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LAND SEA AIR SPACE

TECHNICAL REPORT J211a

INSTRUMENTATION FOR IMPACT TESTS — SAE J211a

SAE Recommended Practice

Report of Automotive Safety Committee approved October 1970 and last revised December 1971.

1. Scope—The purpose of this SAE Recommended Practice is to provide guidelines for instrumentation used in motor vehicle and motor vehicle component impact tests. It is intended to supplement impact test procedures such as those described in SAE J850, J944, J117, etc. The aim is to achieve uniformity in instrumentation practice and in reporting test results, without imposing undue restrictions on the performance characteristics of the individual elements in an instrumentation or data analysis system. Use of this recommended practice will provide a basis for meaningful comparisons of test results from different sources.

2. Definitions

2.1 Data Channel—All of the instrumentation from and including a single transducer (or multiple transducers whose outputs are combined in some specified way) up to and including any analysis procedures that may alter the frequency content of the data.

2.2 Scale Factor—The intended ratio of real-to-analog values (for example, g/in (cm) of trace deflection, lb (g)/V of tape recorder signal.

2.3 Static Accuracy—For d-c channels, the deviation from the channel scale factor at zero frequency. For a-c channels, the deviation from the channel scale factor at a designated frequency between f_L and f_H of Fig. 1.

2.4 Dynamic Accuracy—The change in scale factor as a function of input frequency.

2.5 Full Scale—The maximum usable linear range of an instrument.

2.6 Data Channel Full Scale—That value of a data channel determined by the instrument in the channel with the lowest full-scale level. This is expressed in terms of the measured variable (input). For example, F.S. = 50 g, 1000 lb, 500 g, 100 cm/s, etc.

3. Data Channel Requirements—These requirements fall into two categories: static accuracy and dynamic accuracy.

3.1 Static Accuracy

3.1.1 REQUIREMENTS—The static accuracy of a data channel is dependent upon the complex interaction of many factors, such as linearity, zero drift, hysteresis, etc. As a basis for evaluating the static accuracy of a data channel, each testing agency shall maintain a record of the instrumentation used, listing the equipment by function, manufacturer, model and serial number, date of last calibration, and calibration interval.

3.1.2 SUGGESTED GUIDELINES—The following guidelines are suggested when evaluating the static accuracy of a data channel:

(a) Laboratory calibration checks should be made at ¼, ½, and full scale for each data channel. A calibration signal equal to at least 80% full scale should be provided at the time of test.

(b) Bipolar channels should be checked in each direction.

(c) Data channels should be scaled to make allowance for higher than expected test values.

(d) Consideration should be given to the effects of test site conditions (for example, temperature).

(e) Calibration should be made on a periodic basis utilizing measuring and test equipment traceable to known standards.

3.2 Dynamic Accuracy

3.2.1 REQUIREMENTS—This property of a data channel is specified by a curve which plots the channel output/input ratio versus frequency of the applied calibration signal. Fig. 1 contains recommended limits for the various classes of data channels that are referenced in paragraph 4. If the data channel frequency response falls entirely within the shaded area in Fig. 1, it meets the requirements of this recommended practice.

3.2.2 SUGGESTED GUIDELINES—The following guidelines are suggested when evaluating the dynamic accuracy of a data channel:

(a) The input signal for testing frequency response should be equivalent to at least 80% of full scale for the data channel. For certain transducers, it may not be practical to obtain 80% of full scale for the full frequency range.

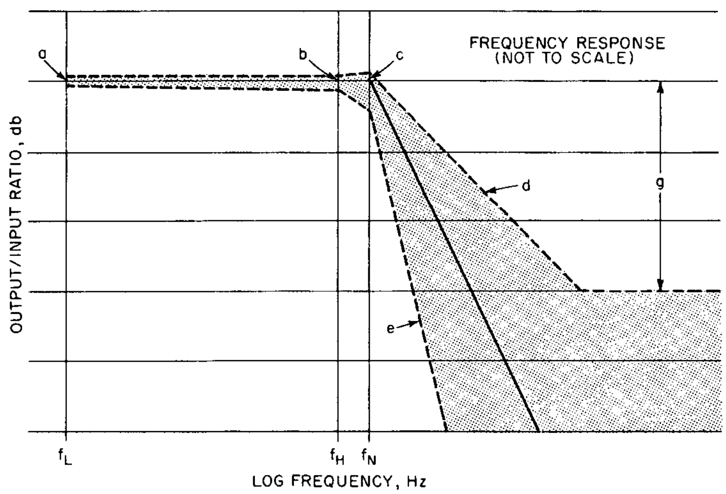
(b) Consideration should be given to the effect of cable length and temperature on frequency response.

3.3 Subsystem Evaluation—If desired, transducers and subsystems may be evaluated individually and the results factored into the total data channel accuracy, taking into account interaction effects.

4. Data Channel Selection—The selection of a frequency response class is dependent upon many considerations, some of which may be unique to a particular test. Engineering usage of the data and judgment will determine what portions of the frequency spectrum are significant or useful. The various classes of frequency response in Fig. 1 are intended to permit appropriate choices for different engineering requirements.

It is important to note that valid comparisons using different frequency response classes may be difficult to make. It is useful to establish specific frequency response classes when comparing test results from different sources. The frequency response classes in Table 1 are recommended for that purpose. These recommendations reflect current practices and equipment. However, it is recognized that other considerations (for example, biomechanics) may impose special instrumentation requirements.

The channel class recommendations for a particular application should not be considered to imply that all the frequencies passed by that channel are significant for the application. In several cases, such



FREQUENCY RESPONSE VALUES

Channel Class	f_L, Hz	a, dB	f_H, Hz	b, dB	f_N, Hz	c, dB	d, dB/octave	e, dB/octave	g, dB
1000	0.1	+½, −½	1000	+½, −1	1650	+1, −4	−6	−24	−30
600	0.1	+½, −½	600	+½, −1	1000	+1, −4	−6	−24	−30
180	0.1	+½, −½	180	+½, −1	300	+1, −4	−6	−24	−30
60	0.1	+½, −½	60	+½, −1	100	+1, −4	−6	−24	−30

FIG. 1—DATA CHANNEL DYNAMIC ACCURACY