GM WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW17366

Center Floor Console – Drive Point Dynamic Stiffness to Ground Evaluation Procedure

1 Introduction

The Transducer Calibration Master Test Procedure, GMW14172 and the Hand Held Force Input Frequency Response Function (FRF) Acquisition Master Test Procedure, GMW14181, shall be referenced for more detailed information corresponding to the following procedure.

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. Define the process for obtaining the lateral drive point dynamic stiffness level on the center floor console to ground. These measurements are used to compare center floor console lateral dynamic stiffness to the specifications.

1.2 Applicability. This test procedure is appropriate for benchmarking fully trimmed competitive and GM center floor console to ground boundary condition.

1.3 Remarks. The drive point dynamic stiffness of the center floor console is an assessment of the lateral dynamic stiffness performance to ground boundary condition.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14172 GMW14181

2.3 Additional References.

- PCB Piezotronics, Inc., 3425 Walden Avenue, Depew, NY 14043-2495 USA.
- Siemens PLM Software - Global Headquarters, 5800 Granite Parkway, Suite 600, Plano, TX 75024.
- Subsystem Technical Specification (SSTS).

3 Resources

3.1 Facilities. A test room or an area which is free of extraneous vibration (per GMW14181). The test setup shall include a qualified test fixture for component mounting to ensure the static and dynamic requirements as defined in 3.7 are met. All interfaces of the console to the vehicle (e.g., instrument panel, shift lever and tunnel) have to be connected to the test fixture. Check Subsystem Technical Specification (SSTS), Appendix C1/C2 for deviations or specific requirements. See Appendix A, Figure A1 for an example of setup.

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 Test Equipment.

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- Data Acquisition System (DAS) with FRF analysis capability.
- Modally tuned impulse hammer (e.g., PCB-086D05 with PCB-084A51 Adaptor and hammer tips range from 084A50 to 086C05, the super soft tip (Grey 15.101, 1 in 10SS) is recommended and available from PCB Piezotronics, Inc.)
- Six (6) triaxial accelerometers (e.g., PCB 356A02 or PCB 356A15, Mass < 11 g) with Integrated Circuit Piezoelectric (ICP) signal amplifiers (available from PCB Piezotronics, Inc.). Minimum requirement is two (2) (acceleration) single axis accelerometer (e.g., PCB 352C33 or PCB 353B03, Mass < 11 g) with ICP signal amplifiers (available from PCB Piezotronics, Inc.)
- Hot glue or light weight mounting clamps are used for positioning the accelerometers on the center floor console. It shall be ensured that no relative motion between the accelerometer and the structure is possible.
- Multi-channel spectrum analyzer front end with Analog/Digital (A/D) converter, computer and software for measurement and analysis (e.g., LMS SCADAS Front End and LMS Test Lab software, available from Siemens PLM Software, Siemens Industry, Inc.). A multi-channel DAS is required to receive all signals simultaneously.

Note: See GMW14181, Appendix A, Transducer Examples for transducer key characteristics.

3.3 Test Vehicle/Test Piece. See GMW14181 for test fixture specifications and examples.

3.4 Test Time.

Calendar time:	2 day
Test time:	4 hours
Test Summary:	1 hour
Coordination time:	2 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Engineer and/or technician skilled in vibration data acquisition and analysis, and operation of the equipment as described in GMW14181.

3.7 Component Test Fixture/Component Boundary Condition. The test fixture to ground boundary conditions must meet the following static and dynamic specifications:

- Lowest Fixture Mode Natural Frequency: 300 Hz.
- Minimal Static Stiffness: 100 N/mm (all attachment points and directions).

4 Procedure

4.1 Preparation. Lateral drive point accelerometer positions should be selected to ensure sufficient exterior console trim attachment to underlying console structure. The attachment surface should be prepared to provide a clean mounting surface. When the armrest is moveable and there is no comment on that in the SSTS, Appendix C1/C2, the front position has to be used. Deviation is allowed and recommended in case a different position is assumed to have a lower lateral dynamic stiffness.

4.1.1 Positions and Leveling. The accelerometers have to be fixed with respect to the global vehicle coordinate system. It is recommended to use a digital level to ensure that an accurate mounting of the accelerometers to the global Cartesian coordinate system is verified to within 5 degrees. For details on the position of the accelerometers see 4.3.2.

4.2 Conditions.

4.2.1 Environmental Conditions. As described in GMW14181.

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.

Test conditions are described in GMW14181.

4.3 Instructions.

4.3.1 Setup for Measurement System. Set up the DAS to acquire accelerance FRF in the units of meters per second squared per Newton ($m/s^2/N$).

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- Frequency range: 0 Hz to 128 Hz.
- Resolution: 0.25 Hz minimum.
- Trigger mode: Hammer Input channel.
- Time windows: Uniform window. If event cannot be completely observed, use Force/Exponential Windows.
- Trigger level: 10% to 50% slope channel. Sign of the slope may vary depending on transducer type and DAS.
- 1% (of time block) trigger delay (pre-trigger) for all channels.
- AC Coupled (1 Hz high pass filter) Enable overload detection.
- Measuring function: FRF with force as reference.
- Number of average: Five (5) minimum.
- Force level input: Select hammer tip to achieve an approximate 12 dB roll off 5 Hz to 100 Hz. Typical time domain input 40 N peak (approximately 1 N to 1.2 N Root Mean Square (RMS) from 5 Hz to 100 Hz).

4.3.2 Instrumentation. The typical accelerometer positions are at the front, middle and rear on both the driver and passenger side of the console (see Appendix A, Figure A1). Check SSTS, Appendix C1/C2 for specific points a lateral stiffness requirement is defined. Accelerometers have to be mounted and aligned in the global vehicle coordinate system. Additional acceleration response locations should be placed in line of action of the drive point measurement on the opposing vertical console face to provide a comparison between the drive point and cross dynamic stiffness. See Appendix A, Figure A2.

4.3.3 Measurement. Using an impact hammer or hand held shaker, apply a force at the same center floor console interface attachment in the same direction. Measure driving point FRFs in the lateral direction at all of the center floor console interfaces specified in the SSTS, Appendix C1/C2. Reference GMW14181 for GM standard vehicle coordinate directions and appropriate accelerometer mounting adhesives.

4.3.4 Saving the Data. For each measurement, measure accelerance, check coherence and verify levels. Upon measurement completion, save accelerance FRF, coherence and force auto-power spectrum. Compare drive point and cross accelerance as well as the drive point and cross dynamic stiffnesses. If there are relevant differences between the drive point and cross dynamic stiffness at 15 Hz, local trim effects may cause the driving point stiffness to be lower and the cross dynamic stiffness can be an appropriate characterization of the global response.

5 Data

5.1 Calculations. This section describes methods to calculate the data for target validation.

5.1.1 Data Calculations for Target Validation.

5.1.1.1 Narrow Band Drive Point Dynamic Stiffness Spectrum.

5.1.1.1.1 Integrate the narrow band accelerance (Appendix B, Figure B1) to obtain narrow band mobility (Appendix B, Figure B2).

5.1.1.1.2 Integrate the narrow band mobility (Appendix B, Figure B2) to obtain narrow band compliance (Appendix B, Figure B3).

5.1.1.1.3 Invert the narrow band compliance (Appendix B, Figure B3) to obtain narrow band stiffness (Appendix B, Figure B4)

5.1.1.1.4 Display:

- X-axis: 0 Hz to 50 Hz, linear scale.
- Y-axis: Linear full scale, based on data peak amplitude.

5.1.1.1.5 Record the lateral dynamic stiffness as specified in the SSTS, Appendix C1/C2 in units of N/mm.

5.2 Interpretation of Results. Verify whether SSTS requirements are achieved using display formats according to 5.1.1.

5.3 Test Documentation. In addition to the necessary specifications of the floor console, the documentation shall give the lateral dynamic stiffness as specified in the SSTS, Appendix C1/C2. An example is shown in Appendix B, Figure B5.

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