



Uw contactpersoon  
Verbeeken Marc  
Industrieel Ingenieur  
Tel. : 02/277.35.84  
Fax : 02/277.40.86  
Gsm : -  
e-mail : vire@mobilitt.fgov.be

GOCA  
Afdeling Autokeuring  
Technologiestraat 21/25

1082 BRUSSEL

Directie Wegverkeer  
dienst Voertuigen  
City Atrium  
Vooruitgangstraat 56  
lokaal 3A03  
1210 Brussel  
Tel. 02 277 31 11  
Fax 02 277 40 05

Ondememingsnr. 0 308 357 852

metro: Rogier  
train: Noordstation  
bus- en tramhalte: Rogier

Uw bericht van :

Uw kenmerk :

Ons kenmerk :  
DVR /2012/ML-MV.047

Bijlage(n) : Brussel  
1 add.

**2 1 NOV. 2012**

**Betreft:** Addendum aan het lastenboek ophangingstesters

Mijnheer de Directeur,

Tijdens de vergadering van de stuurgroep "Project Eusama" die gehouden werd bij de FOD op 15 oktober 2012, werd besloten om twee wijzigingen aan te brengen in het lastenboek "ophangingstesters" onder de vorm van een bijlage of addendum.

Ik verleen hierbij dan ook mijn goedkeuring voor deze wijzigingen die zijn opgenomen in het addendum in bijlage.

Hoogachtend,

De Ingenieur-Directeur,

Michel LOCCUFIER

Onze kantoren zijn open van 9 tot 12 uur en van 14 tot 16 uur. Particulieren die zich tijdens deze openingsuren niet kunnen vrijmaken, kunnen een afspraak bekomen op dinsdag of vrijdag tot 20 uur.



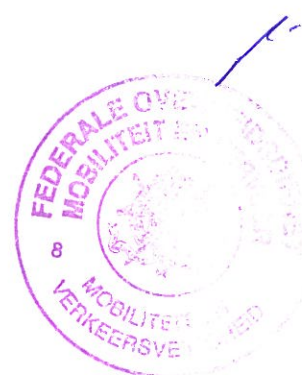


# **Addendum to SUSPENSION TESTER SPECIFICATIONS (SPECSUS2010)**

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**GOCA**

**Project Office  
R & D Department Periodic Technical Inspection**



# SUSPENSION TESTER SPECIFICATIONS (2010)

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# SUSPENSION TESTER SPECIFICATIONS (2010)

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## 2 Addendum

The specifications "SPECSUS2010" SUSPENSION TESTER SPECIFICATIONS (2010), version 01.00 from 13.01.2011 will be added by the following remarks:

### 2.1 Point 3.1.: Definition of The phase shift $\phi$

Minimum phase shift has to be detected on frequency that is between the Eusama frequency and 5Hz instead of 3 Hz below the Eusama frequency.

The text will be:

**The phase shift  $\phi$**  is the angular difference between the absolute "sinusoidal" position of the suspension tester platform and the "sinusoidal" vertical tire contact force between the tire and the suspension tester platform.

**In practice** the phase shift is calculated from the top position of the compensated force signal and the top position of the plate.

The Top position of the plate will be measured on a direct way. The Top position of the compensated force signal should be calculated as the middle of the intersection of the compensated force signal and the static weight, when this intersection is available and static weight is in some range related to max and min. (Parameter: RSWfMAX = 25% means 25% from the top force measurement to the static weight, RSWfMIN = 25% means 25% from the bottom force measurement to the static weight)

For phase shift calculation (into the range of 20Hz to 5Hz) the compensated force signal has to be digitally filtered with such a filter, that doesn't change compensated force signal phase and that removes all parasitic influences.

**Minimum phase shift has to be detected on frequency that is between the Eusama frequency and DeltaF (parameter: DeltaF = 5Hz) below the Eusama frequency.** When the force signal goes under 0 Eusama (underflow), the Eusama Frequency should be taken at the maximum upper envelope of the Force signal in the area where the force signal is 0. When the force signal goes under 0 Eusama (underflow) and goes above the limit of the physical registration of these force signal (overflow), so that the sinus waves are cut off, this deltaF has to be taken from the first waveform where signal gets back within systems hardware range.

Each supplier is to present his method used in order to determine the minimum phase shift  $\phi_{min}$  in detail for approval and for the attention of the R&D department of GOCA.

It should be possible to evaluate the used filter(s) of the signals by providing a tool where a output signal can be evaluated regarding an introduced input signal.





# SUSPENSION TESTER SPECIFICATIONS (2010)

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## 2.2 Point 3.7.: PASS / FAIL criteria

The absolute criteria for Minimum phase shift  $\phi_{\min i,j}$  will be  $35^\circ$ .

The text will be:

### Absolute criteria

The European Shock Absorber Manufacturers Association (EUSAMA) established the following guidelines for adhesion:

Adhesion Measured	EUSAMA Interpretation
61% to 100%	Excellent dynamic wheel contact
41% to 60%	Good dynamic wheel contact
21% to 40%	Fair dynamic wheel contact
1% to 20%	Poor dynamic wheel contact
0%	Bad dynamic wheel contact

Therefore the absolute criterion for EUSAMA is set up to 20% (parameter  $AC_{EUS} = 20\% E$ ).

A. Tsymborov wrote in his SAE paper that dampers with minimum phase angle less than 40 degrees, corresponding to damping ratio  $\zeta_2 = 0.08$  of the unsprung mass, are considered to be weak.

Therefore the absolute criterion for Minimum phase shift  $\phi_{\min i,j}$  is set up to  $35^\circ$  (parameter  $AC_{\phi_{\min}} = 35^\circ$ )

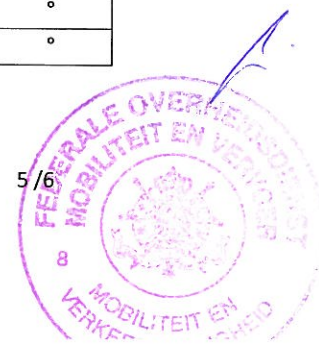


# SUSPENSION TESTER SPECIFICATIONS (2010)

## 2.3 Point 4: Symbols and parameters

Due to point 2.1 and 2.2 the default setting of point 4 of the specifications are:

Symbol	Designation	§ Specification	Type	Value	Unit
$AC_{EUS}$	Parameter for acceptance of the absolute criterion of the EUSAMA value	3.7.	parameter	20,00	% E
$AC_{\phi_{min}}$	Parameter for acceptance of the absolute criterion of the minimum phase shift	3.7.	parameter	<b>35,00</b>	°
$D_{EUS,i}$	Unbalance of the EUSAMA values for each axle	3.3.	calculated	b	%
$D_{\phi_{min,i}}$	Unbalance of the minimum phase shifts for each axle	3.3.	calculated	b	%
DeltaF	Frequency below the Eusama frequency where Minimum phase shift has to be detected	3.1.	Parameter	<b>5,00</b>	Hz
$EUS_{i,l}$	EUSAMA value	3.3.	calculated	b	% E
$N_i$	Vertical force of an axle	3.3.	calculated	b	N
$N_{i,l}$	Vertical force of a wheel	3.3.	measured	v	N
$RC_{EUS}$	Parameter for acceptance of asymmetry of the EUSAMA value	3.7.	parameter	50,00	%
$RC_{EUS < ACEUS}$	Parameter for acceptance of asymmetry of the EUSAMA value when both values have less than $AC_{EUS}$ EUSAMA	3.7.	parameter	10,00	% E
$RC_{\phi_{min}}$	Parameter for acceptance of asymmetry of the minimum phase shift	3.7.	parameter	50,00	%
RSWfMAX	Range related from the top force measurement to the static weight	3.1.	parameter	25,00	%
RSWfMIN	Range related from the bottom force measurement to the static weight	3.1.	parameter	25,00	%
$\phi$	Phase shift	3.1.;3.3.	calculated	b	°
$\phi_{min}$	Minimum phase shift	3.1.;3.3.	calculated	b	°



# SUSPENSION TESTER SPECIFICATIONS (2010)

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