currently available. They were developed by balanced committees representing all concerned interests. They specify procedures, instrumentation, equipment operating requirements, calculation methods, and uncertainty analysis.

When tests are run in accordance with a Code, the test results themselves, without adjustment for uncertainty, yield the best available indication of the actual performance of the tested equipment. ASME Performance Test Codes do not specify means to compare those results to contractual guarantees. Therefore, it is recommended that the parties to a commercial test agree **before starting the test and preferably before signing the contract** on the method to be used for comparing the test results to the contractual guarantees. It is beyond the scope of any Code to determine or interpret how such comparisons shall be made.

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mercury, density of: density of mercury at 32°F [0°C] is 0.491 154 lbm/in³ [13 595.1 kg/m³]. Density at other temperatures may be computed from the equation:

$$\rho_t = 13\,595.1/(1 + 1.184\,56\times10^{-4}t + 9.205\times10^{-9}t^2 + 6.608\times10^{-12}t^3 + 6.732\times10^{-14}t^4)$$

where

t = temperature of mercury, °C

ρ_t = density of mercury at temperature t, kg/m³

sound: acoustic output of a machine or process is its sound power (W). This is usually expressed as a sound power level in decibels. Sound power cannot be measured directly. Instead, sound pressures are measured and sound powers calculated therefrom. Modern instrumentation has imbedded this computational capability. Sound pressures (p) are usually expressed as sound pressure levels, also in decibels. A decibel is the logarithmic expression of the ratio of a quantity to a particular reference quantity. The reference quantity for sound power levels (W_o) is 1 pW and that for sound pressure levels (p_o) is 20 μPa, hence

sound power level (dB) = 10 $\log_{10}$ (W/W_o)

sound pressure level (dB) = 20 $\log_{10}$ (p/p_o)

output, net: of an engine and generator unit, defined by the formula:

$$\text{Net output (kW)} = \begin{pmatrix}\text{electrical power}\\ \text{output of}\\ \text{generator (kW)}\end{pmatrix} - \begin{pmatrix}\text{auxiliary}\\ \text{power}\\ \text{supplied (kW)}\end{pmatrix}$$

Auxiliary power supplied is that external power necessary for the unit's operation and includes, but is not limited to, excitation power, power for separately driven lube oil pumps, hydraulic oil pumps, generator cooling water pumps, fans for generator ventilation, and seal evacuators.

power, air or gas: the equations for air power invoke a compressibility factor K_p in this fashion

$$P = \left\{(p_2 - p_1)\, Q_1\, K_p + m\left[(\alpha_2 V_2^2 - \alpha_1 V_1^2)/2g_c + g\,(Z_2 - Z_1)/g_c\right]\right\}/A$$

where

P = power, hp [W]

$$K_p = \ell n\, \frac{p_2/p_1}{\dfrac{p_2}{p_1} - 1}$$

(for a reversible isothermal process)

$$K_p = \frac{\gamma}{\gamma - 1}\left[\left(\frac{p_2}{p_1}\right)^{\frac{\gamma-1}{\gamma}} - 1\right] \Bigg/ \left[\frac{p_2}{p_1} - 1\right]$$

(for an isentropic process)

$$K_p = \frac{n}{n - 1}\left[\left(\frac{p_2}{p_1}\right)^{\frac{n-1}{n}} - 1\right] \Bigg/ \left[\frac{p_2}{p_1} - 1\right]$$

(for a reversible polytropic process)

K_p = 1 [for a reversible isochoric process (constant density)]

γ = ratio of specific heats

n = polytropic exponent

p_1 = inlet pressure, lb/ft² [Pa]

p_2 = outlet pressure, lb/ft² [Pa]

Q_1 = volumetric flow rate, ft³/sec [m³/s]

α_1 = kinetic energy factor at inlet

α_2 = kinetic energy factor at outlet

V_1 = average velocity at inlet, ft/sec [m/s]

V_2 = average velocity at outlet, ft/sec [m/s]

Z_1 = elevation at inlet, ft [m]

Z_2 = elevation at outlet, ft [m]

g = acceleration due to gravity, ft/sec² [m/s²]

g_c = conversion factor, 32.174(ft–lbm)/(lb–sec²) [1(m–kg)/(N–s²)]

A = conversion factor, 550 (ft–lb)/(hp–sec) [1(N–m)/(W–s)]

power, water: the energy flux contained in flowing water. Water power is to be computed from the equation

$$P_w = g\rho Q\,(H_1 - H_2)/A = Q\,(p_1 - p_2)/A$$

where

P_w = water power, hp [W]

ρ = density of water, slug/ft³ [kg/m³]

Q = volumetric flow, ft³/sec [m³/s]

H_1 = higher head, ft [m]

H_2 = lower head, ft [m]

p_1 = higher pressure, lbf/ft² [Pa]

p_2 = lower pressure, lbf/ft² [Pa]

A = 550 (ft–lbf)/(hp–sec) [1 W/W]

g = local acceleration of gravity, ft/sec² [m/s²]

All heads and pressures shall be measured at, or corrected to, stagnation conditions.

mercury, density of: density of mercury at 32°F [0°C] is 0.491 154 lbm/in^3 [13 595.1 kg/m^3]. Density at other temperatures may be computed from the equation:

$$\rho_t = 13\,595.1/(1 + 1.184\,56\times10^{-4}t + 9.205\times10^{-9}t^2 + 6.608\times10^{-12}t^3 + 6.732\times10^{-14}t^4)$$

where

t = temperature of mercury, °C

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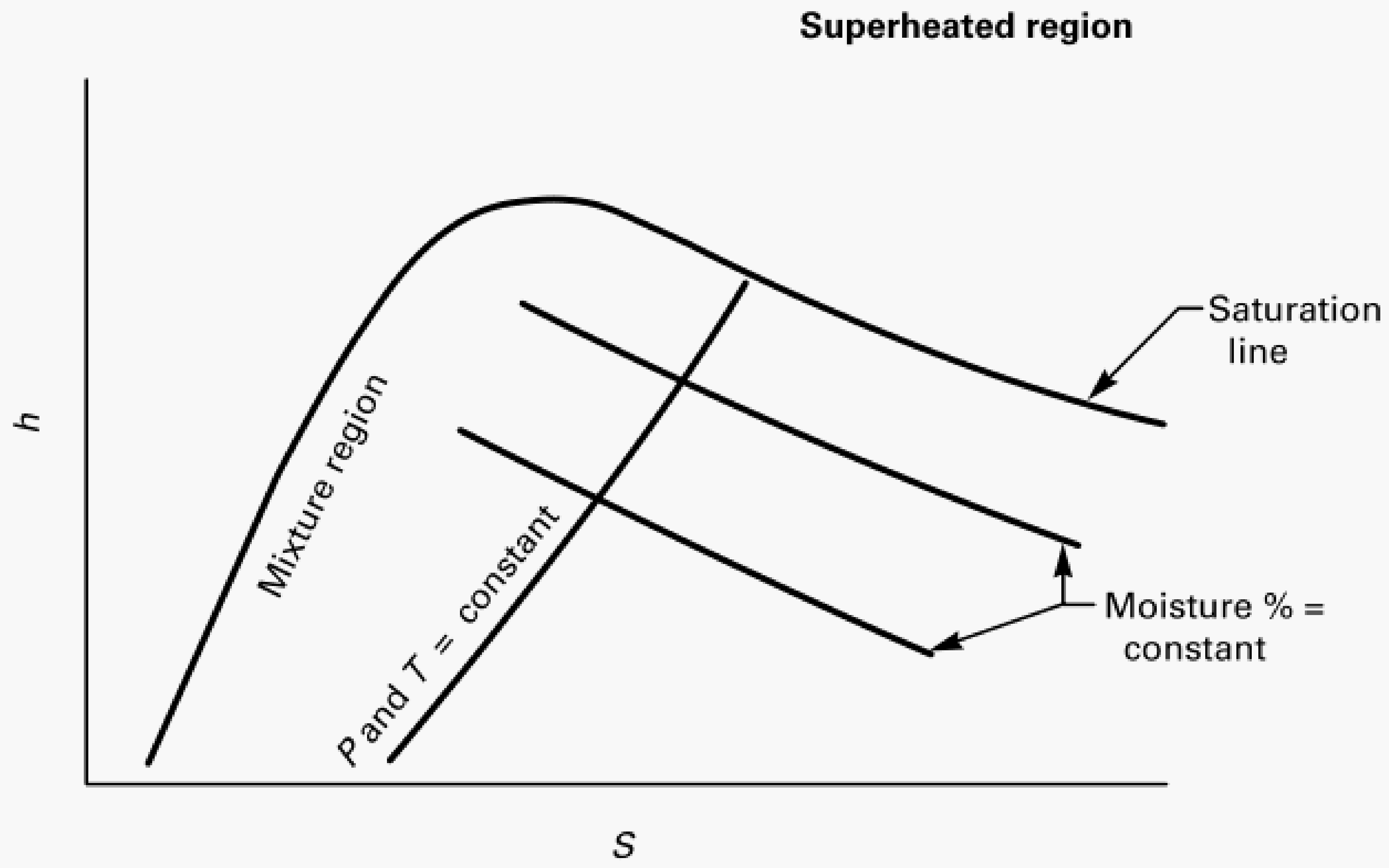

FIG. 3.3 ENTHALPY-ENTROPY DIAGRAM FOR WATER

For ideal pump work, refer to the definition of *pumps* where internal losses are negligible.

steam point: is defined as the temperature of an equilibrium mixture of liquid and condensing water vapor at one standard atmospheric pressure (373.15 K).

steam quality: inside the liquid-vapor-mixture region, quality x is defined as the fraction of the mass which is in the vapor state relative to the total mass of the two-phase mixture:

$$x = m_g/(m_g + m_f)$$

For example, if a mixture at saturated pressure and temperature contains 2.5% moisture, its quality is 97.5%. "Wet" steam means its state is in the mixture region wherein its state is defined by either its pressure or temperature and the portion of water substance which is the vapor phase.

Dry and saturated steam exists when all of the mass of water substance is in the vapor phase at saturation pressure and temperature. This condition exists along the "saturation line" which divides the two-phase mixture region from the superheated region (x = 100% and moisture = 0%). See Fig. 3.3.

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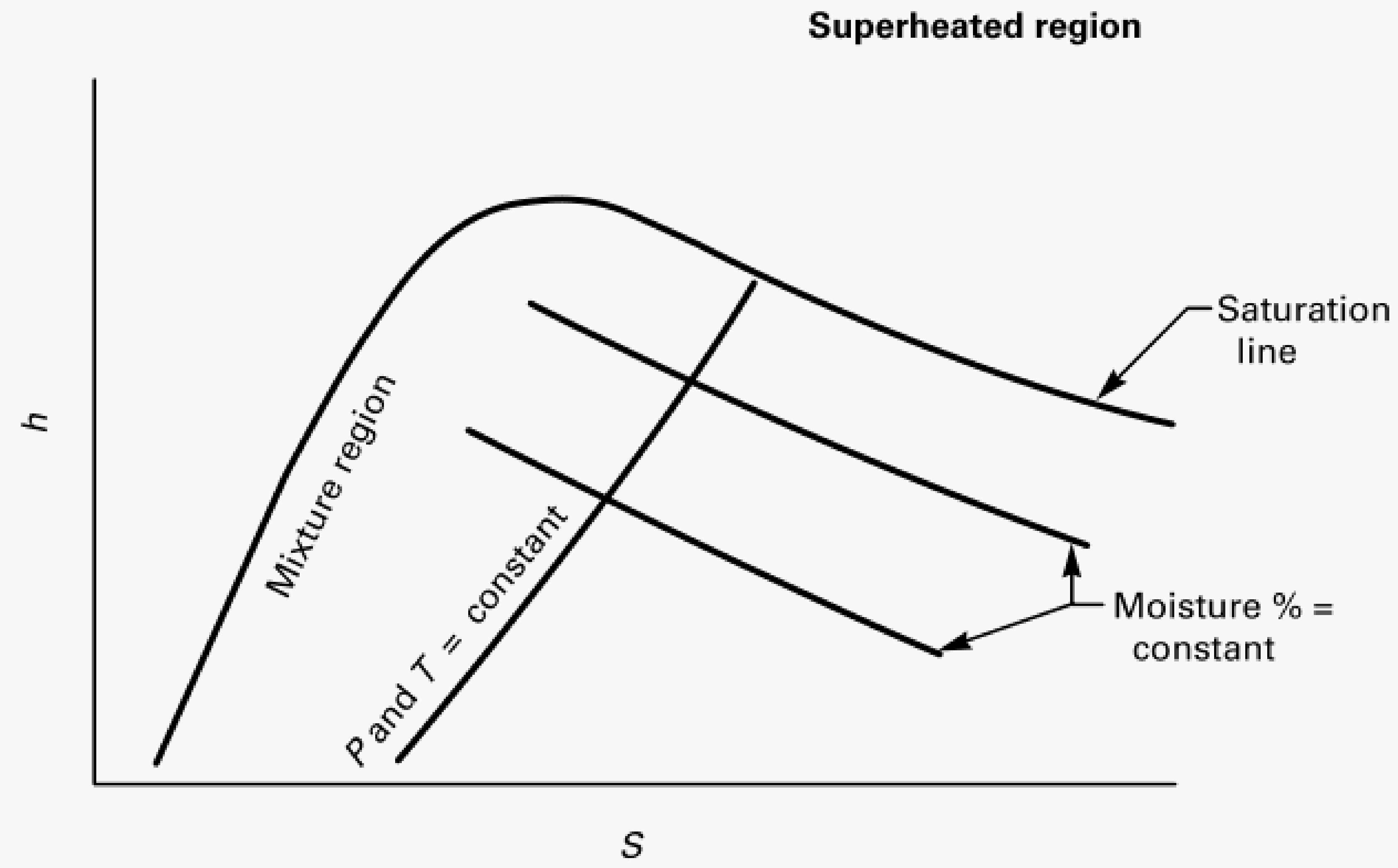

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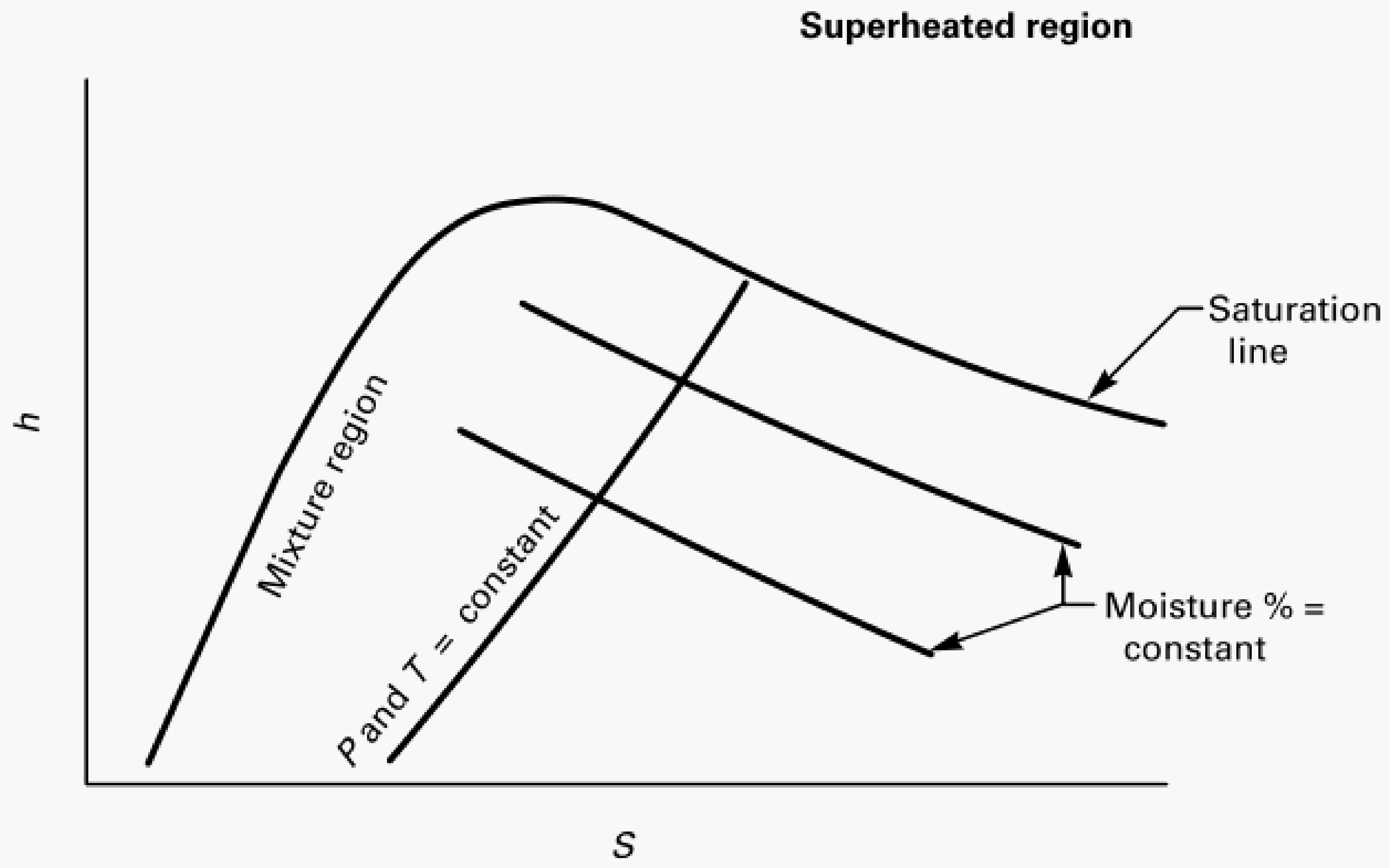

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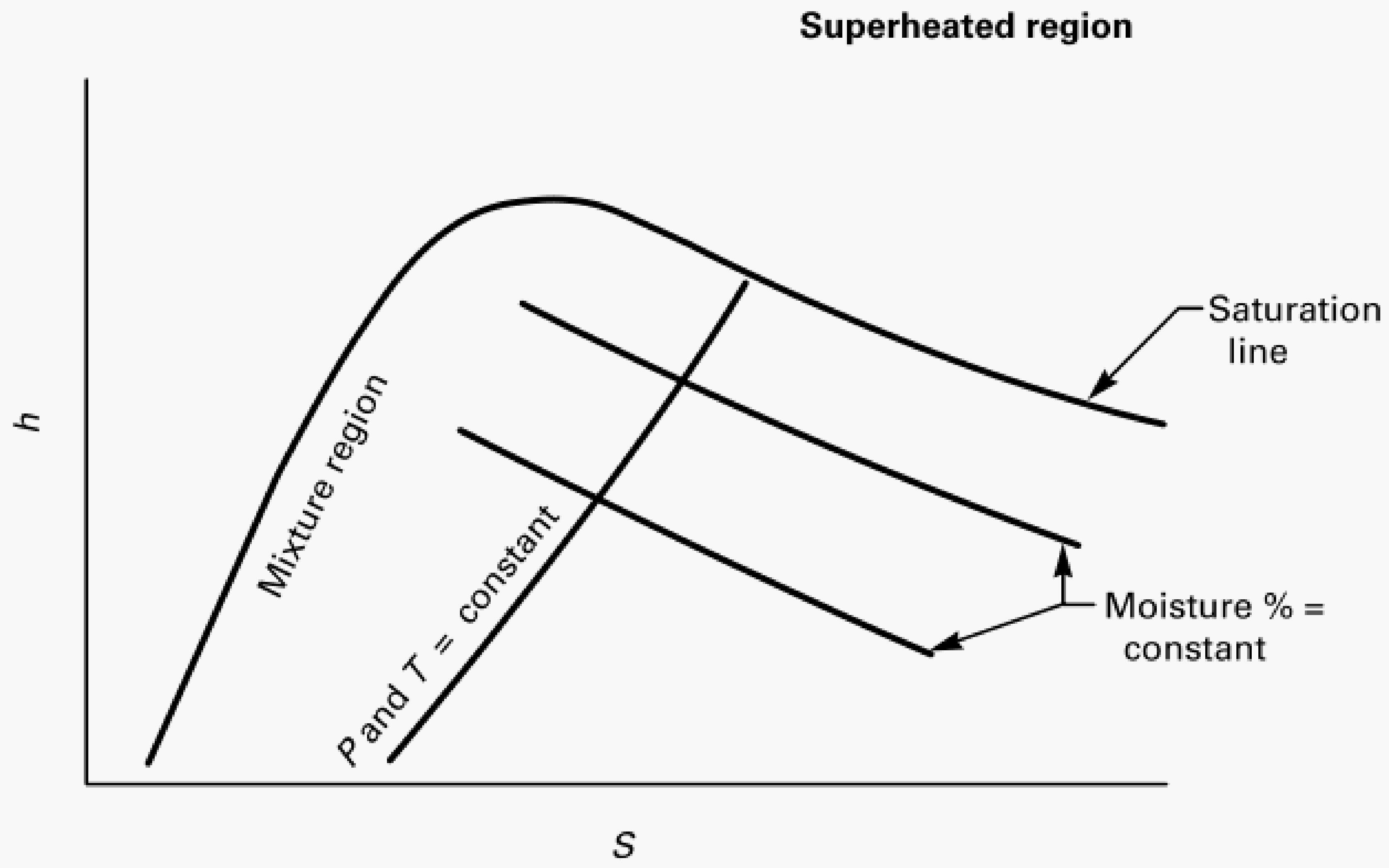

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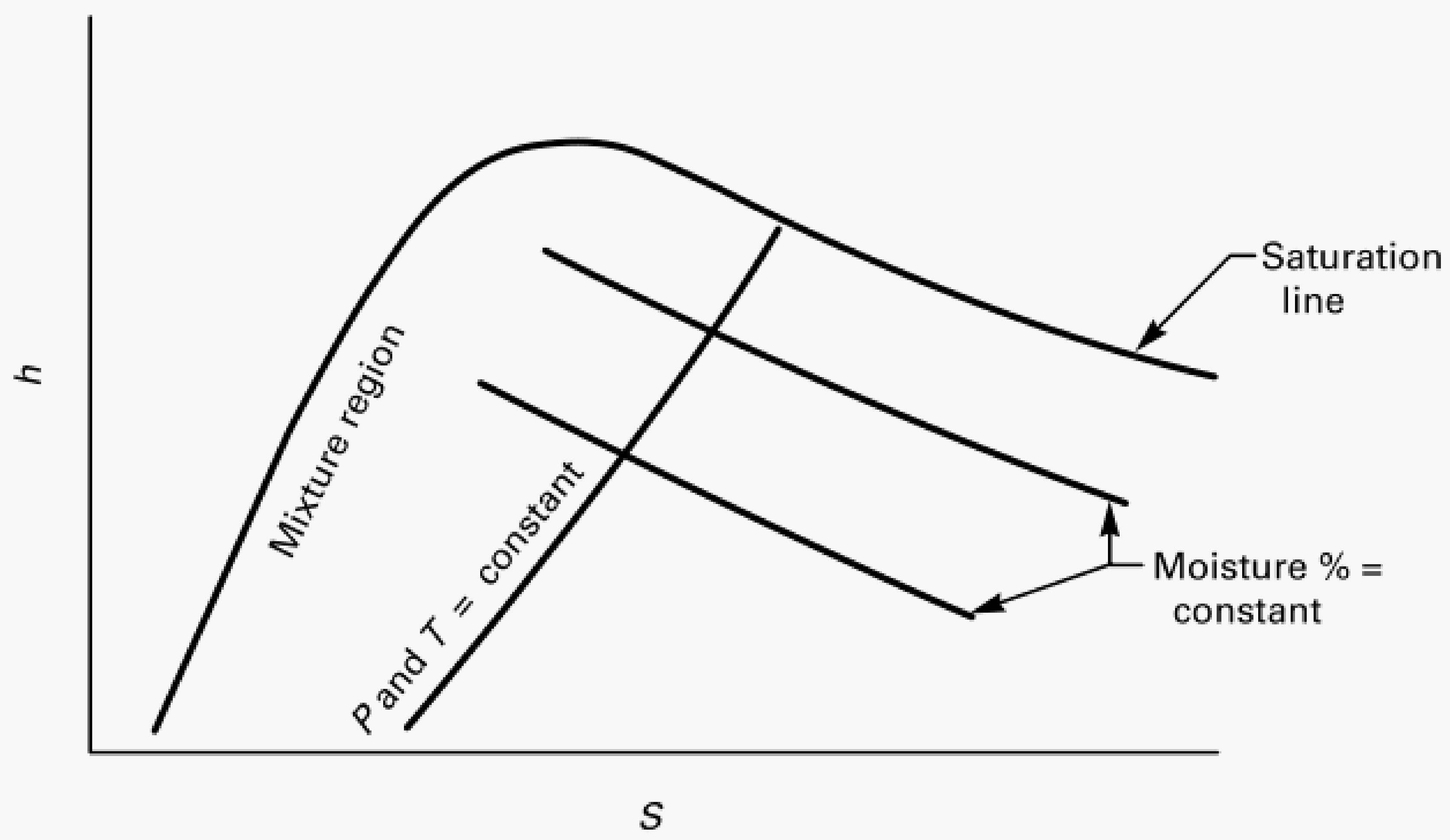

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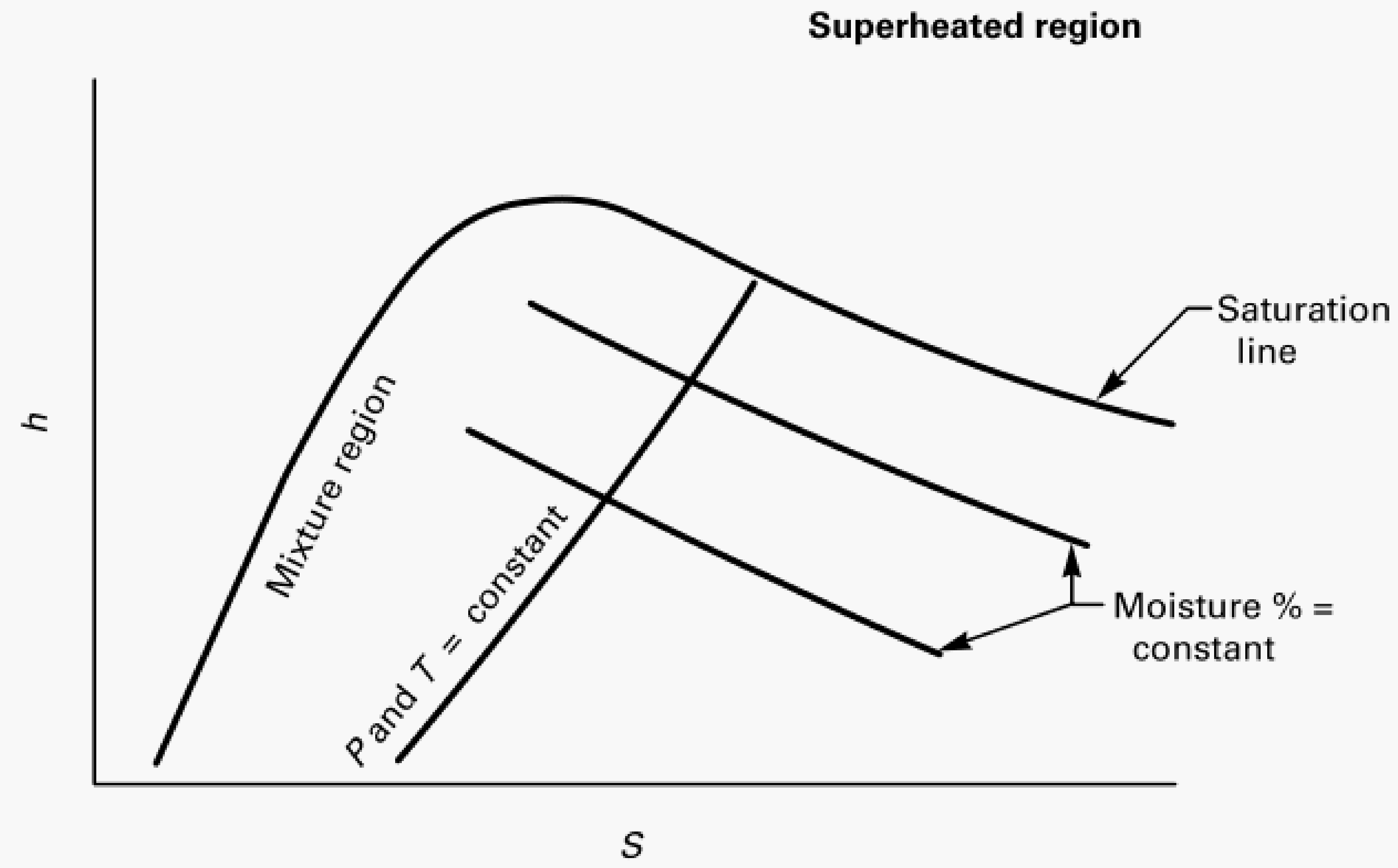

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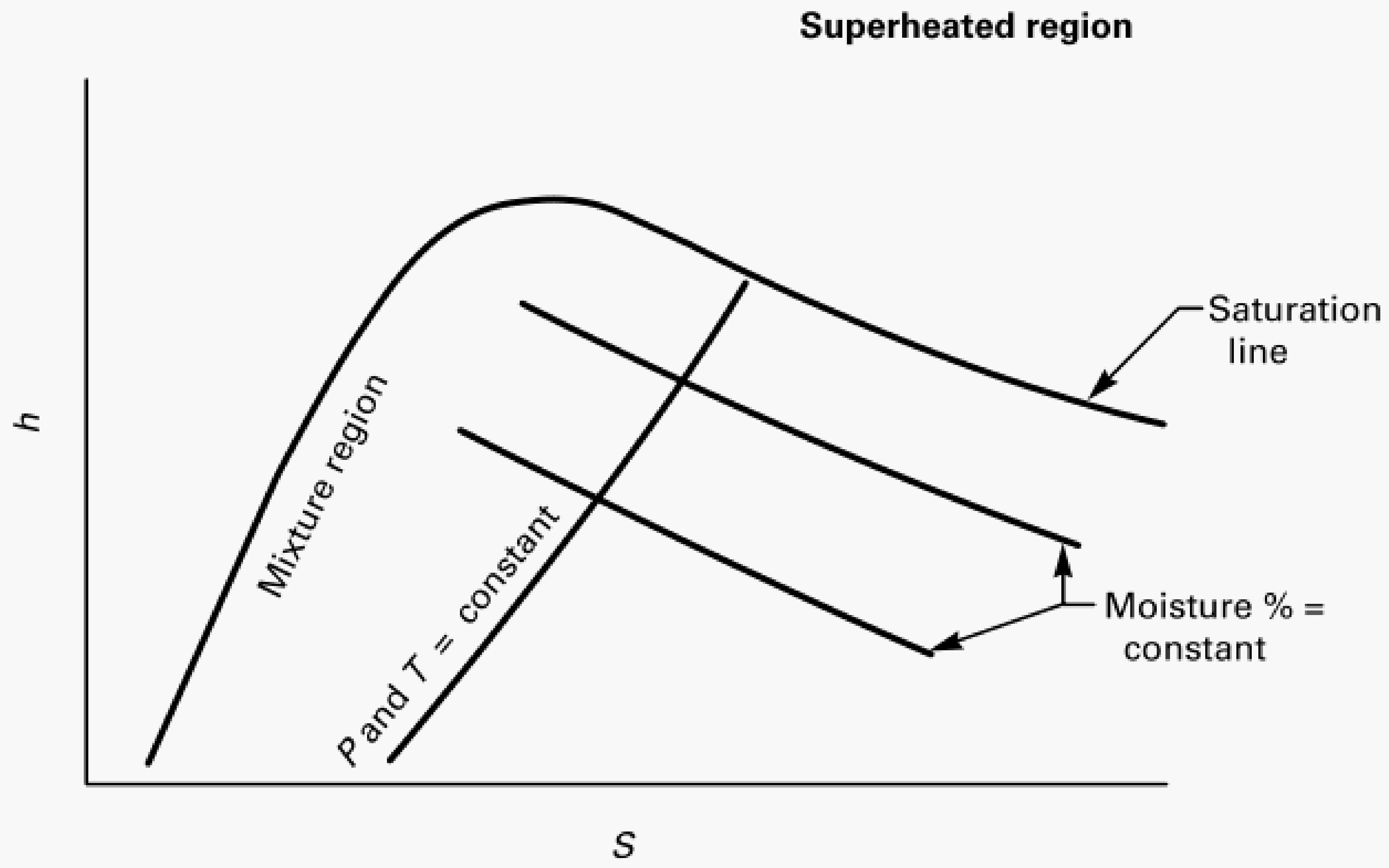

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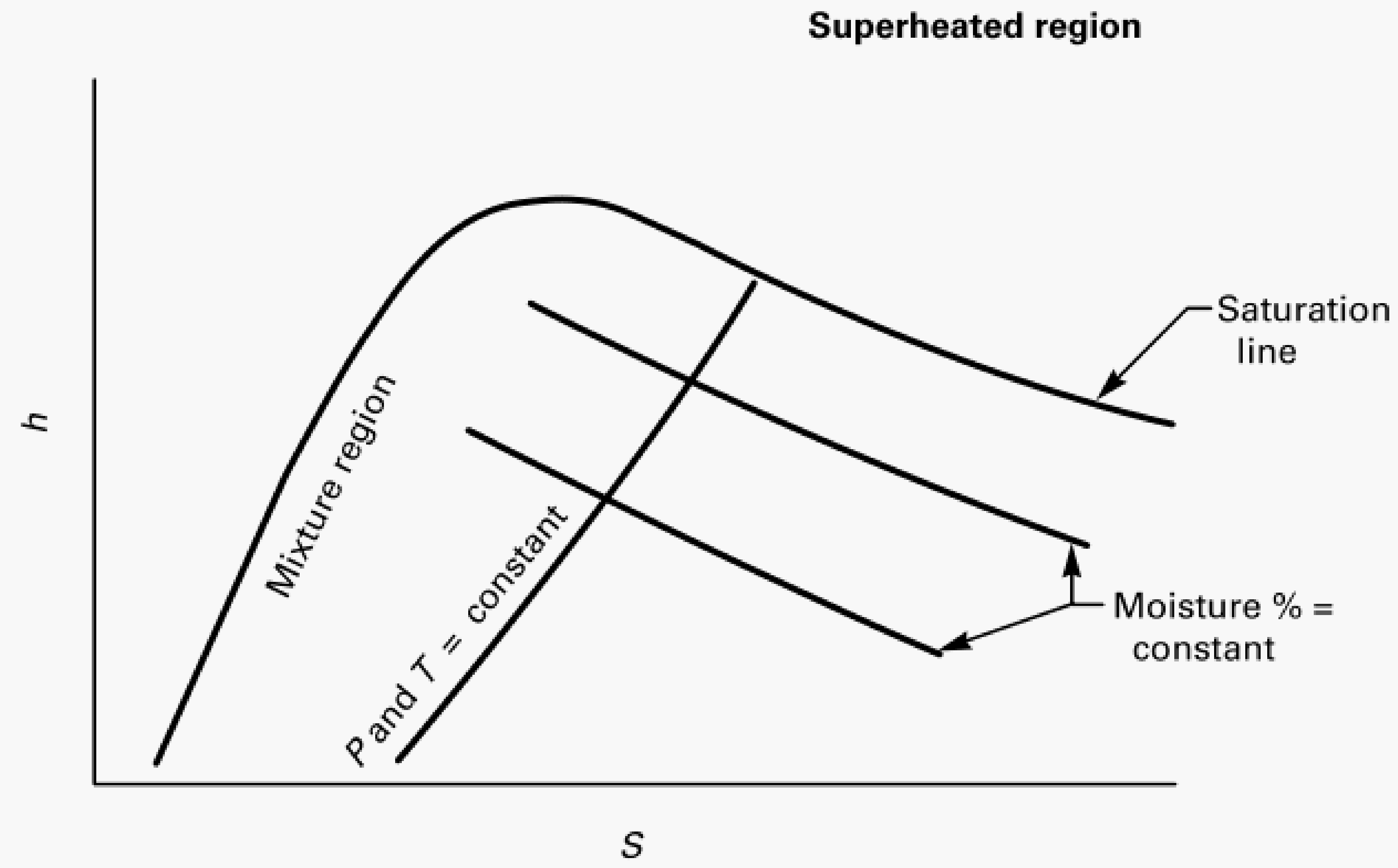

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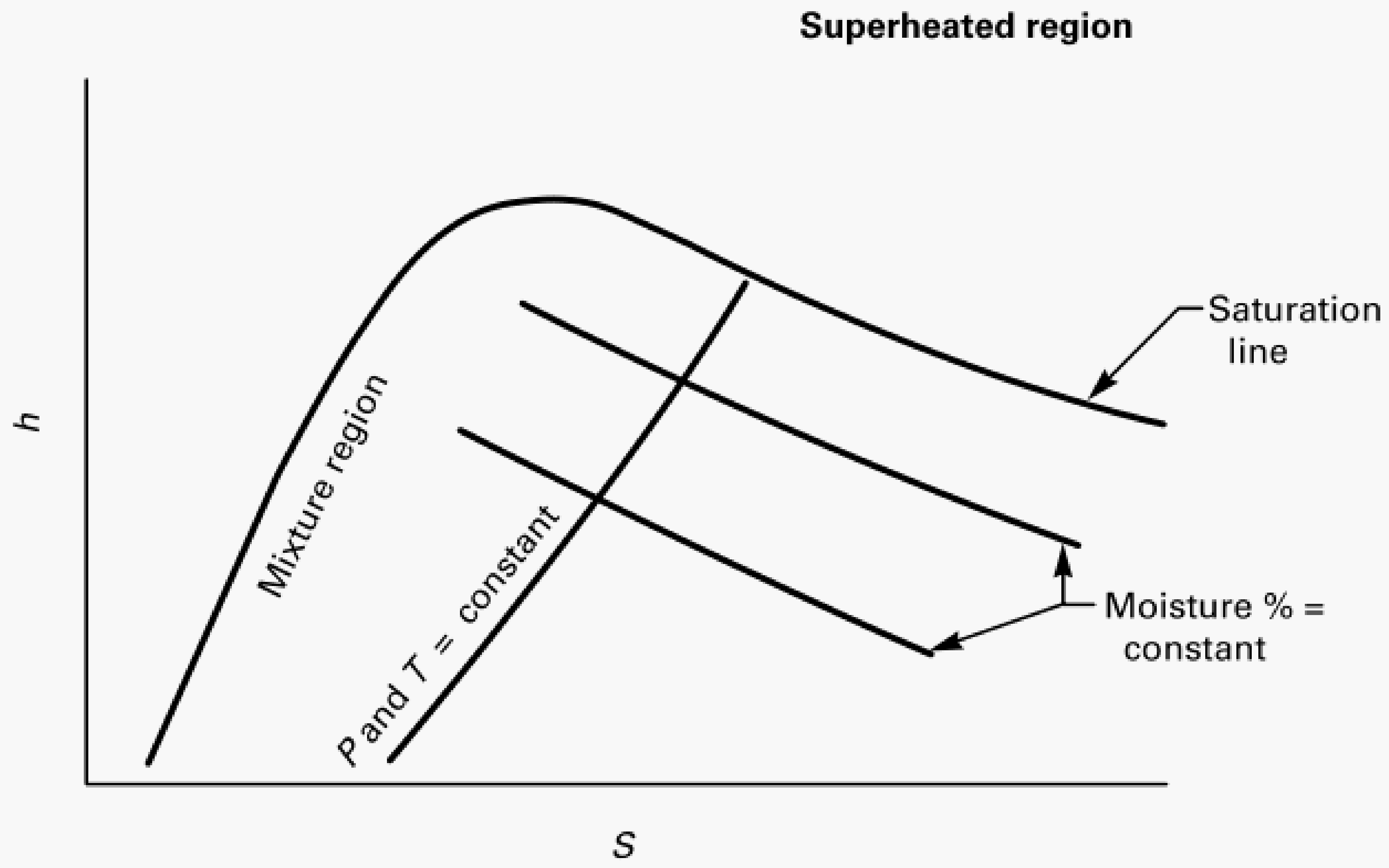

FIG. 3.3 ENTHALPY-ENTROPY DIAGRAM FOR WATER

For ideal pump work, refer to the definition of *pumps* where internal losses are negligible.

steam point: is defined as the temperature of an equilibrium mixture of liquid and condensing water vapor at one standard atmospheric pressure (373.15 K).

steam quality: inside the liquid-vapor-mixture region, quality x is defined as the fraction of the mass which is in the vapor state relative to the total mass of the two-phase mixture:

$$x = m_g/(m_g + m_f)$$

For example, if a mixture at saturated pressure and temperature contains 2.5% moisture, its quality is 97.5%. "Wet" steam means its state is in the mixture region wherein its state is defined by either its pressure or temperature and the portion of water substance which is the vapor phase.

Dry and saturated steam exists when all of the mass of water substance is in the vapor phase at saturation pressure and temperature. This condition exists along the "saturation line" which divides the two-phase mixture region from the superheated region (x = 100% and moisture = 0%). See Fig. 3.3.

steam rate: of an engine, turbine, or complete plant, is expressed as the actual mass of steam per unit of time per unit of output, often expressed in units of lbm/kW.

temperature, absolute: the approximate value of the thermodynamic temperature as defined by the International Practical Temperature Scale. In the U.S. customary system, the absolute temperature is expressed in degrees Rankine, and in the SI (metric) system, in kelvin. For relations between these scales, see Section 5.

temperature, reference: the datum for the steam tables is the triple point of water. The 1968 International Practical Temperature Scale establishes this at 0.01°C or 32.018°F.

For gases, the preferred standard temperature for PTC work is 59°F (15°C). Various industries use different reference conditions; caution is advised.

thermal conductivity: the coefficient of proportionality in the equation of heat transfer by steady unidirectional conduction proposed by Fourier in 1882: $q = -k\ A\ dT/dx$ where q is the rate of heat conduction along the x-axis, A is the cross-sectional area of the path normal to the x-axis, and $-dT/dx$ is the temperature gradient along the path. See Table 5.8. The units of k are Btu/(hr-ft-°F) [W/(m-°C)]

thermal unit conversions: using the identities as defined in the latest edition of ASME steam tables (Appendix 4B) and tables of conversion factors, the following conversions are derived:
Identities:

TABLE 5.3
CONVERSION FACTORS FOR SPECIFIC VOLUME (volume/mass)

To obtain → Multiply, by ↓ ↘	ft³/lbm	in.³/lbm	U.S. gal/lbm	liter/kg	m³/kg
ft³/lbm	1	1 728	$\frac{1\,728}{231}$ = 7.480 519 48	$\frac{30.48^3}{453.592\,37}$ = 62.427 960 6	$\frac{30.48^3 \times 10^{-6}}{0.453\,592\,37}$ = 0.062 427 960 6
in³/lbm	$\frac{1.0}{1\,728}$ = 0.000 578 703 704	1	$\frac{1.0}{231}$ = 0.004 329 004 33	$\frac{2.54^3}{453.592\,37}$ = 0.036 127 292 0	$\frac{2.54^3 \times 10^{-6}}{0.453\,592\,37}$ =0.000 036 127 292
U.S. gal/lbm	$\frac{231}{1\,728}$ = 0.133 680 556	231	1	$\frac{231 \times 2.54^3}{453.592\,37}$ = 8.345 404 45	$\frac{231 \times 2.54^3 \times 10^{-6}}{0.453\,592\,37}$ = 0.008 345 404 45
liter/kg	$\frac{453.592\,37}{30.48^3}$ = 0.016 018 463 4	$\frac{453.592\,37}{2.54^3}$ = 27.679 904 7	$\frac{453.592\,37}{231 \times 2.54^3}$ = 0.119 826 427	1	0.001
m³/kg	$\frac{0.453\,592\,37}{30.48^3 \times 10^{-6}}$ = 16.018 463 4	$\frac{0.453\,592\,37}{2.54^3 \times 10^{-6}}$ = 27 679.904 7	$\frac{0.453\,592\,37}{231 \times 2.54^3 \times 10^{-6}}$ = 119.826 427	1000	1

GENERAL NOTE:
All values given in the rational fractions are exact except 1 U.S. gal = 231 in.^{3} (NBS Misc. Pub. 233 P5).

Example: 1 U.S. gal/lbm =0.133 680 556 ft^3/lbm

TABLE 5.3
CONVERSION FACTORS FOR SPECIFIC VOLUME (volume/mass)

To obtain → Multiply, by ↓ ↘	$\frac{ft^3}{lbm}$	$\frac{in.^3}{lbm}$	$\frac{U.S.\ gal}{lbm}$	$\frac{liter}{kg}$	$\frac{m^3}{kg}$
$\frac{ft^3}{lbm}$	1	1 728	$\frac{1\,728}{231}$ = 7.480 519 48	$\frac{30.48^3}{453.592\,37}$ = 62.427 960 6	$\frac{30.48^3 \times 10^{-6}}{0.453\,592\,37}$ = 0.062 427 960 6
$\frac{in^3}{lbm}$	$\frac{1.0}{1\,728}$ = 0.000 578 703 704	1	$\frac{1.0}{231}$ = 0.004 329 004 33	$\frac{2.54^3}{453.592\,37}$ = 0.036 127 292 0	$\frac{2.54^3 \times 10^{-6}}{0.453\,592\,37}$ =0.000 036 127 292
$\frac{U.S.\ gal}{lbm}$	$\frac{231}{1\,728}$ = 0.133 680 556	231	1	$\frac{231 \times 2.54^3}{453.592\,37}$ = 8.345 404 45	$\frac{231 \times 2.54^3 \times 10^{-6}}{0.453\,592\,37}$ = 0.008 345 404 45
$\frac{liter}{kg}$	$\frac{453.592\,37}{30.48^3}$ = 0.016 018 463 4	$\frac{453.592\,37}{2.54^3}$ = 27.679 904 7	$\frac{453.592\,37}{231 \times 2.54^3}$ = 0.119 826 427	1	0.001
$\frac{m^3}{kg}$	$\frac{0.453\,592\,37}{30.48^3 \times 10^{-6}}$ = 16.018 463 4	$\frac{0.453\,592\,37}{2.54^3 \times 10^{-6}}$ = 27 679.904 7	$\frac{0.453\,592\,37}{231 \times 2.54^3 \times 10^{-6}}$ = 119.826 427	1000	1

GENERAL NOTE:
All values given in the rational fractions are exact except 1 U.S. gal = 231 in.^{3} (NBS Misc. Pub. 233 P5).

Example: 1 U.S. gal/lbm =0.133 680 556 ft^3/lbm

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = 3.766 160 97 × 10^{-7}	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ 1.285 067 46 × 10^{-6}	30.48 × 10^{-5} × 9/5 = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = 6.999 882 25 × 10^{-6}	1	$\frac{1.0}{41\ 868}$ = 2.388 458 97 × 10^{-5}	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = 6.999 882 25 × 10^{-5}	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{\text{Btu}}{\text{lbm} \times \text{R}}$	$\frac{\text{ft} \times \text{lbf}}{\text{lbm} \times \text{R}}$	$\frac{\text{kw} \times \text{hr}}{\text{lbm} \times \text{R}}$	$\frac{\text{bar} \times \text{cm}^3}{\text{g} \times \text{K}}$	$\frac{\text{kcal}}{\text{g} \times \text{K}}$	$\frac{\text{kp} \times \text{m}}{\text{g} \times \text{K}}$	$\frac{\text{kJ}}{\text{kg} \times \text{K}}$
$\frac{\text{Btu}}{\text{lbm} \times \text{R}}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{\text{ft} \times \text{lbf}}{\text{lbm} \times \text{R}}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{\text{kw} \times \text{hr}}{\text{lbm} \times \text{R}}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{\text{bar} \times \text{cm}^3}{\text{g} \times \text{K}}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{\text{kcal}}{\text{g} \times \text{K}}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{\text{kp} \times \text{m}}{\text{g} \times \text{K}}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{\text{kJ}}{\text{kg} \times \text{K}}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
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$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → / Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = 3.766 160 97 × 10^{-7}	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ 1.285 067 46 × 10^{-6}	30.48 × 10^{-5} × 9/5 = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
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$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = 6.999 882 25 × 10^{-6}	1	$\frac{1.0}{41\ 868}$ = 2.388 458 97 × 10^{-5}	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = 6.999 882 25 × 10^{-5}	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{\text{Btu}}{\text{lbm} \times \text{R}}$	$\frac{\text{ft} \times \text{lbf}}{\text{lbm} \times \text{R}}$	$\frac{\text{kw} \times \text{hr}}{\text{lbm} \times \text{R}}$	$\frac{\text{bar} \times \text{cm}^3}{\text{g} \times \text{K}}$	$\frac{\text{kcal}}{\text{g} \times \text{K}}$	$\frac{\text{kp} \times \text{m}}{\text{g} \times \text{K}}$	$\frac{\text{kJ}}{\text{kg} \times \text{K}}$
$\frac{\text{Btu}}{\text{lbm} \times \text{R}}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{\text{ft} \times \text{lbf}}{\text{lbm} \times \text{R}}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{\text{kw} \times \text{hr}}{\text{lbm} \times \text{R}}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{\text{bar} \times \text{cm}^3}{\text{g} \times \text{K}}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{\text{kcal}}{\text{g} \times \text{K}}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{\text{kp} \times \text{m}}{\text{g} \times \text{K}}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{\text{kJ}}{\text{kg} \times \text{K}}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\,37}{3\,600\,000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\,8}{9.806\,65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\,37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = 3.766 160 97 × 10^{-7}	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\,326 \times 10^7}$ 1.285 067 46 × 10^{-6}	30.48 × 10^{-5} × 9/5 = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\,600\,000}{2.326 \times 453.592\,37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\,37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\,37}$ = 142 859.546	$\frac{3\,600\,000}{2\,326 \times 453.592\,37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\,37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\,37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\,37}{3.6 \times 10^7 \times 9/5}$ = 6.999 882 25 × 10^{-6}	1	$\frac{1.0}{41\,868}$ = 2.388 458 97 × 10^{-5}	$\frac{1.0}{98.066\,5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\,326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\,326 \times 453.592\,37}{3\,600\,000}$ = 0.293 071 070	41 868	1	$\frac{4\,186.8}{9.806\,65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\,65}{4.186\,8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\,37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\,65}{4\,186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\,8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\,37}{3.6 \times 10^6 \times 9/5}$ = 6.999 882 25 × 10^{-5}	10	$\frac{1.0}{4\,186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\,65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → / Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\,37}{3\,600\,000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\,8}{9.806\,65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\,37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\,160\,97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\,326 \times 10^7}$ $1.285\,067\,46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\,600\,000}{2.326 \times 453.592\,37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\,37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\,37}$ = 142 859.546	$\frac{3\,600\,000}{2\,326 \times 453.592\,37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\,37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\,37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\,37}{3.6 \times 10^7 \times 9/5}$ = $6.999\,882\,25 \times 10^{-6}$	1	$\frac{1.0}{41\,868}$ = $2.388\,458\,97 \times 10^{-5}$	$\frac{1.0}{98.066\,5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\,326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\,326 \times 453.592\,37}{3\,600\,000}$ = 0.293 071 070	41 868	1	$\frac{4\,186.8}{9.806\,65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\,65}{4.186\,8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\,37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\,65}{4\,186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\,8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\,37}{3.6 \times 10^6 \times 9/5}$ = $6.999\,882\,25 \times 10^{-5}$	10	$\frac{1.0}{4\,186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\,65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
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Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)

TABLE 5.5
CONVERSION FACTORS FOR SPECIFIC ENTROPY, SPECIFIC HEAT, AND GAS CONSTANT
(energy/mass × temperature)

To obtain → Multiply, by ↓ ↘	$\frac{Btu}{lbm \times R}$	$\frac{ft \times lbf}{lbm \times R}$	$\frac{kw \times hr}{lbm \times R}$	$\frac{bar \times cm^3}{g \times K}$	$\frac{kcal}{g \times K}$	$\frac{kp \times m}{g \times K}$	$\frac{kJ}{kg \times K}$
$\frac{Btu}{lbm \times R}$	1	$\frac{2.326 \times 10^7}{980.665 \times 30.48}$ = 778.169 262	$\frac{2.326 \times 453.592\ 37}{3\ 600\ 000}$ =0.000 293 071 070	41.868	0.0001	$\frac{4.186\ 8}{9.806\ 65}$ = 0.426 934 784	4.186 8
$\frac{ft \times lbf}{lbm \times R}$	$\frac{980.665 \times 30.48}{2.326 \times 10^7}$ = 0.001 285 067 46	1	$\frac{453.592\ 37 \times 30.48}{3.6 \times 10^{13}/980.665}$ = $3.766\ 160\ 97 \times 10^{-7}$	$\frac{30.48 \times 980.665 \times 9/5}{10^6}$ = 0.053 803 204 6	$\frac{980.665 \times 30.48}{2\ 326 \times 10^7}$ $1.285\ 067\ 46 \times 10^{-6}$	$30.48 \times 10^{-5} \times 9/5$ = 0.000 548 64	$\frac{980.665 \times 30.48 \times 10^{-7}}{5/9}$ = 0.005 380 320 46
$\frac{kw \times hr}{lbm \times R}$	$\frac{3\ 600\ 000}{2.326 \times 453.592\ 37}$ = 3 412.141 63	$\frac{3.6 \times 10^{13} / 980.665}{453.592\ 37 \times 30.48}$ =2 655 223.73	1	$\frac{3.6 \times 10^7 \times 9/5}{453.592\ 37}$ = 142 859.546	$\frac{3\ 600\ 000}{2\ 326 \times 453.592\ 37}$ = 3.412 141 63	$\frac{3.6 \times 10^8 \times 9/5}{980.665 \times 453.592\ 37}$ =1 456 761 95	$\frac{3.6 \times 10^6 \times 9/5}{453.592\ 37}$ = 14 285.954 6
$\frac{bar \times cm^3}{g \times K}$	$\frac{1.0}{41.868}$ = 0.023 884 589 7	$\frac{10^6}{30.48 \times 980.665 \times 9/5}$ = 18.586 253 5	$\frac{453.592\ 37}{3.6 \times 10^7 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-6}$	1	$\frac{1.0}{41\ 868}$ = $2.388\ 458\ 97 \times 10^{-5}$	$\frac{1.0}{98.066\ 5}$ =0.010 197 1621	0.1
$\frac{kcal}{g \times K}$	1000	$\frac{2\ 326 \times 10^7}{980.665 \times 30.48}$ = 778 169.262	$\frac{2\ 326 \times 453.592\ 37}{3\ 600\ 000}$ = 0.293 071 070	41 868	1	$\frac{4\ 186.8}{9.806\ 65}$ = 426.934 784	4 186.8
$\frac{kp \times m}{g \times K}$	$\frac{9.806\ 65}{4.186\ 8}$ = 2.342 278 11	$\frac{10^5}{30.48 \times 9/5}$ = 1 822.688 83	$\frac{980.665 \times 453.592\ 37}{3.6 \times 10^8 \times 9/5}$ = 0.000 686 453 953	98.066 5	$\frac{9.806\ 65}{4\ 186.8}$ = 0.002 342 278 11	1	9.806 65
$\frac{kJ}{kg \times K}$	$\frac{1.0}{4.186\ 8}$ = 0.238 845 897	$\frac{10^7 \times 5/9}{980.665 \times 30.48}$ = 185.862 535	$\frac{453.592\ 37}{3.6 \times 10^6 \times 9/5}$ = $6.999\ 882\ 25 \times 10^{-5}$	10	$\frac{1.0}{4\ 186.8}$ = 0.000 238 845 897	$\frac{1.0}{9.806\ 65}$ = 0.101 971 621	1

GENERAL NOTE:
All values given in the rational fractions are exact.

Example:1 Btu / (lbm × R) = 778.169 262 ft × lbf / (lbm × R)