

MEASURING AND TESTING FACILITIES



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BUILDING PHYSICS TESTING

Fraunhofer IBP is focused on research, development and testing in all fields of building physics. Based on the competence of more than 350 scientists, engineers and technicians numerous outstanding testing resources and measuring instruments are available. Knowledge, experience and creativity can be offered as the keys to innovative products and sustainable quality of buildings. Tailored laboratories and software tools are available in the following departments:




- » **ACOUSTICS**
- » **BUILDING CHEMISTRY,**
- » **BUILDING BIOLOGY, HYGIENE**
- » **ENERGY SYSTEMS**
- » **HEAT TECHNOLOGY,**
- » **LIGHTING TECHNOLOGY**
- » **HYGROTHERMICS**
- » **INDOOR CLIMATE**
- » **LIFE CYCLE ENGINEERING**

We carry out complex building physics studies at our efficient and well-equipped laboratories and test centers and at our outdoor testing site in Holzkirchen, which to the best of our knowledge is the largest facility of its kind. Modern laboratory measuring techniques and computational methods help researchers develop and optimize building products for practical applications. We also carry out experiments in environmental test chambers, simulation facilities and existing buildings to assess components and overall systems for new buildings and renovation projects based on the principles of building physics.

Fraunhofer IBP has been approved by the German building inspection authorities as a testing, monitoring and certification center for building materials and building techniques in Germany and the rest of Europe. Four of the institute's test laboratories have been granted flexible accreditation by the German accreditation body Deutsche Akkreditierungsstelle GmbH (DAkkS) in accordance with DIN EN ISO/IEC 17025. This entitles them to develop new test methods and to modify existing methods.

How to use this digest

The easiest way to find the right laboratory or facility is to use the keyword register, which is organized in three different ways:

-  **Measurements in laboratories** (type of measurement or quantity to be measured)
-  **Measurement objects** (or part of a building etc. to be measured)
-  **Standards** (DIN, EN, ISO, VDI, etc.)

For technical reasons, the departments are listed following the given alphabetical order of the German department names.

MEASURING AND TESTING FACILITIES – AN OVERVIEW

ENERGY SYSTEMS

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MEASUREMENT AND TEST RANGE

ENERGY SYSTEMS

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TEST FACILITY FOR ENERGETIC AND INDOOR ENVIRONMENT INVESTIGATIONS (VERU)



Measurement	Evaluation of façades performance regarding the energy efficiency, durability and quality of thermal and visual comfort
Measurement object	Glass and metal façades, double skin façades, ventilated façades, (switchable) glazing, sun and glare protection systems, daylight redirection systems, façade integrated HVAC components, building integrated PV, solar thermal absorbers, general HVAC components and their integral interaction with the façade, decentralized storage systems, technical mock-ups for complete room concepts

TECHNICAL DATA

Height between floors	3.8 m
Façade surface area	21 × 15 m ² (for each test field)
Test cell area (W × D)	4 × 4 m up to 8 × 12 m

SPECIAL FEATURES

Field measurements of façade and room concepts	Short- and long-term experiments with real climate conditions
1:1 full scale evaluations in step with real usage situations	Integral consideration of façade, room and building service equipment allow a realistic evaluation of the energy consumption and the visual and thermal comfort.

MORE INFORMATION

Extensive basic equipment of measurement and control systems and building services:

- central supply for heating and chilled water
- supply air preconditioning by heating, cooling, humidification and dehumidification
- freely programmable logic controller, providing among others time-controlled internal heat and moisture sources for simulating usage profiles
- central measurement data acquisition with a web-based analyzing tool (IMEDAS™)
- web browser access to all functionalities (process visualization, database, evaluation templates, measurement channel lists, etc.)

ENERGETIC TWIN ROOMS



Measurement	Comparative measurements of the thermal, visual and energetic performance of building components, building service components and control strategies
Standard	Test cell geometry according to EN ISO 13791
Measurement object	Glass and metal façades, double skin façades, ventilated façades, (switchable) glazing, sun and glare protection systems, daylight redirection systems, façade integrated HVAC components, building integrated PV, solar thermal absorbers, general HVAC components and their integral interaction with the façade, decentralized storage systems and control strategies

TECHNICAL DATA

Clear height	2.8 m
Façade surface area	2 × 15 m ² (on each test field)
Test cell area (W × D)	3.6 × 5.5 m

SPECIAL FEATURES

Adiabatic envelop	Featured by highly insulated and temperature-controlled building envelops it is possible to minimize the heat flow through internal partitions that are not relevant for the current experiment. This allows the calculation of an extremely precise energy balance for each room.
1:1 full scale evaluations in step with real usage and climate situations	The two identical equipped office rooms provide the possibility for comparing investigations of different office concepts regarding their energy efficiency and the thermal and visual comfort in step with real usage conditions.

MORE INFORMATION

Extensive basic equipment of measurement and control systems and building services:

- freely programmable, time-controlled ventilation system with heating and cooling functionality
- electrical room heating
- freely programmable logic controller, providing among others time-controlled internal heat and moisture sources for simulating usage profiles
- central measurement data acquisition with a web-based analyzing tool (IMEDAS™)
- web browser access to all functionalities (process visualization, database, evaluation templates, measurement channel lists, etc.)

TWIN HOUSES



Measurement	Comparative measurements of different building and heating systems under real weather conditions with emphasis on residential buildings
Measurement object	Insulation systems, set ups of walls, windows and roofs, radiators and underfloor heating systems, component and control concepts, intelligent control concepts in smart grids, demand-based ventilation systems, sun protection systems, heating systems

TECHNICAL DATA

Floor area	82 m ² (each floor)
Layout	Ground floor: 6 rooms Attic: 2 rooms
Roof pitch	30° (orientation south and north)

SPECIAL FEATURES

Full size research under real climate boundary conditions	Two structural identical single family houses for comparative examination of different concepts concerning energy efficiency, thermal and visual comfort
Flexible façade design	The structure of the houses has been engineered to admit the replacement of all exterior components on the ground floor.

MORE INFORMATION

Comprehensive building service installation including measuring and regulating systems:

- freely programmable, time-controlled ventilation system with definable heat recovery
- gas condensing boiler, radiator and underfloor heating
- cooling
- photovoltaic modules (1kW_p)
- freely programmable, time-controlled internal heat- and moisture sources to simulate user profiles
- central measurement data acquisition including web-based evaluation tools (IMEDASTM)
- web browser access to all functionalities (process visualization, database access, evaluation templates, measurement channels, etc.)

CALORIMETRIC FAÇADE AND ROOF TEST FACILITY



Measurement	Determination of the energetic and visual performance of (transparent) large-scale façade and roof elements under real climate conditions
Measurement object	Membrane elements, glass and metal façades, double skin façades, (switchable) façades, skylights, light-band, sun and glare protection systems and daylight redirection systems

TECHNICAL DATA

Max. specimen size	3.2 × 2.3 m
Slope	0 to 90°
Orientation	Approx. 360°

SPECIAL FEATURES

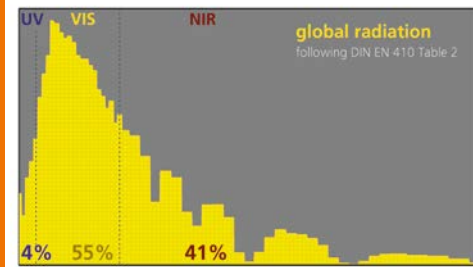
Calorimetric measurement concept	For heating and cooling the internal surfaces of the test chamber are equipped with highly effective water bearing absorbers. From the amount of thermal energy required to keep a certain internal temperature the energetic performance of the specimen can be determined. The SHGC as an example.
3D robot	To investigate specific aspects of local temperatures, air speeds, heat transfer resistances, and lighting and glare evaluations, the facility is equipped with a three-dimensional robot which can be used to position measurement sensors at any point inside the test chamber. By constantly moving this mobile sensor platform it is possible to determine multi-dimensional properties like the areal resolved solar or visual transmissions.

MORE INFORMATION

Focus of investigation:

- field determination of the solar factor (g-value/SHGC) and the heat transfer coefficient (U value) of full scale façade and roof elements under realistic installation conditions
- determination of angle dependent solar factors/properties
- analysis of the light transmission properties of transparent building elements
- evaluation of the users glare risk due to sun shades
- development of test and valuation procedures for novel building elements

UV/VIS/NIR SPECTROMETER



Measurement	UV-, light- and solar direct transmittance, light- and solar direct reflectance, diffuse reflectance, solar direct absorptance, total solar energy transmittance (solar factor), color rendering index
Standards	DIN EN 410, DIN 6169, DIN 5033, DIN EN 13363
Measurement object	Glass, sun shade, glare protection, fabric, synthetic, foil, membrane, metal, plaster, paint coating, concrete surface, coatings

TECHNICAL DATA

Measuring range	300 to 2500 nm (UV/Vis/NIR-range)
Accessory	Integrating sphere (150 mm)
Size of test samples	5 × 5 cm other sizes on request

SPECIAL FEATURE

Measurement and evaluation according to international standards

MORE INFORMATION

The measurement takes place in the testing laboratory for “moisture, mortar, radiation and emissions”, which has got the flexible accreditation by the Deutsche Akkreditierungsstelle (DAkS). Therefore it is authorized – in addition to employing standard test methods – to develop new or modify and improve existing test methods.

FOURIER SPECTROMETER



Measurement	Emissivity (direct-hemispherical)
Standards	DIN EN 12898, DIN EN 673
Measurement object	Glass, sun shade, glare protection, fabric, synthetics, foil, membrane, metal, plaster, paint coating, concrete surface, coatings

TECHNICAL DATA

Measuring range	2.5 to 25 μm (MIR range)
Accessory	Integrating sphere (75 mm)
Size of test samples	Width max. 150 mm, thickness max. 9 mm other sizes on request

SPECIAL FEATURE

Measurement and evaluation according to international standards

MORE INFORMATION

The measurement takes place in the testing laboratory for "moisture, mortar, radiation and emissions", which has got the flexible accreditation by the Deutsche Akkreditierungsstelle (DAkkS). Therefore it is authorized – in addition to employing standard test methods – to develop new or modify and improve existing test methods.

ATTIC FLOOR TEST FACILITY



Measurement	Comparative measurements of different building and heating systems under real weather conditions with emphasis on lightweight building and attic floors
Measurement object	Insulation systems, set ups of walls, windows and roofs, underfloor heating systems, component and control concepts, sun protection systems, thermal storage systems, e.g., on the basis of PCM (Phase Change Materials), air-to-water heat pumps

TECHNICAL DATA

Floor area (per test room)	12 m ²
Roof area (per test room)	6.64 m ² with each having one window
Number of test rooms	3

TECHNICAL DATA (AIR-TO-WATER HEAT PUMP)

Net-heating capacity (A2/W25)	5.6 kW
Net-cooling capacity (A35/W7)	8.8 kW

SPECIAL FEATURE

Full size research under real climate boundary conditions	Three identical living rooms for comparative, close to practise investigations of divers building concepts with respect to energy efficiency, thermal and visual comfort
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MORE INFORMATION

- Comprehensive building service installation including measuring and regulating systems
- Heat pump system for defined heating and cooling of the test rooms
- Controllable shading system

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