BRITISH STANDARD

BS EN
12830:1999

Temperature recorders for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream — Tests, performance and suitability

The European Standard EN 12830:1999 has the status of a British Standard

ICS 17.200.20

National foreword

This British Standard is the English language version of EN 12830:1999.

The UK participation in its preparation was entrusted to Technical Committee RHE/19, Commercial refridgerated food cabinets (cold room and display cases), which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English version

Temperature recorders for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice cream — Tests, performance, suitability

Enregistreurs de température pour le transport, l'entreposage et la distribution de denrées alimentaires réfrigérées, congelées, surgelées et des crèmes glacées — Essais, performance, aptitude à l'emploi

Temperaturregistriergeräte für den Transport, die Lagerung und die Verteilung von gekühlten, gefrorenen, tiefgefrorenen Lebensmittein und Eiskrem — Prüfungen, Leistung, Gebrauchstauglichkeit

This European Standard was approved by CEN on 4 June 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 141, Pressure gauges - Thermometers - Means of measuring and/or recording temperature in the cold chain, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard is a document meeting the objectives of directives :

- 92/1/EEC of January 13, 1992 of the Commission on the monitoring of temperatures in the means of transport, warehousing and storage of quick-frozen foodstuffs intended for human consumption ;

- 93/43/EEC of June 14, 1993 of the Council of the hygiene of foodstuffs and in particular on “temperature control criteria".

1 Scope

This European Standard specifies the technical and functional characteristics of air temperature recorders for equipping the means used for the transport, storage and distribution of chilled, frozen and deep-frozen/quick-frozen food and ice cream.

It specifies the test methods which allow the determination of the equipment's conformity to suitability and performance requirements.

It applies to the whole recorder-temperature sensor(s). The temperature sensor(s) may be integrated into the recorder or remote from it [external sensor(s)].

It does not define the location of the recorder and its sensors with respect to types of usage such as transport, storage and distribution.

2 Normative references

This European Standard incorporates by dated or 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

prEN 13486, *Temperature recorders and thermometers for the transport, storage and distribution of chilled, frozen, deep-frozen/quick-frozen food and ice-cream – Periodic verification*

EN 50081-1, *Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry.*

EN 50082-1, *Electromagnetic compatibility - Generic immunity standard - Part 1: Residential, commercial and light industry.*

EN 60068-2-27, *Basic environmental testing procedures - Part 2: Tests - Test Ea and guidance : Shock. (IEC 60068-2-27:1987)*

EN 60529, *Degrees of protection provided by enclosures (IP Code). (IEC 60529:1989)*

EN 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements. (IEC 61010-1:1990+A1:1992, modified)*

3 Definitions

For the purposes of this European Standard, the following definitions apply:

3.1
(measurable) quantity
attribute of a phenomenon, body or substance that may be distinguished qualitatively and determined quantitatively[1)]

EXAMPLE: Temperature.

3.2
unit (of measurement)
particular quantity, defined and adopted by convention, with which other quantities of the same kind are compared in order to express their magnitudes relative to that quantity[1)]

EXAMPLE: The unit of temperature used in this standard is "degree Celsius".

[1)] Definition taken from VIM2 (see Annex B).

3.3
symbol of a unit
conventional sign designating a unit of measurement[1)]

EXAMPLE : °C is the symbol of "degree Celsius".

3.4
value (of a quantity)
magnitude of a particular quantity generally expressed as a unit of measurement multiplied by a number[1)]

EXAMPLE: 15 °C.

3.5
true value (of a quantity)
value consistent with the definition of a given particular quantity[1)]

NOTE This is a value that would be obtained by a perfect measurement.

3.6
measurement
set of operations having the object of determining a value of a quantity[1)]

3.7
measurand
particular quantity subject to a measurement[1)]

EXAMPLE: Temperature.

3.8
influence quantity
quantity that is not the measurand but that affects the result of the measurement[1)]

3.9
indication (of a measuring instrument)
value of a quantity provided by a measuring instrument[1)]

3.10
accuracy of measurement
closeness of the agreement between the result of a measurement and a true value of the measurand[1)]

3.11
maximum permissible errors (of a measuring instrument)**; limits of permissible error** (of a measuring instrument)
extreme values of an error permitted by specifications, regulations, etc. for a given measuring instrument[1)]

3.12
uncertainty of measurement
parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand[1)]

3.13
error (of measurement)
result of a measurement minus a true value of the measurand[1)]

3.14
relative error
error of a measurement divided by a true value of the measurand[1)]

[1)] Definition taken from VIM2 (see Annex B).

3.15
measuring instrument
device intended to be used to make measurements, alone or in conjunction with supplementary device(s)[1)]

3.16
recording (measuring) **instrument**
measuring instrument that provides a record of the indication[1)]

3.17
displaying device ; indicating device
part of a measuring instrument that displays an indication[1)]

3.18
recording device
part of a measuring instrument that provides a record of an indication[1)]

3.19
temperature sensor
element of a measuring instrument or measuring chain that is directly affected by the temperature

3.20
scale (of a measuring instrument)
ordered set of marks, together with any numbering, forming part of a displaying device of a measuring instrument[1)]

3.21
scale division
part of a scale between two successive scale marks[1)]

3.22
gauging (of a measuring instrument)
operation of fixing the positions of the scale marks of a measuring instrument (in some cases of certain principal marks only), in relation to the corresponding values of the measurands[1)]

3.23
adjustment (of a measuring instrument)
operation of bringing a measuring instrument into a state of performance suitable for its use[1)]

3.24
user adjustment (of a measuring instrument)
adjustment employing the means at the disposal of the user[1)]

3.25
span
modulus of the difference between the two limits of a nominal range[1)]

EXAMPLE: For a nominal range of −35 °C to +25 °C, the span is 60 K.

3.26
measuring range ; working range
set of values for which the error of a measuring instruments is intended to lie within specified limits[1)]

3.27
rated operating conditions
conditions of use for which specified metrological characteristics of a measuring instrument are intended to lie within given limits[1)]

[1)] Definition taken from VIM2 (see Annex B).

3.28
limiting conditions
extreme conditions that a measuring instrument is required to withstand without damage, and without degradation of specified metrological characteristics when it is subsequently operated under its rated operating conditions[1)]

3.29
reference conditions
conditions of use prescribed for testing the performance of a measuring instrument or for intercomparison of results of measurements[1)]

3.30
resolution (of a displaying device)
smallest difference between indications of a displaying device that can be meaningfully distinguished[1)]

3.31
response time
time interval between the instant when a stimulus is subjected to a specified abrupt change and the instant when the response reaches and remains within specified limits around its final steady value[1)]

3.32
intrinsic error (of a measuring instrument)
error of a measuring instrument, determined under reference conditions[1)]

3.33
storage and transport conditions
the extreme conditions which a non-operational measuring instrument can withstand without damage and without degradation of specified metrological characteristics when it is subsequently operated under its rated operating conditions

3.34
chilled food
food which has been subjected to cooling (without freezing) and is intended to be maintained at low temperature

3.35
frozen food
food which has been subjected to a freezing process specially designed to preserve the wholesomeness and quality of the product

3.36
deep-frozen or quick-frozen food
food which has been subjected to a quick freezing process

3.37
recording interval
time interval that has elapsed between two successively stored measurements

3.38
recording duration
time interval between the beginning and the end of the recording

3.39
chart
tape, disk, form or other structure upon which is recorded the measurand

3.40
duration of transport
time interval between loading and unloading

[1)] Definition taken from VIM2 (see Annex B).

4 Requirements

4.1 General

The means of temperature measurement used by the recorder shall be independent of any temperature measurement which is used to control the refrigerating system.

Manufacturers shall make recommendations on the specification of ancillary equipment in order to meet the performance requirements of this European Standard.

4.2 Measuring range

The measuring range shall be appropriate to the use or the refrigerating system used.

In all cases, the measuring range shall conform to the following limits:

- the lower limit value shall be lower than or equal to –25 °C;
- the higher limit value shall be higher than or equal to +15 °C;
- the span shall be higher than or equal to 50 K.

4.3 Locking of settings

The date and time of the beginning of recording shall be readable from the recorded data or it shall be possible to make them readable.

The means for adjusting settings which configure the recording shall:

- either be protected against accidental or unauthorized modifications ;
- or record each adjustment of any settings that remain accessible.

4.4 Recording

4.4.1 General

At least the temperature and the time shall be recorded. The place of measurement (e.g. vehicle, cold store) and the date has to be indicated.

4.4.2 Traceability

It shall be possible to identify and consult the charts and the recorded data. It shall be possible to consult those intended for archiving for a period of at least a year.

The manufacturer shall specify storage conditions so that the data remain readable.

NOTE Depending on the foodstuffs concerned, the recording may be retained for longer.

4.4.3 Chart (disk, tape)

The scrolling speed of the chart shall be greater than or equal to:

- **for transport:**
  - 6 mm/h for a recording duration lower than or equal to 24 h;
  - 2 mm/h for a recording duration higher than 24 h and lower than or equal to 7 d;
  - 0,5 mm/h for a recording duration higher than 7 d.

The choice of the recorder shall be made according to the use including the duration of transport.

- **for storage:**

  - 1 mm/h.

The speed shall be verified on the following graduations:

- –20 °C for deep-frozen applications;
- 0 °C for chilled applications.

4.5 Autonomous power supply

For devices with an autonomous power supply, this shall be indicated on the recorder or on the power supply or in the technical documentation, with the corresponding usage temperature.

NOTE The manufacturer is recommended to install an indicating device (warning light or message) warning the user that the power source needs replacing.

4.6 Degree of protection provided by the enclosure (EN 60529)

The degree of protection provided by the enclosure shall be:

- IP 20 for recorders used in heated/air conditioned closed premises or in the cabin of transport vehicles;
- IP 55 for recorders used inside cold enclosures (storage or transport vehicles) and for external sensor;
- IP 65 for recorders used outside buildings or transport vehicles, with sensor inside the cold enclosure.

4.7 Electrical safety (if applicable)

The recorder shall conform to the requirements of EN 61010-1.

4.8 Operating characteristics linked to external electrical influences

4.8.1 **External supply voltage** (if applicable)

A recorder which requires an external electrical supply shall be suitable for connection to one of the supplies given in Table 1.

Table 1 – Limits of external supply voltage

Alternating current (a.c.)	U_n	+10 %, -15%	
Direct current (d.c.)	U_n	Rated operating conditions	Limiting conditions
	12 V	10 V to 16 V	0 V to 18 V
	24 V	20 V to 32 V	0 V to 36 V

4.8.2 **Autonomous supply** (if applicable)

The manufacturer shall specify the operating time without external power at a reference temperature.

4.8.3 **Frequency (a.c.)** (if applicable)

The manufacturer shall specify the operating frequency with a tolerance of ± 3 Hz.

4.8.4 Power cut-offs

The recorded data shall not be lost during a power cut-off. The manufacturer shall state the duration for which the data is protected when the recorder is disconnected from the primary source of power.

4.8.5 Electrical power disturbances and susceptibility to radiated electromagnetic field

The recorder shall conform with the requirements of EN 50081-1 and EN 50082-1, or any other specific standard, if applicable.

4.9 Metrological characteristics and usage profiles

4.9.1 General

The metrological characteristics of the recorders result from usage profiles which determine the operating criteria.

4.9.2 Metrological characteristics

4.9.2.1 Maximum permissible errors and resolution

The recorder, under rated operating conditions, shall conform to one of the classes indicated in Table 2.

Table 2 – Accuracy classes

Class	1	2
Maximum permissible errors	± 1 °C	± 2 °C
Resolution	≤ 0,5 °C	≤ 1 °C

4.9.2.2 Recording interval

The maximum recording interval shall be one of the three following values:

- for transport:
  - 5 min for a recording duration lower than or equal to 24 h;
  - 15 min for a recording duration higher than 24 h and lower than or equal to 7 d;
  - 60 min for a recording duration higher than 7 d;
- for storage:
  - 30 min.

The manufacturer shall specify the chosen value with its minimum and maximum limits.

These values do not apply to recorders where the record is continuous line on paper.

4.9.2.3 Recording duration

The manufacturer shall specify the recording capacity:

- either as the recording duration at the recording interval chosen according to **4.9.2.2**;
- or as the number of recorded temperature values.

4.9.2.4 Maximum relative timing error

- 0,2 % of the recording duration when the date is reset up to 31 d;
- 0,1 % of the recording duration including the error of the date and time when the date is reset after 31 d.

4.9.2.5 Response time

The response time shall be:

- for recorders with external sensor:
  - maximum 10 min for transport;
  - maximum 20 min for storage;
- for recorders with internal sensor:
  - maximum 60 min.

The response time is the time needed for the recorded value to reach 90 % of the actual change of applied temperature in the conditions mentioned in **5.4**.

4.9.3 Usage profiles

4.9.3.1 Climatic environment

It shall be possible for the recorders to operate and be stored in conditions corresponding to one of the three types of climatic environments given in Table 3:

Table 3 – Climatic environment

Climatic environment type	A	B	C	D
Type of use of the apparatus	Food storage and distribution unit	Food transport vehicle	Food storage and distribution unit	Food transport vehicle
Recorder type and method of use	Recorder located outside refrigeration case, in heated or air conditioned premises, with external sensor	Recorder located inside cabin or outside vehicle with external sensor	Recorder located inside refrigeration case with internal or external sensor	
Recording and displaying device rated operating conditions	+ 5 °C + 40 °C	– 30 °C + 65 °C	– 30 °C + 30 °C [1)]	
Recording and displaying device limiting conditions	0 °C + 50 °C	– 30 °C + 70 °C	– 40 °C + 50 °C	– 40 °C + 70 °C
Recording and displaying device and sensor storage or transport conditions	– 20 °C + 60 °C	– 40 °C + 85 °C	– 40 °C + 60 °C	– 40 °C + 85 °C

[1)] Or specified measuring range.

4.9.3.2 Mechanical vibrations

Equipment for use on transport vehicles shall be able to operate in the following environment conditions:

- vibration frequency: 5 Hz to 8,6 Hz; displacement amplitude: 10 mm;
- vibration frequency: 8,6 Hz to 150 Hz; acceleration: 3*g*.

4.9.3.3 Shock resistance

Equipment for use on transport vehicles shall be able to operate in the conditions as defined in **5.6.6**.

4.10 Data security

The data shall be protected against alteration.

5 Test methods

5.1 Test list

The recorder shall be subjected to the tests listed in Table 4.

Table 4 – Tests and applications

Tests	Storage	Transport	Subclause
- Determination of temperature measurement error	+	+	**5.3**
- Determination of response time	+	+	**5.4**
- Determination of time recording error	+	+	**5.5**
- Variation in supply, voltage [1)]	+	+	**5.6.2**
- Dielectric strength [1)]	+	+	**5.6.9**
- Influence of ambient temperature	+	+	**5.6.3**
- Temperature testing for the recorder under storage and transport conditions	+	+	**5.6.4**
- Shock resistance		+	**5.6.5**
- Mechanical vibrations		+	**5.6.6**
- Degrees of protection provided by enclosure	+	+	**5.6.7**
- Electromagnetic compatibility (EMC) [2)]	+	+	-

[1)] If applicable.

[2)] The recorder shall conform with the requirements of EN 50081-1 and EN 50082-1 or any other specific standard when applicable.

5.2 General conditions for tests

5.2.1 Pre-tests adjustments

The tests shall be carried out without change to the adjustments made in the factory by the manufacturer.

All elements of the recorder shall be put in place according to the manufacturer's instructions.

When possible or necessary the recorder is configured in order to conduct the following tests.

5.2.2 Normal atmospheric conditions

Unless otherwise prescribed the tests are carried out in the atmospheric conditions defined as follows:

- temperature : 23 °C ± 3 °C measured at 10 cm from the recorder;
- relative humidity : 60 % RH ± 20 % RH;
- atmospheric pressure : to be indicated as measured.

Before testing the recorders are placed in these conditions for 24 h. The charts and ink devices are stored in these conditions.

5.2.3 Reference conditions

The reference conditions for the tests are given in Table 5.

Table 5 – Reference conditions for the tests

Influence quantity	Reference conditions	Tolerance
Supply voltage [1)]	Nominal voltage	± 2 %
Frequency [1)]	Nominal frequency	± 1 %
Position	Defined by the manufacturer	± 2 %
Recorder support vibrations	< 0,5*g*	
Chart	Supplied by the manufacturer	
[1)] If applicable.		

5.3 Determination of temperature measurement error

5.3.1 Test method

The temperature sensor, or the recorder when the sensor is internal, is placed:

- either in an enclosure with forced air circulation at 1 m/s ± 0,3 m/s;
- or in a thermostatic bath. The manufacturer shall state whether the equipment is designed to be immersed.

For a cycle of measurements, the temperature is successively held at 0 %, 50 %, and 100 % of the span, or at the following fixed values: –30 °C, 0 °C and +30 °C if the span is greater than those values.

For electronic recorders, one cycle is carried out with increasing and then decreasing values.

For mechanical recorders, three similar cycles are carried out.

The stabilization time of the recorder for each temperature value is at least 1 h, or a duration sufficient to obtain temperature stabilization of the enclosure or thermostatic bath better than the resolution of the recorder under test.

The real temperature surrounding the sensor is measured with a working standard thermometer, the sensor of which is placed 1 cm from the sensor of the recorder under test.

5.3.2 Reading the recording

Following the test, the recorded values are read using devices provided by the manufacturer.

5.3.3 Expression of results

The errors at each temperature value shall be tabulated and all shall fall within the maximum permissible errors for the class of the recorder.

These values shall be given with the uncertainty of the measurement.

5.4 Determination of response time

For this test the recording interval shall if possible be held at its minimum value. The temperature sensor of the recorder is initially placed at a temperature measured using a working standard thermometer.

The recorder sensor is placed as rapidly as possible in an air flow, the temperature of which is stabilized at a value that is 20 K lower or higher than the initial temperature.

The air speed is 1 m/s ± 0,3 m/s.

The response time is the time needed for the recorded value to reach 90 % of the actual change of applied temperature.

5.5 Determination of time recording error

The device is placed in reference conditions.

A recording device using diagrammatic charts is started before the beginning of the measurement, for a time sufficient to take up any mechanical play.

For this test the recording interval shall if possible be held at its minimum value. The test is carried out during a recording duration of at least three days or the whole recording duration. The beginning and the end of the recording duration are defined by a sudden variation in the temperature measured. The elapsed time is measured using a suitable clock.

If applicable, the correspondance between the real time and the time recorded is checked.

The requirements of **4.9.2.4** shall be satisfied.

5.6 Action of influence quantities

5.6.1 General

Unless otherwise indicated, during or at the end of these tests, the determination of the temperature measurement error is carried out using the method given in **5.3** but with only one cycle.

5.6.2 **Variation in voltage supply** (if applicable)

The temperature measurement error is determined while supplying the recorder successively at the minimum and maximum value of the rated operating conditions.

For each value of the supply voltage, the pre-heating time is one hour at the minimum.

The measurement errors shall not exceed the maximum permissible errors in **4.9.2.1**.

5.6.3 Influence of ambient temperature

5.6.3.1 General

The recorder is subjected to its limiting temperatures, and then the measurement performance is tested at the maximum and minimum operating temperatures.

5.6.3.2 Test applicable to recorders with external sensor

The recorder in operation is placed in a case which is brought successively through the temperature phases of Table 6 and as defined in **4.9.3.1**.

Table 6 – Phases for recorder with external sensor

Phase	Temperature
1	Maximum limiting temperature
2	Maximum operating temperature
3	Minimum limiting temperature
4	Minimum operating temperature

Each phase shall last a minimum of 4 h.

The temperature measurement error is determined during phases 2 and 4 with the enclosure maintained at the maximum and minimum operating temperatures stabilized within ± 2 °C.

5.6.3.3 Test applicable to recorders with internal sensor

The recorder in operation is placed in a case which is brought successively through the temperatures phases of Table 7 and as defined in **4.9.3.1**. The ambient temperature shall be stabilized within ± 2 °C.

Table 7 – Phases for recorder with internal sensor

Phase	Temperature
1	Maximum limiting temperature
2	Minimum limiting temperature

Each phase shall last a minimum of 4 h. Following the test, the temperature measurement error is determined after a resettling time of 4 h at the reference temperature (23 °C ± 3 °C).

5.6.4 Temperature testing under storage and transport conditions for the recorder

The test shall be carried out under the following conditions:

- the recorder is not in operation;
- minimum and maximum temperatures as shown in **4.9.3.1** for storage and transport conditions;
- temperature variation speed is 1 °C/min;
- air speed is between 1m/s and 2 m/s;
- dwell time: 3 h;
- number of cycles is 5.

Following the test, the temperature measurement error is determined after a resettling time of 2 h at the reference temperature.

5.6.5 **Shock resistance test** (if applicable)

The test shall be carried out according to the method of EN 60068-2-27 under the following conditions:

- acceleration: 10*g*;
- time duration: 10 ms;
- recorder in normal operating position;
- number of shocks: 1.

If there is more than one operating position, the test shall be repeated for each of the operating positions. The shock is applied in the upward vertical direction.

Following the test, the temperature measurement error is determined after a resettling time of 2 h at the reference temperature.

5.6.6 **Mechanical vibrations** (if applicable)

The test applies to the recorder and its temperature sensor.

The recorder is in operation during the entire duration of the test.

The internal or external temperature sensor is kept at a constant temperature within the span.

The equipment under test is attached to the vibration table by means of a rigid component which holds the device by its usual system of attachment.

The recorder is subjected to sinusoidal rectilinear vibrations that are applied to it in three trirectangular directions. The vibration values are defined in **4.9.3.2**.

The sweep (frequency range path) is continuous and its speed is logarithmic according to time (1 octave/min).

Twenty successive sweep cycles are carried out in each of the three directions.

During the test all resonance phenomena are observed.

After the test, the variations in the value recorded during the test are determined.

5.6.7 Degrees of protection provided by enclosures (IP Code)

The degrees of protection provided by the enclosures of the recorder and any external temperature sensor are checked following the methods defined in EN 60529.

NOTE The enclosure is that of the device in working conditions, i.e. including connectors (with possible stoppers), packing box or other accessories.

5.6.8 **Electrical safety** (if applicable)

The manufacturer shall confirm that the recorder conforms to the requirements of EN 61010-1.

5.6.9 **Dielectric strength** (if applicable)

The test voltage is applied for 1 min between the two supply wires joined together and the earth terminal of the device linked to the metal envelope of an external sensor and to accessible metallic parts.

The test voltage shall be:

- as specified in EN 61010-1, for recorders supplied with external a.c. power source ;
- 500 V, r.m.s. value, 50 Hz, for recorders supplied with external d.c. power source.

6 Conditions of acceptance

6.1 Requirements

The recorder shall correspond with the characteristics set out in clause **4**.

6.2 Operating error limits

The maximum error values shall be less than or equal to maximum permissible errors as given in Table 2 for the class specified by the manufacturer.

7 Designation

The designation shall include the following data in the indicated order:

- reference to this European Standard;
- suitability for transport (T) or storage use (S);
- type of climatic environment (A, B, C or D);
- accuracy class (1 or 2);
- measuring range in degree Celsius.

8 Marking

Each temperature recorder shall be marked, clearly, permanently and in the indicated order on the housing of the recorder, with the following indications:

- reference of this European Standard;
- name of the manufacturer or trade mark;
- individual identification of the product;
- suitability for storage (S) or transport (T);
- type of climatic environment (A, B, C or D);
- accuracy class (1 or 2).

Each sensor separable from the recorder shall carry identification marks which permit, directly or indirectly, determination of its conditions for use with the recorder.

9 Periodic verification

The temperature recorders, when in service, shall be verified periodically in accordance with prEN 13486.

Annex A
(informative)

Example of data form describing suitability for use of equipment of a specific series (to be filled in by the manufacturer)

Name of test body : **Number and date of test reports :**	**Manufacturer stamp :** **Date :** **Signature :**	
Type of recorder		
Suitable for storage		
Suitable for transport		
I - General requirements		
Measuring range (see **4.2**)		
Chart (disk, tape) (see **4.4.3**)		
Autonomous power supply (see **4.5**)		
Degree of protection provided by the enclosure (see **4.6** and **5.6.7**)		
Supply voltage (see **4.8.1** or **4.8.2** and **5.6.2**)		
Frequency (see **4.8.3**)		
Power cut-offs (see **4.8.4**)		
II - Requirements for metrological characteristics		
Maximum permissible error and resolution (see **4.9.2.1**) and temperature measurement error (see **5.3**)		
Recording interval (see **4.9.2.2**)		
Recording duration (see **4.9.2.3**)		
Maximum relative timing error (see **4.9.2.4**) and time recording error (see **5.5**)		
Response time (see **4.9.2.5** and **5.4**)		
Climatic environment (see **4.9.3.1**) and influence of ambient temperature (see **5.6.3**)		
Mechanical vibrations (see **4.9.3.2** and **5.6.6**)		
Shock resistance (see **4.9.3.3** and **5.6.5**)		
Climatic environment (see **4.9.3.1**) and temperature testing under storage and transport conditions for the recorder (see **5.6.4**)		
Electrical power disturbances and susceptibility to radiated electromagnetic field (see **4.8.5**) and dielectric strength (see **5.6.9**)		

Annex B
(informative)

Bibliography

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