INTERIM EUROPEAN TELECOMMUNICATION STANDARD

DRAFT
pr **I-ETS 300 671**
September 1995

Source: ETSI TC-TM

Reference: DI/TM-01029

ICS: 33.180.20

Key words: Optical transmission, optical connectors

Transmission and Multiplexing (TM); Passive optical components; Fibre optical connectors for single-mode optical fibre communication systems; Common requirements and conformance testing

ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Foreword 5

1 Scope 7

2 Normative references 7

3 Symbols 7

4 Details, measurements and performance requirements 7
4.1 Visual Inspection 8
4.1.1 Overall inspection of connectors 8
4.1.2 Inspection of the end face 8
4.2 Dimensions 8
4.3 Insertion loss 8
4.4 Return loss 8
4.5 Vibration (sinusoidal) 9
4.6 Effectiveness of fibre or ferrule retention 9
4.7 Pulling 9
4.8 Torsion 10
4.9 Strength of coupling mechanism 10
4.10 Drop test 11
4.11 Static side load test 11
4.12 Cold 11
4.13 High temperature endurance 12
4.14 Damp heat (steady state) 12
4.15 Change of Temperature 13
4.16 Mechanical endurance 13
4.17 Corrosive atmosphere (salt mist) 14
4.18 Industrial atmosphere 14
4.19 Dust 15
4.20 Condensation Test 15
4.21 Intermateability 16
4.21.1 Insertion loss measurement 16
4.21.2 Return loss measurement 16
4.21.3 Change of temperature 16
4.21.4 Mechanical endurance 16
4.21.5 Strength of coupling mechanism 16
4.22 Endurance test at high power 16
4.23 Mechanical measurements accuracy 16
4.24 Reliability 16

Annex A (informative): Bibliography 17

History 18

Blank page

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it can be converted into an ETS, have it's life extended for a further two years, be replaced by a new version, or be withdrawn.

Proposed announcement date	
Date of latest announcement of this I-ETS (doa):	3 months after ETSI adoption

Blank page

1 Scope

This Interim European Telecommunication Standard I-ETS specifies requirements of the connector set to be used in single-mode optical fibres telecommunication systems; the scope covers establishment of uniform requirements for the following aspects:

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

Acceptance criteria will be interpreted with the consideration that some of the parameters specified in this I-ETS may be affected by measurement uncertainty arising either from measurement or calibration errors. Test methods are in accordance with EN 186 000-1 [1] specifications.

The connector set is defined as: "The complete set of connector components required to provide demountable coupling between one or more pairs of optical fibres."

2 Normative references

This I-ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place 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] EN 186 000-1: "Generic Specification: Connectors for Optical fibres and cables".

[2] EN 186 005: "Blank Detail Specification: Connectors for Optical fibres and cables. Environmental Category V".

[3] IEC 874-1 Amendment 1 (1994): "Connectors for optical fibres and cables. Part1: Generic specification".

3 Symbols

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

dB	decibel
h	hour(s)
Hz	Herz
m	meter
N	newton(s)
mm	millimeters
nm	nanometers
ppm	parts-per-million
s	second

4 Details, measurements and performance requirements

All specified environmental tests in this clause are in accordance with EN 186 005 [2], table 1, with the exception of 3.17 (Corrosive Atmosphere), 3.18 (Industrial Atmosphere) and 3.19 (Dust).

All measurements shall be carried out under normal room conditions, unless otherwise stated. Before the insertion and return loss measurement, careful cleaning (e.g. using alcohol) is necessary.

All optical tests shall be carried out at a light wavelength of 1 310 nm and/or 1 550 nm.
Additionally the wavelength region from 1 600 to 1 650 nm is of increasing interest for monitoring telecommunication cable networks. In this case the allowed limits are under consideration.

4.1 Visual Inspection

4.1.1 Overall inspection of connectors

Each connector shall be properly packed. The package shall be marked with the name of the manufacturer and the production date. Depending on the requirements the connector type will be indicated on the connector assembly.

The connector itself shall be legibly and durably marked with the identity mark of the manufacturer and the manufacturing date code.

4.1.2 Inspection of the end face

The end face shall be clean without any remaining glue. Using a commercial microscope with a maximum magnification of 200x no significant scratches and break out of glass pieces shall be seen. This is mainly required for the centre of the fibre.

4.2 Dimensions

Size dimensions, measurement methods, etc. are specified in the relevant connector specifications.

4.3 Insertion loss

Details:

In accordance with EN 186 000-1 [1] subclause 4.4.7, method 7 (measurements against a reference plug). The excentricity of the reference connector plug (centre of fibre to centre of ferrule) shall be $\leq$ 0,3 µm. The other parameters of the reference plug depend on the connector type and shall be specified by the user.

Launch mode conditions: only the fundamental mode shall propagate at the connector interface and at the detector.

Requirements:

- allowable insertion loss: 0,50 dB max.;
- 0,20 dB mean (minimum sample size 20 connectors).

4.4 Return loss

Details:

In accordance with EN 186 000-1 [1] subclause 4.4.12, method 3 (coupler method).

Launch fibre length: L > 2 m.

Source stability: $\pm$ 0,20 dB over the measuring period or at least one hour.

Reference connector: the reference connector shall be specified and shall belong to the same class.

Requirements:

Unless the user specifies a specific minimum, one of the following limits shall apply:

Allowable return loss:

- >25 and ≤35 dB for standard mated connectors;
- >35 and ≤50 dB for low-reflection mated connectors;
- >50 dB for ultra low-reflection mated connectors;
- >55 dB for ultra-low reflection mated and/or unmated connectors.

4.5 Vibration (sinusoidal)

Details:

In accordance with EN 186 000-1 [1] subclause 4.5.1

Frequency range: 10 - 55 Hz.

Endurance duration per axis: 0,5 h.

Number of axes: three orthogonal.

Number of cycles (10-55-10): 15.

Vibration amplitude: 0,75 mm.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, during and after the test as specified in subclause 4.3.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.6 Effectiveness of fibre or ferrule retention

In accordance with EN 186 000-1 [1] subclause 4.5.2.

Details and performance requirements are to be defined.

4.7 Pulling

Details:

In accordance with EN 186 000-1 [1] subclause 4.5.4.

Magnitude and rate of application of the tensile load:

- 100 ± 5 N at a speed of 5 N/s for reinforced cables;
- 5 ± 0,5 N at a speed of 0,5 N/s for coated fibres.

Point of application of the tensile load:

- 0,3 m from the end-face of the connector [1)].

[1)] Lateral force caused by the machine-eccentricity depends on point of application of the force.

Duration of the test (maintaining the load):

- 120 s at 100 N;
- 60 s at 5 N.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before and after the test as specified in subclause 4.3. Depending on the agreement between manufacturer and user the insertion loss shall also be measured during the test.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.8 Torsion

Details:

In accordance with IEC 86B/561/DIS (to be published) (informative annex A)

Magnitude and rate of application of the tensile load:

- 15 N at a speed of 1 N/s for reinforced cable;
- 2 N at a speed of 0,1 N/s for coated fibre.

Point of application of the tensile load:

- 0,2 m from the end face of the connector.

Duration of the test:

- 10 to 25 cycles, (not to exceed the cable specification) ± 180°.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, during and after the test as specified in subclause 4.3.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.9 Strength of coupling mechanism

The test is applicable on push-pull connector types (for bayonet types the coupling torque shall be ≤ 0,15 Nm).

In accordance with EN 186 000-1 [1] subclause 4.5.6.

Details:

- Magnitude of the tensile load: 40 N;
- rate of application of the load: 2 N/s;
- point of application of the load: 0,2 m from the specimen;
- duration of the test (maintaining the load): 120 s.

Requirements:

Allowable loss variation:

- $\leq$ 0,20 dB.

The insertion loss shall be measured before, during and after the test as specified in subclause 4.3.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.10 Drop test

Details:

In accordance with EN 186 000-1 [1] subclause 4.5.14

- Number of drops: 5;
- drop height: 1,5 m.

Requirements:

Allowable loss variation:

- $\leq$ 0,20 dB.

The connector may be cleaned after the test, before measurement.

4.11 Static side load test

Method under consideration.

Details:

- Magnitude of the tensile load: 1 N (reinforced cable);
- (90° to the connector axis) 0,2 N (for buffered fibre);
- point of application of the tensile load: 0,5 m from the end-face of the connector;
- duration of the test (maintaining load): 1 h for each tensile load.

Requirements:

Allowable loss variation:

- 0,20 dB.

The insertion loss shall be measured before, continuously during, and after the test as specified in subclause 4.3.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test depending upon particular agreement between manufacturer and user.

4.12 Cold

In accordance with EN 186 000-1 [1] subclause 4.5.17

Details:

- Temperature: - 25 °C;
- duration of exposure: 16 hours;
- pre-conditioning procedure: 2 h at normal ambient conditions;
- recovery procedure: 2 h at normal ambient conditions.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, at a maximum interval of 1 hour during, and after the test as specified in subclause 4.3. On completion of the test the insertion loss at normal ambient conditions shall be within ± 0,20 dB of the original value at normal ambient conditions.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

Different temperatures in the range between -10 °C and -45 °C can be agreed between manufacturer and user; the allowable loss variation shall be changed in accordance to the temperature chosen.

4.13 High temperature endurance

In accordance with EN 186 000-1 [1] subclause 4.5.33

Details:

- Temperature: + 70 °C;
- Duration of exposure: 1 000 h;
- Pre-conditioning procedure: 2 h at normal ambient conditions;
- Recovery procedure: 2 h at normal ambient conditions.

Requirements:

- Allowable loss variation: ≤ 0,20 dB;
- strength of coupling mechanism: as in subclause 3.9;
- return loss: the connector shall satisfy the requirements for the specified class.

The insertion loss shall be measured before, at a maximum interval of 1 hour during the first 16 hours, and thereafter at a maximum interval of 24 hours until completion of the test. On completion of the test the insertion loss at normal ambient conditions shall be within ± 0,20 dB of the original value at normal ambient conditions.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.14 Damp heat (steady state)

Details:

In accordance with EN 186 000-1 [1] subclause 4.5.19

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

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, at a maximum interval of 1 hour during, and after the test as specified in subclause 4.3. On completion of the test the insertion loss at normal ambient conditions shall be within ± 0,20 dB of the original value at normal ambient conditions.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.15 Change of Temperature

In accordance with EN 186 000-1 [1] subclause 4.5.22

Details:

- High temperature: + 70 °C;
- low temperature: - 25 °C;
- duration at extreme temperatures: 1 h;
- temperature rate of change: 1 °C/min;
- number of cycles: between 5 and 12;
- pre-conditioning procedure: 2 h at normal ambient conditions;
- recovery procedure: 2 h at normal ambient conditions.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, at a maximum interval of 10 min during, and after the test as specified in subclause 4.3. On completion of the test the insertion loss at normal ambient conditions shall be within ± 0,20 dB of the original value at normal ambient conditions.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

Different temperatures in the range between -10 °C and -45 °C can be agreed between manufacturer and user; the allowable loss variation shall be changed in accordance to the temperature chosen.

4.16 Mechanical endurance

In accordance with EN 186 000-1 [1] subclause 4.5.32

Details:

- Coupling mechanism to be cycled: plug-adapter;
- number of cycles: 500 minimum.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

The connector may be cleaned and measured at a specified interval (not less than 10 mating cycles) during and after the test.

4.17 Corrosive atmosphere (salt mist)

(Where applicable).

This test is intended only for connectors for outdoor applications.

In accordance with EN 186 000-1 [1] subclause 4.5.26

Details:

- Atmosphere: salt solution 5% NaCl, pH 6,5 to 7,2;
- temperature: + 35 °C;
- duration of test: 96 h;
- pre-conditioning procedure: 2 h at normal ambient conditions;
- recovery procedure: 2 h at normal ambient conditions.

Requirements:

Allowable loss variation:

- $\leq$ 0,20 dB.

Return loss:

- The connector shall satisfy the requirement for the specified class.

Measurements shall be carried out before and after the test at normal ambient conditions.

4.18 Industrial atmosphere

(Where applicable).

This test is intended only for connectors for outdoor applications.

In accordance with EN 186 000-1 [1] subclause 4.5.28

Details:

- Atmosphere: sulphur dioxide SO_2 25 ppm;
- temperature: + 25 °C;
- relative humidity 75;
- duration of test: 96 h;
- pre-conditioning procedure: 2 h at normal ambient conditions;
- recovery procedure: 2 h at normal ambient conditions.

Requirements:

Allowable loss variation:

- $\leq$ 0,20 dB.

Return loss:

- The connector shall satisfy the requirement for the specified class.

Measurements shall be carried out before and after the test at normal ambient conditions.

4.19 Dust

(Where applicable).

This test is intended only for connectors for outdoor applications.

In accordance with EN 186 000-1 [1] subclause 4.5.27

Details:

- Dust particle size: d < 150 µm;
- temperature: + 35 °C;
- telative humidity: 60 %;
- duration of test: 24 h.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

Return loss:

- The connector shall satisfy the requirement for the specified class.

Measurements shall be carried out before and after the test at normal ambient conditions.

4.20 Condensation Test

(Where applicable).

This test is intended only for connectors for outdoor applications.

In accordance with EN 186 000-1 [1] subclause 4.5.21.

Details

- High temperature: 65 C;
- low temperature: -10 C;
- humidity: 93 +/- 2 %;
- profile: Z/AD;
- number of cycles: 10;
- pre-conditioning procedure: 2 h at normal ambient conditions;
- precovery procedure: 2 h at normal ambient conditions.

Requirements:

Allowable loss variation:

- ≤ 0,20 dB.

The insertion loss shall be measured before, at a maximum interval of 10 min during, and after the test as specified in subclause 4.3. On completion of the test the insertion loss at normal ambient conditions shall be within ± 0,20 dB of the original value at normal ambient conditions.

The return loss can be measured (as specified in subclause 4.4) before, during and after the test, depending upon particular agreements between manufacturer and user.

4.21 Intermateability

To verify the intermateability between two different sources of the same type of connectors as specified in EN 186 000-1 [1], sectional specification (with the same nominal characteristics) the following tests shall be performed on a minimum of 10 samples from each source's regular production.

4.21.1 Insertion loss measurement

The measurement is performed in accordance with EN 186 000-1 [1], referenced in subclause 4.3 of this I-ETS, but the reference connector is replaced by each of the sample connectors. All possible mating combinations shall be performed.

Allowable insertion loss:

- 0,80 dB max. for 90 % of mating combinations of untuned plugs;
- 1,60 dB max. for 100 % of mating combinations of untuned plugs;
- 0,60 dB max. for 100 % of mating combinations of plugs tuned by the same tuning technique.

4.21.2 Return loss measurement

The measurement is performed in accordance with EN 186 000-1 [1], referenced in subclause 4.4 of this I-ETS.

4.21.3 Change of temperature

The measurement is performed in accordance with EN 186 000-1 [1], referenced in subclause 3.15 of this I-ETS.

4.21.4 Mechanical endurance

The measurement is performed in accordance with EN 186 000-1 [1], referenced in subclause 3.16 of this I-ETS.

4.21.5 Strength of coupling mechanism

The measurement is performed in accordance with EN 186 000-1 [1], referenced in subclause 3.9 of this I-ETS.

4.22 Endurance test at high power

Under consideration

4.23 Mechanical measurements accuracy

Under consideration.

See IEC 874-1 amendment 1 [3]

4.24 Reliability

Under consideration.

Annex A (informative): Bibliography

The following reference is given for information.

- IEC 86B/561/DIS: "Fibre optics interconnecting devices and passive components basic test and measurement. Part 2-5 Tests torsion/twist".

History

Document history			
September 1995	Public Enquiry	PE 91:	1995-9-04 to 1995-12-29
April 1996	Converted into Adobe Acrobat Portable Document Format (PDF)		