ISO 23365:2022-07 (E)

Heavy commercial vehicles and buses - Definitions of properties for the determination of suspension kinematic and compliance characteristics

Contents

Page

Foreword ... **vi**

Introduction ... **vii**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Principle ... **4**

5 Variables ... **5**
5.1 Reference system ... 5
5.2 Variables to be determined ... 5
5.2.1 Vehicle geometry ... 5
5.2.2 Motion variables ... 5
5.2.3 Forces and moments ... 5
5.2.4 Steering geometry ... 6
5.2.5 Kinematics ... 6
5.2.6 Compliances ... 7
5.2.7 Ride and roll stiffness ... 7
5.2.8 Force reactions ... 8

6 Measuring equipment ... **8**
6.1 Measurement accuracy ... 8
6.2 Derived variable accuracy ... 9

7 Suspension parameter measurement guidance ... **9**
7.1 Steering geometry ... 9
7.1.1 Steering ratio ... 9
7.1.2 Overall steering ratio (i_S) ... 10
7.1.3 Ackermann error ... 11
7.1.4 Inclination angle (ε_W) ... 11
7.1.5 Camber angle (ε_V) ... 11
7.1.6 Castor angle (τ) ... 11
7.1.7 Castor offset at ground (n_k) ... 11
7.1.8 Castor offset at wheel centre (n_τ) ... 12
7.1.9 Steering-axis inclination angle (σ) ... 12
7.1.10 Steering-axis offset at ground (r_k) ... 12
7.1.11 Steering-axis offset at wheel centre (r_σ) ... 12
7.1.12 Normal steering-axis offset at ground (q_T) ... 13
7.1.13 Normal steering axis offset at wheel centre (q_W) ... 13
7.1.14 Scrub radius (r) ... 13
7.2 Kinematics ... 14
7.2.1 General ... 14
7.2.2 Ride track change (b_z) ... 15
7.2.3 Ride track change gradient (b_z') ... 15
7.2.4 Ride steer (δ_z) ... 16
7.2.5 Ride steer gradient (δ_z') ... 16
7.2.6 Total ride toe ($\delta_{z(R-L)}$) ... 16
7.2.7 Total ride toe gradient ($\delta_{z(R-L)}$') ... 16
7.2.8 Ride camber (ε_{Vz}) ... 16
7.2.9 Ride camber gradient (ε_{Vz}') ... 16
7.2.10 Ride castor (τ_z) ... 17
7.2.11 Ride castor gradient (τ_z') ... 17
7.2.12 Roll steer (δ_{φ_V}) ... 17

7.2.13 Roll steer gradient ($\delta_{\varphi\,\mathrm{V}}{}'$) 17
7.2.14 Roll camber ($\varepsilon_{\mathrm{V}\varphi_{\mathrm{V}}}$) 17
7.2.15 Roll camber gradient ($\varepsilon_{\mathrm{V}\varphi_{\mathrm{V}}}{}'$) 17
7.3 Compliances 18
7.3.1 General 18
7.3.2 Longitudinal force compliance, with suspension torque ($x_{\vec{F}_{\mathrm{X}}}{}'$) 18
7.3.3 Longitudinal force compliance, without suspension torque ($x_{\vec{F}_{\mathrm{XW}}}{}'$) 19
7.3.4 Longitudinal force camber compliance, with suspension torque ($\varepsilon_{\mathrm{V}\vec{F}_{\mathrm{X}}}{}'$) 19
7.3.5 Longitudinal force camber compliance, without suspension torque ($\varepsilon_{\mathrm{V}\vec{F}_{\mathrm{XW}}}{}'$) 19
7.3.6 Longitudinal force steer compliance, with suspension torque ($\delta_{\vec{F}_{\mathrm{X}}}{}'$) 20
7.3.7 Longitudinal force steer compliance, without suspension torque ($\delta_{\vec{F}_{\mathrm{XW}}}{}'$) 20
7.3.8 Longitudinal force windup compliance, with suspension torque ($\tau_{\vec{F}_{\mathrm{X}}}{}'$) 20
7.3.9 Longitudinal force windup compliance, without suspension torque ($\tau_{\vec{F}_{\mathrm{XW}}}{}'$) 20
7.3.10 Lateral force compliance at the wheel centre ($y_{\vec{F}_{\mathrm{YW}}}{}'$) 21
7.3.11 Lateral force compliance at the contact centre ($y_{\vec{F}_{\mathrm{Y}}}{}'$) 21
7.3.12 Lateral force camber compliance ($\varepsilon_{\mathrm{V}\vec{F}_{\mathrm{Y}}}{}'$) 21
7.3.13 Lateral force steer compliance ($\delta_{\vec{F}_{\mathrm{Y}}}{}'$) 21
7.3.14 Aligning moment camber compliance ($\varepsilon_{\mathrm{V}\vec{M}_{\mathrm{Z}}}{}'$) 22
7.3.15 Aligning moment steer compliance ($\delta_{\vec{M}_{\mathrm{Z}}}{}'$) 22
7.4 Ride and roll stiffness 22
7.4.1 General 22
7.4.2 Ride rate (K_{Z}) 22
7.4.3 Suspension ride rate (K_{ZK}) 23
7.4.4 Roll stiffness ($K_{\varphi_{\mathrm{V}}}$) 23
7.4.5 Suspension roll stiffness ($K_{\varphi_{\mathrm{K}}}$) 23
7.4.6 Auxiliary roll stiffness ($K_{\varphi_{\mathrm{V}},\mathrm{aux}}$) 24
7.4.7 Auxiliary suspension roll stiffness ($K_{\varphi_{\mathrm{K}},\mathrm{aux}}$) 24
7.4.8 Vertical displacement tandem axle load redistribution stiffness (K_{tz}) 24
7.4.9 Vertical suspension displacement tandem axle load redistribution stiffness (K_{tzK}) 25
7.4.10 Tandem axle twist stiffness ($K_{\varphi\mathrm{t}}$) 25
7.4.11 Tandem axle suspension twist stiffness ($K_{\varphi\mathrm{tK}}$) 25
7.4.12 Tyre normal stiffness (K_{ZT}) 25
7.5 Force reactions 25
7.5.1 Anti-squat and anti-dive force gradient ($\vec{F}_{\mathrm{Z}\vec{F}_{\mathrm{X}}}{}'$) 25

7.5.2 Jacking force gradient ($\vec{F}_{Z\vec{F}_Y}{}'$) 26

7.5.3 Longitudinal force tandem axle load redistribution gradient ($W_{Dt\vec{F}_{XT}}{}'$) 26

8 Data presentation 26

8.1 Steering ratio 26

8.2 Kinematic properties 30

8.3 Compliance properties 31

8.4 Ride and roll stiffness properties 32

8.5 Force reaction properties 32

Annex A (informative) **Mathematic fit of steering ratio as a function of steering wheel angle 34**

Bibliography 35