



SURFACE VEHICLE RECOMMENDED PRACTICE

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Automotive Vehicle Brake Squeal Test Recommend Practice

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FOREWORD

There has been much discussion about the need to correlate the results from dynamometer squeal noise tests and full vehicle measurements. However, there is no recognized standard for vehicle brake squeal measurement. This procedure was created to provide a vehicle test definition. As a squeal noise test matrix it may be used on its own or as part of a larger vehicle test protocol.

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1. SCOPE

This procedure is applicable to squeal type noise occurrences for passenger car and light truck type vehicles that are used under conventional operating conditions. For the purposes of this test procedure, squeal is defined as occurring between 900 and 18 000 Hz.

1.1 Purpose

This recommended test practice is intended to establish a common, universally recognized method for performing a series of screening test sequences that identify the propensity of a brake assembly to generate squeal noise under a variety of test conditions.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 724-776-4970 (outside USA), www.sae.org.

SAE J79 Brake Disc and Drum Thermocouple Installation

SAE J184 Qualifying a Sound Data Acquisition System

SAE J1477 Measurement of Interior Sound Levels of Light Vehicles

2.2 Related Publication

The following publication is provided for information purposes only and is not a required part of this document.

2.2.1 SAE Publication

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

SAE J2521 Disc and Drum Brake Dynamometer Squeal Noise Matrix

3. DEFINITIONS

Occurrence (absolute) is the percentage of the total brake applications where the peak interior sound level exceeded the threshold of 50 dB(A). It is calculated by dividing the number of brake applications with a sound level above the threshold by the total number of brake applications in the test. In a specific case, the user can define an alternative threshold, which must be documented.

Relative occurrence is the number of the stops in a particular test section where the peak interior sound level exceeded the threshold of 50 dB(A) divided by all of the brake applications where the sound level exceeded the threshold – expressed as a percentage.

4. DESCRIPTION

This matrix describes the test conditions and steps to investigate the influence of pressure, temperature and velocity on the squeal noise performance of brakes. This matrix is intended to provide a basic vehicle test to obtain a fair comparison for different brake corner sets of components across an axle. Should special conditions such as noise tests adjacent to a wall be used, this shall be noted in the test report.

5. MEASUREMENT REQUIREMENTS

The measurements system components required to perform the measurement procedure as described are listed below:

- Four thermocouples – one at each wheel – embedded in the outboard friction material according to SAE J79 Brake Disc and Drum Thermocouple Installation or equivalent.
- Two brake line pressure measurements – in the front and rear systems. (One can perform the test with a single pressure measurement as long as this is noted.)
- One vehicle velocity measurement must be capable of determining vehicle speed when moving in both the forward and reverse direction.
- One brake apply signal or measurements of pressure or pedal travel may be used for triggering. Such variations from the primary standard should be noted.
- One vehicle deceleration measurement. This could be an indirect measurement using speed differentiation.
- A measurement of ambient temperature.
- Six NVH channels.
 - Four at the corners - microphones or accelerometers.
 - Two channels that could be: one interior microphone, or a combination of interior and exterior microphones.

- A signal from the driver to indicate a subjective noise event.
- Record Relative Humidity for each test – this is not a continuously measured parameter.
- A measurement of vehicle inclination – optional.
- Pedal force measurement – optional.
- Record vehicle ballast conditions for the test.

The application and use of the measurement components are critical to performing this test properly.

5.1 Governing Temperature

Throughout this test the specified temperature is to be determined at either the left or right front wheel position exhibiting the highest temperature. The position of the governing temperature measurement shall be recorded for all tests. This is the preferred measurement procedure. As an option, one may specify the critical temperature location that will be the governing temperature for all measurements. This location shall be recorded.

5.2 Location of Accelerometers

The preferred accelerometers location for disc brakes is at the rear of the leading piston. This provides a well-defined location with generally free access for mounting. If one is stud mounting the accelerometer, care should be taken to avoid drilling too deeply and causing a brake fluid leakage problem. In the event of difficulty in mounting the accelerometer at this location an alternative location can be used. This new location shall be noted.

For drum brakes, the accelerometer shall be mounted on the backing plate at a point where there is clearance and a flat surface for rigid mounting. The accelerometer shall be oriented in a lateral direction to vehicle motion. The location of the accelerometer shall be noted.

5.3 Interior Microphone Specification

The interior microphone shall be of Type 1 or Type II as specified by SAE J184 Qualifying a Sound Data Acquisition System. Which type is used shall be documented.

5.4 Location of Interior Microphone

The interior microphone shall be located as specified in SAE J1477 Measurement of Interior Sound Levels of Light Vehicles.

5.5 Driver Subjective Evaluations of Noise

As an option the user of this procedure may wish to collect the test driver's record of noisy stops. How such stops are defined is beyond the scope of this procedure. Since this is currently a routine part of such tests, it is included for the users convenience only.

6. VEHICLE OPERATION

Since interior noise measurements may be distorted by many factors, the following is required at a minimum to assure accurate and repeatable measurements.

- All windows must be lowered 2.54 cm (1 in)
- The radio, tape player, and CD unit must be switched off
- The vehicle HVAC system fan must not be set above the lowest speed