

Optical amplifiers —

Part 5-2: Qualification specifications — Reliability qualification for optical fibre amplifiers

The European Standard EN 61291-5-2:2002 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 61291-5-2:2002. It is identical with IEC 61291-5-2:2002.

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, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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Optical amplifiers
Part 5-2: Qualification specifications -
Reliability qualification for optical fibre amplifiers
(IEC 61291-5-2:2002)

Amplificateurs optiques
Partie 5-2: Spécifications de qualification -
Qualification de fiabilité pour
amplificateurs à fibres optiques
(CEI 61291-5-2:2002)

Lichtwellenleiter-Verstärker
Teil 5-2: Anerkennungsspezifikation -
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CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 86C/434/FDIS, future edition 1 of IEC 61291-5-2, prepared by SC 86C, Fibre optic systems and active devices, of IEC TC 86, Fibre optics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61291-5-2 on 2002-11-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-11-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B and ZA are normative and annex C is informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61291-5-2:2002 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

ISO 9001	NOTE	Harmonized as EN ISO 9001:2000 (not modified).
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ISO 9004	NOTE	Harmonized as EN ISO 9004:2000 (not modified).
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INTRODUCTION

This International Standard is dedicated to the subject of reliability qualification of optical amplifiers. Since the technology is quite new and still evolving, amendments and new editions to this document can be expected.

Each abbreviation introduced in this International Standard is explained in the text, at least the first time it appears. However, for an easier understanding of the whole text, a list of all abbreviations used in this International Standard is given in annex C.

OPTICAL AMPLIFIERS –

Part 5-2: Qualification specifications – Reliability qualification for optical fibre amplifiers

1 Scope and object

This International Standard applies to optical amplifiers (OAs) and optically amplified, elementary sub-systems for terrestrial applications, using active fibres (optical fibre amplifiers, OFAs), containing rare-earth dopants, which are commercially available.

The black box approach is used in this IEC standard. The black box approach is adopted in order to give product specifications which are independent of OA implementation details. For reliability qualification purposes, some information about the internal components is needed; these internal parts are themselves treated as black boxes. This standard gives requirements for the evaluation of OA reliability by combining the reliability of such internal black boxes.

The objects of this International Standard are the following:

- to specify the requirements for the reliability assessment of OFAs;
- to provide assistance to the purchaser in the selection of consistently high quality OA products for his particular applications;
- to give the minimum list of reliability qualification tests, requirements on failure criteria during testing and on reliability predictions, and give the relevant normative references.

In particular, this International Standard is intended:

- to establish a standard method for the assessment of the reliability of OFA devices and sub-systems in order to minimize risks and to promote product development and reliability qualification;
- to establish means to determine the distribution of failures in time in order to enable the determination of equipment failure rates for specified end-of-life criteria.

In addition, guidance is given on:

- the controls a customer should make, prior to procurement of an OFA, on the test procedures an OFA manufacturer has in place in order to guarantee product reliability;
- the procedures to verify the reliability claims of an OFA manufacturer.

2 Normative references

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

IEC 60068-2-1, *Environmental testing – Part 2: Tests. Tests A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2: Tests. Tests B: Dry heat*

IEC 60068-2-3, *Environmental testing – Part 2: Tests. Test Ca: Damp heat, steady state*

IEC 60068-2-6, *Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2: Tests. Test N: Change of temperature*

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27, *Environmental testing. Part 2: Tests. Test Ea and guidance: Shock*

IEC 60068-2-32, *Environmental testing. Part 2: Tests. Test Ed: Free fall (Procedure 1)*

IEC 60068-2-56, *Environmental testing – Part 2: Tests. Test Cb: Damp heat, steady state, primarily for equipment*

IEC 61300-2-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*

IEC 61300-2-2, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-2: Tests – Mating durability*

IEC 61300-2-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/cable retention*

IEC 61300-2-5, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion/twist*

IEC 61300-2-9, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*

IEC 61300-2-18, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-18: Tests – Dry heat – High temperature endurance*

IEC 61300-2-19, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-19: Tests – Damp heat (steady state)*

IEC 61300-2-22, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*

IEC 61300-2-42, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-42: Tests – Static side load for connectors*

IEC 61291-1, *Optical fibre amplifiers – Part 1: Generic specification*

IEC 61751, *Laser modules used for telecommunication – Reliability assessment*

ISO 9000, *Quality management systems – Fundamentals and vocabulary*

3 Terms and definitions

For the purposes of this part of IEC 61291, the definitions given in IEC 61291-1 and the following apply.

NOTE For ease of reference the definition of OA reliability given in IEC 61291-1 is reported below (definition 3.7).

3.1

failure

non-compliance to product specification or change in parameters as agreed by the customer and supplier

3.2

OFA manufacturer (OFAM)

manufacturer who provides OFA devices or subsystems meeting the requirements of the applicable detail specification (DS)

3.3

system supplier (SS)

manufacturer of fibre-optic telecommunication equipment containing OFAs (that is, the OFA customer)

3.4

system operator (SO)

telecommunication operator using fibre-optic systems with OFAs in the transmissions path

3.5

component supplier (CS)

manufacturer providing the OFAM with components meeting the requirements of the applicable detail specification (DS)

3.6

capability qualifying component (CQC)

components or sub-assemblies representing critical stages of the manufacturing process and limiting the characteristics of mechanical and electro-optic design

NOTE Such components or sub-assemblies enable the determination of activation energies and help in the identification of final product failure mechanisms.

3.7

reliability

a) minimum period of OA continuous operation without any faults at specified operating and environmental conditions;

b) probability of faults per year at specified operating and environmental conditions

NOTE The reliability of an OA is expressed by either of the following two parameters: mean time before failure (MTBF) and failure in time (FIT):

The MTBF is the mean period of OFA continuous operation without any failure at specified operating and environmental conditions.

The FIT is the number of failures expected in 10^9 hours at specified operating and environmental conditions.