IEC/TR 62627-03-01

Edition 1.0 2011-04

TECHNICAL REPORT

colour inside

Fibre optic interconnecting devices and passive components – Part 03-01: Reliability – Design of an acceptance test for fibre pistoning failure of connectors during temperature and humidity cycling: demarcation analysis

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE R

ICS 33.180.01

ISBN 978-2-88912-449-7

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 03-01: Reliability – Design of an acceptance test for fibre pistoning failure of connectors during temperature and humidity cycling: demarcation analysis

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62627-03-01, which is a technical report, has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

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

Enquiry draft	Report on voting
86B/2996/DTR	86B/3038/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 the IEC 62627 series, published under the general title *Fibre optic interconnecting devices and passive components,* 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Fibre optic connectors rely on accurate positioning of the fibre with respect to an optical interface to achieve and maintain acceptable performance. Degradation of performance due to fibre motion (fibre pistoning) is a well known failure mode. It is activated by temperature and humidity exposure, especially cyclic. Clause 3 provides background on the pistoning failure mode.

An acceptance test is an accelerated test designed to detect degradation or failure modes if they would occur during life, and to show no change if no degradation or failure modes will occur. A perfect acceptance test is impossible [1][1] because (a) there can always be non-accelerable failure modes and (b) some failures may occur under acceleration that may not occur in service. However, a well-designed acceptance test provides for a supplier a reasonable check of the space of accelerable modes and is of great value in testing for reliability.

Demarcation mapping provides a method of viewing possible chemical and physical processes that can occur during a given stress exposure over a given time [1-4] and allows for selection of accelerating test conditions that will produce potential degradation or failure mechanisms during service. Clause 2 provides an overview of the demarcation approach and its application to developing acceptance tests.

Clause 3 provides a discussion of plausible physical processes accompanying degradation and fibre pistoning, based on an assumed service environment. It includes some models based on these processes, and mathematical tools necessary to develop the demarcation maps. Clause 4 summarizes the results of a numerical experiment, using demarcation maps for each of the processes developed in Clause 3, to compare 20-year life in an extreme tropical climate with accelerated tests.

---

1 Figures in square brackets refer to the Bibliography.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 03-01: Reliability – Design of an acceptance test for fibre pistoning failure of connectors during temperature and humidity cycling: demarcation analysis

1 Scope

This part of IEC 62627 gives an example of the design of an acceptance test for ferrule style connectors when the dominant failure mode is fibre pistoning. The example applies to connectors which use epoxies or other adhesive polymers to bond the fibre into a ferrule. It combines existing evidence, mechanistic hypotheses and the demarcation approximation to develop an accelerated environmental exposure sequence that can be used on a pass-only basis to help ensure reliable service. This technical report was developed to serve only as an example of how accelerated acceptance tests can be designed. It is not intended as a normative standard for any specific application.