shocks)
- maximum load up to 1000 kg
- head-expander dimension: 800 x 800 mm (guided)
- slip table dimension: 1200 x 1200 mm

Parameters of Climats Climatic chamber

- internal dimension: 1500x1500x1500 mm
- temprature range: -70…180 st.C (10K/min)
- humidity: 10…98 % RH

new vibration system dedicated to EV large battery pack testing



Parameters of Vibration System 125kN

- frequency range: 4…2000 Hz
- maximum displacement: 100mm
- maximum acceleration: 100 g (sinus/random) 200 g (mechanical shocks)
- maximum load up to 2000 kg
- head-expander dimension: 1200 x 1200 mm (guided)
- slip table dimension: 1500 x 1500 mm

Parameters of Climats Climatic chamber

- internal dimension: 2800x2500x1400 mm
- temprature range: -45…180 st.C (5K/min)
- humidity: 10…98 % RH

sinusoidal vibration tests, random vibration tests, vibration tests based on stored time signals (road tests), mechanical shock tests (pulses shape: half-sine, trapezoidal, sawtooth)

Testing according to various standards ECE R100, IEC 60068-2-6, IEC 60068-2-64, IEC 60068-2-27, VW80000, BMW GS97073-1, Renault 31-07-004, Toyota TSC3000 and other

Mechanical Shock & Inertial-Load Validation of HV Vehicle Components (UNECE R100 / ISO 6469-1)

The bench reproduces crash-like acceleration pulses/shocks to verify the structural integrity and electrical safety of high-voltage systems (e.g., battery packs) and other vehicle sub-assemblies.

Parameters / key information:

- Specimen capacity: up to 600 kg (including instrumentation).
- Servo-hydraulic actuator: 400 kN force, 800 mm stroke, 9 m/s peak speed; accumulators for high-energy impulse generation.
- Linear-bearing test table: 245 × 145 cm.
- Hydraulic power unit (air-cooled): 280 bar working pressure, 200 L tank, 40 L/min nominal flow; manifold rated 280 bar.
- Control: closed-loop feedback with test software to generate/iterate target pulses per specified acceleration profiles.

Example photo from Regulation No. 100, showing the requirements for the acceleration pulse to be applied to the test sample.



	20	0	0
	50	20	8
	65	20	8
D	100	0	0
E	0	10	4.5
F	50	24	15
G	80	25	15
H	120	0	0

Test Bench photo

Conformance: **UNECE R100 – Test 9C “Mechanical Shock”**; **ISO 6469-1:2019 §6.4.1.1.2 “Inertial load at a vehicle crash.”**

Mechanical tests

Battery Pack Tests:

- vibration resistance (with parameters monitoring, coolant circulation charging)
- shocks (Reg. 100 Annex 8C)
- integrity (Reg. 100 Annex 8D)
- free fall
- dropping
- crush

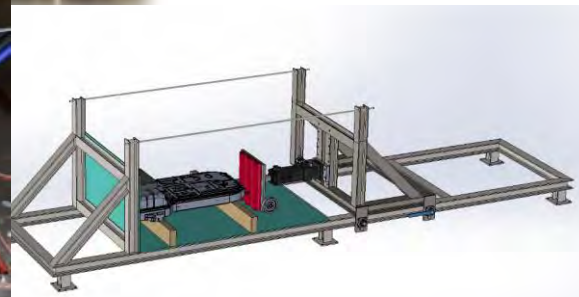
Testing of electric vehicle components:

- battery management system - BMS (with loading)
- battery packs (charge/discharge)
- wires (high voltage wires, cables, bundles, connectors)
- components of the drive system
- communication/entertainment systems
- other electric car equipment (generators, actuators, valves, wipers, heat pumps, PTC heaters, heat exchangers, mirrors)
- LED/conventional lighting
- controllers / charging systems
- charging controllers / systems
- ADAS/LIDAR components
- vision systems

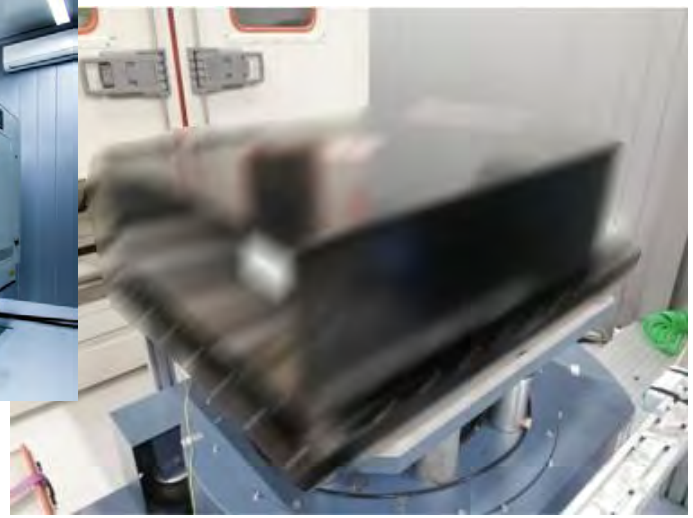












vibration stands with climatic chambers

BOSMAL performs various types of battery tests:

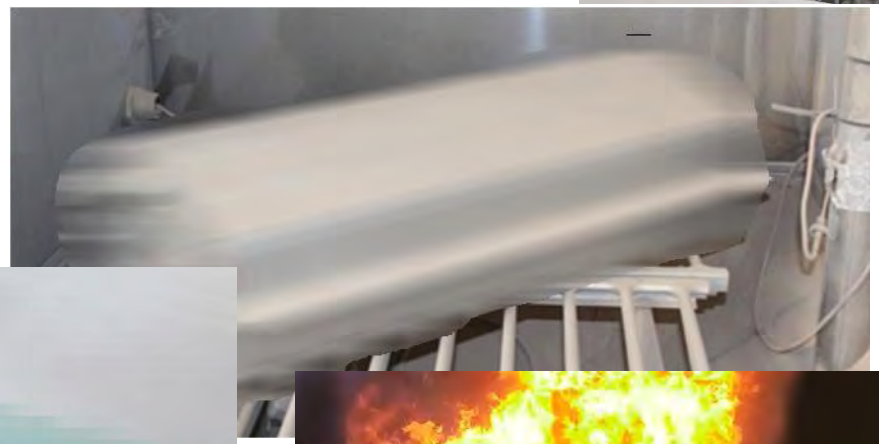
- measurements of electrical parameters and characteristics,
- charge/discharge cycles.
- tests of resistance to environmental conditions,
- mechanical tests (pressure, burst)
- vibration tests
- fire resistance
- water resistance
- dust resistance
- corrosion resistance
- material tests

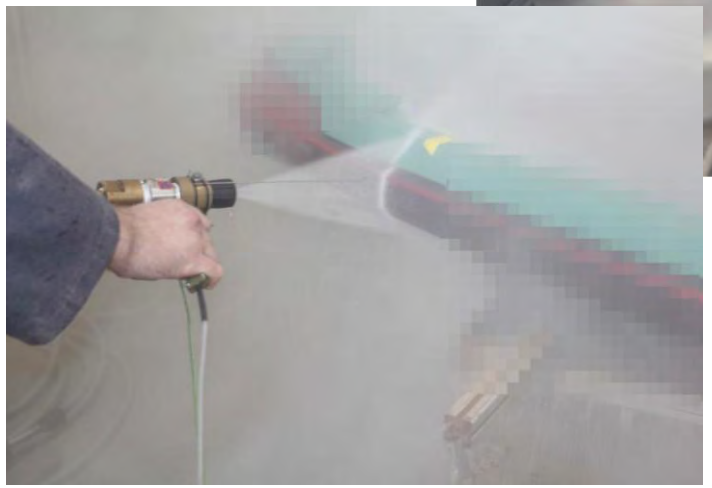
















Vibration, vibroacoustic (NVH) and strain gauge tests

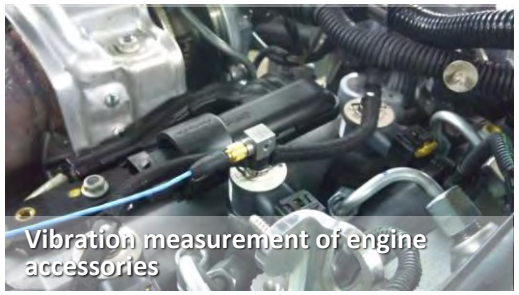
Analyses and solve vibration and acoustic problems in vehicles and vehicle systems, in test bench setups and in other systems

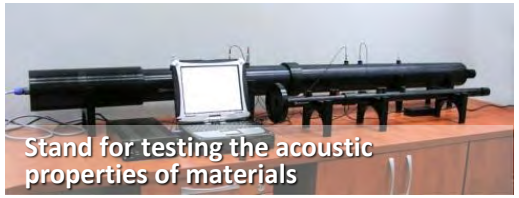
Tests of resistance to sinusoidal vibrations, random vibrations and shocks for forcing in 3 axes sequentially under various climatic conditions.

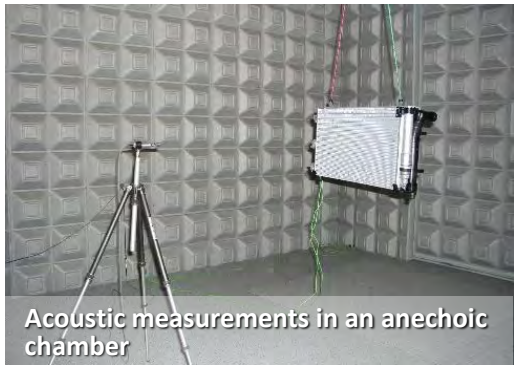
Examples of NVH tests:

- Vibroacoustic (NVH) testing of braking systems
- Noise and vibration (during road testing)
- Vibroacoustic analysis for transmission tests
- Testing resistance to acoustic vibrations
- Vibroacoustic analysis of engines
- Vibroacoustic device measurements
- Acoustic measurements in an anechoic chamber
- Vibration tests
- Strain gauge measurements
- Testing the acoustic properties of materials
- Modal analysis


A vehicle's lamp on a vibrating stand

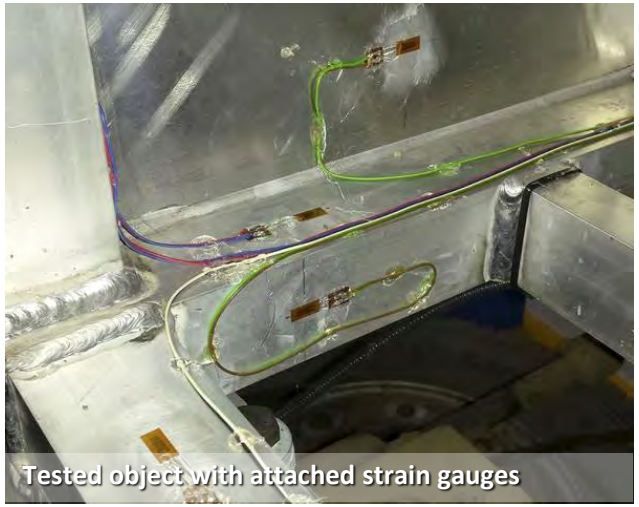

Vibration measurement of engine accessories


Stand for testing the acoustic properties of materials


Acoustic measurements in an anechoic chamber

Strain gauge measurements (tensometric testing):

- direct measurements of strains using strain gauges at temperatures up to 200 ° C
- static, quasi-static and dynamic measurements
- main aim of strain research:
  - Comparison of real values with calculations
  - Assurance of fatigue tests repeatability on various test stands and in different laboratories
  - Determining the root cause of too early cracks
  - Indirect measurements of forces in mechanical system


Tested object with attached strain gauges

HIGH PRESSURE TESTS

High pressure pulsations/ pressure change resistance tests

High pressure pulsations or pressure change resistance tests are usually performed in the pressure range from 0 to 200 bar; to meet special requirements it is also possible to carry out such tests at higher pressures. Testing can be performed using different types of media at a variety of variable temperatures. Often we carry out tests according to DIN SPEC 74104.



Pressure range
- 0 - 200 bar
- > 200 bar - to be agreed upon

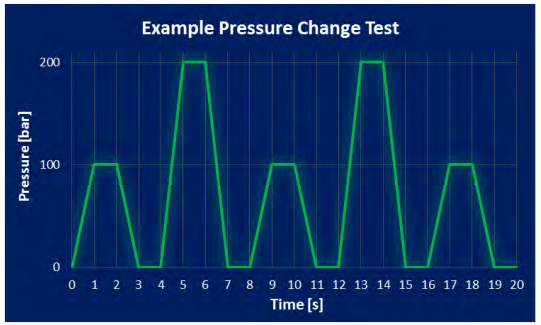
Medium
- hydraulic oil
- water
- glycol
- brake fluid
- other media on request

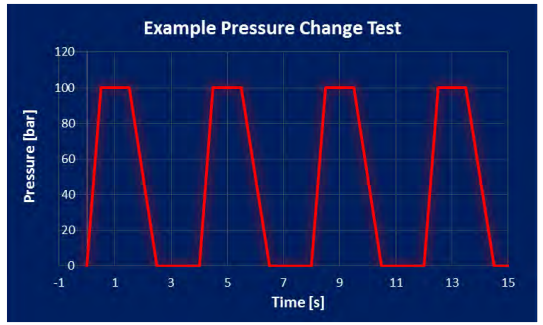
Temperature range
- From -40°C to +180°C
- From ambient to +300°C

Pulse shape
- practically any – to be agreed with Client
- high accuracy of tracking the required pulse shape

Data acquisition
- Pressure and temperature data acquisition throughout the entire test
- Testing several objects simultaneously (up to 5 items)

Charts: Examples of pressure change tests





Tests may apply to:
- Heat exchangers
- Brake Master Cylinders
- Brake Calipers
- Whell Brake Cylinder
- Brake lines
- Brake hoses
- and other

Bursting pressure resistance tests (burst tests)

Burst tests, commonly called burst pressure resistance tests, are typically carried out at pressures up to 1000 bar with different media at varying ambient temperatures.

WATER & DUST RESISTANCE

Resistance to water:

- resistance to dripping water (IPX1, IPX2)
- resistance to rain (IPX3, IPX4) using a tube with oscillating movement,
- resistance to spurts of water (IPX5, IPX6, IPX6K),
- immersion (IPX7, IPX8),
- **resistance to high-pressure washing (IPX9, IPX9K).**

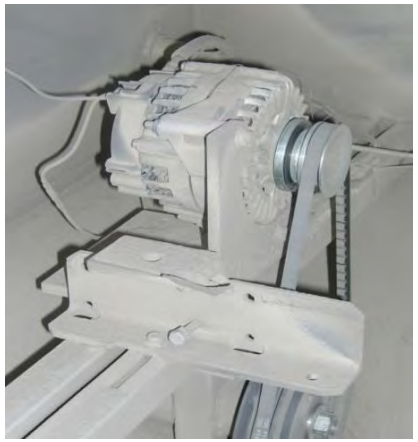




Resistance to dust (IP5X/IP6X) according to PN-EN 60529 and ISO 20653

Objects tested

- elements of electrical and electronic equipment,
- assemblies for machines and devices.





Thermal shocks with cold water (Splash Test)





New investment
Launch date: Q4/2026

Dust Ingress & Sand-Erosion Resistance of Vehicle Components (Large Vertical & Horizontal Chambers)

The chambers reproduce controlled dust and wind-blown sand conditions to verify enclosure integrity (IP/ISO 20653 levels) and assess surface erosion of housings, e-drive units, battery enclosures and electronics under repeatable environmental stress.

Parameters / key information

- **Vertical dust chamber** (ISO 20653 / IEC 60529 / EN 60068-2-68): uniform dust flow for large specimens; internal size **~2.5 × 2.0 × 2.5 m (H × D × W)**; max load **700 kg**.
- **Horizontal dust & sand chamber** (MIL-STD-810H / EN 60068-2-68): wind-blown dust/sand and sandblasting effect; adjustable **dust concentration** and **airflow velocity**.
- **Test media**: Arizona dust, talc, cement powder (others on request).
- **Outcomes**: ingress protection verification, functional endurance under particulate exposure, and erosion/abrasion effects on surfaces and seals.

Conformance: ISO 20653; IEC 60529; EN 60068-2-68; MIL-STD-810H (method-specific, as applicable).







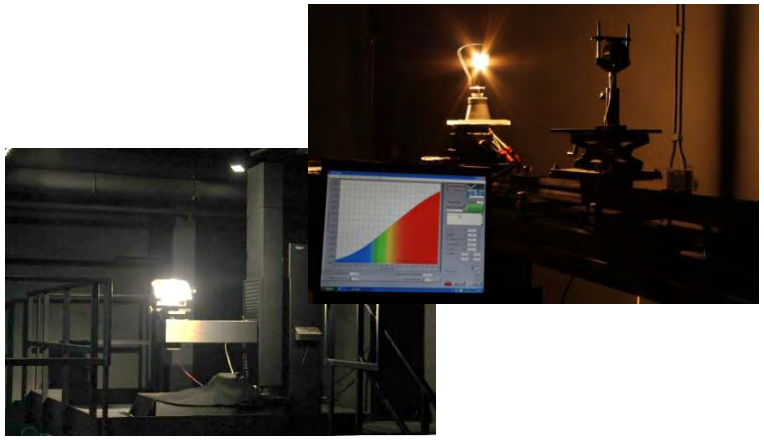


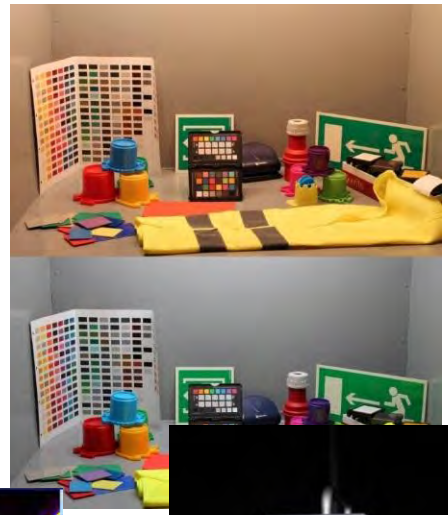


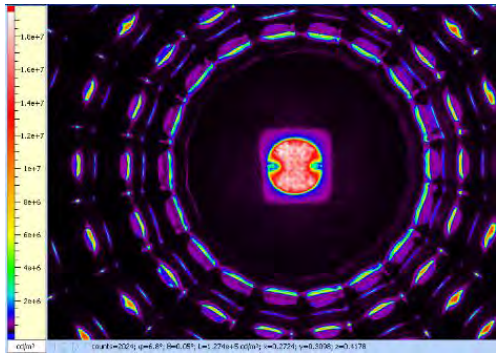
PHOTOMETRIC AND PHOTOBIOLOGICAL MEASUREMENTS, THERMOVISION

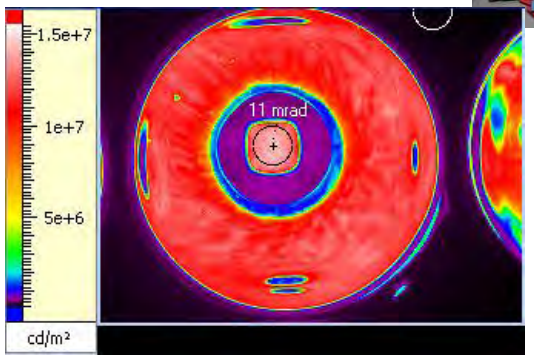
Photometric measurements:

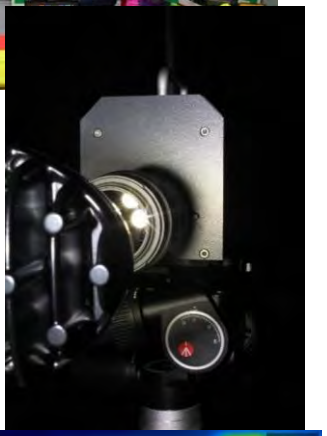
- luminance using matrix luminance meter or a single spot photometer
- luminous intensity distributions effective intensity of flashing lights
- effective luminous intensity of flashing lights, time parameters
- colour of light, correlated colour temperature, colour rendering index
- CIL reflection coefficient, surface density of reflection coefficient
- spectroradiometric measurements: UV (200-400 nm),
- VIS (380-780 nm), NIR (780-1100 nm)
- blue light hazard measurements
- reflectance, transmittance and haze









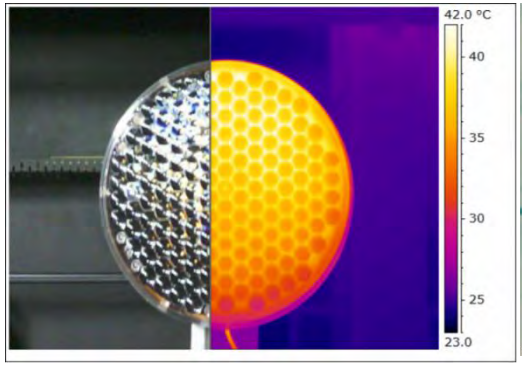


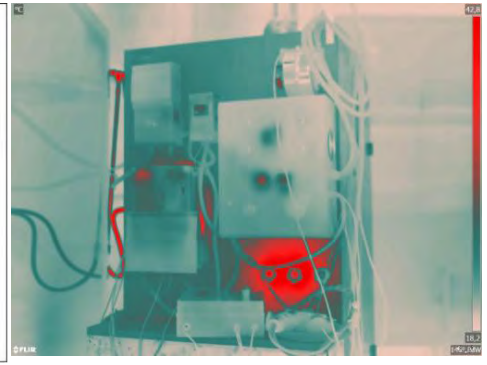
Photobiological risk assessment

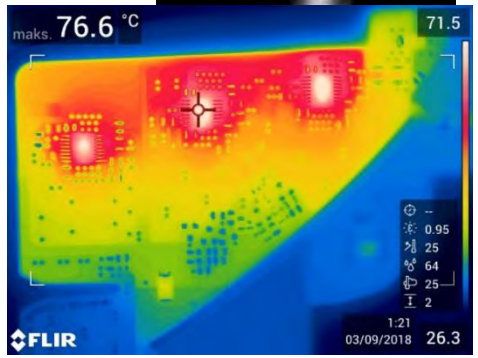
Blue light hazard of lighting devices acc. PN-EN 62471:2010, IEC TR 62778

Infrared thermography — FLIR T1030sc

Non-contact temperature measurement and thermal imaging in the 7.5–14 µm spectral range.
Object temperature measurement range: −40°C to +2000°C, depending on the selected measurement range and installed configuration.







Photometric & Spectroradiometric Characterisation (UV–VIS–NIR 200–2500 nm)

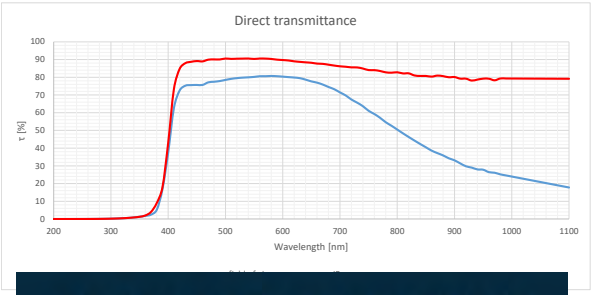
High-accuracy optical characterisation of materials and light/radiation sources—reflectance, transmittance, and full spectral power distribution (SPD)—for product validation and durability studies.

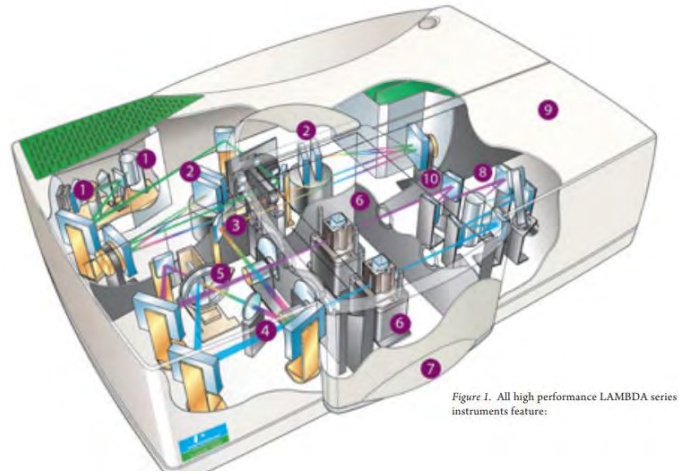
Parameters / key information

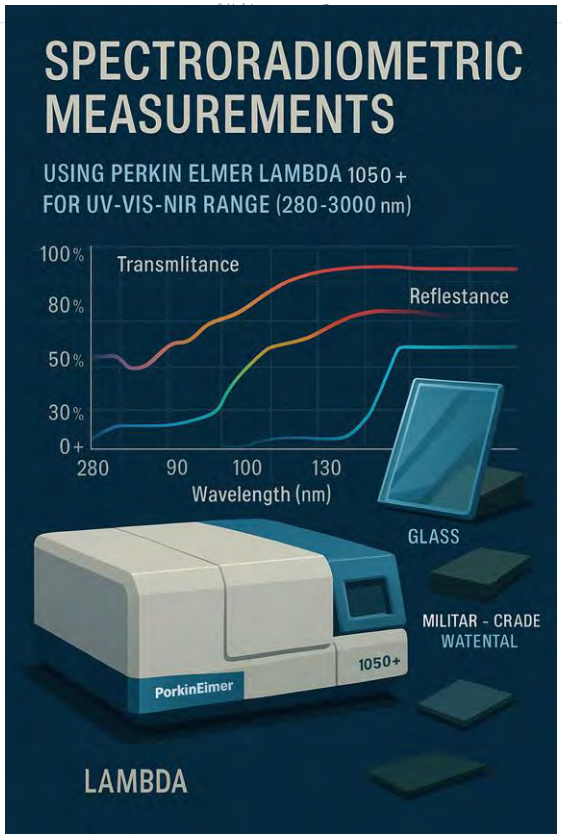
- **Spectral range: 200–2500 nm** (UV–VIS–NIR).
- **Material tests:** precise **reflectance** and **transmittance** measurements per referenced standards.
- **Source tests: spectroradiometry** with full **SPD** analysis per CIE methods.
- **PV modules:** optical/conversion performance under controlled illumination per IEC methods.

Methods as applicable: **ASTM C1036-21**, **ISO 12543**, **STANAG 2338**, **ISO 13468-1/2**, **ISO 4892**, **ASTM E903-20**; **CIE 250:2022** for spectroradiometry; **IEC 61215**, **IEC 61646** for photovoltaic modules.









Solar Irradiation & Thermal-Load Durability of Large Components (280–3000 nm)

Simulate solar radiation and heat-load effects under controlled laboratory conditions to assess durability, performance and ageing of materials, components and assemblies for automotive, aerospace and industrial use.

- **Parameters / key informationSolar sources:** advanced simulators (metal-halide and halogen) with **calibrated spectral power distribution** across **280–3000 nm**.
- **Specimen size:** suited to large items (≈ **2 m** and above).
- **Exposure types: thermal** and **photochemical** loading for environmental and durability testing.

Methods as applicable: **EN 60068-2-5:2018**, **DIN 75220:1992**, **MIL-STD-810H (Method 505.7-1)**, **D45 5232**, and equivalent procedures.

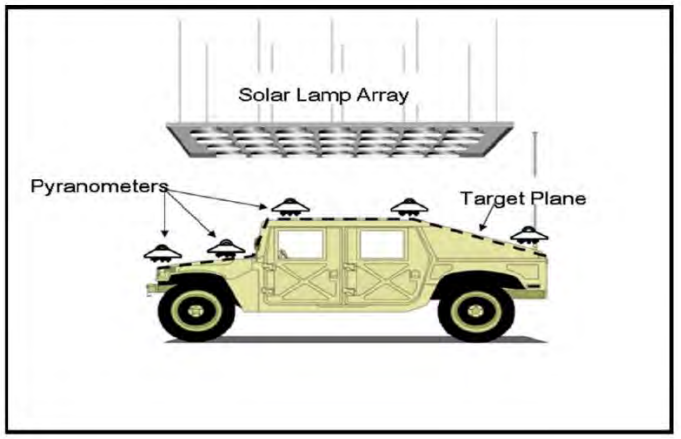


Figure 505.7C-3. Example 2 - Test item surface shape exposure.









Table 505.7C-II. Example calculation of spectral energy distribution and permitted tolerance.

Spectral Region	Bandwidth (nm)[2]	Natural Radiation (% of total)[2]	Tolerance (% of total)[2]		Calculated Irradiance Tolerances For a Given Total Irradiance (W/m2) → 822.5[1]				
			Min	Max	Nominal	Min		Max	
Ultraviolet - B	280-320	0.5	0.3	0.7	4.1	2.5	2.5	5.8	5.8
Ultraviolet - A	320-360	2.4	1.8	3	19.7	14.8	34.5	24.7	60.9
	360-400	3.2	2.4	4.4	26.3	19.7		36.2	
Visible	400-520	17.9	16.1	19.7	147.2	132.4	360.3	162	468.8
	520-640	16.6	14.9	18.3	136.5	122.6		150.5	
	640-800	17.3	12.8	19	142.3	105.3		156.3	
Infrared	800-3000	42.1	33.7	50.5	346.3	277.2	277.2	415.4	415.4

Note: 1. The sum of energy in all spectral bands shall not exceed ±4% of total irradiance or ±15 W/m² (whichever is greater)
2. The values in columns 2 through 5 were obtained from CIE-85 and DIN 75220, Table 1.

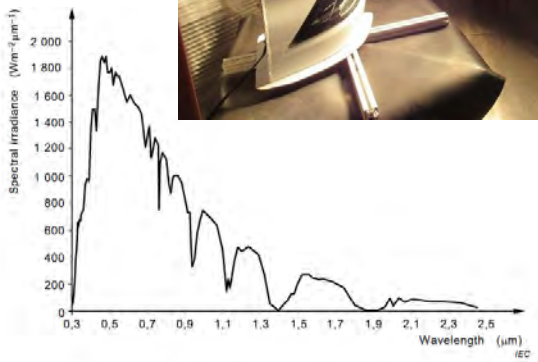


Figure 1 – Global solar spectral irradiance at sea level

Electric/ Electronic Automotive Components Testing

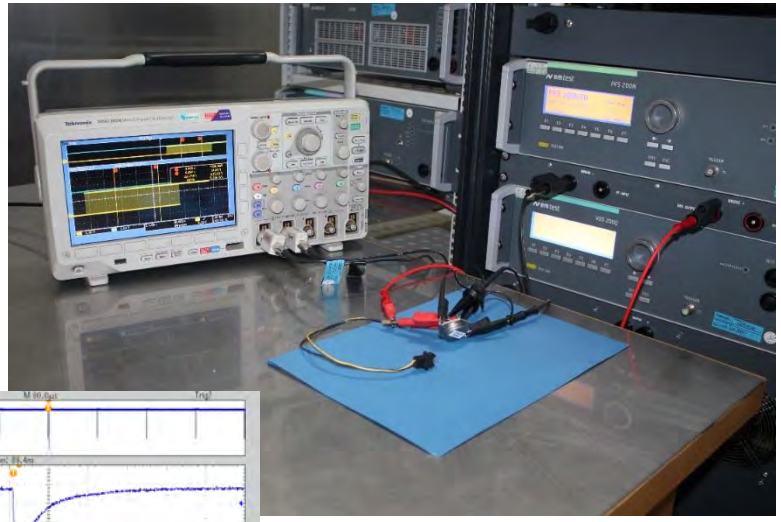
Testing electrical and electronic vehicle systems (battery, electric fan, alternator, sensors and transducers, lighting systems, wiring harnesses, connectors, push connections, windscreen wiper system, window)

Measurements of electrical and functional characteristics, EMC/ESD tests and durability tests of elements and assemblies of electrical and electronic equipment.

Properties of insulating materials - electrical characteristics (electrical resistance, antistatic properties, high voltage tests) of plastic products, rubber, fabrics and textiles and other items used in components for vehicles and other equipment.



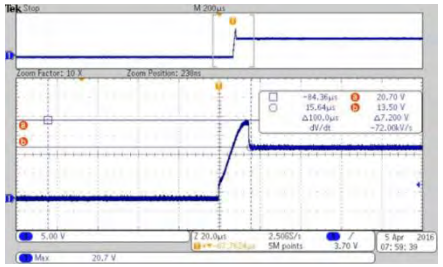


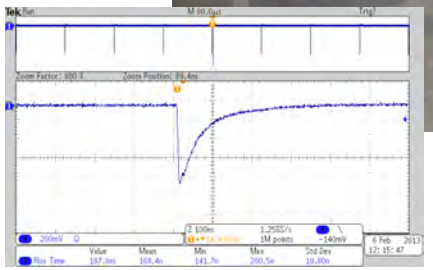


EMC (Electromagnetic compatibility) and ESD (Electrostatic discharge) testing

- tests of resistance of electric and electronic devices to interferences, transients conducted by the power line (EMD).
- tests of resistance of electric and electronic devices to electrostatic discharge (ESD).







ELECTRIC/ ELECTRONIC AUTOMOTIVE COMPONENTS TESTING

New investment
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Electromagnetic Compatibility (EMC) Testing in ALSE Chamber

EMC evaluation of automotive, military and industrial components in an absorber-lined, shielded environment—covering conducted/radiated **emissions** and **immunity** across a very wide frequency range.

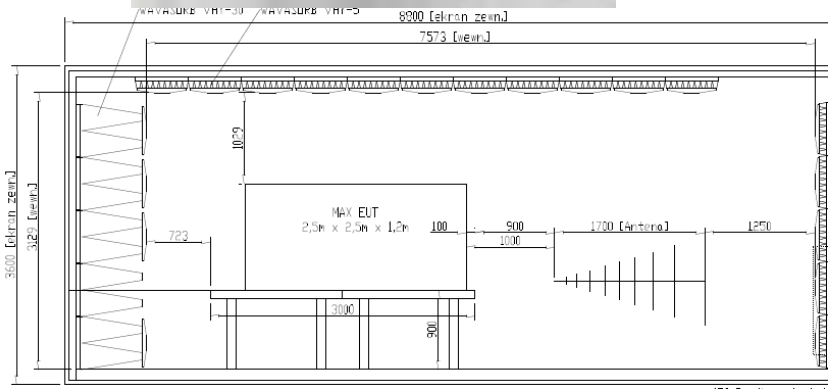
Parameters / key information

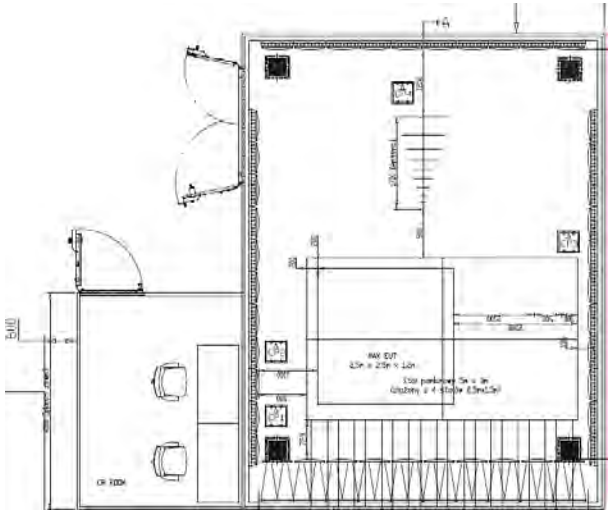
- Usable chamber size: **7.55 × 6.05 × 3.10 m (D × W × H)**.
- Specimen capacity: up to **700 kg**.
- Frequency range: **10 kHz – 40 GHz**.
- Test scope: conducted & radiated **emissions**; RF, bulk current, transient **immunity** (method-dependent).
- Utilities & I/O: programmable DUT (Device Under Test) supply up to **1500 VDC / 2 × 500 A**; **cooling circuits**, **compressed air**, and **communication interfaces** available.
- Operations: **video monitoring** and dedicated control software for continuous visual supervision and functional checks during exposure.

Conformance methods as applicable: **CISPR 25**, **ISO 11452 (series)**, **MIL-STD-461G**.









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RF IMMUNITY TESTING OF AUTOMOTIVE ELECTRICAL AND ELECTRONIC COMPONENTS

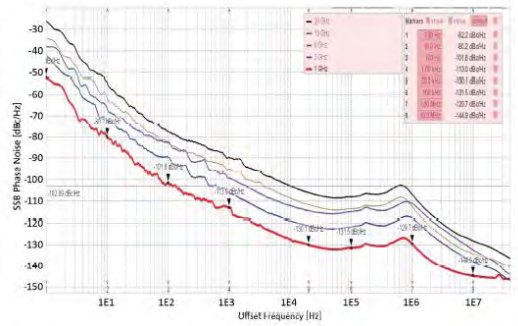
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RF Immunity of Automotive E/E Components (100 kHz–7.12 GHz, up to 600 V/m)

Evaluate the resistance of vehicle electrical/electronic components to narrowband radiated RF energy—supporting EMC validation of control modules, inverters and HV components under vehicle-representative exposure.

Parameters / key information

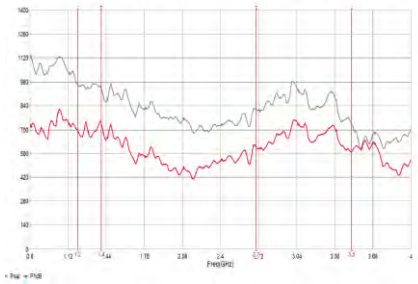
- Radiated RF immunity testing.
- Bulk Current Injection (BCI) testing.
- Radar pulse immunity testing.
- Combined frequency coverage across available methods: 100 kHz to 7.12 GHz.
- Field strengths up to 600 V/m within the supported frequency ranges and test configurations.
- Applicability: passenger-car and component testing per international and OEM requirements.

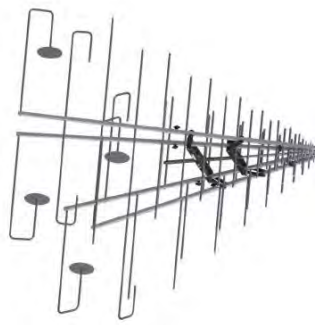




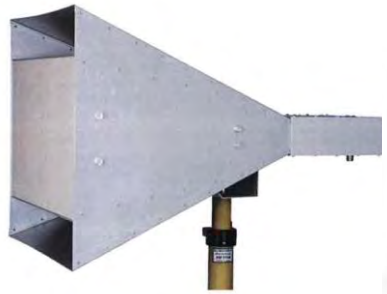














Conformance methods (as applicable): **ISO 11452-2**, **ISO 11452-4**; **UN R10 Rev.06** (20 MHz–2 GHz) and draft **Rev.07** (to 6 GHz); **PSA B21 7110D**, **VW TL 81000**, **BMW GS 95002-2**, **FCA CS-00054**, **Ford FMC 1278**, **MBN 50284-2**.

New investment
Now operational

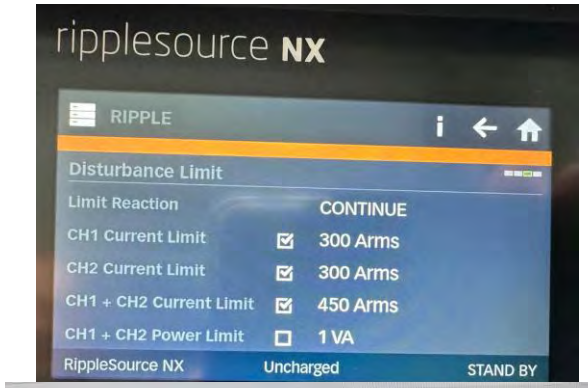
High-Voltage EMC of Electric Powertrain Components (ISO 21498-2 / VW 80300)

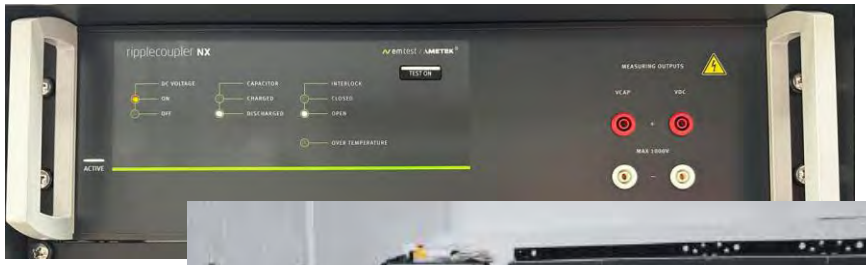
Validate conducted emissions and immunity of **battery packs, inverters and e-drives** under representative HV network conditions.

Parameters / key information

- **HV supply emulator:** programmable AC/DC up to **1500 VDC / 250 kVA** for realistic HV bus operation.
- **Disturbance generation:** fast-switching transient **noise generator** (HV DC lines) and **HV ripple generator**.
- **Artificial networks:** for conducted **emission** and **immunity** measurements.
- **Frequency coverage: DC to 500 kHz** (typical spectral band for modern EV powertrains).
- **Scope:** methods per **ISO 21498-2 Ed.2** (secs **6.2–6.12**) and **VW 80300** (EHV-01, 02, 03, 04, 05, 06, 08, 09, 10, 11, 13, 16).

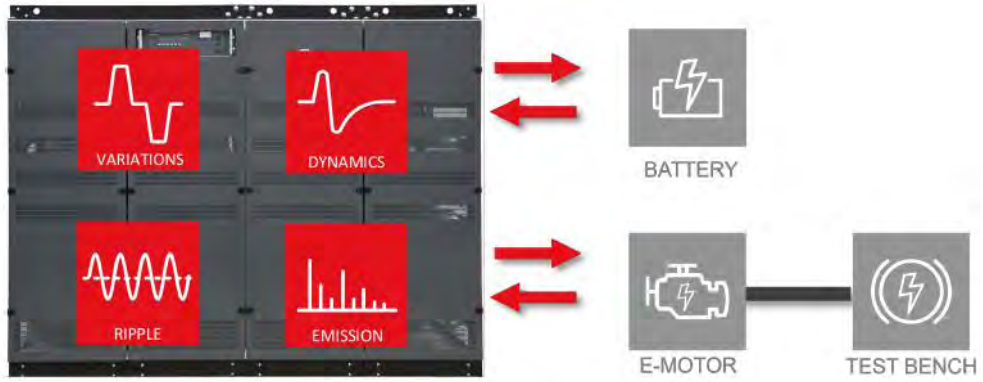
Conformance as applicable to the selected method: **ISO 21498-2 Ed.2**; **VW 80300 (EHV subset)**.













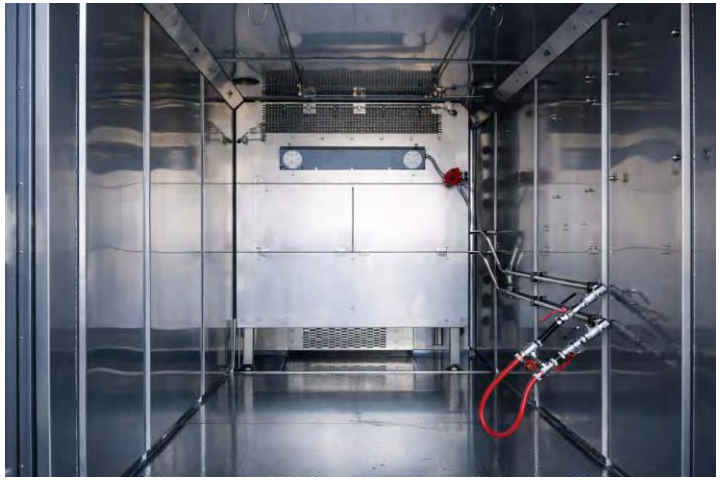
PLUG & TEST LABORATORY

New investment
Now operational

Plug & Test Lab for climatic and temperature loads of e-drives and battery packs

System consisted of:

- Climatic chamber (-60…160˚C)
- bi-directional power supply 250kW
- cooling medium conditioning system (chiller)
- data acquisition (analog/digital signals + CAN/LIN communication)
- fire extinguishing system











- Working area dimensions: WxHxD 2,3x2,2x2,9m
- Performance: 7K/min (3K/min with 800kg load)
- Maximum floor load : 30000 N/m2
- Cycler: 1000V; +/-1000A ; 250kW; max 300kW

Aging tests, climatic and temperature tests, corrosion resistance

The Institute offers a wide range of tests in climatic, temperature, pressure and salt chambers



























BOSMAL's research capabilities in the field of electric vehicles

Electric Vehicles Research, performed according to R101 requirements under standard and non-standard ambient conditions:

- range determination, measurement of wheel power and energy consumption



Examples of vehicle conversion

BOSMAL's other services/ research on electric vehicles

- road tests of functionality and durability under various traffic and climate conditions,
- measurements of geometric dimensions
- safety assessment of vehicles and their electrical components
- evaluation of traction performance (maximum speed, acceleration capacity from a standstill or from a specific starting speed)
- evaluation of operating properties (vehicle real range on different routes, with various driving styles, at sub-zero temperatures)
- tests of the influence of ambient temperature (low, ambient, high) on the efficiency of the electrical energy storage system, its processing system, the mechanical efficiency of the transmission, and the range and performance of the entire drivetrain
- evaluation of steerability and stability of the vehicle on the road
- brake assist and steering system assessment
- assessment of ventilation and heating systems' efficiency
- tests of battery charging parameters (charging time, charging current, temperature of battery cells, others)
- measurements of temperatures of motor and battery parts during operation





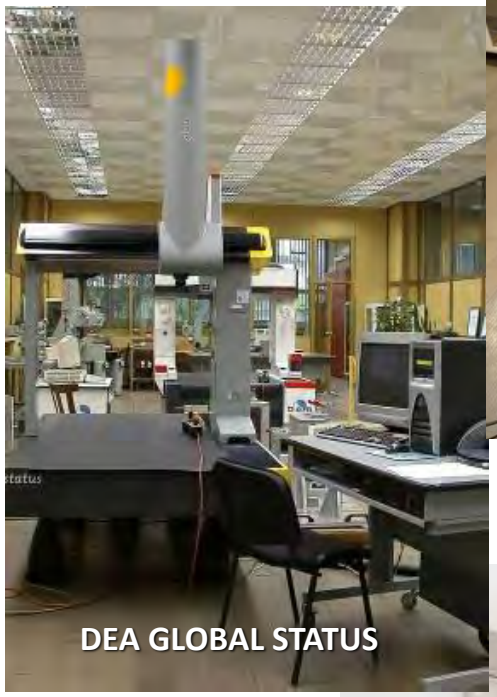
METROLOGICAL MEASUREMENTS

The range of measurement services includes::

- Contact measurements of length and angle, deviations of shape and position
- Non-contact measurements of length and angle, deviations of shape and position
- Measurements of surface roughness
- Comprehensive measurements of complicated shapes and technological devices
- Measurements of series of products using measuring programs
- Dimensional inspection of customer components at prototype and series-production stages, including assessment of form and position deviations.
- Preparation of professional measurement reports, taking into account customer requirements.


OPTIV CLASSIC 321GLTP




DEA GLOBAL STATUS



Hexagon (ROMER)
Absolute Arm 87 serie




DEA GLOBAL PERFORMANCE
1200 X 3000 X 1000 mm

Measuring machines:

- DEA GLOBAL PERFORMANCE (12.30.10) with measurement and inspection software PC-DMIS™ CAD++ On-line with DCT CATIA V5 and DCT UNIGRAPHICS
- DEA GLOBAL STATUS (09.15.08)
- HexMet-OPTIV CLASSIC 321GL tp
- Hexagon (ROMER) Absolute Arm 87 serie – mobile measuring arm - contact measurements and scanning



MATERIAL TESTING



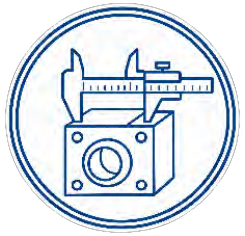
COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL

Road testing, emission testing & engine/powertrain testing



DESIGN AND
ENGINEERING SUPPORT



ENGINEERING
SERVICES



HOMOLOGATION
TYPE APPROVAL

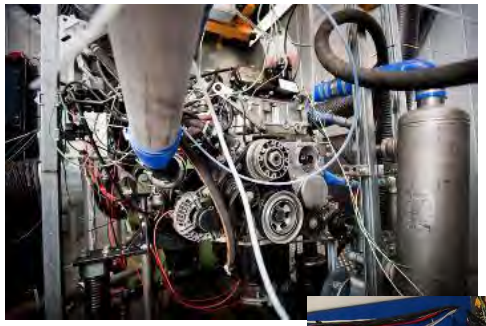
ROAD TESTING, EMISSION TESTING & ENGINE/POWERTRAIN TESTING

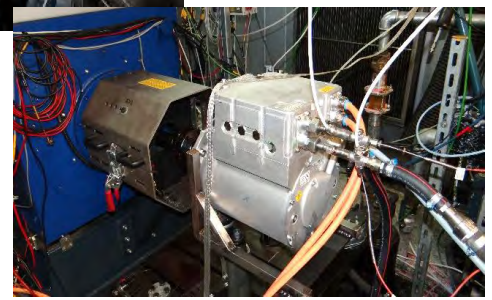
- Vehicle testing
- SORT testing
- RDE testing
- Exhaust emission and fuel consumption test
- Conformity of production (COP)
- Engine testing
- Hybrid vehicle/powertrain testing
- Electromobility
- Accreditation
- Certificates
- Customers' recommendations and accreditations













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VEHICLE TESTING

Durability-fatigue, functional and mileage tests of vehicles with ICE/ hybrid and electric powertrains:

- Road Measurement Tests
- Reliability growth tests
- Fleet – EOBD, ATS, WU, B-Cycle tests
- Tests of traction systems, e.g. ABS, ASR
- Validation calibrations in road test
- Modification of calibrations for improvement of drivability and real world fuel economy
- Road testing: validations (functionality and efficiency, reliability, durability)
- Temperature Chamber Test

Various climatic conditions:

Hot/special climate:
- **Torino (Santena) - Italy**
- **Modena (San Giovanni) - Italy**
- **Livigno - Italy**
- **Granada - Spain**

Temperate climate:
- **Bielsko-Biała - Poland**
- **Slovakia**
- **Serbia**

Cold climate:
- **Sweden**

Various testing tracks/roads:
- Urban
- Heavy urban
- Mountain
- High way
- High speed
- Extra urban
- Mixed
- Off-road
- Door-to-Door



ABS and ASR testing



Tech. inspection, type approval



SORT



Workshop



Road test



PEMS testing (incl. RDE)





Road tests on advanced testing race tracks (Italy, Czech Republic, Germany, Sweden)

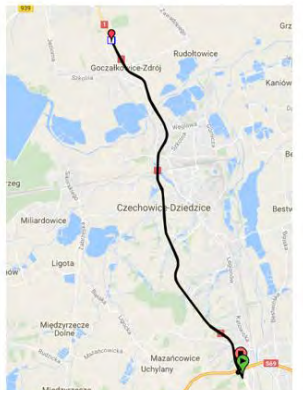
VEHICLE TESTING

Exhaust gas emissions tests on vehicles in the real driving conditions (R using Portable Emissions Measurement Systems (PEMS)

Urban



Rural



Motorway





Dynamic vehicle tests on 2WD and 4WD chassis dynos

- measurements of powertrain power and torque
- road inclination simulation
- engine operation control optimisation
- measurements of vehicle dynamics at temperatures from -35˚C to 60˚C (Chassis AVL Zoellner 48” 4WD, Climatic chamber – WEISS WK 643)

Testing vehicles, machinery and devices in large-dimension cham and low temperature (from -45°C to 75°C)

- Tests of air conditioning and internal heating systems
- Tests of batteries and heating and air conditioning systems installed in electri
- Start-up tests of combustion engines
- Windshield defrosting and demisting tests
- Durability and functional tests of vehicles, devices, machines and parts
- Start-up and pull-away tests of vehicles

Dimensions (length x width x height): 11500 x 4700 x 4200 mm





Tests of electric and hybrid vehicles

Standardised On-Road Tests (SORT) on electric buses

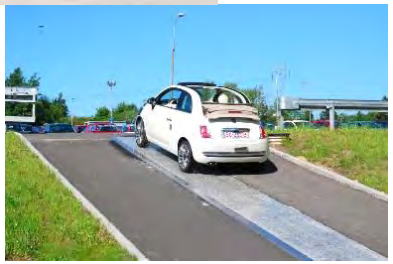
Type approval tests (homologation)



Próby przebiegowe



Rain chamber



ABS i ASR testing



SORT

Fuel consumption of buses according to UITP Project SORT (Standardised On-Road Tests Cycles), New Edition UITP 2014; D/2014/0105/1

- for all types of city buses from small (9 m) up to large (18 m)
- for all types of engines from light-duty up to heavy duty engines







Standardised On-Road Tests (SORT) on electric buses

- Vehicle Energy Consumption in steady and transient states
- Vehicle Energy Consumption in Standardized On-Road Tests (SORT)
- Battery Charger Efficiency
- Usable Energy in Battery Package (for E-Bus SORT methodology)
- Maximal Range in Standardized On-Road Tests (SORT)







RDE TESTING

RDE testing

- Exhaust gas emissions tests on vehicles in the real traffic conditions (‘RDE’) using Portable Emissions Measurement Systems (PEMS)
- Ranging from large heavy-duty engines to the smallest light-duty vehicles and, recently, to non-road mobile machinery
- The currently available PEMS analyzers measure gaseous exhaust components (CO2, CO, HC, NOx), particle number (PN)
- ECU datalogging, monitoring of electrical current and battery SOC, etc.
- Evaluation in accordance with the 4th RDE package (Regulation 2018/1832)

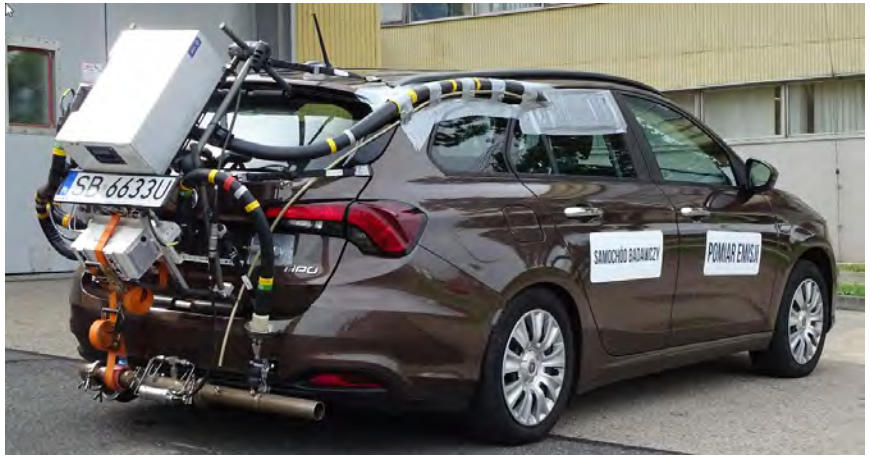




Chassis dyno facilities: an essential tool in the RDE calibration process

- Calibration on vehicle on the chassis dyno
- Simulation of RDE on the chassis dyno
- Cold ambient calibration on the chassis dyno
- Cold/ hot temperature calibration/ testing on the chassis dyno with altitude simulation (planned to be implemented)
- ATS development on chassis dyno
- RDE (PEMS) validation on the road

All types of driving cycle and RDE simulation performed under the entire range of RDE boundary conditions and at -7°C





Chassis dyno verification of PEMS installation

RDE TESTING

New investment
Now operational

Real-Driving Emissions (RDE) with Cube-PEMS & On-Board PN (Euro 7 / GB7-ready)

Mobile and lab-capable measurement of gaseous pollutants and solid particle number under real-world driving to support Euro 7 / GB7 component and vehicle evaluations, including alternative-fuel and H_2 engines.

Parameters / key information

- **PEMS platform:** measures a comprehensive set of exhaust gas concentrations; usable both **on-road (RDE)** and **in-laboratory** workflows.
- **On-board PN module:** quantifies **solid particle number** within the specified regulatory size ranges (configuration options for PN23 and PN10).
- **Applications:** RDE type-approval development, conformity checks, and fuel/aftertreatment calibration across gasoline, diesel, CNG, LPG, alcohol fuels and **H_2**.
- **Outputs:** second-by-second gaseous emissions and PN data for correlation with chassis/engine dyno results.



Conditions	NO_x	PM	PN_{10}	CO	THC	NMHC	NH_3
RDE Test (mg/km)	60	4.5	$6x10^{11}$	500	100	68	20
Trips<10km (mg/trip)	600	45	$6x10^{12}$	5000	1000	680	200

Example systems: **HORIBA MEXAcube PEMS** (gas analysis) and **HORIBA OBS-ONE PN** (on-board particle number). Designed to meet Euro 7 / GB7 component testing and RDE methodologies per manufacturer documentation.

IRLAM Analyzer (XL)

CO-L, CO-H,
CO_2,
NO, NO_2, N_2O,
NH_3,
HCHO,
CH_4-L, CH_4-H
THC

OBS-ONE

PN > 10nm

Light – Duty Vehicles



MEXA Cube PEMS System



Heavy-Duty RDE Emissions with Cube-PEMS (MEXAcube IRLAM + on-board PN)

On-road measurement of gaseous pollutants and solid particle number for heavy-duty vehicles to support Euro 7/Euro VI development, correlation and compliance workflows.

Parameters / key information

- **Gas analysis (IRLAM, QCL-IR):** CO, CO_2, NO, NO_2, NO_x, N_2O, NH_3, HCHO, CH_4.
- **THC (FID):** total hydrocarbons by flame-ionisation detection.
- **On-board PN (optional):** particle number **>10 nm** via dedicated PN module.
- **Ancillary signals:** exhaust flow, air-fuel ratio (λ), GPS/vehicle data, ambient conditions.
- **Outputs:** second-by-second concentrations and **mass emissions**; post-processing software for regulation-based analysis and reporting.

Example setup: **HORIBA MEXAcube IRLAM Analyzer (XL)** with optional **OBS-ONE PN**. Designed for **HDV RDE** methods aligned with Euro 7/Euro VI manufacturer documentation.

IRLAM Analyzer (XL)
OBS-ONE

CO-L, CO-H,
CO_2,
NO, NO_2, N_2O,
NH_3,
HCHO,
CH_4-L, CH_4-H,
THC,
PN>10nm

MEXA Cube

Control Software (DMC)

Heavy – Duty Vehicles

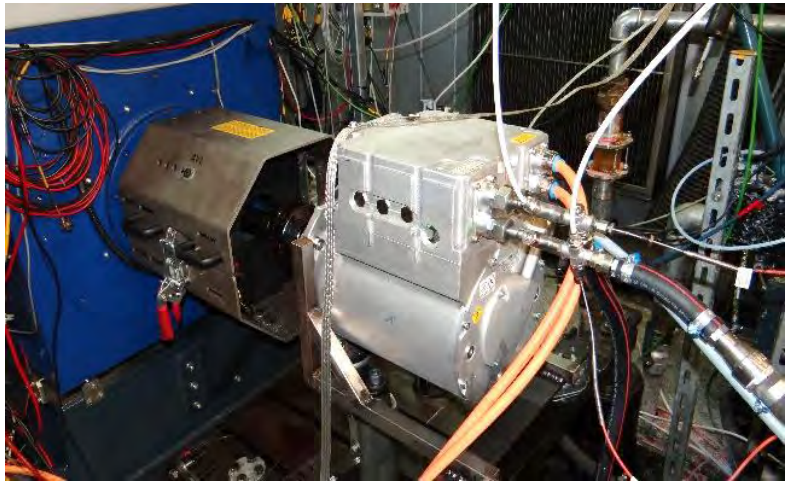




ELECTRIC & HYBRID VEHICLES POWERTRAIN TESTING

E-motor and hybrid powertrains power measurements

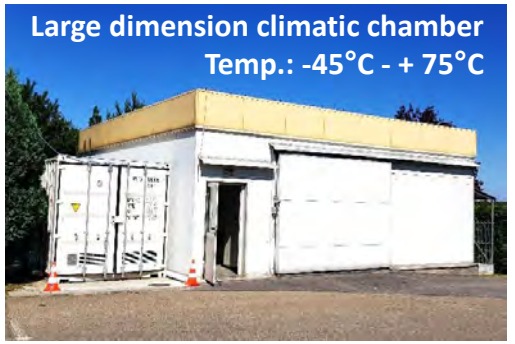
YOKOGAWA High-Performance Power Analyzer
Measures accurately at a wide range of voltage, current and frequency conditions.





Testing hybrid and electric vehicles

- Electric vehicle range determination
- Measurement of electric vehicles' electricity consumption
- Exhaust emission and fuel consumption tests of hybrid vehicles (including charge balance)
- Tests of batteries and heating and air conditioning systems installed in electric vehicles at temperatures from -45°C to 75°C
- CO_2 emission and fuel consumption testing (including consideration of the power balance)











Electric Vehicle Research, performed according to EU requirements (WLTP) under standard and non-standard ambient conditions:

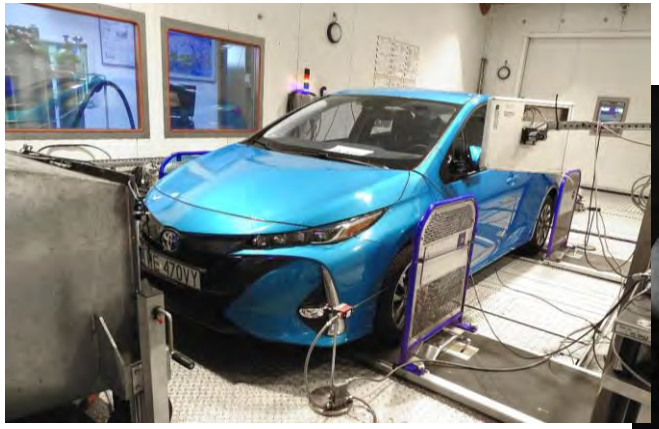
- range determination, measurement of wheel power and energy consumption

Type approval and COP testing of vehicles with pure electric powertrains

HYBRID VEHICLES/ POWERTRAINS TESTING

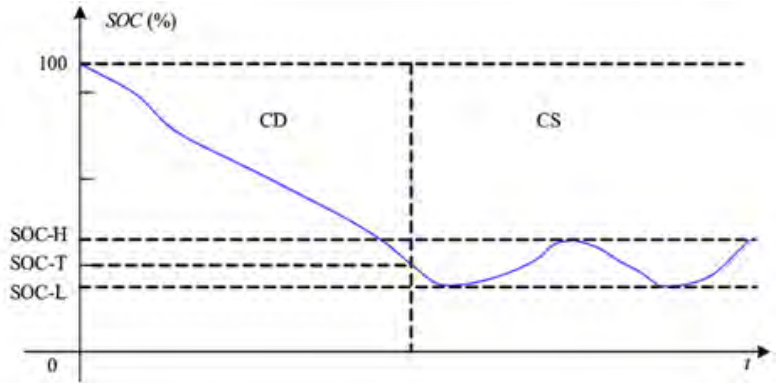
Activities carried out on hybrid vehicles/ powertrains

Chassis dyno: Start-Stop system validation, full hybrid vehicle emissions testing at multiple ambient temperatures and SOC (State of Charge) values; PER (Pure Electric Range) determination, etc.



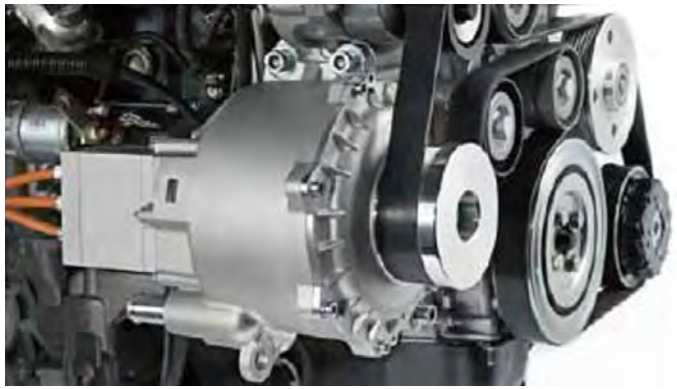






Engine dyno: durability testing of mild hybrid/ BSG (Belt Starter Generator) systems with a low voltage battery emulator, Start-Stop system validation







BOSMAL's research capabilities in the field of electric vehicles

Electric Vehicle Research, performed according to EU requirements (WLTP) under standard and non-standard ambient conditions:

- range determination, measurement of wheel power and energy consumption





Testing hybrid and electric vehicles

- Electric vehicle range determination
- Measurement of electric vehicles' electricity consumption
- Exhaust emission and fuel consumption tests of hybrid vehicles (including charge balance)
- Tests of batteries and heating and air conditioning systems installed in electric vehicles at temperatures from -45°C to 75°C
- CO_2 emission and fuel consumption testing (including consideration of the power balance)

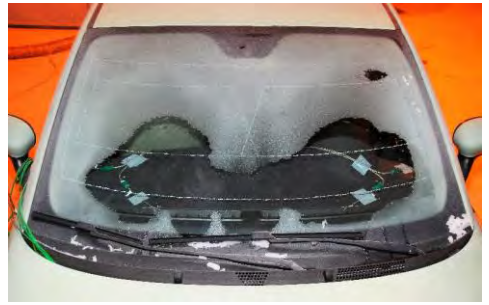




Engineering support for electric vehicle integration:

- Concept development for vehicle electrification.
- Selection and assessment of powertrain and auxiliary components.
- Development of control concepts in cooperation with component suppliers.
- Wiring harness design and preparation of modification documentation.
- Design of component layouts and mounting arrangements.
- Testing to support vehicle approval within BOSMAL's authorised scope.





EXHAUST EMISSION AND FUEL CONSUMPTION TESTING

Exhaust emission and fuel consumption tests:

- Exhaust emission measurements via the CVS method with sample bags
- CO_2 emission and fuel consumption testing (including consideration of the power balance)
- continuous analysis of diluted and undiluted exhaust
- Catalytic gaseous (TWC, DOC, NSC, SCR) and particulate filter (DPF, GPF) aftertreatment efficiency tests
- Vehicle exhaust emission tests at temperatures from -35˚C to 60˚C
- PEMS – exhaust emissions testing under real driving conditions for light duty and heavy duty vehicles
- Continuous measurements of NH_3 concentrations and additionally N_2O, NO and NO_2
- Solid particle number (PN) measurement
- Continuous measurements of solid particle distribution (quantity and size)
- Continuous measurements of soot concentration
- Exhaust gas opacity measurements
- Exhaust emission and fuel consumption tests of hybrid vehicles (including charge balance)
- Testing for type approval



Exhaust emissions tests according to EU requirements (e.g. Euro 6d), EPA/CARB US norms (e.g. SULEV) and Japanese norms.
Emissions measurements of various types, carried out over a range of driving cycles, such as: WLTC, NEDC, FTP-75, HFET, JC08, WMTC, according to the requirements of applicable European, American and Japanese regulations.







Climatic chamber
(-35˚C to +60˚C)
14,3×10,1×4,3 m

EXHAUST EMISSION TESTING

Emissions R&D and emissions / drivability calibration tests for cars, vans & motorcycles

- Including continuous analysis of diluted and undiluted exhaust, tests at various temperatures

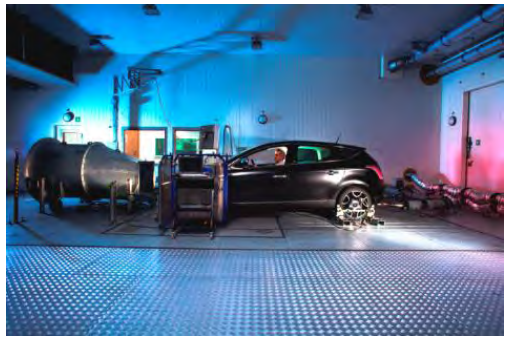
Aftertreatment system tests:

- Periodic emissions tests during mileage accumulation or accelerated aftertreatment system ageing
- Cold start emissions tests at low ambient temperature
- Evaluations of aftertreatment system effectivesness over various driving cycles using continuous analysis of undiluted exhaust
- Long-terms evaluations of Diesel / gasoline particulates filters
- OBD programmes to detect emissions control system failure

Lube oil and fuel tests:

- Comparative tests on various fuels (standard, regional, alternative, liquid & gaseous)
- Investigations of fuel quality/contaminants and their impact on aftertreatment systems and exhaust emissions
- Tests on fuel additives and new engine/ gearbox oil formulations for enhanced fuel economy and reduced emissions

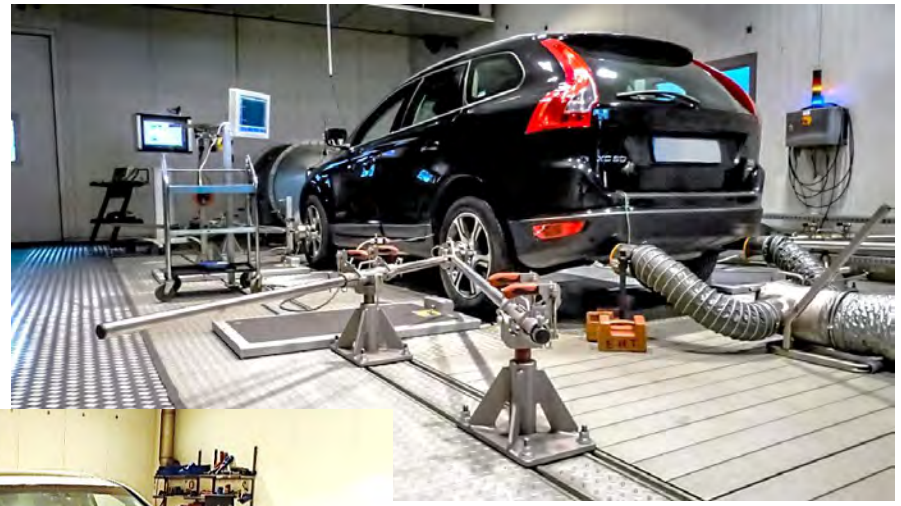




Vehicle type-approval and Conformity of Production (CoP) testing on chassis dynamometers:

For category M and N vehicles running on all fuel types

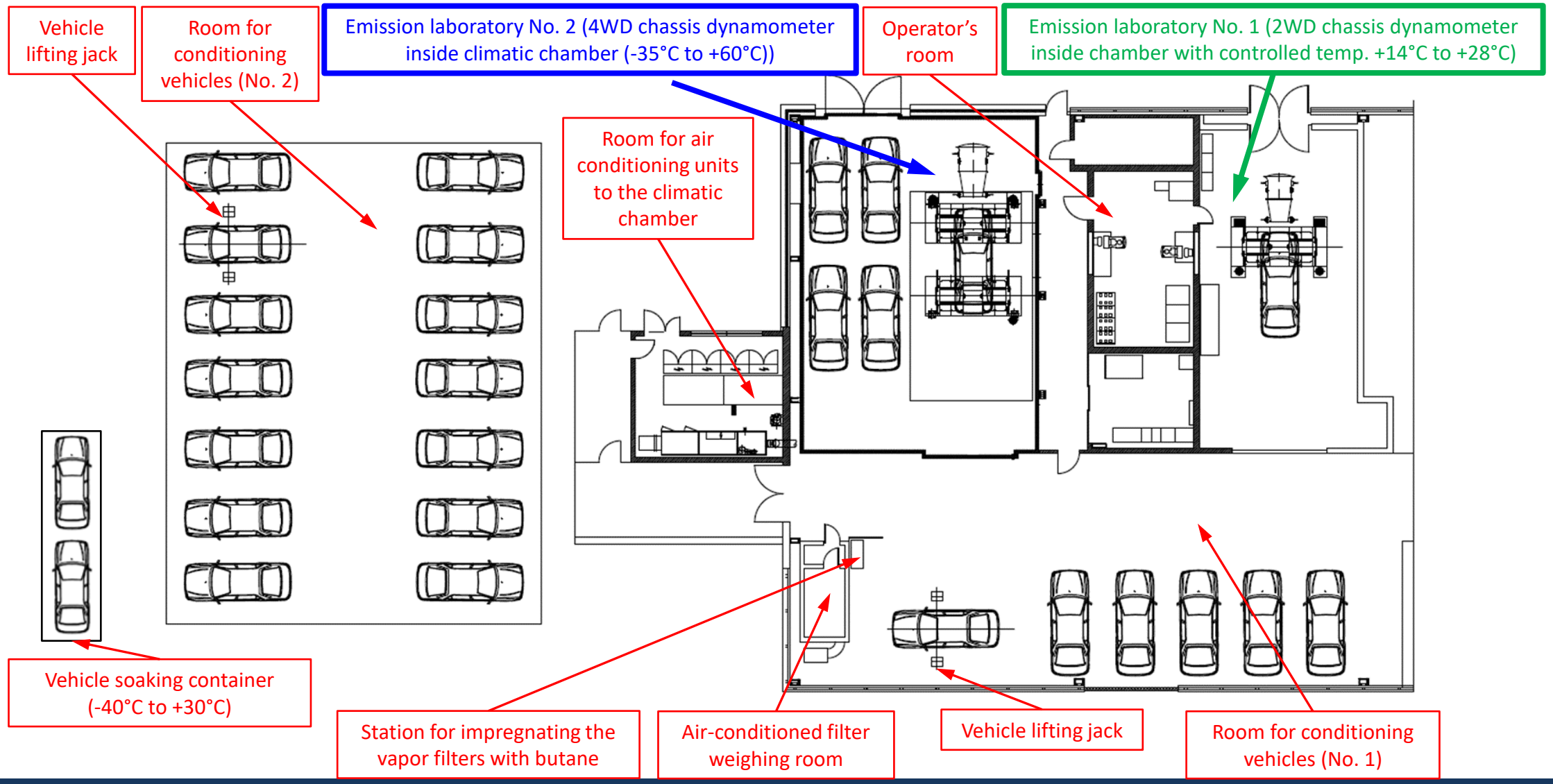
- WLTP, NEDC and Japan TRIAS test procedures and methods
- Additional activities: road load matching, wheel power measurements, additional tests required by Regulations 2017/1151, No. 83, etc.





Chassis dyno facilities for vehicles with ICE and hybrid powertrains

2 x Emissions Testing Laboratories (including 4x4 and climatic chamber and accompanying rooms)



CONFORMITY OF PRODUCTION

Vehicles with ICE and hybrid powertrains testing

Two Euro 6d-compliant test laboratories enabling the full range of certification and COP activities in the field of exhaust emissions





Full range of required test types:

- Type 1 test (emissions after a cold start - WLTP, NEDC, JC08); including road load matching (coastdown) and RCB (for WLTP) and OBFCM
- Type 2 test (CO emissions at engine idle)
- Type 3 test (engine crankcase emissions)
- Alternative procedure for Type 4 test (COP evaporative emissions test, as defined by customer)
- Type 5 test (alternative procedure based on DFs from Euro 6 legislation, or as defined by customer)
- Type 6 test (emissions after a cold start at -7°C, currently only UDC required, but fully WLTP-capable for future requirement)
- Customer-specific verifications: OBD monitoring checks, verification of powertrain components related to emissions control

Additional infrastructure:

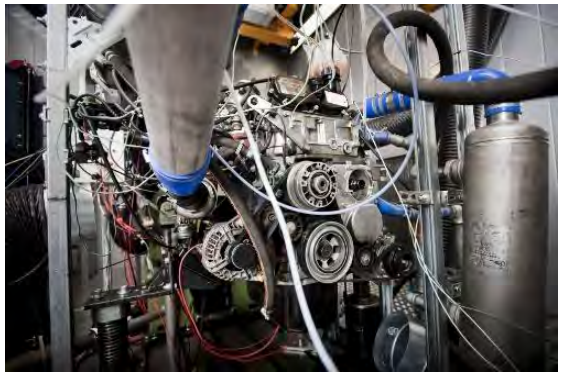
- Temperature-controlled soak facilities for 25+ vehicles
- Workshop facilities
- RDE-compliant PEMS systems for future COP requirements

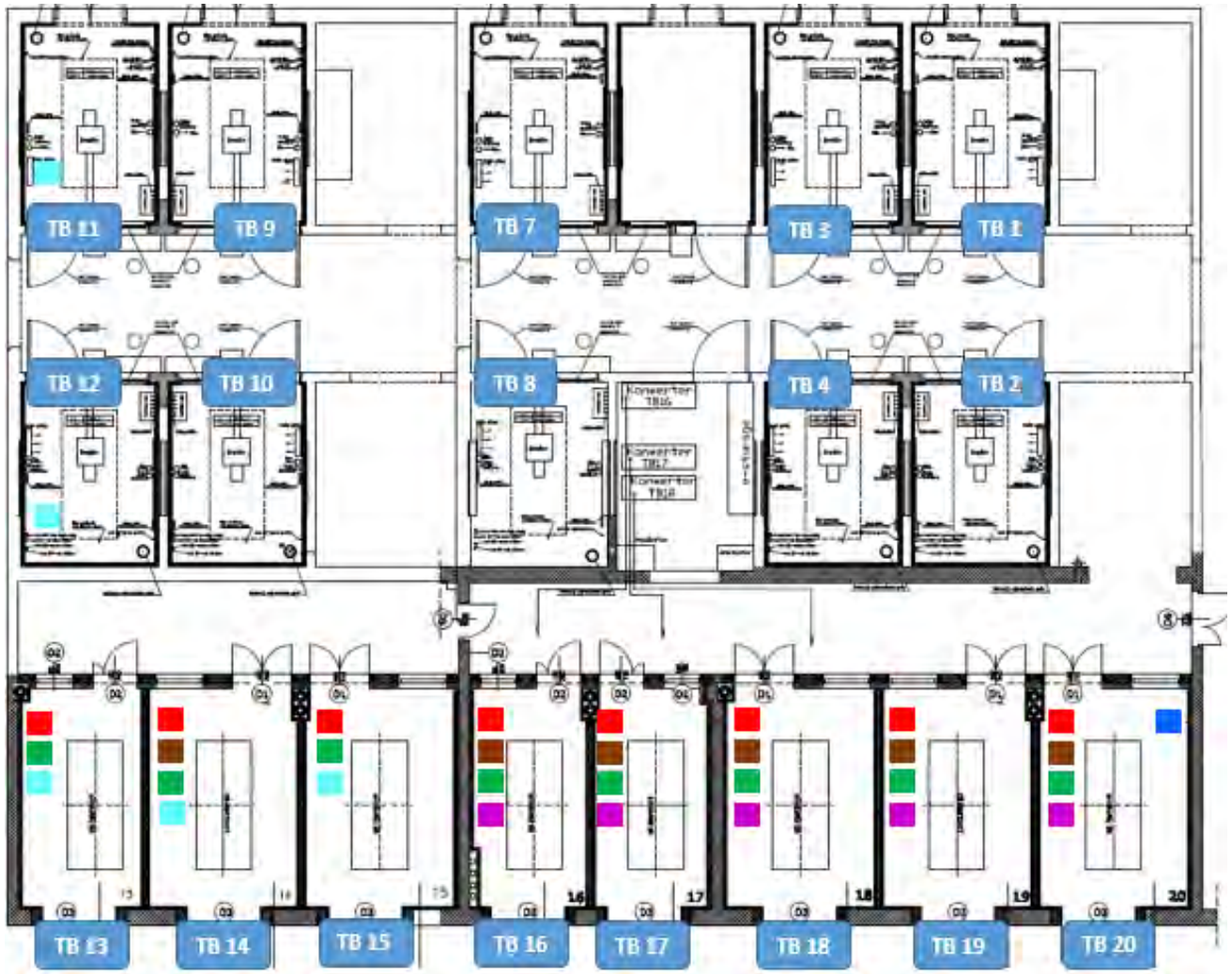
ENGINE TESTING

18 engine test cells:

- 8 fully dynamic test benches with power range from 250 kW to 560 kW, 3 benches equipped with e-storage
- 10 eddy-current test benches with power range from 10 kW to 470 kW









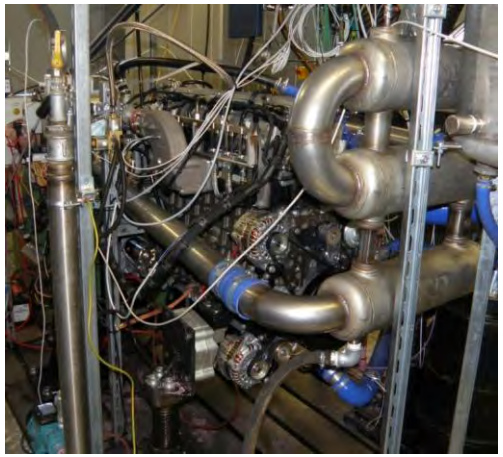
Legend

- Dynamic dyno
- Medium/Heavy Duty dynamic dyno
- Test cells with CNG installation
- Test cells with LPG installation
- Development test cells

ENGINE TESTING

Engine, hybrid powertrains, electric motors testing and development

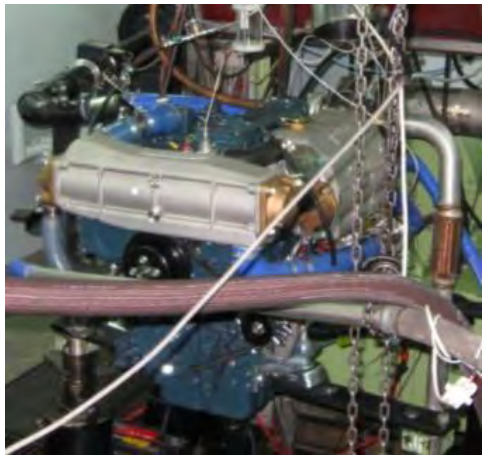
HD On-Road Engines



HD Non-Road Engines



Marine Recreational Engines



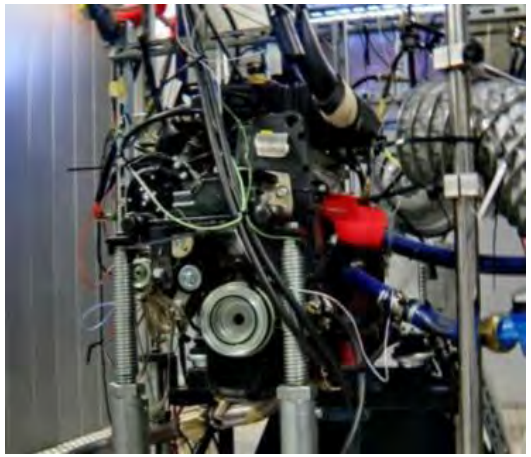
Industrial Engines



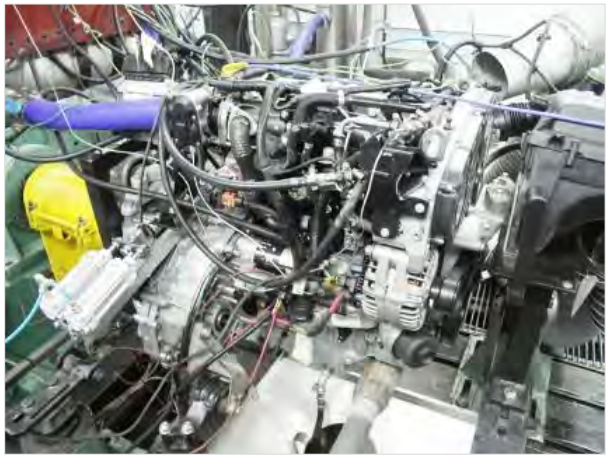
Hand held Engines



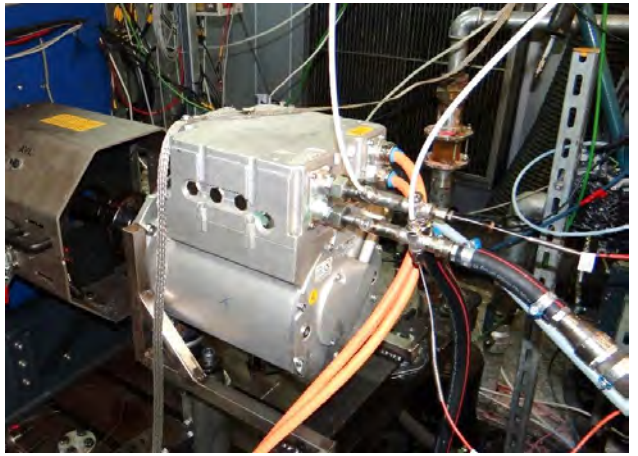
Automotive LD Engines



Hybrid Powertrains



Electric motors



High Performance Engines



55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

ENGINE TESTING

Engine development and testing:

- Base engine development (Euro 6d, post Euro 6)
- Combustion analysis
- Engine mapping and calibration - simulation of RDE on the engine dyno
- Engine vibration measurements
- Engine noise measurements
- Engine component temperature measurements
- Aftertreatment system development and optimisation (TWC, DOC, DPF, SCR, LNT, GPF)
- Engine parts and assemblies qualification
- Engine validation
- Support in launching new engines into production
- Development of engines for alternative (special) fuels and for new markets
- Support in qualification of parts from new suppliers
- Support in product development
- Quality and COP tests
- Type approval tests



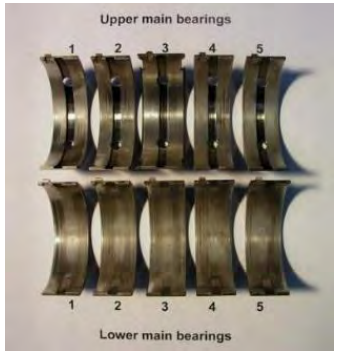


Engine durability and reliability tests:

- Global Engine Durability tests
- Engine component validation tests
- Customised procedures for specific test requirements

Engine thermal tests:

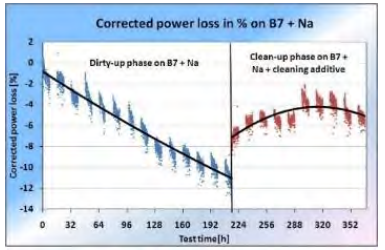
- Thermal Cycle
- Thermal Mapping Test
- Heat Rejection Test
- Piston Temperature Distribution Test



Lube oil and fuel tests:

- Friction Losses Test
- Special Fuel Tests
- Biofuel Tests
- Engine Oil Validation Test
- Fuel Economy Test
- Fuels, fuel additives tests
- Alternative fuels (FAME, HVO, ethanol, fuel blends, CNG, LPG, H_2…
- Fuels for specific markets (Asia, USA, Brasil, others)





55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

New investment
Launch date: Q4/2026

High-Power Engine Dyno Testing for Heavy-Duty, Rail, NRMM & Marine (2.1 MW)

Development, durability and emissions testing of large combustion engines used in:

- **heavy-duty,**
- **military,**
- **rail,**
- **NRMM,**
- **marine applications.**



Parameters / key information

- Power absorption capacity up to **2.1 MW**; peak torque up to **15 000 Nm**.
- Large-frame hydraulic dynamometer with closed-loop control for transient and steady-state work.
- Dedicated high-capacity cooling circuit for **continuous** operation at high output.
- Flexible fuel infrastructure:
  - **diesel, gasoline, military/jet fuels,**
  - **gaseous fuels: CNG, LPG.**
- Full instrumentation for engine homologation/certification, performance mapping, endurance runs and emissions measurements under controlled thermal and environmental conditions.

Example configuration: hydraulic absorber dynamometer (e.g., HORIBA) rated to 2.1 MW.

New investment
Now operational

Euro 7-Ready Raw-Exhaust Emissions Analytics for Engine Dyno Testing

Continuous, high-accuracy measurement of regulated and emerging pollutants in raw exhaust to support calibration, certification, conformity assessment and future Euro 7 readiness across gasoline, diesel, CNG, LPG and alcohol-fuelled engines.

Parameters / key information

- **Measurement scope:** THC, CH_4, $NO/NO_2/NO_x$, CO_2, CO, O_2; plus >20 additional species incl. **N_2O**, **NH_3**, **formaldehyde** and other Euro 7-relevant compounds (simultaneous multi-component FTIR).
- **Operation:** continuous raw-gas analysis with long-term stability for development and certification workflows.
- **Traceability:** calibration using **ISO 17034** Certified Reference Materials (CRMs) for full metrological traceability and accreditation compliance.
- **Legislation coverage:** aligned with **Euro 7**, **Euro VI**, **Stage V**, **EPA 1065/1066**.

Example bench configurations: AVL AMA i60 SII and AVL SESAM i60 FT (FTIR spectrometer) supporting the above measurement matrix and legislative methods.





Ready for Euro 7

Particle Number (PN10 / PN23) Emissions Measurement for Light-Duty Exhaust (Euro 7-ready)

Light – Duty Vehicles

Quantify exhaust particle number emissions with single 10nm, single 23nm or parallel 10 nm and 23 nm channels to support current PN23 requirements and forthcoming PN10 specifications (UNECE PMP / GTR 15, Amendment 6), enabling homologation, validation and calibration for Euro 7 vehicles.

Parameters / key information

- **Dual-channel CPC** measurement: simultaneous PN10 & PN23, single PN10 or single PN23.
- **Volatile removal method:** heated catalytic system (HCS).
- **Measurement range: 0…40 000 #/cm³** (particle concentration).
- **Dilution control ($PCRF_{total}$): 100…20 000**.
- **PNC counting efficiency:**
  - **PN10 path: 65% ±12% at 10 nm**; **≥90% at 15 nm**.
  - **PN23 path: 50% ±12% at 23 nm**; **≥90% at 41 nm**.
- **Use cases:** homologation, development, ISC/ISV conformity, ATS aftermarket homologation.

Euro 7 tailpipe emission limits for passenger cars of category M_1 and light-duty vans of category N_1

Category and class	CO		THC		NMHC		NO_x		$THC + NO_x$		PM	PN_{10}
	SI	CI	SI	CI	SI	SI	SI	CI	CI	CI	SI & CI	SI & CI
M_1 & N_1 class I	1000	500	100	–	68	–	60	80	–	170	4.5	$6x10^{11}$
N_1 class II	1810	630	130	–	90	–	75	105	–	195	4.5	$6x10^{11}$
N_1 class III	2270	740	160	–	108	–	82	125	–	215	4.5	$6x10^{11}$

Notes: SI: Spark ignition; CI: Compression ignition; CO: Carbon monoxide; THC: Total hydrocarbons; NMHC: Non-methane hydrocarbons; NO_x: Nitrogen oxides; PM: Particulate matter; PN_{10}: Number of particles larger than 10 nm

Methods & limits: **UNECE PMP / UN GTR 15 (Amendment 6)**; **Euro 7** PN provisions for light-duty. Example implementation: **APC xApp 10/23** (AVL) as shown in picture.



ENGINE TESTING

MD/HD/hybrid/electric testing



Fully Dynamic AC Dyno:

- DynoExact 504/5 Px - 500kW/3000Nm – 5 000 rpm
- DYNOFORCE ASM 3000/1.8-4.5 - 560kW/3000Nm -4500rpm
- DYNOFORCE ASM 1200/3.6-10 – 450kW/1200Nm-10 000rpm

Automotive electric motor testing

- Measurements of motor performance: T = f(n), P = f(n),
- Net max. power output measurements
- 30-minute power measurements

AVL E-STORAGE

A high-voltage bi-directional DC source / sink unit that is optimized for characterization and verification of electric driveline components for automotive, off-highway, marine and aviation applications.

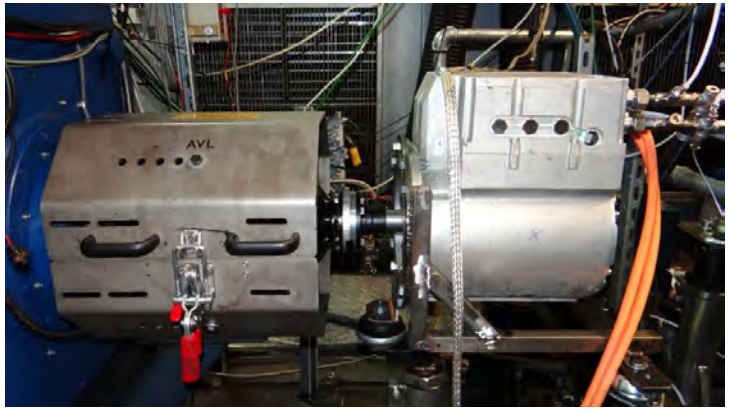
- Nominal capacity: 160 kW
- Output voltage: 8 … 800 VDC
- Output current: up to 600 A
- Battery model simulation

+ 2nd:

- Nominal capacity: 250 kW
- Output voltage: 8-800 VDC
- Output current: 600 A

Regatron Low Voltage Battery Emulator:

- Nominal capacity (max): 20 kW
- Output voltage (max): 65 V
- Output current (max): 385 A
- Portable unit (mobile usage)



Test bench software functionalities:

- iGEM
- ISAC
- InMotion
- AVL PUMA OPEN 1.5.5







Power analyzer (Yokogawa unit)

ICE & ALTERNATIVE FUELS TESTING

BOSMAL provides a wide range of services on up-to-date and future powertrain technologies:

- Light Duty (IC-engines, Hybrids (Mild to PHEV), Electric, Hydrogen)
- Heavy Duty (Diesel, CNG, Hybrid, Hydrogen)
- Marine & Stationary (Diesel, CNG, Biogas)

The scope of the activities on powertrains:

- development tests and measurements
- durability / validation
- homologation / type-approval
- conformity of production
- fuel & lube oil tests
- benchmarking

Chassis dyno facilities for vehicles with ICE, hybrid, alternative powertrains

Two Euro 6d-compliant test facilities enabling full range of certification and R&D activities in the field of emissions

Exhaust gas emissions tests on vehicles in the real driving conditions (RDE) using Portable Emissions Measurement Systems (PEMS)

Emissions R&D and emissions/ drivability calibration tests for cars, vans & motorcycles

- Including modal analysis of emissions, tests at various temperatures





in climatic chamber
(-35°C to +60°C) 14,3×10,1×4,3 m

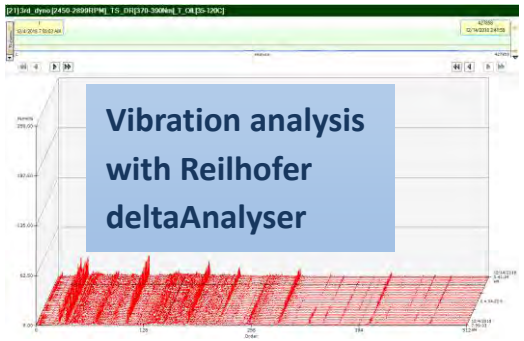


55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

Dynamic transmission test bed for both manual, automatic transmissions and eDrive – drivetrain testing



- Suitable for both manual, automatic transmission and eDrive – drivetrain testing activity
- Durability and dynamic tests of transverse 4x2 drive systems
- Simulation of road load, vehicle, engine, driver, vehicle brake and starter
- Control of vehicle speed via accelerator pedal and vehicle brake (acceleration and deceleration)
- Simulation of various driving behavior (sporty, economic behavior, ...)
- Simulation of various driving situations (starting from rest, acceleration, deceleration, hill driving, coast down)
- Vibration spectrum analysis with **Reilhofer deltaAnalyser**





eDrive drivetrain testing with 250kW emulator

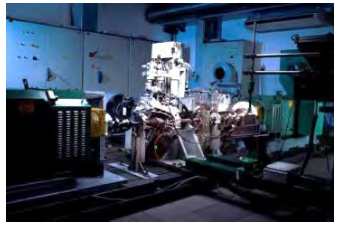


eDrive gearbox testing



Steady state transmission test bed for manual transmissions

- Suitable for manual transmissions testing
- Steady state durability tests of transverse 4x2 drive systems
- Vibration spectrum analysis with Reilhofer delta Analyser





MATERIAL TESTING



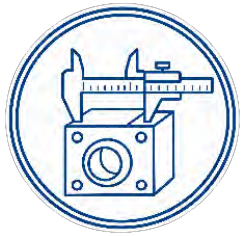
COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL

DESIGN AND ENGINEERING SUPPORT



DESIGN AND
ENGINEERING SUPPORT



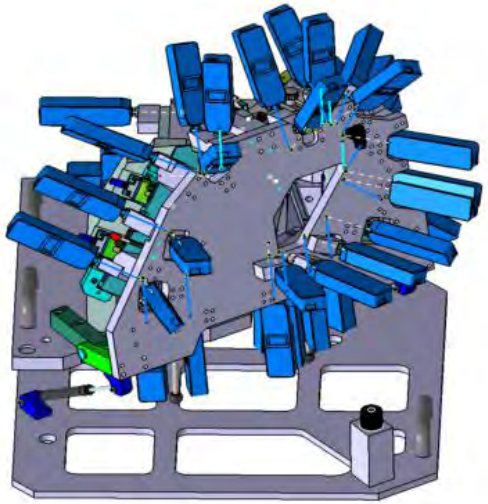
ENGINEERING
SERVICES

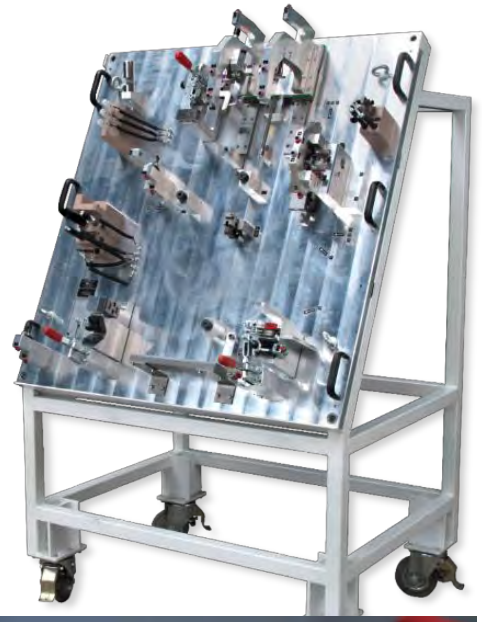


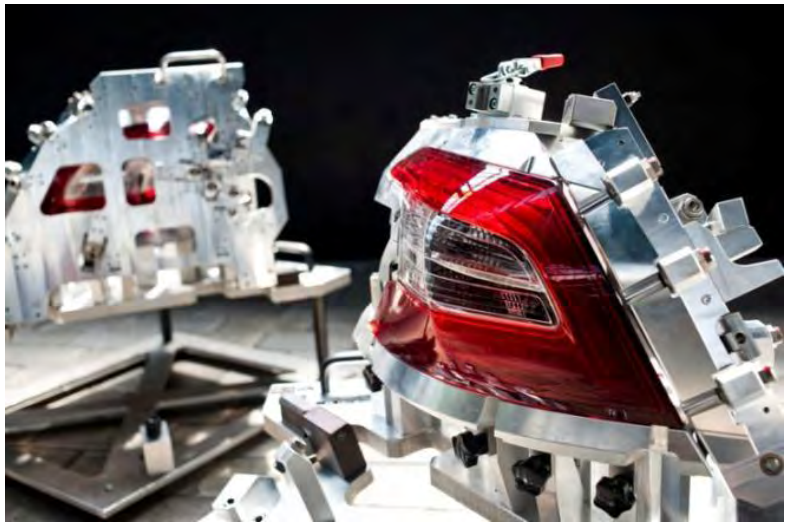
HOMOLOGATION
TYPE APPROVAL

DESIGN AND ENGINEERING SUPPORT

- Mechanical design and technical documentation.
- Engineering calculations and finite element analysis.
- Mechanical tooling design, modification and manufactur
- Models and prototypes of mechanical tooling.
- CAD/CAM programming and CNC machining.
- Dimensional inspection and measurement reports.
- Programming and configuration of off-the-shelf PLCs.
- Engineering support for customers' production processes.





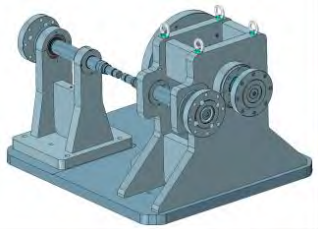




From design requirements to verified mechanical tooling

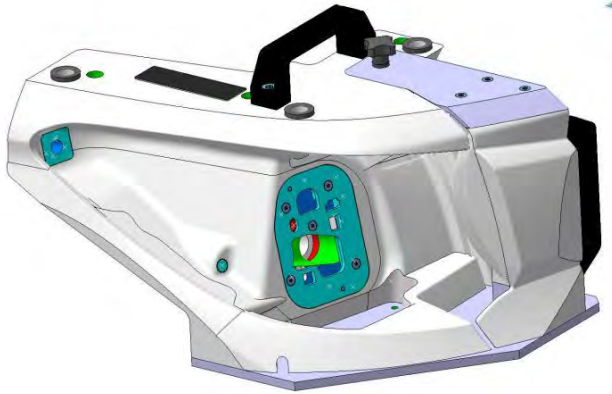
Turnkey systems

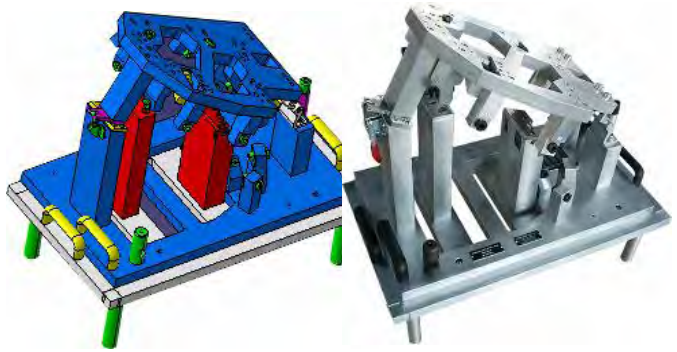
- Definition of requirements
- Engineering calculations
- Mechanical design
- CAD modelling and technical drawings
- Manufacture of tooling models and prototypes
- Dimensional inspection and functional verification
- Engineering support for implementation at the customer's facility

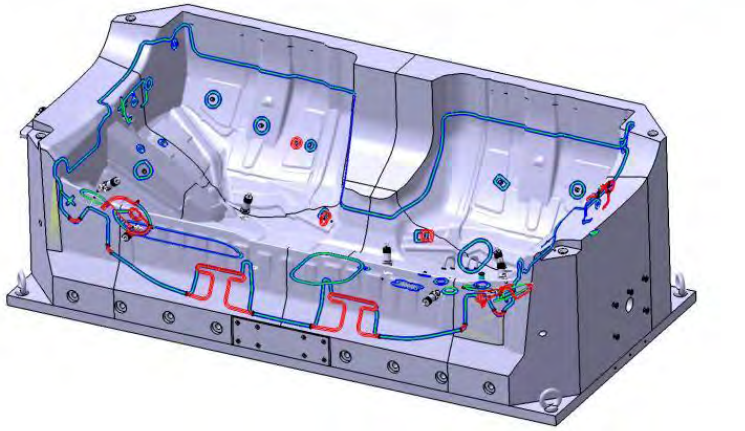




We provide design and engineering analysis services — from defining requirements and design criteria, through 3D modelling and engineering analysis, to preparing technical documentation and providing engineering support for implementation at the customer's facility.For mechanical tooling, we also provide manufacturing, dimensional inspection with a measurement report, and functional testing within the agreed scope.







Design and manufacture of checking fixtures

MECHANICAL DESIGN, ENGINEERING ANALYSIS AND TOOLING MANUFACTURE

Design

- 3D models
- 2D documentation
- Files format conversion

Simulation /Calculation

Finite element analysis (FEA):

- Linear and nonlinear static analysis.
- Dynamic analysis.
- Modal analysis.
- Frequency response analysis.
- Coupled-field analysis.

Machining of mechanical tooling

- Milling
- Turning
- Grinding
- WEDM (wire electrical discharge machining)

Ansys

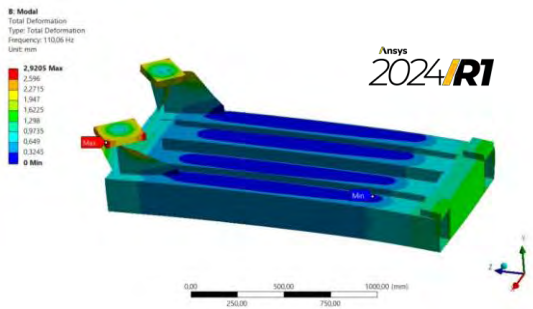
- ANSYS Mechanical Premium.
- ANSYS Discovery Modeling.

Available Analytical Capabilities:

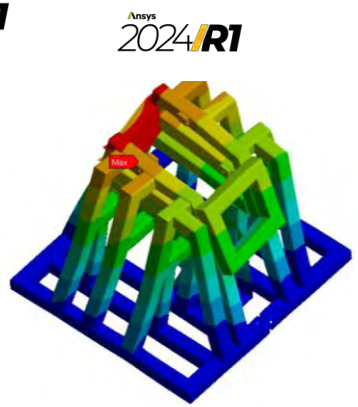
- Fatigue analysis
- Large-deformation analysis
- Structural optimization

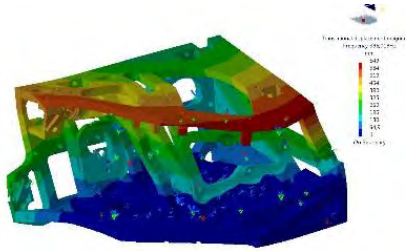
We are working on CAD/CAE/CAM software:

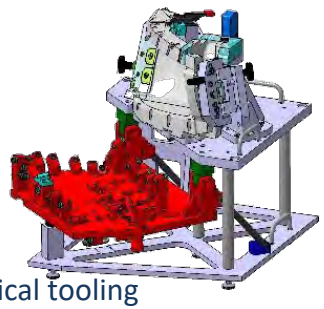
- Dassault Systemes CATIA V5
- Solid EDGE
- Siemens NX
- Autodesk INVENTOR
- SIEMENS NX CAM, Edge CAM
- Creo
- Autodesk AutoCAD
- Dassault Systemes Simulia ABAQUS, CATIA V5 Generative Assembly Structural Analysis

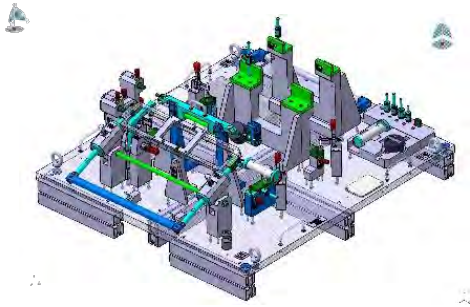
















Machining of mechanical tooling

RETURN

55 years on the automotive market & 30 years as an Accredited Testing Laboratory AB 128

ANALYSIS & SIMULATION

Engineering analysis for industrial applications

- Strength assessment of checking fixtures and mechanical tooling.
- Simulation and optimisation of fixtures for component vibration testing.
- Structural analysis of vehicle load-space partitions to support type-approval testing.
- Structural analysis of rear underrun protection devices.
- Analysis of vehicle adaptations and special-purpose structures.

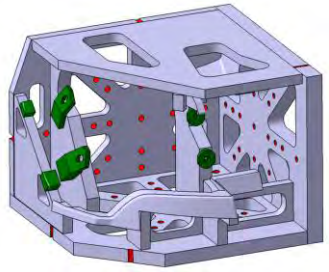
Engineering analysis using:

SIMULIA ABAQUS

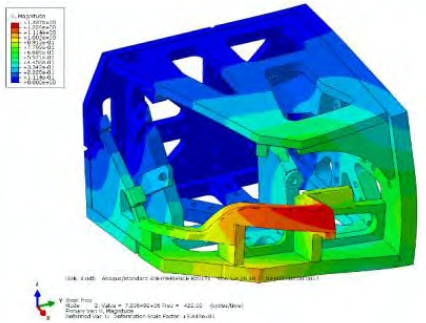
Ansys

CATIA

Generative Assembly Structural Analysis



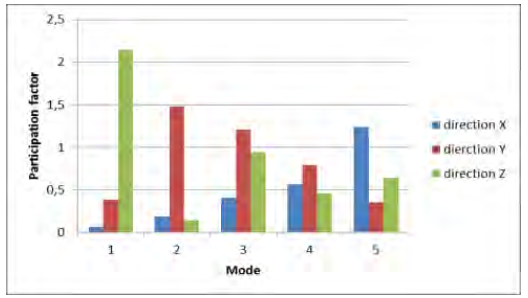
3D model



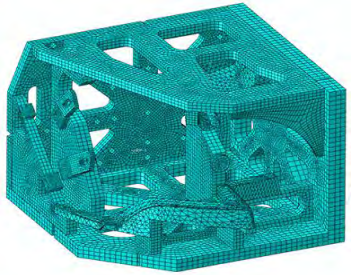
Fixture mode shape and natural frequency

Vibration test fixtures for automotive lighting — development process

- Definition of mounting interfaces and test requirements.
- CAD modelling and preparation of the finite element model.
- Calculation of natural frequencies.
- Dynamic response analysis.
- Design optimisation against test requirements.
- Preparation of manufacturing drawings.
- Fixture manufacture.
- Dimensional inspection.
- Verification of dynamic behaviour through vibration testing.



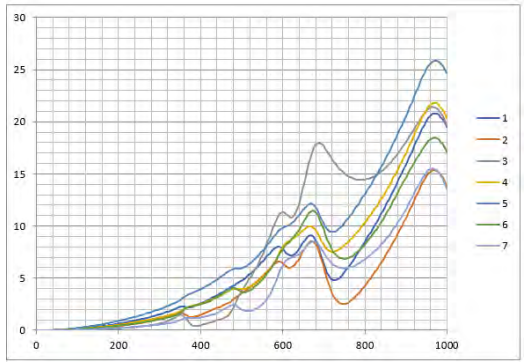
Participation factor for first six modes



Finite element mesh



Automotive lighting vibration test using the developed fixture

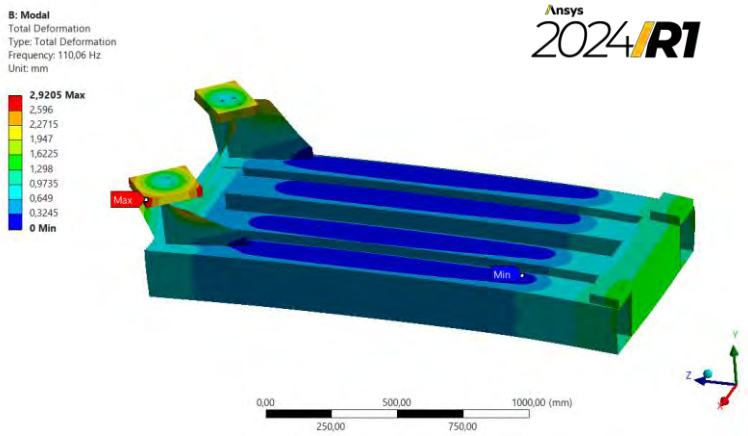


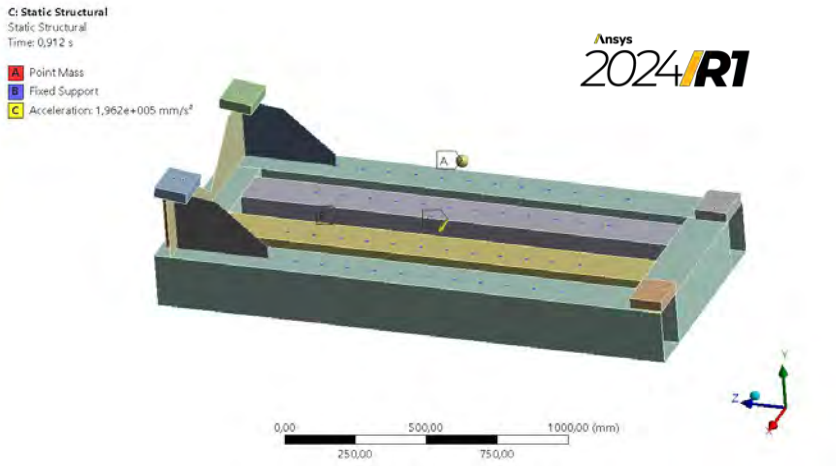
Frequency response function

Computer Simulation Software Ansys 2024 R1

Ansys

- ANSYS Mechanical Premium,
- ANSYS CDF Premium,
- ANSYS LS-DYNA,
- ANSYS OptisLang Premium,
- ANSYS Discovery Modeling.

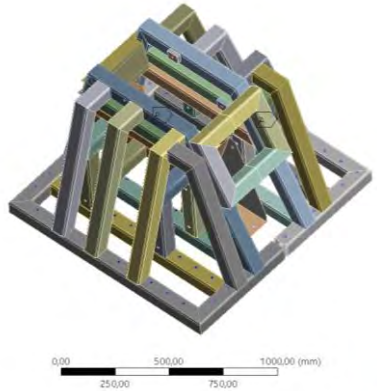


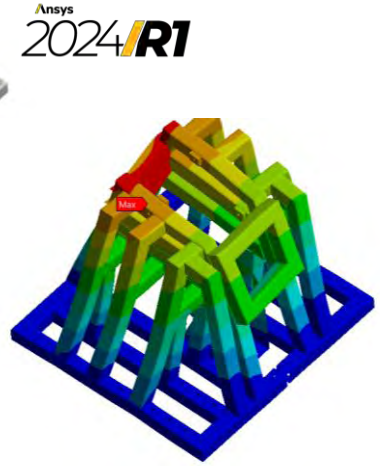


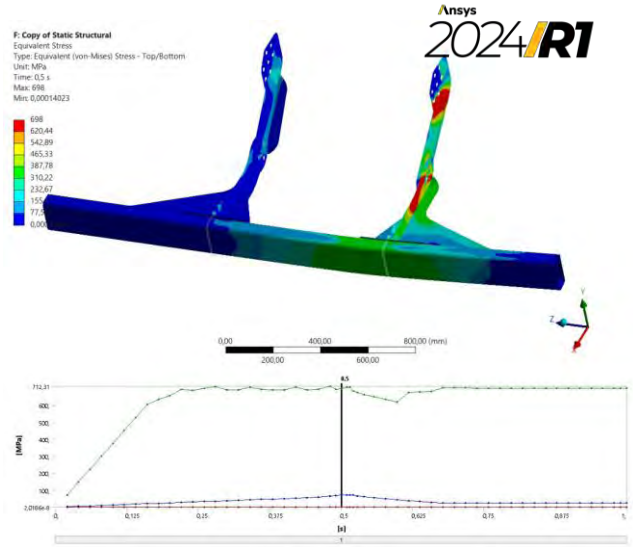
Analysis capabilities

- Fatigue analysis.
- Computational fluid dynamics (CFD).
- Large-deformation analysis.
- Thermal analysis.
- Structural optimisation.
- Model preparation for simulation.





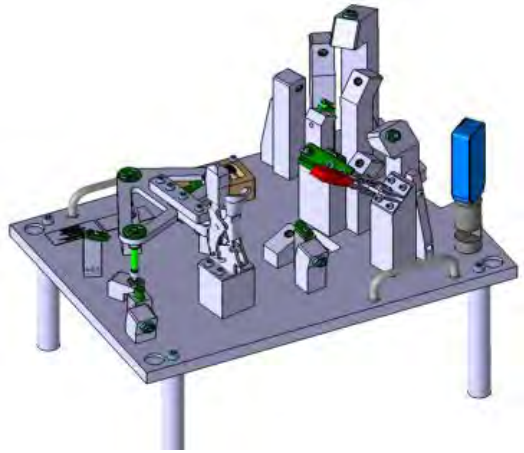




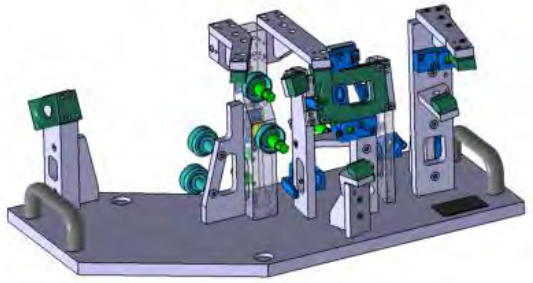
MECHANICAL TOOLING AND CHECKING FIXTURES — DESIGN AND MANUFACTURE

We design and manufacture mechanical tooling for positioning, securing and checking components, including:

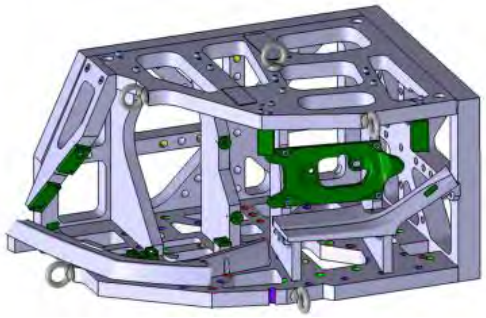
- Automotive lamps and mirrors.
- Seats and seat components.
- Seals.
- Floor mats, insulation panels and parcel shelves.
- Wiper and window mechanisms.
- Other components requiring dedicated locating or checking fixtures.



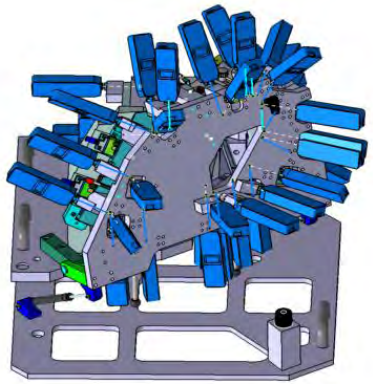
Housing gauge for automotive lighting



3D/Photometry gauge for lamps



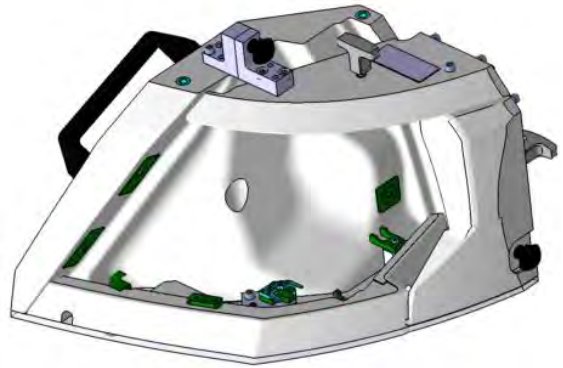
Vibration holder for lamps



Datamyte gauge for automotive lighting

Examples of tooling for automotive lighting:

- Checking fixtures for lamp housings and lenses.
- Fixtures for dimensional inspection of complete lamps.
- Mounting fixtures for photometric testing.
- Mounting fixtures for vibration testing.



Tightness&thermal gauge for lamps

Checking fixtures and templates for dimensional inspection



Checking fixtures for left- and right-hand automotive floor mats and insulation panels









Checking fixtures for automotive seats

CHECKING FIXTURE WITH MEASUREMENT DATA ACQUISITION

Example of a checking fixture used with digital measuring instruments and a tablet-based application for recording and processing measurement results.

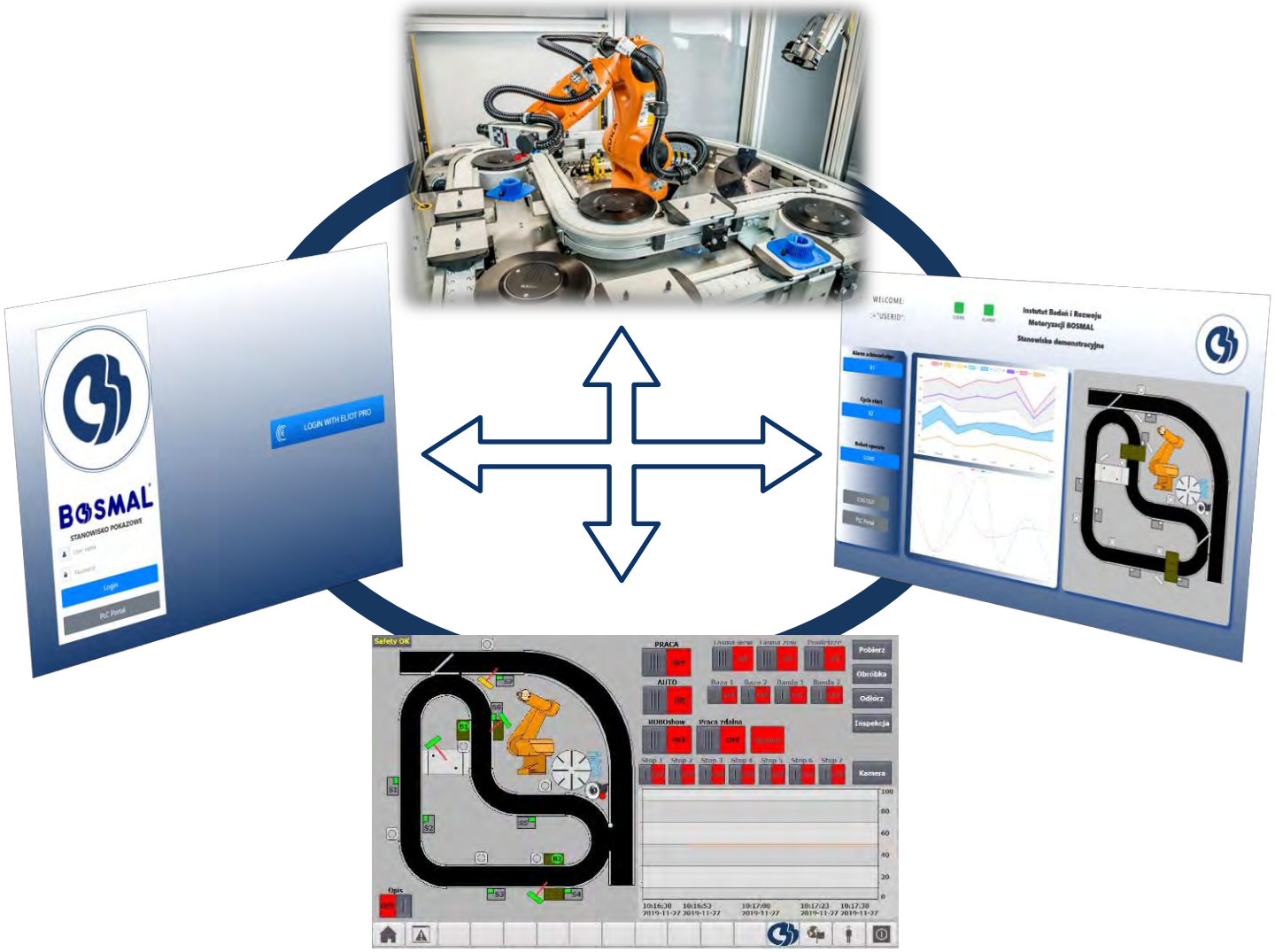


Main functions:

- Measurement data acquisition and processing.
- Configuration of tolerance limits.
- Measurement point correction.
- Measurement report generation.
- Data storage and export.
- Management of users, workstations and measuring equipment.

PROGRAMMING AND CONFIGURATION OF OFF-THE-SHELF PLCs

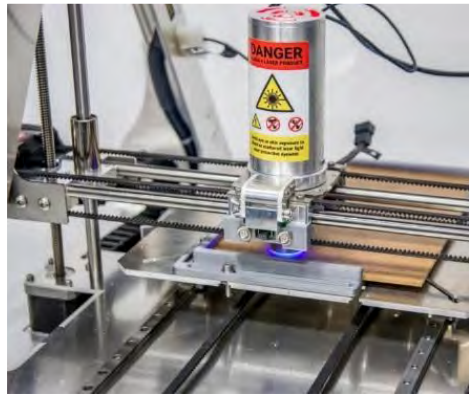
PLC software and configuration tailored to project-specific functional requirements



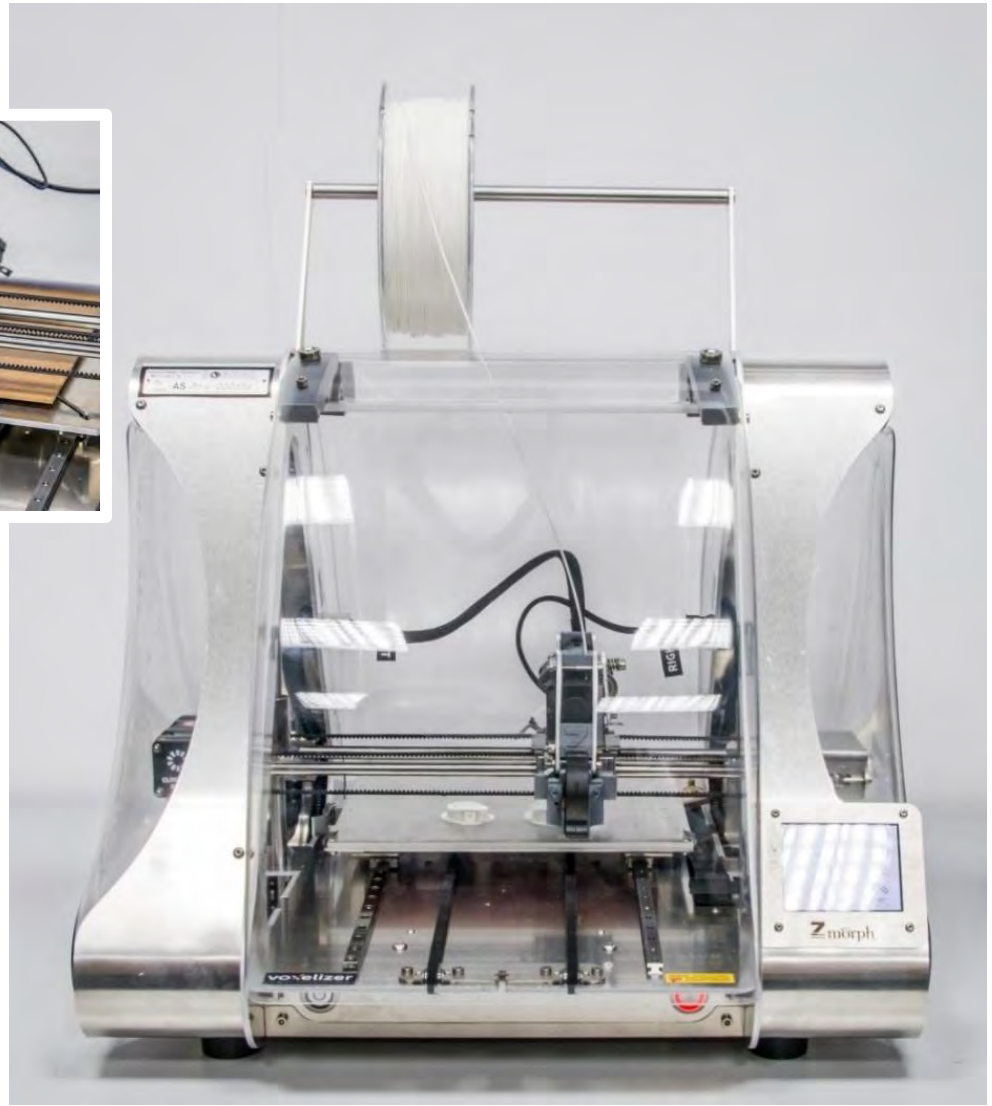
- Analysis of functional requirements.
- Development of control algorithms.
- Programming of off-the-shelf PLCs.
- Configuration of controllers and modules in accordance with project documentation.
- Software testing and functional verification within the agreed scope.
- Preparation of software and configuration documentation.

Additive manufacturing of models, bases, holders, templates and prototypes of mechanical tooling for design verification and testing.









MACHINING CAPABILITIES

5-axis vertical machining centre - C250 HERMLE

Table dimensions	450 x 360 mm
Max. table load	300 kg
Axis travel:	
X-axis travel	600 mm
Y-axis travel	550 mm
Z-axis travel	450 mm
Positioning accuracy	P≤0,008 mm



5-axis vertical machining centre, REMA CONTROL - Leonard LT5 2.5

Table dimensions	2720 x 820 mm
Rotating table dimensions: Built-in table diameter Rotational range of axis a	 800 mm 360°
Max. load of built-in table	2500 kg
Axis travel: X-axis travel Y-axis travel Z-axis travel	 2550 mm 1000 mm 1000 mm
Positioning accuracy	+/- 0,008 mm
Repeatability accuracy	+/- 0,005 mm
Rotational range of axis b	+/- 105°



3-axis vertical machining centre, AKIRA SEIKI - Performa Classic V4A

Table dimensions	1200 x 480 mm
Max. table load	1300 kg
Axis travel: X-axis travel Y-axis travel Z-axis travel	 1050 mm 540 mm 550 mm
Positioning accuracy	+/- 0,01 mm
Repeatability accuracy	+/- 0,003 mm



Wire EDM machine — MITSUBISHI MV2400S Tubular

Travel on axes XYZ	600 x 400 x 310 mm
Max. workpiece dimensions	1050 x 820 x 305 mm
Max. workpiece weight	1500 kg
Max. bath fill depth	305 mm
Table dimensions	840 x 560 mm
Max. cut angle	degrees ± 15°/ 260 mm degrees ± 30°/ 110 mm
Wire diameter	0,10 – 0,30 mm
Automatic wire threading for wires of diameter	0,10 – 0,30 mm
Max. weight of wire spool	10 kg



Opal Waterjet 2D cutting machine

Utilisation of waterjet cutting allows work with a wide variety of materials such as: stone, wood, various steel grades, non-ferrous metals, plastics etc.

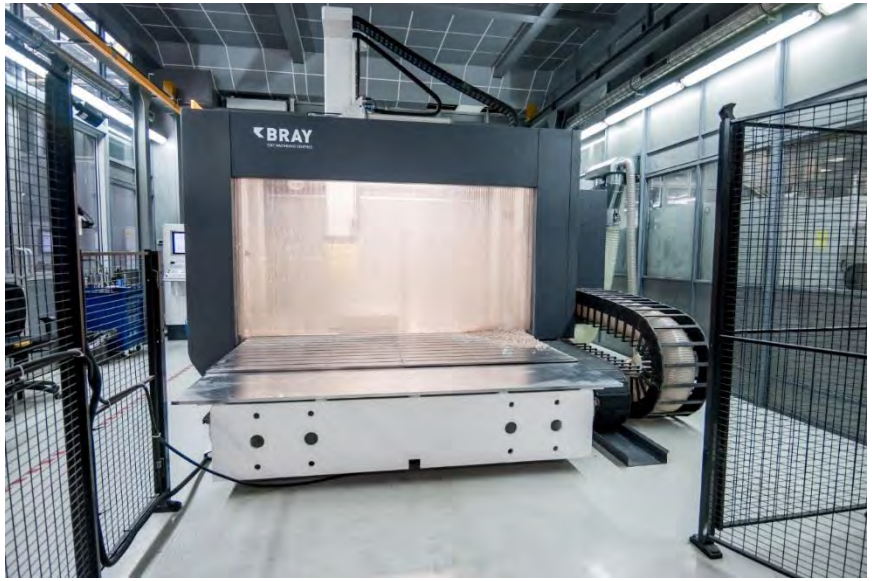
Dimensions of the table working surface	1500x3000 mm
Cutting thickness	0,5 - 150 mm



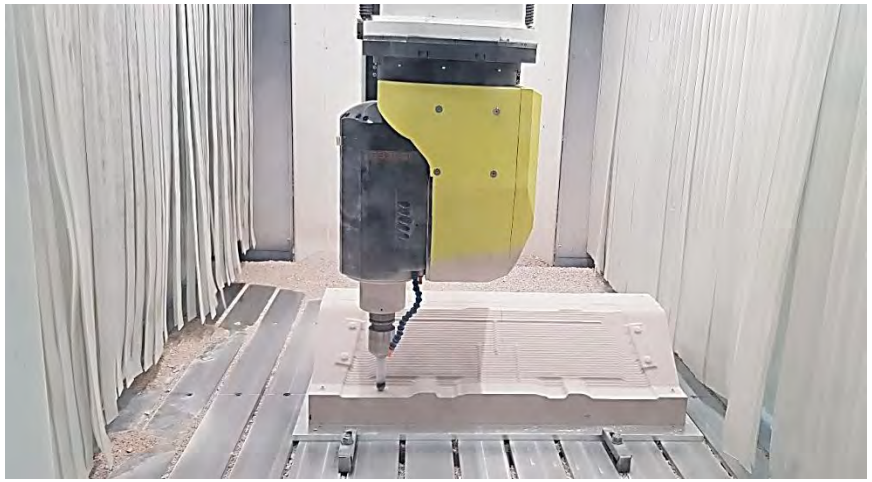
MACHINING CAPABILITIES

5-axis CNC milling machine (work table 4000mm x 2700mm)





Working envelope (X × Y × Z)	4000 x 2700 x 1480 mm
Maximum workpiece dimensions — 3-axis machining	3974 x 2684 x 1168 mm
Maximum workpiece dimensions — 5-axis machining	3166 x 2086 x 1060 mm
The total dimension of the machine	7070 x 4870 x 4810 mm
Maximum axis travel speeds (X/Y/Z)	60/30/30 m/min
Repeatability in the XYZ position	± 0,01 (±0,015) mm
XYZ positioning accuracy	± 0,02 (±0,035) mm/m

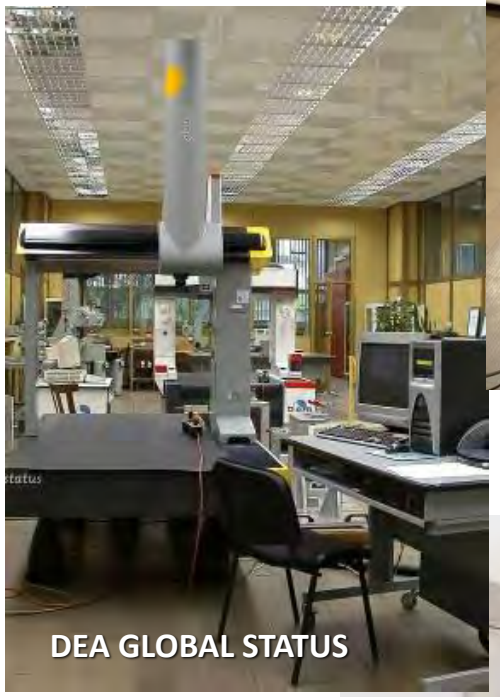


Precision dimensional metrology — contact and non-contact measurements

- Linear and angular measurements.
- Assessment of form, orientation and position deviations.
- Surface topography measurements.
- Surface roughness measurements.
- Measurement reports prepared to customer requirements.


OPTIV CLASSIC 321GLTP




DEA GLOBAL STATUS



Hexagon (ROMER)
Absolute Arm 87 serie




DEA GLOBAL PERFORMANCE
1200 X 3000 X 1000 mm

Measuring machines:

- DEA GLOBAL PERFORMANCE (12.30.10) with measurement and inspection software PC-DMIS™ CAD++ On-line with DCT CATIA V5 and DCT UNIGRAPHICS
- DEA GLOBAL STATUS (09.15.08)
- HexMet-OPTIV CLASSIC 321GL tp
- Hexagon (ROMER) Absolute Arm 87 serie



MATERIAL TESTING



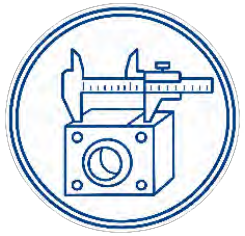
COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL

Engineering services



DESIGN AND
ENGINEERING SUPPORT



ENGINEERING
SERVICES



HOMOLOGATION
TYPE APPROVAL

ENGINEERING SERVICES - OVERVIEW

Engineering support and manufacturing through external partners

Staff augmentation (Body/ team leasing):

1. **Rental of employees (including residents)**
2. **Auditors/ experts outsourcing**
    1. System audits
    2. Product/ service audit
    3. Process audit
    4. Interim Management

Individual design

1. Body Systems
2. Exterior trim systems
3. Interior Trim Systems
4. New Product Development (NPD)
5. Modeling and engineering calculations
6. Draughting and Markup
7. Product analysis and optimization
8. 3D scanning and reverse engineering
9. Assembly design
10. Data Management
11. Materials

Special production

1. 3D Printing
2. Precision parts
3. Surface coating
4. Parts Machining – technologies
5. Injection Moulding

Opinions, analyzes, trainings and workshops

1. Technical analyses and opinions
2. Opinions on innovativeness
3. Root cause analysis (RCA) of non-conformances of components and subassemblies
4. Verifications of the conformity of vehicle production with the producer's requirements,
5. Trainings on type-approval regulations and requirements
6. Workshops on material testing





Development and optimization of processes in the company

1. Production processes simulation
2. Organization of purchases
3. Implementation and improvement of management systems
4. ERP/CAD/CAM/PLM systems
5. Production planning
6. Organization of the supply chain (logistics and warehouses)
7. Total Productive Maintenance (TPM)
8. Analysis and verification of manufacturing technology
9. Energy audits
10. Analysis and optimization of production and/or management processes

RENTAL OF EMPLOYEES

We provide engineers and technical specialists to support customers' teams for an agreed period. Personnel are selected according to project requirements, technical expertise and experience. Team composition can be adjusted as project needs evolve.

Engineering staff augmentation (including residents):

Body Leasing is a form of outsourcing involving the delegation of specialists to work for the client for a specific period of time. Body leasing competences are selected strictly in terms of the required knowledge and skills to implement a given project. During the cooperation, specialists can exchange, guaranteeing all the time matching of skills to the needs of the project.

Depends on the customer requirements we offer 3 levels of workers:

- Junior – for simple activities to support customer team – experience up to 2 years
- Specialist – for more specific tasks, not only support the team but also will behave proactively – experience 3-5 years
- Expert – for new solutions or special tasks like reorganization, audits etc. - more than 5 years of experience.



On-site engineering suport:

In particular, we offer engineering support by resident engineers in the following areas:

- car production
- engine production
- production of agricultural machinery

Available specialist roles:

- Designer
- Project Manager
- Maintenance Engineer
- Sales Engineer/Specialist
- IT Engineer
- Product Engineer
- Process Engineer
- Quality Engineer
- Purchasing Engineer/Specialist
- Logistics Engineer

AUDITORS / EXPERTS OUTSOURCING

Auditors/ experts outsourcing

- System audits
- Product/ service audit
- Process audit
- Interim Management

System audits:
Documentation and processes audit in accordance with the requirements of the quality system.
Identifying areas for improvement and critical points
Audit conducted by an expert in the field of Quality or a certified Auditor of the Quality System
Audits according to:

- ISO 9001 (quality management system requirements)
- ISO 45001 (concerning occupational health and safety management systems)
- ISO 14001 (requirements for an environmental management system)
- IATF 16949 (defines the requirements for the quality management system in companies related to the automotive industry)
- ISO/IEC 27001 (regarding information security management systems)
- TISAX (regarding information security in the automotive industry)

Product/ service audit:
Independent product quality assessment to determine its usability and compliance with the requirements. The criteria for such an audit are: production documentation, technical and functional specification of the product, customer requirements.

- According to VDA 6.5
- According to differently defined criteria

Process Audit:
Process Audit - verification of compliance with the requirements of a given production proces:

- process map verification
- checking process parameters from technology or work instructions
- data collection
- SWOT analysis (indication of strengths and weaknesses of the production process)
- quality control analysis

The process audit can be carried out according to various standards (eg VDA 6.3), depending on the requirements.

Interim Management:
According to the Interim Management Association, “Interim Management is the rapid provision of senior executives to manage change or transition”. In simpler terms, an interim manager is a highly experienced and specialized executive whom you can employ for a short time to solve a specific business problem. He or she is a master project manager who will not only give you advice, but also implement your solution.
In short, an interim manager meets your specialized needs, is more motivated to look out for your best interests, is actively involved from start to finish on achieving solutions, works with your own people and reports directly to you. He or she develops the strategies and then implements them.

Interim management expertise:

- Procurement
- Engineering
- Lean Manufacturing
- SCM
- Quality

ENGINEERING DESIGN SERVICES

Body Systems

- Body panels and closures
- Body structure (underbody structure, crash system)
- Body panels (fender, engine bay, rear quarter, body side)
- Doors (side door, SLD, RCD)
- Closures (hood, tailgate, engine cover)
- Closure mechanisms
- Roof/ upper structure
- Glazing (windscreen, backlight, fixed, dynamic)
- Sealing

Exterior trim systems

- Bumper systems
- Floors, under-trays, aero shields, diffusers
- Ducting, vents, grilles
- Exterior trim, finishers, wheel-arch liners
- Luggage bay trim
- NVH, heat shields, thermal management
- HVAC system, intakes, distribution
- Wipers/ washer systems
- Exterior mirrors
- Polymer/Composite body systems

New Product Development (NPD)

Experience at phases:

- Concept development
- Engineering feasibility
- Prototype part development and release

Interior Trim Systems

- Instrument Panels
- A-Pillar Trim, B-Pillar Trim, C-Pillar Trim
- Centre Consoles
- Handbrake
- Under-Seat Storage
- Headliners/Sun Visors
- Seating Systems
- Door Sills

Modeling and engineering calculations

- Surface modeling
- Solid modeling
- Parametric modeling

Draughting and Markup

- PMI (Product manufacturing information) and annotation
- Sections and auxiliary views
- GD&T ((Geometric dimensions and tolerances)
- SC/CC (Significant and Critical Characteristics)
- 2D draughting/annotation
- 3D functional tolerancing and annotation (FT&A)

Product analysis and optimization

- Product analysis and verification
- Weight calculations (optimalization of weight and quality according to product application)

3D scanning and reverse engineering

- Contact and non-contact measurements of components
- Dimensional inspection of finished components against 3D CAD models.
- 3D scanning of a component in order to build a 3D model (reverse engineering)

Assembly design

- Building assemblies / BOM
- Annotations
- Named views
- Kinematic studies/ collisions / constraints

Data Management

- Following part name, number, version & revision rules
- Data storage rules
- Import/export functions
- Change management
- Release process

Materials

- Polymers & Composites
- Sheet metal (steel, aluminium)
- CFK
- SMC
- Plastic mould parts
- Fibber glass
- BIW Alu & SMC
- Casting (aluminium)
- Metal

ENGINEERING SUPPORT AND MANUFACTURING THROUGH EXTERNAL PARTNERS

BOSMAL provides engineering support and coordinates selected manufacturing processes carried out by external partners. The scope of each project is agreed individually.

Engineering support

- Definition of technical requirements and intended use.
- Review of drawings, materials and manufacturing feasibility.
- Assessment of manufacturing options.
- Preparation and modification of technical documentation.

Manufacturing processes available through cooperation

- Additive manufacturing.
- Precision machining.
- Surface finishing, coating and painting.
- Injection moulding.
- Welding and laser processing.

Project coordination and verification

- Coordination of agreed manufacturing activities.
- Technical communication with manufacturing partners.
- Dimensional inspection and review of results against agreed requirements.
- Preparation of measurement reports and supporting documentation.

TOTAL PRODUCTIVE MAINTENANCE (TPM) CONSULTING

- **Assessment of maintenance organisation and resources.**
- **Support in selecting maintenance providers.**
- **Development of preventive and predictive maintenance approaches.**

Production processes simulation

Pre-start factory process simulations or optimization simulations of existing production / warehouse / transport solutions.

Organization of purchases

- searching for potential direct and indirect suppliers
- audit of potential and implementation support for suppliers
- consulting and training in purchasing
- creating purchase categories - MoB analyses (Make or Buy)
- identification of human resources
- securing the supply chain (including developing and securing deliveries of materials for production)
- purchasing processes outsourcing
- implementation or support in the implementation of strategies, processes and procedures

Implementation and improvement of management systems

- consulting and training
- training and implementation for ISO 9001 / IATF 16949 / ISO 14001 / ISO 45001 certification
- determination of human resources
- implementation or support in the implementation of strategies, processes and procedures

ERP/CAD/CAM/PLM systems

- assistance in the selection and implementation of optimal solutions

Production planning

- layout
- verification of needs for machines, equipment and processes
- implementation in accordance with Lean method
- training and consulting
- identification of human resources
- analysis of the selection of automatic and manual processes
- implementation or support in the implementation of strategies, processes and procedures

Organization of the supply chain (logistics and warehouses)

- choice of appropriate solutions
- layout
- identification of human resources
- analysis of the process automation
- training and consulting
- processes verification
- implementation or support in the implementation of strategies, processes and procedures
- choice of transport companies
- securing the chain of supply (including developing and securing deliveries of materials for production)

Total Productive Maintenance (TPM)

- Choice and verification of companies and/or employees responsible for maintenance (production lines, installations, tool shop, choice of solutions)
- Preventive maintenance
- Predictive maintenance

Analysis and verification of manufacturing technology

- verification whether the adopted technological and process solutions are optimal and properly matched to the customer's needs
- looking for alternative technological solutions in terms of cost and quality

Energy audits

- Power quality assessment
- Improving Energy Efficiency
- Energy Efficiency Audit
- Lighting audit
- Compressed air audit
- Audit of production technology
- Heating substation energy audit
- Enterprise energy audit

Analysis and optimization of production and/or management processes

- 2D and 3D visualization and simulations of production processes
- Optimizations and improvements

TECHNICAL ASSESSMENTS, EXPERT OPINIONS, TRAINING AND WORKSHOPS

Technical analyses and opinions

- Analysis of New Approach directives and related norms harmonised in terms of CE marking of products
- Product analysis and assignment according to given legal requirements of various types (directives, type approval, CE, regulations, marking identifying the producer/supplier of the destination vehicle)
- Analysis of other legal requirements (e.g. GVO directives)
- Technical analysis regarding vehicles and their components
- Electrical and electronic analysis for automotive vehicles
- Carrying out activities related to the verification of the declaration of conformity of automotive parts with the standards and technical conditions
- Agreements with institutions authorised for certification of the technical conditions and selection of representative samples of the parts subject to certification
- Analysis of test results and completion of documents for the Certification Body
- Transfer of full documentation to the Certification Body on behalf of the customer

Assessment of vehicle conversions and bodywork against base vehicle manufacturers' requirements

- Verification of compliance with the base vehicle manufacturer's requirements.
- Inspections of vehicle conversion and body-building companies on behalf of vehicle manufacturers.
- Technical opinions on compliance with manufacturers' body-building and conversion guidelines.

Opinions on innovativeness

BOSMAL is a research and development centre according to the definition from the Act of 30th May 2008 on certain forms of support for innovative activities (consolidated text from the Polish Legal Journal Dziennik Ustaw, 2015, item 1710, with later amendments), taking into account the provisions of the Act of April 30, 2010 – provisions introducing laws reforming the science system (Polish Legal Journal Dziennik Ustaw, No. 96, item 620, with later amendments).

In connection with the above, the Institute is able to offers in its scope of activities the elaboration of objective opinions on innovation for the needs of planned investments with the support of EU Operational Programs, based on the independent evaluations of our experts.

BOSMAL elaborates:

- opinions on product innovation,
- opinions on process innovation,
- opinions on technological innovations,
- opinions on non-technological innovations.

Root cause analysis (RCA) of non-conformances of components and subassemblies

As part of our services, we offer:

- Work in the field of first and second degree technical analysis; reasons for the occurrence of simple damage; functional defects and electrical/electronic defects
- Examination of damaged parts/subassemblies in the scope of the defects detected
- Preparation of reports on the fault analysis
- Meetings with suppliers regarding the introduction of remedial procedures following the technical analysis

Trainings on type-approval regulations and requirements

The training is addressed to manufacturers and distributors of vehicles and trailers and their items of equipment or parts, as well as to vehicle repair workshops, vehicle inspection stations, vehicle bodybuilders, companies involved in the modernization of installations in vehicles, tuning of vehicles or construction of "SAM„ (individually constructed vehicles) vehicles. .

Workshops on selected tests of materials and products



MATERIAL TESTING



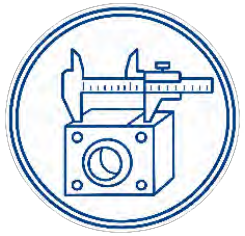
COMPONENT
& ASSEMBLY TESTING



ROAD TESTING, EMISSION TESTING &
ENGINE/POWERTRAIN TESTING

BOSMAL

HOMOLOGATION TYPE APPROVAL



DESIGN AND
ENGINEERING SUPPORT



ENGINEERING
SERVICES



HOMOLOGATION
TYPE APPROVAL

HOMOLOGATION, TYPE APPROVAL

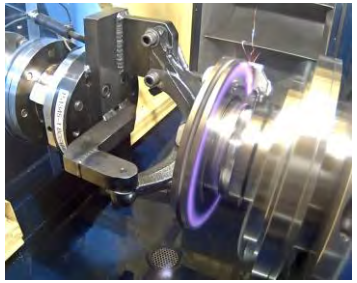
According to the decision No TD-5i-027-17(4)/13 of Polish Ministry of Transport, Construction and Maritime Economy of 14th October 2013, with amendments, BOSMAL Automotive Research and Development Institute Ltd is entitled to perform the following actions:



1. in the scope of approval:
   a) performing EC-type approval tests of vehicles or category **M, N, O, L, T, R, C or S** vehicle type approval tests,
   b) performing the approval tests of parts or equipment for category **M, N, O, L, T, R, C and S** vehicles,
   c) performing approval tests related to the installation process of gas retrofit systems adapting vehicles of category **M or N** to use gaseous fuels,
   d) performing:
   - Conformity of Production of vehicle, parts or equipment for category **M, N, O, L, T, R, C or S** vehicles,
   - Conformity of Production of installation of gas retrofit systems adapting vehicles of category **M or N** to use gaseous fuels;



2. within the scope of national individual vehicle approval, admission of a vehicle carrying out tests confirming the fulfilment of the applicable conditions or technical requirements of a given vehicle, in order to national individual vehicle approval for the categories of vehicles: **M, N** and **O**;



3) within the scope of individual vehicle approval, admission of a vehicle carrying out tests confirming the fulfilment of the applicable conditions or technical requirements of a given vehicle, in order to approve an individual vehicle for the categories of vehicles: **L, T, R, S** and **C**;

4) within the scope of EU individual vehicle approval, carrying out tests confirming the fulfilment of appropriate conditions or technical requirements of a given vehicle, for the purpose of EU approving of an individual vehicle for the categories of vehicles: **M1, N1** and **special vehicles M, N,** and **O**.







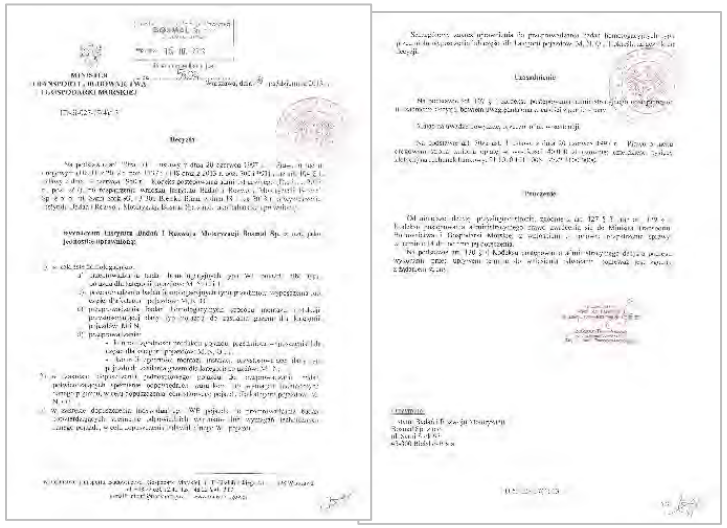




HOMOLOGATION, TYPE APPROVAL

Scope of authorization to carry out type approval tests of the equipment or parts of category M, N, O, L, T, R, C or S vehicles according to the Decision of the Director of Transportation Technical Supervision No. H.732.39.2026.4.H of 25.06.2026 (short list):

- **for motor vehicles and their trailers (M, N, O):** 70/157/EEC, 70/221/EEC (A2), 70/222/EEC, 71/320/EEC, 76/114/EEC, 76/756/EEC, 76/757/EEC, 76/758/EEC, 76/759/EEC, 76/760/EEC, 77/538/EEC, 77/539/EEC, 77/540/EEC, 80/1269/EEC, 89/297/EEC, 91/226/EEC, 92/21/EEC, 92/22/EEC, 94/20/EC (A.V.1, A.V.2), 95/28/EC, 97/27/EC, 2001/85/EC, 2003/97/EC, 2005/55/EC, 2005/64/EC, 2006/40/EC, 715/2007, 692/2008, 595/2009, 672/2010, 1003/2010, 1005/2010, 1009/2010, 19/2011, 109/2011, 458/2011, 582/2011, 130/2012, 1230/2012, 540/2014, 2017/1151, 2017/1347, 2017/2400, 2021/535 (A2, A3, A5, A6, A7, A8, A10, A11, A13), 2022/1362.
- **for agricultural and forestry vehicles (T, R, C, S):** 76/432/EEC, 2009/60/EC (A1.1, A1.2), 2009/144/EC (A1, A2, A3 exc. A3 p.8.1.3.3), 1322/2014, (A17, A22, A24, A25, A26), 2015/68, 2015/208 (A2, A11, A12, A14, A18, A19, A20, A21, A22, A24, A25, A26, A27, A30, A31, A.34), 2016/1628, 2018/985.
- **for two- or three-wheel vehicles and quadricycles (L):** 3/2014 (A4, A6, A9, A15, A16), 44/2014 (A5, A8, A10, A11, A14), 134/2014, 901/2014 (A5), 901/2014 (A5).
- **for vehicles in categories M, N, O , L and T according to UN Regulations No:** 1, 3, 4, 5, 6, 7, 8, 10 (A10), 11, 13, 13H, 14, 18, 19, 20, 23, 24, 26, 27 (exc. A5 p. 10), 28, 31, 37, 38, 39, 43 (exc. A3 p.: 3.2, 6.1-6.3), 46 (exc. p. 6.2 and A10), 48, 49, 50, 51, 53, 55, 56, 57, 58, 59, 61, 65, 67 (part II), 68, 69, 70, 72, 73, 74, 77, 78, 79, 82, 83, 84, 85, 86, 87, 89, 90, 91, 93, 96, 97, 98, 99, 100, 101, 102 (S.I.5, S.II.13), 103, 104, 105, 107, 110 (part II), 112, 113, 115, 116, 118, 119, 120, 123, 128, 132, 133, 136, 141, 142, 143, 145, 147, 148, 149, 150, 154, 168.





HOMOLOGATION, TYPE APPROVAL

Detailed scope of authorization to carry out type approval tests of the equipment or parts of category M, N, O, L, T, R, C or S vehicles according to the Decision of the Director of Transportation Technical Supervision No. H.732.39.2026.4.H of 25.06.2026:

For motor vehicles and their trailers (M,N,O):

- 70/157/EEC Permissible sound level
- 70/221/EEC (A2) Rear protective devices
- 70/222/EEC Rear registration plate space
- 71/320/EEC Braking
- 76/114/EEC Statutory plates
- 76/756/EEC Installation of lighting and light signaling devices
- 76/757/EEC Retro reflectors
- 76/758/EEC End-outline, front-position (side), rear-position (side), stop, side marker, daytime running lamps
- 76/759/EEC Direction indicators
- 76/760/EEC Rear registration plate lamps
- 77/538/EEC Rear fog lamps
- 77/539/EEC Reversing lamps
- 77/540/EEC Parking lamps
- 80/1269/EEC Measurement of engine power
- 89/297/EEC Lateral protection
- 91/226/EEC Spray suppression systems
- 92/21/EEC Masses and dimensions (vehicles of category M1)
- 92/22/EEC Safety glazing
- 94/20/EC (A.V.1, A.V.2) Couplings (COUPLING BALLS AND TOWING BRACKETS, COUPLING HEADS
- 95/28/EC Flammability
- 97/27/EC Masses and dimensions (vehicles of category other than M1)
- 2001/85/EC Buses and coaches
- 2003/97/EC Indirect vision device
- 2005/55/EC Emissions (Euro IV and V) heavy duty vehicles
- 2005/64/EC Recycling
- 2006/40/EC Air-conditioning systems
- 715/2007 Emissions (Euro 5 and 6) light duty vehicles/ access to information
- 692/2008 Emissions (Euro 5 and 6) light duty vehicles/ access to information
- 595/2009 Emissions (Euro VI) heavy duty vehicles/ access to information
- 672/2010 Windscreen defrosting and demisting systems
- 1003/2010 Space for mounting and fixing rear registration plates
- 1005/2010 Towing device
- 1009/2010 Wheel guards
- 19/2011 Manufacturer's statutory plate and vehicle identification number
- 109/2011 Spray suppression systems
- 458/2011 Installation of tyres
- 582/2011 Emissions (Euro VI) heavy duty vehicles/ access to information
- 130/2012 Vehicle access and manoeuvrability
- 1230/2012 Masses and dimensions
- 540/2014 Sound level
- 2017/1151 Emissions (Euro 5 and 6) light duty vehicles/ access to information
- 2017/1347 Emissions (Euro 5 and 6) light duty vehicles/ access to information
- 2017/2400 Emissions (Euro VI) heavy duty vehicles/ access to information
- 2021/535 Statutory plate and the vehicle identification number (A. II), Space for mounting and fixing of front and rear registration plates (A. III), Wheel guards (A. V), Windscreen defrosting and demisting systems (A. VI), Towing devices (A. VII), Spray suppression systems (A. VIII), Vehicle access (A. X), Reversing motion (A. XI), Masses and dimensions (A. XIII)
- 2022/1362 Determination of specific energy efficiency performance of trailer

For agricultural and forestry tractors (T, R, C, S):

- 76/432/EEC Breaking devices
- 2009/60/EC maximum design speed of and load platforms (A1.1 maximum design speed, A1.2 load platforms)
- 2009/144/EC Certain components and characteristics (A1 Dimensions and towable masses, A2 Speed governor and protection of drive components, projections and wheels, A3 Windscreen and other glazing Equipment (exc A3 p.8.1.3.3 Resistance-to-radiation test))
- 1322/2014 Protection of drive components (A. XVII), Operators manual (A. XXII), Protection against mechanical hazards (A. XXIV), Guards and protective devices (A. XXV) and Information, warnings and markings (A. XXVI)
- 2015/68 Braking devices and trailer brake coupling
- 2015/208 Vehicle structure integrity (A. II), Lighting, light signalling devices and their light sources (A. XI), Lighting installation (A. XII), Vehicle exterior and accessories (A. XIV), Devices to prevent unauthorised use (A. XVIII), Registration plate (A. XIX), Statutory plate and marking (A. XX), Dimensions and trailer mass (A. XXI), Maximum laden mass (A. XXII), Safety of electrical systems (A. XXIV and XXV), Rear protective structures (A. XXVI), Lateral protection (A. XXVII), Tyres (A. XXX), Spray-suppression systems (A. XXXI) and Mechanical couplings (A. XXXIV)
- 2016/1628 Gaseous and particulate pollutant emission limits for internal combustion engines for non-road mobile machinery
- 2018/985 Environmental and propulsion unit performance requirements for agricultural and forestry vehicles and their engines

For two- or three-wheel vehicles and quadricycles (L):

- 3/2014: Electrical safety (A.IV), Front and rear protective structures (A.VI), Installation of lighting and light signaling devices, including automatic switching (A.IX), Installation of tyres (A.XV), Vehicle maximum speed limitation plate (A.XVI)
- 44/2014: Coupling devices and attachments (A.V), External projections (A.VIII), Load platforms (A.X), Masses and dimensions (A.XI), Registration plate space (A.XIV)
- 134/2014 Environmental and propulsion unit performance
- 901/2014: Statutory plate and EU type-approval mark (A.V)

For vehicles in categories: M, N, O, L, T, R, S and C according to UN Regulations:

- No 1 Asymmetric headlamps (R2 and/or HS1)
- No 3 Retro-reflecting devices for power-driven vehicles and their trailers
- No 4 Illumination of rear-registration plates of power-driven vehicles and their trailers
- No 5 Asymmetric headlamps (Sealed Beam)
- No 6 Direction indicators for power-driven vehicles and their trailers
- No 7 Front and rear position lamps, stop-lamps and end-outline marker lamps for motor vehicles and their trailers
- No 8 Headlamps (H1, H2, H3, HB3, HB4, H7, H8, H9, HIR1, HIR2 and/or H11)
- No 10 (A10) Electromagnetic compatibility (Testing for immunity to and emission of transients of electrical/electronic sub-assemblies)
- No 11 Door latches and hinges
- No 13 Braking of vehicles and trailers
- No 13H Braking of passenger cars
- No 14 Safety-belt anchorages, ISOFIX anchorages systems, ISOFIX top tether anchorages and i-Size seating positions
- No 18 Anti-theft
- No 19 Front fog lamps of power-driven vehicle
- No 20 Asymmetric headlamps (R2 and/or HS1)
- No 23 Reversing lights for power-driven vehicles and their trailers
- No 24 Visible pollutants, measurement of power of C.I. engines (Diesel smoke)
- No 26 External projections
- No 27 (exc. A5 p.10) Advance warning triangles exc. Test of stability against wind
- No 28 Audible warning devices and audible signals
- No 31 Asymmetric headlamps (halogen sealed beam)
- No 37 Filament lamps
- No 38 Rear fog lamps for power-driven vehicles and their trailers
- No 39 Speedometer equipment including its installation
- No 43 (exc. A3 p.: 3.2, 6.1-6.3) Safety glazing materials and their installation on vehicles exc. Headform test with deceleration measurement, Resistance-to-radiation test
- No 46 (exc. p.6.2 and A10) Devices for indirect vision and their installation exc. Devices for indirect vision other than mirrors, Calculation of the detection distance for CMS of Classes V and VI

HOMOLOGATION, TYPE APPROVAL

Detailed scope of authorization to carry out type approval tests of the equipment or parts of category M, N, O, L, T, R, C or S vehicles according to the Decision of the Director of Transportation Technical Supervision No. H.732.39.2026.4.H of 25.06.2026

For vehicles in categories: M, N, O, L, T, R, S and C according to UN Regulations:

- No 48 Installation of lighting and light-signaling devices on motor vehicles
- No 49 measures to against the emission of gaseous and particulate pollutants
- No 50 Front/rear position lamps, stop lamps, direction indicators, rear registration plate lamps (vehicle cat. L)
- No 51 Noise emissions
- No 53 Installation of lighting and light-signalling devices
- No 55 Mechanical coupling components of combinations of vehicles
- No 56 Headlamps for mopeds
- No 57 Headlamps for motorcycles
- No 58 Rear underrun protective devices (RUPDs) and their installation; rear underrun protection (RUP)
- No 59 Replacement silencing systems
- No 61 Commercial vehicles with regard to their external projections forward of the cab's rear panel
- No 65 Special warning lamps
- No 67 Specific components for liquefied petroleum gases (LPG) and their installation on motor vehicles (part II)
- No 68 Measurement of the maximum speed, including electric vehicles
- No 69 Rear marking plates for slow-moving vehicles
- No 70 Rear marking plates for heavy and long vehicles
- No 72 Headlamps for motorcycles (HS1)
- No 73 Lateral protection of goods vehicles
- No 74 Installation of lighting and light-signalling devices
- No 77 Parking lamps for power-driven vehicles
- No 78 Braking
- No.79 Steering equipment
- No 82 Headlamps for mopeds (HS2)
- No 83 Emissions of M1 and N1 vehicles
- No 84 Fuel consumption
- No 85 Measurement of the net power and the 30 min. power
- No 86 Installation of lighting and light-signalling devices
- No 87 Daytime running lamps for power-driven vehicles
- No 89 Speed limitation devices
- No 90 Replacement braking parts
- No 91 Side-marker lamps for motor vehicles and their trailers
- No 93 Front underrun protective devices
- No 96 Diesel emission (agricultural tractors)
- No 97 Alarm systems
- No 98 Headlamps with gas-discharge light sources
- No 99 Gas-discharge light sources
- No 100 Battery electric vehicles safety
- No 101 CO_2 emission/fuel consumption
- No 102 (S.I.5, S.II.13) Close-coupling device (CCD); fitting of an approved type of CCD - Specifications, Requirements concerning the fitting of an approved CCD
- No 103 Replacement pollution control devices
- No 104 Retro-reflective markings
- No 105 Carriage of dangerous goods
- No 107 M2 and M3 vehicles
- No 110 Specific components for CNG and their installation on motor vehicles (part II)
- No 112 Headlamps equipped with filament lamps and/or light-emitting diode LED modules
- No 113 Headlamps equipped with filament, gas-discharge light sources or LED modules
- No 115 LPG and CNG retrofit systems
- No 116 Anti-theft and alarm systems
- No 118 Burning behaviour of materials used in the interior construction of certain categories of motor vehicles
- No 119 Cornering lamps
- No 120 Internal combustion engines for agricultural and forestry tractors and non-road mobile machinery (net power, net torque and specific fuel consumption)
- No 123 Adaptive front-lighting systems (AFS) for motor vehicles
- No 128 Light Emitting Diode (LED) light sources
- No 132 Retrofit Emission Control Devices (REC) for heavy duty vehicles, agricultural and forestry tractors and non-road mobile machinery
- No 133 Recyclability of motor vehicles
- No 136 Electric vehicles of category L
- No 141 Tyre pressure monitoring system (TPMS)
- No 142 Tyre installation
- No 143 Heavy Duty Dual-Fuel Engine Retrofit Systems (HDDF-ERS)
- No 145 ISOFIX anchorage systems, ISOFIX top tether anchorages and i-Size seating positions
- No 147 Mechanical coupling components of combinations of agricultural vehicles
- No 148 Light Signalling Devices (LSD)
- No 149 Road Illumination Devices (RID)
- No 150 Retro-Reflective Devices (RRD)
- No 154 Emissions of carbon dioxide and fuel consumption, the measurement of electric energy consumption and electric range (WLTP)
- No 168: Real driving emissions (RDE) for light duty passenger and commercial vehicles

APPROVAL TESTS

According to the decision No TD-5i-027-17(4)/13 of Polish Ministry of Transport, Construction and Maritime Economy of 14th October 2013, with amendments, BOSMAL Automotive Research and Development Institute Ltd is entitled to perform the actions in the scope of performing the approval tests of parts or equipment (among others electric batteries) according to the UN Regulations No. 10 and 100 requirements.

Testing capabilities under UN Regulation No. 100, 04 series of amendments Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric powertrain			
No.	**Test name**	**Test description / Remarks**	**Accreditation status**
1	Standard cycle (Appendix 1 / Appendix 2)	Standard cycle to check the functionality of REESS Rechargeable Energy Storage System Battery charging/discharging system 1000VDC/250kW	YES
2	Thermal shock and cycling test (Annex 9B)	Resistance to high/low temperatures Temperature chambers (ca. 8m3 , 9.5 m3, 15m3) - max dimensions of the sample 2.6x2.2x1.2m	YES
3	Mechanical shock (Annex 9C)	Mechanical Shock & Inertial-Load Validation of HV Vehicle Components	YES
4	Mechanical integrity (Annex 9D)	Safety under contact loads which may occur during vehicle crash situation	YES
5	Fire Resistance (Annex 9E)	Resistance of the REESS, against exposure to fire. Testing stand configured according to battery dimensions	YES
6	External short circuit protection (Annex 9F)	Performance of the short circuit protection Short circuits up to several kA	YES
7	Overcharge protection (Annex 9G)	Performance of the overcharge protection	YES
8	Over-discharge protection (Annex 9H)	Performance of the over-discharge protection	YES
9	Over-temperature protection (Annex 9I)	Performance of the protection measures of the REESS against internal overheating during the operation,	YES
10	Protection against direct contacts of parts under voltage	Access probes to verify the protection of persons against access to live parts	YES
11	Insulation resistance measurement	Testing on cells or modules	YES
12	Thermal propagation tests	Testing on cells and modules	YES

APPROVAL TESTS

According to the decision No TD-5i-027-17(4)/13 of Polish Ministry of Transport, Construction and Maritime Economy of 14th October 2013, with amendments, BOSMAL Automotive Research and Development Institute Ltd is entitled to perform the actions in the scope of performing the approval tests of parts or equipment (among others electric batteries) according to the UN Regulations No. 10 and 100 requirements.

Testing feasibility according to ECE Regulation No. 10 Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility			
No.	**Test name**	**Remarks**	**Accreditation status**
1	Method of measurement of radiated broadband/narrowband electromagnetic emissions from electrical/electronic sub-assemblies (Annex 8)	ALSE chamber dimensions: H 3,1m x D 7,5x W 6,05m CISPR25 (full-compliance), ISO 11452-2:2019 (full-compliance), ISO11452-4:2020 (full-compliance), MIL-STD-461G (full-compliance) DUT power supply up to 1000VDC 250kW RF system for immunity testing ONZ Reg.10 Rev.06 20MHz-2GHz (draft rev.7 - 6GHz) Emission measurements up to 6 GHz HV system for mesurements according to ISO 21498	Accreditation extension planned for 2027.
2	Method(s) of testing for immunity of electrical/electronic sub-assemblies to electromagnetic radiation (Annex 9)		
3	Method(s) of testing for immunity to and emission of transients of electrical/electronic sub-assemblies (Annex 10)		
4	Method(s) of testing for emission of harmonics generated on AC power lines from vehicle (Annex 11)		
5	Method(s) of testing for emission of voltage changes, voltage fluctuations and flicker on AC power lines from vehicle (Annex 12)		
6	Method(s) of testing for emission of radiofrequency conducted disturbances on AC or DC power lines from vehicle (Annex 13)		
7	Method(s) of testing for emission of radiofrequency conducted disturbances on network and telecommunication access from vehicle (Annex 14)		
8	Method(s) of testing for immunity of vehicles to electrical fast transient/ burst disturbances conducted along AC and DC power lines (Annex 15)		
9	Method(s) of testing for immunity of vehicles to surges conducted along AC and DC power lines (Annex 16)		

PCBC Certificate AQAP 2110:2016 NATO requirements for quality assurance in design, development and manufacture No. A-73/2/2024

System in the following scope of activities: research, laboratory testing, development and implementation, engineering services, technical consulting, training, design, development, manufacture, distribution and service in the field of transport and their equipment is in conformance with the standard AQAP 2110:2016


POLISH CENTRE FOR TESTING AND CERTIFICATION

CERTIFICATE

No. A - 73/2/2024

This is to certify that:

Instytut Badań i Rozwoju Motoryzacji
BOSMAL Sp. z o.o.
ul. Sarni Stok 93, 43-300 Bielsko-Biała

is in conformance with

AQAP 2110:2016

in the following scope of activities:

design, testing and production
of components for vehicles and their equipment,
as well as test station and equipment
for research and production

The audit carried out by the Polish Centre for Testing and Certification has afforded evidence of the above.

This Certificate shall remain valid provided that above requirements are respected by the Organization.

This certificate is valid:

from 10.08.2024 to 09.08.2027

President

Polish Centre for Testing and Certification

License of the Ministry of Interior and Administration No. B-138/2023 to conduct business activities in the field of production and trade in explosives, weapons, ammunition and products and technology for military or police purposes.


MINISTER SPRAW WEWNĘTRZNYCH I ADMINISTRACJI

KONCESJA

Nr B-138/2023

udziela

INSTYTUTOWI BADAŃ I ROZWOJU MOTORYZACJI BOSMAL
SPÓŁKA Z OGRANICZONĄ ODPOWIEDZIALNOŚCIĄ
z siedzibą: 43-300 Bielsko-Biała, ul. Sarni Stok 93
KRS 0000221939, NIP 5472013139

koncesji
na wykonywanie działalności gospodarczej

0001530

Accredited Testing Laboratory No. 67/MON/2024

The Certificate of Defence and Security Accreditation (D&S Accreditation) confirms that the Testing Laboratory of BOSMAL Automotive Research and Development Institute Ltd meets the requirements of PN-EN ISO/IEC 17025: 2018-02 within the scope of accreditation No 67/MON/2024




MINISTERSTWO OBRONY NARODOWEJ
MINISTRY OF NATIONAL DEFENCE

CERTYFIKAT AKREDYTACJI
W ZAKRESIE OBRONNOŚCI I BEZPIECZEŃSTWA
(Akredytacji OiB)

CERTIFICATE OF DEFENCE AND SECURITY ACCREDITATION
(D&S Accreditation)

Nr 67/MON/2024

Potwierdza się, że / This is to certify that

Laboratorium Badawcze
Instytutu Badań i Rozwoju Motoryzacji BOSMAL Sp. z o.o.

ul. Sarni Stok 93
43-300 Bielsko-Biała

spełnia wymagania / meets the requirements of

normy PN-EN ISO/IEC 17025:2018-02
Ogólne wymagania dotyczące kompetencji laboratoriów badawczych i wzorcujących
ISO/IEC 17025:2017 standard
General requirements for the competence of testing and calibration laboratories

w zakresie / in the scope of

akredytacji Nr 67/MON/2024 / accreditation No. 67/MON/2024

MINISTER OBRONY NARODOWEJ

TISAX label

BOSMAL Automotive Research and Development Institute Ltd, operating, inter alia, in the automotive industry, successively proves that it meets the requirements related to information security. Confirmation of this is provided by TÜV Nord assessment of the BOSMAL Automotive Research and Development Institute Ltd for compliance with the VDA-ISA requirements
Scope-ID: SN7P72, Assessment-ID: ANY5K5-1. TISAX and TISAX results are not intended for general public. The results of the assessment are available on the ENX Portal at: https://portal.enx.com/en-US/TISAX/tisaxassessmentresults

TISAX®
ENX ASSOCIATION
RESULT AVAILABLE

PCBC Certificate No. JBS-199/5/2024

System in the following scope of activities:
design, testing and production of components for vehicles and their equipment, as well as test station and equipment for research and production is in conformance with
PN-EN ISO 9001:2015-10,
PN-EN ISO 45001:2024-02,
and PN-EN ISO 14001:2015-09.



IQNet Certificate of Integrated Management System No. PL-JBS-199/5/2024

In the following scope of activities:
design, testing and production of components for vehicles and their equipment, as well as test station and equipment for research and production system fulfills the requirements of the following standards:
PN-EN ISO 9001:2015-10, PN-ISO 45001:2024-02 and PN-EN ISO 14001:2015-09



PCA Accreditation Certificate of Testing Laboratory No. AB 128

BOSMAL laboratory meets requirements of the PN-EN ISO/IEC 17025:2018-02 standard.
Accredited activities are defined in the Scope of Accreditation No. AB 128

AB 128



TDT Certificate of Approval No. 4 022 2010 L

This is to confirm that Testing Laboratory fulfilling the criteria of the standard
PN-EN ISO/IEC 17025:2018-02 granted approval on conducting tests a range listed enclosure for: certification body TDT-CERT

4 022 2010 L



CUSTOMERS' RECOMMENDATIONS AND ACCREDITATIONS

Recommendation of Stellantis:

- for BOSMAL's tests in range of qualitative qualification of parts and assemblies to final assembly in Fiat manufacturing plants in Poland





- for BOSMAL to carry out certain laboratory test work for Opel Plants



Acceptance of Volvo Car Corporation for BOSMAL interior emission tests (formaldehyde acc. to VCS 1027,2739 and fogging acc. to VCS 1027,2719)



Accreditation of Swiss Federal Office for the Environment (FOEN) for BOSMAL as testing laboratory for tests according to the Swiss Federal Ordinance on Air Pollution Control (OAPC)

BOSMAL LABORATORY APPROVAL FROM VOLKSWAGEN GROUP - BOSMAL certified to perform material testing for Volkswagen Group suppliers with the negative Material Sampling Performance as per VW 52000 Standard. List of laboratories certified by the VW Group - on Volkswagen Group platform: ONE.Konzern Business Plattform (ONE.KBP)

Acceptance of VOLKSWAGEN Group for BOSMAL laboratory for emission tests required by VW 50180: standards PV3015 (fogging), PV3341 (VOC, headspace), PV3925 (formaldehyde, UV/VIS or HPLC), PV3900 (odour), PV3900-leather (Leder) and PV3942 (VOC, chamber emission tests).

Acceptance of BMW for BOSMAL laboratory for emission tests required by standards: VDA270 (odour), VDA278 (VOC and FOG, thermodesorption), GS97014-2 (CARB-Test, CARB-Screening), AA-0061 (formaldehyde and acetaldehyde, HPLC)

Award for the best supplier of the year 2018 in the Engineering Services category of "FCA EMEA AWARD 2018"



Certificate of Business Credibility

BOSMAL - awarded for the highest evaluation of company stability in 2018 according to Bisnode Polska sp. z o.o.

CWB 2018



SAQ 5.0 certification

In 2024, BOSMAL achieved a rating of B with a score of **81%** in the SAQ 5.0 sustainability assessment.

SUPPLIER ASSURANCE

B 81 Rating SAQ 5.0

Membership

silesia automotive & advanced manufacturing

POLSKI KLASTER TECHNOLOGII KOMPOZYTOWYCH
Polish Cluster of Composite Technologies

PTNSS
Polish Scientific Society of Combustion Engines

POL LAB Klub Polskich Laboratoriów Badawczych POLLAB

POLSKIE FORUM ISO 9000

PKN (Polish Committee for Standardization)

- SCOPE OF ACCREDITATION OF THE TESTING LABORATORY NO. AB 128
- CERTIFICATES, RECOMMENDATIONS, AWARDS AND DISTINCTIONS
- CONTACT – kam@bosmal.com.pl, +48 33 8130 544, +48 33 8130 462

We welcome your business



Accredited Research Laboratory AB 128 *

AB 128

4 022 2010 L

Integrated Management System *

Scope-ID: SN7P72, Assessment-ID: ANY5K5-1. TISAX and TISAX results are not intended for general public.
Results are available through the ENX PORTAL Portal (https://portal.enx.com/en-US/TISAX/tisaxassessmentresults)

***Certificates and the scope of systems (including the scope of accreditation covering services accredited by PCA) are indicated on the website: https://www.bosmal.com.pl/zakresy/**

BOSMAL Automotive Research and Development Institute Ltd
Sarni Stok 93
43-300 Bielsko-Biała
POLAND