



<b>SURFACE VEHICLE STANDARD</b>	<b>J2436™</b>	<b>NOV2023</b>
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Superseding J2436 JUL2016		
Accessory Drive Tensioner Test Standards		

## RATIONALE

Updates are needed to Section 4: Contamination Test to include a less severe test procedure.

### 1. SCOPE

To document test procedures and setups that address known failure modes for Accessory Drive automatic tensioners. This SAE Standard does not encompass the pulley or pulley bearing. The sample sizes and acceptance criteria should be determined by agreement between the original equipment manufacturer (OEM) and the supplier.

The failure modes to be addressed are:

Corrosion                      Seizure

Load Output                    Damping

Parallelism                    Offset

Noise

Structural Failures

- Clamp Load
- Lift Lug Failure
- Arm Stop Failure
- Fractures/Cracking/Wear

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Test Factors include:

Contamination	Temperature
Ozone	Arm Displacement and frequency
Input Forces	

NOTE: The Belt Drive Committee recommends that this spec be run using test parts that are close to the upper and lower specifications for load output and damping (tails testing).

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

SAE J2198 Glossary - Automatic Belt Tensioner

#### 2.1.2 ASTM Publications

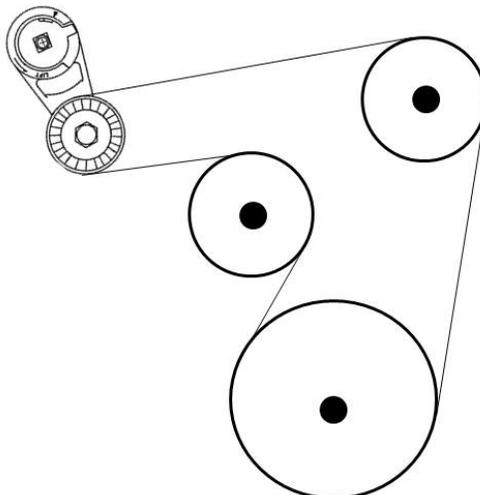
Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org)

ASTM D1149-XX Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimens) - Refer to latest version

## 3. GENERAL

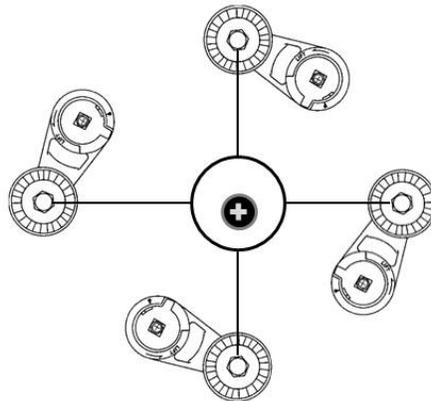
### 3.1 Test Chamber Tensioner Actuation Methods

Tensioner actuation can be achieved using cable, chain, belt, or rod. If a specific actuation method is required, it will be noted in the specific test procedure. Below are figures showing examples of actuation options.



**Figure 1 - Belt-driven test chamber**

Figure 1 is an example of a belt-driven test chamber. One of the pulleys must be eccentric to obtain the desired peak-to-peak arm travel of the tensioner.



**Figure 2 - Cable-driven test chamber**

Figure 2 is an example of a cable-driven test chamber. The center pulley is eccentric to obtain peak-to-peak arm travel.

### 3.2 Inspection and Data Reporting Requirements

Data reporting requirements will be documented in each test procedure. Section 3.2 contains specific information regarding the inspection methodology and data reporting format for typical data reporting requests.

#### 3.2.1 Angularity

Angularity is the tilt of the idler bearing seat relative to the mounting datum of the tensioner. The angularity measurement is to be conducted with the tensioner arm rotated to the nominal arm angle, with the reacting force to rotate the arm located at the proper centerline and hubload angle. Angularity values are to be reported in degrees or mm and can be specifically separated into pitch and yaw.

#### 3.2.2 Offset

Offset is the distance from the idler bearing seat to the mounting datum of the tensioner. The offset measurement is to be conducted with the tensioner arm rotated to the nominal arm angle, with the reacting force to rotate the arm located at the proper centerline and hubload angle. Offset values are to be reported in mm.

#### 3.2.3 Breakaway Torque

Breakaway torque is the torque required to actuate the tensioner after a soak period that tests for tensioner lockup or seizure. Breakaway torque is measured statically, at approximately 1 Hz. Three full strokes should be taken for the measurement, and data should be reported for all three strokes in torque or force versus displacement hysteresis curves. The breakaway torque measurement should be taken starting from the locked or pinned position, without letting the tensioner arm move toward free arm when unlocked.

#### 3.2.4 Tensioner Break-In

Tensioner break-in is the pretest procedure to stabilize the tensioner damping. Break-in is performed by cycling the tensioner for 1 hour at ambient temperature, with an amplitude of 2 degrees pk-pk and a frequency of 20 Hz. Tensioner break-in is to be performed prior to all testing and pretest (0 hour) inspections.

#### 3.2.5 Tensioner (Load) Output

Tensioner output is the force or torque of the tensioner due to the spring. Output is measured dynamically. The tensioner should be tested at  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ , with an amplitude of 2 degrees pk-pk and a frequency of 20 Hz. Output should be reported as torque (N-m) at the nominal arm position and a full hysteresis curve of torque or force versus arm position should be provided. The reported data should include five cycles after warmup/break-in has been reached.

### 3.2.6 Damping

Damping is the force that opposes the displacement of the tensioner arm. Damping is measured dynamically. The tensioner should be tested at  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ , with an amplitude of 2 degrees pk-pk and a frequency of 20 Hz. Damping should be reported as energy (N-cm/mm) and a full hysteresis curve of torque or force versus displacement should be provided. Damping may also be requested in %, force, or torque. The reported data should include five cycles after warmup/break-in has been reached.

## 4. CONTAMINATION TEST

### 4.1 Purpose

To evaluate performance and durability by exposing the tensioner to a contaminated environment. If agreed to, the Moderate Test parameters may be used for applications where contamination is less severe.

### 4.2 Equipment

The test stand is a chamber capable of operating in the range of 15 to 50 °C. The tensioners are to be installed in vehicle nominal position with correct hub load and gravity bias direction. The tensioners are to be actuated by a belt, cable, rod, or chain attached to an eccentric pulley.

### 4.3 Test Parameters

#### 4.3.1 Contamination Solution

Water  
Salt (NaCl) 0.3%  
Clay (Bell Dark) 5%

The tolerance on the % mass of the contaminants is  $\pm 10\%$ .

NOTE: The contamination concentration must be verified on the output side of the nozzle, not what is in the holding tank. Proper concentration of contamination solution must be maintained throughout the test. A study should be conducted to understand concentration change over time, and monitoring during testing may be necessary to ensure proper concentration.

#### 4.3.2 Spray Nozzle(s)

McMaster Carr 3282K35. Hi volume, clog-resistant, full cone, 60 degrees, 2.6 GPM at 40 psi.

NOTE: The width of the actual spray angle will be approximately 30 degrees under the conditions specified for this procedure.

#### 4.3.3 Nozzle Location and Orientation

One nozzle per tensioner, centered (L-R) on the spring case, aimed upward at 45 degree angle. Distance from tip of the nozzle to the center of the spring case to be  $150\text{ mm} \pm 2\text{ mm}$ .

#### 4.3.4 Deflector Shield

360 degree coverage. Shield radius to be  $175\text{ mm} \pm 10\text{ mm}$ . Depth of shield should be 150 mm minimum from tensioner mounting datum. Tensioner is to be mounted in middle of deflector shield. The purpose of the deflector shield is to simulate the spray redirection that would occur underhood. The deflector shield also serves the purpose of eliminating cross-spray between test samples when multiple samples are run in the same test chamber.

#### 4.3.5 Representative Packaging Environment

It is recommended that the tensioner's packaging/mounting environment be represented when possible. This can be accomplished through stereolithography (SLA) components, prototype/production components, etc. The use of this packaging environment provides more representative splash and drip patterns the tensioner may be exposed to in the vehicle environment.

4.3.6 Spray pressure: 8 psi.

4.3.7 Spray time at pressure at nozzle: 10 seconds (Moderate Test: 5 seconds).

4.3.8 Flow/nozzle/10 second spray: 550 mL  $\pm$  20 mL (Moderate Test: 300 mL  $\pm$  20 mL).

4.3.9 Spray frequency: one application per hour (Moderate Test: eight applications per hour).

4.3.10 Cabinet temperature: 15 to 50 °C.

4.3.11 Tensioner arm actuation method: cable, chain, belt, rod, etc.

4.3.12 Tensioner arm amplitude and frequency: 3 degrees pk-pk, 20 Hz.

4.3.13 Test duration: 100 hours (Moderate Test: 200 hours).

4.3.14 Recommended sample size: six tensioners.

#### 4.4 Procedure

4.4.1 Perform pretest inspection after tensioner break-in for alignment, offset, load output, and damping.

4.4.2 Install tensioner(s) on test stand, in vehicle orientation at proper nominal arm angle and hubload direction.

4.4.3 Begin tensioner actuation. After 30 minutes (7.5 minutes for Moderate Test) of testing, apply the spray duration specified in 4.3.7 of contamination solution per 4.3.1. After the first application, repeat per the frequency specified in 4.3.9 every hour. Continue testing for the duration specified in 4.3.13.

4.4.4 At the completion of testing, remove the parts for inspection. It is recommended that three parts be removed and inspected within 24 hours. It is recommended that the remaining three parts be locked in nominal position, with the reaction force on the arm at the proper centerline and soaked for 14 days at ambient temperature and humidity conditions. Inspection should include all items in 3.2, with breakaway torque only measured on the tensioners that have completed the 14-day soak.

#### 4.5 Failure Criteria

The components must remain functional at the end of test and must comply to agreed upon limits for the following parameters:

- a. The noise level cannot exceed agreed limit throughout the duration of the test.
- b. Parallelism.
- c. Offset.
- d. Load output.
- e. Damping.
- f. Contamination ingress.

NOTE: Functional measurements of alignment and offset should be made at in vehicle geometry nominal position. If the damping changes and falls outside of the design specifications, the OEM may choose to continue the test at higher amplitude to induce wear surface failure which would be a secondary failure.

## 5. HOT BOX DURABILITY TEST

### 5.1 Purpose

To evaluate tensioner functional performance and durability by inducing wear on the components and to determine the effects of heat on the damping rate over the range of the test. The components to be evaluated are the bushing, damping elements, the spring, and any plastic parts.

### 5.2 Equipment

The test stand is an environmental chamber capable of maintaining a minimum of  $115\text{ °C} \pm 5\text{ °C}$ . The tensioners are actuated by cables or a belt attached to an eccentric pulley. Test chamber examples are shown in Section 3. Thermocouples should be installed internal to the tensioner to measure temperature of the plastic components at the wear surface interface.

### 5.3 Test Parameters

5.3.1 Cabinet temperature: 90 to 115 °C. Set final cabinet temperature to keep plastic components within operating temperature limit during chosen operating parameters (frequency and arm amplitude).

5.3.2 Tensioner arm actuation method: cable or belt.

5.3.3 Tensioner arm amplitude: Application specific. Typical range is 2 degrees pk-pk to 4 degrees pk-pk.

5.3.4 Tensioner arm frequency: typical test range is 20 to 30 Hz.

5.3.5 Test duration: Application and market dependent. Recommend a minimum of 200 hours.

5.3.6 Contamination: A contamination cycle may be added at the discretion of the OEM.

5.3.7 Recommended sample size: six tensioners.

### 5.4 Procedure

Install the tensioners in a test chamber. Set test chamber temperature, per 5.3.a. Actuate the tensioners based on the application (see 5.3.c and 5.3.d). Every 24 hours, verify tensioner amplitude is within test specification, inspect visually and check for no audible noise of the components. Resetting tensioner amplitude (if it falls outside of specification during the test), should be agreed with by the OEM prior to the start of the test. Inspect the tensioners at pretest (after break-in), 200 hours, and every 200 hours until the full test duration is complete. Inspection should include all items in 3.2. Perform a final inspection once the final test duration has been achieved.

## 5.5 Failure Criteria

The components must remain functional at the end of test and must comply to agreed upon limits for the following parameters:

- a. The noise level cannot exceed the agreed limit throughout the duration of the test.
- b. Parallelism.
- c. Offset.
- d. Load output.
- e. Damping.
- f. Contamination ingress (if applicable).
- g. Wear.

NOTE: Functional measurements of alignment and offset should be made at in vehicle geometry nominal position. If the damping changes and falls outside of the design specifications, the OEM may choose to continue the test at a higher amplitude to induce bushing failure which would be a secondary failure.

## 6. LIFT FEATURE TEST

### 6.1 Purpose

To test the effect on tensioner offset and parallelism due to cycling the tensioner arm to the installation stop with high force. To determine the strength of the lift feature of the tensioner.

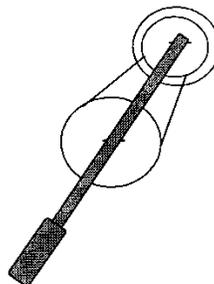
### 6.2 Equipment

The fixture must be able to withstand the force necessary to break the lift feature of the tensioner. Use a torque wrench capable of measuring and recording peak torque. OEM is to specify the torque wrench arm length and extension/socket length.

### 6.3 Procedure

Install the tensioner assembly in the test fixture. Torque the tensioner mounting fasteners to the minimum torque specification. Lift the tensioner arm with the torque wrench as if the belt is being installed. Determine and record the amount of torque necessary to lift the arm to the belt install stop position. Using the torque wrench, lift the arm to the torque measured previously and continue to apply torque until the residual (break away) torque of the pulley bolt is reached. If the lifting feature is not a bolt, continue to apply torque until two times the measured torque as stated previously. Repeat the test six times per test part.

NOTE: The torque wrench should be oriented such that the wrench is along the axis of the tensioner to obtain the maximum force that can be applied (see Figure 3).



**Figure 3 - Torque wrench orientation**

## 6.4 Failure Criteria

The components must remain functional at the end of test and must comply to agreed upon limits for the following parameters:

- a. Parallelism.
- b. Offset.
- c. Load output.
- d. Damping.
- e. Lift feature damage.

NOTE: Functional measurements of alignment and offset should be made at in vehicle geometry nominal position.

## 7. OZONE TEST

### 7.1 Purpose

To test all exposed plastic for cracking resistance when subjected to a test chamber containing ozone.

### 7.2 Test Equipment

Refer to ASTM D1149-XX (refer to latest level).

### 7.3 Procedure

Refer to ASTM D1149-XX (refer to latest level).

### 7.4 Failure Criteria

7.4.1 Cracks visible to the unaided eye.

## 8. SAFETY DROP TEST

### 8.1 Purpose

This test addresses safety issues by ensuring that the tensioner assembly remains intact after sustaining a drop from a specified height, simulating a possible assembly handling occurrence.

### 8.2 Test Equipment

- a. Concrete Floor.
- b. Measuring Tape.

### 8.3 Procedure

Holding the tensioner by the pulley, drop the tensioner on a concrete floor from a height of 1.5 m (lowest point of tensioner to floor). Drop same tensioner assembly three times.

Sample size: An amount to be agreed to by the supplier and OEM.

### 8.4 Failure Criteria

8.4.1 Separation of the arm from the base.