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Common requirements and conformance testing**

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Foreword

This final draft European Telecommunication Standard (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 Voting 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it can be converted into an ETS, have its life extended for a further two years, be replaced by a new version, or be withdrawn.

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

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1 Scope

This Interim European Telecommunication Standard (I-ETS) specifies requirements of connector sets to be used in single-mode optical fibre telecommunication 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 a need to verify performance at lower temperatures. These users should specify connectors conforming to the basic ETSI performance standard, plus additional tests or more severe test conditions.

Connectors for different applications which fall within the scope of this I-ETS have common environmental and mechanical stability requirements, but there are two grades of attenuation requirement and four grades of return loss. The attenuation grades are designated P and Q. The return loss grades are designated S, T, U and V.

Test methods are in accordance with EN 186000-1 [1] or IEC 1300 series [4-7].

For a definition of a connector set, see subclause 3.1 of this I-ETS.

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 186000-1 (1993): "Generic Specification: Connector sets for optical fibres and cables; Part 1: Requirements, test methods and qualification approval procedures". |
| [2] | EN 186005 (1993): "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; Part 1: Generic specification". |
| [4] | draft IEC 1300-3-34: "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Examinations and measurements - Part 3-34: Attenuation of random mated connectors". |
| [5] | draft IEC 1300-3-6: "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Examinations and measurements - Part 3-6: Return loss". |
| [6] | IEC 1300-2-5 (1995): "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Tests - Part 2-5: Torsion/twist". |
| [7] | draft IEC 1300-2-42: "Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Tests - Part 2-42: Static side load". |
| [8] | ETS 300 019: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment". |

3 Definition and abbreviations

3.1 Definition

For the purposes of this I-ETS, the following definition applies:

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

3.2 Abbreviations

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

OTDR	Optical Time Domain Reflectometer
RL	Return Loss

4 Details, measurements and performance requirements

The tests required to prove the performance of connectors for applications covered by this I-ETS are based on those in table 1 of EN 186005 [2]. There are, however, several significant differences and these are listed below.

Table 1 of EN 186005 [2] refers to tests described in EN 186000-1 [1] and in most cases these test details are referred to by this I-ETS. In some case the test methods detailed in the IEC 1300-3 series [4,5] and IEC 1300-2 series [6,7] are considered more suitable and in these cases the IEC test method is called up by this I-ETS.

i) Tests which are additional to those in EN 186005 [2], table 1, see the following subclauses of this I-ETS:

- 4.4 Return loss;
- 4.6 Bending moment;
- 4.11 Static side load;
- 4.17 Corrosive atmosphere (only for ETS 300 019 [8] environment classes 3.3, 3.4, 3.5 or 4.1);
- 4.18 Industrial atmosphere (only for ETS 300 019 [8] environment classes 3.3, 3.4, 3.5 or 4.1);
- 4.19 Dust (only for ETS 300 019 [8] environment classes 3.3, 3.4, 3.5 or 4.1);
- 4.20 Condensation (only for ETS 300 019 [8] environment classes 3.3, 3.4, 3.5 or 4.1);
- 4.21 Intercompatibility (for connectors made to the same detail or product specification).

ii) Tests in EN 186005 [2] table 1 which are not called for by this I-ETS:

- axial compression;
- fibre or ferrule retention.

All measurements shall be carried out under normal room conditions, unless otherwise stated. Before the insertion and return loss measurement, careful cleaning in accordance with manufacturers instructions is necessary.

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. The length of fibre or cable on each side of the connector set shall be 1,5 m (minimum). A minimum length of 1,5 m on each side of the test set shall be exposed to the test conditions of all climatic and environmental tests.

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.

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 and free from residues of glue. No scratches or break out of glass pieces shall be seen when using a microscope with a maximum magnification of 200 times.

4.2 Dimensions and mechanical measurements accuracy

Measurement accuracy and standardization shall be established to ensure consistency of production and consistency of performance of inter-mated connectors from different sources.

Mechanical measurement accuracy shall be demonstrated to be in accordance with IEC 874-1 amendment 1 [3] or EN 186000-1 [1].

4.3 Attenuation

NOTE: Attenuation is referred to as "insertion loss" in EN 186000-1 [1] and EN 186005 [2]. The two terms are interchangeable and "attenuation" is used in this I-ETS.

4.3.1 Attenuation against a reference connector

Details:

In accordance with EN 186000-1 [1], subclause 4.4.7, method 7 (measurements against a reference plug).

Reference plug:

Type A): For qualification testing to determine the loss of connector sets when one side is a defined reference, the eccentricity of the reference connector plug (centre of fibre to centre of ferrule) shall be $\leq 0,3 \mu\text{m}$. The reference plug shall in all other respects conform to the same detail or product specification as the connector under test.

Type B): For environmental, mechanical and climatic testing detailed in this I-ETS, the reference plug shall be selected randomly from the regular production of the connector sets that are undergoing qualification testing. For these tests, the initial loss of the connector sets that are to be tested shall be less than 1,00 dB for plugs conforming to grade P or less than 0,60 dB for plugs conforming to grade Q.

Only the fundamental mode shall propagate at the connector interface and at the detector.

Requirements:

Attenuation: $\leq 0,50$ dB when mated to reference plug Type A. (This is the maximum for any mating).

4.3.2 Attenuation of random mated connectors

Details:

In accordance with IEC 1300-3-34 [4].

Only the fundamental mode shall propagate at the connector interface and at the detector.

Statistical attenuation requirements:

attenuation grade P: Mean $\leq 0,35$ dB;
1,00 dB maximum for ≥ 97 % of mating combinations.

attenuation grade Q: Mean $\leq 0,30$ dB;
0,60 dB maximum for ≥ 99 % of mating combinations.

4.4 Return Loss (RL) of random mated connectors

Details:

In accordance with EN 186000-1 [1] subclause 4.4.12, method 2 (coupler method):

launch fibre length (L): $L \geq 2$ m;
source stability: better than ± 20 dB over the measurement period.

Alternatively, the return loss may be measured using an Optical Time Domain Reflectometer (OTDR) in accordance with IEC 1300-3-6 [5] 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.

Reference connector: the reference connector shall conform to the same detail or product specification as the connector under test.

Requirements:

RL (minimum return loss for every mating):

RL grade S: ≥ 25 dB for standard return loss connectors (as measured when mated);
RL grade T: ≥ 35 dB for low-reflection connectors (as measured when mated);
RL grade U: ≥ 50 dB for ultra low-reflection connectors (as measured when mated);
RL grade V: ≥ 55 dB for ultra-low reflection connectors (as measured when mated and unmated).

4.5 Vibration (sinusoidal)

Details:

In accordance with EN 186000-1 [1], subclause 4.5.1:

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

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. The maximum sampling interval during the test shall be 2 ms.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. The maximum sampling interval during the test shall be 2 ms.

4.6 Bending moment

In accordance with EN 186000-1 [1], subclause 4.5.7.

Details:

severity: 10 N smoothly applied 25 mm from the centre line defined by the optical interface.

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at least once while the load is at the maximum level.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at least once while the load is at the maximum level.

4.7 Cable pulling

Details:

In accordance with EN 186000-1 [1], subclause 4.5.4:

magnitude and rate of application of the tensile load:
 100 ± 5 N applied at 5 N/s for reinforced cables;
 $5 \pm 0,5$ N applied at 0,5 N/s for coated fibres.

duration of the test (maintaining the load): 120 s for reinforced cables;
60 s for coated fibres.

point of application of the tensile load: 0,3 m from the end-face of the connector.

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at least once while the load is at the maximum level.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at least once while the load is at the maximum level.

4.8 Torsion

Details:

In accordance with IEC 1300-2-5 [6]:

magnitude of the tensile load: 15 N for reinforced cable;
2 N for coated fibre.

point of application of the tensile load: 0,2 m from the end face of the connector;
duration of the test: 25 cycles (not to exceed the cable specification).

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before and after the test as specified in subclause 4.3.1.

4.9 Strength of coupling mechanism

In accordance with EN 186000-1 [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 back of the connector;
duration of the test (maintaining the load): 120 s.

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at least once while the load is at the maximum level.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at least once while the load is at the maximum level.

4.10 Drop

Details:

In accordance with EN 186000-1 [1], subclause 4.5.14:

number of drops: 5;
drop height: 1,5 m.

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

Requirements:

Allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
Allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured after each drop.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured after each drop.

4.11 Static side load

In accordance with IEC 1300-2-42 [7].

Details:

number of directions of load application: 1;
magnitude and duration of the tensile load: 1 N for 1 hour (reinforced cable);
0,2 N for 5 minutes (buffered fibre).

Requirements:

Allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 3 minutes.

4.12 Cold

In accordance with EN 186000-1 [1], subclause 4.5.17.

Details:

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

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 1 hour.

4.13 Dry heat

In accordance with EN 186000-1 [1], subclause 4.5.18.

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:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade;
strength of coupling mechanism: as in subclause 4.9.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 1 hour.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at a maximum interval of 1 hour.

The strength of the coupling mechanism shall be measured on completion of the dry heat test after the recovery procedure.

4.14 Damp heat (steady state)

Details:

In accordance with EN 186000-1 [1], subclause 4.5.19:

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

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 1 hour.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at a maximum interval of 1 hour.

4.15 Change of temperature

In accordance with EN 186000-1 [1], subclause 4.5.22.

Details:

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

Requirements:

allowable attenuation variation:	$\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation:	return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 10 minutes.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at a maximum interval of 10 minutes.

4.16 Mechanical endurance

In accordance with EN 186000-1 [1], subclause 4.5.32.

Details:

coupling mechanism to be cycled:	plug-adaptor (one side of the connector set only);
number of cycles:	500.

NOTE: The connector may be cleaned at a specified interval (not less than 10 mating cycles) during the test and it may be cleaned before measurement on completion of the test.

Requirements:

allowable attenuation variation:	$\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation:	return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during, and after the test as specified in subclause 4.3.1. The attenuation shall be measured after each mating.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test. The return loss shall be measured after each mating.

4.17 Corrosive atmosphere (salt mist)

This test shall be carried out on connectors which are to be used in weather protected environments corresponding to ETS 300 019 [8] classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [8] class 4.1.

In accordance with EN 186000-1 [1], subclause 4.5.26.

Details:

atmosphere:	5 % sodium chloride (NaCl) salt solution, pH 6,5 to 7,2;
temperature:	+35 C;
duration of test:	96 hours;
pre-conditioning procedure:	2 hours at normal ambient conditions;
recovery procedure:	2 hours at normal ambient conditions.

Requirements:

allowable attenuation variation:	$\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation:	return loss shall not fall below the minimum for the grade.

Measurements shall be carried out before and after the test at normal ambient conditions. Attenuation shall be measured as specified in subclause 4.3.1 at $1\ 550 \pm 30$ nm. Return loss shall be measured as specified in subclause 4.4 at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm.

4.18 Industrial atmosphere

This test shall be carried out on connectors which are to be used in weather protected environments corresponding to ETS 300 019 classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [8] class 4.1.

In accordance with EN 186000-1 [1], subclause 4.5.28.

Details:

atmosphere:	sulphur dioxide (SO ₂) 25 ppm;
temperature:	+25 C;
relative humidity	75 %;
duration of test:	96 hours;
pre-conditioning procedure:	2 hours at normal ambient conditions;
recovery procedure:	2 hours at normal ambient conditions.

Requirements:

allowable attenuation variation:	$\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation:	return loss shall not fall below the minimum for the grade.

Measurements shall be carried out before and after the test at normal ambient conditions. Attenuation shall be measured as specified in subclause 4.3.1 at $1\ 550 \pm 30$ nm. Return loss shall be measured as specified in subclause 4.4 at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm.

4.19 Dust

This test shall be carried out on connectors which are to be used in weather protected environments corresponding to ETS 300 019 [8] classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [8] class 4.1.

In accordance with EN 186000-1 [1], subclause 4.5.27.

Details:

dust particle size:	diameter < 150 μ m;
dust type:	talc;
temperature:	+35 C;
relative humidity:	60 %;
duration of test:	10 minutes.

Requirements:

allowable attenuation variation: $\leq 0,20$ dB measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

Measurements shall be carried out before and after the test at normal ambient conditions. Attenuation shall be measured as specified in subclause 4.3.1 at $1\ 550 \pm 30$ nm. Return loss shall be measured as specified in subclause 4.4 at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm.

4.20 Condensation

This test shall be carried out on connectors which are to be used in weather protected environments corresponding to ETS 300 019 [8] classes 3.3, 3.4 or 3.5 or in non-weather protected environments corresponding to ETS 300 019 [8] class 4.1.

In accordance with EN 186000-1 [1] subclause 4.5.21.

Details:

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

Requirements:

allowable attenuation variation: $\leq 0,20$ dB, measured at $1\ 550 \pm 30$ nm;
allowable return loss variation: return loss shall not fall below the minimum for the grade.

The attenuation shall be measured at $1\ 550 \pm 30$ nm before, during and after the test as specified in subclause 4.3.1. During the test the attenuation shall be measured at a maximum interval of 10 minutes.

The return loss shall be measured as specified in subclause 4.4 before, during and after the test, at either $1\ 310 \pm 30$ nm or $1\ 550 \pm 30$ nm. During the test the return loss shall be measured at a maximum interval of 10 minutes.

4.21 Intermatibility

To verify the intermatibility of connectors made to the same detail or product specification the following optical, mechanical and environmental test shall be performed on connector sets assembled using plugs and/or adapters from the regular production of each source.

The combination of components making up the connector sets to be tested will be dependent on whether the second source intends to supply plugs only, plugs and adapters or adapters only. The intermatibility tests will usually be performed by the supplier responding to an invitation to tender for the supply of connectors to a user who already has connectors of the same type from another source.

Where the second (or subsequent) supplier intends to supply complete connector sets these sets shall first be qualified in accordance with this I-ETS.

4.21.1 Attenuation measurement

Details and requirements in accordance with subclause 4.3.2 of this I-ETS.

4.21.2 Return loss measurement

The measurement is performed as described in subclause 4.4 of this I-ETS.

4.21.3 Change of temperature

The measurement is performed as described in subclause 4.15 of this I-ETS.

4.21.4 Mechanical endurance

The measurement is performed as described in subclause 4.16 of this I-ETS.

4.21.5 Strength of coupling mechanism

The measurement is performed as described in subclause 4.9 of this I-ETS.

5 Acceptance criteria

The requirements for each test are given in the relevant subclauses of this I-ETS. There is no defined sequence in which the tests shall be run. No deviations from the specified test methods are allowed. This clause specifies the minimum sample sizes required for qualification and defines the pass/fail criteria.

5.1 Minimum sample size for qualification

5.1.1 Qualification to minimum uniform requirements

Visual inspection (subclause 4.1):	20 connector sets.
Attenuation against a reference connector (subclause 4.3.1):	10 plugs (with 10 different adapters for plug-adapter-plug connector sets).
Attenuation of random mated connectors (subclause 4.3.2):	20 randomly mated connectors (total of 190 measurements). For plug-adapter-plug connector sets, 10 adapters, randomly selected, should be used (19 measurements per adapter).
Return loss (subclause 4.4):	20 randomly mated connectors (total of 190 measurements). For plug-adapter-plug connector sets, 10 adapters, randomly selected, should be used (19 measurements per adapter).
Vibration (subclause 4.5):	4 connector sets.
Bending moment (subclause 4.6):	4 connector sets.
Cable pulling (subclause 4.7):	4 connector sets (test on one plug only).
Torsion (subclause 4.8):	4 connector sets (test on one plug only).
Strength of coupling mechanism (subclause 4.9):	4 connector sets (test on one plug only).
Drop (subclause 4.10):	4 connector sets.
Static side load (subclause 4.11):	4 connector sets (test on one plug only).
Cold (subclause 4.12):	4 connector sets.
Dry heat (subclause 4.13):	4 connector sets.
Damp heat (subclause 4.14):	4 connector sets.
Change of temperature (subclause 4.15):	4 connector sets.
Mechanical endurance (subclause 4.16):	4 connector sets.

5.1.2 Qualification for ETS 300 019 environment classes 3.3, 3.4, 3.5 and 4.1

The following four tests shall be carried out on connectors which are to be used in weather protected environments corresponding to ETS 300 019 [8] classes 3.3, 3.4, 3.5 or 4.1.

- Corrosive atmosphere (subclause 4.17): 4 connector sets.
- Industrial atmosphere (subclause 4.18): 4 connector sets.
- Dust (subclause 4.19): 4 connector sets.
- Condensation (subclause 4.20): 4 connector sets.

5.1.3 Qualification of intermatibility of connectors from different sources

	Attenuation (subclause 4.21.1)	Return loss (subclause 4.21.2)	Change of temperature (subclause 4.21.3)	Mechanical endurance (subclause 4.21.4)	Strength of coupling mechanism (subclause 4.21.5)
Second source plugs only	see note 1	see note 1	see note 2	see note 3	see note 4
Second source plugs and adapters	see note 5	see note 5	see note 6	see note 7	see note 8
Second source adapters only	see notes 9 and 10	see notes 9 and 10	see notes 9 and 11	see notes 9 and 11	see notes 9 and 11

In each case the connector sets under test shall consist of a plug from the first source mated to a plug from the second source.

- NOTE 1: 10 plugs from each source. Total of 100 measurements. Each plug from the first source to be used with a different adapter from the first source in the case of plug-adapter-plug connector sets.
- NOTE 2: 4 plugs from each source. Total of 4 connector sets. Each plug from the first source to be used with a different adapter from the first source in the case of plug-adapter-plug connector sets.
- NOTE 3: 4 plugs from each source. Total of 4 connector sets. Each plug from the first source to be used with a different adapter from the first source in the case of plug-adapter-plug connector sets. Plug from second source to be subject to the 500 mating cycles.
- NOTE 4: 4 plugs from each source. Total of 4 connector sets. Each plug from the first source to be used with a different adapter from the first source in the case of plug-adapter-plug connector sets. Plug from second source to be subject to the test load.
- NOTE 5: 10 plugs from each source. Total of 100 measurements. 5 adapters from the first source and 5 adapters from the second source to be used randomly such that each adapter is used for a total of 10 matings.
- NOTE 6: 4 plugs from each source. Total of 4 connector sets. Two of the connector sets to be mated using adapters from the first source and two with adapters from the second source.
- NOTE 7: 4 plugs from each source. Total of 4 connector sets. Two of the connector sets to be mated using adapters from the first source and two with adapters from the second source. Plug from second source to be subject to the 500 mating cycles.
- NOTE 8: 4 plugs from each source. Total of 4 connector sets. Two of the connector sets to be mated using adapters from the first source and two with adapters from the second source. Plug from second source to be subject to the test load.

- NOTE 9: If the second source is supplying only adapters for plug-adapter-plug connector sets the adapter shall be qualified in accordance with this I-ETS as part of a connector set. Interatibility testing with plugs from a different source shall then be carried out in accordance with subclause 4.21.
- NOTE 10: 20 plugs from first source grouped in two batches of 10. Total of 100 measurements. 10 adapters from the second source to be used randomly such that each adapter is used for a total of 10 matings.
- NOTE 11: 8 plugs from first source made up as 4 connector sets using 4 different adapters from second source.

5.2 Pass/fail criteria

To satisfy the qualification approval requirements of this I-ETS performance specification there shall be no failures of any in the sample groups for any test parameter. If a failure does occur this shall be investigated and the cause of failure identified and corrected. The test which is affected shall then be repeated using the minimum sample size stated in this I-ETS.

A fully documented test report and supporting data shall be prepared and shall be available for inspection. Failures and the corrective action taken to eliminate failures shall be documented and evidence must be presented to show that the corrective action will have no detrimental effect on the performance in any of the other tests. Design changes, as opposed to improvements in quality control, will usually be deemed to necessitate a repeat of the full qualification programme.

History

Document history			
September 1995	Public Enquiry	PE 91:	1995-9-04 to 1995-12-29
August 1996	Vote	V 109:	1996-08-12 to 1996-10-18