Servo-hydraulic Testing Rig for Fatigue Tests of Automobile Stabilizer Bars
The testing rig consists of the following functional components:
- Clamping foundation as base plate
- Load generator (two hydraulic testing cylinders)
- Energy generator (hydraulic unit with housing)
- Control incl. software
- Clamping device/specimen adaptation

Clamping foundation (base plate)
The base plate bears the test frame and the specimens. Its dimensions are to be selected the way that future upgrades can be added to the base plate.

The base plate is made of cast iron with steel additive. Lengthwise, 14 T-slots according to DIN 650 – 22H12 for screws M 20 (300 mm distance) are applied. Using appropriate T-slot nuts according to DIN 508 - M20, various structures can be realized. These T-slot nuts are pushed into the T-slots of the clamping plate at the desired position.

In order to ensure the highest possible stability of the plate, a special casting process is used, guaranteeing the greatest possible stress-relieved casting. In addition, the ribs at the end are reinforced in a T-shaped way. The raw surfaces are blasted clean.

The clamping plate is vibration-isolated and level-regulated by means of pneumatic bellow cylinders.

Load generator
The load generator are designed as load chain, consisting of
- 2 joints
- Shifting slide
- Testing cylinders with integrated displacement sensor and
- Load cell
- Servo valve
- Pressure liquid accumulator.

The upper joint is equipped with an adapter plate for connection with the cross beam. It can be adjusted continuously in cross direction. The load cells are adapted to the testing cylinders.

Energy generator (hydraulic unit with housing)
A hydraulic unit, which has been especially developed for the demands of the servo-hydraulic testing technology, is used. Normally, the hydraulic unit is located about 5 m away from the testing rig. The switch cabinet is placed aside the hydraulic unit. The power is transferred at the input terminals of the switch cabinet.

The load generators are connected with the oil supply by means of a 2-manifold block, fulfilling the following functions:
- Gradually increasing pressure before the servo valve
- Switching to operating pressure
- Hose rupture protection
The manifold block is located at the hydraulic unit, provided that the distance between hydraulic unit and testing rig is not more than 5 to 6 m. In case of longer distances, a hard piping between the hydraulic unit and the manifold block must be built and the manifold block is positioned near the testing rig.

The manifold block and the load cylinders are connected by hose. Directly before the load cylinders, terminal units are used, which are equipped with filter and bypass valve.

**Clamping device/specimen adaptation**

The clamping device is the connection between specimen and base plate. It introduces the test forces (and their reactions) into the base plate.

The adaptations mainly consist of elements of the construction kit system SPR100. Using appropriate adaptation, two stabilizer bars can be tested at the same time.

There are various types of testing rig designs. For instance, the testing rig can be prepared for using a testing rocker.

<table>
<thead>
<tr>
<th>Main area of application</th>
<th>Dynamic fatigue tests of automobile stabilizer bars</th>
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</thead>
<tbody>
<tr>
<td><strong>Load generator</strong></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Hydraulic (testing cylinder)</td>
</tr>
<tr>
<td><strong>Parameters</strong></td>
<td></td>
</tr>
<tr>
<td>Test load of each component at maximum:</td>
<td>± 40 kN (static) ± 32 kN (dynamic)</td>
</tr>
<tr>
<td>Displacement at maximum:</td>
<td>± 200 mm</td>
</tr>
<tr>
<td><strong>Dimensions (floor space)</strong></td>
<td>ca. 4000 x 3500 x 3860 mm (width x depth x height)</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Control system dynaSax-D3 (up to 16 control channels)</td>
</tr>
<tr>
<td><strong>Specimen</strong></td>
<td>Automobile stabilizer bars</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>Testing rig:</td>
<td>ca. 16.000 kg</td>
</tr>
<tr>
<td>Hydraulic unit:</td>
<td>ca. 3.200 kg</td>
</tr>
<tr>
<td><strong>Electric connection</strong></td>
<td></td>
</tr>
<tr>
<td>3L/N/PE AC 400V +/-10% 50 Hz</td>
<td>Connected load: 150 kVA</td>
</tr>
</tbody>
</table>
3. Control System – Operating Software and Test Evaluation

As control devices, the in-house developed *dynaSax-D3* are applied. The control system dynaSax-D3 is designed to control complex tests on single- and multi-channel servo-pneumatic or servo-hydraulic fatigue tests.

The tests are configured, controlled, monitored, analyzed and visualized by a commercial operator PC with the test software dynaSax3. The connection is realized by Ethernet. The control program works under the operating system MS Windows.

The measurement and control device dynaSax-D3 is designed for the following operating modes:
- Continuous swing and stage program tests
- Service load test
- Tests with external set point setting
- Static tests

Test Evaluation

The tests are evaluated outside the testing machine. After dynamically loading the automobile stabilizer bars, their properties regarding
- cracks
- rubber mount adhesion
are determined.

Window test graph