Jamaican Standard

2024 Jamaica Energy Conservation Code

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JS 309:2024

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CERTIFICATION MARKS

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JAMAICAN STANDARD
JAMAICA ENERGY CONSERVATION CODE

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Jamaican Standards establish requirements in relation to commodities, processes and practices, but do not purport to include all the necessary provisions of a contract.

The attention of those using this standard is called to the necessity of complying with any relevant legislation.

Amendments

No.	Date of issue	Remarks	Entered by and date

PREFACE

Introduction

This standard is a revision of and supersedes JS 309: 2019 Jamaican Standard Jamaica Application Document for the *International Energy Conservation Code*® (IECC®).

Jamaica imports nearly all of its energy, at considerable cost; for example, in 2008 Jamaica spent approximately US $2.4 billion importing crude and finished petroleum products. The country imports approximately 97% of its energy needs; as such, the economy is susceptible to the repercussions of rapid and fairly frequent petroleum price increases. Added to this is the fact that consumption of petroleum products carries with it the emanation of greenhouse gases that increase global warming and its concomitant byproducts of more intense and frequent floods, droughts and hurricanes. The high cost of petroleum has resulted in an increase in the cost of electricity and transportation, making it extremely difficult for Jamaican industries to be cost competitive within our traditional markets. High energy costs as well as inefficient uses of energy have the effect of forcing industries, jobs and wealth out of Jamaica. The efficient use of energy and energy diversification are the most immediate solutions to the energy crisis facing Jamaica. An Energy Efficiency Building Code (EEBC) is extremely important to achieving the most immediate solutions but this code must be a mandatory requirement for all building types (hotels, apartment complexes, offices, other commercial properties and residences) in Jamaica since buildings consume as much as 55% of the total electrical energy generated.

Recognizing the importance of energy-efficient buildings to Jamaica, an effort was made in 1987/1988 to develop a comprehensive EEBC. This project, sponsored by the Canadian International Development Agency (CIDA) through the World Bank Energy Sector Management Assistance Program (ESMAP), saw to the development of an energy efficiency code that covered the building envelope; lighting (use of natural and energy-efficient artificial lighting); electrical power distribution; air-conditioning, heating and ventilation; operation and maintenance for commercial buildings and high-rise conditioned residential buildings. With this code, building envelopes and services were targeted for energy savings and, while the minimum targeted savings was 30% on the then-conventional construction techniques used, the building owner was encouraged to look beyond the minimum savings where construction budgets could afford an energy increment greater than the 5% increase that it took to deliver the 30% energy savings.

The 2003 version of the *International Energy Conservation Code*® (IECC) has concentrated its energy-saving possibilities on the building envelope of all building types including those of the low-rise residential sector. The 2003 IECC therefore complements the existing Jamaica EEBC that targets only the commercial sector and conditioned residential buildings above four storeys.

The 2019 Application Document combined the IECC and EEBC as well as updated where necessary EEBC requirements that were over 10 years old. The approach taken was to specify the minimum energy-saving requirement while supporting greater energy-saving possibilities where it could be accommodated. That Application Document covered energy savings in the Low-Rise Residential Sector for the first time in Jamaica and provided the following three approaches for designing energy-efficient buildings in this Sector:

a. A Systems Analysis Method utilizing renewable energy sources.

b. A Component Performance Method.

c. A Prescriptive Method that simply specifies practical measures to achieve major energy savings.

Perhaps the most radical difference between that Application Document and the IECC is that the Application Document required unconditioned buildings to practice energy conservation for the building envelope, lighting, appliances and equipment including hot water heaters. That difference arises from the fact that in Jamaica, most residential and small commercial buildings are initially constructed as unconditioned buildings that need heat-alleviating measures especially in the summer months.

This *Jamaica Energy Conservation Code* incorporates the 2018 *CARICOM Regional Energy Efficiency Building Code* (CREEBC), which is itself substantially based on the 2018 version of the IECC. Differences with the EEBC described above no longer exist. IECC now incorporates the prescriptive, component performance, and system analysis methods, which are referred to in the 2018 CREEBC. And the CREEBC makes no provision for unconditioned buildings, although most residential and small commercial buildings in the CARICOM region are also initially constructed as unconditioned buildings.

This standard is voluntary.

Applicable Version of the IECC

This document is based on the 2018 version of the *International Energy Conservation Code* (IECC). However, the user will not have to reference that document unless specifically instructed to do so.

Subsequent versions of the IECC may result in subsequent versions of this document.

Use and Structure

Users wishing to apply the IECC in Jamaica must first consult this Application Document in order to get guidance on what applies, additional data and information that applies only to Jamaica.

The structure of this application document runs parallel to that of the IECC at the Chapter level. This means that all chapter titles from the IECC are covered and included in the application document. The numbering system of the chapters is also maintained as far as is practicable.

Section and subsection titles and the numbering system are maintained according to the following rules:

1. Where there are national requirements, the section and/or subsection number and title along with the appropriate clause are included in this Application Document. The number and title of sections and subsections follow the numbering sequence of the IECC;

2. For ease of use and to minimize any ambiguity in the reading or interpretation of this Application Document, there are instances when number and title of a section or subsection are retained; this rule applies mainly to scope and application or when the information may be helpful to establish sequence or context.

Development

A Steering or Managing Committee comprising stakeholders from the Jamaica Institution of Engineers (JIE), Jamaica Institution of Architects (JIA), Incorporated Master-builders Association of Jamaica (IMAJ), University of Technology, Jamaica (UTECH), Ministry of Local Government & Community Development (MLGCD), Ministry of Land and Development (MLD), Bureau of Standards Jamaica (BSJ), Housing Developers & Mortgagers/Financiers, National Environmental Protection Agency (NEPA) and Practicing Architects and Engineers was first put in place to manage the code development process. This Committee started monthly meetings in September 2003 to plan the adoption process, develop implementation strategy and put in place the organizational structure to accomplish the adoption process.

Maintenance

Application Documents will require updating and changes over time. Jamaica will participate in the ICC Standards Development and Maintenance programme. CREEBC is intended to be updated within 6 years from the completion of the document. The CARICOM Regional Organisation for Standards and Quality (CROSQ) will participate in the ICC Standards Development and Maintenance programme.

Committee Representation

The preparation of this Jamaica Application Document for the Standards Council, established under the Standards Act of 1969, was carried out under the supervision of the National Building Code Technical Committee which at the time comprised the following members:

NATIONAL BUILDING CODE TECHNICAL COMMITTEE

Mr. Paul Hay (Consultant)	PHC Facilities Development
Mr. Oneil Josephs	University of Technology, Jamaica
Mr. Roosevelt DaCosta	Endacosta Ltd.
Mr. Karl Kaiser	Brandschutz Kaiser
Mr. Stanley Smellie	University of the West Indies, Mona
Ms. Winsome Grant	Jamaica Fire Brigade
Ms. Alciann Samuels Bennett	Ministry of Health & Wellness
Mr. Alfrico Adams	SMADA Consultants Ltd.
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Ms. Erica Boswell Munroe	Endacosta Ltd.
Mr. Richard Lawrence	Bureau of Standards Jamaica
Mr. Wilfred Francis	Bureau of Standards Jamaica
Mr. Shane Slater (Facilitator)	Bureau of Standards Jamaica

ACKNOWLEDGEMENTS

CREEBC COMMITTEE REPRESENTATION

The development of the CARICOM Regional Energy Efficiency Building Code [CREEBC] was facilitated by a Regional Project Team (hosted by the CARICOM Member State, Jamaica), which at the time comprised the following members:

Members	Representing
Mr. Zepherinus Churchill Norbert (Chairman)	Project Coordinator/Consultant Department of Environment Ministry of Health, Wellness and the Environment Antigua and Barbuda
Mr. Mali Barnes	Energy Officer Ministry of Public Utilities, Civil Aviation, Transport and Energy Antigua and Barbuda
Mr. Craig Delancy	Building Control Officer Ministry of Works and Urban Development Bahamas
Mr. Fabian Scott	Chief Technical Officer Barbados National Standards Institution (BNSI) Barbados
Mr. Jonathan Platt	Technical Officer Barbados National Standards Institution (BNSI) Barbados
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Mr. Fred Esprit	Managing Director Esprit Ultimate Design, Inc. Member Dominica Society of Architects Dominica
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Mr. Verne Emmanuel (Vice Chairman)	Chairman Mechanical Products Technical Committee Saint Lucia Bureau of Standards President Saint Lucia Association of Professional Engineers Saint Lucia

Members	Representing
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Mr. Ellsworth Dacon	Director of Energy St. Vincent and the Grenadines
Mr. Ricardo Adams	Chairman National Mirror Committee St. Vincent and the Grenadines Bureau of Standards St. Vincent and the Grenadines
Mr. Devanand Ragbir	Chairman National Mirror Committee Engineer Member Trinidad and Tobago Green Building Council Trinidad and Tobago
Ms. Nadita Ramachala	Standards Officer Trinidad and Tobago Bureau of Standards Trinidad and Tobago
Ms. Andia Persad-Maharaj	Standards Officer Trinidad and Tobago Bureau of Standards Trinidad and Tobago

Technical Advisory Board

Members	Representing
Mr. Christopher Lou	Architect The Jamaican Institute of Architects (JIA)
Mr. Douet Stennett	Director, Regulatory Affairs Ministry of Science, Energy and Technology (MSET) Jamaica

Acknowledgements

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Ms. Amanda Harris-Logie	Energy Efficiency Officer Renewable Energy and Energy Efficiency Technical Assistance Programme (REEETA)
Mr. Nigel Duncan	Project Officer, Administration Renewable Energy and Energy Efficiency Technical Assistance Programme (REEETA)
Mr. Deryck Omar	Chief Executive Officer CARICOM Regional Organisation for Standards and Quality (CROSQ)
Ms. Euleen Alleyne	Administrative Assistant CARICOM Regional Organisation for Standards and Quality (CROSQ)
Mr. Fulgence St. Prix	Technical Officer—Standards CARICOM Regional Organisation for Standards and Quality (CROSQ)

The Bureau of Standards Jamaica (BSJ) also wishes to acknowledge the kind cooperation and assistance of the International Code Council (ICC) in allowing the use of its IECC Document in the production of the CREEBC.

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EFFECTIVE USE OF THE CARICOM REGIONAL ENERGY EFFICIENCY BUILDING CODE

The *CARICOM Regional Energy Efficiency Building Code* (CREEBC) is a model code that regulates minimum energy conservation requirements for new buildings. The CREEBC addresses energy conservation requirements for all aspects of energy uses in both commercial and residential construction, including heating and ventilating, lighting, water heating, and power usage for appliances and building systems.

The CREEBC is a design document. For example, before one constructs a building, the designer must determine the minimum insulation *R*-values and fenestration *U*-factors for the building exterior envelope. Depending on whether the building is for residential use or for commercial use, the CREEBC sets forth minimum requirements for exterior envelope insulation, window and door *U*-factors and SHGC ratings, duct insulation, lighting and power efficiency, and water distribution insulation.

Arrangement and Format of the CREEBC 2018

The CREEBC contains two separate sets of provisions—one for commercial buildings and one for residential buildings. Each set of provisions is applied separately to buildings within their scope. The CREEBC—Commercial Provisions apply to all buildings except for residential buildings three storeys or less in height. The CREEBC—Residential Provisions apply to detached one- and two-family dwellings and multiple single-family dwellings as well as *Group R*-2, R-3 and R-4 buildings three storeys or less in height. These scopes are based on the definitions of "Commercial building" and "Residential building," respectively, in Chapter 2 of each set of provisions. Note that the CREEBC—Commercial Provisions therefore contain provisions for residential buildings four storeys or greater in height. Each set of provisions is divided into five different parts:

Chapters	Subjects
1–2	Administration and definitions
3	Climate zones and general materials requirements
4	Energy efficiency requirements
5	Existing buildings
6	Referenced standards

The following is a chapter-by-chapter synopsis of the scope and intent of the provisions of the *International Energy Conservation Code* and applies to both the commercial and residential energy provisions:

Chapter 1 Scope and Administration. This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. Chapter 1 is largely concerned with maintaining "due process of law" in enforcing the energy conservation criteria contained in the body of this code. Only through careful observation of the administrative provisions can the code official reasonably expect to demonstrate that "equal protection under the law" has been provided.

Chapter 2 Definitions. Chapter 2 is the repository of the definitions of terms used in the body of the code. Codes are technical documents and every word, term and punctuation mark can impact the meaning of the code text and the intended results. The code often uses terms that have a unique meaning in the code and the code meaning can differ substantially from the ordinarily understood meaning of the term as used outside of the code.

The terms defined in Chapter 2 are deemed to be of prime importance in establishing the meaning and intent of the code text. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and the user may not be aware that a term is defined.

Additional definitions regarding climate zones are found in Tables 301.3(1) and (2). These are not listed in Chapter 2.

Where understanding of a term's definition is especially key to or necessary for understanding of a particular code provision, the term is shown in *italics*. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code is provided.

Chapter 3 General Requirements. Chapter 3 specifies the climate zones that will serve to establish the exterior design conditions. In addition, Chapter 3 provides interior design conditions that are used as a basis for assumptions in heating and cooling load calculations, and provides basic material requirements for insulation materials and fenestration materials.

Climate has a major impact on the energy use of most buildings. The code establishes many requirements such as wall and roof insulation *R*-values, window and door thermal transmittance (*U*-factors) and provisions that affect the mechanical systems based on the climate where the building is located. This chapter contains information that will be used to properly assign the building location into the correct climate zone and is used as the basis for establishing or eliminating requirements.

Chapter 4 Energy Efficiency. Chapter 4 of each set of provisions contains the technical requirements for energy efficiency.

Commercial Energy Efficiency. Chapter 4 of the CREEBC—Commercial Provisions contains the energy-efficiency-related requirements for the design and construction of most types of commercial buildings and residential buildings greater than three stories in height above grade. This chapter defines requirements for the portions of the building and building systems that impact energy use in new commercial construction and new residential construction greater than three stories in height, and promotes the effective use of energy. In addition to energy conservation requirements for the building envelope, this chapter contains requirements that impact energy efficiency for the HVAC systems, the electrical systems and the plumbing systems. It should be noted, however, that requirements are contained in other codes that have an impact on energy conservation. For instance, requirements for water flow rates are regulated by the *International Plumbing Code*.

Residential Energy Efficiency. Chapter 4 of the CREEBC—Residential Provisions contains the energy-efficiency-related requirements for the design and construction of residential buildings regulated under this code. It should be noted that the definition of a *residential building* in this code is unique for this code. In this code, a *residential building* is a detached one- and two-family dwelling and multiple single-family dwellings as well as R-2, R-3 or R-4 buildings three stories or less in height. All other buildings, including residential buildings greater than three stories in height, are regulated by the energy conservation requirements in the CREEBC—Commercial Provisions. The applicable portions of a residential building must comply with the provisions within this chapter for energy efficiency. This chapter defines requirements for the portions of the building and building systems that impact energy use in new residential construction and promotes the effective use of energy. The provisions within the chapter promote energy efficiency in the building envelope, the heating and cooling system and the service water heating system of the building.

Chapter 5 Existing Buildings. Chapter 5 of each set of provisions contains the technical energy efficiency requirements for existing buildings. Chapter 5 provisions address the maintenance of buildings in compliance with the code as well as how additions, alterations, repairs and changes of occupancy need to be addressed from the standpoint of energy efficiency. Specific provisions are provided for historic buildings.

Chapter 6 Referenced Standards. The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 6 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the code official, contractor, designer and owner.

Chapter 6 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based on the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

Abbreviations and Notations

The following is a list of common abbreviations and units of measurement used in this code. Some of the abbreviations are for terms defined in Chapter 2. Others are terms used in various tables and text of the code.

AFUE	Annual fuel utilization efficiency
bhp	Brake horsepower (fans)
Btu	British thermal unit
Btu/h-ft^2	Btu per hour per square foot
C-factor	See Chapter 2—Definitions
CDD	Cooling degree days
cfm	Cubic feet per minute
cfm/ft^2	Cubic feet per minute per square foot
ci	Continuous insulation
COP	Coefficient of performance
DCV	Demand control ventilation
°C	Degrees Celsius
°F	Degrees Fahrenheit
DWHR	Drain water heat recovery
DX	Direct expansion
E_c	Combustion efficiency
E_v	Ventilation efficiency
E_t	Thermal efficiency
EER	Energy efficiency ratio
EF	Energy factor
ERI	Energy rating index
F-factor	See Chapter 2—Definitions

FDD	Fault detection and diagnostics
FEG	Fan efficiency grade
FL	Full load
ft^2	Square foot
gpm	Gallons per minute
HDD	Heating degree days
hp	Horsepower
HSPF	Heating seasonal performance factor
HVAC	Heating, ventilating and air conditioning
IEER	Integrated energy efficiency ratio
IPLV	Integrated Part Load Value
Kg/m^2	Kilograms per square meter
kW	Kilowatt
LPD	Light power density (lighting power allowance)
L/s	Liters per second
Ls	Liner system
m^2	Square meters
MERV	Minimum efficiency reporting value
NAECA	National Appliance Energy Conservation Act
NPLV	Nonstandard Part Load Value
Pa	Pascal
PF	Projection factor
pcf	Pounds per cubic foot
psf	Pounds per square foot
PTAC	Packaged terminal air conditioner
PTHP	Packaged terminal heat pump
R-value	See Chapter 2—Definitions
SCOP	Sensible coefficient of performance
SEER	Seasonal energy efficiency ratio
SHGC	Solar Heat Gain Coefficient
SPVAC	Single packaged vertical air conditioner
SPVHP	Single packaged vertical heat pump
SRI	Solar reflectance index
SWHF	Service water heat recovery factor
U-factor	See Chapter 2—Definitions
VAV	Variable air volume
VRF	Variable refrigerant flow
VT	Visible transmittance
W	Watts
w.c.	Water column
w.g.	Water gauge

UNITS CONVERSION TABLE

SI Unit		I-P Unit		Conversion Factor
1 COP	=	3.412969283	EER	0.293
1 EJ	=	0.947867299	quad (10^{15} Btu)	1.055
1 g	=	15.43209877	grain (1/7000 lb)	0.0648
1 g	=	0.035273369	oz (mass, avoirdupois)	28.35
1 g	=	0.002204624	lb (avoirdupois, mass)	453.592
1 g/kg	=	6.993006993	gr/lb	0.143
1 g/m^3	=	0.058479532	gr/gal	17.1
1 ha	=	2.470966148	acre (43,560 ft^2)	0.4047
1 J	=	0.000947817	Btu (International Table)	1055.056
1 J	=	0.000948452	Btu (thermochemical)	1054.35
1 J	=	0.239005736	calorie (thermochemical)	4.184
1 J	=	0.737463127	ft • lb_f (work)	1.356
1 J/kg	=	0.334448161	ft • lb_f/lb (specific energy)	2.99
1 J/m^2	=	8.80551E-05	Btu/ft^2 (International Table)	11,356.53
1 J/m^3	=	2.68392E-05	Btu/ft^3 (International Table)	37,258.95
1 J/m^3	=	3.58787E-06	Btu/gal	278,717.18
1 kg	=	2.20462442	lb (avoirdupois, mass)	0.453592
1 kg/(Pa • s • m)	=	6.87938E+11	perm inch (permeability at 32 °F)	1.45E-12
1 kg/(Pa • s • m^2)	=	17478392337	perm (permeance at 32 °F)	5.7214E-11
1 kg/m^2	=	0.204918033	lb/ft^2	4.88
1 kg/m^3	=	0.133526466	ounce (avoirdupois) per gallon	7.489152
1 kg/m^3	=	0.0625	lb/ft^3 (density r)	16
1 kg/m^3	=	0.008333333	lb/gallon	120
1 kg/s	=	7936.507937	lb/h	0.000126
1 kg/s	=	132.2926313	lb/min	0.007559
1 kJ/(kg • K)	=	0.238845897	Btu/lb • °F (specific heat c_p)	4.1868
1 kJ/kg	=	0.429922614	Btu/lb	2.326
1 kJ/m^3	=	0.471947444	kW/1000 cfm	2.11888
1 km	=	0.62150404	mile	1.609
1 kN	=	0.224719101	kip (1000 lb_f)	4.45
1 kPa	=	0.009869233	atmosphere (standard)	101.325
1 kPa	=	0.01	bar	100
1 kPa	=	0.295298842	in. of mercury (60 °F)	3.3864
1 kPa	=	10	millibar	0.1
1 kPa	=	7.518796992	mm of mercury (60 °F)	0.133
1 kPa	=	0.145032632	psi	6.895
1 kW	=	0.101936799	horsepower (boiler) (33, 470 Btu/h)	9.81
1 kW	=	1.341021859	horsepower (550 ft • lb_f/s)	0.7457
1 kW	=	3.517411185	lb/h [steam at 212 °F (100 °C)]	0.2843
1 kW	=	0.284333239	ton, refrigeration (12,000 Btu/h)	3.517

(continued)

UNITS CONVERSION TABLE—continued

SI Unit		I-P Unit		Conversion Factor
1 L	=	0.006289308	barrel (42 U.S. gal, petroleum)	159
1 L	=	0.035314667	ft^3	28.316846
1 L	=	0.264172037	gallon (U.S., 231 in^3)	3.785412
1 L	=	1.056747332	quart (liquid, U.S.)	0.9463
1 L/(s • m^2)	=	1.472537182	gpm/ft^2	0.6791
1 L/s	=	2.118881993	ft^3/min, cfm	0.471947
1 L/s	=	0.035314669	ft^3/s, cfs	28.316845
1 L/s	=	15.84786054	gpm	0.0631
1 lx	=	0.092903044	footcandle	10.76391
1 m	=	3.280839895	ft	0.3048
1 m^2	=	10.76391505	ft^2	0.092903
1 m^2	=	0.107639151	square (100 ft^2)	9.2903
1 m^2	=	1.196029183	yd^2	0.8361
1 m^2	=	0.000247104	acre (43,560 ft^2)	4046.873
1 (m^2 • K)/W	=	6.451612903	clo	0.155
1 (m^2 • K)/W	=	5.678269264	ft^2 • h • °F/Btu (thermal resistance *R*)	0.17611
1 m^3	=	6.325162699	barrel (42 U.S. gal, petroleum)	0.1580987
1 m^3	=	28.37732765	bushel (dry, U.S.)	0.0352394
1 m^3	=	35.31073446	ft^3	0.02832
1 m^3	=	1000	litre	0.001
1 m^3	=	2113.378531	pint (liquid, U.S.)	4.73E-04
1 m^3	=	1.307873398	yd^3	0.7646
1 Mg	=	0.984207408	ton, long (2240 lb)	1.016046
1 mg/kg	=	1	ppm (by mass)	1
1 Mg; t (tonne)	=	1.10231221	ton, short (2000 lb)	0.907184
1 MJ	=	0.277777778	kWh	3.6
1 MJ	=	0.009478673	therm (U.S.)	105.5
1 mL	=	0.061022493	in^3 (volume)	16.3874
1 mL	=	0.033783784	oz (liquid, U.S.)	29.6
1 mL	=	0.066666667	tablespoon (approximately)	15
1 mL	=	0.2	teaspoon (approximately)	5
1 mL/J	=	55.86592179	gpm/ton refrigeration	0.0179
1 mL/s	=	0.952380952	gph	1.05
1 mL/s	=	3.661434477	in^3/min (SCIM)	0.273117

(continued)

UNITS CONVERSION TABLE—continued

SI Unit		I-P Unit		Conversion Factor
1 mm	=	0.00328084	ft	304.8
1 mm	=	0.039370079	in	25.4
1 mm/m	=	1.200480192	in/100 ft, thermal expansion coefficient	0.833
1 mm^2	=	0.001550003	in^2	645.16
1 mPa	=	0.007518797	micron (mm) of mercury (60 °F)	133
1 mPa • s	=	1	centipoise (dynamic viscosity m)	1
1 mPa • s	=	2.418964683	lb/ft • h (dynamic viscosity m)	0.4134
1 mPa • s	=	0.000671141	lb/ft • s (dynamic viscosity m)	1490
1 N	=	100000	dyne	1.00E-05
1 N	=	0.101936799	kilopond (kg force)	9.81
1 N	=	3.597122302	ounce (force or thrust)	0.278
1 N	=	0.224808924	lb_f (force or thrust)	4.448222
1 N/m	=	0.06852178	lb_f/ft (uniform load)	14.5939
1 N • m	=	0.737562121	ft • lb_f (torque or moment)	1.355818
1 Pa	=	10	dyne/cm^2	0.1
1 Pa	=	0.00033456	ft of water	2989
1 Pa	=	0.004018647	in. of water (60 °F)	248.84
1 Pa	=	0.102040816	mm of water (60 °F)	9.8
1 Pa	=	0.020876827	lb_f/ft^2	47.9
1 Pa	=	0.007518797	torr (1 mm Hg at 0 °C)	133
1 Pa/m	=	0.01019368	ft of water per 100 ft pipe	98.1
1 Pa • s	=	0.020885434	lb_f • s/ft^2 (dynamic viscosity m)	47.88026
1 W	=	3.412141286	Btu/h	0.2930711
1 W	=	0.022747642	EDR hot water (150 Btu/h)	43.9606
1 W	=	0.014217256	EDR steam (240 Btu/h)	70.33706
1 W	=	44.24778761	ft • lb_f/min (power)	0.0226
1 W/(m • K)	=	0.577789205	Btu • ft/h • ft^2 • °F	1.730735
1 W/(m • K)	=	6.933471263	Btu • in/h • ft^2 • °F (thermal conductivity *k*).	0.1442279
1 $W/(m^2$ • K)	=	0.176110194	Btu/h • ft^2 • °F (overall heat transfer coefficient *U*)	5.678263
1 W/m^2	=	0.316998305	Btu/h • ft^2	3.154591
1 W/m^2	=	0.017196905	met	58.15
1 W/m^2	=	0.092936803	watt per ft^2	10.76

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