



 **DEKRA**



30 years' material expertise in fabric architecture

Advances in textiles and structural engineering make it possible to create exciting new shapes and spaces – airy, light-filled structures. Ever lighter, ever stronger. These advances in technology require stringent testing of materials, modelling of acoustics and climate-related properties, standardization and consulting. That's what we do.

Advances in textiles and lightweight structures mean that we are constantly devising new project-specific test and measurement apparatus and methods as well as clamping systems for membranes. We also carry out quality control, manufacturing supervision, material and detail development as well as on-site inspection for major construction projects worldwide.

As an impartial third party we undertake initial type-testing, factory and production inspection, and grant product certificates. We also carry out audit testing, initial factory inspection and production control and certification at European level. We have been involved in various research projects both at national and European level. Research projects finished or in progress include the EC projects ISIMEM (CRAFT program), Tensinet (elaboration of design guidelines and creating a

worldwide network of specialists and companies dealing with all aspects of membrane architecture from architects to suppliers), Contex-T (development of new concepts and expertise in multi-functional technical textile materials using nanotechnology and nanostructured materials), as well as an AiF program (transparent insulation), and a European Regional Development Fund project with a special focus on building physics ('Polar Bear' biomimetic approach to energy gain). A new European standard is currently under development. We sit on several national and European standardisation committees, such as Eurocode on Membrane Structures and Testing Procedures for Coated Fabrics and films.

Labor Blum is an independent laboratory recognized by the German Institute for Structural Engineering (DIBt) – the German approval body for construction products and types of construction – as an institute for testing, surveying and certification of foils and coated fabrics (PÜZ) according to state building codes (LBO).

Labor Blum was founded by Dr. Rainer Blum in 1985 in Leonberg. Originally called Laboratory for Dynamics and Optics, it has since been renamed and relocated to Stuttgart-Vaihingen. Dr.-Ing. habil. Rainer Blum and his partner, Prof. Dr.-Ing. Heidrun Bögner-Balz, both hold teaching positions at the first international masters course for membrane structures at the Anhalt University of Applied Sciences, Dessau. They also hold lectures for the master's course "Membrane Lightweight Structures" at Vienna University of Technology. Dipl.-Ing Jochen Köhnlein is our material testing manager and your contact person for all project-related queries.



Getting it right from start to finish

In fabric architecture, every link in the supply and installation chain has to be subject to close quality control and supervision. The best material can fail if incorrectly installed – and the best installation technique can never make up for suboptimal materials or material choices.

That's why quality control is a major focus of our business. We develop quality assurance strategies and supervise the manufacture of material in the factory and its installation on site. A number of reference projects are shown on the right.



Reference projects

- Mercedes-Benz-Arena, Extension, Stuttgart, Germany, 2011
- Berlin International Airport, Germany, 2011
- Lia Manoliu Stadium, Bucharest, Romania, 2011
- National Stadium, Warsaw, Poland, 2011
- Kiev Stadium, Ukraine, 2011
- Legia Stadium Warsaw, Poland, 2011
- Miejski Stadium, Wroclaw, Poland, 2011
- BC Place, Vancouver, Canada, 2011
- Airport Delhi, New Dehli, India, 2010
- Greenpoint Stadium, Cape Town, South Africa, 2009
- Moses Mabhida Stadium, Durban, South Africa, 2009
- FNB Stadium, Johannesburg, South Africa, 2009
- Nelson Mandela Bay Stadium, Port Elizabeth, South Africa, 2009
- Jawaharlal Nehru Stadium Delhi, India, 2009
- Forum Montrouge, Paris, France, 2009
- Munich Airport Centre, Munich, Germany, 2009
- Velodrome, Abuja, Nigeria, 2006



Mercedes-Benz-Arena - Stuttgart, Germany
Engineer: sbp GmbH
Fabricator: Taiyo Europe GmbH
Labor Blum: Third-party and installation monitoring, quality control



BC Place - Vancouver, Canada
Engineer: sbp GmbH
Fabricator: Hightex GmbH
Labor Blum: Quality control for the inner roof



Lia Manoliu - Bucharest, Romania
Engineer: sbp GmbH
Fabricator: Graboplan
Labor Blum: Quality control



Velodrome - Abuja, Nigeria
Engineer: form TL
Fabricator: Canobbio
Labor Blum: Production, third-party and installation monitoring, quality control

Approval and consultancy

Architects, construction companies and principals require specialist consultancy and support in the area of textile architecture. We provide help with project-specific material selection, material specification and the development of new materials. We also carry out project-specific evaluation of the mechanical, optical, acoustic and climatic properties of materials.

For German material approvals (Project-Specific Technical Approval ZiE and General Technical Approval AbZ) we provide support for concept development and project execution, including material and detail tests, and supervision of external manufacturing and on-site installation. We also handle communication with the approval authority. We have experience with approvals in France and Poland, and are positioned to carry out European Technical Approvals (ETA).

We write official expert reports on specific requirements and damage claims, as well as expert opinions on damage to membrane roofs, foils, and coated fabrics.



Reference projects

- Airport Berlin Brandenburg, Berlin, Germany, 2011
- National Library, Berlin, Germany, 2011
- Radom Raisting, Germany, 2010
- Adidas Laces, Herzogenaurach, 2010
- Exhibition Entrance Hall, Nuremberg, Germany, 2009
- Olympic Sports Hall, Munich, Germany, 2009
- Forum Montrouge, Paris, France, 2009
- Umbrellas, Medinah, Saudi Arabia, 2008
- Thermal Bath, Bad Seelze, Germany 2008
- Bus Station Poppenbüttel, Hamburg, Germany, 2008
- Altana Atrium Roof, Constance, Germany, 2007
- Shopping Centre Migros, Neydens, France, 2006
- Olympic Swim Hall, renovation, Munich, Germany, 2005
- ABG, Ottobrunn, Germany, 2005
- Airport Tower, Vienna, Austria, 2005
- Allianz Arena, Munich, Germany, 2004
- Underground Train Station, Fröttmaning, Germany, 2004
- Commerzbank Arena, Frankfurt, Germany, 2004
- Autoliv, Dachau, Germany, 2004
- Technology Centre, Erfurt, Germany, 2001
- Artist Hall, Berlin, Germany, 2001
- Bus Station, Augsburg, Germany, 2001



Airport Tower - Vienna, Austria
 Engineer: Peter Mandl ZT GmbH
 Fabricator: Covertex
 Labor Blum: Material expertise



National Library „Unter den Linden“ - Berlin, Germany
 Engineer: Werner Sobek Stuttgart GmbH & Co. KG
 Fabricator: Graboplan
 Labor Blum: German approval (Z.i.E.), installation monitoring



Allianz Arena - Munich, Germany
 Engineer: formTL
 Fabricator: Covertex
 Labor Blum: German approval (Z.i.E.), production inspection



Forum Montrouge - Paris, France
 Engineer: IFgroup
 Fabricator: Graboplan
 Labor Blum: French approval (Atex), quality control, biaxial testings, membrane stress measuring

Building physics

In addition to material testing, we specialise in the simulation and optimisation of building physical properties and physical processes of thin and lightweight material systems. The conventional approach of evaluating the U-value (under static conditions) is not realistic for membrane structures. For this reason, we evaluate the energy balance for specific conditions dependent on radiation inputs and losses, with parameters including radiation, convection and conduction. We use a proprietary software application developed in-house as well as physical measurements.



Olympic Swimming Pool - Munich, Germany

Climate

Here our services cover the simulation and measurement of heat transmission properties, spectroscopic measurements, and monitoring.
Reference projects: Furniture Store, Leonberg;
Renovation of Olympic Swimming Pool, Munich;
and Olympic Sports Hall, Munich

Acoustics

We provide consulting in room and architectural acoustics and develop special solutions for sound insulation. Reference projects include the Mediadrom Sports Hall, Frankfurt; Arena 2000, Coventry, United Kingdom; and the New Bangkok International Airport, Thailand.



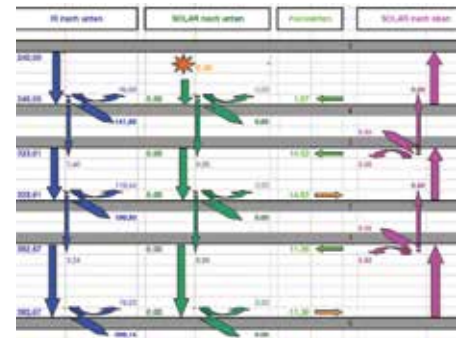
New Bangkok International Airport - Bangkok, Thailand
Engineer: Werner Sobek Stuttgart GmbH & Co. KG
Fabricator: Hightex GmbH
Labor Blum: Incoming goods control, quality assurance



Furniture Store - Leonberg, Germany
Engineer: SL Rasch
Labor Blum: Monitoring temperatures and humidity



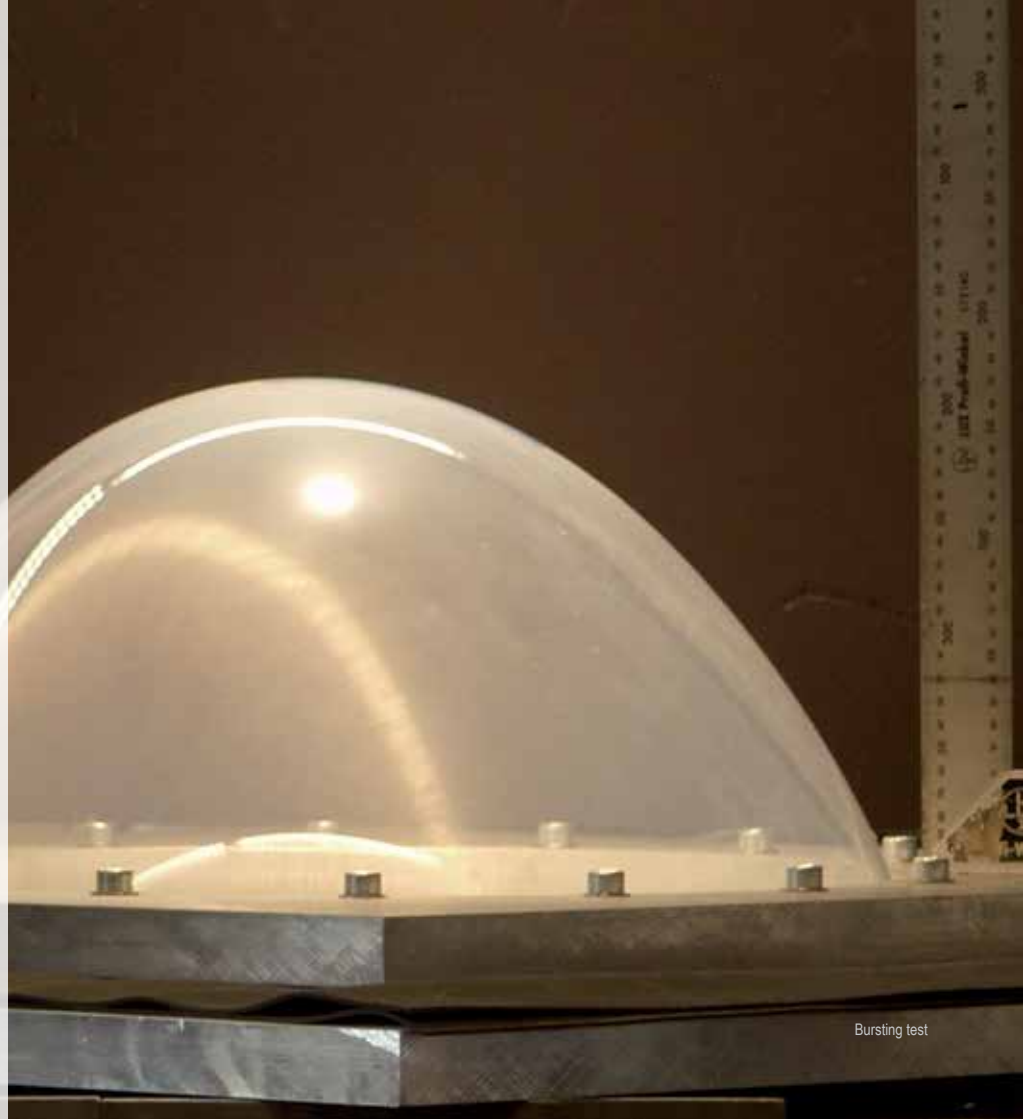
Hotboxes for the measurement of thermal behaviour of multilayer membrane assemblies



Proprietary building physics software application, energy balance (non-static)

Test and measurement equipment

Advances in structural engineering, cables, clamping systems, foils and fabrics require constant innovation on the part of Labor Blum to allow the necessary stringent testing and measurement for approval by the German Institute for Structural Engineering (DIBt) or the local national regulatory authority. The list of equipment developed for special tasks demonstrates our extensive expertise in this area.



Bursting test

Blum proprietary equipment

- Various clamping systems for membrane materials
- Folding apparatus for architectural textiles, based on Labor Blum standard, including dynamic test possibilities
- Climatic chambers from -30 to 70 °C for uniaxial testing machine
- Uniaxial long-term test frame for more than 150 specimens
- Climatic chamber for uniaxial long-term test frame
- Biaxial test frame, control possibilities: Stress controlled, deformation-controlled and mixed, stresses up to 200 kN/m
- Biaxial relaxation test frame
- Biaxial creep test frame
- Measurement device non-destructive in-situ stress testing of membrane
- Folding apparatus according to DIN 53359
- Bursting test, diameter 500 mm, pressure-controlled
- Water vapour diffusion measurement in dependence of the temperature
- Hotboxes to measure energy balance of multilayer membrane structures under natural climatic conditions (including radiation parameters and convection)
- Resonance tube for membrane materials



Uniaxial long-term test frame



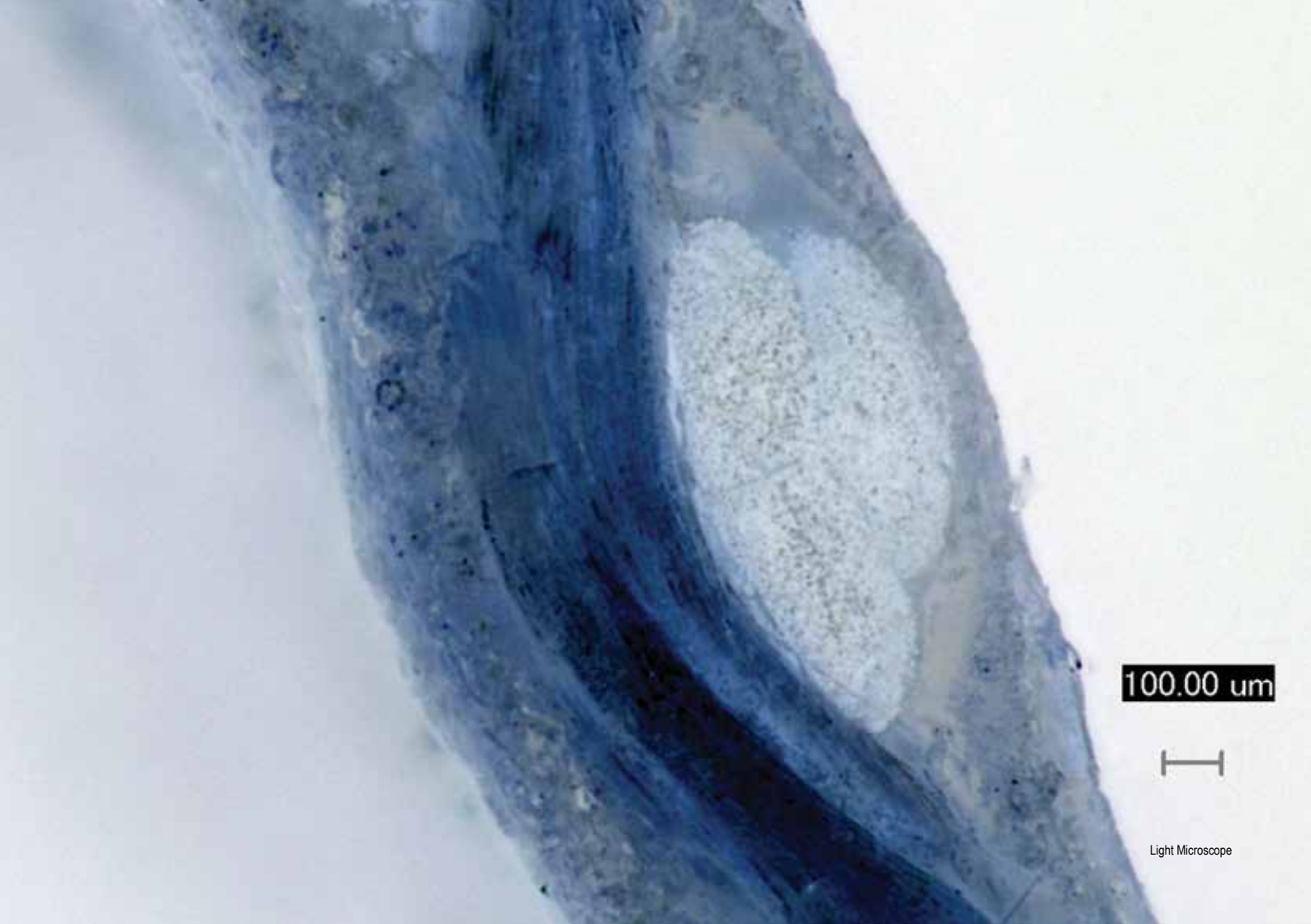
Measurement of membrane stresses on site



Folding apparatus



Biaxial testing machine



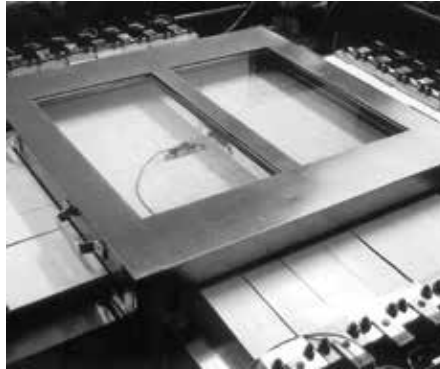
100.00 μm



Light Microscope

Other equipment

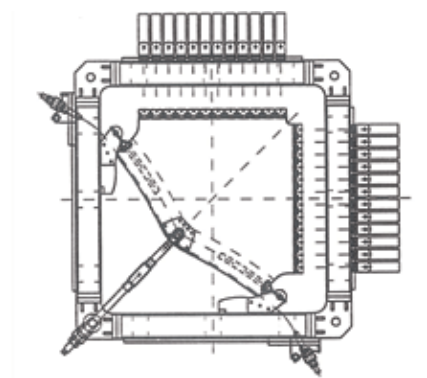
- Uniaxial testing machine
- Climatic chamber from -30 to 70 °C for biaxial testing machine and other measurement
- Transducers for displacement, force, temperature, pressure etc.
- Scanning light microscope, magnification up to 1000x



Climatic chamber for various testing machines



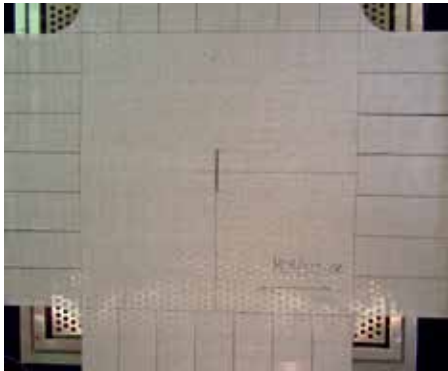
Shear test



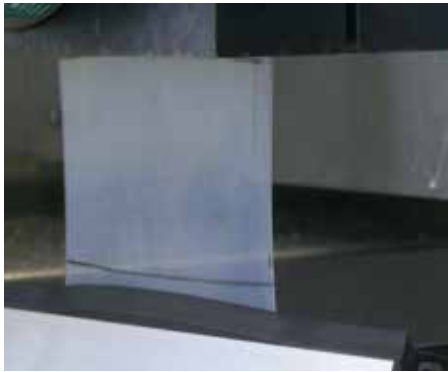
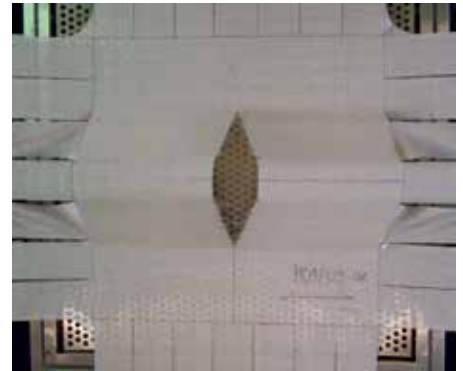
Detail test



Tangential force test



Wide-panel tear test



Uniaxial test

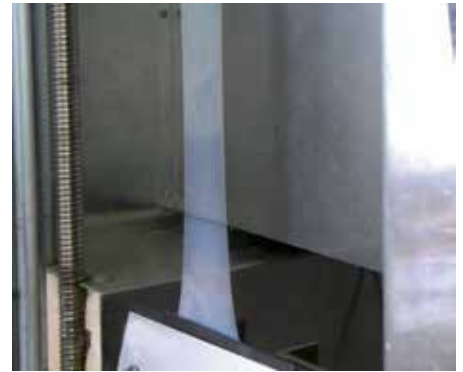


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Page 1; 4 Kiev Stadium

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Page 7 Airport Tower Vienna

Page 9 Furniture store

Hotboxes

Page 9; 16 International Airport Bangkok

Page 8 Olympic Swimming Pool

Page 10 Bursting test

Page 11 Uniaxial long-term test frame

Measurement of membrane

Folding apparatus

Biaxial testing machine

Page 12 Microscope

Page 13 Climatic chamber

Shear test

Tangential force test

Page 14 Wide-panel tear test

Uniaxial test

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