

Sincotec NEWS

Another Step up the Ladder of Success

Successful accreditation of our calibration laboratory in accordance with DIN EN ISO 17025:2018

Keep on Rolling, Now also Modular!

Efficient range extension through wheel bearing tests

Fatigue Strength Tests in Hydrogen Pressure Chamber

Turbo for component development in a hydrogen atmosphere



Dear SincoTec friends,
Dear SincoTec customers,

big challenges lie ahead of us. The current world situation is characterized by many crises and wars. There are new bloc formations in the world order that did not exist before.

Meanwhile, a change in the way we move around and experience our world is on the horizon. The shift in vehicle propulsion technology from fossil fuels to alternative and renewable energy sources reflects not only the change in consumer behavior, but also humanity's desire to create a more sustainable and environmental-friendly future.

A new era is also approaching in the world of work: the advent of AI. There is no question that ChatGPT and

similar technologies will have a significant impact on the way we work and communicate in the coming years. AI experts predict that we will be supported by AI assistants in both our private and professional lives in the future. They will be able to take over many tasks in the future and make our lives easier. As a technology-oriented family business, we also see the opportunities rather than the risks and try to use AI to our advantage.

We are pleased to present our latest developments and testing services in this SincoTec News and look forward to solving exciting testing tasks with you in the coming year.

Together we make the world safer!

On behalf of the **SincoTec-Team**

Dr.-Ing. Joachim Hug,
Sabrina Hug-Lohmüller, M. Sc.
Dipl.-Ing. (FH) Sven Henze,
Dipl.-Ing. Steffen Krause and
Dr.-Ing. Marcel Heß



From left: Managing Partners Sabrina Hug-Lohmüller, Sven Henze and Dr. Joachim Hug at the Testing Expo 2023 in Stuttgart

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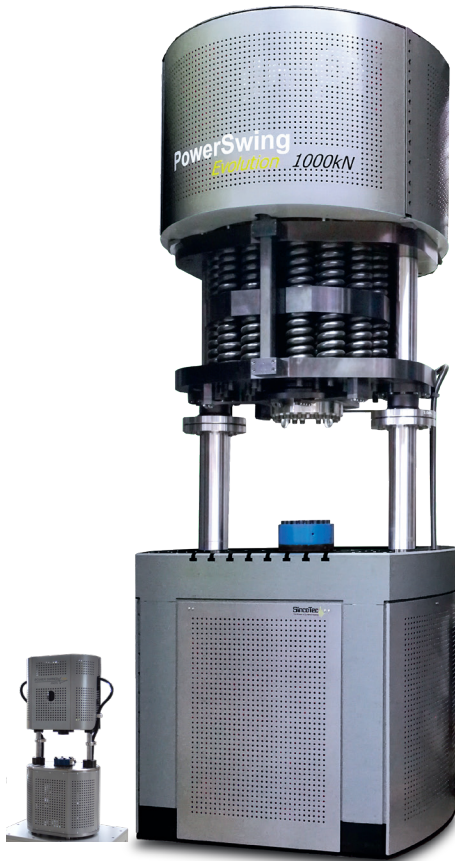
IMPRESSUM

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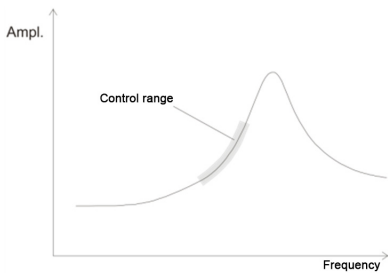
Executive board: Dr.-Ing. Joachim Hug, Dipl.-Ing. (FH) Sven Henze and Sabrina Hug-Lohmüller, M. Sc.

Which is Better? POWER SWING MAG or MOT

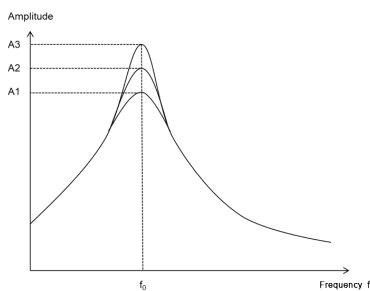
- That is the question



Our all-rounders the POWER SWINGLY micro (l.) and the POWER SWING MOT 1 MN (r.)



Functional principle of the motorized unbalance drive from the POWER SWING MOT



Functional principle magnetic drive from the POWER SWING MAG

SincoTec is closely associated with energy-efficient, highly accurate and fast testing technology.

Two basic drive principles are used for our resonance test systems: **motorized and magnetic drive**.

Test systems with **motorized drive** operate below the resonance frequency of the test setup in the rising branch of the resonance curve. The load amplitude is set via the rotational frequency of the unbalance drive. The stiffness of the specimen determines the test frequency. This is constantly monitored during the test. If a change in the stiffness of the test setup occurs due to an incipient crack, which leads to a reduction in the test frequency - this allows us to detect the crack with high precision and stop the test (see also the article on frequency difference on p. 6).

Test systems with a **magnetic drive** operate at the resonance frequency of the test setup and the load amplitude is controlled by the level at which the magnets are activated. Here too, the test frequency is monitored and a crack is detected just as precisely by a drop in frequency.

Why do these two principles exist side by side? Both principles have their particular strengths. Our **POWER SWING MAG** magnetic universal test rigs enable very high test frequencies of 500 Hz and even up to 1,000 Hz, which opens up new horizons

in the very high cycle fatigue range thanks to extremely short test times.

If you move on from material samples to components or systems, you encounter high test strokes, high damping and even clearance. Fatigue strength tests under these difficult conditions are the strengths of the **POWER SWING MOT** high-frequency pulsers. Difficult conditions such as those encountered when testing a connecting rod for a marine application with original clearance and pressurized oil application or a tensile threshold test of a commercial vehicle brake caliper are just two examples of the many applications where frequencies of up to 120 Hz are required!

If you have to choose the right test system, the following rule of thumb can be used: If only fatigue strength tests are to be carried out on metallic material samples or components without clearance, small displacements and low damping, then the **POWER SWING MAG** is a good choice.

However, if versatility is required, if samples and components or assemblies are to be tested, a **POWER SWING MOT** should be chosen.

If you have any questions about our high energy efficient test systems, just get in touch!

What is the Reason for the High Energy Efficiency of Resonance Test Systems?

The resonance principle explained simply!

A simple swinging system, the children's swing, is often used to explain this. Here you can see the same principle in the playground as in the resonance test system: The child on the swing is given a small boost at the right time, just enough to compensate for the air friction and the friction of the swing and the swing system oscillates sinusoidally.

If you take this example further and use this comparison for a servo-hydraulic test system, we compulsively run back and forth with the child on the swing to guide the swing through the entire swing. Everyone immediately realizes that this requires more work. This makes the high energy consumption of a servo-hydraulic system and the energy efficiency of resonance systems immediately clear. The latter are 100 times more energy efficient.

Another Step on the Ladder of Success

Accreditation of our calibration laboratory in accordance with DIN EN ISO 17025:2018

After intensive preparation and testing, our calibration laboratory has now been officially accredited in accordance with DIN EN ISO 17025:2018. This is a reason for us to be pleased and also a great confirmation in our efforts to meet the highest quality standards and offer our customers precise and reliable calibration services.



SincoTec Test Systems GmbH has been operating its own calibration laboratory for many years in order to be able to regularly calibrate the transducers in our testing machines and the testing machines at our customers.

This is very important because only with regularly calibrated transducers can it be ensured that the testing machines actually maintain the accuracy required for the testing tasks. Without regular calibration, there is a risk that the transducers will become less accurate or even deliver incorrect values due to drift, incorrect parameterization or overloads. This can have serious consequences under certain circumstances.



Calibration of a displacement transducer

During calibration, the measured value displayed by the measuring sensors is compared with the displayed value of another measuring sensor,

the so-called calibration standard. The accuracy or rather inaccuracy of the calibration standard must be known. The comparison then provides a statement about the accuracy or inaccuracy of the calibrated sensor. It is important that the calibration standard used has also been calibrated by comparison with a higher-value standard, etc. A correct calibration is always an uninterrupted chain of comparisons with which the transducer to be calibrated is finally compared with a national or international standard. Such a calibration is then called „traceable“. We have always carried out traceable calibrations in the SincoTec calibration laboratory. However, many quality standards increasingly require calibration laboratories to be accredited in order to „prove“, so to speak, that they carry out correct calibrations. For this purpose, the competence of the laboratory, compliance with the calibration procedures used and the functionality of the quality management system are determined and continuously checked in a corresponding procedure by the national accreditation (DAkkS). After successful accreditation, calibration laboratories are allowed to issue calibration certificates with the DAkkS logo, which are internationally recognized. SincoTec Test Systems' calibration

laboratory has been successfully accredited since August of this year and we can now issue calibration certificates with the accreditation symbol for the measured variables force, torque and length to our customers. Are you interested in calibrating your transducers? Then contact us, we will be happy to advise you.



Calibration of a POWER SWING MOT resonance test system



Did you know, that ...

... we can also calibrate force transducers for testing machines up to 1,000 kN on your premises?

Keep on Rolling, Now also Modular!

Efficient range extension through wheel bearing tests

Wheel bearings play a central role in vehicle safety. A defective wheel bearing can lead to unpredictable driving behavior and instability and also significantly reduce the service life of other vehicle components.

In particular, wheel bearings help to reduce component wear and increase the energy efficiency of the vehicle, which leads to a greater range, especially in electric vehicles. In testing technology, we have been working intensively for years on the diverse testing requirements and objectives in connection with wheel bearing tests. We have developed various test benches for this purpose and contribute to the safety of wheel bearings.

In order to meet the increasing demand for flexibility and a wide range of test system variants, SincoTec has combined the successful concepts of the past into a new, standardized and modular test system concept for durability tests on wheel bearings. The biaxial wheel bearing test rig, which includes the wheel contact force axis (F_z) and the lateral force axis (F_y), serves as the basis. Various modules can be added to this depending on customer requirements:

- Third axis, the longitudinal force axis (F_x)
- False brinelling
- Dirt/salt water application (spraying) also with (minus) temperatures
- Dirt/salt water application (according to PV 2010 wheel bearing, VW)
- Temperature application (-40°C to $+150^{\circ}\text{C}$)

The test system is available in „dry“ and „wet“ versions. The flexibility of the test system starts with the basic version, the dual-axis wheel bearing test system: depending on local conditions and customer preferences, the dual-axis wheel bearing test system can be equipped with high-precision servo-electric or servo-pneumatic axles (F_x , F_y , F_z).



Servopneumatics



Servo electrics

The dry application („dry“) is a two- or three-axis wheel bearing test system in which the test part is enclosed in an aluminum profile test chamber together with the clamping device and test system-side replacement rim. Either a universal clamping device with adaptation for the wheel bearing or an individual solution for the integration

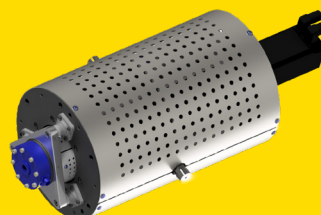
of customer attachments, such as the swivel bearing, is used for clamping. If dirty water or temperature applications are required („wet“), a stainless steel chamber optimized over generations of test systems is available. The drive, sealing and clamping components are made of stainless steel accordingly. The temperature is controlled via an external conditioning unit. The **DIRTY LAKE** unit from SincoTec is available for dirty water applications. A specially controlled drip unit is also integrated for drip tests. Integration of the third axis is also possible here. The false brinelling module can be integrated into the test system independently of the other modules - even at a later date. All test system components and modules have been revised and optimized for the new modular concept. Particular focus was placed on ease of use and the clamping concept.

E-Drive also in Testing Technology

High-precision DRIVE ACT servo-electric actuator units get a new design

The **DRIVE ACT** product series comprises universal, servo-electric actuator units as complete systems for flexible, customer-specific test setups in load frames, test systems or on clamping fields. The low-maintenance spindle drives, which can be used to apply tensile or compressive forces, are equipped with a force transducer, a displacement transducer and a guide system to compensate for transverse forces and bending moments. Over the course of the year, the product series got a facelift with a focus on user-friendliness and flexibility. To save weight, for example, the housing of the actuator units was slimmed down. In addition, we have standardized the mounting pattern across the entire product series and the guide system has also been optimized. Lifting and connection options have been added. Optional accessories also offer new options for mounting on clamping fields. The newly created articulated suspen-

sion also creates the feature of articulating the actuator unit as part of a pendulum support. The actuator units, which are available with nominal forces between 1.0 kN and 16.0 kN and effective strokes of up to 164 mm, are completed with the SincoTec **TestPilot** controller. Up to four axes can be integrated at the same time so that multi-axis applications can also be realized. Bending and torsional moments can also be generated using appropriate devices.



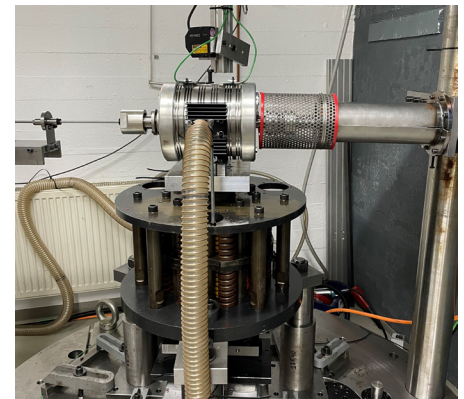
The new DRIVE ACT after the facelift

Resonance-Based Acceleration Testing on Rolling Bearings

Inexpensive and fast alternative to hydraulic or shaker tests

Hydraulic or shaker systems are not necessarily required to expose rolling bearings to high radial accelerations - resulting from road excitation. These systems have the disadvantage of high energy and maintenance costs. Acceleration-controlled tests can be carried out more effectively on resonance-based vibration testing systems, which incur only a fraction of the usual energy and maintenance costs. In this particular case, we have developed a unique testing system on which rolling bearing units can be subjected to radial accelerations of up to 80 g at frequencies of approx. 60 to 70 Hz. In parallel, the bearing shaft is driven at a speed of 3,500 rpm and simultaneously excited in the axial direction with a

noise of approx. 0.2 mm at 25 Hz. Damage is reliably detected via temperature sensors on the bearings. In addition, the motor current of the drive motor of the bearing unit to be tested is continuously monitored. With this test method, the damage occurring during operation can be reproduced after similar running times and thus a comparison of variants can be carried out quickly and cost-effectively. Furthermore, with this test method, the highest accelerations that occur during operation can be simulated quickly and efficiently under laboratory conditions.



Test setup for resonance-based acceleration tests on rolling bearings

High-Precision and Efficient Fatigue Strength Tests on Resonance Test Systems

Δf : The frequency difference as a switch-off criterion

Our **POWER SWING** resonance test systems are the benchmark for high test frequency and very high energy efficiency. Another interesting aspect is that the need for sensors and measuring channels is also very efficient. While servo-hydraulic test systems, for example, rely on one control channel (force) and one monitoring channel (displacement) a **POWER SWING** only requires one control channel.

But how can a test be monitored?

With the test frequency!

For tests on resonance testing machines, a test frequency is set at or just below the resonance frequency of the test setup.

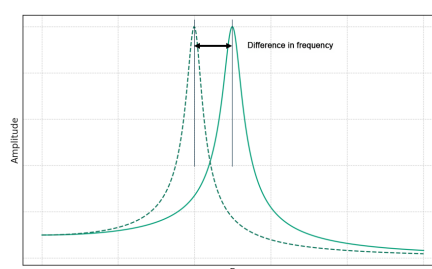
In simplified terms, such a test setup can be imagined as a spring pendulum. Its natural frequency ω_0 is defined as follows:

$$\omega_0 = \sqrt{\frac{D}{m}}$$

The square root of the ratio of the spring constant D and the mass acting on the spring m .

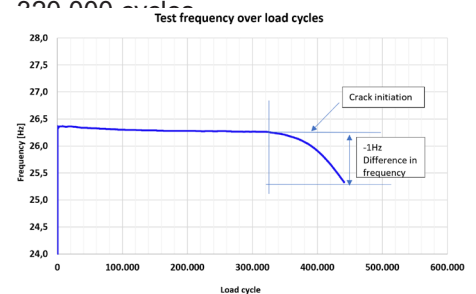
The test part in turn is a part of the spring and its spring constant or spring stiffness D and therefore also determines the test frequency ω .

If such a test is running, for example an alternating torsion test on a crankshaft, then a test frequency is set according to the above formula and as long as nothing happens, the test frequency remains constant. If a crack occurs, the spring stiffness decreases and so does the test frequency. A common value for the cut-off is a frequency difference of -1 Hz. In the case of a crankshaft, this corresponds to a visible crack 1 mm deep.



If our example crankshaft runs at a frequency of 26 Hz at the start of the test and this frequency drops to 25 Hz in the course of the test, the intuitive **EMOTION** control software stops the test.

The diagram below shows the frequency over the number of load cycles. An additional piece of information contained in the test frequency is also visible here: the moment of crack initiation. While the switch-off criterion is reached at around 440,000 cycles, the moment of crack initiation can be seen in the frequency curve at 300,000 cycles.



This is a great side effect that greatly simplifies the performance and damage analysis of the tests. Please contact us for further information!

Fatigue Strength Tests in Hydrogen Pressure Chamber:

Turbo for component development under hydrogen atmosphere

The energy transition is forcing us to take a closer look at new technologies and energy sources such as hydrogen. There are still many unknown factors, especially when combining hydrogen embrittlement with dynamic loads, high pressures and extreme temperatures.

The challenge

Despite the enormous development pressure in the energy transition, tests under such extreme conditions have so far been little researched. Tests with high test frequencies are particularly necessary for applications in hydrogen engines and compressors in order to determine their fatigue strength. This applies, for example, to valve materials, the conversion of large gas engines, hydrogen combustion engine and research projects. Traditional tests encountered the problem of rapidly wearing seals, particularly at extreme temperatures and high test frequencies. This not only led to time-consuming and expensive replacement processes, but also to less precise results.

The solution: SincoTec's seal-less concept

Thanks to our innovative, seal-less pressure chamber, these tests can now be carried out more efficiently and accurately. Temperatures from -60 to 900 C° and test frequencies of 100 Hz at up to 1,000 bar can now be realized at SincoTec.



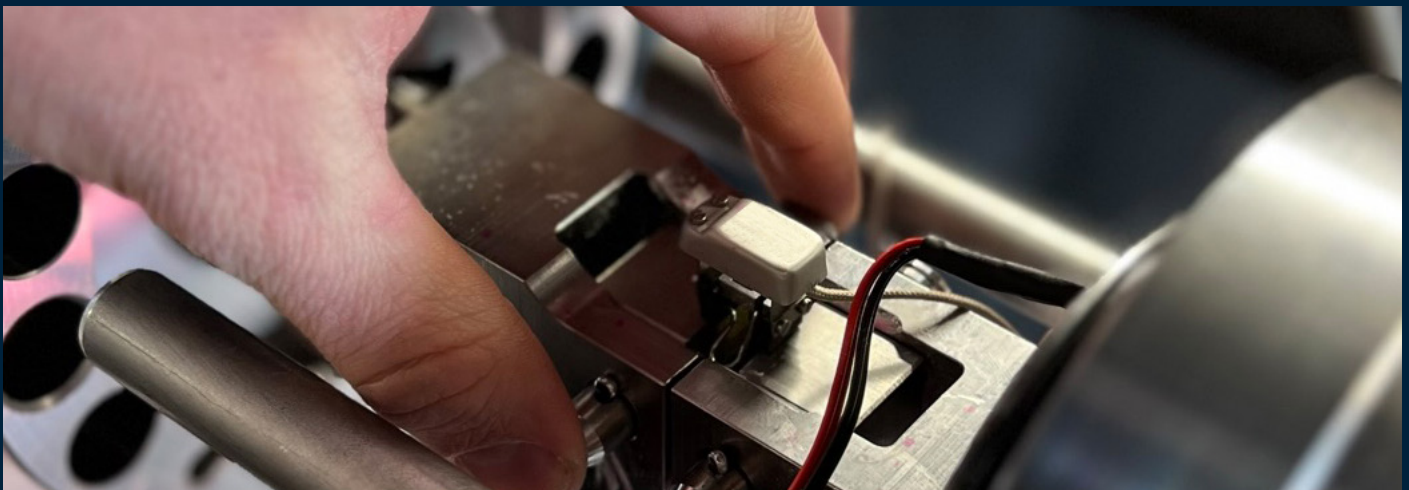
SincoTec hydrogen test cell with a CT sample

Without the use of seals, the pressure chamber offers various advantages:

1. No friction: no stochastic frictional forces, thus no interference signal and therefore precise force or strain control
2. No wear (micromovement on the seal) and therefore no replacement times and lower costs. This makes the tests more efficient and reliable.
3. No compensation force resulting from pressure and piston area
4. High test frequencies: This means that fatigue strength tests can also be carried out cost-effectively with statistical validation
5. The tests produce material data that can be used in finite element method (FEM) programs

Another advantage is the possibility of combining the seal-less pressure chamber with the SincoTec **POWER SWING**, which is known for its energy efficiency and high test frequency. This enables fast development cycles. If necessary, slower tests with servo hydraulics are also possible.

In summary, this seal-less pressure chamber opens the door to more precise, faster and more reliable tests in hydrogen research and represents an important step towards a sustainable energy future.

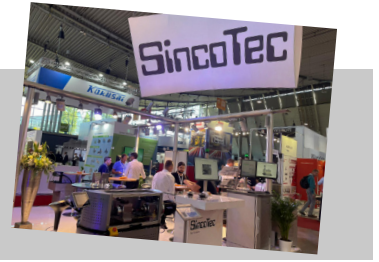


SincoTec trade fair dates 2024

Be part of it!

04. - 06. June 2024 Automotive Testing Expo Europe in Stuttgart

28. - 30. August 2024 Automotive Testing Expo China in Shanghai



Lots of Fun on the Way to GlowGolf

Our annual company outing

Over 200 team photos with animals were taken on this year's company outing. The production department that organized this year's outing proved to be particularly creative. We started with a breakfast and then had lots of fun on the hike to GlowGolf in Wildemann! Our task was to take selfies with an animal with the whole team - all faces of the team and the animal must be clearly recognizable! There were no limits to our creativity - from „borrowed“ dogs, snails and

horses to small worms and spiders or even from the freezer in the supermarket - we took some incredibly funny photos! Full of energy, we then went to GlowGolf - GlowGolf turns mini golf into a whole new experience. We tried to hit the hole with as few shots as possible in the rooms, which were colorfully lit by black light.

This team score and the number of valid „animal selfies“ were the basis for the later award ceremony. After our return hike, we were welcomed back to the headquarters with a delicious evening buffet. We rounded off the eventful and fun-filled day in a convivial atmosphere.



Apprenticeship at SincoTec

For a family business, apprenticeship is the best way to obtain qualified and motivated employees, who know and fulfill the special requirements of the company today and in the future.

This year, a new apprentice is starting in our production department as an industrial mechanic. We wish our new apprentice a successful start and a great training period!

Future Day at SincoTec

9 students gained their first insight into working life at SincoTec. They spent an exciting day in production building a wardrobe from sheet metal and soldering a bicycle from wire. The students were also able to take a look at the testing machines in our fatigue strength laboratory and soldered a

circuit board kit in the electronics department. Hands-on technology - the students were fascinated - and who knows, maybe our apprentice of tomorrow will be among them.

