Irish Standard
I.S. EN 60584-1:2013

Thermocouples -- Part 1: EMF specifications and tolerances

I.S. EN 60584-1:2013

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NSAI	T +353 1 807 3800	Sales:
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English version

Thermocouples -
Part 1: EMF specifications and tolerances
(IEC 60584-1:2013)

Couples thermoélectriques -
Partie 1: Spécifications et tolérances en matière de FEM
(CEI 60584-1:2013)

Thermoelemente -
Teil 1: Thermospannungen und Grenzabweichungen
(IEC 60584-1:2013)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

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Foreword

The text of document 65B/873/FDIS, future edition 3 of IEC 60584-1, prepared by SC 65B "Measurement and control devices" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60584-1:2013.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-07-02
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-10-02

This document supersedes EN 60584-1:1995 and EN 60584-2:1993.

EN 60584-1:2013 includes the following significant technical changes with respect to EN 60584-1:1995 and EN 60584-2:1993:

a) EN 60584-1:1995 and EN 60584-2:1993 have been merged;

b) the standard is now explicitly based on the reference polynomials which express thermocouple EMF as functions of temperature. The tables derived from the polynomials are given in Annex A;

c) inverse polynomials expressing temperature as functions of EMF are given in Annex B, but inverse tables are not given;

d) the range of the polynomial relating the EMF of Type K thermocouples is restricted to 1 300 °C;

e) values of the Seebeck coefficients are given at intervals of 10 °C;

f) thermoelectric data (EMF and Seebeck coefficients) are given at the fixed points of the ITS-90;

g) some guidance is given in Annex C regarding the upper temperature limits and environmental conditions of use for each thermocouple type.

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The text of the International Standard IEC 60584-1:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60584-1:1995	NOTE	Harmonized as EN 60584-1:1995 (not modified).
IEC 60584-2:1982	NOTE	Harmonized as EN 60584-2:1993 (not modified).
IEC 60584-3:2007	NOTE	Harmonized as EN 60584-3:2008 (not modified).
IEC 61515	NOTE	Harmonized as EN 61515.

IEC 60584-1

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Thermocouples –
Part 1: EMF specifications and tolerances

Couples thermoélectriques –
Partie 1: Spécifications et tolérances en matière de FEM

IEC 60584-1:2013

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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THERMOCOUPLES –

Part 1: EMF specifications and tolerances

FOREWORD

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International Standard IEC 60584-1 has been prepared by sub-committee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement,control and automation.

This third edition cancels and replaces the second edition published in 1995. This edition constitutes a technical revision.

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

a) IEC 60584-1:1995 and IEC 60584-2:1982 have been merged;
b) the standard is now explicitly based on the reference polynomials which express thermocouple EMF as functions of temperature. The tables derived from the polynomials are given in Annex A;
c) inverse polynomials expressing temperature as functions of EMF are given in Annex B, but inverse tables are not given;

d) the range of the polynomial relating the EMF of Type K thermocouples is restricted to 1 300 °C;

e) values of the Seebeck coefficients are given at intervals of 10 °C;

f) thermoelectric data (EMF and Seebeck coefficients) are given at the fixed points of the ITS-90;

g) some guidance is given in Annex C regarding the upper temperature limits and environmental conditions of use for each thermocouple type.

The text of this standard is based on the following documents:

FDIS	Report on voting
65B/873/FDIS	65B/888/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60584 series, under the general title *Thermocouples* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This International Standard relates the electromotive force (hereafter abbreviated as EMF) generated by the designated thermocouple types to temperature, based upon the International Temperature Scale of 1990 (ITS-90).

The reference polynomials for Types R, S, B, J, T, E, K and N are those used in the previous edition of this standard, IEC 60584-1:1995[1]. They were originally produced by the National Institute of Standards and Technology of the USA and published in NIST Monograph 175, 1993.

The major revision of this version is standardization of two kinds of tungsten-rhenium thermocouple, designated Type C and Type A. Both of them have been used in industry for a long time. Temperature versus EMF relationships for Type C and Type A are those published in the ASTM E230/E230-M12 and GOST R 8.585-2001 standards, respectively.

This edition merges two parts of the former IEC 60584 series, IEC 60584-1:1995 (*Reference tables*) and IEC 60584-2:1982 (*Tolerances*) and supersedes both standards. IEC 60584-3:2007 remains valid.

1 See Bibliography.

THERMOCOUPLES –

Part 1: EMF specifications and tolerances

1 Scope

This part of IEC 60584 specifies reference functions and tolerances for letter-designated thermocouples (Types R, S, B, J, T, E, K, N, C and A). Temperatures are expressed in degrees Celsius based on the International Temperature Scale of 1990, ITS-90 (symbol t_{90}), and the EMF (symbol E) is in microvolts.

The reference functions are polynomials which express the EMF, E in μV, as a function of temperature t_{90} in °C with the thermocouple reference junctions at 0 °C. Values of EMF at intervals of 1 °C are tabulated in Annex A.

For convenience of calculating temperatures, inverse functions are given in Annex B which express temperature as functions of EMF within stated accuracies.

This International Standard specifies the tolerances for thermocouples manufactured in accordance with this standard. The tolerance values are for thermocouples manufactured from wires, normally in the diameter range 0,13 mm to 3,2 mm, as delivered to the user and do not allow for calibration drift during use.

Annex C gives guidance on the selection of thermocouples with regard to temperature range and environmental conditions.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
thermoelectric effect
Seebeck effect
production of an electromotive force (EMF) due to a temperature gradient along a conductor

2.2
Seebeck coefficient of a thermocouple
change in EMF of a thermocouple combination per unit of temperature change, being the first derivative of EMF with respect to temperature.

Note 1 to entry: The Seebeck coefficient dE/dt_{90}, is expressed in μV/°C.

2.3
thermocouple
pair of conductors of dissimilar materials joined at one end and forming part of an arrangement using the thermoelectric effect for temperature measurement

2.4
measuring junction
junction of the thermocouple subjected to the temperature to be measured