

INTERNATIONAL STANDARD



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

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IEC 61300-2-22

Edition 3.0 2024-06
COMMENTED VERSION

INTERNATIONAL STANDARD



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.20

ISBN 978-2-8322-9272-3

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CONTENTS

FOREWORD	3
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 General description	6
5 Apparatus	6
5.1 Environmental test chamber	6
5.2 Examination and measurement equipment	6
6 Procedure	6
6.1 General	6
6.2 Preconditioning	7
6.3 Initial examination and measurement	7
6.4 Testing Setting DUT	7
6.5 Examination and measurement during test	7
6.6 Test conditions	7
6.7 Recovery	9
6.8 Final examinations and measurements	9
7 Severity	9
8 Details to be specified and reported	10
Bibliography	11
List of comments	12
Figure 1 – Temperature profile	8
Figure 2 – Optional temperature profile	8
Table 1 – Severities	10

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 2-22: Tests – Change of temperature

FOREWORD

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This commented version (CMV) of the official standard IEC 61300-2-22:2024 edition 3.0 allows the user to identify the changes made to the previous IEC 61300-2-22:2007 edition 2.0. Furthermore, comments from IEC SC 86B experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 61300-2-22 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics. It is an International Standard.

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) include a passive component, patch cord, splices, fibre management system or protective housing to withstand the effects of a change of temperature or a succession of changes of temperature into the project scope;
- b) update the severity categories description, number of cycles, and duration of the extremes in Table 1 to be in line with IEC 61753-1.

The text of this International Standard is based on the following documents:

Draft	Report on voting
86B/4904/FDIS	86B/4931/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts of the IEC 61300 series, published under the general title *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 2-22: Tests – Change of temperature

1 Scope

This part of IEC 61300 describes a procedure to determine the suitability of a fibre optic interconnecting device and a passive component **1** to withstand the effects of a change of temperature or a succession of changes of temperature.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-14, ~~Basic Environmental testing procedures~~ – Part 2-14: Tests – Test N: Change of temperature

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-2-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-38: Tests – Sealing for pressurized fibre optic closures*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss* **2**

IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components – Performance standard*

IEC 62005 (all parts), *Reliability of fibre optic interconnecting devices and passive components*

3 Terms and definitions **3**

For the purposes of this document, the terms and definitions given in IEC 61300-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 General description

This procedure is conducted in accordance with IEC 60068-2-14, test Nb, change of temperature with specified rate of change.

The device under test (DUT) is first subjected to one extreme of temperature for a given period of time. It is then subjected to the other extreme of temperature for an equal period of time. It can be subjected to one or more changes of temperatures defined by the temperature profile and the number of cycles.

5 Apparatus

~~The apparatus consists of suitable environmental chambers in accordance with IEC 60068-2-14, test Nb.~~

~~The rate of change of temperature shall be: $(1 \pm 0,2)$ °C/min.~~ **4**

5.1 Environmental test chamber

A suitable environmental test chamber shall be used in accordance with IEC 60068-2-14, Test Nb.

5.2 Examination and measurement equipment

Suitable examination and optical measurement equipment shall be used in accordance with IEC 60529, IEC 61300-2-38, IEC 61300-3-1, IEC 61300-3-3, IEC 61300-3-4, or IEC 61300-3-6 as required by the relevant IEC 61753 series performance standard or IEC 62005 series reliability document. **5**

6 Procedure

6.1 General

The procedure is in accordance with IEC 60068-2-14, Test Nb.

~~Unless otherwise stated in the relevant specification:~~

- ~~— include 1,5 m of cable in the climatic chamber for each port monitored during the test;~~
- ~~— if optical measurements are requested during the test by the relevant specification, these measurements shall be performed (at a minimum) at the end of each dwell at each temperature extreme;~~
- ~~— allow dependence on wavelength scan time for components that require wavelength scanning.~~ **6**

6.2 Preconditioning

~~Unless otherwise stated in the relevant specification,~~ **7** Maintain the DUT under standard atmospheric conditions as defined in IEC 61300-1 for at least 2 h. For large devices such as protective housings, the duration shall be at least 4 h **8**. Clean the mechanical and optical alignment parts of the DUT according to the manufacturer's instructions.

NOTE Cleaning method for optical connector and optical transceiver are described in IEC TR 62627-01 and IEC TR 62572-4, respectively. **9**

6.3 Initial examination and measurement

Perform initial examinations and measurements as required in the relevant ~~specification~~ IEC 61753 series performance standard or IEC 62005 series reliability document.

6.4 Testing Setting DUT

Place the ~~specimen~~ DUT in the environmental test chamber in its normal operating position and make connections to the monitoring equipment. Test sample configuration in the chamber shall be according to IEC 61300-1. **10**

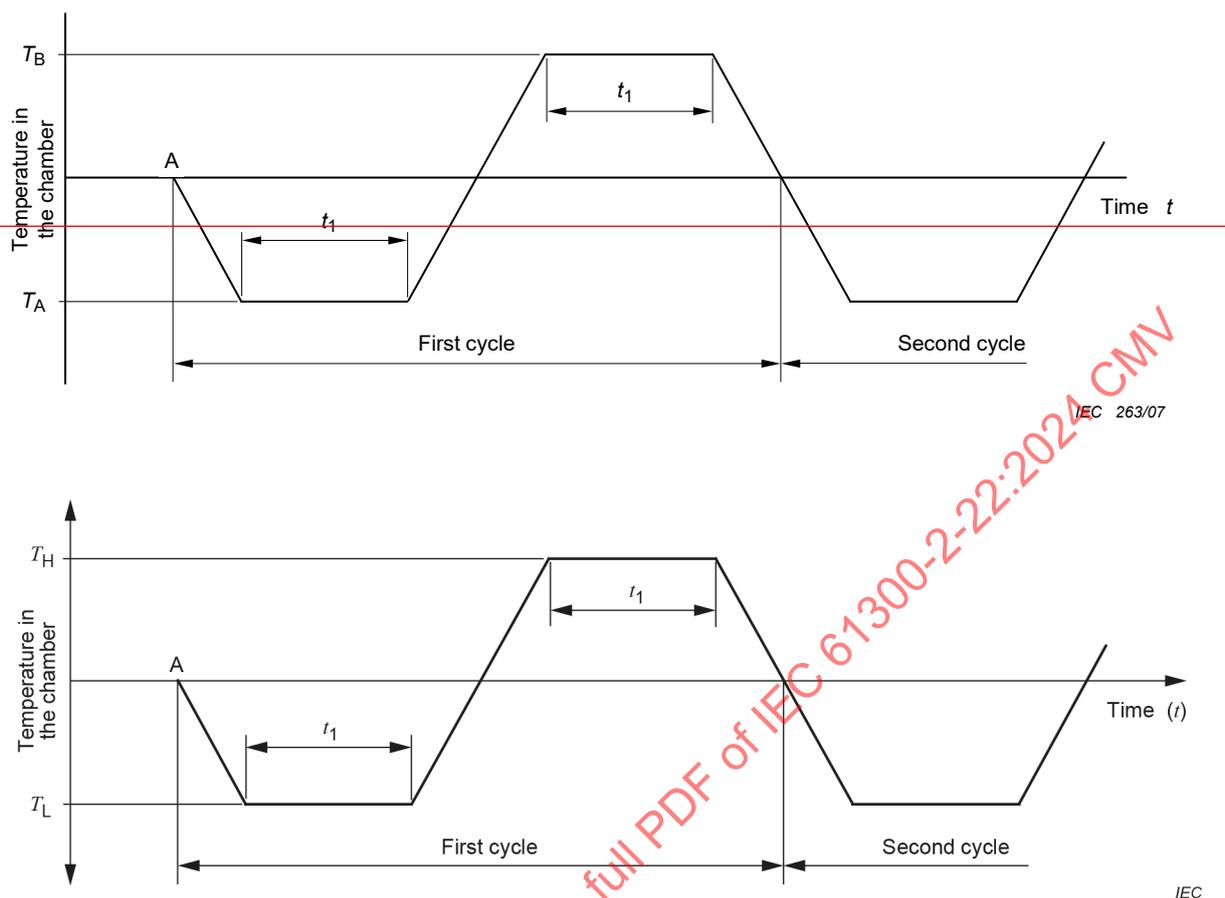
6.5 Examination and measurement during test

Perform all examinations and measurements during the test as required by the relevant IEC 61753 series performance standard or IEC 62005 series reliability document. The following applies:

- These measurements shall be performed (at a minimum) at the end of each dwell at each temperature extreme before starting the temperature change. Use a maximum measurement period of 10 min between optical measurements during the performance test.
- Allow dependence on wavelength scan time for components that require wavelength scanning.

6.6 Test conditions

Unless otherwise specified, the temperature profile in Figure 1 shall be applied. Start at standard atmospheric conditions and ramp down to the low temperature ~~at 1 °C/min~~ T_L . Maintain the low temperature during t_1 for a minimum of 1 h. Ramp up to the high temperature ~~at 1 °C/min~~ T_H . Maintain the temperature during t_1 for a minimum of 1 h. Ramp down to the low temperature and repeat this profile for the required number of cycles. The rate of change of temperature shall be $(1 \pm 0,2) \text{ °C/min}$. For larger devices, such as protective housings, the dwell time, t_1 , shall be a minimum of 4 h. **11**



Key 12

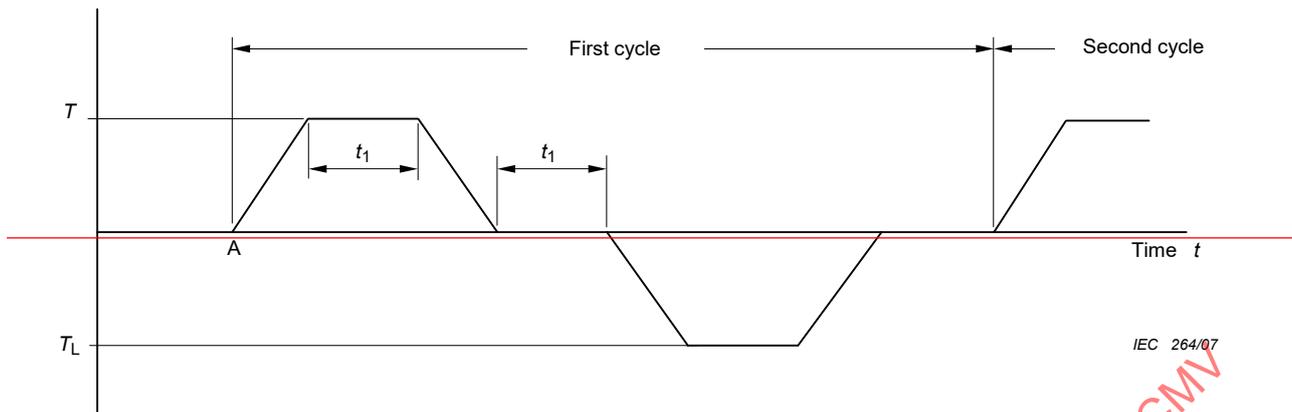
- A start of the first cycle
- T_L low chamber temperature
- T_H high chamber temperature
- t_1 dwell time

Figure 1 – Temperature profile

NOTE It is permissible to increase the dwell time at each extreme to allow sufficient time to perform a complete set of measurements.

5.3.3 ~~Optional cycle: for some performance categories, it may be necessary to ramp to the high temperature first and include a dwell at room temperature between ramps to the extreme temperatures. In this case, the profile in Figure 2 shall be applied.~~

~~Start at standard atmospheric conditions and ramp up to the high temperature T at $1^\circ\text{C}/\text{min}$. Then maintain the high temperature during t_1 for a minimum of 60 min. Ramp down to standard atmospheric conditions at $1^\circ\text{C}/\text{min}$. Maintain standard atmospheric conditions for a minimum of 60 min. Ramp down to the low temperature T_L at $1^\circ\text{C}/\text{min}$. Maintain that temperature during t_1 for a minimum of 60 min. Ramp up to standard atmospheric conditions at $1^\circ\text{C}/\text{min}$ and dwell for a minimum of 60 min. The subsequent cycles will have the same pattern.~~



— A = start of first cycle

Figure 2 – Optional temperature profile 13

6.7 Recovery

~~Allow the specimen to remain under standard atmospheric conditions for a period of at least 2 h.~~

Unless otherwise stated, maintain the DUT under standard atmospheric conditions as defined in IEC 61300-1 for at least 2 h. For large devices such as protective housings, the duration shall be at least 4 h.

6.8 Final examinations and measurements

~~Record final measurements as required by the relevant specification. Unless otherwise specified in the relevant specification, clean the DUT according to the manufacturer's instructions prior to recording final measurements.~~

Perform final examinations and measurements as required in the relevant IEC 61753 series performance standard or IEC 62005 series reliability document. **14**

7 Severity

Table 1 shows the specified test severities in relation to the performance categories. It is recommended to verify the test severities with the relevant IEC 61753 series performance standards and IEC 62005 series reliability documents for the normative values. **15**

Each of the following severities is defined by a combination of a low temperature with the corresponding high temperature exposure and the corresponding number of cycles. ~~One of them shall be specified in the relevant specification:~~

Table 1 – Severities 16

Category	Category description	Low temperature °C	High temperature °C	Number of cycles	Dwell time h
C	Indoor controlled environment	–10 (±2)	+60 (±2)	5	1 or 4 ^a
U		–25	+70	12	
Q		–40	+75	24	
OP	Outdoor protected environment	–25 (±2)	+70 (±2)	12	1 or 4 ^a
OP+	Extended outdoor protected environment	–40 (±2)	+75 (±2)	12	1 or 4 ^a
E	Extreme environment	–40 (±2)	+85 (±2)	12	1 or 4 ^a
I	Industrial environment	–40 (±2)	+70 (±2)	12	4
A	Outdoor aerial environment	–40 (±2)	+65 (±2)	20 12	4
G	Outdoor ground level environment	–40 (±2)	+65 (±2)	20 12	4
S	Outdoor subterranean or sub-surface environment	–30 (±2)	+60 (±2)	20 12	4
C ^{HD}	Indoor controlled environment with additional heat dissipation	–10 (±2)	+70 (±2)	5	1 or 4 ^a
OP ^{HD}	Outdoor controlled environment with additional heat dissipation	–25 (±2)	+85 (±2)	12	1 or 4 ^a
OP+ ^{HD}	Extended outdoor controlled environment with additional heat dissipation	–40 (±2)	+85 (±2)	12	1 or 4 ^a
I ^{HD}	Industrial environment with additional heat dissipation	–40 (±2)	+85 (±2)	12	4

NOTE A suitable operating service environment (performance category) is selected according to the application.

^a 1 h for connectors, field mountable connectors, passive components, splices and fibre management systems.
4 h for wall outlets, boxes, optical distribution frame modules and closures. 17

8 Details to be specified and reported

The following details, as applicable, shall be specified as noted below and reported in the test report:

- severity (see Clause 7);
- initial examinations and measurements and performance requirements (see 6.3) ;
- examinations and measurements during test and performance requirements (see 6.5);
- final examinations and measurements and performance requirements (see 6.8);
- deviations from this test procedure;
- additional pass/fail criteria.

~~– relevant monitoring procedure.~~

Bibliography

~~IEC 61300-1, Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance~~

~~IEC 61300-2-47, Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-47: Tests – Thermal shocks~~ **18**

IEC TR 62572-4, Fibre optic active components and devices – Reliability standards – Part 4: Guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers

IEC TR 62627-01, Fibre optic interconnecting devices and passive components – Part 01: Fibre optic connector cleaning methods

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List of comments

- 1 Change from “device” to “interconnecting device and a passive component” to ensure reader the specific scope of this document.
 - 2 IEC 60068-2-14, IEC 60529, and IEC 61300 series are added to the normative references to ensure accurate testing procedures as stated in Subclause 5.2.
 - 3 Clause 3 - Terms and definitions is added according to IEC requirements.
 - 4 Sentence moved to Subclause 6.6 - Test conditions.
 - 5 IEC 60068-2-14, IEC 60529, and IEC 61300 series are added to ensure accurate testing procedures.
 - 6 Sample configurations is defined in IEC 61300-1 to avoid inconsistency amongst other test documents.
 - 7 Previous edition 2.0 had the statement “unless otherwise stated in the relevant specification”. The statement “relevant specification” is very general and needs to be clarified or removed. The ambiguous statement “relevant specification” is removed in Clause 6.
 - 8 The duration of preconditioning for devices such as protective housings is longer due to their size.
 - 9 The note is added to refer to IEC TR 62627-01 and IEC 62572 for cleaning methods.
 - 10 Sample configurations is defined in IEC 61300-1 to avoid inconsistency amongst other test documents.
 - 11 Rate of temperature change is moved here and dwell time now depends on DUT type: it is 1 h for connectors, field mountable connectors, passive components, splices, and fibre management systems. It is 4 h for wall outlets, boxes, optical distribution frame modules, and closures.
 - 12 A key is added to explain the T_L - low chamber temperature, T_H - high chamber temperature and t_1 - dwell time.
 - 13 The optional cycle and optional temperature profile as described in previous edition 2.0 are removed.
 - 14 Examination and measure reference IEC 61753 and IEC 62005 series to ensure consistency.
 - 15 Added recommendation to verify the test severities with relevant IEC 61753 performance standards and IEC 62005 reliability documents for the normative values.
 - 16 Categories are aligned with the performance categories described in IEC 61753-1.
 - 17 A dwell time depends on DUT type: it is 1 h for connectors, field mountable connectors, passive components, splices, and fibre management systems. It is 4 h for wall outlets, boxes, optical distribution frame modules, and closures.
 - 18 IEC 61300-1 and IEC 61300-2-47 are moved to the normative references.
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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Dispositifs d'interconnexion et composants passifs fibroniques – Procédures fondamentales d'essais et de mesures –
Partie 2-22 : Essais – Variations de température**

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	6
4 General description	6
5 Apparatus.....	6
5.1 Environmental test chamber.....	6
5.2 Examination and measurement equipment.....	6
6 Procedure.....	6
6.1 General.....	6
6.2 Preconditioning.....	6
6.3 Initial examination and measurement.....	6
6.4 Setting DUT.....	7
6.5 Examination and measurement during test.....	7
6.6 Test conditions	7
6.7 Recovery	7
6.8 Final examinations and measurements	8
7 Severity.....	8
8 Details to be specified and reported.....	9
Bibliography.....	10
Figure 1 – Temperature profile.....	7
Table 1 – Severities	8

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Part 2-22: Tests – Change of temperature

1 Scope

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IEC 61300-2-38, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-38: Tests – Sealing for pressurized fibre optic closures*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-4, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-4: Examinations and measurements – Attenuation*

IEC 61300-3-6, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61753 (all parts), *Fibre optic interconnecting devices and passive components – Performance standard*

IEC 62005 (all parts), *Reliability of fibre optic interconnecting devices and passive components*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61300-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 General description

This procedure is conducted in accordance with IEC 60068-2-14, test Nb, change of temperature with specified rate of change.

The device under test (DUT) is first subjected to one extreme of temperature for a given period of time. It is then subjected to the other extreme of temperature for an equal period of time. It can be subjected to one or more changes of temperatures defined by the temperature profile and the number of cycles.

5 Apparatus

5.1 Environmental test chamber

A suitable environmental test chamber shall be used in accordance with IEC 60068-2-14, Test Nb.

5.2 Examination and measurement equipment

Suitable examination and optical measurement equipment shall be used in accordance with IEC 60529, IEC 61300-2-38, IEC 61300-3-1, IEC 61300-3-3, IEC 61300-3-4, or IEC 61300-3-6 as required by the relevant IEC 61753 series performance standard or IEC 62005 series reliability document.

6 Procedure

6.1 General

The procedure is in accordance with IEC 60068-2-14, Test Nb.

6.2 Preconditioning

Maintain the DUT under standard atmospheric conditions as defined in IEC 61300-1 for at least 2 h. For large devices such as protective housings, the duration shall be at least 4 h. Clean the mechanical and optical alignment parts of the DUT according to the manufacturer's instructions.

NOTE Cleaning method for optical connector and optical transceiver are described in IEC TR 62627-01 and IEC TR 62572-4, respectively.

6.3 Initial examination and measurement

Perform initial examinations and measurements as required in the relevant IEC 61753 series performance standard or IEC 62005 series reliability document.

6.4 Setting DUT

Place the DUT in the environmental test chamber in its normal operating position and make connections to the monitoring equipment. Test sample configuration in the chamber shall be according to IEC 61300-1.

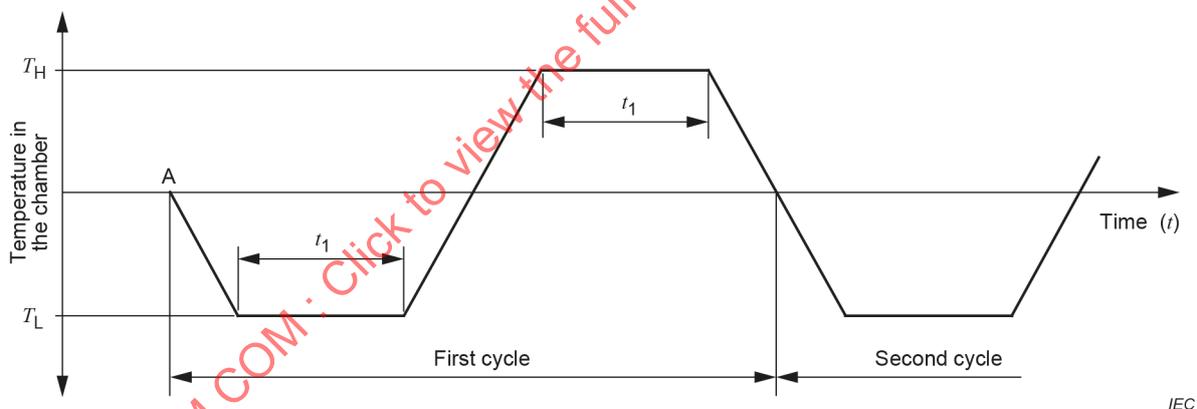
6.5 Examination and measurement during test

Perform all examinations and measurements during the test as required by the relevant IEC 61753 series performance standard or IEC 62005 series reliability document.. The following applies:

- These measurements shall be performed (at a minimum) at the end of each dwell at each temperature extreme before starting the temperature change. Use a maximum measurement period of 10 min between optical measurements during the performance test.
- Allow dependence on wavelength scan time for components that require wavelength scanning.

6.6 Test conditions

Unless otherwise specified, the temperature profile in Figure 1 shall be applied. Start at standard atmospheric conditions and ramp down to the low temperature T_L . Maintain the low temperature during t_1 for a minimum of 1 h. Ramp up to the high temperature T_H . Maintain the temperature during t_1 for a minimum of 1 h. Ramp down to the low temperature and repeat this profile for the required number of cycles. The rate of change of temperature shall be $(1 \pm 0,2) \text{ }^\circ\text{C/min}$. For larger devices, such as protective housings, the dwell time, t_1 , shall be a minimum of 4 h.



IEC

Key

- A start of the first cycle
- T_L low chamber temperature
- T_H high chamber temperature
- t_1 dwell time

Figure 1 – Temperature profile

It is permissible to increase the dwell time at each extreme to allow sufficient time to perform a complete set of measurements.

6.7 Recovery

Unless otherwise stated, maintain the DUT under standard atmospheric conditions as defined in IEC 61300-1 for at least 2 h. For large devices such as protective housings, the duration shall be at least 4 h.

6.8 Final examinations and measurements

Perform final examinations and measurements as required in the relevant IEC 61753 series performance standard or IEC 62005 series reliability document.

7 Severity

Table 1 shows the specified test severities in relation to the performance categories. It is recommended to verify the test severities with the relevant IEC 61753 series performance standards and IEC 62005 series reliability documents for the normative values.

Each of the following severities is defined by a combination of a low temperature with the corresponding high temperature exposure and the corresponding number of cycles.

Table 1 – Severities

Category	Category description	Low temperature °C	High temperature °C	Number of cycles	Dwell time h
C	Indoor controlled environment	-10 (±2)	+60 (±2)	5	1 or 4 ^a
OP	Outdoor protected environment	-25 (±2)	+70 (±2)	12	1 or 4 ^a
OP+	Extended outdoor protected environment	-40 (±2)	+75 (±2)	12	1 or 4 ^a
E	Extreme environment	-40 (±2)	+85 (±2)	12	1 or 4 ^a
I	Industrial environment	-40 (±2)	+70 (±2)	12	4
A	Outdoor aerial environment	-40 (±2)	+65 (±2)	12	4
G	Outdoor ground level environment	-40 (±2)	+65 (±2)	12	4
S	Outdoor subterranean or sub-surface environment	-30 (±2)	+60 (±2)	12	4
C ^{HD}	Indoor controlled environment with additional heat dissipation	-10 (±2)	+70 (±2)	5	1 or 4 ^a
OP ^{HD}	Outdoor controlled environment with additional heat dissipation	-25 (±2)	+85 (±2)	12	1 or 4 ^a
OP+ ^{HD}	Extended outdoor controlled environment with additional heat dissipation	-40 (±2)	+85 (±2)	12	1 or 4 ^a
I ^{HD}	Industrial environment with additional heat dissipation	-40 (±2)	+85 (±2)	12	4

NOTE A suitable operating service environment (performance category) is selected according to the application.

^a 1 h for connectors, field mountable connectors, passive components, splices and fibre management systems.
4 h for wall outlets, boxes, optical distribution frame modules and closures.

8 Details to be specified and reported

The following details, as applicable, shall be specified as noted below and reported in the test report:

- severity (see Clause 7);
- initial examinations and measurements and performance requirements (see 6.3) ;
- examinations and measurements during test and performance requirements (see 6.5);
- final examinations and measurements and performance requirements (see 6.8);
- deviations from this test procedure;
- additional pass/fail criteria.

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Bibliography

IEC TR 62572-4, *Fibre optic active components and devices – Reliability standards – Part 4: Guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers*

IEC TR 62627-01, *Fibre optic interconnecting devices and passive components – Part 01: Fibre optic connector cleaning methods*

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SOMMAIRE

AVANT-PROPOS	13
1 Domaine d'application	15
2 Références normatives	15
3 Termes et définitions	16
4 Description générale.....	16
5 Appareillage	16
5.1 Enceinte d'essai climatique.....	16
5.2 Équipement d'examen et de mesure	16
6 Procédure.....	16
6.1 Généralités	16
6.2 Préconditionnement	16
6.3 Examen initial et mesurage initial.....	16
6.4 Mise en place du DUT.....	17
6.5 Mesurages et examens pendant l'essai.....	17
6.6 Conditions d'essai.....	17
6.7 Rétablissement	18
6.8 Examens et mesurages finaux	18
7 Sévérité.....	18
8 Informations détaillées à spécifier et à consigner.....	19
Bibliographie.....	20
Figure 1 – Profil de température	17
Tableau 1 – Sévérités	19

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**DISPOSITIFS D'INTERCONNEXION
ET COMPOSANTS PASSIFS FIBRONIQUES –
PROCÉDURES FONDAMENTALES D'ESSAIS ET DE MESURES –****Partie 2-22: Essais – Variations de température****AVANT-PROPOS**

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Cette troisième édition annule et remplace la deuxième édition parue en 2007. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) intégration, dans le domaine d'application, de ce projet d'un composant passif, d'un cordon de brassage, d'épissures, d'un système de gestion des fibres ou d'un boîtier de protection pour résister aux effets d'une variation de température ou d'une succession de variations de température;
- b) mise à jour de la description des catégories de sévérité, du nombre de cycles et de la durée des valeurs extrêmes dans le Tableau 1 dans un souci d'alignement sur l'IEC 61753-1.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
86B/4904/FDIS	86B/4931/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

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