IEC/TR 62627-05

Edition 1.0 2013-10

TECHNICAL REPORT

colour inside

Fibre optic interconnecting devices and passive components – Part 05: Investigation on impact of contamination and scratches on optical performance of single-mode (SM) and multimode (MM) connectors

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE V

ICS 33.180.20

ISBN 978-2-8322-1159-5

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 05: Investigation on impact of contamination and scratches on optical performance of single-mode (SM) and multimode (MM) connectors

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/TR 62627-05, 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/3442/DTR	86B/3489A/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 the parts in 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

Contaminated optical connectors result in degradation of optical performance, which can be quantified by return loss (RL) and attenuation (A), functional failures and increased deployment costs. Fibre optic connector endface cleaning is recognized as a necessity for optimal signal performance. It is known that contamination impacts signal performance by blocking the core and impeding light transmission, as well as by preventing direct physical contact creating an air gap between the two connector enfaces [1, 2][1]. If an air gap exists, optical performance will be impacted due to the change in transmission medium. As contaminated connectors are mated and demated, contamination can be redistributed around the connectors' endface and block the fibre core. This presents a risk of signal performance degradation during the service life.

Since 2002, the iNEMI (International Electronics Manufacturing Initiative) working group has done substantial work, both theoretical and experimental, on impact of scratches and contamination on connector optical performance (A and RL). The following connector types have been used for this research: single-mode (SM) physical contact (PC) connectors, SM angle polished connectors (APC) and SM APC MPO connector. The impact of polishing scratches has been investigated for SM and multimode (MM) connectors. The work presented in this technical report was used as a base work for the development of IPC-8497-1 [3] and IEC 61300-3-35 [4].

[1] Figures in square brackets refer to the Bibliography.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS –

Part 05: Investigation on impact of contamination and scratches on optical performance of single-mode (SM) and multimode (MM) connectors

1 Scope

This part of IEC 62627, which is a technical report, summarizes the extensive industry research on development of cleanliness specifications for single-mode (SM) and multimode (MM) connectors.

The summary of the result shows Table 1.

Table 1 – Summary of the result

Samples		Scratch/Contamination/Defect	A/RL	Clause	Reference
SM/MM	Single-fibre/ multi-fibre				
SM PC	Single-fibre	Scratch	RL	3	[1], [5], [6]
MM PC	Single-fibre	Scratch	RL	4	[7]
SM PC	Single-fibre	Contamination	A and RL	5	[2], [6]. [8]
SM APC	Single-fibre	Contamination	A	7	[11]
SM APC	Single-fibre	Scratch	RL	7.2	[11]
SM APC	Multi-fibre	Contamination	A and RL	8	[12]

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61755-3-1, *Fibre optic connector optical interfaces – Part 3-1: Optical interface, 2,5 mm and 1,25 mm diameter cylindrical full zirconia PC ferrule, single mode fibre*