



Suspension Bushing Durability Test

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. The purpose of this standard is to test the service life of suspension bushings.

1.2 Applicability. For all passenger vehicle suspension bushings.

1.3 Remarks. Table 1 defines the variable to be used in this standard and Figure 1 shows the location of each axis.

Table 1: Bushing Axis Definition

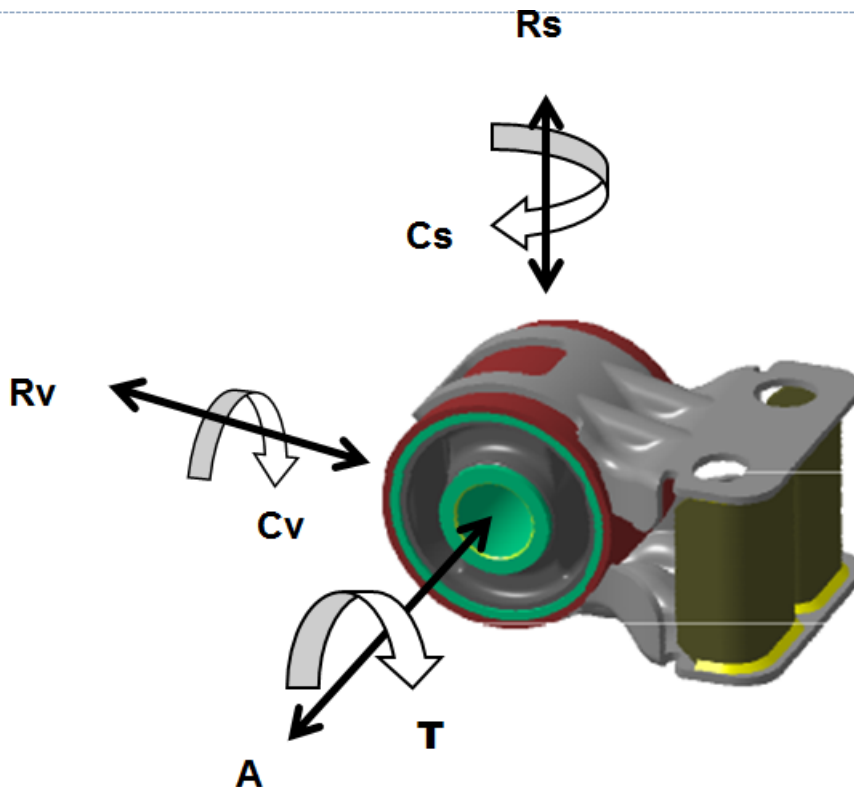
Axis	Designator	Description
Radial	R	Perpendicular to the centerline, A axis, of the bushing. Use if the bushing is symmetrical.
Radial Solid	Rs	Perpendicular to the centerline, A axis, of the bushing through the center of the solid part of the bushing.
Radial Void	Rv	Perpendicular to the centerline, A axis, of the bushing through the center of the Voided (low rate) part of the bushing.
Axial	A	Collinear with the centerline, A axis, of the bushing. Typically, the through bolt axis.
Torsion	T	Torque about the centerline, A axis, of the bushing.
Torsion Work	Tw	Torque about the working axis of the bushing, i.e., Vehicle Y axis of a compound crank rear axle A bushing that is installed on an angle in the plan view.
Conical	C	Torque about the Radial, R axis, of the bushing. Use if the bushing is symmetrical.
Conical Solid	Cs	Torque about the Radial Void, Rv axis, of the bushing.
Conical Void	Cv	Torque about the Radial Solid, Rs axis, of the bushing.

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Note: Shows loading application directions to the bushing.

Figure 1: Axis Definitions

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.

- CG2731 Suspension Bushing Component Technical Specification (ID)
- MTS Systems Corporation, Eden Prairie, Minnesota (www.mts.com)

(ID) = This document is limited to internal use within General Motors and shall not be accessed outside this company. Contact the GM Lead Engineer for further instructions.

3 Resources

3.1 Facilities. A bedplate large enough for securing the test rig (bedplate approximately 2.2 m × 2.2 m) and capable of withstanding the dynamic loading of the test rig/specimen is required. Also required is a hydraulic system capable of supplying oil at a rate consumed by hydraulic cylinders. The test facilities and equipment shall be in good working order and all instrumentation shall have a valid calibration label. The bedplate and hydraulic system must be isolated from outside influences that can affect the data collection portion of the test. This standard describes the setup for one (1) rig/station capable of evaluating one (1) bushing specimen at a time (Figures A1, A2, A3, A4, A5 and A6).

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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. Sections 3.2.1 through 3.2.4.1 include test rig, fixtures, transducers, instrumentation, and controllers typically used by the General Motors North America Warren Structural Development Laboratory to perform this test. Other equipment may be substituted at the discretion of the local testing facility as long as it provides equivalent accuracy as specified herein or by the requestor. Any setup must be approved by the Bushing Bill of Material (BOM) Family Owner (BFO) and Subsystem Validation Engineer.

3.2.1 Hydraulic Actuators. Linear and/or rotary hydraulic actuators with low friction bearings and seals. The actuators must be capable of providing both high and low frequency small displacements. An example of an actuator with these characteristics is the MTS Series 242 Actuator, available from MTS Systems Corporation.

3.2.2 Fixtures. Fixtures necessary to support the bushing at the actuator end simulating the load axes surface of the frame/body rail attachment. The fixtures must simulate the interfacing parts of the bushing.

3.2.3 Angle Stands. Angle/tube stands to support the actuator and bushing reaction fixture.

3.2.4 Transducers. Both linear and rotational displacement transducers will be needed to measure part deflections for rate checks.

3.2.4.1 Load Cell. The test setup requires load cells capable of measuring loads in the required range.

3.3 Test Vehicle/Test Piece.

3.3.1 A minimum of six (6) samples of each bushing design variant shall be tested.

3.3.2 For initial samples, type samples, and in cases of arbitration, the durability test must be made no earlier than 7 d and for quality control, no earlier than 72 h after vulcanization of the part. Before the durability test, the parts shall be stored for at least 8 h at room temperature in an unstressed condition.

3.3.3 Bushings shall be fixtured using actual mating parts or matching representations as approved by the design responsible engineer. Bushings shall be mounted in vehicle orientation.

3.4 Test Time. The test will take roughly 3.5 d per sample per vehicle life. A part running to a full 3.4 lives would take 12 d.

Calendar time: 3.5 d per sample,
per vehicle life.
(3.33 d of test time)

Test time: 80 h of test time per
sample per life
(based on 561 020
cycles at 2 Hz.)

Coordination time: Set up and tear
down, based on a
24 h per day up-
time

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. The test personnel should be familiar with running fatigue testing on a servo hydraulic test rig, as well as performing static and dynamic spring rate testing on elastomer and/or hydro-elastic bushings. The test personnel will need to be able to perform both linear rate testing for the radial and axial directions, and rotational testing for the torsional and conical directions.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions. The bushing shall be tested by applying load in a minimum of three (3) primary working axes of the application in the vehicle (reference Figure 1). All three (3) axes must be dynamic inputs. The first two (2) dynamic loads are radial and torsional. The third axis can be either a dynamic axial or a dynamic conical load,

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