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Dynamic modules

Part 6-5: Design guide — Investigation of operating mechanical shock and vibration tests for dynamic modules

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The UK participation in its preparation was entrusted by Technical Committee GEL/86, Fibre optics, to Subcommittee GEL/86/3, Fibre optic systems and active devices.

A list of organizations represented on this committee can be obtained on request to its secretary.

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FOREWORD

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IEC 62343-6-5, which is a technical report, has been prepared by subcommittee 86C: Fibre optic systems and active devices, of IEC technical committee 86: Fibre optics.

This second edition cancels and replaces the first edition published in 2011. It constitutes technical revision.

The main change with respect to the previous edition is the addition of "Results of a questionnaire on dynamic module operating shock and vibration test conditions" in Annex A.

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The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86C/1206/DTR	86C/1246/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62343 series, published under the general title *Dynamic modules,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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DYNAMIC MODULES –

Part 6-5: Design guide – Investigation of operating mechanical shock and vibration tests for dynamic modules

1 Scope

This part of IEC 62343, which is a technical report, describes an investigation into operating mechanical shock and vibration for dynamic modules. It also presents the results of a survey on the evaluation and mechanical simulation of mechanical shock and vibration testing. Also included is a study of standardization for operating mechanical shock and vibration test methods.

2 Background

The recent deployment of advanced, highly flexible optical communication networks using ROADM (*reconfigurable optical add drop multiplexing*) systems has been accompanied by the practical utilization of dynamic wavelength dispersion compensators, wavelength blockers and wavelength selective switches as “dynamic modules.” Since these dynamic modules incorporate such new technology as MEMS (*micro electromechanical systems*), there are concerns about the vulnerability to operating shock and vibration conditions, which urgently require establishing evaluation methods and conditions. Standards for shock and vibration test conditions pertaining to storage and transport are already established, but methods and conditions for evaluating operating shock and vibration are not yet established.

The JIS (*Japanese Industrial Standards*) committee consequently conducted a questionnaire survey on the shock and vibration testing of passive optical components and dynamic modules in commercial use. The survey revealed that many respondents confirmed a need to standardize evaluation conditions for operating shock and vibration; some suggested earthquake, hammer impact testing and inserting an adjacent board as cases of shock and vibration during dynamic module operation. Based on the survey results, the JIS committee evaluated operating shock and vibration by conducting hammer impact tests using several dynamic modules, compared the results through simulation, and then recommended specific evaluation conditions.

This technical report is based on OITDA (Optoelectronic Industry and Technology Development Association) – TP (Technical Paper), TP05/SP_DM-2008, "Investigation on operating vibration and mechanical impact test conditions for optical modules for telecom use."

3 Questionnaire results in Japan

The JIS committee conducted a questionnaire on operating shock and vibration testing. The questionnaire allowed the respondents to specify the optical components to be tested. This questionnaire included optical switches, VOAs (*variable optical attenuators*) and tuneable filters among the mechanical components used in all possible situations. The survey covered 18 organizations: eight Japanese manufacturers of mechanical optical components, eight device makers as users of such components, and two research institutes. Reponses were received from 14 of these organizations for a response rate of 78 %, among which 12 respondents specified optical switches, seven specified VOAs and three chose tuneable filters. In tabulating the data, the survey asked questions regarding these three types of components and described occurrences not dependent on the type of component, the manufacturer and the user, and evaluation conditions.

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The results revealed a strong need for the standardization of operating shock and vibration evaluation methods and conditions for such dynamic modules as optical switches and VOAs. A majority of respondents also requested that the hammer impact testing and the insertion of an adjacent PC board be included as cases of operating shock and vibration.

4 Evaluation plan

Based on the survey results described in Clause 3, the appropriate conditions for shock and vibration testing were determined based on an evaluation. The evaluation method consisted of the following three steps:

Step 1: Measure the shock and vibration characteristics of a board with a shock sensor inserted into a standard rack by striking the front face of the board with a hammer or by inserting an adjacent PC board.

Step 2: Test an optical module installed in a standard rack by repeating the procedure in Step 1. Measure any changes in the optical characteristics of the optical module.

Step 3: Use standard shock and vibration test equipment to reproduce the shock and vibration characteristics obtained in Step 1 and the optical characteristics of the optical module obtained in Step 2.

5 Evaluation results

5.1 Step 1

5.1.1 Evaluation of hammer impact

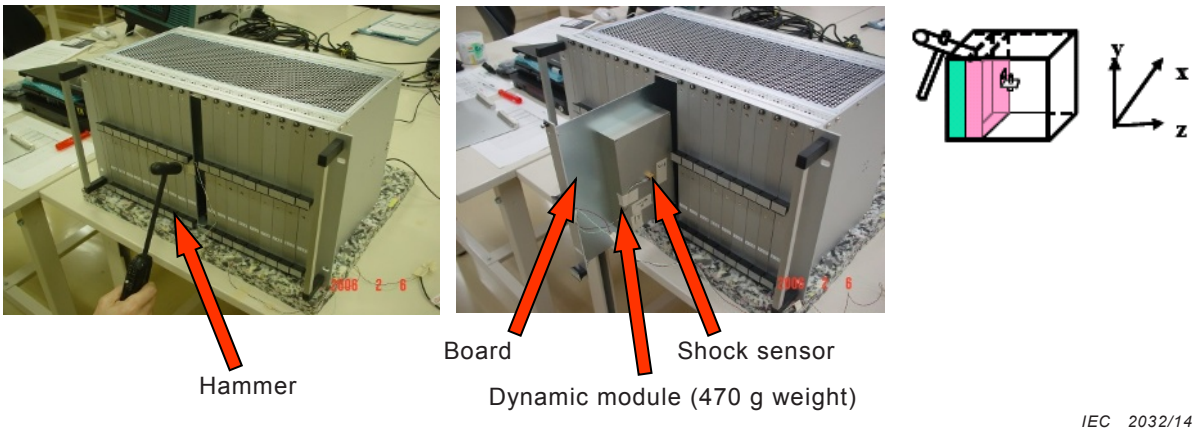

Figure 1 – Photos of evaluating hammer impact, rack and boards

A PC board with a shock sensor attached is inserted into the rack. The front of the board is then struck repeatedly by a hammer, along with an adjacent board being forcibly inserted in order to measure the impact and frequency detected by the shock sensor. The handles attached to the front edge of the rack are also forcibly struck by hand, with the impact being measured as well. Figure 1 shows photos of the hammer impact as well as the rack and PC boards. Table 1 below summarizes the specifications of the rack and PC boards, and the conditions of evaluating hammer impact and the acquisition of data.

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