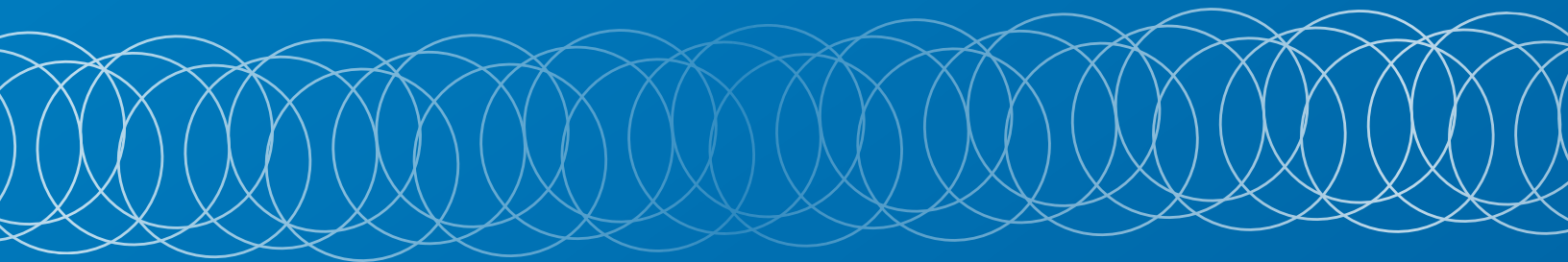


Tire Rolling Resistance Measurement System

Supporting the Development of Tomorrow's Fuel-Efficient Tires

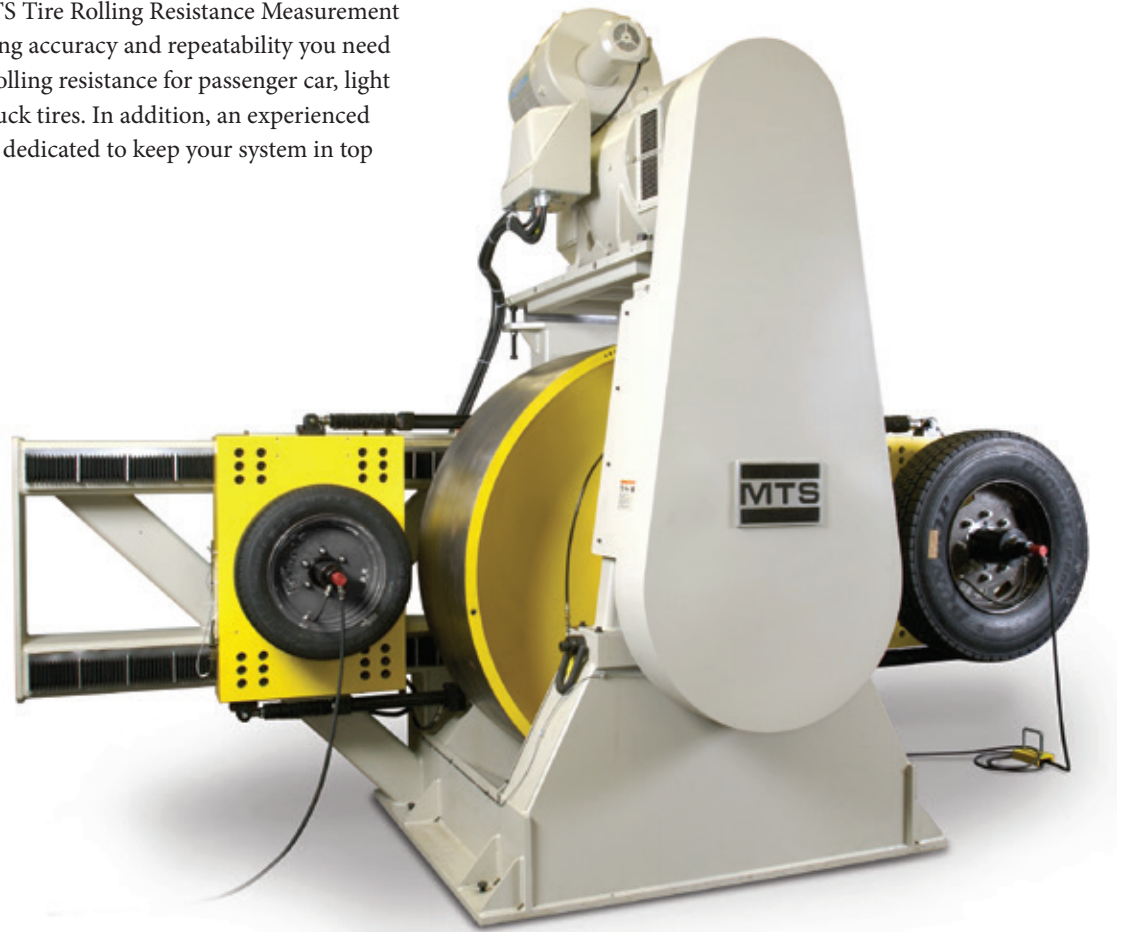
THE **MTS TIRE ROLLING RESISTANCE MEASUREMENT SYSTEM**

DELIVERS THE ACCURATE AND REPEATABLE RESULTS NEEDED TO ASSESS
TIRE ROLLING RESISTANCE FOR A WIDE VARIETY OF TIRES. THE SYSTEM'S
TIGHT TOLERANCES, SYSTEM-LEVEL CALIBRATION AND FLEXIBLE CONTROLS
ARE JUST SOME OF THE WAYS THAT THIS SYSTEM CAN HELP YOU MEET
YOUR OBJECTIVES WITH CONFIDENCE.



A flexible system delivers accurate, repeatable results

The industry-leading MTS Tire Rolling Resistance Measurement System provides the testing accuracy and repeatability you need to effectively assess tire rolling resistance for passenger car, light truck and commercial truck tires. In addition, an experienced global service network is dedicated to keep your system in top running condition.



Force and torque measurement capability provides flexibility

The MTS rolling resistance system supports both the force and torque methods of measurement. Using the force method, sensor performance is not influenced by drum inertia. It allows you to take independent carriage measurements and boost productivity because the system lets you separate the rolling resistance of multiple tires running at the same time.

The torque method has the advantage of no cross talk from Fz into the measurement for rolling resistance. This allows the tire test to be run in just one direction, while the force method requires averaging the results from running in both directions.

System-level calibration maximizes accuracy

System-level calibration minimizes the Fz into Fx cross talk because the reference forces are aligned with the drum axis and the output from the on-system load transducer is digitally compensated with a calibration matrix. This delivers a level of accuracy that is virtually impossible to achieve when the load cell is calibrated outside of the machine. The system is oriented to use gravity and Class F weights for Fx calibration, eliminating the uncertainty of cable-pulley arrangements. The system also features a Class AA load standard to achieve tire load accuracy required by ISO and SAE standards.

Tight tolerances, precise alignment and software compensation minimize errors

Tight machine tolerances and precision laser alignment reduce errors due to off-axis loading. The integrated spindle and sensor eliminate carriage friction error in radial load measurement. The multi-component sensor package is optimized to maximize the sensitivity of the axis of interest and reject off-axis force and moment loading errors. Software features like Auto-Zero compensate for the weight of the test tire and wheel, and Stabilization Monitor shortens test time by automatically detecting stabilization of Fx force during steady-state tests.

Flexibility to accommodate change and meet your unique demands

Whether you are using routine tests or developing proprietary tests, test definition is easy with the MTS Tire Test Definition application. It lets you run the full range of tests, while quickly adapting your test definition and analysis templates. This flexibility lets you easily add new tests as testing needs change.

The system uses the same intuitive software as the MTS Flat-Trac® Tire Test System. This familiar interface boosts productivity. Common test definition and reporting help make it easier than ever to get the data you need.

Designed to accurately test, meet and exceed ISO and SAE standards

In addition to SAE J1269, SAE J2452 and ISO 18164, MTS test systems now meet the ISO 28580 standard. MTS programs these standard tests, and analysis templates are in place, allowing you to easily run tests and generate reports on the data. The MTS software also offers the flexibility to define custom test procedures in addition to routine SAE and ISO procedures.

Worldwide service, support and experienced consultation

With expert technicians and consultants at locations around the world, MTS is uniquely equipped to provide customers with consulting services, training, and maintenance and support.

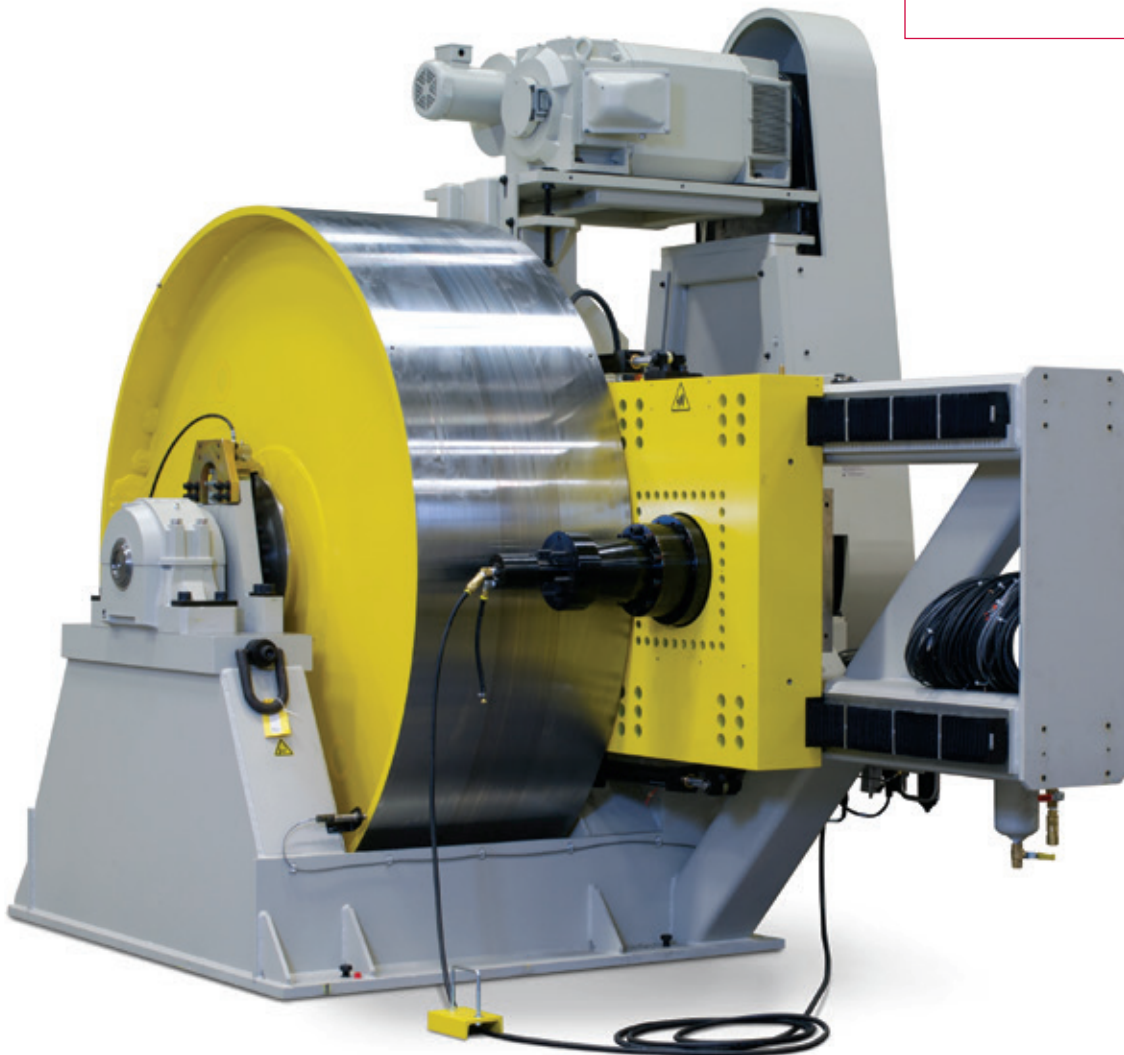
Selected Applications

STANDARD TESTS

- » ISO 28580 Passenger Car, Truck and Bus Tires – Single Point Test
- » ISO 18164 Passenger Car, Truck, Bus and Motorcycle Tires
- » SAE J1269 Steady-State Procedure for Car and Truck
- » SAE J2452 Coast-Down Procedure for Car

NON-STANDARD TESTS

- » End-level Test Definition enabling:
 - Definition of custom test procedures
 - Ability to do arbitrary time histories and non-standard analysis
- » Real-time rolling resistance measurements
- » Rolling-loss computations over custom driving cycles
- » Transient tire temperature and velocity tests
- » Revolution per kilometer tests



The features you need to lead in today's competitive markets

Precisely controlling and measuring rolling resistance in the laboratory is key to delivering accurate, repeatable results needed to support your testing program. These MTS tire rolling resistance system features prove that your competitive difference is in the details.

LOW CROSS TALK, MULTIAXIAL FORCE TRANSDUCER TECHNOLOGY

Industry-leading MTS multi-axis force sensor technology is employed to maximize sensitivity and resolution while minimizing errors from off-axis loading. Using the same technology employed on the highly accurate MTS Flat-Trac Tire Test System, the Fz and Fx sensors are designed for high overturning moments and capacity to withstand overloads such as tire landing spikes.

IN-SYSTEM CALIBRATION

Our in-system calibration method improves measurement accuracy. The fixture is designed to ensure the reference loads are aligned to the drum. Calibration software built into the control system allows simultaneous system load transducer measurement and generates a calibration matrix that compensates for sensitivity and cross talk.

TORQUE OR FORCE TESTING METHODS

The system supports both torque and force testing methods for maximum flexibility. The force method eliminates the influence of drum inertia. The torque method eliminates cross talk from Fz into the measurement for rolling resistance.

ROTATING TORQUE CELL

The torque cell signal is delivered through a telemetry system so there are no parts to wear out or cause errors in the signal. The torque cell is calibrated using an off-system dead weight calibration fixture designed to eliminate bearing friction errors. This method provides the most accurate calibration available.



LOW-FRICTION, EASY-TO-MAINTAIN SPINDLE ASSEMBLY

Our unique spindle design minimizes bearing loads and therefore, bearing friction. Bearing friction is a source of error since it is compensated for under minimal load. Reducing bearing friction also reduces error in the rolling resistance measurement. The spindle has no contacting seals, eliminating maintenance and providing repeatable spindle friction.

AUTOMATED SOFTWARE

MTS software can be programmed to automatically load raw data into analysis reports and place them on specific network location. This feature allows immediate access to reports after tests are completed.

MONITORED TIRE STABILIZATION

Tire rolling resistance stabilization is detected by monitoring Fx over time. If the stabilization meets the tolerance criteria specified in the automated test, the system will collect data. This feature ensures that tire rolling resistance has stabilized before a measurement is taken. The stabilization criteria may be used to conduct tests more efficiently than to approximate the time required for tire stabilization.

PRECISION LASER ALIGNMENT

MTS uses a laser alignment system during machine assembly and to confirm that the system meets the ISO 28580 under tire load.

SECOND CARRIAGE OPTION

Adding a second carriage allows for greater flexibility and productivity. The second carriage can be of the same type to increase productivity, or MTS can deliver a PC and TB carriage, giving you flexibility to test a full range of tires.

AC ELECTRIC DRIVE

An AC electric drive delivers exceptional speed control capability and requires low maintenance.

ULTRA-STIFF FRAME TO MINIMIZE DEFLECTIONS

The frame is designed to maintain camber and steer angles within ISO tolerances at all tire load conditions.

TIRE INFLATION CONTROL AND MONITORING

This feature allows for measuring tire inflation pressure during capped or regulated pressure operation.

MTS SILENTFLO™ HYDRAULIC PUMP

Compact and efficient, the MTS SilentFlo pump delivers the lowest-rated sound power emissions in the industry, eliminating the need for a separate pump room.

Additional tire and vehicle performance testing systems

SWIFT® Evo Wheel Force Transducer

The SWIFT Evo Spinning Wheel Integrated Force Transducer complements all MTS tire test systems. It features a high stiffness one-piece design that yields high sensitivity, excellent linear behavior and high overload capacity. Unique among wheel force transducers, this design delivers unmatched precision and long life, enables easy installation and measures loads directly at the spindle, eliminating the need to convert data.

Data generated with SWIFT Evo transducers are useful for many applications, including analysis, design, and modeling of the system for creation of virtual models, and application in virtual testing. They quickly attach to a modified rim for data acquisition on the road or in the lab, significantly reducing instrumentation time and costs.



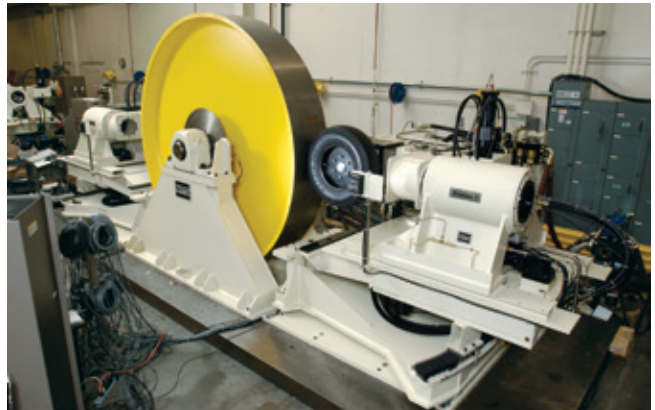
Kinematic and Compliance Deflection Measurement System

This system measures the kinematic and compliance deflections of a vehicle's suspension to quickly provide the information engineers need to achieve their handling objectives. The system applies precisely controlled displacements and forces to a vehicle's tires through four independent loading platforms while holding the body fixed. The resulting wheel displacements are measured with a six-axis wheel motion sensor and the forces produced at each wheel are measured with a six-axis load cell.



Tire Tread Wear Simulation System

This system sets the standard for tread wear and advanced endurance testing of passenger car, light truck and heavy truck tires in a laboratory setting. It provides repeatable and accelerated replication of tread wear patterns in the test laboratory by precisely controlling tire loads and position. This coordination of lateral force, normal force, wheel torque and inclination angle (camber) enables highly accurate replication of tread wear.



Flat-Trac Tire Test System

Virtually every major tire or vehicle manufacturer in the world depends on MTS Flat-Trac tire test systems for critical tire performance data. These systems apply forces and motions to a tire running on a continuous flat belt and allow you to quickly gain insight about the contribution of the tire to vehicle dynamic behavior. Whether you need precision, repeatability or power, MTS Flat-Trac tire test systems will help you meet your objectives with confidence.



MTS global service and training

MTS service provides timely, cost-effective monitoring, maintenance and repair support. Hundreds of experienced local service technicians working around the world are kept current on maintenance and repair techniques through regular internal training courses.

Responsive maintenance and repair

Many MTS maintenance and repair parts are available locally; most others are available via air shipping. Our local focus, organization and commitment ensure timely maintenance and repair to maximize your uptime.

Software update agreements

MTS Software Maintenance Enhancement and Support agreements make it easy and affordable to keep up with changing technology. Over the contracted period, you automatically receive updates to all covered software, including minor enhancements and upgrades to existing MTS software.

Consulting services and training

MTS engineering consultants specialize in a variety of performance evaluation methods. Using a team approach, this allows our consultants to deliver innovative performance evaluation solutions. In addition, MTS provides in-depth, focused training on the operation and maintenance of our products. We provide onsite presentations for all standard course offerings and can develop custom courses on a range of subjects if needed.



Specifications

Tire Classification	Passenger Car & Light Truck	Commercial Truck
RR Standard Deviation	0.5 N	2.2 N
Roadwheel		
Outside diameter	1708 mm or 2000 mm	
Diameter tolerance	± 0.254 mm	
Total indicated run-out	0.051 mm	
Surface width (standard)	508 mm or 650 mm or Custom	
Base surface roughness	3.18 µm	
Test surface	80 Grit Abrasive	
Roadway velocity, Vr	± 5 to ± 250 km/h	
Vr calibration accuracy	± 0.5 km/h	
Drive power	112 kW	
Tire Size Range		
Maximum outside diameter	1010 mm	1400 mm
Minimum tire diameter	450 mm	700 mm
Maximum width	400 mm	610 mm
Maximum tire and wheel weight	150 N to 750 N	250 N to 1600 N
Loaded Radius, RL		
RL accuracy	200 mm to 525 mm	325 mm to 725 mm
	± 0.5 mm	± 0.5 mm
Maximum Spindle Speed		
	2000 RPM	900 RPM
	(150 km/h for smallest tire)	(120 km/h for smallest tire)
Radial Load, Fz (Rated Capacity)		
Fz calibrated range	15000 N	60000 N
Fz calibration accuracy	0 to 15000 N	0 to 60000 N
	± 10 N	± 30 N
Spindle Load, Fx (Rated Capacity)		
Fx measurement range	± 5000 N	± 22500 N
Fx calibration accuracy	± 500 N	± 1250 N
	± 0.5 N	± 1N
Fx Cross Talk from Fz Load		
	± 1 N	± 1 N ± 0.00008*Fz
Alignment		
Tire load angular alignment	± 0.057°	± 0.057°
Slip angle	± 0.057°	± 0.057°
Camber angle	± 0.114°	± 0.114°
Inflation Pressure, Pt		
Pt range	0 - 700 kPa	0 - 1050 kPa
Pt calibration accuracy	± 0.7 kPa	± 0.7 kPa
Pt control accuracy	± 1.5 kPa	± 1.5 kPa
Pt control capability	Cap & Control	Cap & Control
Ambient Temperature, TA		
TA range	10 to 35 °C	10 to 35 °C
TA accuracy	± 0.5 °C	± 0.5 °C
TA control	Customer Responsibility	Customer Responsibility

Regional Business Centers

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