

EQUIPMENT FRAGILITY DATA

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Revised

1. FOREWORD:

- 1.1 In the design of equipment packaging, the practice has been to select a cushioning material and a cushioning thickness by empirical and/or economic methods some of the time and by rather arbitrary or guess methods on other occasions.
 - 1.2 Judgment has played a large part in cushion design. Judgment based on safety to the product tends toward excess cushion and, when based on cost of cushion, tends toward inadequate cushion. The net result is a tendency for oversize and overweight packages or inadequate packages and no common ground has existed from which to judge the adequacy of a cushion.
 - 1.3 It has become the practice to design much equipment to resist a specified number of shocks in each of three mutually perpendicular directions. These shocks are usually defined as a number of "g's" or the ratio of terminal deceleration to 32.2 ft. per second per second. The definition is sometimes augmented by a specification of the time duration of the shock which is very important from the standpoint of energy imparted to the equipment. The product of "g's" and seconds (g - sec) is finding increasing use.
 - 1.4 The manner of presentation of shock test specifications has frequently not been a concise or precise description of the desired phenomenon. The test methods specified do not consistently and dependably duplicate the specified phenomena. It seems reasonable to expect that the method of specification and test can ultimately be rationalized and more precisely defined.
2. GENERAL: If equipment can be evaluated for a fragility rating in terms of physical shock and duration which it will generally withstand without damage, mathematical means may be devised whereby a proper cushion can be designed. It is recommended that the manufacturer consider determination of cushion design based on the following criteria:
- 2.1 Degree of shock (number of g's) which the equipment is known to withstand and the time duration of each shock, milliseconds.
 - 2.2 Total number of shocks (all directions) given equipment.
 - 2.3 Resonant frequencies in packaged equipment.

These data should be recorded and used for design in their most severe known satisfactory values and as subsequent testing may show more severe values to be satisfactory, the new figures should be used for guidance in package re-design.

3. CRITERIA FOR DETERMINING RATING:

- 3.1 Fragility rating is a group of numbers which forms a definition or specification of the largest magnitude of likely accidents and their nature which a device can tolerate without impairing its usefulness.

Section 7C of the SAE Technical Board rules provides that: "All technical reports...ing standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."



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- 3.2 The first significant evidence of change of performance characteristics occurs when the fragility rating has been exceeded.
- 3.3 Any evident mechanical damage shall be cause for suitable adjustment of the fragility rating or shall be cause for redesign at the option of the manufacturer.
- 3.4 Significant resonances up to 55 cps shall form a part of the rating or shall be the resonant element(s) subject to redesign at the option of the manufacturer.
- 3.5 It is the intent that the rating numbers be stated at the nearest practical point above which damage will occur and without introduction of safety factors.
- 3.6 It is recognized that test equipment may not be available for testing in the region of 2 to 10 cycles per second. Important resonances in this region may be determined by such other physical or mathematical measurement means as may prove practical.
4. REPORTING AND RECORDING OF FRAGILITY DATA: On request of authorized persons or agencies, fragility rating information should be reported in the form shown in Figure I.