

# Individual and customized test rigs

The testing industry has changed dramatically in the 40 years since FGB was established, but the engineering company knows that identifying and reacting to trends while offering solid turnkey solutions are the way to ensure business continues to boom

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➤ What makes a person or thing outstanding? Usually it is their ability to unify more than one great talent. For the same reason, visitors to FGB, a medium-sized but highly technology-oriented German engineering enterprise, are astonished when they first take a walk through the company's premises. The enterprise offers one-stop turnkey solutions, as well as a range of test components such as servohydraulic cylinders and rotary drives, valve units, hydraulic power units, and also electric actuators.

One such solution is a special kind of rotary drive that has been designed for the assessment of automotive items such as gearboxes. In principle, the rotary drive itself is pivot-mounted, which enables a rotation without a limiting angle. Gearbox testbeds need such a feature, as the shafts have to carry out a continuing rotation.

In this case, the whole of the torsion system is an electrohydraulic-mechanical converter. The drive with electrically actuated hydraulic valves constitutes the torque control element and is integrated in a mechanically closed torsion circuit.

In order to load the component accordingly, the pivoting wing principle is used, so the pivoting wings can be alternately loaded as required, which triggers corresponding rotary movements.

FGB's pivot-mounted rotary drives are low-friction and hysteresis-free due to the hydrostatic radial and axial bearings. The couplings are connected to the test specimens in a torsionally stiff way and without play.

The test system comprises all peripheral devices such as control block and valve assembly block, leakage oil extraction (for leakage oil drainage without back-pressure), control electronics, control and measurement lines, as well as connection hoses.



ABOVE: The pivot-mounted rotary drive enables rotation without a limiting angle

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The company offers torsion drives with nominal torques of 1,000Nm to 20kNm for speed ranges up to 6,000min<sup>-1</sup>. FGB torsion systems are equally suitable for the use in static and highly dynamic applications.

The company has also manufactured servohydraulic rotary drives for many years. The drives are, for example, fixed on a fixing plate or device in order to actuate test specimens (such as elastomers, shafts, etc.) with angles of +/-60°. FGB has also recently begun developing and producing a range of torque motors. These electric drives have a larger swivel angle and complete the product portfolio in the lower torque range.

As a system supplier, FGB offers test solutions for a great range of products. The following example was designed as a lifetime testbed for pneumatic systems/bellows in railway traffic in accordance with EN 13597. However, the test system is not limited to such applications and can also be used for other testing purposes. The system does not require a hydraulic supply of any kind and consequently represents a very efficient and powerful electromechanical testing solution. This makes the test rig an energy-saving, and therefore economical, system to operate.

This test machine is capable of handling pneumatic systems with an external diameter of up to 1m and an installation height of up to 650mm, and loading with a vertical force of up to 250kN. For verification of the lifetime of an element the test system enables very realistic reproduction of the installation conditions as well as simulation of the loads acting on the pneumatic system.

In order to achieve faithful reproduction of the attachment geometries between the bogie pivot point and the pneumatic system in the test machine, it is possible to infinitely adjust the distance of the bogie pivot point to the

center point of the pneumatic system between 750mm and 1,150mm.

Dynamic deflection of the pneumatic spring in the X direction is realized by means of a rotary crankshaft combined with a motor. The deflection value is infinitely adjustable from 0mm to 200mm, determining the cyclic fatigue load (X direction, in the vehicle: outward rotational movement while traveling across curves). The adjustment options are specially designed for test applications for rail vehicles.

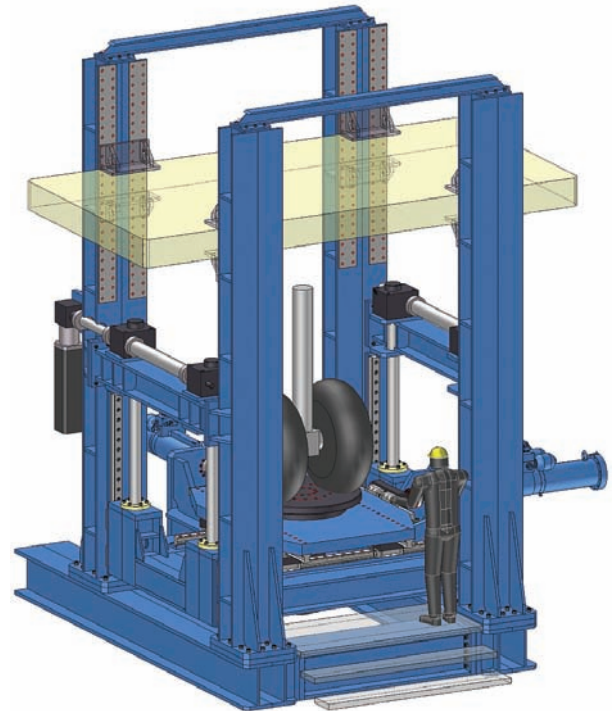
The test frequencies are below 1Hz, depending on the respective amplitude values. On the basis of the connecting rod ratio, which is exactly adjusted to every specific case of application, a nearly optimal sinusoidal load characteristic is achieved for the test specimen. In addition to dynamic deflection, static deflection of the pneumatic system can be realized in a range between -80mm and +80mm in Y direction. This factor corresponds to transverse acceleration in the vehicle when traveling across curves. Static and dynamic deflection can be individually defined for each test specimen. For execution of component testing to failure, various load amplitudes can be set.

Moreover, the test machine can be used for identification of the static lifetime of a pneumatic bellow/system, and is capable of demonstrating Wöhler lines (lifetime period via load amplitude) or Wöhler planes (lifetime period via load amplitude in X direction and load height Fz), using the corresponding software extension. Of course, the test rig can also be used for lifetime period calculations on the basis of the determined values and in accordance with the load spectrums.

Test machines with rather large dimensions challenge engineers, especially when the loads reach some 100,000N. FGB is used to working on such projects. In fact, it recently

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ABOVE RIGHT: The servohydraulic nose-gear test system

LEFT: Lifetime testbed for pneumatic systems/bellows



delivered its airliner nose-gear test system, which is a servohydraulic inspection solution. It is capable of stressing a complete nose-gear unit to the limit of its load conditions, which of course occur during take-off and landing, but also when the aircraft is on the taxiway. The cylinders in this application are capable of applying up to 200kN in X/Y direction and up to 500kN for the Z direction. The maximum torque around the Z axis is 25kNm.

The test machine is a modular system that can be used for a variety of specimens. For this reason a similar solution can also be used for the testing of suspension parts.

This unique design has some clear advantages over other solutions. For example, by using only one platform for the movement in both X and Y directions, the mass of the system is halved, as is the inertia. Additionally, the servohydraulic cylinders as well as the attached servovalves, remain in their position and the load cells can work independently of any shear forces. These characteristics improve control quality considerably. Furthermore, the linear bearings of the X-Y platform are loaded mainly in Z direction.

The concepts discussed here are fairly general; the designs of FGB machines are actually based on many small details that have evolved over almost half a decade of engineering in this area. It is often these little details that are the deciding factors for customers, helping them to choose an FGB solution. Judging by the latest news published by the company, the next big engineering challenges are already in the pipeline.

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