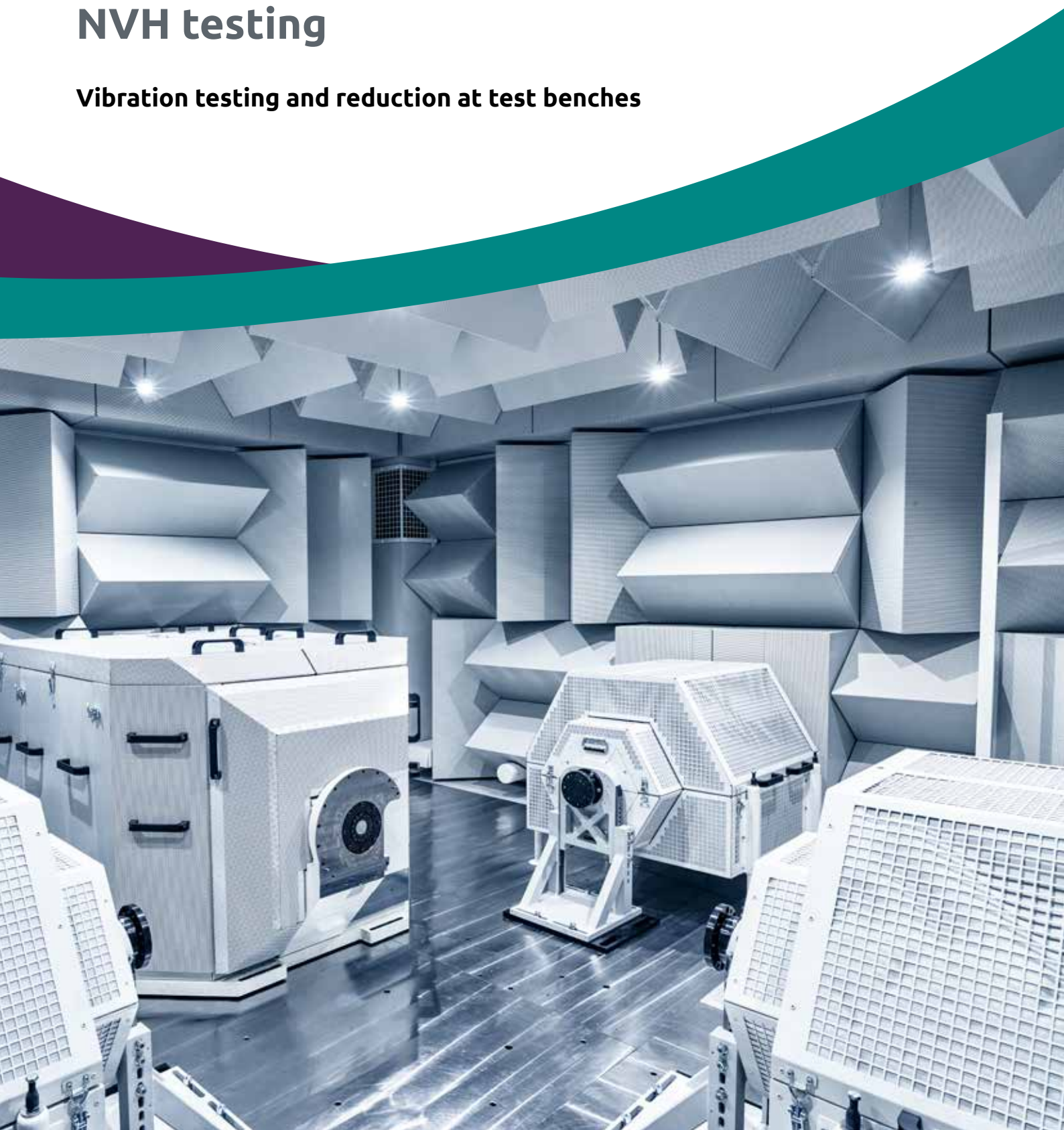
ATESTEO

Excellence in drivetrain testing

NVH testing

Vibration testing and reduction at test benches



Your strong partner for NVH testing

ATESTEO is the leading specialist for drivetrain testing combined with component validation, vehicle measurement technology, and engineering services. Internationally, we are among the number one partners of the automotive and automotive supply industries. With the considerable specialist expertise of our employees in operative testing and pre- and post-processing, transmissions and products are reliably validated. ATESTEO is everywhere where transmission development takes place in the automotive industry. More than 150 test benches in Germany and China, as well as representative offices in the USA and Japan, enable our smoothly accomplishing your measurement, technical testing, and analytic tasks at any time.

For over 20 years, ATESTEO has also offered reliable noise, vibration, and harshness (NVH) testing in test benches. At the largest independent European testing centre for drivetrains, our headquarters in Alsdorf, Germany, we test your transmissions during development for audible and tangible vibrations in the vehicle. With our own key equipment for testing powertrains and a total of five test benches for NVH testing of electric drivetrains, electric motors and gearboxes, an acoustics dynamometer, and a test track, we assist you to identify NVH phenomena early and to optimise your transmissions during development.

NVH timeline

2022 Construction of two new high-performance NVH test benches

2017 Battery simulator 950 V, 1,200 A

2016 Construction of two new NVH test benches

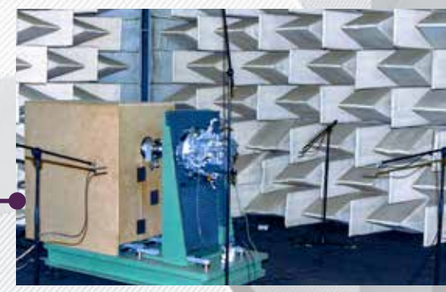
2015 HIL testing

2010 Battery simulator 600 V, 600 A

2003 First tests of transmission howling; construction of the ATE bench

2002 Tests of rattling during idling

1997 Construction of the acoustics dynamometer and test track



Fewer vibrations — more driving comfort

Enabling the recognition of NVH phenomena early during development; thus, avoiding them in later standard production vehicles, is the aim of ATESTEO's NVH test benches. This is accomplished by frontloading the NVH issues during development of the transmission and system. Besides the previous NVH test benches, ATESTEO now offers you two new particularly powerful NVH test benches of class 1 according to ISO 3745 on which both the FWD and AWD transmissions may be tested. The new test benches permit NVH testing of all forms of transmissions, including AWD, and are set up for the special needs of electric and hybrid drives. An additional electric machine (permanent magnet motor) may be employed to enable HIL (Hardware in the Loop) testing.

Range of services of our modern NVH test benches

Conventional NVH testing

- Engine torque pulsation simulation drive
- Rattle and howling tests
- Background noise <35 dB(A)
- Start-stop simulation
- Sound pressure and sound power measurements from 150 Hz to 16,000 Hz

HIL testing

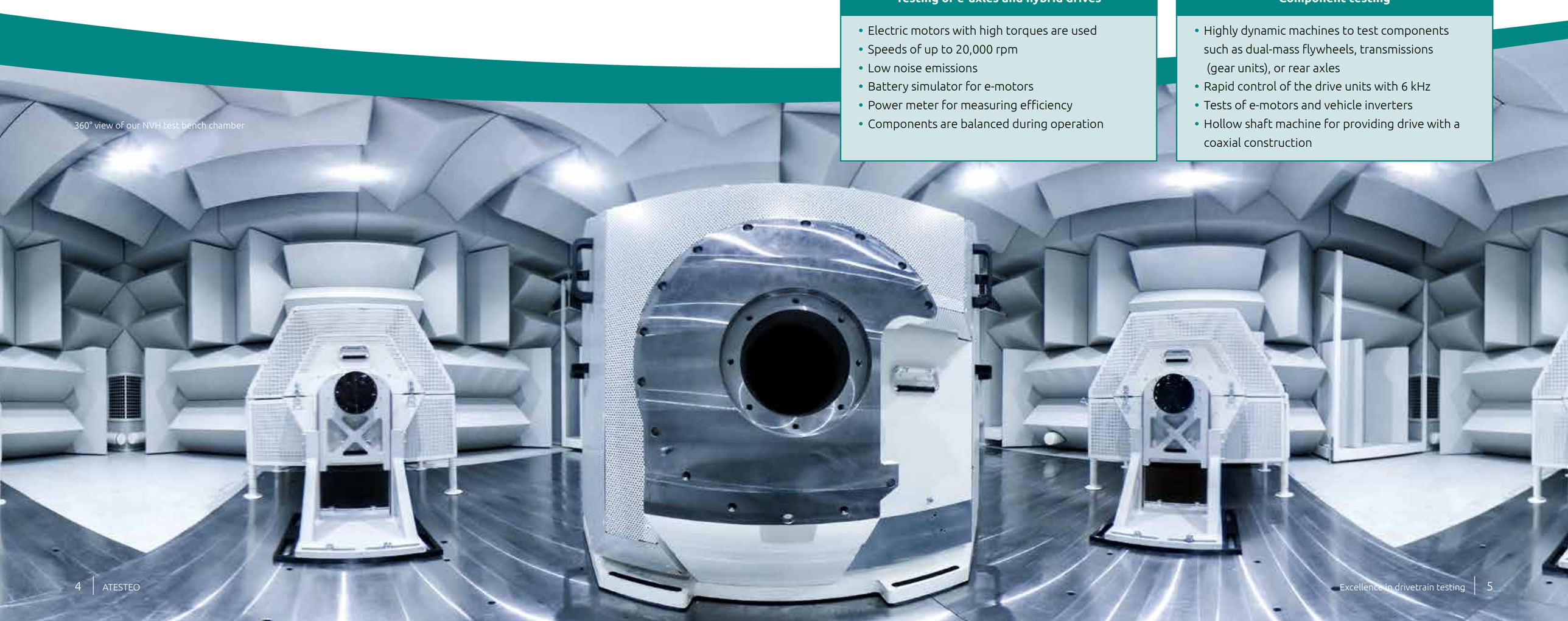
- Highly dynamic tests under real operating conditions
- Substitution of simulation models for real mechanics
- Real-time drive line simulation to control the machines
- Low inertia valuesn

Testing of e-axles and hybrid drives

- Electric motors with high torques are used
- Speeds of up to 20,000 rpm
- Low noise emissions
- Battery simulator for e-motors
- Power meter for measuring efficiency
- Components are balanced during operation

Component testing

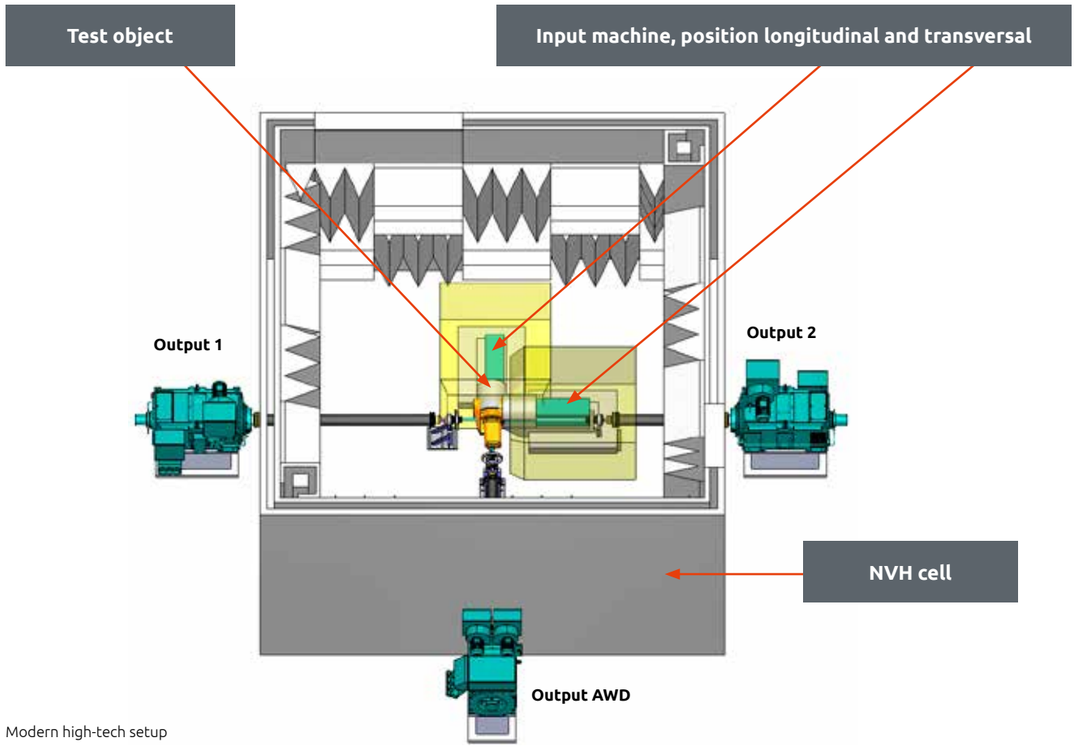
- Highly dynamic machines to test components such as dual-mass flywheels, transmissions (gear units), or rear axles
- Rapid control of the drive units with 6 kHz
- Tests of e-motors and vehicle inverters
- Hollow shaft machine for providing drive with a coaxial construction



360° view of our NVH test bench chamber

Layout of our high-end NVH test benches

Our NVH test benches feature a modern, high-tech layout. The input drive is, for example, performed by a hollow shaft, which enables testing state-of-the-art coaxial transmissions. To avoid influences of the swiftly rotating input motor on measurements, the input motor is decoupled from the rest of the test bench by pneumatic springs. Likewise, the corresponding swiftly rotating drive shafts are supplied with a balance quality of 2.5G.



Modern high-tech setup

Technical data of the NVH test benches

Simulation possibilities:

- of pulsation of the engine torque (ETPS drive)
- of the drivetrain and its components
- of the vehicle battery

HIL testing with additional permanent magnet (PM) motor

Technical data of the input machine with hollow shaft

- Torque: 575 Nm
- Rotation: 20,000 rpm
- Acceleration: 4,000 rad/s2

NVH cell data

- Class 1 NVH cell in accordance with ISO 3745
- Sizes of test objects up to 500 mm x 800 mm
- Frequency range: 150–16,000 Hz
- Background noise: <35 dB(A)

NVH testing for electric drives

The development of hybrid and electric vehicles involves new challenges for the development of NVH testing. We have taken these into account when developing our modern NVH test benches. Because of the properties of electric drives, new demands on the drives of NVH test benches arise, such as low vibration response or a low system response up to speeds of 20,000 rpm and low noise emission.

We meet these demands through comprehensive new developments:

NVH drive unit
Reinforced, preloaded, high balance quality, and filter
► Low vibration excitation

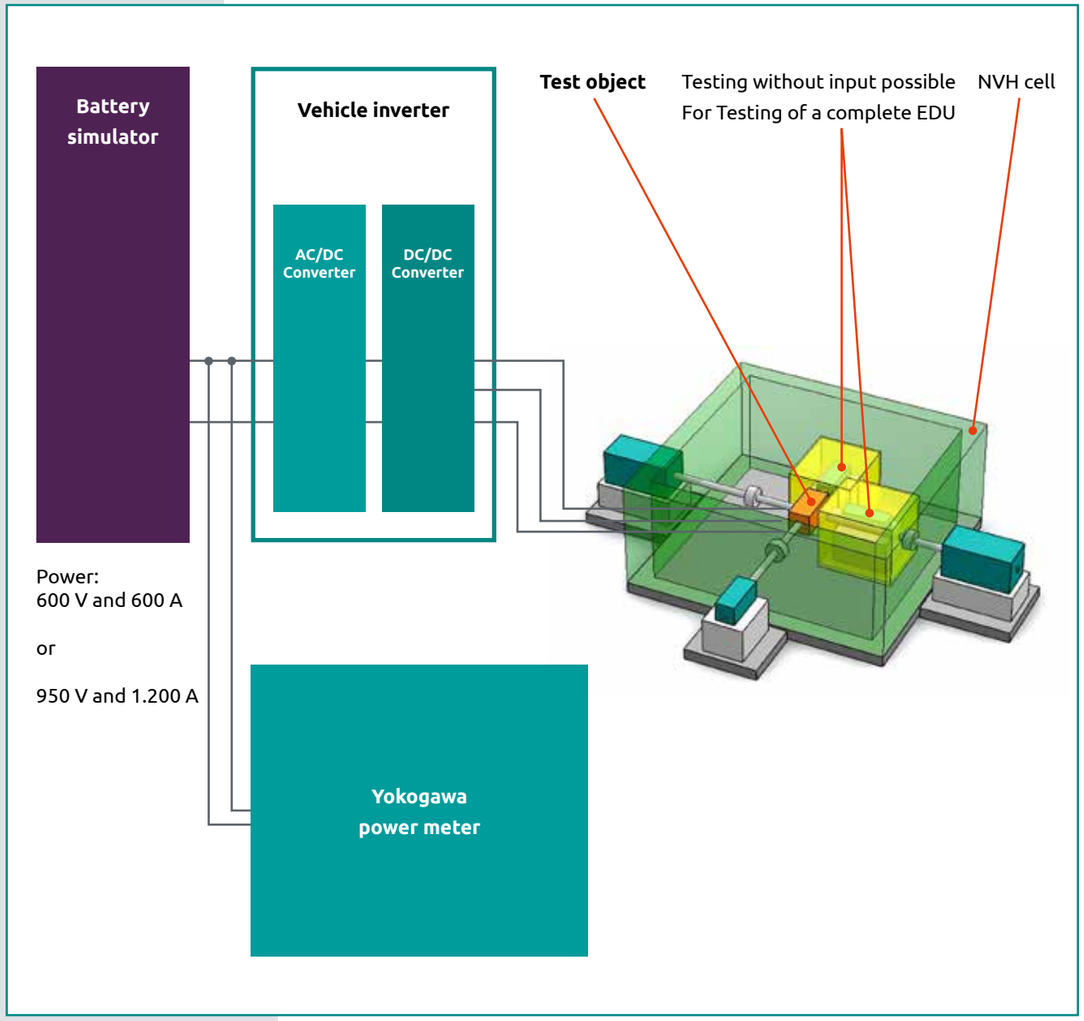
NVH measurement of electric drive units (EDUs)

Motor sheathing
Curved, covered, and with double-walled insulation
► Sound emission <35 dB(A)

NVH measurement of e-vehicle engines

NVH testing for hybrid drive systems

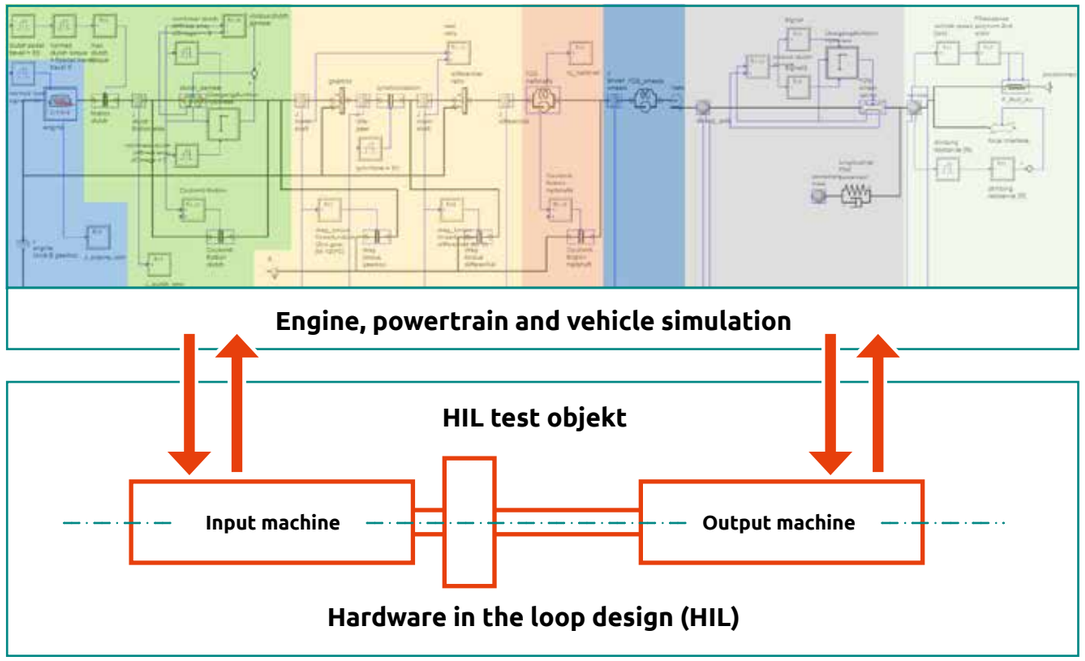
For testing electric and hybrid drive systems, it is possible to simulate the correspondingly necessary components of the electric or hybrid vehicle in the NVH test bench. First and foremost, battery simulators are required.



NVH testing for electric and hybrid drive systems

HIL testing on the NVH test bench

Our NVH test benches are equipped not only for NVH analysis, but also for HIL testing. By using an additional permanent magnet (PM) motor, hardware in the loop simulations may be conducted directly on the ATESTEO test bench. HIL involves testing individual components by substituting a simulation model for the real mechanics and constructing a realistic test environment for the test object.

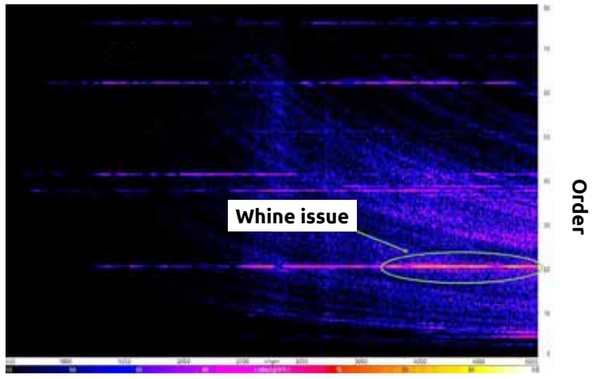


Principle construction of test bench

Reproduction of the simulation by machines

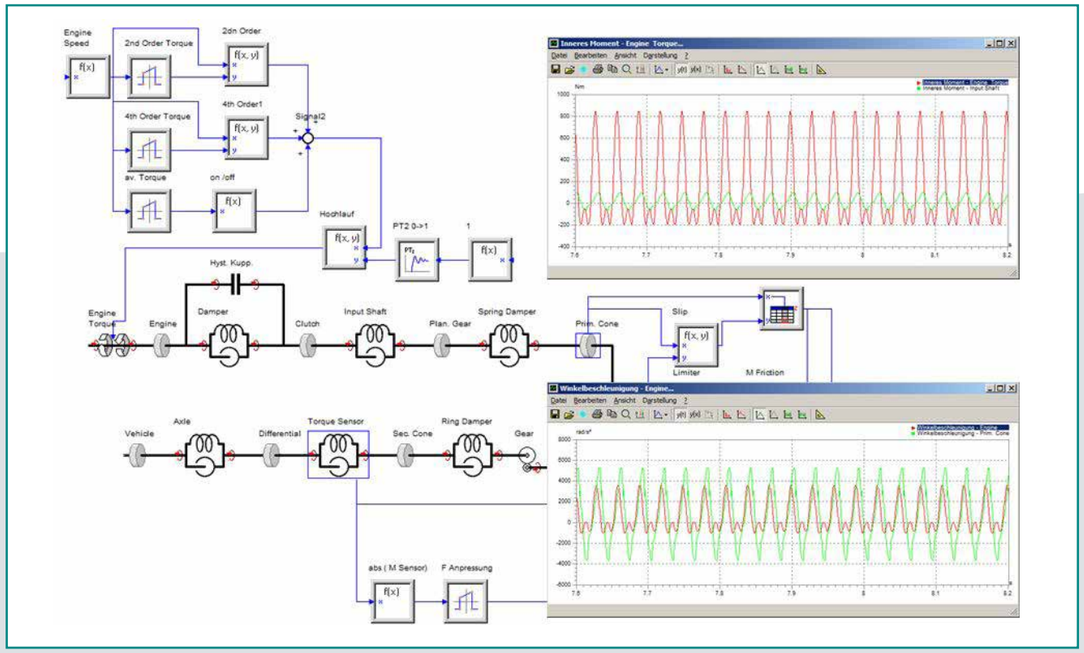
Considerable development expertise

Employing NVH test benches enables the frontloading of NVH testing during the development process. Through using corresponding analysis software, (e. g. ArtemiS by HEAD acoustics), NVH phenomena such as gear whining become visible.



Analysis of gear whining

ATESTEO has the know-how and technical facilities to conduct complex simulations; for example, those of the powertrain. For this, ATESTEO uses tools such as Simulation X and Simscape Driveline. This great expertise also flows into the development of new test benches.



Drivetrain simulation

ATESTEO expert teams for your NVH testing challenges

So that we can offer you a wide spectrum of services and know-how in the field of NVH testing, the ATESTEO NVH teams in Alsdorf support various fields of activity:

NVH

Team for NVH test benches

- Experienced experts with 20 years of experience in manual transmissions, automatic transmissions, and dual-clutch transmissions
- Expert team for e-mobility: competence for electric, hybrid, and conventional power systems
- Testing of drivetrain components, conventional drives, and e-drives
- NVH benchmarking of transmissions and gear mechanisms

Team for early recognition of damage and NVH measurements at endurance test benches

- Structure-borne noise measurements
- Airborne noise: Measurements of noise intensity in the near field

Team for the acoustics roller dynamometer test bench and test track

NVH measurements of the entire vehicle

- Interior and near-field sound measurements
- Measurements of and on the motor and gearboxes in the system
- Pass-by noise and sound transmission measurements

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Would you like to learn more about the possibilities of NVH testing at ATESTEO? Then call us at +49 2404 9870-241 or send mail to nvh@atesteo.com. Your personal ATESTEO contact partner is pleased to assist you.

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V4_05-2022