**Addendum to**

**SUSPENSION TESTER SPECIFICATIONS**

**(SPECSUS2010)**

**GOCA**

**Project Office**

**R & D Department Periodic Technical Inspection**

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# Addendum

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

## Point 3.1.: Definition of The phase shift φ

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 φ** 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 statique 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 bottum 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 Frequence 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 fysical registration of these forse 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 φmin i,j   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 evalauated regarding an introduced input signal.

## Point 3.7.: PASS / FAIL criteria

The absolute criteria for Minimum phase shift φmin i,l  will be 35°.

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 ACEUS = 20% E).

A. Tsymberov wrote in his SAE paper that dampers with minimum phase angle less than 40 degrees, corresponding to damping ratio 2 = 0.08 of the unsprung mass, are considered to be weak.

Therefore the absolute criterion for Minimum phase shift φmin i,l  is set up to **35° (parameter ACφmin= 35°)**

## 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** |
|  |  |  |  |  |  |
| ACEUS | Parameter for acceptance of the absolute criterion of the EUSAMA value | 3.7. | parameter | 20,00 | % E |
| ACφmin | Parameter for acceptance of the absolute criterion of the minimum phase shift | 3.7. | parameter | **35,00** | ° |
| DEUS,i  | Unbalance of the EUSAMA values for each axle | 3.3. | calculated | b | % |
| Dφmin,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 | **5,00** | Hz |
| EUSi,l | EUSAMA value | 3.3. | calculated | b | % E |
| Ni  | Vertical force of an axle | 3.3. | calculated | b | N |
| Ni,l  | Vertical force of a wheel | 3.3. | measured | v | N |
| RCEUS | Parameter for acceptance of asymmetry of the EUSAMA value | 3.7. | parameter | 50,00 | % |
| RCEUS < ACEUS  | Parameter for acceptance of asymmetry of the EUSAMA value when both values have less than ACEUS EUSAMA | 3.7. | parameter | 10,00 | % E |
| RCφmin | 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 bottum force measurement to the static weight | 3.1. | parameter | 25,00 | % |
| φ | Phase shift | 3.1.;3.3. | calculated | b | ° |
| φmin | Minimum phase shift | 3.1.;3.3. | calculated | b | ° |
|  |  |  |  |  |  |
|  |  |  |  |  |  |