

BS EN 62460:2008



BSI Standards Publication

Temperature — Electromotive force (EMF) tables for pure-element thermocouple combinations

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National foreword

This British Standard is the UK implementation of EN 62460:2008. It is identical to IEC 62460:2008.

The UK participation in its preparation was entrusted by Technical Committee GEL/65, Measurement and control, to Subcommittee GEL/65/2, Elements of systems.

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

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EUROPEAN STANDARD
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English version

**Temperature -
Electromotive force (EMF) tables
for pure-element thermocouple combinations
(IEC 62460:2008)**

Tableaux température -
Force électromotrice (F.É.M.)
pour les combinaisons de couples
thermoélectriques à éléments purs
(CEI 62460:2008)

Temperatur -
Tabellen der elektromotorischen Kraft
(EMK) für Kombinationen
von Reinelement-Thermoelementen
(IEC 62460:2008)

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CENELEC

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

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Foreword

The text of document 65B/665/FDIS, future edition 1 of IEC 62460, prepared by SC 65B, Devices & process analysis, of IEC TC 65, Industrial-process measurement, control and automation, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62460 on 2008-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2009-05-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2011-08-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62460:2008 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60584-1	- ¹⁾	Thermocouples - Part 1: Reference tables	EN 60584-1	1995 ²⁾

¹⁾ Undated reference.

²⁾ Valid edition at date of issue.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TEMPERATURE – ELECTROMOTIVE FORCE (EMF) TABLES FOR PURE-ELEMENT THERMOCOUPLE COMBINATIONS

FOREWORD

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International Standard IEC 62460 has been prepared by subcommittee 65B: Devices and process analysis, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65B/665/FDIS	65B/684/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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

TEMPERATURE – ELECTROMOTIVE FORCE (EMF) TABLES FOR PURE-ELEMENT THERMOCOUPLE COMBINATIONS

1 Scope

This International Standard specifies the equations and reference tables relating temperature to EMF (electro-motive force) for Gold versus Platinum and Platinum versus Palladium thermocouples. For information and convenience of use it also provides the approximate equations for temperature as functions of EMF.

The tables and equations in this standard are intended for use with thermocouples made from elements of purity not less than 99.999 % for Platinum and Gold and of 99.99 % for Palladium, by weight.

Tolerances on initial values of EMF versus temperature have not been established for the thermocouples in this standard. Where required, these tolerances should be agreed between the wire manufacturer and the user.

Temperatures in this standard are based on the International Temperature Scale of 1990 (ITS-90). They are expressed in degrees Celsius, symbol t_{90} . Values of EMF, symbol $E/\mu V$, are given in microvolts.

This standard does not cover extension or compensating wires for use with the pure-element thermocouples. The questions of their use shall be agreed between the manufacturer and the user.

2 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 60584-1, *Thermocouples – Reference tables*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60584-1 apply, as well as the following.

3.1

thermocouple types

the following thermocouple wire types are covered by this standard:

- Gold versus Platinum (Au/Pt or Gold/Platinum)
- Platinum versus Palladium (Pt/Pd or Platinum/Palladium)

Following international convention, as in IEC 60584-1, when identifying thermocouples the positive element/wire is given first.

3.2 thermoelectric values at the ITS-90 fixed points

values are given for the defining triple points (TP), melting points (MP) and freezing points (FP) in the temperature range of the corresponding tables. The Seebeck coefficient S is the first derivative of the EMF with respect to temperature.

4 Information on tables and equations

The following tables are included in this standard:

- Gold versus Platinum: EMF at intervals of 1 °C
- Gold versus Platinum: temperatures at intervals of 10 µV
- Gold versus Platinum: thermoelectric values at the fixed points of the ITS-90
- Platinum versus Palladium: EMF at intervals of 1 °C
- Platinum versus Palladium: temperatures at intervals of 10 µV
- Platinum versus Palladium: thermoelectric values at the fixed points of the ITS-90

For the tables in this document, the reference temperature is 0 °C.

The definitive equations of EMF, $E/\mu\text{V}$, as functions of temperature, $t_{90}/^{\circ}\text{C}$, which are used to generate the tables, are given in Annex A for Gold/Platinum thermocouples and Annex B for Platinum/Palladium thermocouples.

For information and convenience in use, approximate equations are also given, expressing $t_{90}/^{\circ}\text{C}$ as functions of $E/\mu\text{V}$ for the respective thermocouples within the stated error limits.

5 Tables for Gold versus Platinum thermocouples

5.1 Gold versus Platinum: EMF at intervals of 1 °C

$t_{90} / ^\circ\text{C}$	0	1	2	3	4	5	6	7	8	9	$t_{90} / ^\circ\text{C}$
$E/\mu\text{V}$											
0	0.0	6.1	12.1	18.3	24.5	30.7	36.9	43.2	49.5	55.9	0
10	62.3	68.7	75.2	81.7	88.2	94.8	101.4	108.1	114.8	121.5	10
20	128.3	135.1	141.9	148.8	155.7	162.7	169.7	176.7	183.7	190.8	20
30	197.9	205.1	212.3	219.5	226.8	234.1	241.4	248.8	256.2	263.6	30
40	271.1	278.6	286.1	293.7	301.3	308.9	316.6	324.3	332.1	339.8	40
50	347.6	355.5	363.3	371.2	379.2	387.1	395.1	403.2	411.2	419.3	50
60	427.5	435.6	443.8	452.1	460.3	468.6	476.9	485.3	493.6	502.1	60
70	510.5	519.0	527.5	536.0	544.6	553.2	561.8	570.5	579.2	587.9	70
80	596.6	605.4	614.2	623.1	632.0	640.9	649.8	658.7	667.7	676.8	80
90	685.8	694.9	704.0	713.1	722.3	731.5	740.7	750.0	759.2	768.6	90
100	777.9	787.3	796.7	806.1	815.5	825.0	834.5	844.1	853.6	863.2	100
110	872.8	882.5	892.2	901.9	911.6	921.4	931.2	941.0	950.8	960.7	110
120	970.6	980.5	990.5	1000.4	1010.4	1020.5	1030.5	1040.6	1050.7	1060.9	120
130	1071.0	1081.2	1091.4	1101.7	1112.0	1122.3	1132.6	1142.9	1153.3	1163.7	130
140	1174.1	1184.6	1195.1	1205.6	1216.1	1226.7	1237.2	1247.8	1258.5	1269.1	140
150	1279.8	1290.5	1301.3	1312.0	1322.8	1333.6	1344.4	1355.3	1366.2	1377.1	150
160	1388.0	1399.0	1410.0	1421.0	1432.0	1443.1	1454.1	1465.3	1476.4	1487.5	160
170	1498.7	1509.9	1521.1	1532.4	1543.7	1555.0	1566.3	1577.6	1589.0	1600.4	170
180	1611.8	1623.3	1634.7	1646.2	1657.7	1669.3	1680.8	1692.4	1704.0	1715.6	180
190	1727.3	1739.0	1750.7	1762.4	1774.1	1785.9	1797.7	1809.5	1821.3	1833.2	190
200	1845.1	1857.0	1868.9	1880.9	1892.8	1904.8	1916.8	1928.9	1941.0	1953.0	200
210	1965.1	1977.3	1989.4	2001.6	2013.8	2026.0	2038.3	2050.5	2062.8	2075.1	210
220	2087.4	2099.8	2112.2	2124.6	2137.0	2149.4	2161.9	2174.4	2186.9	2199.4	220
230	2211.9	2224.5	2237.1	2249.7	2262.3	2275.0	2287.7	2300.4	2313.1	2325.8	230
240	2338.6	2351.4	2364.2	2377.0	2389.8	2402.7	2415.6	2428.5	2441.4	2454.4	240
250	2467.3	2480.3	2493.3	2506.4	2519.4	2532.5	2545.6	2558.7	2571.9	2585.0	250
260	2598.2	2611.4	2624.6	2637.8	2651.1	2664.4	2677.7	2691.0	2704.3	2717.7	260
270	2731.1	2744.5	2757.9	2771.3	2784.8	2798.3	2811.8	2825.3	2838.9	2852.4	270
280	2866.0	2879.6	2893.2	2906.9	2920.5	2934.2	2947.9	2961.6	2975.4	2989.1	280
290	3002.9	3016.7	3030.5	3044.4	3058.2	3072.1	3086.0	3099.9	3113.8	3127.8	290
300	3141.8	3155.8	3169.8	3183.8	3197.9	3211.9	3226.0	3240.1	3254.3	3268.4	300
310	3282.6	3296.8	3311.0	3325.2	3339.4	3353.7	3368.0	3382.3	3396.6	3410.9	310
320	3425.3	3439.7	3454.1	3468.5	3482.9	3497.4	3511.8	3526.3	3540.8	3555.4	320
330	3569.9	3584.5	3599.1	3613.7	3628.3	3642.9	3657.6	3672.2	3686.9	3701.7	330
340	3716.4	3731.1	3745.9	3760.7	3775.5	3790.3	3805.2	3820.0	3834.9	3849.8	340
350	3864.7	3879.6	3894.6	3909.6	3924.6	3939.6	3954.6	3969.6	3984.7	3999.8	350
360	4014.9	4030.0	4045.1	4060.3	4075.4	4090.6	4105.8	4121.0	4136.3	4151.5	360
370	4166.8	4182.1	4197.4	4212.8	4228.1	4243.5	4258.9	4274.3	4289.7	4305.1	370
380	4320.6	4336.1	4351.6	4367.1	4382.6	4398.1	4413.7	4429.3	4444.9	4460.5	380
390	4476.1	4491.8	4507.4	4523.1	4538.8	4554.6	4570.3	4586.1	4601.8	4617.6	390