



Valve and Sliding Surface Durability Test of Suspension Hydraulic Shocks and Struts with Muddy Water

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. Testing of service life of suspension hydraulic struts and shocks during loading similar to operating conditions, specifically to verify the durability of the shock/strut rod seals during operation in the presence of muddy water.

1.2 Applicability. This procedure applies to all suspension hydraulic struts and shocks. The intent is to validate the rod, seal and striker cap interface. To be run for new architectures and component changes in this interface (including design, manufacturing or processing).

2 References

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

2.1 External Standards/Specifications.

JIS Z 8901

2.2 GM Standards/Specifications.

GMW14243

2.3 Additional References.

Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities. Servo-hydraulic vibration damper testing machine. Test specimen holder, see Figure 1. Mechanism to apply and recover (or drain) muddy water solution.

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 Calibrated measuring instruments (permissible tolerance is 1% for machines and measuring devices) for recording the test specimen temperature and damping force during the durability test.

3.2.2 Cooling device for cooling the test specimens during the durability test:

3.2.2.1 Cooling fluid: Liquid.

3.2.2.2 Cooling jacket cooling liquid inlet: In the vicinity of the piston rod guide.

3.2.2.3 Cooling jacket water outlet: In the vicinity of the base valve, or bottom of the shock.

3.2.2.4 A cooling jacket shall be placed around the test specimen reservoir tube.

3.2.3 If the damper is a strut, is part of a coil-over shock module, or has known significant side load in its application, the test specimen shall be subjected to a lateral force of net lateral force applied to shock (F_s).

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F_s = Mean lateral force applied to shock (F_m) $\pm$ alternating lateral force applied to shock (F_a) in the vicinity of the piston rod guide. Therefore a side load fixture will be required. See Figure 1 or Figure 2.

3.2.4 Equipment to apply muddy water solution at regular intervals. Agitation device should be used to maintain suspension of solution. Solution application pressure may be as low as ambient (high pressure application is not required).

3.3 Test Vehicle/Test Piece. A minimum number of samples to meet the reliability and confidence for validation (i.e., 99% reliability with 50% confidence) should be tested for validation purposes. At least six (6) samples are recommended.

3.4 Test Time.

Calendar time: 28 days
Test hours: 350 hours
Coordination hours: 12 hours

3.5 Test Required Information. Use program specific side load magnitudes (if available).

3.6 Personnel/Skills. Operators shall be experienced with using a servo-hydraulic vibration testing machine.

3.6.1 Operator shall be skilled in the installation of the part, routing and application of the muddy water solution, and application of the instrumentation in the appropriate locations (see Figures 1 and 2).

3.6.2 Operator shall be skilled in the monitoring and control of the test to ensure consistent results.

3.6.3 Grade classification for the muddy water solution is dependent on vehicle parameters and shall be determined by the Design Responsible Engineer.

4 Procedure

4.1 Preparation.

4.1.1 Run all dampers through the GMW14243 Damper Basic Performance Test prior to starting this test.

4.1.2 Record mass to nearest 0.1 g on parts in "as-tested condition". (This will be the m_{di} mass, damper initial mass.)

4.1.3 If necessary, externally mounted parts which are not required for holding the specimen on the test bench can be removed.

4.1.4 The test specimen shall be installed in the testing machine as described in 3.1.

4.2 Conditions.

4.2.1 Environmental Conditions. The test temperature shall be measured at the point illustrated in Figure 1 or Figure 2.

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.

4.2.2.1 Define the application side loads, temperatures and aggregate expectations to determine the test schedule per the parameters indicated in Tables 1 through 4. Severe duty schedules are include in Tables 3 and 4.

4.2.2.2 Bump cap (also known as a jounce cap or striker cap) must be present for test.

4.2.2.3 Dust boot should be removed.

4.2.2.4 Apply a minimum of 15 cm³ of test fluid to the piston rod seal area for an interval up to 30 s every 10 minutes of test time. See Figure 1 and Figure 2 for application of fluid and loading configuration. See Appendix A (Sections A1 and A2) for test fluid composition. Apparatus should allow fluid drainage to avoid continued submersion of seal. Apply solution to the rod 15 mm to 20 mm above the seal sufficient to cover the seal and flush the medium during application. Then allow the self-generating heat from the damper rod to dry the medium on the rod to seal interface to create the abrasion.

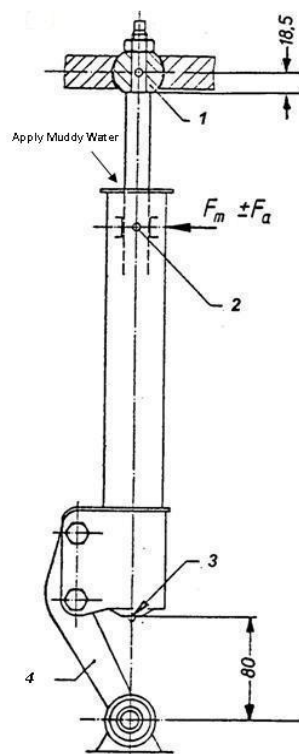
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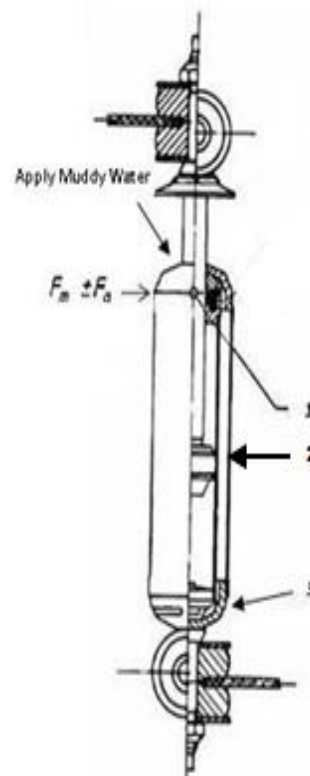
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Note: 1 = Ball,
2 = Center of Guide,
3 = Temperature Measuring Point
4 = Adapter
(Dimensions in millimeters are for reference only.
Use application specific dimensions.)

Figure 1: Strut Muddy Water Application



Note: 1 = Center of Guide,
2 = Temperature Measuring Point (Monotube Shock)
3 = Temperature Measuring Point (Twin Tube Shock)

Figure 2: Shock Muddy Water Application

4.2.2.5 Optional jounce bumper evaluation. For applications with jounce bumpers and striker caps integrated, demonstration of the capability to properly flush the anticipated contaminants is required. The striker cap must allow for the evacuation of the fluid from the rod/seal interface when a jounce bumper is acting to pump contaminants into the seal system. To this end, testing with a jounce bumper may be required to demonstrate capability of the bumper, striker cap and seal as a system.

4.2.2.6 Basic stroke (H), at frequency of basic stroke (f_1), Center of basic stroke = Nominal design position of the shock/strut.

4.2.2.7 Heterodyne stroke (h), at heterodyne frequency stroke (f_2).

4.2.2.8 Test duration (n) vibration cycles which is one (1) basic stroke cycle.

4.2.2.9 Application of a sinusoidal lateral force $F_s = F_m \pm F_a$ in phase opposition to the basic stroke, i.e., maximum F_s when piston rod is in maximum retracted position, and minimum F_s when piston rod is in maximum extended position. The lateral forces may deviate from values shown Tables 1 through 4 as directed by the Design Responsible Engineer. Application of side load may be modified if program specific information requires it.

4.2.2.10 Dampers with Electronic Control. The shock absorber is controlled by the current as specified in the damper drawing. It can be run at full soft if the above control temperature is maintained. Otherwise, adjust the current to maintain the temperature.

4.3 Instructions.

4.3.1 The dynamic durability test shall be performed under the conditions described in 4.2.

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