

PRE-STANDARD

**Fibre optic interconnecting devices
and passive components –
Reliability of fibre optic interconnecting
devices and passive optical components –**

**Part 9-2:
Reliability qualification for
fibre optic connectors**

PUBLICLY AVAILABLE SPECIFICATION



INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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Withdrawn

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P U B L I C L Y A V A I L A B L E S P E C I F I C A T I O N



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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – RELIABILITY OF FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE OPTICAL COMPONENTS

Part 9-2: Reliability qualification for fibre optic connectors

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public.

IEC/PAS 62005-9-2 has been processed by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:

Draft PAS	Report on voting
86B/1818/PAS	86B/1838/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

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This PAS shall remain valid for an initial maximum period of 3 years starting from 2003-03. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

INTRODUCTION

This PAS/Pre-standard has been produced by IEC/TC 86 Fibre Optics, SC 86B Fibre Optic Interconnecting Devices and Passive Optical Components, WG 5 Reliability of Fibre Optic Interconnecting Devices and Passive Components.

Both a Performance Qualification Standard (PQS) and a Reliability Qualification Standard (RQS) define a set of prescribed conditions and contain a series or a set of tests and measurements (which may or may not be grouped into a specific schedule) with clearly defined conditions, severities and pass/fail criteria. The tests are intended to be run on a 'once-off' basis to prove the product's ability to satisfy the performance or reliability requirements of a specific application, market sector or user group.

The subsequent parts of this PAS/Pre-standard contain those sets of reliability criteria that have been standardized for international use. A product that has been shown to meet all the requirements of a reliability standard may be declared as complying with that reliability standard.

It is recognised that component reliability qualification could be accomplished in alternative ways. The procedures in this standard are a baseline, but other qualification methods could prove to be more cost-effective. Alternative methods may be included in future revisions of this PAS/Pre-standard if they are demonstrated to be effectively equivalent to the baseline procedures.

Compliance with an RQS demonstrates that a product has met its optical and mechanical performance over the duration of the applied test programs. Consistency of manufacture should be maintained using a recognized Quality Assurance program.

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – RELIABILITY OF FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE OPTICAL COMPONENTS

Part 9-2: Reliability qualification for fibre optic connectors

1 Scope

This PAS/Pre-standard applies to passive optical components and optical elements such as connectors, patchcords, pig-tails.

As the optical power of transmission systems increases, high-power ageing and optical transient effects may become important for some components. At present, limited data and understanding are available for the development of reliability tests for high optical power; therefore, these are not included in this PAS/Pre-standard.

2 Normative References

The following standards contain provisions that, through reference in this text, constitute provisions of this PAS/Pre-standard. All standards are subject to revision, and parties to agreement based on this PAS/Pre-standard are encouraged to use the most recent editions. A catalogue of current IEC and ISO standards can be found on <http://www.iec.ch> and <http://www.iso.ch>, respectively.

IEC 61753-1, *General and guidance for performance standards*

IEC 61300 series, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*

IEC 62005 series, *Reliability of fibre optic interconnecting devices and passive components*

NOTE Informative (not normative) references are given in Section 8.

3 Definitions

The following definition applies for the purpose of this PAS/Pre-standard:

Reliability standard test report: A fully documented report which contains supporting evidence that the reliability tests have been carried out and the stated performance requirements met.

4 Preparation of the Reliability Qualification Standard

In the preparation of the RQS, the following items were considered and instructions pertaining to them included: Product Definition, Service Environments, Tests, Details, Requirements, Sample Size, Groupings/Sequences, Pass/Fail Criteria, and Reference Product Definition.

4.1 Product Definition

The passive optical component product to which the RQS relates shall be clearly defined, for example, any of those components mentioned in the Scope above.

4.2 Service Environments

These are taken from and defined in IEC 61753-1 as follows:

Table 1 – Categories of service environments for fibre optic connectors

Category	Environment
C	controlled
U	uncontrolled

U = An uncontrolled environment (tests are intended to be run sequentially)

C = A controlled environment (typically within an office or building)

Reliability qualification testing for categories E and O are subject for further study.

4.3 Tests

The tests to be carried out on the product for it to meet the reliability standard shall be clearly defined. No ambiguity or options are allowed. The tests selected/combined with the severities/durations, groupings/sequencing, method used and pass/fail criteria are indicative of a defined product location within a service environment.

The test method to be used shall be clearly defined for each test. Wherever possible the test method shall be selected from the IEC 61300 series. Where this is not possible, other test methods may be defined. If a previously undefined test method is used, the test method and details to be specified shall be included in an Annex of the RQS.

In some cases the user may wish to test the product to this PAS/Pre-standard and to a particular operating service environment found in 61753-1-1. Testing to the more severe conditions found in either standard shall be regarded as having satisfied the criteria for both standards, without the need for performing redundant, tests of a lesser severity of environment and duration.

4.4 Details

The details to be considered, severities, and durations, are given for all tests and measurements called up in the RQS. These are related to the requirements specified for a product location within a service environment that the reliability standard is intended to equate to. No ambiguity or options are allowed.

4.5 Requirements

The reliability requirements that must be satisfied for the product to comply with the RQS is specified for each test and/or measurement. No ambiguities are allowed.

4.6 Groupings/sequences

Test grouping and sequencing shall be subject to agreement between the seller and buyer. Where agreed, tests may be performed in parallel to facilitate testing.

NOTE Parallel testing allows completion of reliability qualification in a shorter period of time. Sequential testing may induce cumulative stress effects causing a specific failure mechanism during the next testing steps.

4.7 Sample size

For sequential testing, the default number of samples is 11. For parallel testing, the default number of samples is 11 unless it is made larger as agreed by the seller and the buyer.

All samples shall be taken from production and shall be representative of normal production output. Normal screens (IEC 62005-4), if any, shall be performed before beginning testing; additional screening is not allowed.

4.8 Pass/fail criteria

The pass/fail criteria are to be stated for each test and each passive optical component. (Examples are change in insertion loss, return loss, with no change to the outside appearance.) The component passes if there are no failures for 11 samples. If a single failure does occur, the test must be repeated.

4.9 Reference product definition

Where a reference product is called for in any of the Test and Measurement Methods used within the RQS, the reference product shall be clearly defined. Reliability qualification by similarity (testing a similar but not identical product) is a matter of negotiation between the seller and buyer.

4.10 Reliability standard test report

Conformance to the RQS shall be supported by a Test Report. The Test Report may be prepared by an independent test laboratory. The Test Report shall clearly demonstrate that the tests were carried out as per the requirements of the RQS and provide full details of the tests together with a Pass/Fail declaration.

Any product failing a particular test or sequence of tests shall be reported in the RQS Test Report. The cause of the failure shall be given and any corrective action taken shall be described. If no significant design or process changes are made to the product, the test or test sequence where the failure occurred shall be rerun with the results of both the tests reported.

Any significant design or process changes shall be identified in the reliability standard test report. In this case, the full set of reliability tests must be rerun and the results reported.

5 Reliability qualification tests for fibre optic connectors

This clause contains test lists and test conditions suitable to assess the reliability of interconnecting devices and passive optical components (seen as black boxes). These reflect the common practice in the industry.

NOTE IEC References included in the following tables are subject to updating, to include new documents as they are published.

Table 2 describes the tests required for fibre optic connectors in a controlled environment (Category C) and table 3 describes tests in an uncontrolled environment (Category U).

The optical performance is monitored during and just after each test. Conformance to this standard requires that optical performance and mechanical performance both meet specifications during and after each test.

Under "Duration": the letter Q means "for qualification" and the letter I means "for information". Nonconformances to Section 4.8 for the latter does not constitute non-conformance with this PAS/Pre-standard, but shall be reported in the Test Report.

Table 2 – Reliability tests required for fibre optic connectors used in the controlled service environment of Category C

Nr.	Test	Conditions	Duration/Number	IEC Ref.
1	Attenuation	1 310 ± 30 nm / 1 550 nm Specified class		61300-3-4
2	Return Loss	1 310 ± 30 nm / 1550 nm Specified class		61300-3-6 Method 1
3	Fibre cable retention	50 N ± 2 N reinforced cables 5 N ± 0,2 N for coated fibres Specified class	Duration of extreme force: 2 minutes	61300-2-4
4	Tensile Strength of Coupling Mechanism	40 N ± 1 N Specified class	Duration of extreme force: 2 minutes	61300-2-6
5	High temperature storage (Dry heat - High temperature endurance)	$T_{\text{stg max}} = 70 \pm 2 \text{ }^{\circ}\text{C}$ <40 % RH (uncontrolled) IL monitoring	Q = 2 000 h $\Delta\text{IL} \leq 0,5 \text{ dB}$	61300-2-18
6	Humidity cycling	high temperature: +55 °C low temperature: +25 °C relative Humidity: 90..100 % RH IL monitoring +25 °C	Q = 100 cycles $\Delta\text{IL} \leq 0,5 \text{ dB}$	61300-2-46
7	Change of Temperature	Temperature: $-25 \pm 2 \text{ }^{\circ}\text{C}$ to $70 \pm 2 \text{ }^{\circ}\text{C}$ Rate of temperature: 1 °C/min Humidity: uncontrolled IL monitoring	Q = 500 cycles $\Delta\text{IL} \leq 0,5 \text{ dB}$	61300-2-22
8	Attenuation	1310 ± 30 nm / 1550 nm Specified class		61300-3-4
9	Return Loss	1 310 ± 30 nm / 1 550 nm Specified class		61300-3-6 Method 1
10	Fibre cable retention	50 N ± 2 N reinforced cables 5 N ± 0,2 N for coated fibres Specified class	Duration of extreme force: 2 minutes	61300-2-4
11	Tensile Strength of Coupling Mechanism	40 N ± 1 N Specified class	Duration of extreme force: 2 minutes	61300-2-6
12	Mating durability	IL monitoring 50 cycles Specified class		61300-2-2

NOTE Test 4 only for push-pull connectors.

General note: Test severities are changed because the performance of the products are tested by specific performance standards. RL measurements are not necessary due to the IL monitoring.

Table 3 – Reliability tests required for fibre optic Connectors used in the uncontrolled environment of Category U

Nr.	Test	Conditions	Duration/Number	IEC Ref.
1	Attenuation	1 310 ± 30 nm / 1 550 nm Specified class		61300-3-4
2	Return Loss	1 310 ± 30 nm / 1 550 nm Specified class		61300-3-6 Method 1
3	Fibre cable retention	50 N ± 2 N reinforced cable / 1 550 nm 5 N ± 0,2 N for coated fibres	Duration of extreme force: 2 minutes	61300-2-4
4	Tensile Strength of Coupling Mechanism	40 N ± 1 N / 1550 nm	Duration of extreme force: 2 minutes	61300-2-6
5	High temperature storage (Dry heat - High temperature endurance)	$T_{stg\ max} = 85 \pm 2\ ^\circ\text{C}$ <40 % RH IL monitoring	Q = 2000 h $\Delta\text{IL} \leq 0,5\ \text{dB}$	61300-2-18
6	Humidity Cycling	high temperature: +55 °C low temperature: +25 °C relative Humidity: 90..100 % RH IL monitoring +25 °C	Q = 100 cycles $\Delta\text{IL} \leq 0,5\ \text{dB}$	61300-2-46
7	Change of Temperature	Temperature: $-40 \pm 2\ ^\circ\text{C}$ to $85 \pm 2\ ^\circ\text{C}$ Rate of temperature: 1 °C/min Humidity: uncontrolled IL monitoring	Q = 500 cycles $\Delta\text{IL} \leq 0,5\ \text{dB}$	61300-2-22
8	Attenuation	1 310 ± 30 nm / 1550 nm Specified class		61300-3-4
9	Return Loss	1 310 ± 30 nm / 1 550 nm Specified class		61300-3-6 Method 1
10	Fibre cable retention	50 N ± 2 N reinforced cable / 1 550 nm 5 N ± 0,2 N for coated fibres	Duration of extreme force: 2 minutes	61300-2-4
11	Tensile Strength of Coupling Mechanism	40 N ± 1 N / 1 550 nm	Duration of extreme force: 2 minutes	61300-2-6
12	Mating durability	IL monitoring 50 cycles Specified class		61300-2-2

NOTE Test 4 only for push-pull connectors.

General note: Test severities are changed because the performance of the products are tested by specific performance standards. RL measurements are not necessary due to the IL monitoring.

Notes to tables 2 and 3 above:

1 $T_{stg,min}$: minimum storage temperature

2 $T_{stg,max}$: maximum storage temperature

3 The failure criteria depends on the component and may be a drift in insertion loss, in return loss, a change in appearance, and any other non conformance to the relevant specification.

4 The fibre and cable integrity tests shall be applicable to passive components which incorporate fibre or fibre cable pigtails in their product design.

6 Informative references

IEC 62005 series, Reliability of Fibre Optic Interconnecting Devices and Passive Components

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