

Suspension Tester FWT 3800 Based on Theta Principle

for Cars, Vans and Light Trucks up to 2.2 t Axle Weight



- Unmistakable results
- Simple and accurate procedure
- Determination of Lehr's damping ratio δ
- No vehicle-specific reference data required

Simple and accurate determination



Shock absorber function

In a vehicle, the suspension elements provided between wheels and vehicle body absorb the effect of shock or rough ground. None the less it comes to vibrations on suspension, wheel or vehicle body, which are reduced by shock absorbers.

During the life of a shock absorber its damping efficiency is, however, continuously decreasing which results into poor road grip of the wheels and steering issues. Consequently the efficiency of electronic driver assistance systems is considerably reduced. Serial studies revealed that up to 15% of vehicles on the road have at least one defective shock absorber. In such a case the braking distance is increased by 5% at an initial speed of 80 km/h, on vehicles with ABS anti-lock braking systems even by 14%. The influence of defective shock absorbers has similar disastrous effects on cars with ESP (electronic stability programs) – in such a case the braking distance can even be increased by 20%.



Example showing the effect of defective shock absorbers.

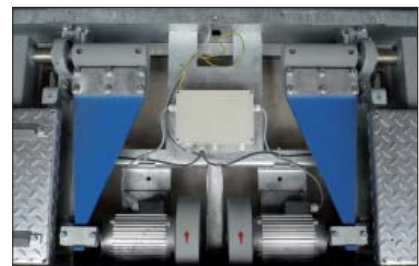
Therefore it is very important to unmistakably qualify the safety-related function of a shock absorber. The qualifying value is the damping ratio δ according to Lehr.

The decisive improvement of suspension tests based on the Theta principle

The suspension tester FWT 3800 operates according to the Theta principle and meets the requirement of a determination which is universally valid:

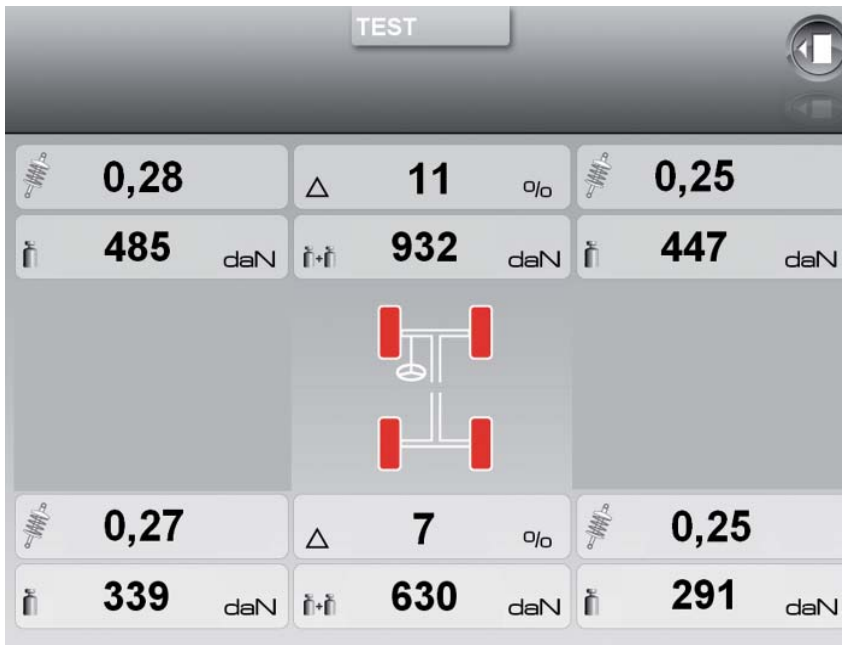
- clear physical basis
- simple measurement principle
- accurate determination
- high level of repeatability

The FWT 3800 guarantees testing conditions which correspond to actual road handling, for instance not too low piston speed in the shock absorber, alternating traction and compression on the piston of the shock absorber.



The vibrating mass-spring-system of the test stand is specially adjusted to the resonance vibrations of vehicle suspension. Consequently the damping ratio according to Lehr is determined without any interferences from the test stand.

Clear and conspicuous structure



Limit value of the damping ratio (Theta) to ensure sufficient vehicle safety

Lehr's damping ratio is a non-dimensional quantity characterising the property of dissipating energy from a vibrating system. It is equally a design variable to describe wheel suspension, hence the road handling of a car, ranging from comfortable at $\vartheta \sim 0.2$ up to sports cars at $\vartheta \sim 0.35$.

The limit value of the damping ratio where wheel suspension no longer guarantees sufficient vehicle safety is $\vartheta = 0.1$

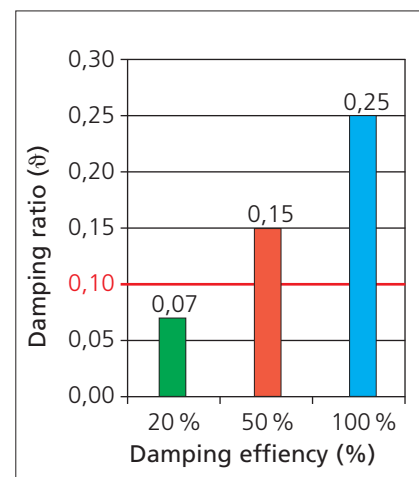
If the measured value falls short of the limit value, the damping components must be thoroughly checked and replaced, if necessary. Using such an evaluation vehicle-specific reference values are no longer necessary.

Based on the damping ratio ϑ it is possible to evaluate the difference between values for the left-hand and right-hand vehicle side.

Suspension testers presently in the market are based on different principles. Test results can be read out in principle-related manufacturer-specific quantities only.

The most important advantage of the Theta principle is based on the fact that no vehicle-specific data must be used to clearly determine the condition of wheel suspension. Hence there is no need for periodic updates of the limit value specifications.

Determination of damping ratio ϑ in shock absorbers with different damping efficiencies



Damping ratios ϑ determined with suspension tester FWT 3800 on shock absorbers having different damping efficiencies; the ratios were determined on a car under in-situ conditions.

Suspension Tester FWT 3800

The Theta principle – Damping ratio according to Lehr

Various basic models



Equipped with display cabinet and integrated control unit:

- indication of cut-out at wheel lock, left/right
- wheel weight left / right
- permanent determination of braking force imbalance
- side-slip
- pedal force
- damping ratio left / right
- PC/printer interface
- braking forces left / right

Videoline 2204/2304 Theta

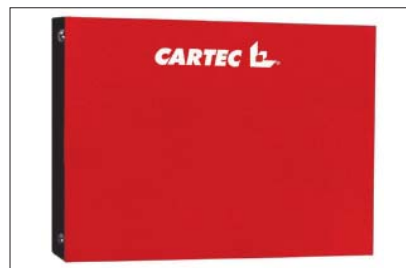
Test lane for cars and vans – Videoline 2204 up to 3 t axle load and Videoline 2304 up to 4 t axle load. User guidance via PC; PC not included in delivery.

Videoline 2204/2304 Theta K

The test lane comes standard with PC cabinet. The cabinet offers ample space for the integrated control unit, a PC, a TFT monitor, an A4 inkjet printer, keyboard, and mouse.

Videoline 2204/2304 Theta B

This test lane comes standard with a simple E box instead of PC cabinet.



In addition there is the possibility of simultaneous operation, e.g. with the display cabinet installed in the check-in bay and connected via COM lead to the PC which is for instance located in the shop office.

Optional built-in frame

These built-in frames considerably facilitate preparation of foundations. There is no need to embed in concrete a steel beam with edge guards which is otherwise inevitable. None the less a built-in frame always ensures the test stand is exactly level with ground.



Combiline 2204/2304 Theta (PC required)

for cars and vans - Combiline 2204 up to 3 t axle load and Combiline 2304 up to 4 t axle load. User guidance via PC; PC not included in delivery.

PC required for calculation of the damping ratio.

Optional roller covers



The rugged roller covers completely cover and protect the roller set.

Suspension Tester FWT 3800

The Theta principle – Damping ratio according to Lehr

Standard equipment



Optional pneumatic lifting device



As the lifting device raises the vehicle to ground level, driving in and off the rollers is considerably facilitated and hence especially advantageous for vehicles with sports chassis, low ground clearance or small wheel diameters in that it minimises the risk of underbody damage.

Note: Suitable foundation must be available. Compressed air supply of 8 bars required.

Brake tester BDE

This unit consists of brake tester and – depending on configuration – display cabinet, PC cabinet, or E box.

Standard equipment of the roller sets:

- Mechanics in compact flat design, galvanised and consequently suitable for outdoor installation
- Rollers with long-life ceramics-silicon coating are abrasion-proof and hence drastically reduce the risk of tyre damage
- Roller sets are equipped with rust-proof feeler rolls
- Splash-proof motors
- Measurement with wear-free strain-gauge type load cells
- Electric automatic drive-off aid

The brake tester, which forms the basic unit of the test lane, is also available with braking motors (4 t models only) and for 4WD vehicles.

All brake testers allow tests of electric parking brakes

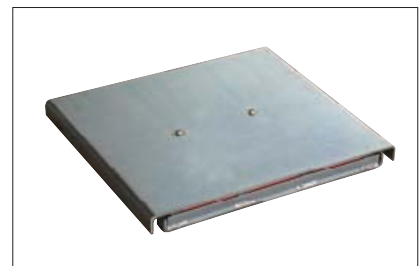
Graphical analysis of brake



The brake test covers the following quantities:

- rolling resistance
- ovality
- braking force imbalance left/right
- braking force left/right
- pedal force

Optional side-slip tester SSP 2500



The side-slip tester is designed to immediately measure side-slip of the vehicle under test. No additional tests are necessary as the testing plate is positioned directly in front of the suspension tester and the vehicle simply rolls over.

The data automatically detected supplies a sound diagnostics of toe-in and toe-out. The measured value is read out in 0 +/- 20 mm/m.

Suspension Tester FWT 3800

The Theta principle – Damping ratio according to Lehr

Technical data

		Combiline 2204 Theta	Combiline 2304 Theta	Videoline 2204 Theta	Videoline 2304 Theta
Brake tester					
Max. axle weight	t	3	4	3	4
Indication range	kN	0 – 6	0 – 8	0 – 6	0 – 8
Roller coefficient dry – wet		0.9 – 0.5	0.9 – 0.5	0.9 – 0.5	0.9 – 0.5
Test width min. – max.	mm	800 / 2200	800 / 2200	800 / 2200	800 / 2200
Idling speed	km/h	3.4	5.4	3.4	5.4
Dimensions of roller set	mm	580 x 2320 x 205	670 x 2320 x 255	580 x 2320 x 205	670 x 2320 x 255
Roller diameter	mm	175	216	175	216
Roller length	mm	700	700	700	700
Motor power	kw	2 x 2.5	2 x 3.7	2 x 2.5	2 x 3.7
Weight	kg	330	370	330	370
Suspension tester Theta					
Axle weight max.	t	2.2	2.2	2.2	2.2
Dimensions of mechanical structure (W x L x H)	mm	800 x 2350 x 286	800 x 2350 x 286	800 x 2350 x 286	800 x 2350 x 286
Test width min. / max.	mm	900 / 2200	900 / 2200	900 / 2200	900 / 2200
Exciter stroke	mm	3.5	3.5	3.5	3.5
Exciter frequency approx.	Hz	10	10	10	10
Measuring range - max. stroke	mm	70	70	70	70
Indication range		0 – 0.35	0 – 0.35	0 – 0.35	0 – 0.35
Accuracy of readings		+/- 2% of full-scale reading	+/- 2% of full-scale reading	+/- 2% of full-scale reading	+/- 2% of full-scale reading
Motor power	kW	2 x 1.1	2 x 1.1	2 x 1.1	2 x 1.1
Weight of mechanical structure approx.	kg	500	500	500	500
Power supply		3/N/PE230/400 VAC 50/60 Hz	3/N/PE230/400 VAC 50/60 Hz	3/N/PE230/400 VAC 50/60 Hz	3/N/PE230/400 VAC 50/60 Hz
Fusing, slow-blow type	A	16	16	16	16
Side-slip tester					
Axle weight	t	4	4	4	4
Measuring range	mm/m	0 +/- 20	0 +/- 20	0 +/- 20	0 +/- 20
Dimensions (L x W x H)	mm	500 x 570 x 50	500 x 570 x 50	500 x 570 x 50	500 x 570 x 50
Weight	kg	25	25	25	25

Snap-on Equipment

France

Snap-on Equipment France · ZA du Vert Galant · 15, rue de la Guivernone BP97175
ST Ouen L'Aumone · 95056 Cergy Pontoise Cedex
Phone: +33 (0) 134/48 58-78 · Fax: +33 (0) 134/48 58-70 · www.snapon-equipment.eu

Germany

Snap-on Equipment GmbH · Werner-von-Siemens-Str. 2 · D-64319 Pfungstadt
Phone: +49 (0) 6157 / 12-0 · Fax: +49 (0) 6157 / 12-286 · www.snapon-equipment.de

Testing Division

Konrad-Zuse-Straße 1 · D-84579 Unterneukirchen
Phone: +49 (0) 8634 / 622-0 · Fax: +49 (0) 8634 / 5501 · www.snapon-equipment.eu

United Kingdom

Snap-on Equipment Ltd. · 48 Sutton Park Avenue · Reading RG6 1AZ
Phone: +44 (0) 118 / 929-6811 · Fax: +44 (0) 118 / 966-4369 · www.snapon-equipment.eu

Other Countries

Snap-on Equipment GmbH · Testing Division · Konrad-Zuse-Str. 1 · D-84579 Unterneukirchen
Phone: +49 (0) 8634 / 622-0 · Fax: +49 (0) 8634 / 5501 · www.snapon-equipment.eu

Part of the machines is illustrated with optional equipment which is available at extra cost. Technical modifications reserved.

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