Designation: C899 – 79 (Reapproved 2022)

Standard Practice for Use of Metric Units of Measure for Reporting Properties of Refractory Materials[1] (COMMITTEE C08 SUPPLEMENT TO E380)

This standard is issued under the fixed designation C899; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice presents the units to be employed for reporting the properties of refractories, such as density, crushing stress, modulus of rupture, tensile stress, thermal conductivity, and permeability.

1.2 For convenience, a table of conversion factors between inch-pound units and SI units is included.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E380 Practice for Use of the International System of Units (SI) (the Modernized Metric System) (Withdrawn 1997)[3]

2.2 *ISO Standard:*[4]

ISO 1000 SI Units and Recommendations for the Use of Their Multiples and of Certain Other Units

3. Significance and Use

3.1 This practice is provided to facilitate comparison of physical and mechanical properties of refractory materials by establishing uniform presentation of data.

3.2 Units have been chosen, where possible, to result in numbers of magnitude familiar in the refractories industry, that is, g/cm^3 rather than the SI preferred unit kg/m^3. It is recommended that SI prefixes be selected for use with the units such that the resulting numerical values lie between 0.1 and 1000. For most properties, the prefixes kilo (k) and mega (M) are preferred. Other prefixes are given in the following table:

Multiplication Factor	Prefix	Symbol
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto[A]	h
10^1	deka[A]	da
10^{-1}	deci[A]	d
10^{-2}	centi[A]	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n

[A] To be avoided where practical.

3.3 The conversion factors, which have been selected for their general utility in the refractories industry, have been taken from Practice E380, where possible. For uniformity, they have been presented to four decimal places. In use, the converted values should be rounded to the same number of significant figures as in the original value.

4. Standard Units

4.1 *Density*—Grams per cubic centimetre (g/cm^3).

4.2 *Energy or Work*—Joules (J) or megajoules (MJ).

4.3 *Mass*—Grams (g), kilograms (kg), or megagrams (Mg).

4.4 *Permeability* is currently expressed in darcys. One darcy is a flow of 1.00 cm^3/s of a fluid of 1 centipoise (cP) viscosity through a 1-cm cube of the material being measured under a pressure differential of 1 atmosphere. Thus, a darcy is not an SI unit. No permeability units are given in Practice E380. Until an SI unit of permeability is adopted, express permeability in darcys.

4.5 *Power*—Watts (W) or kilowatts (kW).

4.6 *Pressure or Stress*—Megapascals (MPa) (preferred). For stress less than 1 MPa, kilopascals (kPa) may be used.

[1] This practice is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.92 The Joseph E. Kopanda Subcommittee for Editorial, Terminology and Classification.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

TABLE 1 Conversion Factors

To convert from	to	Multiply by
AREA		
square inch (in^2)	square centimetre (cm^2)	6.4516[A]
square foot (ft^2)	square centimetre (cm^2)	929.0304[A]
square yard (yd^2)	square metre (m^2)	0.8361
DENSITY		
pound per cubic foot (lb/ft^3)	gram per cubic centimetre (g/cm^3)	0.01602
ENERGY (Includes WORK)		
British thermal unit (Btu)	joule (J)	1055.0559
calorie (cal)	joule (J)	4.1868[A]
kilowatt hour (kWh)	megajoule (MJ)	3.6000[A]
LENGTH		
inch (in)	millimetre (mm)	25.4000[A]
foot (ft)	millimetre (mm)	304.8000[A]
yard (yd)	metre (m)	0.9144[A]
MASS		
ounce (oz)	gram (g)	28.3495
pound (lb)	kilogram (kg)	0.4536
ton (short, 2000 lb)	megagram (Mg)	0.9072
ton (long, 2240 lb)	megagram (Mg)	1.0160
POWER		
British thermal unit per hour (Btu/h)	watt (W)	0.2931
horsepower (hp) (550 ft·lbf/s)	kilowatt (kW)	0.7457
PRESSURE OR STRESS		
pound-force per square inch (psi)	megapascal (MPa)	0.0068948
kilogram-force per square centimetre (kgf/cm^2)	megapascal (MPa)	0.0980665[A]
atmosphere	megapascal (MPa)	0.1013250[A]
bar	megapascal (MPa)	0.1000000[A]
THERMAL CONDUCTIVITY		
Btu·in/ft^2·h·°F	watt per metre kelvin [W/(m·k)]	0.1442
cal/cm·s·°C	watt per metre kelvin [W/(m·k)]	418.4000[A]
THERMAL EXPANSION COEFFICIENT		
1/°F (Δ*l*/*l*·°F)	1/K(Δ*l*/*l*·K)	1.8000[A]

[A]Denotes exact conversion.

NOTE 1—Included are bending, crushing, shear and tensile stress, modulus of rupture, and elastic modulus.

4.7 *Thermal Conductivity*—Watts per metre kelvin (W/m·K).

4.8 *Thermal Expansion Coefficient*—Change in length per unit length per kelvin.

5. Conversion Factors

5.1 *Converson Factors*—See Table 1.

6. Keywords

6.1 metric; practice; properties; refractory