

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

**Directly heated negative temperature coefficient thermistors –
Part 1-1: Blank detail specification – Sensing application – Assessment level EZ**



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECTLY HEATED NEGATIVE TEMPERATURE COEFFICIENT
THERMISTORS –****Part 1-1: Blank detail specification –
Sensing application –
Assessment level EZ****FOREWORD**

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This PAS shall be read in conjunction with IEC 60539-1:2008.

IEC-PAS 60539-1-1 has been processed by IEC technical committee 40: Capacitors and resistors for electronic equipment.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
40/1927/PAS	40/1934/RVD

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DIRECTLY HEATED NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS –

Part 1-1: Blank detail specification – Sensing application – Assessment level EZ

INTRODUCTION

Blank detail specification

A blank detail specification is a supplementary document to the generic specification and contains requirements for style and layout and minimum content of detail specifications. Detail specifications not complying with these requirements shall not be considered as being in accordance with IEC specifications nor shall they so be described.

In the preparation of detail specifications, the content of 1.1 of the generic specification shall be taken into account.

The numbers between brackets on the first page correspond to the following information which shall be inserted in the position indicated.

Identification of the detail specification

- [1] The "International Electrotechnical Commission" or the National Standards Organization under whose authority the detail specification is drafted.
- [2] The IEC or National Standards number of the detail specification, date of issue and any further information required by the national system.
- [3] The number and issue number of the IEC or national generic specification.
- [4] The IEC number of the blank detail specification.

Identification of the thermistor

- [5] A short description of the type of thermistor.
- [6] Information on typical construction (if applicable).

NOTE When the thermistor is not designed for use on printed boards, this should clearly be stated in the detail specification in this position.

- [7] Outline drawing with main dimensions which are of importance for interchangeability and/or reference to the national or international documents for outlines. Alternatively, this drawing may be given in an annex to the detail specification.
- [8] Application or group of applications covered and/or assessment level.
- [9] Reference data on the most important properties, to allow comparison between the various thermistor types.

1 General data

1.1 Method(s) of mounting (to be inserted)

(See 4.4 of IEC 60539-1:2008.)

1.2 Dimensions

(All dimensions are in millimetres or inches and millimetres; it shall be stated which dimensions are suitable for gauging.)

Dimensioned drawing(s) shall be given in the detail specification. If necessary, the dimensions may be listed in tabular form with reference to styles or codes.

1.3 Coating

The detail specification shall state:

- a) whether the thermistor is insulated or non insulated;
- b) the material;
- c) the colour, if applicable.

1.4 Terminations

The detail specification shall state whether the terminations are suitable for soldering. If they are not, suitable methods of connection shall be stated for example: welding, clamping or crimping.

1.5 Flammability

The detail specification shall state whether the thermistor is actively or passively flammable, if applicable. The test method shall be given in the test schedule.

1.6 Resistance to solvents

The detail specification shall state whether the coating and the marking of the thermistor are solvent resistant, if applicable. The test methods shall be given in the test schedule.

1.7 Packaging

The detail specification shall give the following information (if required):

- a) whether bulk packed or taped and if taped, drawing or references;
- b) the dimensions of the immediate packaging and the number of thermistors packed;
- c) the dimensions of the outer package and the number of immediate packages;
- d) methods of disposal of the packaging material.

1.8 Electrical data/Ratings and characteristics

The detail specification shall give units and tolerances or limiting values for the following parameters. If necessary, electrical data may be listed in tabular form, with reference to styles and codes.

Upper/Lower category temperatures ($\theta_{\max}/\theta_{\min}$);

Maximum current at ambient temperature θ ($I_{\max \theta}$);

Zero-power resistance (R_T);

Resistance-temperature characteristics;

Maximum power dissipation at ambient temperature θ ($P_{\max \theta R}$);

B-value;
Isolation voltage (insulated thermistors only);
etc.

1.9 Normative references

The following referenced documents are indispensable for the application 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 60539-1:2008, *Directly heated negative temperature coefficient thermistors – Part 1: Generic specification*

1.10 Marking

The marking of the thermistors and package containing the thermistors shall be in accordance with the requirements of 4.5.2 of IEC 60539-1:2008.

The details of the marking of the thermistors and package containing the thermistor shall be given in full in the detail specification.

1.11 Ordering information

Orders for thermistors covered by this specification shall contain, in clear or in coded form, the following minimum information:

- a) style reference;
- b) maximum current at ambient temperature;
- c) number and issue reference of the detail specification;
- d) maximum dissipation power at ambient temperature;
- e) B-value.

1.12 Additional information (not for inspection purposes)

1.13 Additional or increased severities or requirements to those specified in the generic sectional specification

NOTE Additions or increased requirements should be specified only when essential.

2 Inspection requirements

2.1 Procedures

2.1.1 For qualification approval, the procedures shall be in accordance with the generic specification, IEC 60539-1:2008, 3.4.

2.1.2 For quality conformance inspection, the test schedules (see Tables 1 and 2) include sampling, periodicity, severities and requirements. The formation of inspection lots is covered by the generic specification IEC 60539-1:2008, 3.5.

The following list applies to the test schedules developed in Tables 1 and 2:

- 1) Subclause numbers of tests and performance requirements refer to the generic specification IEC 60539-1 and Clause 1 of this Blank Detail Specification.
- 2) Number to be tested: sample size as directly allotted to the code letter for IL in table IIA of IEC 60410:1973 (Single sampling plans for normal inspection).

- 3) In these tables:
 - p is the periodicity (in months)
 - n is the sample size
 - c is the acceptance criterion (permitted number of non-conforming items)
 - D indicates a destructive test
 - ND indicates a non-destructive test
 - IL is the inspection level
- 4) The temperature at which the zero-power resistance shall be measured is the temperature specified in the detail specification. This temperature shall be stated, where required, in the test schedule.
- 5) The specimens used for this group may, at the discretion of the manufacturer, be used for any subsequent group which is identified as being "destructive".
- 6) The soldering – solderability and soldering resistance to heat tests – shall only be applied where the thermistor has terminations which are appropriate for soldering.
- 7) Where the terminations are stated to be suitable for printed wiring applications, the appropriate test conditions in IEC 60068-2-58 shall apply.
- 8) The thermistors shall be mounted by their normal means.
- 9) The bump test and the shock test are alternatives. The test selected in the detail specification shall be used.
- 10) The detail specification shall specify which test is appropriate to the construction and application of the thermistor for measuring the thermal time constant.
- 11) Any deviation from Annex B of the generic specification shall be given in the detail specification.
- 12) 100 % testing shall be followed by re-inspection by sampling in order to monitor outgoing quality level by non-conforming items per million ($\times 10^{-6}$). The sampling level shall be established by the manufacturer. For the calculation of $\times 10^{-6}$ values, any parametric failure shall be counted as a non-conforming item. In case one or more non-conforming items occur in a sample, this lot shall be rejected.

Table 1 – Test schedule for quality conformance inspection: lot-by-lot

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and criterion of acceptability (see list item 3)			Performance requirements (see list item 1)
			IL	n	c	
GROUP A INSPECTION (lot-by-lot) (see note 5) Subgroup A0 4.6 Zero power resistance R_T	ND	Temperature:...°C Voltage:... V d.c	100 % (see list item 12)			As in 4.6.3
Subgroup A1 4.5.1 Visual examination	ND		S-4	(see list item 2)	0	As in 4.5.1
Subgroup A2 4.5.2 Marking 4.5.3 Dimensions (gauging)	ND		S-4	(see list item 2)	0	As specified in the detail specification
GROUP B INSPECTION (lot-by-lot) (see list item 5) Subgroup B1 4.7 B-Value 4.10 Resistance / temperature characteristic	ND		S-2	(see list item 2)	0	As in 4.7.2 As specified in the detail specification
Subgroup B2 4.9 Voltage proof 4.16 Solderability	ND	(Insulated thermistors only) Method:... Applied voltage:... V a.c. (see list item 6 and 7) Solder bath method	S-2	(see list item 2)	0	As in 4.9.4 As in 4.16.2

Table 2 – Test schedule for quantity conformance inspection: periodic

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and criterion of acceptability (see list item 3)			Performance requirements (see list item 1)
			p	n	c	
GROUP C INSPECTION (periodic)						
Subgroup C1A						
Part of sample						
4.15 Resistance to soldering heat	D	(see list item 6 and 7) Visual examination Zero power resistance R_T	6	5	0	No visible damage As in 4.6.3
4.14 Robustness of terminations		Tensile, bending and torsion test as appropriate to type of terminations Visual examination Zero power resistance R_T				No visible damage As in 4.6.3
Subgroup C1B						
Other part of sample						
4.17 Rapid change of temperature	D	$T_A = \theta_{\min}$ $T_B = \theta_{\max}$ Number of cycles: ... Visual examination Zero power resistance R_T	6	5	0	No visible damage As in 4.6.3
4.18 Vibration		(see list item 8) Frequency range: 10 to 55 Hz Amplitude: 0,75 mm or Acceleration: 98 m/s ² (whichever is the less severe) Endurance: 6 h Visual examination Zero power resistance R_T				No visible damage As in 4.6.3
4.19 Bump		(see list item 9) Acceleration: ... m/s ² Number of bumps: ... Visual examination Zero power resistance R_T				No visible damage As in 4.6.3
4.20 Shock		(see list item 9) Acceleration: 500 m/s ² Pulse shape: halfsine Pulse duration: 11 ms Visual examination Zero power resistance R_T				No visible damage As in 4.6.3

Table 2 (continued)

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and criterion of acceptability (see list item 3)			Performance requirements (see list item 1)
			p	n	c	
Subgroup C1 Combined sample of specimens of subgroups C1A and C1B Climatic sequence 4.24 Dry heat 4.33 Temperature / humidity cycle Final measurement	D	Temperature = θ_{\max} Duration: 16 h Number of cycles: ... Visual examination Zero power resistance R_T Insulation resistance 4.8 (Insulated thermistors only) Voltage proof 4.9 (Insulated thermistors only)	6	10	0	No visible damage As in 4.6.3 As in 4.8.6 As in 4.9.4
GROUP D INSPECTION Subgroup D1 4.11 Power dissipation 4.12 Thermal time constant by ambient temperature change 4.13 Thermal time constant by cooling after self-heating	D	$T_b = 85\text{ }^{\circ}\text{C}$ (unless otherwise specified) (see list item 10) (see list item 10)	6	10	0	As in 4.11.5 As in 4.12.4 As in 4.13.4
Subgroup D2 4.26.4 Endurance at upper category temperature	D	Temperature = θ_{\max} Duration: 1 000h Examination at 168 h and 500 h (if applicable) Visual examination Zero power resistance R_T Examination at 1 000h Visual examination Zero power resistance R_T	12	10	0	No visible damage As in 4.6.3 No visible damage As in 4.6.3

Table 2 (continued)

Subclause number and test (see list item 1)	D or ND	Conditions of test (see list item 1)	Sample size and criterion of acceptability (see list item 3)			Performance requirements (see list item 1)
			p	n	c	
Subgroup D3 4.26.3 Endurance at θ_3 and $P_{\max \theta}$	D	Temperature θ_3 :... °C $P_{\max \theta}$:... W Duration: 1 000h Examination at 168 h and 500 h (if applicable): Visual examination Zero power resistance R_T Examination at 1 000h: Visual examination Zero power resistance R_T	12	10	0	No visible damage As in 4.6.3 No visible damage As in 4.6.3
Subgroup D4 4.25 Damp heat, steady state	D	Temperature: 40 °C Humidity: 93 %rF Duration:... d Examination at 168 h and 500 h (if applicable): Visual examination Zero power resistance R_T Examination at 1 000 h: Visual examination Zero power resistance R_T Insulation resistance 4.8 (Insulated thermistors only) Voltage proof 4.9 (Insulated thermistors only)	12	10	0	No visible damage As in 4.6.3 No visible damage As in 4.6.3 As in 4.8.6 As in 4.9.4

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