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## Foreword

This draft Interim European Telecommunication Standard (I-ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI), and is now submitted for the Public Enquiry phase of the ETSI standards approval procedure.

An ETSI standard may be given I-ETS status either because it is regarded as a provisional solution ahead of a more advanced standard, or because it is immature and requires a "trial period". The life of an I-ETS is limited to three years after which it can be converted into an ETS, have its life extended for a further two years, be replaced by a new version, or be withdrawn.

<b>Proposed announcement date</b>	
Date of latest announcement of this I-ETS (doa):	3 months after ETSI publication

## Introduction

This is a draft I-ETS on fusion splices for optical fibres. The optical fibres are those described in EN 188100 [4] and EN 188101 [5]. The splices considered are between single fibres, between ribbon fibres and between ribbon and multiple single fibres.

In order to obtain the required functional behaviours of the fusion splices, it is necessary to follow a number of procedures for fibres preparation, fibres alignment, jointing and protection as described in CCITT Recommendation L.12 [6].

All the following requirements are referred to the protected splice measured in a laboratory. The I-ETS is intended to provide criteria for the assessment of splicing equipment and techniques, including the splice protector.

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## 1 Scope

This Interim European Telecommunication Standard (I-ETS) specifies requirements of fusion splices to be used in single mode optical fibre telecommunications land based (not submarine) systems. The scope covers the establishment of minimum uniform requirements for the following aspects:

- optical, environmental and mechanical properties;
- test conditions;
- acceptance criteria.

Some users may have additional specific requirements, such as the need to verify performance at lower temperatures. These users should specify splices conforming to the basic ETSI performance standard, plus the additional tests or more severe test conditions.

For the purpose of qualification, a splice is defined as "fusion spliced fibres protected by a splice protector with fibre tails of 1,5 metres on each side of the splice protector". A minimum length of 1,5 m on each side of the splice protector needs to be exposed to the test conditions of all climatic and environmental tests.

## 2 Normative references

This I-ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this I-ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- |     |   |
|-----|---|
| [1] | IEC 1073-1: "Splices for optical fibres and cables - Part 1: Generic specification - Hardware and accessories".   |
| [2] | ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment".   |
| [3] | IEC specification 1300-3-6: "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Examinations and measurements - Part 3-6: Return loss". |
| [4] | EN 188100: "Sectional Specification: Single-mode (SM) optical fibre".   |
| [5] | EN 188101: "Family Specification: Single-mode dispersion unshifted (B1.1) optical fibre".   |
| [6] | CCITT Recommendation L.12 (1992): "Optical fibre joints".   |

## 3 Abbreviations

For the purposes of this I-ETS, the following abbreviations apply:

OTDR	Optical Time Domain Reflectometer
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## 4 Tests

All tests called for by this specification shall be carried out in accordance with the prescribed IEC standard tests defined in IEC 1073-1 [1].

All optical tests shall be carried out in both the 1 310 nm window and the 1 550 nm window unless otherwise stated. Light sources with peak wavelengths of  $1\ 310 \pm 30$  nm and  $1\ 550 \pm 30$  nm shall be used.

In this I-ETS, a performance requirement stating that there shall be no change in attenuation shall be interpreted as a change of less than  $\pm 0,05$  dB to allow for measurement uncertainties.

#### 4.1 Attenuation

In accordance with IEC 1073-1 [1] subclause 3.5.1, method 1 or method 6.

Details:

- fibre lengths (L) (for method 1): L > 4 m, L1 > 2 m, L2 > 2 m;
- fibre lengths (L) (for method 6): L1 > 1 km, L2 > 1 km.

Requirements:

Category	mean attenuation (note)	maximum attenuation
<b>Single fibres:</b>		
Class I	≤ 0,10 dB	≤ 0,20 dB (99 %)
Class II	≤ 0,20 dB	≤ 0,50 dB (95 %)
<b>Ribbon and multiple fibres:</b>		
Class III	≤ 0,40 dB	≤ 0,80 dB (95 %)
NOTE: Applies to 1 310 nm and 1 550 nm.		

#### 4.2 Return loss

In accordance with IEC 1073-1 [1], subclause 3.5.4.

Alternatively, the return loss may be measured using an Optical Time Domain Reflectometer (OTDR) in accordance with IEC 1300-3-6 [3] method 2. If this method is used, the OTDR pulse length shall be selected to give return loss measurements equivalent to those which would be given by the coupler based technique.

Requirements:

- allowable return loss: > 60 dB.

Throughout all the environmental and climatic tests, the return loss shall be > 60 dB.

#### 4.3 Vibration (sinusoidal)

In accordance with IEC1073-1 [1], subclause 3.6.2.

Details:

- frequency range: 10-55 Hz;
- endurance duration per axis: 0,5 hour;
- number of axes: three orthogonal;
- number of cycle (10-55-10 Hz): 15;
- vibration amplitude: 0,75 mm.

Requirements:

- during the test the attenuation shall be within ± 0,10 dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at 1 550 ± 30 nm before, during and after the test. The maximum sampling interval during the test shall be 2 ms.



#### 4.4 Effectiveness of fibre retention (pulling)

In accordance with IEC1073-1 [1], subclause 3.6.4.

Details:

- magnitude and rate of application of the tensile load:  $5 \pm 0,5$  N at a speed of 0,5 N/s;
- duration at the maximum load: 60 seconds.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at least once while the load is at the maximum level.

#### 4.5 Effectiveness of fibre retention (fibre flexing)

In accordance with IEC1073-1 [1], subclause 3.6.4.

Details:

- axial force: 2 N;
- point of application: 0,30 m from the end face of the splice;
- maximum bending angle:  $\pm 90^\circ$ ;
- number of cycles: 50.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at least once every time that the bending angle is at the maximum level.

#### 4.6 Cold

In accordance with IEC1073-1 [1], subclause 3.7.2.

Details:

- temperature:  $- 25^\circ\text{C}$ ;
- duration of exposure: 16 hours;
- pre-conditioning procedure: 2 hours at normal ambient conditions;
- recovery procedure: 2 hours at normal ambient conditions.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at a maximum interval of 1 hour.

#### 4.7 Damp heat (steady state)

In accordance with IEC1073-1 [1], subclause 3.7.4.

Details:

- temperature: + 40°C;
- relative humidity: 93 %;
- duration of exposure: 96 hours;
- pre-conditioning procedure: 2 hours at normal ambient conditions;
- recovery procedure: 2 hours at normal ambient conditions.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at a maximum interval of 1 hour.

#### 4.8 Dry heat

In accordance with IEC1073-1 [1], subclause 3.7.3.

Details:

- temperature: + 70°C;
- duration of exposure: 96 hours;
- pre-conditioning procedure: 2 hours at normal ambient conditions;
- recovery procedure: 2 hours at normal ambient conditions.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at a maximum interval of 1 hour.

#### 4.9 Change of temperature

In accordance with IEC1073-1 [1], subclause 3.7.7.

Details:

- high temperature: + 70°C;
- low temperature: - 25°C;
- temperature rate of change: 1°C/minute;
- duration at extreme temperatures: 1 hours;
- number of cycles: 12;
- pre-conditioning procedure: 2 hours at normal ambient conditions;
- recovery procedure: 2 hours at normal ambient conditions.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at a maximum interval of 10 minutes.

#### 4.10 Condensation

This test shall be carried out on splices which are to be used in weather protected environments corresponding to ETS 300 019 [2], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [2], class 4.1.

In accordance with IEC1073-1 [1], subclause 3.7.6.

Details:

- pre-conditioning procedure: 2 hours at normal ambient conditions;
- recovery procedure: 2 hours at normal ambient conditions.

Requirements:

- during the test the attenuation shall be within  $\pm 0,10$  dB of the initial value. On completion of the test there shall be no difference between the initial and final attenuation;
- the attenuation shall be measured at  $1\ 550 \pm 30$  nm before, during and after the test. During the test the attenuation shall be measured at a maximum interval of 10 minutes.

#### 4.11 Water immersion

This test shall be carried out on splices which are to be used in weather protected environments corresponding to ETS 300 019 [2], classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [2], class 4.1.

At present there are several different user requirements. ETSI is attempting to harmonize these requirements. Until this is achieved, water immersion testing should be carried out in accordance with specific user test methods and requirements.

### 5 Acceptance criteria

Fusion splicing machines used to produce splices conforming to the performance requirements of this I-ETS are required to demonstrate conformance by means of the following test procedure.

A minimum of 100 splices shall be made using randomly oriented fibre conforming to the standards quoted in the introduction of this I-ETS.

Category	mean attenuation (note)	maximum attenuation	Notes
<b>Single fibres:</b>			
Class I	$\leq 0,10$ dB	$\leq 0,20$ dB (99 %)	core concentricity error of fibre used for qualification shall be $\geq 0,4$ $\mu\text{m}$ .
Class II	$\leq 0,20$ dB	$\leq 0,50$ dB (95 %)	
<b>Ribbon and multiple fibres:</b>			
Class III	$\leq 0,40$ dB	$\leq 0,80$ dB (95 %)	
NOTE: Applies to 1 310 nm and 1 550 nm.			

## History

Document history	
August 1996	Public Enquiry PE 112: 1996-08-19 to 1996-12-13