Overview Test Facilities
Tests and Analyses
Overview Test Sites
IABG’s Test Resources – Available Test Equipment

IABG has a wide range of test facilities and components at its disposal for structural tests.

- **Testing Buildings**
  - Ottobrunn: 5,600 m², height up to 15 m
  - Erding: 5,000 m², height up to 27 m
  - Dresden – Hall 1: 5,000 m², height up to 23 m
  - Dresden – Hall 2: 1,800 m², height up to 17 m

- **Hydraulic Jacks**
  - Total Number: More than 850
  - Nominal Load: 5 – 8,000 kN
  - Stroke: 20 – 6,500 mm

- **Hydraulic Power Supply Systems – stationary**
  - Ottobrunn: 3,740 l/min at 280 bar (4,060 psi)
  - Dresden – Hall 1: 6,000 l/min at 280 bar (4,060 psi)
  - Dresden – Hall 2: 2,100 l/min at 280 bar (4,060 psi)

- **Hydraulic Power Supply Systems – mobile**
  - Erding: 2,100 l/min (2x 1,050 l/min) at 280 bar (4,060 psi)

- **Air Pressure Supply**
  - Erding: 160 m³/min (4 x 40 m³/min) at 7.5 bar
  - Dresden – Hall 1: 270 m³/min at 7.5 bar
  - Dresden – Hall 2: 100 m³/min at 3.5 bar

- **Overhead crane (lifting power)**
  - Ottobrunn: 15 t & 20 t
  - Erding: 30 t
  - Dresden – Hall 1: 2 x 20 t
  - Dresden – Hall 2: 20 t
Test infrastructure - Sites

Ottobrunn

- Base area: 5,600 m²
- Height: 15 m
- Overhead crane (lifting power): 15 t & 20 t

Infrastructure

- Hydraulics: 3,740 l/min, 280 bar
- Pneumatic (mobile) currently on the site of Erding: 160 m³/min (4 x 40 m³/min), 7.5 bar
Test infrastructure - Sites

Dresden – Halle 1

- Base area 5,000 m²
- Height 23 m
- Overhead crane (lifting power) 2x 20t

Infrastructure (static)
- Hydraulics 6,000 l/min, 280 bar
- Pneumatic 270 m³/min, 7,5 bar
Test infrastructure - Sites

Dresden – Halle 2

- Base area: 1,800 m²
- Height: 17 m
- Overhead crane (lifting power): 20 t

Infrastructure (static)

- Hydraulics: 2,000 l/min, 280 bar
- Pneumatic: 100 m³/min, 3.5 bar
Test infrastructure - Sites

Erding – Mobile Test Hangar

- Base area 5,000 m²
- Height 27 m
- Overhead crane (lifting power) 30 t

Infrastructure (mobile)

- Hydraulics 2,100 l/min (280 bar)
- Pneumatic 160 m³/min (7.5 bar)
Mobile Modular Test-Infrastructure by IABG

Semi-mobile strong floor modules
(reinforced concrete modules with anchor rails – interconnectable even for major test purposes)

Heating system
(environmental control for the hangar and equipment)

Hydraulic pump stations
(hydraulic pumps including tanks, stilling basins and power electronics in sea containers)

Cooling system
(environmental control for the high-energetic hydraulic pump stations)

Flexible due to scalability and mobility
Cost efficiency by higher usage intensity
Quick installation due to standardized interfaces

Modular light-weight hangar
(quick-erection system with removable walls for specimen introduction)

Pneumatic compressor stations
(pneumatic compressors in sea containers including air dryers and power electronics)

Pneumatic accumulators
(pneumatic vessels for loading adjustment at harmonized compressor utilization)

Electric power stations
(electric power transformer including low voltage distribution in sea containers)
Test Benches – Overview

Test Beds
- Modular test facility (MTA)
- HYDRA / ELEKTRA

Large / Special Test Benches
- Loading Frame with 4,000 t capacity
- Test Pit
- Cylinder head test benches
- Shaker table HyMAS and LiMAS
- Fast single-cylinder test unit
- Large drop hammer

Resonance Test Benches
- Resonance test bench for springs with/without corrosion unit (CSTM/DSTM)
- Large resonance test bench for springs (GRFP)
- Stabilizer bar test bench (STAP42)
- Valve spring test bench (VSTM)
- Stone impact simulator (GISM)
- Spring/shock absorber test bench (FDP63)

Material Testing / Durability / Material Fatigue
- IABG fatigue strength test laboratory
- Electromechanical testing machine for shafts 100 kN (EMP)
- Diverse servo hydraulic test benches, 10 kN up to 100 kN
- Resonance test benches 100 kN (HFT 1-4)
- Resonance test benches 10 kN (HFT 5-6)
- Measuring equipment for deformation measurement (high/low temperature)
- Measuring equipment for other measuring tasks, e.g. roughness measurement
- Thermo-mechanical-fatigue test bench
- High-frequency pulser (HFP 20, 400)
- Rotating bending fatigue test bench (RBTM / ULB 1-2)
- Diverse hydraulic universal test benches
- Micromexx X-Ray Inspection System (2D/CT)
- Macro-thermogravimetric analyser LECO TGA 701

Wheel Testing Equipment
- Radial impact test bench (RADIAS)
- Flat track tyre test bench
  Flat Trac® III CT [MTS]
- Biaxial wheel test bench (ZWARP) and brake disc test bench (BSP)
- Rotating bending facilities (ULB)
- Wheel bearing test bench (REZ)
- Automatic half-axle test bench (AHAP)

Environmental Simulation
- High altitude chamber
- Altitude chamber II
- Temperature chamber
- Climatic chamber
- Vehicle chambers I & II
- Climate combination chamber
- Solar radiation unit
- Soaking boxes & preparation area
- Splash water cabinet
- Dust test chambers
- Combination cabinet BFV 64
- Pressure vessels
- Salt fog chamber
- Temperature shock unit
- Temperature and climatic test cabinets
- Fluid susceptibility and contamination devices

Miscellaneous
- High and low-pressure test equipment (HD/ND)
Test Beds
Modular test facility (MTA)

APPLICATION
Structural tests mainly on aeronautical and automotive components

TECHNICAL DATA
- Rigid, planar 10 m x 9 m floor plate
- Modular design for flexible and fast test setup
- 4 independent supply units
- Permanently installed connections for hydraulics, pneumatics and power supply
- 2 cabinets with 20 control and monitor channels each for force, pressure and path control
- 400-channel measuring unit
- Maximum load: 400 kN
Variable test bed setups (HYDRA / ELEKTRA)

APPLICATION

Functional, endurance and fatigue tests on components for the automotive, energy and aerospace industry

- Short lead times thanks to modular architecture
- Parallel execution of independent individual tests
- Individual and fast integration of test components
- Multitude of servohydraulic cylinders and pneumatic cylinders
- Digital measurement and control system to set, control and monitor signals online
- Execution of tests under simulated environmental conditions

TECHNICAL DATA

- Rigid, planar floor plate (main floor plate: 6 x 3 m, secondary floor plate: 3 x 2 m, t-slots in 250 mm grid)
- Servohydraulic cylinders for forces up to 1,200 kN and torques up to 4,000 Nm
- Digital controller with multiple control PCs, up to 16 control channels and various bridge amplifiers, analogue and digital IOs
- 9 oil supply connections, each 120 l/min at 280 bar
- Various flexible mechanical superstructures, e.g. cylinder brackets, portals and clamping brackets, that enable us to quickly set up component tests with multidimensional test item loads
- Modelling of setups in CAD (SolidWorks), optional stiffness optimisation with FEM
- Optional simulation of environmental conditions
  - Temperature: -75°C to 180°C
  - Humidity: 90% RH at max. 80°C
  - Abrasive media, e.g. dust, gravel or Skydrol and Pentosin oils
Major Test Benches
Loading frame with 400 t capacity

APPLICATION

- Uniaxial loading
  - Static
  - Fatigue
- Measurement of all relevant parameters at 2,5 kHz
  - Load
  - Displacement
  - Strain at relevant areas

TECHNICAL DATA

- Load capacity:
  - Static: Up to 4 MN (compression) and 1,9 MN (tension)
  - Dynamic: Up to 1,4 MN (compression)
- Load cell: Specified measuring range up to 5 MN (compression)
- Width of test specimen: Max. 1,6 m
- Height of test specimen: Max. 1,7 m
- Flexible measurement of loads, deformations/strain
Test Pit

APPLICATION

The IABG test pit is used for tests on aerospace structures to allow:

- To simplify the steel test rig using the side walls
- To test high test articles (up to 20 m) like Payload Stage of the Ariane Rocket

Features

- Strong floor and walls with anchors rails
- Hydraulic supply connection for load jacks
- Air ventilation

TECHNICAL DATA

- Dimension (l x w x h) 8 m x 6 m x 5 m
- Construction
  - Type of Construction Heavy Reinforced Concrete
  - Thickness (all around) 1000 mm
- Anchor Rails
  - Loading Capacity
    - Tension 200 kN/m
    - Compression 200 kN/m
    - Shear 100 kN/m
  - Distance Rail to Rail
    - Test Pit Wall 500 mm
    - Test Pit Floor 1000 mm
APPLICATION

Thermal fatigue strength tests for cylinder heads

- Examination of the thermal fatigue strength of cylinder heads
- Investigation of the fracture propagation behaviour in the top part of the combustion chamber
- Temperature measurements in the top part of the combustion chamber using an automatic infra-red camera system
- Unstaffed endurance tests; 10,000 cycles in roughly 10 days (approx. 1 min/cycle)

TECHNICAL DATA

- **Powering:** Six oxygen/propane torches with a max. heating performance of 75 kW
- **Coolant:** Water-glycol mixture
  - Cold water: Max. 200 l/min at 26°C
  - Hot water: Max. 25 l/min at max. 80°C
  - Return temperature: Max. 120°C
- **Gas supply:** 2.9 t propane
  - 24 t oxygen
- **Compressed air supply:** 600 m³/h
- **Ventilation:** Recirculating air: 13,000 m³/h
  - Discharged air used for heat recovery
Cylinder head test bench II (ZKP II)

APPLICATION
Thermal fatigue strength tests for cylinder heads

- Investigation of the thermo-mechanical fatigue and fracture propagation behaviour in the top part of the combustion chamber of a cylinder head
- Automated operation; approx. 1,000 thermal shock cycles per day
- Automated fracture documentation via high-res camera system
- Cylinder head tests on passenger cars, HGVs and buses as well as for shipbuilding and power engineering customers (stationary diesel and gas engines)

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Powering:</th>
<th>Six oxygen/propane torches with a max. heating performance of 75 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coolant:</td>
<td>Water-glycol mixture</td>
</tr>
<tr>
<td></td>
<td>Cold water: Max. 200 l/min at 26°C</td>
</tr>
<tr>
<td></td>
<td>Hot water: Max. 25 l/min at max. 80°C</td>
</tr>
<tr>
<td></td>
<td>Return temperature: Max. 120°C</td>
</tr>
<tr>
<td>Gas supply:</td>
<td>2.9 t propane</td>
</tr>
<tr>
<td></td>
<td>24 t oxygen</td>
</tr>
<tr>
<td>Compressed air supply:</td>
<td>600 m³/h</td>
</tr>
<tr>
<td>Ventilation:</td>
<td>Recirculating air: 13,000 m³/h</td>
</tr>
<tr>
<td></td>
<td>Discharged air used for heat recovery</td>
</tr>
</tbody>
</table>
Shaker table HyMAS (Heavy Multi-Axis Shaker)

APPLICATION

Simultaneous multi-axial (6DoF) vibration tests for the following applications:

- **Energy**: Simulation of synthetic design basis/safe shutdown earthquakes and the real-time course of earthquakes / reproduction of transient events (gusts of wind, plane crashes on buildings, detachment of components as a result of spallation)
- **Automotive**: Vibration tests on passenger car and commercial vehicle components
- **Transport**: Resonance and shock tests (rail vehicle equipment, electronic rail vehicle components)
- **Aeronautics**: Windmilling tests (fan blade-out, sustained engine imbalance)

TECHNICAL DATA

- **Test item weight**: Max. 10,000 kg
- **Frequency range**: 0.5 Hz to 80 Hz
- **Table dimensions**: 2.5 x 2 m
- **Max. acceleration**:
  - Vertical Z ±80 m/s²
  - Longitudinal X ±50 m/s²
  - Lateral Y ±40 m/s²
- **Max. path**:
  - Vertical ±50 mm
  - Longitudinal X ±125 mm
  - Lateral Y ±125 mm
- **Connection power**: 700 l/min at 280 bar
- **Measurement data acquisition**:
  - Acceleration, paths, strains
  - Simultaneous acquisition and evaluation of up to 64 measurement data channels
Shaker table LiMAS (Light Multi-Axis Shaker)

APPLICATION

Simultaneous multi-axial (6DoF) vibration tests for the following applications:

- **Automotive**: Vibration tests on passenger car and commercial vehicle components
- **Energy**: Simulation of synthetic design basis/safe shutdown earthquakes and the real-time course of earthquakes / reproduction of transient events (gusts of wind, plane crashes on buildings, detachment of components as a result of spallation)
- **Transport**: Resonance and shock tests (rail vehicle equipment, electronic rail vehicle components)
- **Aeronautics**: Windmilling tests (fan blade-out, sustained engine imbalance)

TECHNICAL DATA

- **Test item weight**: Max. 1,000 kg
- **Frequency range**: 0.5 Hz to 200 Hz
- **Table dimensions**: 2.3 x 2 m
- **Max. accelerations (600 kg / 1,000 kg)**:
  - Vertical Z: ±130 m/s² / ±100 m/s²
  - Longitudinal X: ±80 m/s² / ±70 m/s²
  - Lateral Y: ±105 m/s² / ±70 m/s²
- **Max. path/angle**:
  - Vertical Z: +135 to -160 / Roll ±7.4°
  - Longitudinal X: ±100 mm / Pitch +7.0° to -8.2°
  - Lateral Y: ±115 mm / Yaw ±5.2°
- **Environmental conditions**:
  - Temperature range: -40°C to +95°C
  - Humidity: Up to 95% RH
- **Measurement data acquisition**:
  - Acceleration, paths, strains, temperatures
  - Simultaneous acquisition and evaluation of up to 64 measurement data channels
APPLICATION

Tests with single-axis (vertical) vibration signals in accordance with the following test standards:

- DIN EN 60068-2-6: Vibration – sinusoidal
- DIN EN 60068-2-50: Combined test – cold/vibration – sinusoidal
- DIN EN 60068-2-57: Vibration – time history method
- DIN EN 60068-2-59: Vibration – sine beat method
- DIN EN 60068-2-64: Vibration – broadband random
- DIN EN 60068-2-80: Vibration – mixed-mode

TECHNICAL DATA

- Cylinder force: ± 50 kN (stat.), +/- 40 kN (dyn.)
- Cylinder path: ± 200 mm
- Test frequency range: 0.5 Hz to 200 Hz
- Max. test item weight: 1,000 kg (40 m/s² at 3 Hz to 200 Hz)
- Maximum velocity: 4 m/s
- Max. acceleration: 600 m/s² at 80 Hz
- Temperature range: -40°C to 120°C
Fast single-cylinder test unit II (SEZ II)

APPLICATION

- High-speed tensile bond strength tests

TECHNICAL DATA

- Clear span: 900 mm
- Max. test setup height: 1600 mm
- Test force: ± 30 kN
- Test path: ± 200 mm
- Maximum velocity: 11 m/s
Large drop hammer (automotive tests)

APPLICATION

- Roll and burst tests
- Endurance tests, slide tests
- Cleat tests
- Drop and landing tests

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Drum</th>
<th>Test bench</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. circumferential velocity: 400 km/h</td>
<td>Adaptable and multi-functional setup</td>
</tr>
<tr>
<td>Drum diameter:                4.0 m</td>
<td>Obstacles and cleats of up to 150 mm</td>
</tr>
<tr>
<td>Drum width:                   1.5 m</td>
<td>Adjustable slip angle, camber angle and vertical load</td>
</tr>
<tr>
<td>Drum driver power:            130 kW</td>
<td>Various steel or friction surfaces</td>
</tr>
<tr>
<td></td>
<td>Various metrology equipment (wheel force sensor, wheel force dynamometer, load cells, strain gauges)</td>
</tr>
</tbody>
</table>
Large drop hammer (aeronautics tests)

APPLICATION
- Drop tests for aircraft landing gear
- Roll tests, endurance tests, slide tests, brake tests, vibration tests, tyre burst tests, tyre tests
- Cleat tests

Test bench
- Adaptable and multi-functional setup
- Obstacles and cleats of up to 150 mm
- Adjustable slip angle, camber angle and vertical load
- Various metrology equipment (wheel force sensor, wheel force dynamometer, load cells, strain gauges)

TECHNICAL DATA

Drum
- Max. circumferential velocity: 400 km/h
- Drum diameter: 4.0 m
- Drum width: 1.5 m
- Drum driver power: 130 kW (4Q drive / drive and brake)
- Drum surface: Blank steel or friction surface
- Maximum drum load:
  - Vertical: 560 kN
  - Axial: 200 kN
  - Tangential: 400 kN
- Mass moment of inertia for drum: 29,500 kgm²
- Drop mass: Max. 14,000 kg
- Drop height: Max. 11 m
- Fall velocity with counterweight: Max. 7 m/s
- Fall velocity without counterweight: Max. 10 m/s

Drum
- Max. circumferential velocity: 400 km/h
- Drum diameter: 4.0 m
- Drum width: 1.5 m
- Drum driver power: 130 kW (4Q drive / drive and brake)
- Drum surface: Blank steel or friction surface
- Maximum drum load:
  - Vertical: 560 kN
  - Axial: 200 kN
  - Tangential: 400 kN
- Mass moment of inertia for drum: 29,500 kgm²
- Drop mass: Max. 14,000 kg
- Drop height: Max. 11 m
- Fall velocity with counterweight: Max. 7 m/s
- Fall velocity without counterweight: Max. 10 m/s
Resonance Test Benches
Resonance test bench for springs with/without corrosion unit (CSTM/DSTM)

APPLICATION

Fatigue strength tests on springs exposed to corrosive media

- Measurement of spring force and compression (recording of spring characteristic and relaxation)
- Test items: Springs of all kinds with parallel and circular deformation, with and without corrosion impact
- Saltwater vessel (250 l) with individually programmable spray intervals and heating up to 50°C
- Low noise and low vibration (no special foundations required)
- Time- and cost saving method for determining the fatigue strength of springs with and without exposure to corrosive media

TECHNICAL DATA

- Machine dimensions: L = 1,800 mm, W = 2,000 mm, H = 2,600 mm (additional floor space required for control console, corrosion unit, water treatment unit and hydraulic oil supply)
- Weight: Approx. 3.5 t
- Maximum load allowed for each of the two test positions: $F_{\text{max}} = 40$ kN
- Number of springs that can be tested simultaneously: 2, 4, ... $F_{\text{max}}$
- Stroke (path-controlled): $S = 10 – 300$ mm
- Maximum spring length: $L_0 = 750$ mm
- Test frequency: $f_0 = 0.23...0.33 \times \sqrt{n} \times \sqrt{R}$ [Hz]  
  $n = \text{Number of springs to be tested simultaneously}$  
  $R = \text{Spring constant [N/mm]}$  
  $f_0 = 1.8$ Hz to 15 Hz
Large resonance test bench for springs (GRFP)

APPLICATION
Fatigue strength tests on large springs and leaf springs under laboratory conditions

- Time and cost saving method for determining the fatigue strength of springs under normal laboratory conditions (measuring the spring force and spring length)
- Simultaneous testing of multiple spring elements. The number of spring elements that can be tested simultaneously is limited only by the maximum load allowed and the available set-up space.
- Low noise and low vibration (no special foundations required)
- Test items: Springs of all kinds with parallel deformation

TECHNICAL DATA

- Machine dimensions: L = 2,200 mm, W = 2,200 mm, H = 3,500 mm (additional floor space required for control console, control cabinet and hydraulic oil supply)
- Weight: Approx. 8.5 t
- Hydraulic oil station
- Maximum load allowed for each of the two test positions: \( F_{\text{max}} = 200 \text{kN} \)
- Number of springs that can be tested simultaneously: 2, 4, \( \ldots \) \( F_{\text{max}} \)
- Stroke (path-controlled): \( S = 10 \text{ to } 400 \text{ mm} \)
- Maximum spring length: \( L_0 = 1,000 \text{ mm} \)
- Test frequency:
  \[ f_0 = 0.19 \ldots 0.28 \times \sqrt[n]{(n \times R)} \text{ [Hz]} \]
  \( n = \) Number of springs to be tested simultaneously
  \( R = \) Spring constant [N/mm]
  \( f_0 = 2 \text{ Hz to } 20 \text{ Hz} \)
Stabilizer bar test bench (STAP42)

APPLICATION

Validation of the fatigue strength of anti-roll bars in passenger cars and HGVs

- Deduction of measures to increase fatigue strength
- Design approval
- Examination of the influence of different production parameters
- Flaw detection
- In situ acceptance testing as per specifications

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Test items:</th>
<th>Anti-roll bars of all kinds for passenger cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter:</td>
<td>d = 10 mm to 42 mm</td>
</tr>
<tr>
<td>Length:</td>
<td>L ≤ 2,000 mm</td>
</tr>
<tr>
<td>Test frequency range:</td>
<td>f = 10 Hz to 25 Hz</td>
</tr>
<tr>
<td>Type of load:</td>
<td>Wöhler and fatigue strength tests at R = -1</td>
</tr>
<tr>
<td>Weight:</td>
<td>3,200 kg</td>
</tr>
<tr>
<td>Dimensions:</td>
<td>L x W x H = 4,500 x 1,500 x 1,800 mm</td>
</tr>
</tbody>
</table>

Benefits of the IABG anti-roll bar test bench

- Energy-efficiency by utilising the principle of resonance in tests
- Reliability and low maintenance
- Exclusion of exogenic forces and vibrations
- Software-based testing, documentation and evaluation
- Recognised by all leading car manufacturers
- Compliance with industry-standard anti-roll bar and spring specifications
Valve spring test bench (VSTM)

APPLICATION

Time and cost-saving tests based on the principle of resonance to determine the fatigue strength of valve springs at certain temperatures

- Tests with maximum stress almost to a block
- Simultaneous testing of a high number of valve springs
- Simulation of environmental conditions incl. increased temperature
- Statistical validation with systematic testing and a sufficient number of test items
- Determination of dynamic relaxation behaviour

TECHNICAL DATA

- Maximum load allowed for each of the two test positions: $F_{\text{max}} = 20 \text{kN}$
- Maximum mean load allowed for each of the two test positions: $F_{\text{m, max}} = 13 \text{kN}$
- Maximum possible stroke: $S = 80 \text{ mm}$
- Maximum setup height: $L = 250 \text{ mm}$
- Test frequency: $f_0 = 0.6 \sqrt{(n \cdot R)} \text{ [Hz]} = 2 \text{ Hz} \text{ to } 20 \text{ Hz}$
  - $n =$ Number of springs
  - $R =$ Spring constant $[\text{N/mm}]$
- Temperature regulation: $T_{\text{max}} = 200^\circ \text{C}$
- Constant or variable amplitudes (collective loading)
# Stone impact simulator (GISM)

## APPLICATION

Defined and reproducible simulations of stone chip damage to components

- Type and amount of the test media as well as the impact velocity can be varied
- Defined impact velocity of the test media – independent of shape, size and weight
- Applications:
  - Testing axle springs, anti-roll bars, shock absorbers, axle-mounted components, fronts of road and rail vehicles, vehicle body parts, fuel tanks, gearboxes, oil sumps, windscreens and wheelset axles / simulating the impact of hailstones on wind turbine blade tips or photovoltaic modules

## TECHNICAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. impact speed:</td>
<td>140 km/h (39 m/s) / 300 km/h (83 m/s)</td>
</tr>
<tr>
<td>Angular adjustment:</td>
<td>Horizontal/vertical</td>
</tr>
<tr>
<td>Height adjustment:</td>
<td>Up to 700 mm</td>
</tr>
<tr>
<td>Target area localisation via:</td>
<td>Laser</td>
</tr>
<tr>
<td>Max. particle size of the test medium:</td>
<td>20 mm / 40 mm</td>
</tr>
<tr>
<td>Weight without control cabinet:</td>
<td>Approx. 800 kg</td>
</tr>
<tr>
<td>Dimensions without control cabinet:</td>
<td>L = 2,300mm, W = 1,100mm, H = 2,000mm</td>
</tr>
</tbody>
</table>
Spring/shock absorber test bench (FDP63)

APPLICATION

Fatigue strength tests for spring/shock absorber elements and air spring systems

- Dynamic and static fatigue strength and functional tests to validate the expected service life of a component
- Testing under realistic environmental conditions and simulation of the axle kinematics
- Vehicle-specific excitation of electronic shock absorber components
- Loading with block programmes (sine), superimposed sine or real-time signals

TECHNICAL DATA

- Max. static load: 63 kN
- Max. dynamic load: Approx. 50 kN
- Max. stroke: +/-125 mm
- Maximum velocity: 1.6 m/s
- Frequency ranges: 0 Hz to 20 Hz
- Max. mounting height: 1,000 mm
- Clear span: 600 mm
- Temperature range: -40°C to +100°C
- Measured variables: Path, pressure, force and temperature
- Test items: 2 or 4 air springs, with or without spring leg
- Optional simulation of the kinematics of a cam disc or a deflexion lever in a vehicle; automated pressure feeding
Fatigue Strength / Material Fatigue
IABG fatigue strength test laboratory

APPLICATION

- Performance of material and fatigue tests at metallic materials and fibre-plastic-composite materials (tension/compression, bending, torsion)
- Test portfolio
  - Quasistatic
  - High Cycle Fatigue (HCF)
  - Low Cycle Fatigue (LCF)
  - Complex Low Cycle Fatigue (CLCF)
  - Thermo Mechanical Fatigue (TMF)
  - Creep tests
  - Relaxation tests
  - Determination of fracture mechanic parameters

TECHNICAL DATA

- Servohydraulic test systems 10 kN – 100 kN
- Electromechanical testing system 100 kN
- Resonance Test Benches 15 kN – 150 kN
- Controlling method: distance, force, strain
- Measuring system: displacement sensor, load cell, Extensometer, optical extensometer
- Comprehensive potential of data recording e.g. displacement, force, strain
- Temperature control from -196 °C to 950 °C in temperature chambers and radiation furnaces, up to 2000 °C in vacuum chamber
- Inductive heating with high-frequency generator 10 kW
- Defined cooling of specimens with controlled compressed air cooling
- Self-sufficiently hydraulic supply
Electromechanical Testing Machine for Shafts 100kN (EMP)

APPLICATION
- Quasi-static tests
- $K_{IC}$ as per ASTM399
- Thermal chamber
- Corrosion chamber

TECHNICAL DATA
- Maximum test force: 100 kN
- Frame: Manufactured by Instron
- Digital controller: Manufactured by Doli
- Various clamping devices
## Servo-hydraulic test benches (SHP)

<table>
<thead>
<tr>
<th></th>
<th>SHP 1/3/9/10</th>
<th>SHP 2</th>
<th>SHP 4/5</th>
<th>SHP 8</th>
<th>SHP 6/7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing force / kN</td>
<td>± 100</td>
<td>± 63</td>
<td>± 40</td>
<td>± 25</td>
<td>± 10</td>
</tr>
<tr>
<td>Clear span / mm</td>
<td>440 - 640</td>
<td>350</td>
<td>430 - 650</td>
<td>440</td>
<td>400 - 440</td>
</tr>
<tr>
<td>Max. height of test setup / mm</td>
<td>850 - 1500</td>
<td>900</td>
<td>850</td>
<td>850</td>
<td>850</td>
</tr>
<tr>
<td>Test distance / mm</td>
<td>± 50 - 125</td>
<td>± 50</td>
<td>± 125</td>
<td>± 125</td>
<td>± 50 - 125</td>
</tr>
</tbody>
</table>

![Images of Servo-hydraulic test benches](image_url)
Resonance test benches (HFP)

APPLICATION

- Fatigue tests
  - Tension / Compression
  - Axial bending
  - Torsion
- $K_{IC}$: generating of a pre-crack
- Variable clamping tools
- Temperature chamber
- Corrosion chamber

<table>
<thead>
<tr>
<th>Description</th>
<th>HFP1/2/3</th>
<th>HFP4</th>
<th>HFP5/6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear span / mm</td>
<td>400</td>
<td>525</td>
<td>400</td>
</tr>
<tr>
<td>Max. height of test setup / mm</td>
<td>500</td>
<td>630</td>
<td>500</td>
</tr>
<tr>
<td>Test force / kN</td>
<td>± 150</td>
<td>± 100</td>
<td>± 10</td>
</tr>
<tr>
<td>Others</td>
<td>-</td>
<td>Clamping field for component tests</td>
<td>-</td>
</tr>
</tbody>
</table>
# Measuring equipment for deformation measurement

<table>
<thead>
<tr>
<th>Operationing temperature</th>
<th>Crack-opening measurement</th>
<th>Deformation measurement, room temperature</th>
<th>Deformation measurement, high temperature</th>
<th>Deformation measurement, low temperature</th>
<th>Optic strain measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room temperature</td>
<td>±4mm</td>
<td>±4mm – 12,5mm</td>
<td>±4mm – 1,2mm – +2,4mm</td>
<td>±0,5mm</td>
<td>0,0005% – 1000%</td>
</tr>
<tr>
<td>20°C – 1500°C</td>
<td>±5mm</td>
<td>±0,5mm</td>
<td>±0,5mm</td>
<td>0,0005% – 1000%</td>
<td></td>
</tr>
<tr>
<td>20°C – -270°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No restrictions at testing temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Measuring range**

- **Quasi static:**
  - ±4mm
  - ±4mm

- **Dynamic:**
  - ±2,5mm – 12,5mm
  - ±5mm

- **Room temperature:**
  - ±2,5mm – 12,5mm
  - ±5mm

- **High temperature:**
  - ±4mm
  - ±1,2mm – +2,4mm

- **Low temperature:**
  - ±0,5mm
  - ±0,5mm

- **Optic strain measurement:**
  - 0,0005% – 1000%
  - 0,0005% – 1000%
# Measuring equipment for other measuring tasks

<table>
<thead>
<tr>
<th>Measuring of surface roughness</th>
<th>Potential drop measurements</th>
<th>Temperature measurement</th>
<th>Strain gauge measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operationing temperature</td>
<td>Room temperature</td>
<td>Room temperature</td>
<td>-196°C – 1500°C</td>
</tr>
<tr>
<td>Range of application</td>
<td>Quality insurance at testing process</td>
<td>Measurement of crack propagation at test specimens</td>
<td>Tests for determination of fretting corrosion depending on LV214-PG16</td>
</tr>
</tbody>
</table>

![Image 1](image1.jpg)

![Image 2](image2.jpg)

![Image 3](image3.jpg)

![Image 4](image4.jpg)
Thermo-mechanical-fatigue test bench

APPLICATION

- Service life assessment and optimisation of components subjected to thermomechanical loads
- Thermo-mechanical fatigue tests
- Material and failure analysis
- Material modelling
- Computational fluid dynamics (CFD)
- FEM-Simulation
- Component tests

TECHNICAL DATA

- Test force: up to 100 kN
- Measurement range
  - Strain measurement: ±2 mm
- Min. test range: 15 mm
- Measurement range of temperature controlling: +50°C – 1000°C
- Heating rate: up to 10K/s
- Cooling rate: depending of test configuration up to 5K/s – 10K/s
APPLICATION

Vibration tests on components with a single-stage load or block programme

- Determination of cyclical material and component properties (Wöhler tests)
- Applications: Automotive and aeronautics components (particularly engine and control elements, piston rods and crankshafts)

TECHNICAL DATA

- Test force: Up to 20 kN
- Maximum test frequency: 250 Hz
- Dynamic path: 4 mm (± 2 mm)
- Clear span: 500 mm
- Max. test setup height: 800 mm
- T-slotted floor plate to mount any type of component (550 x 740 mm, M16 t-slots, slot distance: 125 mm)
- Positioning of load cell at top or bottom
- Grease or pressure oil lubrication
High-frequency pulser (HFP 400)

APPLICATION

Vibration tests on components with a single-stage load or block programme

- Determination of cyclical material and component properties (Wöhler tests)
- Applications: Automotive and aeronautics components (particularly engine and control elements, piston rods and crankshafts)

TECHNICAL DATA

- Test force: Up to 400 kN
- Maximum test frequency: 200 Hz
- Dynamic path: 6 mm (± 3 mm)
- Clear span: 600 mm
- Max. test setup height: 1200 mm
- T-slotted floor plate to mount any type of component (1,000 x 1,000 mm, M24 t-slots, slot distance: 100 mm)
- Positioning of load cell at top or bottom
- Grease or pressure oil lubrication
Rotating bending fatigue test bench (RBTM / ULB 1-2)

APPLICATION

Determining the fatigue strength of high-tensile materials used to manufacture springs and anti-roll bars

- Comparison of fatigue strength before machining of the raw material into the end product
- Material optimisation (e.g. type of material, heat treatment, shot blasting parameters, reduction of variance etc.)
- Determination of fractures, inclusions and similar flaws in materials to assess the material quality
- Assessment of surface quality

TECHNICAL DATA

- Test items: Machined or unmachined cylindrical bars or tubes (also for stepped shafts)
- Bar/tube diameter: \(d = 8 \text{ mm} \text{ to } 30 \text{ mm}\)
- Bar/tube length: \(L = 60 \ d + 140 \ \text{ mm} \) (or special lengths)
- Test frequency: \(f = 5 \text{ Hz} \text{ to } 50 \text{ Hz} \) (variable)
- Power consumption: < 1 kW
- Properties: No outgoing vibrations, very quiet
- Weight/Dimensions: Approx. 1,000 kg, \(L = 2,600 \ \text{ mm}, W = 1,000 \ \text{ mm}, H = 1,500 \ \text{ mm}\)
- Circumferential bend, load input via crowned, non-wearing plastic rings
- Load (stress) and strain measurement, load cycle counter
## Hydraulic universal test benches

<table>
<thead>
<tr>
<th></th>
<th>UHU 1</th>
<th>UHU 2</th>
<th>UHU 160</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clear span</strong></td>
<td>700 mm</td>
<td>900 mm</td>
<td>1,000 mm</td>
</tr>
<tr>
<td><strong>Max. test setup height</strong></td>
<td>1,600 mm</td>
<td>1,600 mm</td>
<td>1,500 mm</td>
</tr>
<tr>
<td><strong>Test force</strong></td>
<td>± 40 kN</td>
<td>± 40 kN</td>
<td>± 160 kN</td>
</tr>
<tr>
<td><strong>Test path</strong></td>
<td>± 125 mm</td>
<td>± 125 mm</td>
<td>± 125 mm</td>
</tr>
</tbody>
</table>
Hydraulic universal test benches

<table>
<thead>
<tr>
<th></th>
<th>SchwiFe 1</th>
<th>SchwiFe 2</th>
<th>SchwiFe 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear span</td>
<td>480 mm</td>
<td>480 mm</td>
<td>420 mm</td>
</tr>
<tr>
<td>Max. test setup height</td>
<td>800 mm</td>
<td>800 mm</td>
<td>1,000 mm</td>
</tr>
<tr>
<td>Test force</td>
<td>± 25 kN</td>
<td>± 10 kN</td>
<td>± 40 kN</td>
</tr>
<tr>
<td>Test path</td>
<td>± 50 mm</td>
<td>± 50 mm</td>
<td>± 125 mm</td>
</tr>
<tr>
<td></td>
<td>Pulser 5</td>
<td>Pulser 10</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Clear span</td>
<td>700 mm</td>
<td>1,000 mm</td>
<td></td>
</tr>
<tr>
<td>Max. test setup height</td>
<td>1,600 mm</td>
<td>1,600 mm</td>
<td></td>
</tr>
<tr>
<td>Test force</td>
<td>± 630 kN</td>
<td>± 160 kN</td>
<td></td>
</tr>
<tr>
<td>Test path</td>
<td>± 50 mm</td>
<td>± 50 mm</td>
<td></td>
</tr>
</tbody>
</table>
APPLICATION

X-ray inspection is a non-destructive volumetric testing method for components and semi-finished parts made of various materials. Radiographic tests can be performed on solid materials including metals, steels and cast materials as well as plastics, ceramics and fibre composites. X-ray inspection is also used for foods in order to determine pore volumes and visualise internal structures.

- Non-destructive volumetric tests to detect defects
- Geometric measurements
- Collection of real CAD data for calculations
- Assembly tests for complex machinery
- Characterisation of composites and compound materials
- Failure analyses

TECHNICAL DATA

- Micro-focus tube: 180 kV / 20 W
- Cone angle: 180°
- Maximum sample size: 680 x 635 x 170 mm
- Maximum sample weight: 10 kg
- Geometric magnification: 2,160 x
- Total magnification: 23,320 x
- Detail detectability: < 1 μm
- Number of axes: 5
- View angle: 70°
Macro-thermogravimetric analyser LECO TGA 701

APPLICATION

- Quality assurance for fibre-reinforced plastics (CFRP, GRP) by determining the fibre-to-resin ratio
- Cost-efficient alternative to the wet-chemical determination of the fibre volume ratio of fibre-reinforced plastics as per DIN EN 2564 or a standard procedure for automotive manufacturers and suppliers, e.g. BMW Standard Test Method PR 527
- Determination of humidity, volatile components, ash, ignition loss in plastics as well as any kind of organic material, e.g. paper, food, coal/coke and – in cement – bonding agents

TECHNICAL DATA

- Sample weight: Max. 5 g
- Sample count: Max. 19 (simultaneous measuring)
- Weighing accuracy: 0.1 mg
- Furnace control: 15°C/min RT…100°C; 50°C/min 100°C…1,000°C
- Gas flow: 3.5 l/min to 10.0 l/min
- Gas pressure: 2.4 bar
- Electricity supply: ~ 230 V, single-phase, 50 Hz, 25 A
- Suction: 35 l/s to 75 l/s
- Environment: 15°C to 35°C; max. RH: 80%
- Device dimensions (without computer): 520 mm x 610 mm x 560 mm
Wheel Testing Equipment
APPLICATION

Fatigue strength tests and simulation of failure behaviour under impact loads

- Radial impact test on car wheels with tyres
  - Safeguarding the fatigue strength of rims from fracture (e.g. when driving through potholes)
  - Preloading of wheels with impact loads for subsequent fatigue strength tests
- Impact load tests for motorbike forks and control arms
- Crash tests for semi-finished CFRP parts and crash energy-absorbing elements

TECHNICAL DATA

- Drop weight (increasable): 150 kg
- Maximum drop height: 8 m
- Impact energy at a drop height of 1m: 1471.5 J
- Velocity at drop height of 1m: 4.43 m/s
- Max. impact force at the centre of fin: 100 kN
- Fin angle: 150° (exchangeable)
- Fin dimensions (W x L): 195 x 500 mm
- Wheel dimensions: Currently 15 - 21 inches
- Wheel camber angle: 1° (variable, 0 – 3°)
Flat track tyre test bench Flat Trac® III CT [MTS]

APPLICATION
- Determination of characteristics, stationary and dynamic measurements
- Standardised and customer-specific test procedures
- Definition of tyre parameters
- Data evaluation for parameterising different tyre models
- Special tyre measurements

TECHNICAL DATA
- Wheel diameter: 910 mm
- Wheel width: 450 mm
- Track speed: 250 km/h
- Braking / driving with separate spindle drive
- Slip angle: ±30°
- Camber angle: -12°... 45°
- Measuring of force and torque with multi-component wheel measuring hub:
  Fx 10,000 N, Fy 15,000 N, Fz 25,000 N, Mx 10,000 Nm, My 2,800 Nm, Mz 3,000 Nm (maximum values)
Biaxial wheel test bench (ZWARP) and brake disc test bench (BSP)

APPLICATION

Fatigue strength tests on wheels (ZWARP) and brake discs (BSP) in operating load simulation tests

- Dynamic loading of lateral and radial forces
- Simplified simulation of endurance tests on the Nordschleife (North Loop) of the Nürburgring race track in Germany (lateral force through thrust rings, managed and controlled impact in optimum emulations of loads locally exerted in the wheel rim)
- Operational load simulation tests or New European Driving Cycle (NEDC)

TECHNICAL DATA

- ZWARP drive: AC asynchronous induction motor with a power of 65 kW
- BSP drive: DC motor with a power of 166 kW
- Drum: External diameter: 1,170 mm, Internal diameter: 1,050 mm, depth: 740 mm
- Thrust rings: Distance variable from 160 mm to 300 mm
- Test items: Maximum radius: 440 mm, maximum tyre width: 315 mm
- Hydraulic cylinder for $F_y$ and $F_z$: Stroke: 250 mm, maximum static force: 40 kN, maximum dynamic force: 25 kN
- Hydraulic cylinder for camber angle setting: Stroke: 150 mm, maximum force: 100 kN
- Camber angle setting: From -15° to +15°
Rotating bending facility (ULB) for wheels

APPLICATION
Tests to evaluate the fatigue strength of vehicle wheels, in particular the dynamic fatigue strength of wheel discs exposed to extreme lateral force

- Loading through rotating bending torque until failure through cracks and/or fracture
- Prerequisite for approval by TÜV and DEKRA material test centres

TECHNICAL DATA
- Rotating flyweight to realise different bending torques (up to 15 kNm)
- Wheel bolt control with embedded torque measurement system
- Velocity range: 500 rpm to 2,400 rpm
- Nominal wheel diameter: 10 inches to 23 inches
- Total weight: 2,000 kg
APPLICATION

Biaxial tests to assess the service life of passenger car and SUV wheel bearings

- Service life test with additional thermal loads
- High strain test
- Service life test applying real-life loads to wheel bearings

TECHNICAL DATA

- Maximum radial load: ± 40 kN
- Maximum axial load: ± 25 kN
- Maximum velocity: 1,600 rpm
- Signals: Block programmes with variable forces and velocities
- Measured variables: Force, path, temperature and acceleration ("noise")
- Test items: 2 or 4 wheel bearings installed with adapters or original mounting components
- Optional: External heating of bearings
  Assessment of bearings (races, ball bearing, grease analysis etc.)
  Additional mud testing with a mixture of Arizona dust, salt and water
APPLICATION

Fatigue strength tests for spring/shock absorber elements and air spring systems

- Dynamic and static fatigue strength and functional tests to validate the expected service life of a component
- Testing under realistic environmental conditions and simulation of the axle kinematics
- Vehicle-specific actuation of electronic shock absorber components; automated pressure feeding
- Loading with block programmes (sine), superimposed sine or real-time signals

TECHNICAL DATA

<table>
<thead>
<tr>
<th></th>
<th>Vertical</th>
<th>Horizontal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. static load:</td>
<td>±100 kN</td>
<td>±10 kN</td>
</tr>
<tr>
<td>Max. dynamic load:</td>
<td>±80 kN</td>
<td>±8 kN</td>
</tr>
<tr>
<td>Max. stroke:</td>
<td>±125 mm</td>
<td>±50 mm</td>
</tr>
<tr>
<td>Max. piston speed:</td>
<td>±3.0 m/s</td>
<td>±0.5 m/s</td>
</tr>
<tr>
<td>Temperature range:</td>
<td>-40°C to +100°C</td>
<td></td>
</tr>
<tr>
<td>Measured variables:</td>
<td>Path, force, pressure and temperature</td>
<td></td>
</tr>
<tr>
<td>Water cooling</td>
<td>using cooling jackets</td>
<td></td>
</tr>
<tr>
<td>Testing with original</td>
<td>kinematics, also with simulation of the steering angle</td>
<td></td>
</tr>
</tbody>
</table>
Environmental Simulation
High altitude chamber – up to 3,800 m above zero

APPLICATION

- Altitude simulation
- Exhaust analysis and fuel consumption measurements (EU and US)
- Driving dynamic analysis in combination with altitude and temperature

TECHNICAL DATA

- Dimension (L x W x H): 8.50 m x 4.50 m x 4.30 m
- Temperature range: -30 °C to +50 °C
- Cooling capacity: max. 180 kW
- Ambient pressure: approx. 960 hPa to 630 hPa (abs.) (approx. 560 m to 3,800 m)
- Controlled humidity: up to 95 % RH

- Single roller dynamometer:
  \[ P_{\text{max}} = 210 \text{ kW}, \quad \text{tractive force} = 6 \text{ kN}, \]
  \[ v_{\text{max}} = 200 \text{ km/h}, \quad \text{vehicle weight simulation of up to 8,000 lbs}, \]
  \[ \text{axle load max.} 2,000 \text{ kg} \]

- Air fan:
  Rear wheel drive vehicle: max. 34,000 m³/h, max. 130 km/h
  Front wheel drive vehicle: max. 26,000 m³/h, max. 100 km/h

- CVS emission measurement with two sampling lines:
  1. tailpipe: diluted emissions in bags and modal emissions
  2. engine out: undiluted emissions at separate sampling point
Altitude chamber II – up to 20,000 m above zero

APPLICATION

- Function tests, e.g. cold-start tests with altitude simulation
- Endurance tests

Please bear in mind, that a medical certificate is needed while attending the tests in a chamber under reduced pressure. If you want to attend the tests, this certificate is needed and it should be adhere, that there is no concern against abidance under reduced pressure. Above an altitude of 4,000 m, entry to the chamber is not permitted.

TECHNICAL DATA

- Dimension (L x W x H): 6.00 m x 3.00 m x 3.00 m
- Temperature range: -70 °C to +80 °C
- Cooling capacity: max. 70 kW
- Ambient pressure: approx. 960 hPa to 50 hPa (abs.) / (approx. 560 m to 20,000 m)
- Humidity: not controlled
- Floor loading: max. 10 kN/m
- Cable entry: d = 100 mm and d = 140 mm
- Power supply: 230 VAC or 400 VAC (16 A, 32 A, 63 A and 125 A CEE) & programmable AC Power Source
- Air pressure supply: max. 25 bar
- Water supply: Well water (in- and outlet)
- Exhaust gas extraction system: Up to max. 4,500 m
Temperature chamber

APPLICATION
- Functional tests, e.g. low - and high temperature testing, snow and icing tests
- Endurance tests
- Combined environmental simulation (temperature, rain, snow or ice)

TECHNICAL DATA
- Dimension (L x W x H): 5.50 m x 4.50 m x 4.00 m
  Door (W x H): 4.50 m x 4.00 m
- Temperature range: -70 °C to 150°C
- Temperature gradient: max. 1 K/min
- Cooling capacity: max. 70 kW
- Humidity: not controlled
- Floor loading: max. 50 kN/m²
- Cable feedthrough: d = 100mm (3x)
- Power supply: 230 VAC or 400 VAC (16 A, 32 A, 63 A and 125 A CEE) & programmable AC Power Source

Functional tests, e.g. low - and high temperature testing, snow and icing tests
Endurance tests
Combined environmental simulation (temperature, rain, snow or ice)
## Climate chamber

### APPLICATION
- Ageing with temperature / climate cycles
- Endurance tests
- Functional tests, e.g. cold start
- Combined environmental simulation (temperature, rain, snow, ice or sun)

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Dimension (L x W x H):</th>
<th>9.00 m x 4.50 m x 4.30 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door (W x H):</td>
<td>4.00 m x 3.00 m</td>
</tr>
<tr>
<td>Temperature range:</td>
<td>-40 °C to +120 °C</td>
</tr>
<tr>
<td>Temperature gradient:</td>
<td>max. 1 K/min.</td>
</tr>
<tr>
<td>Cooling capacity:</td>
<td>max. 120 kW</td>
</tr>
<tr>
<td>Controlled humidity:</td>
<td>0 % to 95 % RH (at a temperature of +10 °C to +80 °C)</td>
</tr>
<tr>
<td>Exhaust gas volume flow:</td>
<td>max. 1,500 m³/h</td>
</tr>
<tr>
<td>Floor loading:</td>
<td>max. 35 kN/m² (respectively 20 kN max. wheel load)</td>
</tr>
<tr>
<td>Cable feedthrough:</td>
<td>d = 150 mm (2x)</td>
</tr>
</tbody>
</table>

| Power supply: | 230 VAC or 400 VAC (16 A, 32 A, 63 A and 125 A CEE) & programmable AC Power Source |
| Air pressure supply: | max. 25 bar |
| Water supply:   | Well water (in- and outlet) |
Vehicle chamber I

APPLICATION

- Function tests, e.g. cold-start tests
- Endurance tests

TECHNICAL DATA

- Dimensions (L x W x H): 7.00 m x 3.50 m x 2.60 m
- Temperature range: -70 °C to +80 °C
- Cooling capacity: Max. 190 kW
- Humidity: Not controlled
- Single Roller Dynamometer: $P_{\text{max}} = 40$ kW, $v_{\text{max}} = 120$ km/h
Vehicle chamber II

APPLICATION
- Dynamic measurements
- Endurance tests

TECHNICAL DATA
- Dimensions (L x W x H): 8.00 m x 5.00 m x 2.50 m
- Temperature range: -30 °C to +60 °C
- Cooling capacity: Max. 110 kW
- Ambient pressure: Not controlled
- Humidity: Not controlled
- Single Roller Dynamometer: $P_{\text{max}} = 53$ kW, $v_{\text{max}} = 120$ km/h H2-compatible, explosion-proof for hydrogen-powered vehicles
Climate combination chamber

APPLICATION

- Ageing with temperature / climate cycles
- Endurance tests
- Functional tests, e.g. cold start

TECHNICAL DATA

- Dimension (L x W x H): 4,00 m x 2,20 m x 2,70 m
- Temperature range: -70 °C to +120 °C
- Temperature gradient: max. 5 K/min
- Cooling capacity: max. 70 kW
- Controlled humidity: 10 % to 95 % relative humidity
- Cable feedthrough: d = 125 mm (3x)
- Power supply: 230 VAC or 400 VAC (16A, 32A, 63A and 125A CEE) & programmable AC Power Source
- Pressure supply: max. 25 bar
- Water supply: well water (in- and outlet)
Solar radiation unit

APPLICATION

- Ageing of surfaces
- Measurement of the temperature distribution of components and systems
- Artificial sunlight and temperature superposition function tests

TECHNICAL DATA

- Dimension (L x W): 2,00 m x 3,00 m
- Solar radiation: up to 1200 W/m²
- Variable distance to the solar panel
- Temperature range: -30…90°C
- Controlled humidity: up to 95% relative humidity
- Test box to simulate also indoor conditions
Soaking boxes & preparation area

APPLICATION

- Vehicle preconditioning for tests in the high altitude chamber e.g. for emission measurements
- Preparation of the vehicles (mounting test wheels, measurement systems etc.)

TECHNICAL DATA

- Dimension per cell (L x W x H): 5.70 m x 2.70 m x 2.35 m
- Temperature range: -25...50°C
- Independent temperature control of both cells
Splash water cabinet

APPLICATION

- Temperature shock test with splash water to evaluate the thermal shock resistance of components and systems located in the splash water area of a vehicle.

TECHNICAL DATA

- Dimensions (L x W x H): 0,8 m x 1,2 m x 0,8 m
- Temperature range test sample: RT ... 120 °C
- Temperature range water: 0 ... 4 °C
- Test medium: distilled water with 3% Arizona dust
- Nozzle head: 2 jets with 220 mm width each
- Splash water cycle: 3s every 30min or 60min
- Standard: ISO 16750-4
APPLICATION

IABG has three dust test chambers to examine the dustproofness, contamination, surface resistance and operability of objects exposed to dust. Test items can be examined in an operating state to validate their functionality.

The facilities can be used for testing in compliance with standards such as IP protection tests according to IEC EN 60529 and ISO 20653, as well as tests according to various manufacturer-specific standards.

Typical test items
Housings, Measuring devices, notebooks, bearings, sensors, actuators, fuel cells, electric motors, aerials etc.

TECHNICAL DATA

Dust test chamber 1
- Dimension (L x W x H): 2.9 m x 1.9 m x 1.9 m
- Temperature range: RT
- Floor loading: max. 2,000 kg
- Cable feedthrough: d = 100 mm
- Electricity supply for test item: 230 V, 16 A / 32 A

Dust test chambers 2 and 3
- Dimensions (Ø x H): 0.8 m x 0.8 m and 0.5 m x 0.45 m
- Access door (W x H): 0.4 m x 0.4 m and 0.3 m x 0.3 m
Combination cabinet BFV 64 (TAH – temp., altitude, humidity)

APPLICATION

- Pressure Tests
- Icing Tests
- Rapid and Explosive Decompression Tests
- Combined Temperature-, Altitude- and Humidity-Tests (TAH-Tests)

The facility can be used for testing in compliance with standards such as: 
RTCA/DO-160 & MIL-STD 810

TECHNICAL DATA

- Pressure range: 25 ... 1000 hPa
- Temperature range: -70...150°C
- Controlled humidity: up to 95% RH
- Dimension (L x W x H): 1,10 m x 0,79 m x 0,70 m
- Flange for connection of cables: pressure sealed flange (d = 35, 55 and 85 mm)
Pressure vessels

APPLICATION

- Low pressure and overpressure tests
- Rapid pressure change tests and explosive decompression tests

The facility can be used for testing in compliance with standards such as:
RTCA/DO-160 & MIL-STD 810

TECHNICAL DATA

- **Pressure range:** 10 ... 2500 mbar (abs)
- **Temperature range:** RT
- **Humidity:** not controlled
- **Flange for connection of cables:** pressure sealed (d = 100mm)
- **Pressure vessel No. 1**
  - Dimensions test space (Lxd): 600 mm x 345 mm
- **Pressure vessel No. 2**
  - Dimensions test space (Lxd): 1300 mm x 1090 mm
- **Pressure vessel No. 3**
  - Dimensions test space (Lxd): 2000 mm x 1580 mm
Salt Fog Chamber

APPLICATION

Test facilities for simulation of corrosion on components

- Salt spray tests
- Humidity tests

The facility can be used for testing in compliance with standards such as: ASTM B 117, EN ISO 9227, RTCA/DO-160 & MIL-STD 810

TECHNICAL DATA

- Dimensions (L x W x H): 1560 mm x 510 mm x 740 mm
- Floor loading: max. 100 kg
- Cable feedthrough: by water basin
- Salt Fog: Temperature range: 23° to 60°C
- Climate tests: Temperature: 23° to 60°C, Rel. humidity: 20 to 95% RH
- Drying/ventilating: Temperature: 23° to 60°C, Rel. humidity: ≤ 30% RH
Temperature shock unit (air/air)

APPLICATION

Temperature shock test air/air to evaluate the thermal shock resistance of components and systems (test cabinet with two test spaces – hot and cold.

The facility can be used for testing in compliance with standards such as:
DIN EN 60068-2-14 Na & MIL-STD 810

TECHNICAL DATA

- Temperature range: -70 to +220 °C
- Change rate: < 10 sec.
- Humidity: not controlled
- Flange for connection of cables: d = 35 mm
- Dimension (L x W x H): 640 mm x 460 mm x 400 mm
- Weight of test specimen: max. 35 kg
Temperature and Climatic Test Cabinets (180l up to 1500l)

APPLICATION

- Rapid temperature change tests
- Temperature and humidity tests
- Low and high-temperature tests
- Icing tests
- Ageing tests

The facility can be used for testing in compliance with standards such as:

DIN EN 60068-2, RTCA/DO-160 & MIL-STD 810

TECHNICAL DATA

- Temperature range: -70 to +180 °C
- Temperature gradient: up to 15 K/min
- Rel. Humidity: 10…98 % RH
- Cable feedthrough: d = 125 mm
- Dimensions (L x W x H): 450 mm x 580 mm x 750 mm
  720 mm x 650 mm x 750 mm
  650 mm x 800 mm x 950 mm
  870 mm x 880 mm x 940 mm
  1600 mm x 1000 mm x 900 mm
Fluid susceptibility and contamination devices

APPLICATION

Fluid susceptibility and contamination tests to determine whether the materials can withstand the effects of various fluids.

The facility can be used for testing in compliance with standards such as:
RTCA/DO-160 & MIL-STD 810

TECHNICAL DATA

- Approx. 250 fluids available
  e.g. insecticides, lubricating oils, hydraulic fluids/liquids, solvents, cleaning fluids, alcohol, fuels, de-icing fluids, greases, fire extinguishants...

- Temperature storage: from -70 °C to +180 °C possible
Miscellaneous Test Facilities
High and low-pressure test equipment (HD/ND)

**APPLICATION**

Assessment of the fatigue strength and endurance limit of components and systems under internal pressure load

- Static load tests and burst tests
- Cyclical variable-pressure tests with adjustable mid-load
- Parallel assessment of up to 18 test items
- Test bench adaptable to test items
- Computer-operated control and test monitoring
- Simulation of variable ambient temperatures
- Use of different pressurising media (e.g. water, special oils)

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th><strong>High-pressure test</strong></th>
<th><strong>Low-pressure test</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. pressure (static/cyclical):</td>
<td>Max. pressure (static/cyclical):</td>
</tr>
<tr>
<td>4,000 bar / 3,000 bar</td>
<td>280 bar</td>
</tr>
<tr>
<td>Max. test frequency:</td>
<td>Approx. 10 Hz to 15 Hz, depending on number of test items</td>
</tr>
<tr>
<td>Approx. 5 Hz to 20 Hz, depending on number of test items and load range</td>
<td></td>
</tr>
<tr>
<td>Test chamber dimensions:</td>
<td>Test chamber dimensions:</td>
</tr>
<tr>
<td>L = 0.8 m, W = 0.8 m, H = 0.4 m</td>
<td>L = 1.2 m, W = 0.7 m, H = 0.7 m</td>
</tr>
<tr>
<td>Test medium:</td>
<td>Test medium:</td>
</tr>
<tr>
<td>Hydraulic oil</td>
<td>Hydraulic oil or alternative media (e.g. water)</td>
</tr>
<tr>
<td>Climate control (optional):</td>
<td>Climate control (optional):</td>
</tr>
<tr>
<td>-40°C to +120°C</td>
<td>-40°C to +180°C</td>
</tr>
<tr>
<td>Test item installation</td>
<td>Test item installation</td>
</tr>
<tr>
<td>High-pressure distributor with 18 connections</td>
<td>Test adapter as arranged with the customer</td>
</tr>
</tbody>
</table>