

# PERRY'S CHEMICAL ENGINEERS' HANDBOOK

佩里化学工程师手册

SEVENTH EDITION

(第七版)

Robert H. Perry  
Don W. Green



McGraw-Hill



科学出版社

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江苏工业学院图书馆  
藏书章



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McGraw-Hill Companies, Inc.

2001

ISBN: 7-03-008789-5/TQ·36

图字: 01-2000-2403

Robert H. Perry, Don W. Green: Perry's Chemical Engineers' Handbook,  
Seventh Edition

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ISBN: 0-07-115982-7

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**科学出版社 出版**

北京东黄城根北街16号

邮政编码:100717

**新蕾印刷厂 印刷**

科学出版社发行 各地新华书店经销

\*

2001年2月第一版 开本: 850×1168 1/16

2001年2月第一次印刷 印张: 165

印数: 1—3 000

字数: 5 820 000

**定价: 390.00元 (上、下册)**

(如有印装质量问题,我社负责调换〈新欣〉)

## ABOUT THE EDITORS

The late **Robert H. Perry** served as chairman of the Department of Chemical Engineering at the University of Oklahoma and program director for graduate research facilities at the National Science Research Foundation. He was a consultant to various United Nations and other international organizations. From 1973 until his death in 1978 Dr. Perry devoted his time to a study of the cross impact of technologies within the next half century. The subjects under his investigation on a global basis were energy, minerals and metals, transportation and communications, medicine, food production, and the environment.

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**James O. Maloney** is Professor Emeritus of the Department of Chemical and Petroleum Engineering, University of Kansas. He holds a Ph.D. degree in chemical engineering from Pennsylvania State University. In 1941 he began his professional career at the DuPont de Nemours Company, before joining the University of Kansas in 1945, where he taught for 40 years. He served as department chairman for nineteen years. He is a fellow of the AIChE.

*Dedicated to  
Robert H. Perry*

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# Conversion Factors and Mathematical Symbols\*

**James O. Maloney, Ph.D., P.E.,** Emeritus Professor of Chemical Engineering, University of Kansas; Fellow, American Institute of Chemical Engineering; Fellow, American Association for the Advancement of Science; Member, American Chemical Society, American Society for Engineering Education

## CONVERSION FACTORS

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## CONVERSION OF VALUES FROM U.S. CUSTOMARY UNITS TO SI UNITS

### MATHEMATICAL SYMBOLS

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\* Much of the material was taken from Sec. 1. of the fifth edition. The contribution of Cecil H. Chilton in developing that material is acknowledged.



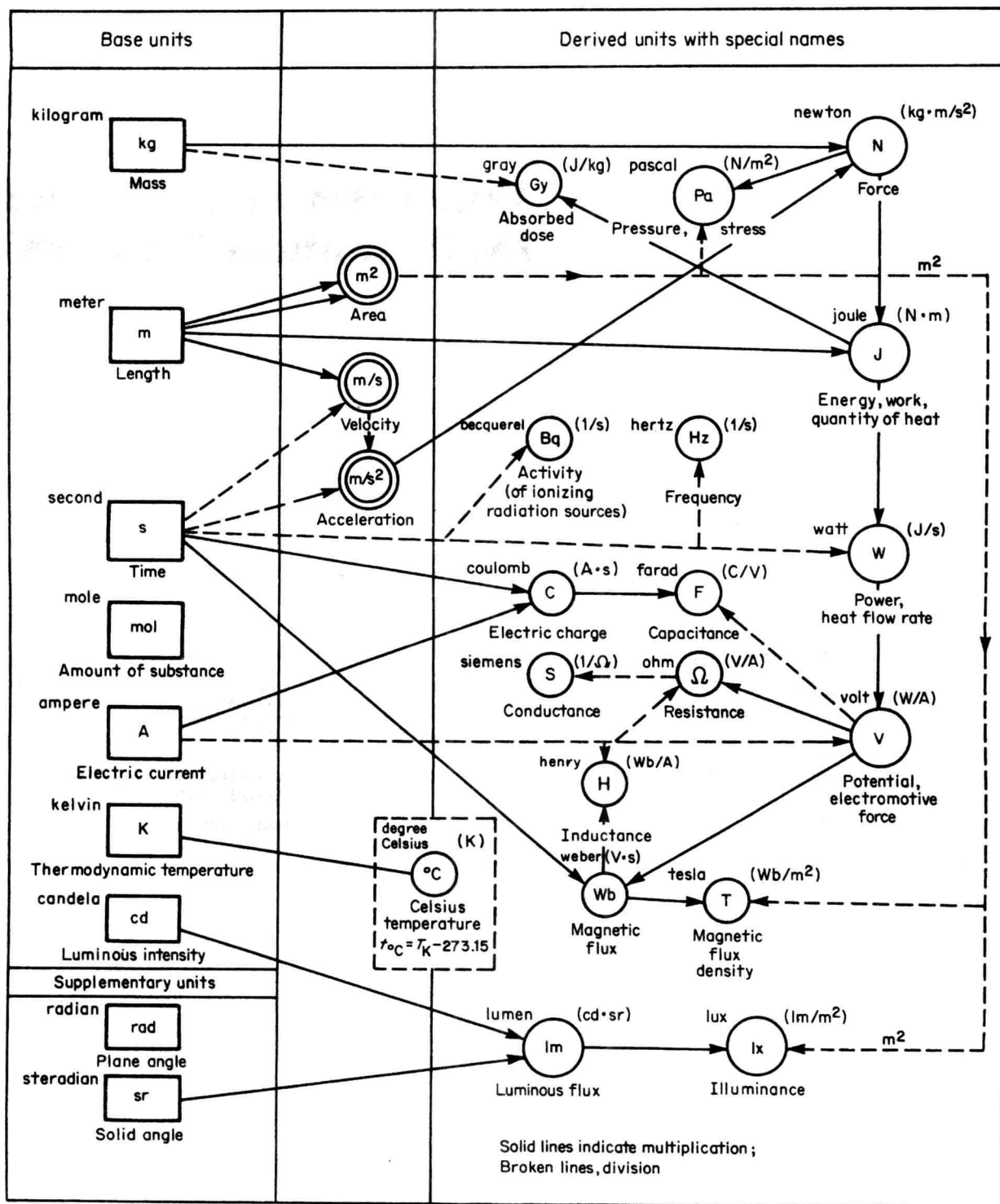


FIG. 1-1 Graphic relationships of SI units with names (U.S. National Bureau of Standards, LC 1078, December 1976.)

**TABLE 1-1 SI Base and Supplementary Quantities and Units**

| Quantity or "dimension"               | SI unit   | SI unit symbol<br>("abbreviation");<br>Use roman<br>(upright) type |
|---------------------------------------|-----------|--------------------------------------------------------------------|
| Base quantity or "dimension"          |           |                                                                    |
| length                                | meter     | m                                                                  |
| mass                                  | kilogram  | kg                                                                 |
| time                                  | second    | s                                                                  |
| electric current                      | ampere    | A                                                                  |
| thermodynamic temperature             | kelvin    | K                                                                  |
| amount of substance                   | mole*     | mol                                                                |
| luminous intensity                    | candela   | cd                                                                 |
| Supplementary quantity or "dimension" |           |                                                                    |
| plane angle                           | radian    | rad                                                                |
| solid angle                           | steradian | sr                                                                 |

\*When the mole is used, the elementary entities must be specified; they may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

**TABLE 1-2a Derived Units of SI that Have Special Names**

| Quantity                                                      | Unit      | Symbol | Formula               |
|---------------------------------------------------------------|-----------|--------|-----------------------|
| frequency (of a periodic phenomenon)                          | hertz     | Hz     | 1/s                   |
| force                                                         | newton    | N      | (kg·m)/s <sup>2</sup> |
| pressure, stress                                              | pascal    | Pa     | N/m <sup>2</sup>      |
| energy, work, quantity of heat                                | joule     | J      | N·m                   |
| power, radiant flux                                           | watt      | W      | J/s                   |
| quantity of electricity, electric charge                      | coulomb   | C      | A·s                   |
| electric potential, potential difference, electromotive force | volt      | V      | W/A                   |
| capacitance                                                   | farad     | F      | C/V                   |
| electric resistance                                           | ohm       | Ω      | V/A                   |
| conductance                                                   | siemens   | S      | A/V                   |
| magnetic flux                                                 | weber     | Wb     | V·s                   |
| magnetic-flux density                                         | tesla     | T      | Wb/m <sup>2</sup>     |
| inductance                                                    | henry     | H      | Wb/A                  |
| luminous flux                                                 | lumen     | lm     | cd·sr                 |
| illuminance                                                   | lux       | lx     | lm/m <sup>2</sup>     |
| activity (of radionuclides)                                   | becquerel | Bq     | 1/s                   |
| absorbed dose                                                 | gray      | Gy     | J/kg                  |

**TABLE 1-2b Additional Common Derived Units of SI**

| Quantity                               | Unit                            | Symbol                 |
|----------------------------------------|---------------------------------|------------------------|
| acceleration                           | meter per second squared        | m/s <sup>2</sup>       |
| angular acceleration                   | radian per second squared       | rad/s <sup>2</sup>     |
| angular velocity                       | radian per second               | rad/s                  |
| area                                   | square meter                    | m <sup>2</sup>         |
| concentration (of amount of substance) | mole per cubic meter            | mol/m <sup>3</sup>     |
| current density                        | ampere per square meter         | A/m <sup>2</sup>       |
| density, mass                          | kilogram per cubic meter        | kg/m <sup>3</sup>      |
| electric-charge density                | coulomb per cubic meter         | C/m <sup>3</sup>       |
| electric-field strength                | volt per meter                  | V/m                    |
| electric-flux density                  | coulomb per square meter        | C/m <sup>2</sup>       |
| energy density                         | joule per cubic meter           | J/m <sup>3</sup>       |
| entropy                                | joule per kelvin                | J/K                    |
| heat capacity                          | joule per kelvin                | J/K                    |
| heat-flux density, irradiance          | watt per square meter           | W/m <sup>2</sup>       |
| luminance                              | candela per square meter        | cd/m <sup>2</sup>      |
| magnetic-field strength                | ampere per meter                | A/m                    |
| molar energy                           | joule per mole                  | J/mol                  |
| molar entropy                          | joule per mole-kelvin           | J/(mol·K)              |
| molar-heat capacity                    | joule per mole-kelvin           | J/(mol·K)              |
| moment of force                        | newton-meter                    | N·m                    |
| permeability                           | henry per meter                 | H/m                    |
| permittivity                           | farad per meter                 | F/m                    |
| radiance                               | watt per square-meter-steradian | W/(m <sup>2</sup> ·sr) |
| radiant intensity                      | watt per steradian              | W/sr                   |
| specific-heat capacity                 | joule per kilogram-kelvin       | J/(kg·K)               |
| specific energy                        | joule per kilogram              | J/kg                   |
| specific entropy                       | joule per kilogram-kelvin       | J/(kg·K)               |
| specific volume                        | cubic meter per kilogram        | m <sup>3</sup> /kg     |
| surface tension                        | newton per meter                | N/m                    |
| thermal conductivity                   | watt per meter-kelvin           | W/(m·K)                |
| velocity                               | meter per second                | m/s                    |
| viscosity, dynamic                     | pascal-second                   | Pa·s                   |
| viscosity, kinematic                   | square meter per second         | m <sup>2</sup> /s      |
| volume                                 | cubic meter                     | m <sup>3</sup>         |
| wave number                            | 1 per meter                     | 1/m                    |

**TABLE 1-3 SI Prefixes**

| Multiplication factor                         | Prefix | Symbol |
|-----------------------------------------------|--------|--------|
| 1 000 000 000 000 000 000 = 10 <sup>18</sup>  | exa    | E      |
| 1 000 000 000 000 000 = 10 <sup>15</sup>      | peta   | P      |
| 1 000 000 000 000 = 10 <sup>12</sup>          | tera   | T      |
| 1 000 000 000 = 10 <sup>9</sup>               | giga   | G      |
| 1 000 000 = 10 <sup>6</sup>                   | mega   | M      |
| 1 000 = 10 <sup>3</sup>                       | kilo   | k      |
| 100 = 10 <sup>2</sup>                         | hecto* | h      |
| 10 = 10 <sup>1</sup>                          | deka*  | da     |
| 0.1 = 10 <sup>-1</sup>                        | deci*  | d      |
| 0.01 = 10 <sup>-2</sup>                       | centi  | c      |
| 0.001 = 10 <sup>-3</sup>                      | milli  | m      |
| 0.000 001 = 10 <sup>-6</sup>                  | micro  | μ      |
| 0.000 000 001 = 10 <sup>-9</sup>              | nano   | n      |
| 0.000 000 000 001 = 10 <sup>-12</sup>         | pico   | p      |
| 0.000 000 000 000 001 = 10 <sup>-15</sup>     | femto  | f      |
| 0.000 000 000 000 000 001 = 10 <sup>-18</sup> | atto   | a      |

\*Generally to be avoided.

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units**

| TABLE 1-4 Conversion factors: U.S. customary and commonly used units to SI units |                                  |                                 |                   | Conversion factor; multiply customary unit by factor to obtain SI unit |        |
|----------------------------------------------------------------------------------|----------------------------------|---------------------------------|-------------------|------------------------------------------------------------------------|--------|
| Quantity                                                                         | Customary or commonly used unit  | SI unit                         | Alternate SI unit |                                                                        |        |
| Space,† time                                                                     |                                  |                                 |                   |                                                                        |        |
| Length                                                                           | naut mi                          | km                              |                   | 1.852*                                                                 | E + 00 |
|                                                                                  | mi                               | km                              |                   | 1.609 344*                                                             | E + 00 |
|                                                                                  | chain                            | m                               |                   | 2.011 68*                                                              | E + 01 |
|                                                                                  | link                             | m                               |                   | 2.011 68*                                                              | E - 01 |
|                                                                                  | fathom                           | m                               |                   | 1.828 8*                                                               | E + 00 |
|                                                                                  | yd                               | m                               |                   | 9.144*                                                                 | E - 01 |
|                                                                                  | ft                               | m                               |                   | 3.048*                                                                 | E - 01 |
|                                                                                  |                                  | cm                              |                   | 3.048*                                                                 | E + 01 |
|                                                                                  | in                               | mm                              |                   | 2.54*                                                                  | E + 01 |
|                                                                                  | in                               | cm                              |                   | 2.54                                                                   | E + 00 |
|                                                                                  | mil                              | μm                              |                   | 2.54*                                                                  | E + 01 |
| Length/length                                                                    | ft/mi                            | m/km                            |                   | 1.893 939                                                              | E - 01 |
| Length/volume                                                                    | ft/U.S. gal                      | m/m <sup>3</sup>                |                   | 8.051 964                                                              | E + 01 |
|                                                                                  | ft/ft <sup>3</sup>               | m/m <sup>3</sup>                |                   | 1.076 391                                                              | E + 01 |
|                                                                                  | ft/bbl                           | m/m <sup>3</sup>                |                   | 1.917 134                                                              | E + 00 |
| Area                                                                             | mi <sup>2</sup>                  | km <sup>2</sup>                 |                   | 2.589 988                                                              | E + 00 |
|                                                                                  | section                          | ha                              |                   | 2.589 988                                                              | E + 02 |
|                                                                                  | acre                             | ha                              |                   | 4.046 856                                                              | E - 01 |
|                                                                                  | ha                               | m <sup>2</sup>                  |                   | 1.000 000*                                                             | E + 04 |
|                                                                                  | yd <sup>2</sup>                  | m <sup>2</sup>                  |                   | 8.361 274                                                              | E - 01 |
|                                                                                  | ft <sup>2</sup>                  | m <sup>2</sup>                  |                   | 9.290 304*                                                             | E - 02 |
|                                                                                  | in <sup>2</sup>                  | mm <sup>2</sup>                 |                   | 6.451 6*                                                               | E + 02 |
|                                                                                  |                                  | cm <sup>2</sup>                 |                   | 6.451 6*                                                               | E + 00 |
| Area/volume                                                                      | ft <sup>3</sup> /in <sup>3</sup> | m <sup>2</sup> /cm <sup>3</sup> |                   | 5.699 291                                                              | E - 03 |
|                                                                                  | ft <sup>3</sup> /ft <sup>3</sup> | m <sup>2</sup> /m <sup>3</sup>  |                   | 3.280 840                                                              | E + 00 |
| Volume                                                                           | cubem                            | km <sup>3</sup>                 |                   | 4.168 182                                                              | E + 00 |
|                                                                                  | acre-ft                          | m <sup>3</sup>                  |                   | 1.233 482                                                              | E + 03 |
|                                                                                  |                                  | ha·m                            |                   | 1.233 482                                                              | E - 01 |
|                                                                                  | yd <sup>3</sup>                  | m <sup>3</sup>                  |                   | 7.645 549                                                              | E - 01 |
|                                                                                  | bbl (42 U.S. gal)                | m <sup>3</sup>                  |                   | 1.589 873                                                              | E - 01 |
|                                                                                  | ft <sup>3</sup>                  | m <sup>3</sup>                  |                   | 2.831 685                                                              | E - 02 |
|                                                                                  |                                  | dm <sup>3</sup>                 | L                 | 2.831 685                                                              | E + 01 |
|                                                                                  | U.K. gal                         | m <sup>3</sup>                  |                   | 4.546 092                                                              | E - 03 |
|                                                                                  |                                  | dm <sup>3</sup>                 | L                 | 4.546 092                                                              | E + 00 |
|                                                                                  | U.S. gal                         | m <sup>3</sup>                  |                   | 3.785 412                                                              | E - 03 |
|                                                                                  |                                  | dm <sup>3</sup>                 | L                 | 3.785 412                                                              | E + 00 |
|                                                                                  | U.K. qt                          | dm <sup>3</sup>                 | L                 | 1.136 523                                                              | E + 00 |
|                                                                                  | U.S. qt                          | dm <sup>3</sup>                 | L                 | 9.463 529                                                              | E - 01 |
|                                                                                  | U.S. pt                          | dm <sup>3</sup>                 | L                 | 4.731 765                                                              | E - 01 |
|                                                                                  | U.K. fl oz                       | cm <sup>3</sup>                 |                   | 2.841 307                                                              | E + 01 |
|                                                                                  | U.S. fl oz                       | cm <sup>3</sup>                 |                   | 2.957 353                                                              | E + 01 |
|                                                                                  | in <sup>3</sup>                  | cm <sup>3</sup>                 |                   | 1.638 706                                                              | E + 01 |
| Volume/length (linear displacement)                                              | bbl/in                           | m <sup>3</sup> /m               |                   | 6.259 342                                                              | E + 00 |
|                                                                                  | bbl/ft                           | m <sup>3</sup> /m               |                   | 5.216 119                                                              | E - 01 |
|                                                                                  | ft <sup>3</sup> /ft              | m <sup>3</sup> /m               |                   | 9.290 304*                                                             | E - 02 |
|                                                                                  | U.S. gal/ft                      | m <sup>3</sup> /m               |                   | 1.241 933                                                              | E - 02 |
|                                                                                  |                                  | L/m                             |                   | 1.241 933                                                              | E + 01 |
| Plane angle                                                                      | rad                              | rad                             |                   | 1                                                                      |        |
|                                                                                  | deg (°)                          | rad                             |                   | 1.745 329                                                              | E - 02 |
|                                                                                  | min (')                          | rad                             |                   | 2.908 882                                                              | E - 04 |
|                                                                                  | sec (")                          | rad                             |                   | 4.848 137                                                              | E - 06 |
| Solid angle                                                                      | sr                               | sr                              |                   | 1                                                                      |        |
| Time                                                                             | year                             | a                               |                   | 1                                                                      |        |
|                                                                                  | week                             | d                               |                   | 7.0*                                                                   | E + 00 |
|                                                                                  | h                                | s                               |                   | 3.6*                                                                   | E + 03 |
|                                                                                  |                                  | min                             |                   | 6.0*                                                                   | E + 01 |
|                                                                                  | min                              | s                               |                   | 6.0*                                                                   | E + 01 |
|                                                                                  |                                  | h                               |                   | 1.666 667                                                              | E - 02 |
|                                                                                  | μs                               | ns                              |                   | 1                                                                      |        |
| Mass, amount of substance                                                        |                                  |                                 |                   |                                                                        |        |
| Mass                                                                             | U.K. ton                         | Mg                              | t                 | 1.016 047                                                              | E + 00 |
|                                                                                  | U.S. ton                         | Mg                              | t                 | 9.071 847                                                              | E - 01 |
|                                                                                  | U.K. cwt                         | kg                              |                   | 5.080 234                                                              | E + 01 |
|                                                                                  | U.S. cwt                         | kg                              |                   | 4.535 924                                                              | E + 01 |
|                                                                                  | lbm                              | kg                              |                   | 4.535 924                                                              | E - 01 |
|                                                                                  | oz (troy)                        | g                               |                   | 3.110 348                                                              | E + 01 |
|                                                                                  | oz (av)                          | g                               |                   | 2.834 952                                                              | E + 01 |
|                                                                                  | gr                               | mg                              |                   | 6.479 891                                                              | E + 01 |

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                                                | Customary or commonly used unit     | SI unit            | Alternate SI unit  | Conversion factor; multiply customary unit by factor to obtain SI unit |        |
|---------------------------------------------------------|-------------------------------------|--------------------|--------------------|------------------------------------------------------------------------|--------|
| Amount of substance                                     | lbm-mol                             | kmol               |                    | 4.535 924                                                              | E - 01 |
|                                                         | std m <sup>3</sup> (0°C, 1 atm)     | kmol               |                    | 4.461 58                                                               | E - 02 |
|                                                         | std ft <sup>3</sup> (60°F, 1 atm)   | kmol               |                    | 1.195 30                                                               | E - 03 |
| Enthalpy, calorific value, heat, entropy, heat capacity |                                     |                    |                    |                                                                        |        |
| Calorific value, enthalpy (mass basis)                  | Btu/lbm                             | MJ/kg              |                    | 2.326 000                                                              | E - 03 |
|                                                         |                                     | kJ/kg              | J/g                | 2.326 000                                                              | E + 00 |
|                                                         |                                     | kWh/kg             |                    | 6.461 112                                                              | E - 04 |
|                                                         | cal/g                               | kJ/kg              | J/g                | 4.184*                                                                 | E + 00 |
|                                                         | cal/lbm                             | J/kg               |                    | 9.224 141                                                              | E + 00 |
| Caloric value, enthalpy (mole basis)                    | kcal/(g-mol)                        | kJ/kmol            |                    | 4.184*                                                                 | E + 03 |
|                                                         | Btu/(lb-mol)                        | kJ/kmol            |                    | 2.326 000                                                              | E + 00 |
| Calorific value (volume basis—solids and liquids)       | Btu/U.S. gal                        | MJ/m <sup>3</sup>  | kJ/dm <sup>3</sup> | 2.787 163                                                              | E - 01 |
|                                                         |                                     | kJ/m <sup>3</sup>  |                    | 2.787 163                                                              | E + 02 |
|                                                         |                                     | kWh/m <sup>3</sup> |                    | 7.742 119                                                              | E - 02 |
|                                                         | Btu/U.K. gal                        | MJ/m <sup>3</sup>  | kJ/dm <sup>3</sup> | 2.320 800                                                              | E - 01 |
|                                                         |                                     | kJ/m <sup>3</sup>  |                    | 2.320 800                                                              | E + 02 |
|                                                         |                                     | kWh/m <sup>3</sup> |                    | 6.446 667                                                              | E - 02 |
|                                                         | Btu/ft <sup>3</sup>                 | MJ/m <sup>3</sup>  | kJ/dm <sup>3</sup> | 3.725 895                                                              | E - 02 |
|                                                         |                                     | kJ/m <sup>3</sup>  |                    | 3.725 895                                                              | E + 01 |
|                                                         |                                     | kWh/m <sup>3</sup> |                    | 1.034 971                                                              | E - 02 |
|                                                         | cal/mL                              | MJ/m <sup>3</sup>  |                    | 4.184*                                                                 | E + 00 |
|                                                         | (ft-lbf)/U.S. gal                   | kJ/m <sup>3</sup>  |                    | 3.581 692                                                              | E - 01 |
| Calorific value (volume basis—gases)                    | cal/mL                              | kJ/m <sup>3</sup>  | J/dm <sup>3</sup>  | 4.184*                                                                 | E + 03 |
|                                                         | kcal/m <sup>3</sup>                 | kJ/m <sup>3</sup>  | J/dm <sup>3</sup>  | 4.184*                                                                 | E + 00 |
|                                                         | Btu/ft <sup>3</sup>                 | kJ/m <sup>3</sup>  | J/dm <sup>3</sup>  | 3.725 895                                                              | E + 01 |
|                                                         |                                     | kWh/m <sup>3</sup> |                    | 1.034 971                                                              | E - 02 |
| Specific entropy                                        | Btu/(lbm-°R)                        | kJ/(kg-K)          | J/(g-K)            | 4.186 8*                                                               | E + 00 |
|                                                         | cal/(g-K)                           | kJ/(kg-K)          | J/(g-K)            | 4.184*                                                                 | E + 00 |
|                                                         | kcal/(kg-°C)                        | kJ/(kg-K)          | J/(g-K)            | 4.184*                                                                 | E + 00 |
| Specific-heat capacity (mass basis)                     | kWh/(kg-°C)                         | kJ/(kg-K)          | J/(g-K)            | 3.6*                                                                   | E + 03 |
|                                                         | Btu/(lbm-°F)                        | kJ/(kg-K)          | J/(g-K)            | 4.186 8*                                                               | E + 00 |
|                                                         | kcal/(kg-°C)                        | kJ/(kg-K)          | J/(g-K)            | 4.184*                                                                 | E + 00 |
| Specific-heat capacity (mole basis)                     | Btu/(lb-mol-°F)                     | kJ/(kmol-K)        |                    | 4.186 8*                                                               | E + 00 |
|                                                         | cal/(g-mol-°C)                      | kJ/(kmol-K)        |                    | 4.184*                                                                 | E + 00 |
| Temperature, pressure, vacuum                           |                                     |                    |                    |                                                                        |        |
| Temperature (absolute)                                  | °R                                  | K                  |                    | 5/9                                                                    |        |
|                                                         | K                                   | K                  |                    | 1                                                                      |        |
| Temperature (traditional)                               | °F                                  | °C                 |                    | 5/9(°F - 32)                                                           |        |
| Temperature (difference)                                | °F                                  | K, °C              |                    | 5/9                                                                    |        |
| Pressure                                                | atm (760 mmHg at 0°C or 14,696 psi) | MPa                |                    | 1.013 250*                                                             | E - 01 |
|                                                         |                                     | kPa                |                    | 1.013 250*                                                             | E + 02 |
|                                                         |                                     | bar                |                    | 1.013 250*                                                             | E + 00 |
|                                                         | bar                                 | MPa                |                    | 1.0*                                                                   | E - 01 |
|                                                         |                                     | kPa                |                    | 1.0*                                                                   | E + 02 |
|                                                         | mmHg (0°C) = torr                   | MPa                |                    | 6.894 757                                                              | E - 03 |
|                                                         |                                     | kPa                |                    | 6.894 757                                                              | E + 00 |
|                                                         |                                     | bar                |                    | 6.894 757                                                              | E - 02 |
|                                                         | μmHg (0°C)                          | kPa                |                    | 3.376 85                                                               | E + 00 |
|                                                         | μ bar                               | kPa                |                    | 2.488 4                                                                | E - 01 |
|                                                         | mmHg = torr (0°C)                   | kPa                |                    | 1.333 224                                                              | E - 01 |
|                                                         | cmH <sub>2</sub> O (4°C)            | kPa                |                    | 9.806 38                                                               | E - 02 |
|                                                         | lbf/ft <sup>2</sup> (psf)           | kPa                |                    | 4.788 026                                                              | E - 02 |
|                                                         | mHg (0°C)                           | Pa                 |                    | 1.333 224                                                              | E - 01 |
|                                                         | bar                                 | Pa                 |                    | 1.0*                                                                   | E + 05 |
|                                                         | dyn/cm <sup>2</sup>                 | Pa                 |                    | 1.0*                                                                   | E - 01 |
| Vacuum, draft                                           | inHg (60°F)                         | kPa                |                    | 3.376 85                                                               | E + 00 |
|                                                         | inH <sub>2</sub> O (39.2°F)         | kPa                |                    | 2.490 82                                                               | E - 01 |
|                                                         | inH <sub>2</sub> O (60°F)           | kPa                |                    | 2.488 4                                                                | E - 01 |
|                                                         | mmHg (0°C) = torr                   | kPa                |                    | 1.333 224                                                              | E - 01 |
|                                                         | cmH <sub>2</sub> O (4°C)            | kPa                |                    | 9.806 38                                                               | E - 02 |
| Liquid head                                             | ft                                  | m                  |                    | 3.048*                                                                 | E - 01 |
|                                                         | in                                  | mm                 |                    | 2.54*                                                                  | E + 01 |
|                                                         |                                     | cm                 |                    | 2.54*                                                                  | E + 00 |
| Pressure drop/length                                    | psi/ft                              | kPa/m              |                    | 2.262 059                                                              | E + 01 |

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                                        | Customary or commonly used unit               | SI unit                          | Alternate SI unit              | Conversion factor; multiply customary unit by factor to obtain SI unit |           |
|-------------------------------------------------|-----------------------------------------------|----------------------------------|--------------------------------|------------------------------------------------------------------------|-----------|
| Density, specific volume, concentration, dosage |                                               |                                  |                                |                                                                        |           |
| Density                                         | lbm/ft <sup>3</sup>                           | kg/m <sup>3</sup>                |                                | 1.601 846                                                              | E + 01    |
|                                                 |                                               | g/m <sup>3</sup>                 |                                | 1.601 846                                                              | E + 04    |
|                                                 | lbm/U.S. gal                                  | kg/m <sup>3</sup>                |                                | 1.198 264                                                              | E + 02    |
|                                                 |                                               | g/cm <sup>3</sup>                |                                | 1.198 264                                                              | E - 01    |
|                                                 | lbm/U.K. gal                                  | kg/m <sup>3</sup>                |                                | 9.977 633                                                              | E + 01    |
|                                                 | lbm/ft <sup>3</sup>                           | kg/m <sup>3</sup>                |                                | 1.601 846                                                              | E + 01    |
|                                                 |                                               | g/cm <sup>3</sup>                |                                | 1.601 846                                                              | E - 02    |
|                                                 | g/cm <sup>3</sup>                             | kg/m <sup>3</sup>                |                                | 1.0*                                                                   | E + 03    |
|                                                 | lbm/ft <sup>3</sup>                           | kg/m <sup>3</sup>                |                                | 1.601 846                                                              | E + 01    |
| Specific volume                                 | ft <sup>3</sup> /lbm                          | m <sup>3</sup> /kg               |                                | 6.242 796                                                              | E - 02    |
|                                                 |                                               | m <sup>3</sup> /g                |                                | 6.242 796                                                              | E - 05    |
|                                                 | ft <sup>3</sup> /lbm                          | dm <sup>3</sup> /kg              |                                | 6.242 796                                                              | E + 01    |
|                                                 | U.K. gal/lbm                                  | dm <sup>3</sup> /kg              | cm <sup>3</sup> /g             | 1.002 242                                                              | E + 01    |
|                                                 | U.S. gal/lbm                                  | dm <sup>3</sup> /kg              | cm <sup>3</sup> /g             | 8.345 404                                                              | E + 00    |
| Specific volume (mole basis)                    | L/(g·mol)                                     | m <sup>3</sup> /kmol             |                                | 1                                                                      |           |
|                                                 | ft <sup>3</sup> /(lb·mol)                     | m <sup>3</sup> /kmol             |                                | 6.242 796                                                              | E - 02    |
| Specific volume                                 | bbl/U.S. ton                                  | m <sup>3</sup> /t                |                                | 1.752 535                                                              | E - 01    |
|                                                 | bbl/U.K. ton                                  | m <sup>3</sup> /t                |                                | 1.564 763                                                              | E - 01    |
| Yield                                           | bbl/U.S. ton                                  | dm <sup>3</sup> /t               | L/t                            | 1.752 535                                                              | E + 02    |
|                                                 | bbl/U.K. ton                                  | dm <sup>3</sup> /t               | L/t                            | 1.564 763                                                              | E + 02    |
|                                                 | U.S. gal/U.S. ton                             | dm <sup>3</sup> /t               | L/t                            | 4.172 702                                                              | E + 00    |
|                                                 | U.S. gal/U.K. ton                             | dm <sup>3</sup> /t               | L/t                            | 3.725 627                                                              | E + 00    |
| Concentration (mass/mass)                       | wt %                                          | kg/kg                            |                                | 1.0*                                                                   | E - 02    |
|                                                 |                                               | g/kg                             |                                | 1.0*                                                                   | E + 01    |
|                                                 | wt ppm                                        | mg/kg                            |                                | 1                                                                      |           |
| Concentration (mass/volume)                     | lbm/bbl                                       | kg/m <sup>3</sup>                | g/dm <sup>3</sup>              | 2.853 010                                                              | E + 00    |
|                                                 | g/U.S. gal                                    | kg/m <sup>3</sup>                |                                | 2.641 720                                                              | E - 01    |
|                                                 | g/U.K. gal                                    | kg/m <sup>3</sup>                | g/L                            | 2.199 692                                                              | E - 01    |
|                                                 | lbm/1000 U.S. gal                             | g/m <sup>3</sup>                 | mg/dm <sup>3</sup>             | 1.198 264                                                              | E + 02    |
|                                                 | lbm/1000 U.K. gal                             | g/m <sup>3</sup>                 | mg/dm <sup>3</sup>             | 9.977 633                                                              | E + 01    |
|                                                 | gr/U.S. gal                                   | g/m <sup>3</sup>                 | mg/dm <sup>3</sup>             | 1.711 806                                                              | E + 01    |
|                                                 | gr/ft <sup>3</sup>                            | mg/m <sup>3</sup>                |                                | 2.288 351                                                              | E + 03    |
|                                                 | lbm/1000 bbl                                  | g/m <sup>3</sup>                 | mg/dm <sup>3</sup>             | 2.853 010                                                              | E + 00    |
|                                                 | mg/U.S. gal                                   | g/m <sup>3</sup>                 | mg/dm <sup>3</sup>             | 2.641 720                                                              | E - 01    |
|                                                 | gr/100 ft <sup>3</sup>                        | mg/m <sup>3</sup>                |                                | 2.288 351                                                              | E + 01    |
|                                                 | Concentration (volume/volume)                 | ft <sup>3</sup> /ft <sup>3</sup> | m <sup>3</sup> /m <sup>3</sup> |                                                                        | 1         |
| bbl/(acre·ft)                                   |                                               | m <sup>3</sup> /m <sup>3</sup>   |                                | 1.288 931                                                              | E - 04    |
| vol%                                            |                                               | m <sup>3</sup> /m <sup>3</sup>   |                                | 1.0*                                                                   | E - 02    |
| U.K. gal/ft <sup>3</sup>                        |                                               | dm <sup>3</sup> /m <sup>3</sup>  | L/m <sup>3</sup>               | 1.605 437                                                              | E + 02    |
| U.S. gal/ft <sup>3</sup>                        |                                               | dm <sup>3</sup> /m <sup>3</sup>  | L/m <sup>3</sup>               | 1.336 806                                                              | E + 02    |
| mL/U.S. gal                                     |                                               | dm <sup>3</sup> /m <sup>3</sup>  | L/m <sup>3</sup>               | 2.641 720                                                              | E - 01    |
| mL/U.K. gal                                     |                                               | dm <sup>3</sup> /m <sup>3</sup>  | L/m <sup>3</sup>               | 2.199 692                                                              | E - 01    |
| vol ppm                                         |                                               | cm <sup>3</sup> /m <sup>3</sup>  |                                | 1                                                                      |           |
|                                                 |                                               | dm <sup>3</sup> /m <sup>3</sup>  | L/m <sup>3</sup>               | 1.0*                                                                   | E - 03    |
| U.K. gal/1000 bbl                               |                                               | cm <sup>3</sup> /m <sup>3</sup>  |                                | 2.859 403                                                              | E + 01    |
| U.S. gal/1000 bbl                               |                                               | cm <sup>3</sup> /m <sup>3</sup>  |                                | 2.380 952                                                              | E + 01    |
| U.K. pt/1000 bbl                                |                                               | cm <sup>3</sup> /m <sup>3</sup>  |                                | 3.574 253                                                              | E + 00    |
| Concentration (mole/volume)                     |                                               | (lb·mol)/U.S. gal                | kmol/m <sup>3</sup>            |                                                                        | 1.198 264 |
|                                                 | (lb·mol)/U.K. gal                             | kmol/m <sup>3</sup>              |                                | 9.977 644                                                              | E + 01    |
|                                                 | (lb·mol)/ft <sup>3</sup>                      | kmol/m <sup>3</sup>              |                                | 1.601 846                                                              | E + 01    |
|                                                 | std ft <sup>3</sup> (60°F, 1 atm)/bbl         | kmol/m <sup>3</sup>              |                                | 7.518 21                                                               | E - 03    |
| Concentration (volume/mole)                     | U.S. gal/1000 std ft <sup>3</sup> (60°F/60°F) | dm <sup>3</sup> /kmol            | L/kmol                         | 3.166 91                                                               | E + 00    |
|                                                 | bbl/million std ft <sup>3</sup> (60°F/60°F)   | dm <sup>3</sup> /kmol            | L/kmol                         | 1.330 10                                                               | E - 01    |
| Facility throughput, capacity                   |                                               |                                  |                                |                                                                        |           |
| Throughput (mass basis)                         | U.K. ton/year                                 | t/a                              |                                | 1.016 047                                                              | E + 00    |
|                                                 | U.S. ton/year                                 | t/a                              |                                | 9.071 847                                                              | E - 01    |
|                                                 | U.K. ton/day                                  | t/d                              |                                | 1.016 047                                                              | E + 00    |
|                                                 |                                               | t/h                              |                                | 4.233 529                                                              | E - 02    |
|                                                 | U.S. ton/day                                  | t/d                              |                                | 9.071 847                                                              | E - 01    |
|                                                 |                                               | t/h                              |                                | 3.779 936                                                              | E - 02    |
|                                                 | U.K. ton/h                                    | t/h                              |                                | 1.016 047                                                              | E + 00    |
|                                                 | U.S. ton/h                                    | t/h                              |                                | 9.071 847                                                              | E - 01    |
|                                                 | lbm/h                                         | kg/h                             |                                | 4.535 924                                                              | E - 01    |
|                                                 |                                               |                                  |                                |                                                                        |           |

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                        | Customary or commonly used unit         | SI unit                | Alternate SI unit                   | Conversion factor; multiply customary unit by factor to obtain SI unit |
|---------------------------------|-----------------------------------------|------------------------|-------------------------------------|------------------------------------------------------------------------|
| Throughput (volume basis)       | bbl/day                                 | t/a                    |                                     | 5.803 036 E + 01                                                       |
|                                 |                                         | m <sup>3</sup> /d      |                                     | 1.589 873 E - 01                                                       |
|                                 | ft <sup>3</sup> /day                    | m <sup>3</sup> /h      |                                     | 1.179 869 E - 03                                                       |
|                                 | bbl/h                                   | m <sup>3</sup> /h      |                                     | 1.589 873 E - 01                                                       |
|                                 | ft <sup>3</sup> /h                      | m <sup>3</sup> /h      |                                     | 2.831 685 E - 02                                                       |
|                                 | U.K. gal/h                              | m <sup>3</sup> /h      |                                     | 4.546 092 E - 03                                                       |
|                                 |                                         | L/s                    |                                     | 1.262 803 E - 03                                                       |
|                                 | U.S. gal/h                              | m <sup>3</sup> /h      |                                     | 3.785 412 E - 03                                                       |
|                                 |                                         | L/s                    |                                     | 1.051 503 E - 03                                                       |
|                                 | U.K. gal/min                            | m <sup>3</sup> /h      |                                     | 2.727 655 E - 01                                                       |
| Throughput (mole basis)         |                                         | L/s                    |                                     | 7.576 819 E - 02                                                       |
|                                 | U.S. gal/min                            | m <sup>3</sup> /h      |                                     | 2.271 247 E - 01                                                       |
|                                 |                                         | L/s                    |                                     | 6.309 020 E - 02                                                       |
|                                 | (lbm-mol)/h                             | kmol/h                 |                                     | 4.535 924 E - 01                                                       |
|                                 |                                         | kmol/s                 |                                     | 1.259 979 E - 04                                                       |
| Flow rate                       |                                         |                        |                                     |                                                                        |
| Flow rate (mass basis)          | U.K. ton/min                            | kg/s                   |                                     | 1.693 412 E + 01                                                       |
|                                 | U.S. ton/min                            | kg/s                   |                                     | 1.511 974 E + 01                                                       |
|                                 | U.K. ton/h                              | kg/s                   |                                     | 2.822 353 E - 01                                                       |
|                                 | U.S. ton/h                              | kg/s                   |                                     | 2.519 958 E - 01                                                       |
|                                 | U.K. ton/day                            | kg/s                   |                                     | 1.175 980 E - 02                                                       |
|                                 | U.S. ton/day                            | kg/s                   |                                     | 1.049 982 E - 02                                                       |
|                                 | million lbm/year                        | kg/s                   |                                     | 5.249 912 E + 00                                                       |
|                                 | U.K. ton/year                           | kg/s                   |                                     | 3.221 864 E - 05                                                       |
|                                 | U.S. ton/year                           | kg/s                   |                                     | 2.876 664 E - 05                                                       |
|                                 | lbm/s                                   | kg/s                   |                                     | 4.535 924 E - 01                                                       |
|                                 | lbm/min                                 | kg/s                   |                                     | 7.559 873 E - 03                                                       |
|                                 | lbm/h                                   | kg/s                   |                                     | 1.259 979 E - 04                                                       |
| Flow rate (volume basis)        | bbl/day                                 | m <sup>3</sup> /d      |                                     | 1.589 873 E - 01                                                       |
|                                 |                                         | L/s                    |                                     | 1.840 131 E - 03                                                       |
|                                 | ft <sup>3</sup> /day                    | m <sup>3</sup> /d      |                                     | 2.831 685 E - 02                                                       |
|                                 |                                         | L/s                    |                                     | 3.277 413 E - 04                                                       |
|                                 | bbl/h                                   | m <sup>3</sup> /s      |                                     | 4.416 314 E - 05                                                       |
|                                 |                                         | L/s                    |                                     | 4.416 314 E - 02                                                       |
|                                 | ft <sup>3</sup> /h                      | m <sup>3</sup> /s      |                                     | 7.865 791 E - 06                                                       |
|                                 |                                         | L/s                    |                                     | 7.865 791 E - 03                                                       |
|                                 | U.K. gal/h                              | dm <sup>3</sup> /s     | L/s                                 | 1.262 803 E - 03                                                       |
|                                 | U.S. gal/h                              | dm <sup>3</sup> /s     | L/s                                 | 1.051 503 E - 03                                                       |
|                                 | U.K. gal/min                            | dm <sup>3</sup> /s     | L/s                                 | 7.576 820 E - 02                                                       |
|                                 | U.S. gal/min                            | dm <sup>3</sup> /s     | L/s                                 | 6.309 020 E - 02                                                       |
|                                 | ft <sup>3</sup> /min                    | dm <sup>3</sup> /s     | L/s                                 | 4.719 474 E - 01                                                       |
| Flow rate (mole basis)          | ft <sup>3</sup> /s                      | dm <sup>3</sup> /s     | L/s                                 | 2.831 685 E + 01                                                       |
|                                 | (lb-mol)/s                              | kmol/s                 |                                     | 4.535 924 E - 01                                                       |
|                                 | (lb-mol)/h                              | kmol/s                 |                                     | 1.259 979 E - 04                                                       |
| Flow rate/length (mass basis)   | million scf/D                           | kmol/s                 |                                     | 1.383 45 E - 02                                                        |
|                                 | lbm/(s-ft)                              | kg/(s-m)               |                                     | 1.488 164 E + 00                                                       |
|                                 | lbm/(h-ft)                              | kg/(s-m)               |                                     | 4.133 789 E - 04                                                       |
| Flow rate/length (volume basis) | U.K. gal/(min-ft)                       | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 2.485 833 E - 04                                                       |
|                                 | U.S. gal/(min-ft)                       | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 2.069 888 E - 04                                                       |
|                                 | U.K. gal/(h-in)                         | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 4.971 667 E - 05                                                       |
|                                 | U.S. gal/(h-in)                         | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 4.139 776 E - 05                                                       |
|                                 | U.K. gal/(h-ft)                         | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 4.143 055 E - 06                                                       |
|                                 | U.S. gal/(h-ft)                         | m <sup>2</sup> /s      | m <sup>3</sup> /(s-m)               | 3.449 814 E - 06                                                       |
| Flow rate/area (mass basis)     | lbm/(s-ft <sup>2</sup> )                | kg/(s-m <sup>2</sup> ) |                                     | 4.882 428 E + 00                                                       |
|                                 | lbm/(h-ft <sup>2</sup> )                | kg/(s-m <sup>2</sup> ) |                                     | 1.356 230 E - 03                                                       |
| Flow rate/area (volume basis)   | ft <sup>3</sup> /(s-ft <sup>2</sup> )   | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 3.048* E - 01                                                          |
|                                 | ft <sup>3</sup> /(min-ft <sup>2</sup> ) | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 5.08* E - 03                                                           |
|                                 | U.K. gal/(h-in <sup>2</sup> )           | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 1.957 349 E - 03                                                       |
|                                 | U.S. gal/(h-in <sup>2</sup> )           | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 1.629 833 E - 03                                                       |
|                                 | U.K. gal/(min-ft <sup>2</sup> )         | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 8.155 621 E - 04                                                       |
|                                 | U.S. gal/(min-ft <sup>2</sup> )         | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 6.790 972 E - 04                                                       |
|                                 | U.K. gal/(h-ft <sup>2</sup> )           | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 1.359 270 E - 05                                                       |
|                                 | U.S. gal/(h-ft <sup>2</sup> )           | m/s                    | m <sup>3</sup> /(s-m <sup>2</sup> ) | 1.131 829 E - 05                                                       |

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                                 | Customary or commonly used unit       | SI unit                 | Alternate SI unit | Conversion factor; multiply customary unit by factor to obtain SI unit |
|------------------------------------------|---------------------------------------|-------------------------|-------------------|------------------------------------------------------------------------|
| Energy, work, power                      |                                       |                         |                   |                                                                        |
| Energy, work                             | therm                                 | MJ                      |                   | 1.055 056 E + 02                                                       |
|                                          |                                       | kJ                      |                   | 1.055 056 E + 05                                                       |
|                                          |                                       | kWh                     |                   | 2.930 711 E + 01                                                       |
|                                          | U.S. tonf·mi                          | MJ                      |                   | 1.431 744 E + 01                                                       |
|                                          |                                       | MJ                      |                   | 2.684 520 E + 00                                                       |
|                                          |                                       | kJ                      |                   | 2.684 520 E + 03                                                       |
|                                          | hp·h                                  | kWh                     |                   | 7.456 999 E - 01                                                       |
|                                          |                                       | MJ                      |                   | 2.647 780 E + 00                                                       |
|                                          |                                       | kJ                      |                   | 2.647 780 E + 03                                                       |
|                                          | ch·h or CV·h                          | kWh                     |                   | 7.354 999 E - 01                                                       |
|                                          |                                       | MJ                      |                   | 3.6° E + 00                                                            |
|                                          |                                       | kJ                      |                   | 3.6° E + 03                                                            |
|                                          | kWh                                   | kJ                      |                   | 1.899 101 E + 00                                                       |
|                                          |                                       | kWh                     |                   | 5.275 280 E - 04                                                       |
|                                          |                                       | kJ                      |                   | 1.055 056 E + 00                                                       |
|                                          | Btu                                   | kWh                     |                   | 2.930 711 E - 04                                                       |
|                                          |                                       | kJ                      |                   | 4.184° E + 00                                                          |
|                                          |                                       | kJ                      |                   | 4.184° E - 03                                                          |
|                                          | cal                                   | kJ                      |                   | 1.355 818 E - 03                                                       |
|                                          |                                       | kJ                      |                   | 1.355 818 E - 03                                                       |
|                                          |                                       | kJ                      |                   | 1.0° E - 03                                                            |
| Impact energy                            | J                                     | kJ                      |                   | 4.214 011 E - 05                                                       |
|                                          |                                       | kJ                      |                   | 1.0° E - 07                                                            |
|                                          |                                       | J                       |                   | 9.806 650° E + 00                                                      |
|                                          | (lbf·ft <sup>2</sup> )/s <sup>2</sup> | J                       |                   | 1.355 818 E + 00                                                       |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          | erg                                   | J                       |                   | 1.0° E + 00                                                            |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          | kgf·m                                 | J                       |                   | 9.806 650° E + 00                                                      |
|                                          |                                       | J                       |                   | 1.355 818 E + 00                                                       |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          | lbf·ft                                | J                       |                   | 1.355 818 E + 00                                                       |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          | kgf·m                                 | J                       |                   | 9.806 650° E + 00                                                      |
|                                          |                                       | J                       |                   | 1.355 818 E + 00                                                       |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          | lbf·ft                                | J                       |                   | 1.355 818 E + 00                                                       |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
|                                          |                                       | J                       |                   | 1.0° E + 00                                                            |
| Power                                    | million Btu/h                         | MW                      |                   | 2.930 711 E - 01                                                       |
|                                          |                                       | kW                      |                   | 3.516 853 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          | ton of refrigeration                  | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          | Btu/s                                 | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          | kW                                    | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          |                                       | kW                      |                   | 1.055 056 E + 00                                                       |
|                                          | hydraulic horsepower—hhp              | kW                      |                   | 7.460 43 E - 01                                                        |
|                                          |                                       | kW                      |                   | 7.46° E - 01                                                           |
|                                          |                                       | kW                      |                   | 7.46° E - 01                                                           |
|                                          | hp (electric)                         | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          | hp [(550 ft·lbf)/s]                   | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.456 999 E - 01                                                       |
|                                          | ch or CV                              | kW                      |                   | 7.354 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.354 999 E - 01                                                       |
|                                          |                                       | kW                      |                   | 7.354 999 E - 01                                                       |
|                                          | Btu/min                               | kW                      |                   | 1.758 427 E - 02                                                       |
|                                          |                                       | kW                      |                   | 1.758 427 E - 02                                                       |
|                                          |                                       | kW                      |                   | 1.758 427 E - 02                                                       |
|                                          | (ft·lbf)/s                            | kW                      |                   | 1.355 818 E - 03                                                       |
|                                          |                                       | kW                      |                   | 1.355 818 E - 03                                                       |
|                                          |                                       | kW                      |                   | 1.355 818 E - 03                                                       |
|                                          | kcal/h                                | W                       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | W                       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | W                       |                   | 1.162 222 E + 00                                                       |
|                                          | Btu/h                                 | W                       |                   | 2.930 711 E - 01                                                       |
|                                          |                                       | W                       |                   | 2.930 711 E - 01                                                       |
|                                          |                                       | W                       |                   | 2.930 711 E - 01                                                       |
|                                          | (ft·lbf)/min                          | W                       |                   | 2.259 697 E - 02                                                       |
|                                          |                                       | W                       |                   | 2.259 697 E - 02                                                       |
|                                          |                                       | W                       |                   | 2.259 697 E - 02                                                       |
| Power/area                               | Btu/(s·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.135 653 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.135 653 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.135 653 E + 01                                                       |
|                                          | cal/(h·cm <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.162 222 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E - 02                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 3.154 591 E - 03                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.154 591 E - 03                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.154 591 E - 03                                                       |
|                                          | hp/ft <sup>2</sup>                    | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          | cal/(h·cm <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          | Btu/(s·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
| Heat-release rate, mixing power          | hp/ft <sup>2</sup>                    | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 2.633 414 E + 01                                                       |
|                                          | cal/(h·cm <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.162 222 E + 00                                                       |
|                                          | Btu/(s·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 3.725 895 E + 01                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          | Btu/(h·ft <sup>2</sup> )              | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
|                                          |                                       | kW/m <sup>2</sup>       |                   | 1.034 971 E - 02                                                       |
| Cooling duty (machinery)                 | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          | Btu/(bhp·h)                           | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
|                                          |                                       | W/kW                    |                   | 3.930 148 E - 01                                                       |
| Specific fuel consumption (mass basis)   | lbm/(hp·h)                            | mg/J                    |                   | 1.689 659 E - 01                                                       |
|                                          |                                       | mg/J                    |                   | 1.689 659 E - 01                                                       |
|                                          |                                       | mg/J                    |                   | 1.689 659 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          | lbm/(hp·h)                            | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
|                                          |                                       | kg/MJ                   |                   | 6.082 774 E - 01                                                       |
| Specific fuel consumption (volume basis) | m <sup>3</sup> /kWh                   | dm <sup>3</sup> /MJ     |                   | 2.777 778 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.777 778 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.777 778 E + 02                                                       |
|                                          | U.S. gal/(hp·h)                       | dm <sup>3</sup> /MJ     |                   | 1.410 089 E + 00                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 1.410 089 E + 00                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 1.410 089 E + 00                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          | U.K. pt/(hp·h)                        | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
|                                          |                                       | dm <sup>3</sup> /MJ     |                   | 2.116 806 E - 01                                                       |
| Fuel consumption                         | U.K. gal/mi                           | dm <sup>3</sup> /100 km |                   | 2.824 807 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /100 km |                   | 2.824 807 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /100 km |                   | 2.824 807 E + 02                                                       |
|                                          | U.S. gal/mi                           | dm <sup>3</sup> /100 km |                   | 2.352 146 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /100 km |                   | 2.352 146 E + 02                                                       |
|                                          |                                       | dm <sup>3</sup> /100 km |                   | 2.352 146 E + 02                                                       |
|                                          | mi/U.S. gal                           | km/dm <sup>3</sup>      |                   | 4.251 437 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 4.251 437 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 4.251 437 E - 01                                                       |
|                                          | mi/U.K. gal                           | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          | mi/U.K. gal                           | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          | mi/U.K. gal                           | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01                                                       |
|                                          |                                       | km/dm <sup>3</sup>      |                   | 3.540 064 E - 01</                                                     |



**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                                                    | Customary or commonly used unit  | SI unit                      | Alternate SI unit | Conversion factor; multiply customary unit by factor to obtain SI unit |
|-------------------------------------------------------------|----------------------------------|------------------------------|-------------------|------------------------------------------------------------------------|
| Velocity (linear), speed                                    | knot                             | km/h                         |                   | 1.852° E + 00                                                          |
|                                                             | mi/h                             | km/h                         |                   | 1.609 344° E + 00                                                      |
|                                                             | ft/s                             | m/s                          |                   | 3.048° E - 01                                                          |
|                                                             |                                  | cm/s                         |                   | 3.048° E + 01                                                          |
|                                                             | ft/min                           | m/s                          |                   | 5.08° E - 03                                                           |
|                                                             | ft/h                             | mm/s                         |                   | 8.466 667 E - 02                                                       |
|                                                             | ft/day                           | mm/s                         |                   | 3.527 778 E - 03                                                       |
|                                                             |                                  | m/d                          |                   | 3.048° E - 01                                                          |
|                                                             | in/s                             | mm/s                         |                   | 2.54° E + 01                                                           |
| Corrosion rate                                              | in/year (ipy)                    | mm/a                         |                   | 2.54° E + 01                                                           |
|                                                             | mil/year                         | mm/a                         |                   | 2.54° E - 02                                                           |
| Rotational frequency                                        | r/min                            | r/s                          |                   | 1.666 667 E - 02                                                       |
|                                                             |                                  | rad/s                        |                   | 1.047 198 E - 01                                                       |
| Acceleration (linear)                                       | ft/s <sup>2</sup>                | m/s <sup>2</sup>             |                   | 3.048° E - 01                                                          |
|                                                             |                                  | cm/s <sup>2</sup>            |                   | 3.048° E + 01                                                          |
| Acceleration (rotational)                                   | rpm/s                            | rad/s <sup>2</sup>           |                   | 1.047 198 E - 01                                                       |
| Momentum                                                    | (lbm-ft)/s                       | (kg-m)/s                     |                   | 1.382 550 E - 01                                                       |
| Force                                                       | U.K. tonf                        | kN                           |                   | 9.964 016 E + 00                                                       |
|                                                             | U.S. tonf                        | kN                           |                   | 8.896 443 E + 00                                                       |
|                                                             | kgf (kp)                         | N                            |                   | 9.806 650° E + 00                                                      |
|                                                             | lbf                              | N                            |                   | 4.448 222 E + 00                                                       |
|                                                             | dyn                              | mN                           |                   | 1.0 E - 02                                                             |
| Bending moment, torque                                      | U.S. tonf-ft                     | kN-m                         |                   | 2.711 636 E + 00                                                       |
|                                                             | kgf-m                            | N-m                          |                   | 9.806 650° E + 00                                                      |
|                                                             | lbf-ft                           | N-m                          |                   | 1.355 818 E + 00                                                       |
|                                                             | lbf-in                           | N-m                          |                   | 1.129 848 E - 01                                                       |
| Bending moment/length                                       | (lbf-ft)/in                      | (N-m)/m                      |                   | 5.337 866 E + 01                                                       |
|                                                             | (lbf-in)/in                      | (N-m)/m                      |                   | 4.448 222 E + 00                                                       |
| Moment of inertia                                           | lbm-ft <sup>2</sup>              | kg-m <sup>2</sup>            |                   | 4.214 011 E - 02                                                       |
| Stress                                                      | U.S. tonf/in <sup>2</sup>        | MPa                          | N/mm <sup>2</sup> | 1.378 951 E + 01                                                       |
|                                                             | kgf/mm <sup>2</sup>              | MPa                          | N/mm <sup>2</sup> | 9.806 650° E + 00                                                      |
|                                                             | U.S. tonf/ft <sup>2</sup>        | MPa                          | N/mm <sup>2</sup> | 9.576 052 E - 02                                                       |
|                                                             | lbf/in <sup>2</sup> (psi)        | MPa                          | N/mm <sup>2</sup> | 6.894 757 E - 03                                                       |
|                                                             | lbf/ft <sup>2</sup> (psf)        | kPa                          |                   | 4.788 026 E - 02                                                       |
|                                                             | dyn/cm <sup>2</sup>              | Pa                           |                   | 1.0° E - 01                                                            |
| Mass/length                                                 | lbm/ft                           | kg/m                         |                   | 1.488 164 E + 00                                                       |
| Mass/area structural loading, bearing capacity (mass basis) | U.S. ton/ft <sup>2</sup>         | Mg/m <sup>2</sup>            |                   | 9.764 855 E + 00                                                       |
|                                                             | lbm/ft <sup>2</sup>              | kg/m <sup>2</sup>            |                   | 4.882 428 E + 00                                                       |
| Miscellaneous transport properties                          |                                  |                              |                   |                                                                        |
| Diffusivity                                                 | ft <sup>2</sup> /s               | m <sup>2</sup> /s            |                   | 9.290 304° E - 02                                                      |
|                                                             | m <sup>2</sup> /s                | mm <sup>2</sup> /s           |                   | 1.0° E + 06                                                            |
|                                                             | ft <sup>2</sup> /h               | m <sup>2</sup> /s            |                   | 2.580 64° E - 05                                                       |
| Thermal resistance                                          | (°C-m <sup>2</sup> -h)/kcal      | (K-m <sup>2</sup> )/kW       |                   | 8.604 208 E + 02                                                       |
|                                                             | (°F-ft <sup>2</sup> -h)/Btu      | (K-m <sup>2</sup> )/kW       |                   | 1.761 102 E + 02                                                       |
| Heat flux                                                   | Btu/(h-ft <sup>2</sup> )         | kW/m <sup>2</sup>            |                   | 3.154 591 E - 03                                                       |
| Thermal conductivity                                        | (cal-cm)/(s-cm <sup>2</sup> -°C) | W/(m-K)                      |                   | 4.184° E + 02                                                          |
|                                                             | (Btu-ft)/(h-ft <sup>2</sup> -°F) | W/(m-K)                      |                   | 1.730 735 E + 00                                                       |
|                                                             |                                  | (kJ-m)/(h-m <sup>2</sup> -K) |                   | 6.230 646 E + 00                                                       |
|                                                             | (kcal-m)/(h-m <sup>2</sup> -°C)  | W/(m-K)                      |                   | 1.162 222 E + 00                                                       |
|                                                             | (Btu-in)/(h-ft <sup>2</sup> -°F) | W/(m-K)                      |                   | 1.442 279 E - 01                                                       |
|                                                             | (cal-cm)/(h-cm <sup>2</sup> -°C) | W/(m-K)                      |                   | 1.162 222 E - 01                                                       |
|                                                             |                                  |                              |                   |                                                                        |
| Heat-transfer coefficient                                   | cal/(s-cm <sup>2</sup> -°C)      | kW/(m <sup>2</sup> -K)       |                   | 4.184° E + 01                                                          |
|                                                             | Btu/(s-ft <sup>2</sup> -°F)      | kW/(m <sup>2</sup> -K)       |                   | 2.044 175 E + 01                                                       |
|                                                             | cal/(h-cm <sup>2</sup> -°C)      | kW/(m <sup>2</sup> -K)       |                   | 1.162 222 E - 02                                                       |
|                                                             | Btu/(h-ft <sup>2</sup> -°F)      | kW/(m <sup>2</sup> -K)       |                   | 5.678 263 E - 03                                                       |
|                                                             |                                  | kJ/(h-m <sup>2</sup> -K)     |                   | 2.044 175 E + 01                                                       |
|                                                             | Btu/(h-ft <sup>2</sup> -°R)      | kW/(m <sup>2</sup> -K)       |                   | 5.678 263 E - 03                                                       |
|                                                             | kcal/(h-m <sup>2</sup> -°C)      | kW/(m <sup>2</sup> -K)       |                   | 1.162 222 E - 03                                                       |

**TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)**

| Quantity                             | Customary or commonly used unit                        | SI unit                | Alternate SI unit    | Conversion factor; multiply customary unit by factor to obtain SI unit |        |
|--------------------------------------|--------------------------------------------------------|------------------------|----------------------|------------------------------------------------------------------------|--------|
| Volumetric heat-transfer coefficient | Btu/(s·ft <sup>2</sup> ·°F)                            | kW/(m <sup>2</sup> ·K) |                      | 6.706 611                                                              | E + 01 |
|                                      | Btu/(h·ft <sup>2</sup> ·°F)                            | kW/(m <sup>2</sup> ·K) |                      | 1.862 947                                                              | E - 02 |
| Surface tension                      | dyn/cm                                                 | mN/m                   |                      | 1                                                                      |        |
| Viscosity (dynamic)                  | (lbf·s)/in <sup>2</sup>                                | Pa·s                   | (N·s)/m <sup>2</sup> | 6.894 757                                                              | E + 03 |
|                                      | (lbf·s)/ft <sup>2</sup>                                | Pa·s                   | (N·s)/m <sup>2</sup> | 4.788 026                                                              | E + 01 |
|                                      | (kgf·s)/m <sup>2</sup>                                 | Pa·s                   | (N·s)/m <sup>2</sup> | 9.806 650*                                                             | E + 00 |
|                                      | lbm/(ft·s)                                             | Pa·s                   | (N·s)/m <sup>2</sup> | 1.488 164                                                              | E + 00 |
|                                      | (dyn·s)/cm <sup>2</sup>                                | Pa·s                   | (N·s)/m <sup>2</sup> | 1.0*                                                                   | E - 01 |
|                                      | cP                                                     | Pa·s                   | (N·s)/m <sup>2</sup> | 1.0*                                                                   | E - 03 |
| Viscosity (kinematic)                | lbm/(ft·h)                                             | Pa·s                   | (N·s)/m <sup>2</sup> | 4.133 789                                                              | E - 04 |
|                                      | ft <sup>2</sup> /s                                     | m <sup>2</sup> /s      |                      | 9.290 304*                                                             | E - 02 |
|                                      | in <sup>2</sup> /s                                     | mm <sup>2</sup> /s     |                      | 6.451 6*                                                               | E + 02 |
|                                      | m <sup>2</sup> /h                                      | mm <sup>2</sup> /s     |                      | 2.777 778                                                              | E + 02 |
|                                      | ft <sup>2</sup> /h                                     | m <sup>2</sup> /s      |                      | 2.580 64*                                                              | E - 05 |
| Permeability                         | cSt                                                    | mm <sup>2</sup> /s     |                      | 1                                                                      |        |
|                                      |                                                        |                        |                      |                                                                        |        |
| Thermal flux                         | darcy                                                  | μm <sup>2</sup>        |                      | 9.869 233                                                              | E - 01 |
|                                      | millidarcy                                             | μm <sup>2</sup>        |                      | 9.869 233                                                              | E - 04 |
| Thermal flux                         | Btu/(h·ft <sup>2</sup> )                               | W/m <sup>2</sup>       |                      | 3.152                                                                  | E + 00 |
|                                      | Btu/(s·ft <sup>2</sup> )                               | W/m <sup>2</sup>       |                      | 1.135                                                                  | E + 04 |
|                                      | cal/(s·cm <sup>2</sup> )                               | W/m <sup>2</sup>       |                      | 4.184                                                                  | E + 04 |
| Mass-transfer coefficient            | (lb·mol)/[h·ft <sup>2</sup> (lb·mol/ft <sup>3</sup> )] | m/s                    |                      | 8.467                                                                  | E - 05 |
|                                      | (g·mol)/[s·m <sup>2</sup> (g·mol/L)]                   | m/s                    |                      | 1.0                                                                    | E + 01 |
| Electricity, magnetism               |                                                        |                        |                      |                                                                        |        |
| Admittance                           | S                                                      | S                      |                      | 1                                                                      |        |
| Capacitance                          | μF                                                     | μF                     |                      | 1                                                                      |        |
| Charge density                       | C/mm <sup>3</sup>                                      | C/mm <sup>3</sup>      |                      | 1                                                                      |        |
| Conductance                          | S                                                      | S                      |                      | 1                                                                      |        |
|                                      | Ω (mho)                                                | S                      |                      | 1                                                                      |        |
| Conductivity                         | S/m                                                    | S/m                    |                      | 1                                                                      |        |
|                                      | Ω/m                                                    | S/m                    |                      | 1                                                                      |        |
|                                      | mΩ/m                                                   | mS/m                   |                      | 1                                                                      |        |
| Current density                      | A/mm <sup>2</sup>                                      | A/mm <sup>2</sup>      |                      | 1                                                                      |        |
| Displacement                         | C/cm <sup>2</sup>                                      | C/cm <sup>2</sup>      |                      | 1                                                                      |        |
| Electric charge                      | C                                                      | C                      |                      | 1                                                                      |        |
| Electric current                     | A                                                      | A                      |                      | 1                                                                      |        |
| Electric-dipole moment               | C·m                                                    | C·m                    |                      | 1                                                                      |        |
| Electric-field strength              | V/m                                                    | V/m                    |                      | 1                                                                      |        |
| Electric flux                        | C                                                      | C                      |                      | 1                                                                      |        |
| Electric polarization                | C/cm <sup>2</sup>                                      | C/cm <sup>2</sup>      |                      | 1                                                                      |        |
| Electric potential                   | V                                                      | V                      |                      | 1                                                                      |        |
|                                      | mV                                                     | mV                     |                      | 1                                                                      |        |
| Electromagnetic moment               | A·m <sup>2</sup>                                       | A·m <sup>2</sup>       |                      | 1                                                                      |        |
| Electromotive force                  | V                                                      | V                      |                      | 1                                                                      |        |
| Flux of displacement                 | C                                                      | C                      |                      | 1                                                                      |        |
| Frequency                            | cycles/s                                               | Hz                     |                      | 1                                                                      |        |
| Impedance                            | Ω                                                      | Ω                      |                      | 1                                                                      |        |
| Linear-current density               | A/mm                                                   | A/mm                   |                      | 1                                                                      |        |
| Magnetic-dipole moment               | Wb·m                                                   | Wb·m                   |                      | 1                                                                      |        |
| Magnetic-field strength              | A/mm                                                   | A/mm                   |                      | 1                                                                      |        |
|                                      | Oe                                                     | A/m                    |                      | 7.957 747                                                              | E + 01 |
|                                      | gamma                                                  | A/m                    |                      | 7.957 747                                                              | E - 04 |
| Magnetic flux                        | mWb                                                    | mWb                    |                      | 1                                                                      |        |