



Steering Wheel Bending Strength

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine the deflection under load of all the variant (Polyurethane/Leather Wrap and or Wood) steering wheels, with a representative Driver Air Bag (DAB) Module/Horn pad, when a bending load is applied at the Rim Position of 12:00 and 6:00.

1.2 Applicability. Steering wheels used in passenger cars, Multipurpose Passenger Vehicles (MPV), and trucks.

1.3 Remarks. Not applicable.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

CG2982 Steering Wheel Load Stiffness Calculator

3 Resources

3.1 Facilities. Not applicable.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Tensile compression test machine or equivalent capable of transmitting up to (2500 ± 25) N, at a rate of deflection of (25 ± 2.5) mm per minute and measuring and recording that deflection in a Microsoft Office 2007 Excel compatible format (sample rate of 0.1 mm increments or finer). Test ambient temperature must be controlled to (23 ± 5) °C.

3.2.2 Metal-faced load application device as described in Appendix A, Figure A3, Figure A4, Figure A5 and Figure A6.

3.2.3 Fixture to support the steering wheel such that a load can be applied either in a direction parallel to the axis of the steering wheel hub (12:00 o'clock alignment) or 30 degrees from that direction (6:00 o'clock alignment).

3.2.4 Bearing Lubricant.

3.2.5 CG2982 Steering Wheel Load Stiffness Calculator (Microsoft Office 2007 Excel).

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Note: All instrumentation is to be calibrated as required; record instrumentation details and date of calibration on Data Sheet A1 (see Appendix A), unless the information is otherwise preserved in the testing laboratory records.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time.

Calendar time: 2 days

Test time: 12 h

Coordination time: 168 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

3.7 Development/Validation Items.

3.7.1 Test Material. Complete steering wheel assemblies with a representative DAB module; i.e., all variants (Polyurethane/Leather Wrap and or Wood) of the steering wheel with DAB module. Samples for 12:00 rim force/deflection shall be the same samples previously tested for modal frequency, and the sample number shall be recorded in the data sheet for each evaluation. Pairing of stiffness and frequency results is required. Upon completion of this test, the steering wheel shall not be used for any further testing.

4 Procedure

4.1 Preparation.

4.1.1 Rim Stiffness at 12:00 (For Each Variant).

4.1.1.1 Mount the steering wheel on the horizontal support fixture and secure it to the loading machine table. Locate the 12:00 midpoint of the upper unsupported rim span in line with the vertical load application device pad (see Appendix A, Figure A1).

4.1.1.2 Apply bearing lubricant as needed. Record the ambient temperature.

4.1.1.3 Align the loading pad such that its 64 mm dimension is radial to the steering wheel (see Appendix A, Figure A1).

Note: Start load pad at one end of linear bearing to allow for linear translation due to steering wheel deformation.

4.1.2 Rim Stiffness at 6:00 (For Each Variant).

4.1.2.1 Mount the steering wheel on the support fixture and secure it to the loading machine table. Locate the 6:00 midpoint of the lower rim span 30 degrees from the load application device pad (see Appendix A, Figure A2).

4.1.2.2 Apply bearing lubricant as needed. Record the ambient temperature.

4.1.2.3 Align the loading pad such that its 64 mm dimension is radial to the steering wheel (see Appendix A, Figure A2).

Note: Start load pad at one end of linear bearing to allow for linear translation due to steering wheel deformation.

4.2 Conditions.

4.2.1 Environmental Conditions. Testing to be conducted at (23 ± 3) °C ambient temperature.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Rim Stiffness at 12:00.

4.3.1.1 Move cross head until the load application device pad is within 1 to 2 mm of contact to the 12:00 rim. Zero the load/deflection.

4.3.1.2 Deflect at a cross head rate of (25 ± 2.5) mm per minute until 65 mm of deflection is reached. Collect load deflection data at a sample rate of 0.1 mm increments or finer.

4.3.1.3 Remove Load.

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4.3.1.4 Transfer data into Microsoft Excel format in order to use the stiffness calculator.

Note: Do not average multiple load/deflection data before calculating stiffness. Do not force fit data into 0.1 mm increments.

Calculate 12:00 stiffness: Follow the instructions in the stiffness calculator and record the stiffness results on Data Sheet A2. Attach the summary graph to Data Sheet A2 (see Appendix A).

4.3.2 Bending Strength at 6:00.

4.3.2.1 Move cross head until the load application device pad is within 1 to 2 mm of contact to the 6:00 rim. Zero the load/deflection recorder.

4.3.2.2 Deflect at a cross head rate of (25 ± 2.5) mm per minute until 65 mm of deflection reached. Collect load deflection data at a sample rate of 0.1 mm increments or finer.

4.3.2.3 Remove Load.

4.3.2.4 Transfer data into a Microsoft Excel format in order to use the 6:00 steering wheel load plotter.

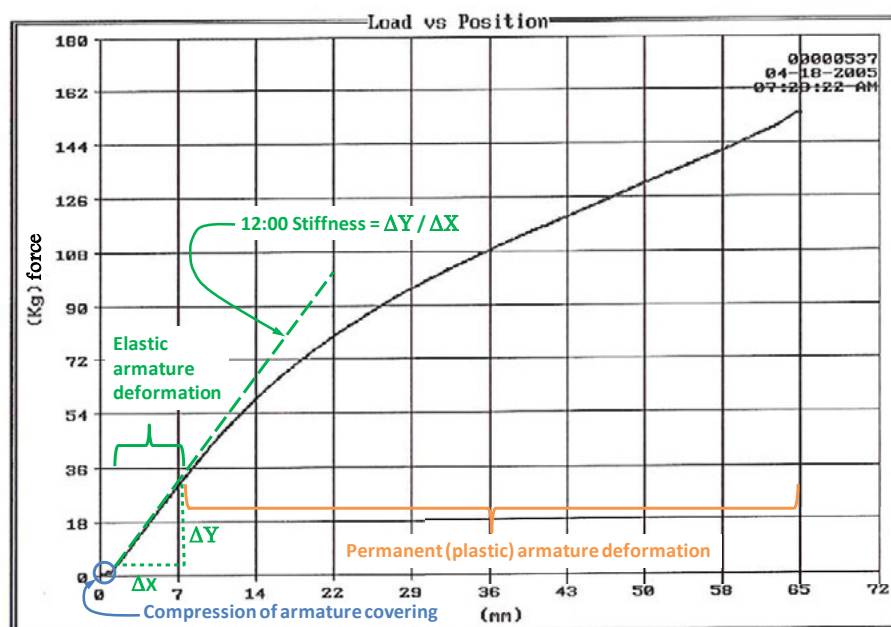
Note: Do not average multiple load/deflection data before plotting. Plot load/deflection curve: Using stiffness calculator Plot Load/Deflection curve. Attach the summary graph to Data Sheet A2 (see Appendix A).

5 Data

5.1 Calculations. Use CG2982 Steering Wheel Load Stiffness Calculator.

5.2 Interpretation of Results. The 12:00 rim stiffness used in the upper rim load calculation is the slope of the armature deflection versus load during its initial elastic deformation. Compression of the armature covering (wrap) prior to armature deformation (non-linear/lower force immediately following contact of loading device to covering) is not to be used in determining the 12:00 rim stiffness as shown in Figure 1. Likewise, non-linear deflection versus load (plastic) deformation following the initial elastic deformation is not to be used in determining the upper rim stiffness as shown in Figure 1. Typically 12:00 rim displacements from 4 to 7 mm are in the elastic region, however, the elastic region is wheel specific. It is recommended to select the longest linear region defined by the elastic region to improve the accuracy of the calculation.

Figure 1: Typical Load/Deflection Curve



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