TesT

Testing Machines

for friction coefficient analysis of screws, nuts and bolts

www.test-gmbh.com

TesT

We stay connected

Top international position

TesT GmbH is known for its expertise in force and torque measurement and provides application-oriented testing machines for leading industries such as automotive, aerospace, electricity, construction and energy all over the world. Whether destructive testing of various materials or tests of components such as nuts and bolts, there is always a testing machine available. In developing economies such as East Asia, India, Latin America and the Russian Federation, but also in remote locations on the African continent, the experience of **TesT**'s engineers contributes to the successful implementation of testing projects. The **TesT** service team or partner companies are available anywhere for maintenance and calibration of the equipment.

Intersectoral connections

Testing of bolted connections and fastening components is a matter of course in many industries and accordingly regulated by standards and internal rules.

TesT provides all machines with the freely editable measurement, control and analysis software **TesTWinner**. In case of any changes in the standards, the customer can easily adapt test sequences to the new situations.

Especially in development testing with deviating parameters is mandatory to obtain new insights, which is why **TesTWinner** is the leading solution in this sector.

Typical standards

DIN EN ISO 16047: Fasteners, torque / clamp force testing

DIN EN 14399: High-strength structural bolting assemblies for preloading

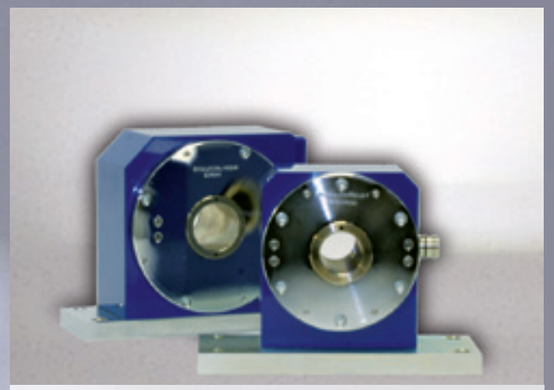
DIN 65151: Dynamic testing of the locking characteristics of fasteners under transverse loading conditions (Junkers vibration test)

PSA C10 0054: Applicability of the friction coefficient determination method

VW 01131: Determination of friction coefficients, practice-oriented testing

VDA 235-203: Tightening behaviour / friction coefficients, practice- and assembly-oriented testing

TesT



Detailed and highly accurate determination of parameters by patented sensors

TesT's combined force/torque sensors are based on the strain gauge technology and allow, in the maximum configuration, parallel measuring of up to four parameters of screws, nuts and various fasteners. Clamping force and overall torque are always measured. In the versions with three and four channels, in addition the partial momenta are determined at the bearing face and in the thread. Here, an effect of the clamping force on the torque measurement is ruled out by mechanical decoupling.

TesT supplies machines and transducers for screws in M2…M80. Here drives with up to 60,000 Nm are used. The sensors accordingly register clamping forces up to 5 MN at 60,000 Nm.

By use of the **TesTController** and the **TesTWinner** Software parallel use of a second actuator can be implemented, allowing testing of self-tapping screws at constant axial load as well.

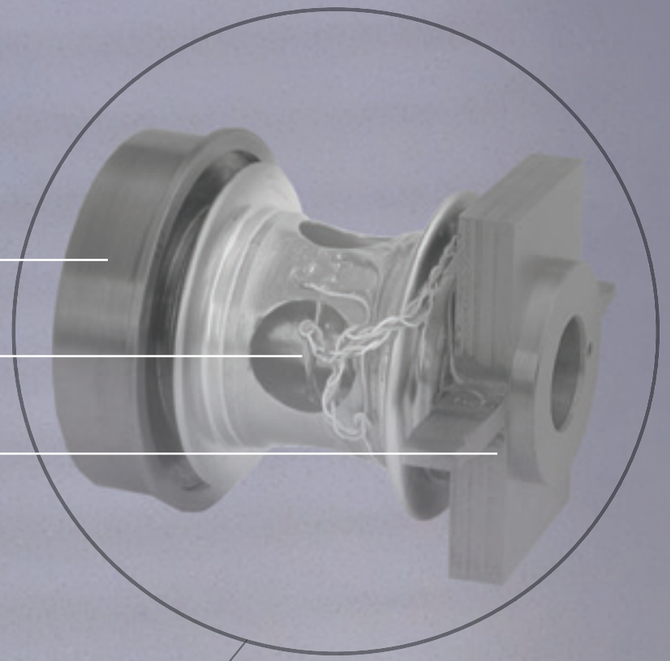
For permanently reliable operation of the testing machine, the DKD-accredited **TesT** Calibration Lab is at your service, which prepares, in close cooperation with government institutions, special guidelines for screws test rigs.

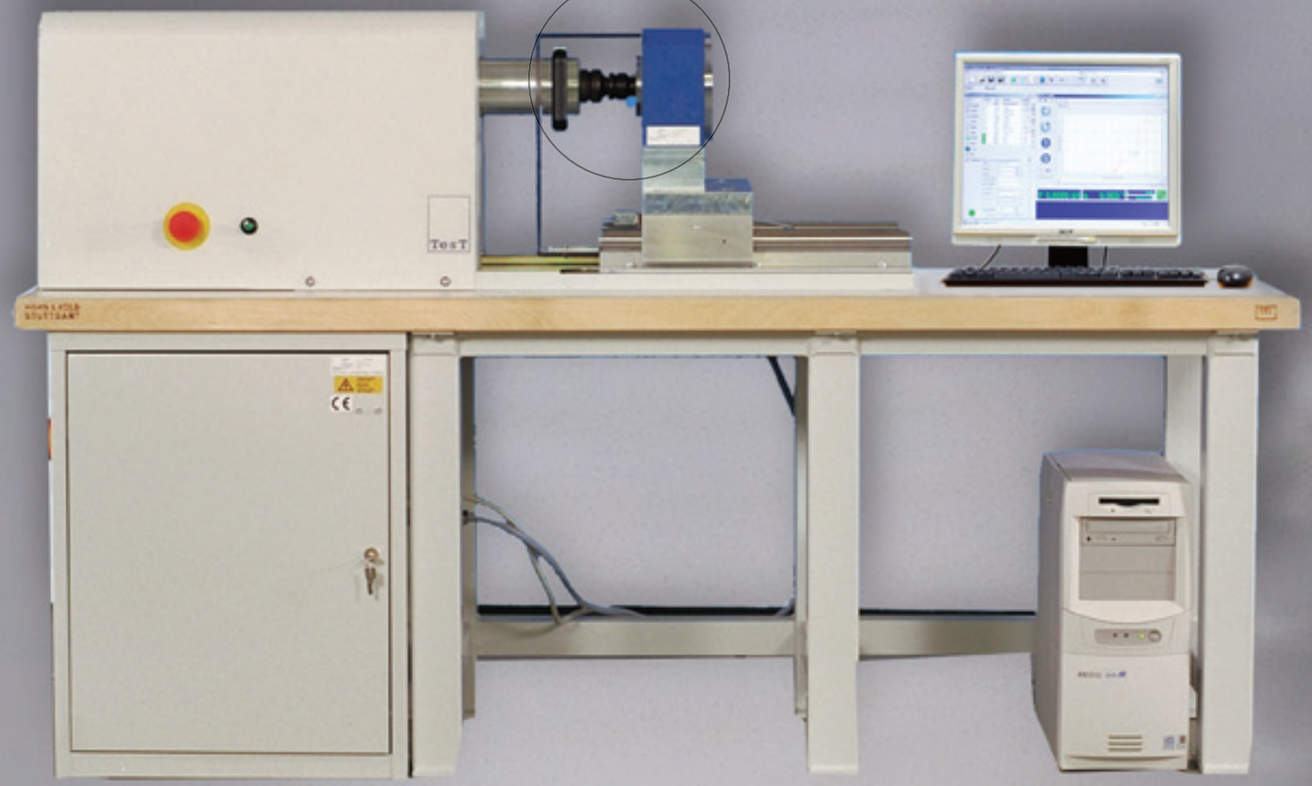
Sensor core

Mechanical decoupling force / torque

Data capture via strain gauges

Fitting body





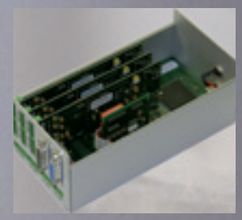
Test rigs and drives…

…are defined starting from the maximum required measurement range and the standard-specific requirements. Use of multiple drives at different speeds, inertia and power levels is possible and can be operated alternately with the same testing electronics. A guard with auto power off is always present. Of course, **TesT** delivers only systems with CE declaration of conformity.

Transducer…

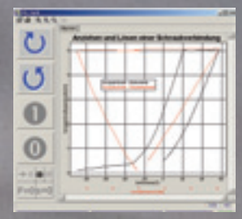
…are dimensioned in accordance with the planned tests, standards and screw dimensions. In addition to the number of measurement channels, the ranges of force and torque as well as the installation size are to be defined based on the screw dimensions.

TesTController…



…is the central, intelligent electronic component for machine control (1 kHz) and data capture. Based on a core system having a micro-controller of its own, modular extension for up to 3 electromechanical drive systems is possible. Likewise, up to 6 primary measurement channels (24 bit), 12 secondary channels (10 bit) and another 3 channels for incremental signals are provided. As the central machine hardware this also comprises the safeguards that ensure controlled shutdown in case of emergency.

TesTWinner…



…denotes the control, analysis and reporting software with real-time display of measured values and test situation. The macro commands available in the software permit users to design or modify their own test sequences. The optionally available test specifications according to international or customer-specific standards can thus be adapted to the individual needs of the user at any time. This configuration permits all important parameters of bolted connections, as required by international standards and building standards of major car manufacturers, to be recorded and analyzed according to the relevant standard. Freely definable calculations and test reports provide results (e.g. friction coefficients) and charts (e.g. friction plots), also for export in various formats. User management and all functions for automatic data archiving are likewise included.

Measuring ranges from micro to MEGA for industries from A to Z

Over the years, the requirements in screw testing have steadily increased. Where initially tests were only used in the automotive sector for creating installation specifications and in development for optimization of connections, today in-process testing of HV and HR bolts in steel construction prevails. Last but not least the ongoing development of wind turbines and associated steel pillar structures will further increase the dimensions. Today **TesT** already provides systems for torques up to 60,000 Nm with clamping forces up to 5 MN for connections up to M80.

At the other end, there are industries such as medical technology, micromechanics and horology which take the requirements to ever smaller dimensions. Here **TesT** provides torsion testing machines with torque ranges of a few Ncm and force ranges of less than one Newton.

Tools

For bracing of fasteners into the transducer, tools of various designs are available.

As “Basic” version, **TesT** provides hexagonally die-sunk clamping sleeves for fixing the screw head and the threaded nut in the sensor. The clamping sleeve is suitable for one screw head shape and size. The advantage is the extremely speed and ease of use, making this type perfectly suited for testing in large batches.

As an enhancement, **TesT** provides the “Clever” tool. This is a multi-component tool, where individual components are replaced in accordance with the test specimen. Commercially available box nuts on a square-end lock nuts or screw heads. This allows test specimens with different head shapes to be used flexibly. With only one main tool per sensor, a significant cost advantage is achieved.

Moreover, tools for special screws such as tension bolts are available. This is made possible by a planetary gear at the drive and a special tools set that allows tightening and shearing of the torque absorber at the tension bolt from one side.

Length measurement / Extensometer

An extensometer for measuring the length change of the connection to be tested is optionally available. Optionally, the measuring is performed between the head and foot of the screw via a hollow shaft or referentially between bearing face and screw foot.

Temperature control

Additionally, a system is available (patent pending) which allows determination of the influence of temperature (RT…+150 °C / 302 °F) on a bolted connection. The test specimens are warmed by an actively heated sleeve in the transducer and can thus be screwed and removed at controlled temperature. A concurrent water cooling system prevents negative effects on the measurement system and thus corruption of the measurement results.

Mobile equipment for friction coefficient testing

For efficient quality assurance, fast and flexible testing options in varying locations in production are needed. **TesT** provides a range of solutions for mobile test rigs with manual tightening.

If required by the customer, here the measuring sensors are mounted on mobile workbenches. Upon the customer's request, linear displacements with bearing brackets for the central force application minimize operating error.

Integrated tool drawers allow easy handling when changing the dimensions of the screws to be tested.

We will be pleased to offer you complete solutions for your in-process tests.

Contact us:
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Manual friction coefficient determination

The combination of our sensors with the **TesT** measurement electronic and a special firmware allows straightforward determination of friction coefficients. Here, by measuring the parameters of force and torque, the friction coefficient according to alternative standards is determined and shown directly.

The device comprises two independent measurement channels with 24-bit A/D converter with freely selectable measurement frequency (100 Hz…2 kHz). Force and torque are displayed, and after completion of the inspection also the calculated friction coefficient, alternatively according to the standards ISO 16047, ISO 14399 or Renault 01-50-005. Up to 10 MB of readings can be stored in *.csv file format (Excel™-compatible) on the removable memory chip. This corresponds to about 500 friction coefficients. A USB port facilitates data export, and an integrated battery provides for 8 hours of mobile use.

Software supported friction coefficient determination

In this variant, the values measured by the sensors are captured via the **TesTController** measurement electronics. In cooperation with the associated software **TesTWinner** this allows extensive analysis, data management (archiving, exporting) and flexible reporting. In addition, already during the performance of the test an online curve permits conclusions about the measurement and the expected friction coefficients.

Vibration testing machines

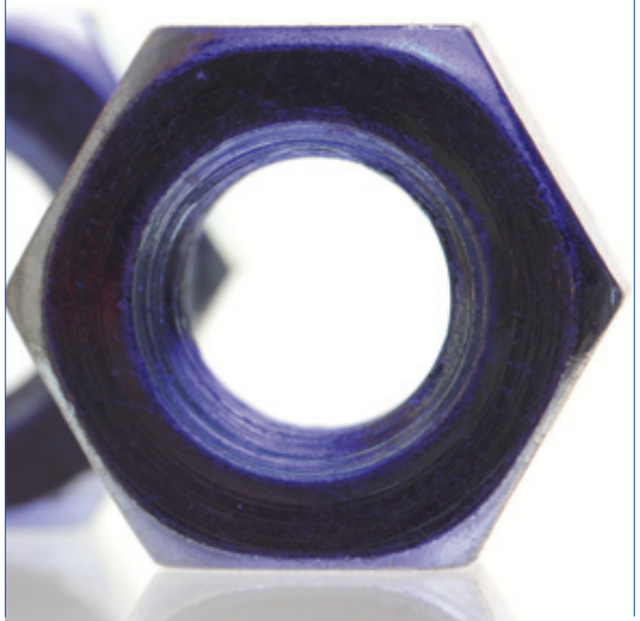
Bolted connections in rail networks and trains, as well as in vehicles and machinery, are exposed to various vibration levels during operations. These are caused by irregularities in the subgrade or by engine vibrations. During operations, these vibration loads occur over extended periods of time and with differing dynamics.

The vibration intesting machine acc. to Junker is designed for dynamic testing of fasteners under transverse loading. It permits, among other things, control in accordance with DIN 65151. The test specimens are tightened in the machine with a defined clamp force and then exposed, at a variable frequency (depending on the model), to dynamic transverse loading. The temporal variation of the clamping force and the release angle (optionally) are directly presented during the test. The graphical plotting immediately provides the user with quality-relevant information on the release behaviour of the bolted connection.

Technical designs / model	T208.50kN	T208.200kN	T208.400kN	T208.600kN
Screw dimensions	M3…M8	M8…M16	M12…M24	M20…M36
Sensor clamp force	1…50 kN	4…200 kN	8…400 kN	12…600 kN
Sensor shear force	0.2…10 kN	0.5…25 kN	1…50 kN	2…100 kN
Release angle sensor (optional)	360° ± 0.25°	360° ± 0.25°	360° ± 0.25°	360° ± 0.25°
Transversal stroke	± 1 mm fixed	± 0…2 mm variable	± 0…2 mm variable	± 0…2 mm variable
Frequency shear force	12.5 Hz fixed	0…30 Hz variable	0…30 Hz variable	0…15 Hz variable
Accuracy class	0.5	0.5	0.5	0.5
Measurement uncertainty force	≤ 0.5 % of indicated value	≤ 0.5 % of indicated value	≤ 0.5 % of indicated value	≤ 0.5 % of indicated value
Measurement uncertainty stroke	≤ 1 % of indicated value	≤ 1 % of indicated value	≤ 1 % of indicated value	≤ 1 % of indicated value
Combined error	≤ 1 % of indicated value	≤ 1 % of indicated value	≤ 1 % of indicated value	≤ 1 % of indicated value
Supply voltage	230 V / 1P+N+PE	400 V / 3P+N+PE	400 V / 3P+N+PE	400 V / 3P+N+PE
Working table	Option	yes	yes	yes
Electrics / Electronics	Desktop case	Substructure cabinet	Substructure cabinet	Switching cabinet
Safety device	yes	yes	yes	yes
EC – Certificate of Conformity	yes	yes	yes	yes
Measurement range extensions		T208.ALC.100/20	T208.ALC.100/20	T208.ALC.100/20
Screw dimensions		M5…M10	M5…M10	M5…M10
Sensor clamp force		2…100 kN	2…100 kN	2…100 kN
Sensor shear force		0.4…20 kN	0.4…20 kN	0.4…20 kN
Measurement range extensions			T208.ALC.300/30	T208.ALC.300/30
Screw dimensions			M10…M18	M10…M18
Sensor clamp force			6…300 kN	6…300 kN
Sensor shear force			0.6…30 kN	0.6…30 kN
Parameters: Axial force, shear force amplitude, shearing distance amplitude effective, count of cycles, release angle (optional)				

TesT

Universal testing machines
Torsion testing machines
Screw test benches
Calibration machines
Load cells
Torque transducers
DKD - Calibration Lab



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