ZWARP

BIAXIAL WHEEL TEST MACHINE
The biaxial wheel test machine called ZWARP, is used for fatigue tests or life tests of disc wheels. The wheel is running inside a drum and is applied to with radial- and lateral forces as well as tilt angle force.

At the biaxial test the wheels are rolled on a standardized axis arrangement on an inner drum. The forces (radial, tangential and lateral) actually occurring can be simulated by the corresponding axis arrangement and thrust rings on the test system. The respective load spectra are set by the automotive industry and of relevant test specifications (such as AK-LH-08) and scaled to the respective application. The measurement and evaluation of the test results is done according to the patented method of Schwendemann.

Your advantages

- **CERTIFIED TEST EQUIPMENT SUPPLIER**
  The test machine from MAKRA are accepted and certified by all german car manufacturer (BMW, AUDI, Daimler, Volkswagen, Porsche, ...)

- **SAFETY DEVICES FOR THE TYRE / WHEEL**
  Monitoring of traveled distance, inner rim flange monitoring (laser sensor), measurement and monitoring of tyre compression, limit value monitoring (force, angle, pressure, and temperatures), tyre pressure monitoring (optional), tyre temperature monitoring (optional)

- **CALIBRATION**
  Calibration device allows an independent calibrating in short time

- **WHEEL DAMAGE CONTROL**
  In case of a wheel damage during the test, the machine will stop immediately

- **OPERATION**
  Intuitive software with real time display

- **TELEMETRY**
  For wireless data transfer of the wheel data

- **USER-FRIENDLY WHEEL CHANGE POSITION**
  Due to the compact design of the test bench and the arrangement of the axis a very easily accessible wheel change resulst

- **ELECTROMECHANIC DRIVES**
  The use of electromechanical drives results in cost advantages through lower energy consumption compared to hydraulic systems. Additionally there is no leakage in long term perspective.
LOAD DRUM

The drum is consisting of steel body in circumference direction. The steel wrap will be underwent to a rift test. The flange has enough space inside for insert of telemetry for a test wheel. The geometry of thrust ring is done according SAE-standard. Adjusting of thrust rings will be done by hard, changeable distance bolt. The drum is balanced on two levels with vehemence quality of \( Q = 2.5 \). The running surface is shiny swivelled.

LOAD CARRIAGE

Two load sleigh are moving crosswords. A third load sleigh is moving linear beared on two centre of rotation, for adjusting of tilt angle. The load sleighs are beared on frictional free and accurate linear guiding. In this biaxial test bench, be biaxial loading forces and the indication angle are introduced by electromechanical actuators. By appropriately combining the highest load conditions in the load collective, the damage content of a wheel travelling 300,000 km in everyday use can be reproduced with a test run on 10,000 km per wheel.

TEST RECORD

The recorded data can be printed as a test record. The standard test record contains the general header data as well as testing time, load step and the associated or reached cycle numbers, the respective kilometerage and also the load values (forces, angles, speed). In the event of a fault, a corresponding message is displayed on the screen and an error log can be printed out.

VISUALISATION / TEST SOFTWARE

Visualisation is carried out with WinCC Flexible from Siemens. The visualised and acquired data are stored and logged. The test data are stored under the test number as Excel and PDF files (or in a database). The stored data can be relected by test number and can be used for repeat test. The current measurement data, test duration and test distance are permanently stored. In the event of failures during the test, data consistency is always guaranteed.
The test bench is equipped with 2 drums - \( D = 1000 \text{ mm} / D = 820 \text{ mm} \). Other drum diameters (on request) are possible.

**PROTECTIVE COVER**
Tunnel-shaped protective cover over the drum and the test unit for protection against parts and tire rubber abrasion in the test room.

**DRUM WITH TRUST RINGS**
The test bench is equipped with 2 drums - \( D = 1000 \text{ mm} / D = 820 \text{ mm} \). Other drum diameters (on request) are possible.
CONTROL UNIT
The control cabinet can be positioned either inside or outside of the protected space

LOAD UNIT

ZWARP
**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main drive</td>
<td>89 kW</td>
</tr>
<tr>
<td>Force axial/horizontal</td>
<td>50 kN</td>
</tr>
<tr>
<td>Force tilt angle</td>
<td>100 kN</td>
</tr>
<tr>
<td>Max. tilt angle</td>
<td>± 25°</td>
</tr>
<tr>
<td>Drum diameter</td>
<td>to 1250 mm</td>
</tr>
<tr>
<td>Drum width</td>
<td>500 mm</td>
</tr>
<tr>
<td>Max. tyre width</td>
<td>400 mm</td>
</tr>
<tr>
<td>Wheel size</td>
<td>13-24&quot; (other sizes on request)</td>
</tr>
<tr>
<td>Speed</td>
<td>till 180 km/h</td>
</tr>
<tr>
<td>Control</td>
<td>Software Diadem</td>
</tr>
<tr>
<td>Test specification</td>
<td>wheel-guideline §30 StVZO, SAEJ2562, AK-LH08</td>
</tr>
<tr>
<td>Machine type</td>
<td>ZWARP, Type B und C</td>
</tr>
<tr>
<td>Control method</td>
<td>according Schwendemann</td>
</tr>
<tr>
<td>Size</td>
<td>4500 x 2550</td>
</tr>
</tbody>
</table>

**Diagram:**
- Control cabinet
- Supply from the top of the cabinet
- 400V, 50Hz, 315A
- Pneumatic connection
- min. 5bar

**Note:**
- Machine type ZWARP, type B und C
- Size 4500 x 2550
- Control method according to Schwendemann
- Supply from the top of the cabinet 400V, 50Hz, 315A
- Pneumatic connection min. 5 bar

**Wheel size:**
- 13-24" (other sizes on request)

**Test specification:**
- wheel-guideline §30 StVZO, SAEJ2562, AK-LH08
CALIBRATION DEVICE

Mobile precision load cell unit with auxiliary device for fixing on the wheel shaft. The forces in the x and y direction are directly measured by the load cell unit which is pushed radially or axially to the drum. The angular force is calculated using the method of Schwendemann.

DRUM

The adjustment of the thrust rings is realized with fixed, removable spacer bolts. Other adjustment or special customer requirements on request (option).

INNER FLANGE MONITORING

These and other protective devices ensure the safety of your specialised personnel.

TEMPERATURE MEASUREMENT

Monitoring the tire temperature using an infrared sensor. Limit value monitoring with a variably adjustable limit value for switching off the station and feedback on the software.

ADJUSTMENT DEVICE FOR THE THRUST RINGS

Outer adjustment rings at the drum body with a clamping screw, by means of which the thrust rings are displaced by a lever. On the outside of the drum a scale for the tentering is applied.

TELEMETRY

8-canal telemetry with long distance sender. 300 Hz each canal, 8 selectable programmable canals for DMS measurements, integrated akku supply.

MAIN DRIVE

The drum will be driven with AC-motor, which is built horizontal on test machine. A belt drive with V-belt will be used. A device for re-stressing of belt is supposed. The test speed will be regulated with frequency converter and close loop control.

PRE-DAMAGE DEVICE

Integrated pre-damage device with electrical protection and control extension for pre-damage according specification.