Thermocouples -- Part 1: EMF specifications and tolerances

EESTI STANDARDIKESKUS
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NATIONAL FOREWORD

See Eesti standard EVS-EN 60584-1:2013 sisaldab Euroopa standardi EN 60584-1:2013 inglisekeelset teksti.	This Estonian standard EVS-EN 60584-1:2013 consists of the English text of the European standard EN 60584-1:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.12.2013.	Date of Availability of the European standard is 13.12.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.200.20

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60584-1

December 2013

ICS 17.200.20

Supersedes EN 60584-1:1995, EN 60584-2:1993

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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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 CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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CENELEC

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

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Ref. No. EN 60584-1:2013 E

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

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.

CONTENTS

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