SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME 114 (WHOLE VOLUME)

SMITHSONIAN METEOROLOGICAL TABLES

SIXTH REVISED EDITION

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SMITHSONIAN INSTITUTION PRESS
CITY OF WASHINGTON

Smithsonian Publication 4014
Sixth revised edition published 1949
Fourth reprint issued 1968

PREFACE

The rapid development of the science of meteorology during the past two decades has made necessary a complete revision of both the scope and contents of the Smithsonian Meteorological Tables. A. Wetmore, Secretary of the Smithsonian Institution, which has been publishing these tables since 1852, and F. W. Reichelderfer, Chief of the Weather Bureau, recognized this need. A steering committee of Weather Bureau meteorologists, consisting of H. Wexler, Chairman, R. A. Allen, J. E. Caskey, Jr., P. F. Clapp, R. N. Culnan, R. D. Fletcher, J. R. Fulks, C. Harmantas, L. P. Harrison, W. C. Jacobs, J. K. McGuire, J. Namias, and H. W. Norton, was formed to make recommendations concerning the new revision and to serve in an advisory capacity. Funds for the preparation of the manuscript were transferred by the Weather Bureau to the Smithsonian Institution, and under the supervision of L. B. Aldrich, Director of the Astrophysical Observatory, work on the new manuscript was started. It is a pleasure to acknowledge both the administrative cooperation and scientific information received from Mr. Aldrich.

In preparing this volume, every effort has been made to obtain the latest and most authoritative data available, and to follow as far as possible the most recent recommendations of the International Meteorological Organization. Suggestions were also solicited from the various branches of the armed forces concerned with meteorological problems, from the several universities having meteorology departments, and from other interested individuals and organizations. Explanations, sources of data, methods of computation, and pertinent references accompany all tables. No material on meteorological codes and symbols, descriptions of meteorological stations, or climatological data have been included in this revision.

It would be impossible to acknowledge all the cooperation and assistance received in the preparation of this volume. A particularly large debt of gratitude is owed to L. P. Harrison, Chief of the Technical Investigations Section of the Weather Bureau, who has unhesitatingly given so much of his time and attention to this project, and without whose mature judgment it would have been impossible to complete this work in its present form. Grateful acknowledgments are also due to J. A. Goff and S. Gratch of the Towne Scientific School of the University of Pennsylvania for contributing all the material for tables 84-92 and for furnishing the computations for table 72; to S. Fritz of the Weather Bureau for his assistance in preparing the section on radiation; to W. D. Lambert and J. A. Duerksen of the Coast and Geodetic Survey for information concerning gravity and other geodetic problems; to E. W. Woolard of the Nautical Almanac Office of the Naval Observatory for astronomical and related data; and to the many experts consulted at the National Bureau of Standards. Computations for several of the longer tables were made by the Machine Tabulation Unit of the Weather Bureau. Special data or computations for individual tables were furnished by R. Gunn, I. F. Hand, W. E. Howell, L. D. Kaplan, J. B. Leighly, T. H. MacDonald, and R. B. Montgomery, all of which have added greatly to the value of this volume. Permission to reproduce copyrighted material has been kindly granted by the American Air Filter Company, Inc., the McGraw-Hill Book Company, Inc., Prentice-Hall, Inc., and the Reinhold Publishing Corporation; all such material is acknowledged at its point of insertion in the text. Thanks are also due Mrs. G. B. Morgan for her invaluable assistance in performing many of the computations and in typing the manuscript.

ROBERT J. LIST

WASHINGTON, D. C.
September 30, 1949.

NOTE TO FIRST REPRINT

Opportunity has been taken in this reprint to correct the few errors that have been discovered in these tables since the original printing.

EDITOR.

February 1958

NOTE TO SECOND REPRINT

This reprint corrects three or four errors discovered in these tables since the first reprinting.

EDITOR.

March 1963

NOTE TO THIRD REPRINT

This reprint is without change in the text, since no errors have been brought to our attention since the second reprinting.

EDITOR.

April 1966

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INTRODUCTION

CONVERSION OF UNITS OF LENGTH AND MASS

United States usage.—No general agreement yet exists on the factors to be used in the conversion between the metric and the English systems of units. In the United States, an Act of Congress of July 28, 1866 (14 Stat. 339; 15 U.S.C. 204) established the metric system as lawful throughout the United States and ordered the units of weights and measures in common use to be defined in terms of this system. A schedule annexed to this Act established 39.3700 inches as the equivalent of the meter and 2.2046 pounds (avoirdupois) as the equivalent of the kilogram. In 1893 T. C. Mendenhall, Superintendent of Standard Weights and Measures, issued an order [1] stating that his office would regard the International Prototype Meter and Kilogram [2] as the fundamental standards and affirmed the equivalents of the Act of 1866.

In actual practice, the National Bureau of Standards still uses the length ratio annexed to this Act, which yields 1 inch = 2.540005 centimeters. However, in the case of the pound, the National Bureau of Standards has adopted the results of a comparison of the British Imperial Standard Pound and the International Prototype Kilogram made in 1883, 1 pound = 453.5924277 grams, rather than the ratio annexed to the Act of 1866, which yields 1 pound = 453.597+ grams.

British usage.—In Great Britain, the English standards of length and mass are legally defined by the Imperial Standard Yard and the Imperial Standard Pound, respectively, and the relation of the English to the metric units are experimentally determined by direct comparison.[3] The conversions now legally sanctioned in Great Britain are:

1 inch = 2.539998 centimeters
1 pound = 453.59234 grams

Recent comparisons.—According to the most recent comparisons:[4]

$$\frac{\text{1 Imperial Yard}}{\text{1 meter}} = \frac{3600000}{3937014}, \text{ which yields}$$

1 inch = 2.539996 centimeters

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[1] U. S. Coast and Geodetic Survey, Bull. 26, 1893.

[2] Prepared by the International Bureau of Weights and Measures, Sevres, France. This bureau was established by the International Metric Convention, 1875, and is supported by the contributions of many nations, including the United States.

[3] For a discussion of the problems involved, see Darwin, C., et al., Proc. Roy. Soc. London, ser. A, vol. 186, p. 175, 1946.

[4] Nat. Bur. Stand., private communication, July 1949.

In the case of the pound, this comparison resulted in the conversion:

1 pound = 453.59234 grams

Industrial usage.—In recent years improved industrial techniques have made it desirable to standardize the relationships used by the various English-speaking countries. The conversion 1 inch = 2.54 centimeters has been suggested as the best compromise, with the practical advantage of facilitating mechanical conversion between the two systems by means, for example, of a 127-tooth gear wheel on a lathe or measuring instrument. The above relationship has been the standard for American and British industrial use for several years and has been adopted by both the American Standards Association [5] and the British Standards Institution.[6]

Even less practical difference exists between the various definitions of the pound, but the conversion 1 pound = 453.5923 grams has been urged, since this figure is divisible by 7000, the number of grains in a pound.

At this writing a bill to legalize these two conversions has been prepared for introduction in Congress and the British are expected to legally sanction them by an Order in Council upon enactment of the bill into law. Australia has already adopted the new conversion factors.

Accordingly, all conversions between the English and metric systems in this volume are based on the relationships:

1 inch = 2.54 centimeters
1 pound = 453.5923 grams

Nautical mile.—Originally and practically for uses at sea, the nautical mile was considered to be the length of 1 minute of arc on the earth's surface for the given latitude and in the given azimuth on a representative spheroid. A more precise definition is desirable and in the tables issued by the U. S. Office of Standard Weights and Measures, September 1898, the nautical mile is defined as a minute of arc of a great circle on a sphere whose surface equals that of the Clarke spheroid of 1866. The value now given for the nautical mile by the National Bureau of Standards [7] is 1853.248 meters. Using Clarke's ratio of the foot to the meter this length is 6080.27 feet, the value given in Bowditch; [8] using the ratio annexed to the Act of 1866 this length is 6080.20 feet, the value given in previous editions of these tables. The adoption of the new ratio of the foot to the meter (1 foot = 0.3048 meter)

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[5] American Standards Association Report B 48.1, "Inch-Millimeter Conversion for Industrial Use," 1933.

[6] British Standards Institution Report B. S. 350, "Conversion Factors and Tables," 1944.

[7] U. S. Nat. Bur. Stand. Misc. Publ. M 121, 1936.

[8] Bowditch, N., American Practical Navigator, 1938 rev. ed., pp. 20 and 327. U. S. Navy Hydrographic Office, Washington, 1939. On page 144 the factor 6080.20 is given.

results in the following definition of the U. S. nautical mile, which is used throughout this volume:

1 U. S. nautical mile = 1853.248 meters = 6080.21 feet

Other definitions of the nautical mile are in use. The British Admiralty defines the nautical mile as being 6080 feet (exactly); the international nautical mile is defined as being 1852 meters (exactly).[11a]

STANDARD GRAVITY FOR REDUCING BAROMETRIC OBSERVATIONS

Prior to the introduction of the *millibar* as the common unit of pressure in meteorology, it was customary to express barometric pressures in terms of the height of a column of mercury reduced to standard conditions of temperature and gravity. Conventionally, the standard value for the acceleration of gravity adopted was that at latitude 45° and sea level.[9]

To reduce units of pressure expressed in terms of the height of a mercury column to standard gravity, it is only necessary to know the *ratio* of the local acceleration of gravity to the standard value. In general, this ratio is determinable with more precision than the absolute value of the acceleration of gravity at a given place. However, if pressures are to be converted to absolute units (e.g., millibars), it is necessary to know the standard acceleration of gravity.

At the 1891 meetings of the International Committee on Weights and Measures, Defforges and Lubanski [10] announced the results of an investigation made in 1888 which yielded an acceleration of gravity at latitude 45° and sea level of 980.665 cm. sec.$^{-2}$ This value has been used extensively since that time by physicists and others as an arbitrary standard value of gravity, although it has long been known that it does not represent the absolute value of gravity at latitude 45° and sea level.[11] The most recent determinations indicate that the best value is near 980.616 cm. sec.$^{-2}$ (see Table 167).

Most meteorological services, including the U. S. Weather Bureau, first reduce barometer readings in terms of inches or millimeters of mercury to gravity at latitude 45° and sea level ($g_{45,\,0}$) by means of a correction depending on the ratio of local gravity to $g_{45,\,0}$ (see Table 47) and then convert to absolute units. Strictly speaking, it is therefore necessary to use the best estimate of the value of gravity at latitude 45° and sea level in converting the inch or millimeter of mercury to millibars. This procedure was adopted by the International Meteorological Organization in 1939 (Resolution 25, Berlin). However, for many physical applications (e.g., the definition of the International Temperature Scale, 1948, see footnote, page 17) one atmosphere is defined as 1013.250 mb. This pressure corresponds to the pressure exerted by a column

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[9] International Meteorological Tables, Paris, 1890.

[10] Defforges and Lubanski, Com. Int. des Poids et Mes., Ann. I, p. 135, Paris, 1892.

[11] Dryden, H. L., Nat. Bur. Stand. Journ. Res., vol. 29, p. 303, 1942.

[11a] Effective July 1, 1954, the international nautical mile was adopted by the U. S. Department of Defense and the Department of Commerce.

of mercury 760 mm. high, having a density of 13.5951 gm. cm.$^{-3}$ and subject to a gravitational attraction of 980.665 cm. sec.$^{-2}$

A distinction is therefore necessary between the standard inch or millimeter of mercury based on 980.665 cm. sec.$^{-2}$ and the "45°" inch or millimeter of mercury based on 980.616 cm. sec.$^{-2}$ (see Table 1). Owing to the action of the International Committee on Weights and Measures, in adopting the conventional standard value 980.665 cm. sec.,$^{-2}$ it is advisable to employ this datum for all barometric readings. Accordingly, with a view to maintaining consistency with the basis on which the International Temperature Scale of 1948 is established, the tables presented herein for conversions of inches or millimeters of mercury to millibars, and vice versa, are based on the conventional standard acceleration of gravity (980.665 cm. sec.$^{-2}$).

If it is desired to convert "45°" inches or millimeters of mercury to millibars, the tabular values in Tables 9 and 11 must be decreased by 0.005 percent. Conversely, if millibars are to be converted to "45°" inches or millimeters of mercury, the tabular values in Tables 10 and 12 must be increased by 0.005 percent.

CALORIE

15° gram-calorie.—The small- or gram-calorie [12] was originally defined as the quantity of heat necessary to raise the temperature of 1 gram of water 1 degree centigrade. It was found necessary to specify the exact range of temperature over which the water was heated and it became possible to define many such calories, depending on the range. The 15° gram-calorie ($cal._{15}$), the quantity of heat necessary to raise the temperature of 1 gram of water from 14.5° C. to 15.5° C., has until recently been one of the most common units of heat used in scientific work.

International Steam Tables calorie.—Modern laboratory procedures for the determination of amounts of heat usually involve electrical apparatus and it has been found advantageous to define the calorie in terms of electrical equivalents. Therefore in 1929 the First International Conference on Steam Tables [13] defined the International Steam Tables calorie (ITcal.) as being equivalent to $1/860 \times 10^3$ mean international kilowatt-hours, where 1 mean international kilowatt-hour = 1.00019 absolute kilowatt-hours.[14] This definition has also been adopted by the International Meteorological Organiza-

[12] The large- or kilogram-calorie (Kcal.) has not been used in this volume.

[13] Mech. Eng., vol. 52, p. 120, 1930.

[14] In the United States, the National Bureau of Standards uses the relation 1 international joule = 1.000170 absolute joules, where the "international joule" is the international joule as maintained in this country, and not the mean international joule. This definition yields the relation:

1 ITcal. = 4.18674 absolute joules = 4.18605 international joules.

tion.[15] The relation of the International Steam Tables calorie to the 15° gram-calorie is:[16]

$$1 \text{ ITcal.} = 1.00032 \text{ cal.}_{15}$$

Meteorological practice.—From the relationship above, it is evident that for most ordinary meteorological purposes the difference between the IT calorie and the 15° calorie is negligible. However, it is still customary to use the 15° calorie in radiation and associated fields of meteorology, while the IT calorie has become the standard for use in thermodynamic calculations. This dual usage has been adopted in general throughout this volume. In some instances the type of calorie is unspecified; here the nature of the data is such that the difference is immaterial.

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[15] Int. Meteorol. Org. Twelfth Conference of Directors, Resolution 164, Washington, 1947.

[16] See Birge, R. T., Rev. Mod. Phys., vol. 13, p. 233, 1941.

Section I

CONVERSION TABLES

CONVERSION FACTORS[1]

ORGANIZATION OF TABLE

A. Length
B. Area
C. Volume
D. Time
E. Velocity; speed
F. Mass
G. Density, specific volume
H. Viscosity
I. Pressure
J. Force
K. Energy, work
L. Power
M. Energy per unit area
N. Power per unit area
O. Illumination, brightness, etc.

A. Length:

1 Ångström unit (Å.)
= 10^{-4} μ
= 10^{-8} cm.
= 10^{-10} m.

1 micron (μ)
= 10^{4} Å.
= 10^{-4} cm.
= 10^{-6} m.

1 millimeter (mm.)
= 10^{-1} cm.
= 10^{-3} m.
= 0.039370079 in.

1 centimeter (cm.)
= 10^{-2} m.
= 0.39370079 in.
= 0.032808399 ft.

1 meter (m.)
= 10^{2} cm.
= 3.2808399 ft.
= 39.370079 in.

1 kilometer (km.)
= 10^{5} cm.
= 10^{3} m.
= 3280.8399 ft.
= 0.621371 stat. mi.
= 0.539593 naut. mi.

1 degree of latitude * (°lat.)
= 111137 m.
= 111.137 km.
= 69.057 stat. mi.
= 59.969 ≅ 60 naut. mi.

1 inch (in.)
= 25.4 mm.
= **2.54 cm.**

1 foot (ft.)
= 12 in.
= 30.48 cm.
= 0.3048 m.

1 yard (yd.)
= 36 in.
= 3 ft.
= 91.44 cm.
= 0.9144 m.

1 fathom (fath.)
= 6 ft.
= 1.8288 m.

1 rod (rd.)
= 16.5 ft.
= 5.0292 m.

1 statute mile (stat. mi.)
= 5280 ft.
= 0.868391 naut. mi.
= 1609.344 m.
= 1.609344 km.

1 U. S. nautical mile (naut. mi.) †
= 6080.21 ft.
= 1.151555 stat. mi.
= **1853.248 m.**
= 1.853248 km.

1 British Admiralty nautical mile
= **6080 ft.**

1 International nautical mile
= 1852 m.
= 6076.1 ft.
= 1.150779 stat. mi.

B. Area:

1 square millimeter (mm.^{2})
= 0.001550003 in.^{2}

1 square inch (in.^{2})
= 6.4516 cm.^{2}

* Average value, 1/90 of meridian quadrant.

† See Introduction, p. 2.

[1] See Introduction for discussion of the basic conversion factors adopted. All metric-English unit conversions are based on the factors:

1 in. = 2.54 cm.
1 lb. = 453.5923 g.

Fundamental conversion factors are in bold-face type.

(*continued*)

CONVERSION FACTORS

B. Area: (continued)

1 square centimeter ($cm.^2$)
= 10^2 $mm.^2$
= 0.1550003 $in.^2$

1 square meter ($m.^2$)
= 10^4 $cm.^2$
= 1550.003 $in.^2$
= 10.76391 $ft.^2$

1 square kilometer ($km.^2$)
= 10^{10} $cm.^2$
= 10^6 $m.^2$
= 1.076391×10^7 $ft.^2$
= 247.1054 acre
= 0.3861022 stat. $mi.^2$

1 square foot ($ft.^2$)
= 144 $in.^2$
= 929.0304 $cm.^2$
= 0.09290304 $m.^2$

1 square yard ($yd.^2$)
= 9 $ft.^2$
= 8361.2736 $cm.^2$
= 0.83612736 $m.^2$

1 acre
= 43560 $ft.^2$
= 4840 $yd.^2$
= 4046.8564 $m.^2$

1 square statute mile (stat. $mi.^2$)
= 2.78784×10^7 $ft.^2$
= 640 acres
= 2.58999 $km.^2$

C. Volume:

1 cubic centimeter ($cm.^3$)
= 0.999972 ml.
= 0.0610237 $in.^3$
= 0.0338140 U. S. fl. oz.

1 cubic meter ($m.^3$) or stere (s.)
= 10^6 $cm.^3$
= 999.972 l.
= 35.3147 $ft.^3$
= 264.172 U. S. gal.
= 219.97 Brit. gal.

1 milliliter (ml.)
= 1.000028 $cm.^3$
= 0.0610255 $in.^3$
= 0.033815 U. S. fl. oz.
= 0.035196 Brit. fl. oz.

1 liter (l.)
(1 liter is defined as the volume occupied by 1 kilogram of water at its temperature of maximum density.)
= 1000.028 $cm.^3$
= 61.0255 $in.^3$
= 33.815 U. S. fl. oz.
= 1.05672 U. S. qt.
= 0.264179 U. S. gal.
= 35.196 Brit. fl. oz.

1 cubic inch ($in.^3$)
= 0.554113 U. S. fl. oz.
= 16.3871 $cm.^3$
= 16.3866 ml.

1 cubic foot ($ft.^3$)
= 1728 $in.^3$
= 29.9221 U. S. qt.
= 7.48052 U. S. gal.
= 28316.8 $cm.^3$
= 28.3161 l.

1 fluid ounce, U. S. (U. S. fl. oz.)
= 1.80469 $in.^3$
= 29.5735 $cm.^3$
= 29.5727 ml.
= 1.0408 Brit. fl. oz.

1 fluid ounce, British (Brit. fl. oz.)
= 1.7339 $in.^3$
= 28.413 $cm.^3$
= 28.412 ml.
= 0.96076 U. S. fl. oz.

1 quart, liquid, U. S. (U. S. qt.)
= 57.75 $in.^3$
= 32 U. S. fl. oz.
= 946.353 $cm.^3$
= 0.946326 l.

1 gallon, U. S. (U. S. gal.)
= 231 $in.^3$
= 128 U. S. fl. oz.
= 133.23 Brit. fl. oz.
= 0.83267 Brit. gal.
= 3785.41 $cm.^3$
= 3.78531 l.

(continued)

CONVERSION FACTORS

C. Volume: (continued)

1 gallon, British (Brit. gal.) (Imperial gallon)
(1 British gallon is defined as the volume occupied by 10 pounds of water at 62° F.)
= 160 Brit. fl. oz.
= 277.42 in.^{3}
= 1.2010 U. S. gal.
= 153.72 U. S. fl. oz.
= 4546.1 cm.^{3}
= 4.5460 l.

D. Time:

1 mean solar second (sec., s.)
= 1.002738 sidereal seconds

1 mean solar minute (min., m.)
= 60 sec. (mean solar)

1 mean solar hour (hr., h.)
= 3600 sec. (mean solar)
= 60 min. (mean solar)

1 mean solar day (da., d.)
= 86400 sec. (mean solar)
= 1440 min. (mean solar)
= 24 hr. (mean solar)
= 24 hours 3 minutes 56.555 seconds of mean sidereal time

1 tropical (mean solar, ordinary) year (yr.)
= 31.5569×10^6 sec. (mean solar)
= 525949 min. (mean solar)
= 8765.81 hr. (mean solar)
= 365.2422 da. (mean solar)
= 366.2422 sidereal days

1 sidereal second
= 0.997270 sec. (mean solar)

1 sidereal day
= 86164.1 sec. (mean solar)
= 23 hr. 56 min. 4.091 sec. (mean solar)

E. Velocity; speed:

1 meter per second (m. sec.$^{-1}$, mps)
= 3.6 km. hr.$^{-1}$
= 1.94254 knots
= 2.23694 mi. hr.$^{-1}$
= 3.28084 ft. sec.$^{-1}$
= 196.850 ft. min.$^{-1}$
= 0.77742 °lat. day^{-1}

1 kilometer per hour (km. hr.$^{-1}$, kph)
= 0.277778 m. sec.$^{-1}$
= 0.539593 knot
= 0.621371 mi. hr.$^{-1}$
= 0.911344 ft. sec.$^{-1}$
= 0.21595 °lat. day^{-1}

1 knot
= 1 naut. mi. hr.$^{-1}$
= 1.15155 mi. hr.$^{-1}$
= 1.68895 ft. sec.$^{-1}$
= 0.514791 m. sec.$^{-1}$
= 1.85325 km. hr.$^{-1}$
= 101.337 ft. min.$^{-1}$
= 0.40021 $\cong$ 0.4 °lat. day^{-1}

1 mile per hour (mi. hr.$^{-1}$, mph)
= 0.868391 knot
= 1.46667 ft. sec.$^{-1}$
= 0.44704 m. sec.$^{-1}$
= 1.609344 km. hr.$^{-1}$
= 88 ft. min.$^{-1}$
= 0.34754 °lat. day^{-1}

(continued)

CONVERSION FACTORS

E. Velocity; speed: (continued)

1 degree of latitude per day (°lat. day^{-1})
= 1.2863 m. sec.$^{-1}$
= 4.6307 km. hr.$^{-1}$
= 2.4987 ≅ 2.5 knots
= 2.8774 mi. hr.

1 foot per second (ft. sec.$^{-1}$, fps)
= 0.592085 knot
= 0.681818 mi. hr.$^{-1}$
= 60 ft. min.$^{-1}$
= 0.3048 m. sec.$^{-1}$
= 1.09728 km. hr.$^{-1}$

1 foot per minute (ft. min.$^{-1}$, fpm)
= 0.00986808 knot
= 0.0113636 mi. hr.$^{-1}$
= 0.00508 m. sec.$^{-1}$
= 0.018288 km. hr.$^{-1}$

F. Mass:

1 gram (g.)
= 15.4324 gr.
= 0.0352740 oz.
= 0.002204623 lb.

1 kilogram (kg.)
= 10^3 g.
= 35.2740 oz.
= 2.204623 lb.

1 metric ton, tonne (t.)
= 10^3 kg.
= 2204.623 lb.
= 1.10231 short tons
= 0.9842107 long ton

1 grain (gr.)
= 0.0647989 g.
= 0.00228571 oz.

1 ounce avoirdupois (oz.)
= 437.5 gr.
= 28.3495 g.

1 pound avoirdupois (lb.)
= 7000 gr.
= 16 oz.
= 453.5923 g.
= 0.4535923 kg.

1 short ton
= 2000 lb.
= 0.892857 long ton
= 907.1846 kg.
= 0.9071846 t.

1 long ton
= 2240 lb.
= 1.12 short tons
= 1016.047 kg.
= 1.016047 t.

G. Density, specific volume:

1 g. cm.$^{-3}$
= 62.4280 lb. ft.$^{-3}$
= 1 t. m.$^{-3}$

1 cm.^{3} g.$^{-1}$
= 0.0160185 ft.^{3} lb.$^{-1}$

1 lb. ft.$^{-3}$
= 0.0160185 g. cm.$^{-3}$

1 ft.^{3} lb.$^{-1}$
= 62.4280 cm.^{3} g.$^{-1}$

H. Viscosity

1 poise
= 1 g. cm.$^{-1}$ sec.$^{-1}$
= 0.002089 lb. (wt.) sec. ft.$^{-2}$

1 lb. (wt.) sec. ft.$^{-2}$
= 478.8 poises

(continued)

CONVERSION FACTORS

I. Pressure:

NOTE.—The pressure units *one standard inch of mercury, one standard millimeter of mercury,* and *one standard atmosphere* are defined in terms of the conventional *standard* value of gravity 980.665 cm. sec.$^{-2}$, which was adopted by the International Committee on Weights and Measures. These units have been proposed for general meteorological use. The pressure units *one 45° inch of mercury, one 45° millimeter of mercury,* and *one 45° atmosphere* are defined in terms of the best value of gravity at 45° latitude and sea level, 980.616 cm. sec.$^{-2}$ See introduction, page 3.

1 dyne per square centimeter (dyne cm.$^{-2}$)
= 1 barye
= 10^{-3} mb.
= 10^{-6} bar.

1 millibar (mb.)
= 10^3 dynes cm.$^{-2}$
= 0.00101972 kg. cm.$^{-2}$
= 0.750099 mm. Hg. (45°)
= 0.750062 mm. Hg. (standard)
= 0.0295315 in. Hg. (45°)
= 0.0295300 in. Hg. (standard)
= 0.0145038 lb. in.$^{-2}$

1 centibar (cb.)
= 10 mb.

1 bar (b.)
= 10^6 dynes cm.$^{-2}$
= 10^3 mb.
= 10^6 barye

1 standard millimeter of mercury (mm. Hg. (standard))
= 1.000050 mm. Hg. (45°)
= 1.333224 mb.
= 0.001359504 kg. cm.$^{-2}$
= 0.03937205 in. Hg. (45°)
= 0.03937008 in. Hg. (standard)
= 0.0193368 lb. in.$^{-2}$

1 45° millimeter of mercury (mm. Hg. (45°))
= 0.999950 mm. Hg. (standard)
= 1.333157 mb.
= 0.00135944 kg. cm.$^{-2}$
= 0.03937008 in. Hg. (45°)
= 0.0393681 in. Hg. (standard)
= 0.0193358 lb. in.$^{-2}$

1 standard inch of mercury (in. Hg. (standard))
= 0.491154 lb. in.$^{-2}$
= 33.8639 mb.
= 0.0345316 kg. cm.$^{-2}$
= 25.4013 mm. Hg. (45°)
= 25.4 mm. Hg. (standard)

1 45° inch of mercury (in. Hg. (45°))
= 0.491130 lb. in.$^{-2}$
= 33.8622 mb.
= 0.0345298 kg. cm.$^{-2}$
= 25.4 mm. Hg. (45°)
= 25.3987 mm. Hg. (standard)

1 pound per square inch (lb. in.$^{-2}$, psi)
= 2.03612 in. Hg. (45°)
= 2.03602 in. Hg. (standard)
= 68.9476 mb.
= 0.0703069 kg. cm.$^{-2}$
= 51.7175 mm. Hg. (45°)
= 51.7149 mm. Hg. (standard)

1 standard atmosphere
= 1013.250 mb.
= 1.03323 kg. cm.$^{-2}$
= **760 mm. Hg. (standard)**
= 29.9213 in. Hg. (standard)
= 14.6960 lb. in.$^{-2}$
= 760.038 mm. Hg. (45°)
= 29.9228 in. Hg. (45°)
= 1.000050 45° atmosphere

(*continued*)

CONVERSION FACTORS

I. Pressure: (continued)

1 kilogram per square centimeter (kg. $cm.^{-2}$)
= 980665 dynes $cm.^{-2}$
= 980.665 mb.
= 735.596 mm. Hg. (45°)
= 735.559 mm. Hg. (standard)
= 28.9605 in. Hg. (45°)
= 28.9590 in. Hg. (standard)
= 14.2233 lb. $in.^{-2}$

1 45° atmosphere
= 1013.200 mb.
= 1.03318 kg. $cm.^{-2}$
= 760 mm. Hg. (45°)
= 29.9213 in. Hg. (45°)
= 14.695 lb. $in.^{-2}$
= 759.962 mm. Hg. (standard)
= 29.9198 in. Hg. (standard)
= 0.999950 standard atmosphere

1 inch of water, 4° C.
= 2.491 mb.

J. Force:

1 gram weight
= 980.665 dynes

1 kilogram weight
= 9.80665×10^5 dynes

1 newton
= 10^5 dynes

1 pound weight
= 32.174 poundals
= 444822 dynes

1 poundal
= 13825.5 dynes

K. Energy, work:

1 erg
= 1 dyne-centimeter
= 10^{-7} abs. joule
= 2.38844×10^{-8} ITcal.
= 2.3892×10^{-8} $cal._{15}$

1 absolute joule (abs. joule)
= 10^7 ergs
= 0.238844 ITcal.
= 0.23892 $cal._{15}$

1 kilogram-meter (kg.-m.)
= 9.80665 abs. joules

1 International Steam Tables calorie (ITcal.)*
= 4.18684×10^7 ergs
= 4.18684 abs. joules
= 1.00032 $cal._{15}$
= $\frac{1}{860 \times 10^3}$ Int. kw.-hr.

1 15° gram-calorie ($cal._{15}$)*
= 4.1855 abs. joules

1 kilogram-calorie (Kcal.)
= 10^3 gram-calories

1 absolute kilowatt-hour (abs. kw.-hr.)
= 3.6×10^9 abs. joules

1 mean International kilowatt-hr.
= 1.00019 abs. kw.-hr.
= 860000 ITcal.
= 3.60068×10^6 abs. joules
= 3412.756 Btu

1 British thermal unit (Btu)
(The Btu used here is defined by the relationship:
1 Btu $°F.^{-1}$ $lb.^{-1}$ = 1 ITcal. $°C.^{-1}$ $g.^{-1}$)
= 251.996 ITcal.
= 252.08 $cal._{15}$
= 1055.07 abs. joules
= 0.00029302 Int. kw.-hr.

1 foot-pound (ft.-lb.)
= 1.35582 abs. joules

* See Introduction, p. 4.

(continued)

CONVERSION FACTORS

L. Power:

1 absolute watt (abs. watt)
- = 1 abs. joule sec.$^{-1}$
- = 0.238844 ITcal. sec.$^{-1}$
- = 14.33062 ITcal. min.$^{-1}$
- = 0.23892 cal.$_{15}$ sec.$^{-1}$
- = 14.33527 cal.$_{15}$ min.$^{-1}$
- = 0.056868 Btu min.$^{-1}$

1 mean International watt
- = 1.00019 abs. watts

1 ITcal. sec.$^{-1}$
- = 4.18684 abs. watts

1 ITcal. min.$^{-1}$
- = 0.069781 abs. watt

1 cal.$_{15}$ sec.$^{-1}$
- = 4.1855 abs. watts

1 cal.$_{15}$ min.$^{-1}$
- = 0.069758 abs. watt

1 horsepower, electrical, U. S., Brit.
- = 746 abs. watts

1 horsepower (mechanical)
- = 550 ft. lb. sec.$^{-1}$
- = 745.70 abs. watts

1 horsepower (continental)
- = 736 abs. watts

1 cheval-vapeur
- = 75 kg. m. sec.$^{-1}$
- = 735.499 abs. watts

1 Btu min.$^{-1}$
- = 17.5844 abs. watts
- = 251.996 ITcal. min.$^{-1}$
- = 252.08 cal.$_{15}$ min.$^{-1}$

M. Energy per unit area:

1 langley (ly.)
- = 1 cal.$_{15}$ cm.$^{-2}$
- = 4.1855 abs. joules cm.$^{-2}$
- = 0.011624 Int. kw.-hr. m.$^{-2}$
- = 3.6855 Btu ft.$^{-2}$

1 abs. joule cm.$^{-2}$
- = 0.23892 cal.$_{15}$ cm.$^{-2}$
- = 0.00277725 Int. kw.-hr. m.$^{-2}$
- = 0.88054 Btu ft.$^{-2}$

1 Int. kw.-hr. m.$^{-2}$
- = 86.028 cal.$_{15}$ cm.$^{-2}$
- = 360.068 abs. joules cm.$^{-2}$

1 Btu ft.$^{-2}$
- = 0.27133 cal.$_{15}$ cm.$^{-2}$
- = 1.13566 abs. joules cm.$^{-2}$

N. Power per unit area:

1 cal.$_{15}$ cm.$^{-2}$ min.$^{-1}$
- = 1 ly. min.$^{-1}$
- = 0.069758 abs. watt cm.$^{-2}$
- = 0.069745 Int. watt cm.$^{-2}$
- = 69.745 Int. kw. dekameter^{-2}
- = 3.6855 Btu ft.$^{-2}$ min.$^{-1}$
- = 1440 cal.$_{15}$ cm.$^{-2}$ day^{-1}
- = 5307.1 Btu ft.$^{-2}$ day^{-1}

1 Btu ft.$^{-2}$ min.$^{-1}$
- = 0.27133 cal.$_{15}$ cm.$^{-2}$ min.$^{-1}$
- = 0.0189277 abs. watt cm.$^{-2}$

O. Illumination, brightness, etc.:

The total luminous flux from a source of unit spherical candlepower is 4π lumens.

1 lux (lx.)
- = 1 lumen incident per square meter
- = 0.0001 ph.
- = 0.09290 ft.-c.

1 footcandle (ft.-c.)
- = 1 lumen incident per square foot
- = 10.76 lx.

(continued)

CONVERSION FACTORS

O. Illumination, brightness, etc.: (continued)

1 phot (ph.)
= 1 lumen incident per square centimeter

1 stilb (sb.)
= 1 Int. c. $cm.^{-2}$
= π L. = 3.142 L.
= 2919 ft.-L.

1 lambert (L.)
= $1/\pi$ sb. = 0.3183 sb.
= 2.054 c. $in.^{-2}$
= 929 ft.-L.

1 millilambert (mL.)
= 10^{-3} L.

1 apostilb, in International units
= $1/(\pi \times 10^4)$ sb. = $\frac{1}{\pi \times 10^4}$ stilb
= 0.1 mL.

1 apostilb, in German (Hefner) units
= 0.09 mL.

1 candle per $in.^2$ (c. $in.^{-2}$)
= 0.1550 sb.
= 0.487 L.
= 452.4 ft.-L.

1 footlambert (ft.-L.)
= 0.0003426 sb.
= 0.001076 L.
= 0.002211 c. $in.^{-2}$

1 candle per $ft.^2$
= 3.142 ft.-L.

Luminous efficiency: At wave length of maximum luminosity *0.555* μ for photopic vision, the luminous efficiency is 680 lumens per watt, corresponding to a *minimum* "mechanical equivalent of light" of 0.00151 watt per lumen.

Table 2

APPROXIMATE ABSOLUTE, CENTIGRADE, FAHRENHEIT, AND REAUMUR TEMPERATURE SCALES

Scale	Symbol	Freezing point of water (1 atmos.)	Boiling point of water (1 atmos.)	Conversion formulae
Centigrade*	C.	0°	100°	C=(5/9)(F−32)=(5/4)R=K−273.16=AA−273
Fahrenheit	F.	32	212	F=(9/5)C+32=(9/4)R+32=(9/5)(K−273.16)+32
Reaumur	R.	0	80	R=(4/9)(F−32)=(4/5)C=(4/5)(K−273.16)
Thermodynamic‡ Kelvin Absolute Centigrade	K., A.	273.16± 0.01†	373.16± 0.01†	K=C+273.16=AA+0.16=(5/9)(F−32)+273.16
Approximate Absolute	AA.	273	373	AA=C+273=K−0.16=(5/9)(F−32)+273
Rankine Absolute Fahrenheit	——	491.69	671.69	Rankine=F+459.69

PROPORTIONAL PARTS

C, K, AA	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
F	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62
R	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72
F	0.055+	0.111+	0.166+	0.222+	0.277+	0.333+	0.388+	0.444+	0.5
C, K, AA	0.044+	0.088+	0.133+	0.177+	0.222+	0.266+	0.311+	0.355+	0.4
R	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
R	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
C, K, AA	0.125	0.25	0.375	0.5	0.625	0.75	0.875	1.0	1.125
F	0.225	0.45	0.675	0.9	1.125	1.35	1.575	1.8	2.025

AA.	C.	F.	R.	AA.	C.	F.	R.	AA.	C.	F.	R.
375°	102°	215°.6	81°.6	350°	77°	170°.6	61°.6	325°	52°	125°.6	41°.6
374	101	213.8	80.8	349	76	168.8	60.8	324	51	123.8	40.8
373	100	212.0	80.0	348	75	167.0	60.0	323	50	122.0	40.0
372	99	210.2	79.2	347	74	165.2	59.2	322	49	120.2	39.2
371	98	208.4	78.4	346	73	163.4	58.4	321	48	118.4	38.4
370	97	206.6	77.6	345	72	161.6	57.6	320	47	116.6	37.6
369	96	204.8	76.8	344	71	159.8	56.8	319	46	114.8	36.8
368	95	203.0	76.0	343	70	158.0	56.0	318	45	113.0	36.0
367	94	201.2	75.2	342	69	156.2	55.2	317	44	111.2	35.2
366	93	199.4	74.4	341	68	154.4	54.4	316	43	109.4	34.4
365	92	197.6	73.6	340	67	152.6	53.6	315	42	107.6	33.6
364	91	195.8	72.8	339	66	150.8	52.8	314	41	105.8	32.8
363	90	194.0	72.0	338	65	149.0	52.0	313	40	104.0	32.0
362	89	192.2	71.2	337	64	147.2	51.2	312	39	102.2	31.2
361	88	190.4	70.4	336	63	145.4	50.4	311	38	100.4	30.4
360	87	188.6	69.6	335	62	143.6	49.6	310	37	98.6	29.6
359	86	186.8	68.8	334	61	141.8	48.8	309	36	96.8	28.8
358	85	185.0	68.0	333	60	140.0	48.0	308	35	95.0	28.0
357	84	183.2	67.2	332	59	138.2	47.2	307	34	93.2	27.2
356	83	181.4	66.4	331	58	136.4	46.4	306	33	91.4	26.4
355	82	179.6	65.6	330	57	134.6	45.6	305	32	89.6	25.6
354	81	177.8	64.8	329	56	132.8	44.8	304	31	87.8	24.8
353	80	176.0	64.0	328	55	131.0	44.0	303	30	86.0	24.0
352	79	174.2	63.2	327	54	129.2	43.2	302	29	84.2	23.2
351	78	172.4	62.4	326	53	127.4	42.4	301	28	82.4	22.4
350	77	170.6	61.6	325	52	125.6	41.6	300	27	80.6	21.6

(continued)

* The Ninth General Conference on Weights and Measures, October 1948, gave the degree of temperature the designation of *degree Celsius* in place of *degree centigrade*. See Stimson, H. F., The international temperature scale of 1948, Nat. Bur. Stand. Journ. Res., vol. 42, p. 209, 1949, and Amer. Journ. Phys., vol. 23, p. 614, 1955.

† R. T. Birge, Rev. Mod. Phys., vol. 13, p. 233, 1941.

‡ In 1954, the thermodynamic temperature was defined so that 273.16°K corresponds to the triple point, yielding the value 273.15°K as equivalent to 0°C. Dixieme Conférence Générale Poids et Mesures, Compt. Rend., 1954.

APPROXIMATE ABSOLUTE, CENTIGRADE, FAHRENHEIT, AND REAUMUR TEMPERATURE SCALES

AA.	C.	F.	R.	AA.	C.	F.	R.	AA.	C.	F.	R.
300°	27°	80°6	21°6	250°	—23°	— 9°4	—18°4	200°	— 73°	— 99°4	—58°4
299	26	78.8	20.8	249	24	11.2	19.2	199	74	101.2	59.2
298	25	77.0	20.0	248	25	13.0	20.0	198	75	103.0	60.0
297	24	75.2	19.2	247	26	14.8	20.8	197	76	104.8	60.8
296	23	73.4	18.4	246	27	16.6	21.6	196	77	106.6	61.6
295	22	71.6	17.6	245	—28	—18.4	—22.4	195	— 78	—108.4	—62.4
294	21	69.8	16.8	244	29	20.2	23.2	194	79	110.2	63.2
293	20	68.0	16.0	243	30	22.0	24.0	193	80	112.0	64.0
292	19	66.2	15.2	242	31	23.8	24.8	192	81	113.8	64.8
291	18	64.4	14.4	241	32	25.6	25.6	191	82	115.6	65.6
290	17	62.6	13.6	240	—33	—27.4	—26.4	190	— 83	—117.4	—66.4
289	16	60.8	12.8	239	34	29.2	27.2	189	84	119.2	67.2
288	15	59.0	12.0	238	35	31.0	28.0	188	85	121.0	68.0
287	14	57.2	11.2	237	36	32.8	28.8	187	86	122.8	68.8
286	13	55.4	10.4	236	37	34.6	29.6	186	87	124.6	69.6
285	12	53.6	9.6	235	—38	—36.4	—30.4	185	— 88	—126.4	—70.4
284	11	51.8	8.8	234	39	38.2	31.2	184	89	128.2	71.2
283	10	50.0	8.0	233	40	40.0	32.0	183	90	130.0	72.0
282	9	48.2	7.2	232	41	41.8	32.8	182	91	131.8	72.8
281	8	46.4	6.4	231	42	43.6	33.6	181	92	133.6	73.6
280	7	44.6	5.6	230	—43	—45.4	—34.4	180	— 93	—135.4	—74.4
279	6	42.8	4.8	229	44	47.2	35.2	179	94	137.2	75.2
278	5	41.0	4.0	228	45	49.0	36.0	178	95	139.0	76.0
277	4	39.2	3.2	227	46	50.8	36.8	177	96	140.8	76.8
276	3	37.4	2.4	226	47	52.6	37.6	176	97	142.6	77.6
275	+ 2	35.6	+ 1.6	225	—48	—54.4	—38.4	175	— 98	—144.4	—78.4
274	+ 1	33.8	+ 0.8	224	49	56.2	39.2	174	99	146.2	79.2
273	0	32.0	0.0	223	50	58.0	40.0	173	100	148.0	80.0
272	— 1	30.2	— 0.8	222	51	59.8	40.8	172	101	149.8	80.8
271	— 2	28.4	— 1.6	221	52	61.6	41.6	171	102	151.6	81.6
270	— 3	26.6	— 2.4	220	—53	—63.4	—42.4	170	—103	—153.4	—82.4
269	4	24.8	3.2	219	54	65.2	43.2	169	104	155.2	83.2
268	5	23.0	4.0	218	55	67.0	44.0	168	105	157.0	84.0
267	6	21.2	4.8	217	56	68.8	44.8	167	106	158.8	84.8
266	7	19.4	5.6	216	57	70.6	45.6	166	107	160.6	85.6
265	— 8	17.6	— 6.4	215	—58	—72.4	—46.4	165	—108	—162.4	—86.4
264	9	15.8	7.2	214	59	74.2	47.2	164	109	164.2	87.2
263	10	14.0	8.0	213	60	76.0	48.0	163	110	166.0	88.0
262	11	12.2	8.8	212	61	77.8	48.8	162	111	167.8	88.8
261	12	10.4	9.6	211	62	79.6	49.6	161	112	169.6	89.6
260	—13	8.6	—10.4	210	—63	—81.4	—50.4	160	—113	—171.4	—90.4
259	14	6.8	11.2	209	64	83.2	51.2	159	114	173.2	91.2
258	15	5.0	12.0	208	65	85.0	52.0	158	115	175.0	92.0
257	16	3.2	12.8	207	66	86.8	52.8	157	116	176.8	92.8
256	17	+1.4	13.6	206	67	88.6	53.6	156	117	178.6	93.6
255	—18	—0.4	—14.4	205	—68	—90.4	—54.4	155	—118	—180.4	—94.4
254	19	2.2	15.2	204	69	92.2	55.2	154	119	182.2	95.2
253	20	4.0	16.0	203	70	94.0	56.0	153	120	184.0	96.0
252	21	5.8	16.8	202	71	95.8	56.8	152	121	185.8	96.8
251	22	7.6	17.6	201	72	97.6	57.6	151	122	187.6	97.6
250	—23	—9.4	—18.4	200	—73	—99.4	—58.4	150	—123	—189.4	—98.4

(*continued*)

APPROXIMATE ABSOLUTE, CENTIGRADE, FAHRENHEIT, AND REAUMUR TEMPERATURE SCALES

AA.	C.	F.	R.	AA.	C.	F.	R.	AA.	C.	F.	R.
150°	−123°	−189°.4	− 98°.4	100°	−173°	−279°.4	−138°.4	50°	−223°	−369°.4	−178°.4
149	124	191.2	99.2	99	174	281.2	139.2	49	224	371.2	179.2
148	125	193.0	100.0	98	175	283.0	140.0	48	225	373.0	180.0
147	126	194.8	100.8	97	176	284.8	140.8	47	226	374.8	180.8
146	127	196.6	101.6	96	177	286.6	141.6	46	227	376.6	181.6
145	−128	−198.4	−102.4	95	−178	−288.4	−142.4	45	−228	−378.4	−182.4
144	129	200.2	103.2	94	179	290.2	143.2	44	229	380.2	183.2
143	130	202.0	104.0	93	180	292.0	144.0	43	230	382.0	184.0
142	131	203.8	104.8	92	181	293.8	144.8	42	231	383.8	184.8
141	132	205.6	105.6	91	182	295.6	145.6	41	232	385.6	185.6
140	−133	−207.4	−106.4	90	−183	−297.4	−146.4	40	−233	−387.4	−186.4
139	134	209.2	107.2	89	184	299.2	147.2	39	234	389.2	187.2
138	135	211.0	108.0	88	185	301.0	148.0	38	235	391.0	188.0
137	136	212.8	108.8	87	186	302.8	148.8	37	236	392.8	188.8
136	137	214.6	109.6	86	187	304.6	149.6	36	237	394.6	189.6
135	−138	−216.4	−110.4	85	−188	−306.4	−150.4	35	−238	−396.4	−190.4
134	139	218.2	111.2	84	189	308.2	151.2	34	239	398.2	191.2
133	140	220.0	112.0	83	190	310.0	152.0	33	240	400.0	192.0
132	141	221.8	112.8	82	191	311.8	152.8	32	241	401.8	192.8
131	142	223.6	113.6	81	192	313.6	153.6	31	242	403.6	193.6
130	−143	−225.4	−114.4	80	−193	−315.4	−154.4	30	−243	−405.4	−194.4
129	144	227.2	115.2	79	194	317.2	155.2	29	244	407.2	195.2
128	145	229.0	116.0	78	195	319.0	156.0	28	245	409.0	196.0
127	146	230.8	116.8	77	196	320.8	156.8	27	246	410.8	196.8
126	147	232.6	117.6	76	197	322.6	157.6	26	247	412.6	197.6
125	−148	−234.4	−118.4	75	−198	−324.4	−158.4	25	−248	−414.4	−198.4
124	149	236.2	119.2	74	199	326.2	159.2	24	249	416.2	199.2
123	150	238.0	120.0	73	200	328.0	160.0	23	250	418.0	200.0
122	151	239.8	120.8	72	201	329.8	160.8	22	251	419.8	200.8
121	152	241.6	121.6	71	202	331.6	161.6	21	252	421.6	201.6
120	−153	−243.4	−122.4	70	−203	−333.4	−162.4	20	−253	−423.4	−202.4
119	154	245.2	123.2	69	204	335.2	163.2	19	254	425.2	203.2
118	155	247.0	124.0	68	205	337.0	164.0	18	255	427.0	204.0
117	156	248.8	124.8	67	206	338.8	164.8	17	256	428.8	204.8
116	157	250.6	125.6	66	207	340.6	165.6	16	257	430.6	205.6
115	−158	−252.4	−126.4	65	−208	−342.4	−166.4	15	−258	−432.4	−206.4
114	159	254.2	127.2	64	209	344.2	167.2	14	259	434.2	207.2
113	160	256.0	128.0	63	210	346.0	168.0	13	260	436.0	208.0
112	161	257.8	128.8	62	211	347.8	168.8	12	261	437.8	208.8
111	162	259.6	129.6	61	212	349.6	169.6	11	262	439.6	209.6
110	−163	−261.4	−130.4	60	−213	−351.4	−170.4	10	−263	−441.4	−210.4
109	164	263.2	131.2	59	214	353.2	171.2	9	264	443.2	211.2
108	165	265.0	132.0	58	215	355.0	172.0	8	265	445.0	212.0
107	166	266.8	132.8	57	216	356.8	172.8	7	266	446.8	212.8
106	167	268.6	133.6	56	217	358.6	173.6	6	267	448.6	213.6
105	−168	−270.4	−134.4	55	−218	−360.4	−174.4	5	−268	−450.4	−214.4
104	169	272.2	135.2	54	219	362.2	175.2	4	269	452.2	215.2
103	170	274.0	136.0	53	220	364.0	176.0	3	270	454.0	216.0
102	171	275.8	136.8	52	221	365.8	176.8	2	271	455.8	216.8
101	172	277.6	137.6	51	222	367.6	177.6	1	272	457.6	217.6
100	−173	−279.4	−138.4	50	−223	−369.4	−178.4	0	−273	−459.4	−218.4

TABLE 3

FAHRENHEIT TO CENTIGRADE

Fahrenheit	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
+130°	+54.44	+54.50	+54.56	+54.61	+54.67	+54.72	+54.78	+54.83	+54.89	+54.94
129	53.89	53.94	54.00	54.06	54.11	54.17	54.22	54.28	54.33	54.39
128	53.33	53.39	53.44	53.50	53.56	53.61	53.67	53.72	53.78	53.83
127	52.78	52.83	52.89	52.94	53.00	53.06	53.11	53.17	53.22	53.28
126	52.22	52.28	52.33	52.39	52.44	52.50	52.56	52.61	52.67	52.72
+125	+51.67	+51.72	+51.78	+51.83	+51.89	+51.94	+52.00	+52.06	+52.11	+52.17
124	51.11	51.17	51.22	51.28	51.33	51.39	51.44	51.50	51.56	51.61
123	50.56	50.61	50.67	50.72	50.78	50.83	50.89	50.94	51.00	51.06
122	50.00	50.06	50.11	50.17	50.22	50.28	50.33	50.39	50.44	50.50
121	49.44	49.50	49.56	49.61	49.67	49.72	49.78	49.83	49.89	49.94
+120	+48.89	+48.94	+49.00	+49.06	+49.11	+49.17	+49.22	+49.28	+49.33	+49.39
119	48.33	48.39	48.44	48.50	48.56	48.61	48.67	48.72	48.78	48.83
118	47.78	47.83	47.89	47.94	48.00	48.06	48.11	48.17	48.22	48.28
117	47.22	47.28	47.33	47.39	47.44	47.50	47.56	47.61	47.67	47.72
116	46.67	46.72	46.78	46.83	46.89	46.94	47.00	47.06	47.11	47.17
+115	+46.11	+46.17	+46.22	+46.28	+46.33	+46.39	+46.44	+46.50	+46.56	+46.61
114	45.56	45.61	45.67	45.72	45.78	45.83	45.89	45.94	46.00	46.06
113	45.00	45.06	45.11	45.17	45.22	45.28	45.33	45.39	45.44	45.50
112	44.44	44.50	44.56	44.61	44.67	44.72	44.78	44.83	44.89	44.94
111	43.89	43.94	44.00	44.06	44.11	44.17	44.22	44.28	44.33	44.39
+110	+43.33	+43.39	+43.44	+43.50	+43.56	+43.61	+43.67	+43.72	+43.78	+43.83
109	42.78	42.83	42.89	42.94	43.00	43.06	43.11	43.17	43.22	43.28
108	42.22	42.28	42.33	42.39	42.44	42.50	42.56	42.61	42.67	42.72
107	41.67	41.72	41.78	41.83	41.89	41.94	42.00	42.06	42.11	42.17
106	41.11	41.17	41.22	41.28	41.33	41.39	41.44	41.50	41.56	41.61
+105	+40.56	+40.61	+40.67	+40.72	+40.78	+40.83	+40.89	+40.94	+41.00	+41.06
104	40.00	40.06	40.11	40.17	40.22	40.28	40.33	40.39	40.44	40.50
103	39.44	39.50	39.56	39.61	39.67	39.72	39.78	39.83	39.89	39.94
102	38.89	38.94	39.00	39.06	39.11	39.17	39.22	39.28	39.33	39.39
101	38.33	38.39	38.44	38.50	38.56	38.61	38.67	38.72	38.78	38.83
+100	+37.78	+37.83	+37.89	+37.94	+38.00	+38.06	+38.11	+38.17	+38.22	+38.28
99	37.22	37.28	37.33	37.39	37.44	37.50	37.56	37.61	37.67	37.72
98	36.67	36.72	36.78	36.83	36.89	36.94	37.00	37.06	37.11	37.17
97	36.11	36.17	36.22	36.28	36.33	36.39	36.44	36.50	36.56	36.61
96	35.56	35.61	35.67	35.72	35.78	35.83	35.89	35.94	36.00	36.06
+ 95	+35.00	+35.06	+35.11	+35.17	+35.22	+35.28	+35.33	+35.39	+35.44	+35.50
94	34.44	34.50	34.56	34.61	34.67	34.72	34.78	34.83	34.89	34.94
93	33.89	33.94	34.00	34.06	34.11	34.17	34.22	34.28	34.33	34.39
92	33.33	33.39	33.44	33.50	33.56	33.61	33.67	33.72	33.78	33.83
91	32.78	32.83	32.89	32.94	33.00	33.06	33.11	33.17	33.22	33.28
+ 90	+32.22	+32.28	+32.33	+32.39	+32.44	+32.50	+32.56	+32.61	+32.67	+32.72
89	31.67	31.72	31.78	31.83	31.89	31.94	32.00	32.06	32.11	32.17
88	31.11	31.17	31.22	31.28	31.33	31.39	31.44	31.50	31.56	31.61
87	30.56	30.61	30.67	30.72	30.78	30.83	30.89	30.94	31.00	31.06
86	30.00	30.06	30.11	30.17	30.22	30.28	30.33	30.39	30.44	30.50
+ 85	+29.44	+29.50	+29.56	+29.61	+29.67	+29.72	+29.78	+29.83	+29.89	+29.94
84	28.89	28.94	29.00	29.06	29.11	29.17	29.22	29.28	29.33	29.39
83	28.33	28.39	28.44	28.50	28.56	28.61	28.67	28.72	28.78	28.83
82	27.78	27.83	27.89	27.94	28.00	28.06	28.11	28.17	28.22	28.28
81	27.22	27.28	27.33	27.39	27.44	27.50	27.56	27.61	27.67	27.72
+ 80	+26.67	+26.72	+26.78	+26.83	+26.89	+26.94	+27.00	+27.06	+27.11	+27.17

(*continued*)

FAHRENHEIT TO CENTIGRADE

Fahren-heit	.0 °C.	.1 °C.	.2 °C.	.3 °C.	.4 °C.	.5 °C.	.6 °C.	.7 °C.	.8 °C.	.9 °C.
+80°	+26.67	+26.72	+26.78	+26.83	+26.89	+26.94	+27.00	+27.06	+27.11	+27.17
79	26.11	26.17	26.22	26.28	26.33	26.39	26.44	26.50	26.56	26.61
78	25.56	25.61	25.67	25.72	25.78	25.83	25.89	25.94	26.00	26.06
77	25.00	25.06	25.11	25.17	25.22	25.28	25.33	25.39	25.44	25.50
76	24.44	24.50	24.56	24.61	24.67	24.72	24.78	24.83	24.89	24.94
+75	+23.89	+23.94	+24.00	+24.06	+24.11	+24.17	+24.22	+24.28	+24.33	+24.39
74	23.33	23.39	23.44	23.50	23.56	23.61	23.67	23.72	23.78	23.83
73	22.78	22.83	22.89	22.94	23.00	23.06	23.11	23.17	23.22	23.28
72	22.22	22.28	22.33	22.39	22.44	22.50	22.56	22.61	22.67	22.72
71	21.67	21.72	21.78	21.83	21.89	21.94	22.00	22.06	22.11	22.17
+70	+21.11	+21.17	+21.22	+21.28	+21.33	+21.39	+21.44	+21.50	+21.56	+21.61
69	20.56	20.61	20.67	20.72	20.78	20.83	20.89	20.94	21.00	21.06
68	20.00	20.06	20.11	20.17	20.22	20.28	20.33	20.39	20.44	20.50
67	19.44	19.50	19.56	19.61	19.67	19.72	19.78	19.83	19.89	19.94
66	18.89	18.94	19.00	19.06	19.11	19.17	19.22	19.28	19.33	19.39
+65	+18.33	+18.39	+18.44	+18.50	+18.56	+18.61	+18.67	+18.72	+18.78	+18.83
64	17.78	17.83	17.89	17.94	18.00	18.06	18.11	18.17	18.22	18.28
63	17.22	17.28	17.33	17.39	17.44	17.50	17.56	17.61	17.67	17.72
62	16.67	16.72	16.78	16.83	16.89	16.94	17.00	17.06	17.11	17.17
61	16.11	16.17	16.22	16.28	16.33	16.39	16.44	16.50	16.56	16.61
+60	+15.56	+15.61	+15.67	+15.72	+15.78	+15.83	+15.89	+15.94	+16.00	+16.06
59	15.00	15.06	15.11	15.17	15.22	15.28	15.33	15.39	15.44	15.50
58	14.44	14.50	14.56	14.61	14.67	14.72	14.78	14.83	14.89	14.94
57	13.89	13.94	14.00	14.06	14.11	14.17	14.22	14.28	14.33	14.39
56	13.33	13.39	13.44	13.50	13.56	13.61	13.67	13.72	13.78	13.83
+55	+12.78	+12.83	+12.89	+12.94	+13.00	+13.06	+13.11	+13.17	+13.22	+13.28
54	12.22	12.28	12.33	12.39	12.44	12.50	12.56	12.61	12.67	12.72
53	11.67	11.72	11.78	11.83	11.89	11.94	12.00	12.06	12.11	12.17
52	11.11	11.17	11.22	11.28	11.33	11.39	11.44	11.50	11.56	11.61
51	10.56	10.61	10.67	10.72	10.78	10.83	10.89	10.94	11.00	11.06
+50	+10.00	+10.06	+10.11	+10.17	+10.22	+10.28	+10.33	+10.39	+10.44	+10.50
49	9.44	9.50	9.56	9.61	9.67	9.72	9.78	9.83	9.89	9.94
48	8.89	8.94	9.00	9.06	9.11	9.17	9.22	9.28	9.33	9.39
47	8.33	8.39	8.44	8.50	8.56	8.61	8.67	8.72	8.78	8.83
46	7.78	7.83	7.89	7.94	8.00	8.06	8.11	8.17	8.22	8.28
+45	+7.22	+7.28	+7.33	+7.39	+7.44	+7.50	+7.56	+7.61	+7.67	+7.72
44	6.67	6.72	6.78	6.83	6.89	6.94	7.00	7.06	7.11	7.17
43	6.11	6.17	6.22	6.28	6.33	6.39	6.44	6.50	6.56	6.61
42	5.56	5.61	5.67	5.72	5.78	5.83	5.89	5.94	6.00	6.06
41	5.00	5.06	5.11	5.17	5.22	5.28	5.33	5.39	5.44	5.50
+40	+4.44	+4.50	+4.56	+4.61	+4.67	+4.72	+4.78	+4.83	+4.89	+4.94
39	3.89	3.94	4.00	4.06	4.11	4.17	4.22	4.28	4.33	4.39
38	3.33	3.39	3.44	3.50	3.56	3.61	3.67	3.72	3.78	3.83
37	2.78	2.83	2.89	2.94	3.00	3.06	3.11	3.17	3.22	3.28
36	2.22	2.28	2.33	2.39	2.44	2.50	2.56	2.61	2.67	2.72
+35	+1.67	+1.72	+1.78	+1.83	+1.89	+1.94	+2.00	+2.06	+2.11	+2.17
34	+1.11	+1.17	+1.22	+1.28	+1.33	+1.39	+1.44	+1.50	+1.56	+1.61
33	+0.56	+0.61	+0.67	+0.72	+0.78	+0.83	+0.89	+0.94	+1.00	+1.06
32	0.00	+0.06	+0.11	+0.17	+0.22	+0.28	+0.33	+0.39	+0.44	+0.50
31	−0.56	−0.50	−0.44	−0.39	−0.33	−0.28	−0.22	−0.17	−0.11	−0.06
+30	−1.11	−1.06	−1.00	−0.94	−0.89	−0.83	−0.78	−0.72	−0.67	−0.61

(*continued*)

FAHRENHEIT TO CENTIGRADE

Fahrenheit	.0 °C.	.1 °C.	.2 °C.	.3 °C.	.4 °C.	.5 °C.	.6 °C.	.7 °C.	.8 °C.	.9 °C.
+30°	−1.11	−1.06	−1.00	−0.94	−0.89	−0.83	−0.78	−0.72	−0.67	−0.61
29	1.67	1.61	1.56	1.50	1.44	1.39	1.33	1.28	1.22	1.17
28	2.22	2.17	2.11	2.06	2.00	1.94	1.89	1.83	1.78	1.72
27	2.78	2.72	2.67	2.61	2.56	2.50	2.44	2.39	2.33	2.28
26	3.33	3.28	3.22	3.17	3.11	3.06	3.00	2.94	2.89	2.83
+25	−3.89	−3.83	−3.78	−3.72	−3.67	−3.61	−3.56	−3.50	−3.44	−3.39
24	4.44	4.39	4.33	4.28	4.22	4.17	4.11	4.06	4.00	3.94
23	5.00	4.94	4.89	4.83	4.78	4.72	4.67	4.61	4.56	4.50
22	5.56	5.50	5.44	5.39	5.33	5.28	5.22	5.17	5.11	5.06
21	6.11	6.06	6.00	5.94	5.89	5.83	5.78	5.72	5.67	5.61
+20	−6.67	−6.61	−6.56	−6.50	−6.44	−6.39	−6.33	−6.28	−6.22	−6.17
19	7.22	7.17	7.11	7.06	7.00	6.94	6.89	6.83	6.78	6.72
18	7.78	7.72	7.67	7.61	7.56	7.50	7.44	7.39	7.33	7.28
17	8.33	8.28	8.22	8.17	8.11	8.06	8.00	7.94	7.89	7.83
16	8.89	8.83	8.78	8.72	8.67	8.61	8.56	8.50	8.44	8.39
+15	−9.44	−9.39	−9.33	−9.28	−9.22	−9.17	−9.11	−9.06	−9.00	−8.94
14	10.00	9.94	9.89	9.83	9.78	9.72	9.67	9.61	9.56	9.50
13	10.56	10.50	10.44	10.39	10.33	10.28	10.22	10.17	10.11	10.06
12	11.11	11.06	11.00	10.94	10.89	10.83	10.78	10.72	10.67	10.61
11	11.67	11.61	11.56	11.50	11.44	11.39	11.33	11.28	11.22	11.17
+10	−12.22	−12.17	−12.11	−12.06	−12.00	−11.94	−11.89	−11.83	−11.78	−11.72
9	12.78	12.72	12.67	12.61	12.56	12.50	12.44	12.39	12.33	12.28
8	13.33	13.28	13.22	13.17	13.11	13.06	13.00	12.94	12.89	12.83
7	13.89	13.83	13.78	13.72	13.67	13.61	13.56	13.50	13.44	13.39
6	14.44	14.39	14.33	14.28	14.22	14.17	14.11	14.06	14.00	13.94
+ 5	−15.00	−14.94	−14.89	−14.83	−14.78	−14.72	−14.67	−14.61	−14.56	−14.50
4	15.56	15.50	15.44	15.39	15.33	15.28	15.22	15.17	15.11	15.06
3	16.11	16.06	16.00	15.94	15.89	15.83	15.78	15.72	15.67	15.61
2	16.67	16.61	16.56	16.50	16.44	16.39	16.33	16.28	16.22	16.17
1	17.22	17.17	17.11	17.06	17.00	16.94	16.89	16.83	16.78	16.72
+ 0	17.78	17.72	17.67	17.61	17.56	17.50	17.44	17.39	17.33	17.28
− 0	−17.78	−17.83	−17.89	−17.94	−18.00	−18.06	−18.11	−18.17	−18.22	−18.28
1	18.33	18.39	18.44	18.50	18.56	18.61	18.67	18.72	18.78	18.83
2	18.89	18.94	19.00	19.06	19.11	19.17	19.22	19.28	19.33	19.39
3	19.44	19.50	19.56	19.61	19.67	19.72	19.78	19.83	19.89	19.94
4	20.00	20.06	20.11	20.17	20.22	20.28	20.33	20.39	20.44	20.50
− 5	−20.56	−20.61	−20.67	−20.72	−20.78	−20.83	−20.89	−20.94	−21.00	−21.06
6	21.11	21.17	21.22	21.28	21.33	21.39	21.44	21.50	21.56	21.61
7	21.67	21.72	21.78	21.83	21.89	21.94	22.00	22.06	22.11	22.17
8	22.22	22.28	22.33	22.39	22.44	22.50	22.56	22.61	22.67	22.72
9	22.78	22.83	22.89	22.94	23.00	23.06	23.11	23.17	23.22	23.28
−10	−23.33	−23.39	−23.44	−23.50	−23.56	−23.61	−23.67	−23.72	−23.78	−23.83
11	23.89	23.94	24.00	24.06	24.11	24.17	24.22	24.28	24.33	24.39
12	24.44	24.50	24.56	24.61	24.67	24.72	24.78	24.83	24.89	24.94
13	25.00	25.06	25.11	25.17	25.22	25.28	25.33	25.39	25.44	25.50
14	25.56	25.61	25.67	25.72	25.78	25.83	25.89	25.94	26.00	26.06
−15	−26.11	−26.17	−26.22	−26.28	−26.33	−26.39	−26.44	−26.50	−26.56	−26.61
16	26.67	26.72	26.78	26.83	26.89	26.94	27.00	27.06	27.11	27.17
17	27.22	27.28	27.33	27.39	27.44	27.50	27.56	27.61	27.67	27.72
18	27.78	27.83	27.89	27.94	28.00	28.06	28.11	28.17	28.22	28.28
19	28.33	28.39	28.44	28.50	28.56	28.61	28.67	28.72	28.78	28.83
−20	−28.89	−28.94	−29.00	−29.06	−29.11	−29.17	−29.22	−29.28	−29.33	−29.39

(*continued*)

FAHRENHEIT TO CENTIGRADE

Fahrenheit	.0 °C.	.1 °C.	.2 °C.	.3 °C.	.4 °C.	.5 °C.	.6 °C.	.7 °C.	.8 °C.	.9 °C.
—20°	—28.89	—28.94	—29.00	—29.06	—29.11	—29.17	—29.22	—29.28	—29.33	—29.39
21	29.44	29.50	29.56	29.61	29.67	29.72	29.78	29.83	29.89	29.94
22	30.00	30.06	30.11	30.17	30.22	30.28	30.33	30.39	30.44	30.50
23	30.56	30.61	30.67	30.72	30.78	30.83	30.89	30.94	31.00	31.06
24	31.11	31.17	31.22	31.28	31.33	31.39	31.44	31.50	31.56	31.61
—25	—31.67	—31.72	—31.78	—31.83	—31.89	—31.94	—32.00	—32.06	—32.11	—32.17
26	32.22	32.28	32.33	32.39	32.44	32.50	32.56	32.61	32.67	32.72
27	32.78	32.83	32.89	32.94	33.00	33.06	33.11	33.17	33.22	33.28
28	33.33	33.39	33.44	33.50	33.56	33.61	33.67	33.72	33.78	33.83
29	33.89	33.94	34.00	34.06	34.11	34.17	34.22	34.28	34.33	34.39
—30	—34.44	—34.50	—34.56	—34.61	—34.67	—34.72	—34.78	—34.83	—34.89	—34.94
31	35.00	35.06	35.11	35.17	35.22	35.28	35.33	35.39	35.44	35.50
32	35.56	35.61	35.67	35.72	35.78	35.83	35.89	35.94	36.00	36.06
33	36.11	36.17	36.22	36.28	36.33	36.39	36.44	36.50	36.56	36.61
34	36.67	36.72	36.78	36.83	36.89	36.94	37.00	37.06	37.11	37.17
—35	—37.22	—37.28	—37.33	—37.39	—37.44	—37.50	—37.56	—37.61	—37.67	—37.72
36	37.78	37.83	37.89	37.94	38.00	38.06	38.11	38.17	38.22	38.28
37	38.33	38.39	38.44	38.50	38.56	38.61	38.67	38.72	38.78	38.83
38	38.89	38.94	39.00	39.06	39.11	39.17	39.22	39.28	39.33	39.39
39	39.44	39.50	39.56	39.61	39.67	39.72	39.78	39.83	39.89	39.94
—40	—40.00	—40.06	—40.11	—40.17	—40.22	—40.28	—40.33	—40.39	—40.44	—40.50
41	40.56	40.61	40.67	40.72	40.78	40.83	40.89	40.94	41.00	41.06
42	41.11	41.17	41.22	41.28	41.33	41.39	41.44	41.50	41.56	41.61
43	41.67	41.72	41.78	41.83	41.89	41.94	42.00	42.06	42.11	42.17
44	42.22	42.28	42.33	42.39	42.44	42.50	42.56	42.61	42.67	42.72
—45	—42.78	—42.83	—42.89	—42.94	—43.00	—43.06	—43.11	—43.17	—43.22	—43.28
46	43.33	43.39	43.44	43.50	43.56	43.61	43.67	43.72	43.78	43.83
47	43.89	43.94	44.00	44.06	44.11	44.17	44.22	44.28	44.33	44.39
48	44.44	44.50	44.56	44.61	44.67	44.72	44.78	44.83	44.89	44.94
49	45.00	45.06	45.11	45.17	45.22	45.28	45.33	45.39	45.44	45.50
—50	—45.56	—45.61	—45.67	—45.72	—45.78	—45.83	—45.89	—45.94	—46.00	—46.06
51	46.11	46.17	46.22	46.28	46.33	46.39	46.44	46.50	46.56	46.61
52	46.67	46.72	46.78	46.83	46.89	46.94	47.00	47.06	47.11	47.17
53	47.22	47.28	47.33	47.39	47.44	47.50	47.56	47.61	47.67	47.72
54	47.78	47.83	47.89	47.94	48.00	48.06	48.11	48.17	48.22	48.28
—55	—48.33	—48.39	—48.44	—48.50	—48.56	—48.61	—48.67	—48.72	—48.78	—48.83
56	48.89	48.94	49.00	49.06	49.11	49.17	49.22	49.28	49.33	49.39
57	49.44	49.50	49.56	49.61	49.67	49.72	49.78	49.83	49.89	49.94
58	50.00	50.06	50.11	50.17	50.22	50.28	50.33	50.39	50.44	50.50
59	50.56	50.61	50.67	50.72	50.78	50.83	50.89	50.94	51.00	51.06
—60	—51.11	—51.17	—51.22	—51.28	—51.33	—51.39	—51.44	—51.50	—51.56	—51.61
61	51.67	51.72	51.78	51.83	51.89	51.94	52.00	52.06	52.11	52.17
62	52.22	52.28	52.33	52.39	52.44	52.50	52.56	52.61	52.67	52.72
63	52.78	52.83	52.89	52.94	53.00	53.06	53.11	53.17	53.22	53.28
64	53.33	53.39	53.44	53.50	53.56	53.61	53.67	53.72	53.78	53.83
—65	—53.89	—53.94	—54.00	—54.06	—54.11	—54.17	—54.22	—54.28	—54.33	—54.39
66	54.44	54.50	54.56	54.61	54.67	54.72	54.78	54.83	54.89	54.94
67	55.00	55.06	55.11	55.17	55.22	55.28	55.33	55.39	55.44	55.50
68	55.56	55.61	55.67	55.72	55.78	55.83	55.89	55.94	56.00	56.06
69	56.11	56.17	56.22	56.28	56.33	56.39	56.44	56.50	56.56	56.61
—70	—56.67	—56.72	—56.78	—56.83	—56.89	—56.94	—57.00	—57.06	—57.11	—57.17

(*continued*)

FAHRENHEIT TO CENTIGRADE

Fahrenheit	.0 °C.	.1 °C.	.2 °C.	.3 °C.	.4 °C.	.5 °C.	.6 °C.	.7 °C.	.8 °C.	.9 °C.
−70°	−56.67	−56.72	−56.78	−56.83	−56.89	−56.94	−57.00	−57.06	−57.11	−57.17
71	57.22	57.28	57.33	57.39	57.44	57.50	57.56	57.61	57.67	57.72
72	57.78	57.83	57.89	57.94	58.00	58.06	58.11	58.17	58.22	58.28
73	58.33	58.39	58.44	58.50	58.56	58.61	58.67	58.72	58.78	58.83
74	58.89	58.94	59.00	59.06	59.11	59.17	59.22	59.28	59.33	59.39
−75	−59.44	−59.50	−59.56	−59.61	−59.67	−59.72	−59.78	−59.83	−59.89	−59.94
76	60.00	60.06	60.11	60.17	60.22	60.28	60.33	60.39	60.44	60.50
77	60.56	60.61	60.67	60.72	60.78	60.83	60.89	60.94	61.00	61.06
78	61.11	61.17	61.22	61.28	61.33	61.39	61.44	61.50	61.56	61.61
79	61.67	61.72	61.78	61.83	61.89	61.94	62.00	62.06	62.11	62.17
−80	−62.22	−62.28	−62.33	−62.39	−62.44	−62.50	−62.56	−62.61	−62.67	−62.72
81	62.78	62.83	62.89	62.94	63.00	63.06	63.11	63.17	63.22	63.28
82	63.33	63.39	63.44	63.50	63.56	63.61	63.67	63.72	63.78	63.83
83	63.89	63.94	64.00	64.06	64.11	64.17	64.22	64.28	64.33	64.39
84	64.44	64.50	64.56	64.61	64.67	64.72	64.78	64.83	64.89	64.94
−85	−65.00	−65.06	−65.11	−65.17	−65.22	−65.28	−65.33	−65.39	−65.44	−65.50
86	65.56	65.61	65.67	65.72	65.78	65.83	65.89	65.94	66.00	66.06
87	66.11	66.17	66.22	66.28	66.33	66.39	66.44	66.50	66.56	66.61
88	66.67	66.72	66.78	66.83	66.89	66.94	67.00	67.06	67.11	67.17
89	67.22	67.28	67.33	67.39	67.44	67.50	67.56	67.61	67.67	67.72
−90	−67.78	−67.83	−67.89	−67.94	−68.00	−68.06	−68.11	−68.17	−68.22	−68.28
91	68.33	68.39	68.44	68.50	68.56	68.61	68.67	68.72	68.78	68.83
92	68.89	68.94	69.00	69.06	69.11	69.17	69.22	69.28	69.33	69.39
93	69.44	69.50	69.56	69.61	69.67	69.72	69.78	69.83	69.89	69.94
94	70.00	70.06	70.11	70.17	70.22	70.28	70.33	70.39	70.44	70.50
−95	−70.56	−70.61	−70.67	−70.72	−70.78	−70.83	−70.89	−70.94	−71.00	−71.06
96	71.11	71.17	71.22	71.28	71.33	71.39	71.44	71.50	71.56	71.61
97	71.67	71.72	71.78	71.83	71.89	71.94	72.00	72.06	72.11	72.17
98	72.22	72.28	72.33	72.39	72.44	72.50	72.56	72.61	72.67	72.72
99	72.78	72.83	72.89	72.94	73.00	73.06	73.11	73.17	73.22	73.28
−100	−73.33	−73.39	−73.44	−73.50	−73.56	−73.61	−73.67	−73.72	−73.78	−73.83
101	73.89	73.94	74.00	74.06	74.11	74.17	74.22	74.28	74.33	74.39
102	74.44	74.50	74.56	74.61	74.67	74.72	74.78	74.83	74.89	74.94
103	75.00	75.06	75.11	75.17	75.22	75.28	75.33	75.39	75.44	75.50
104	75.56	75.61	75.67	75.72	75.78	75.83	75.89	75.94	76.00	76.06
−105	−76.11	−76.17	−76.22	−76.28	−76.33	−76.39	−76.44	−76.50	−76.56	−76.61
106	76.67	76.72	76.78	76.83	76.89	76.94	77.00	77.06	77.11	77.17
107	77.22	77.28	77.33	77.39	77.44	77.50	77.56	77.61	77.67	77.72
108	77.78	77.83	77.89	77.94	78.00	78.06	78.11	78.17	78.22	78.28
109	78.33	78.39	78.44	78.50	78.56	78.61	78.67	78.72	78.78	78.83
−110	−78.89	−78.94	−79.00	−79.06	−79.11	−79.17	−79.22	−79.28	−79.33	−79.39
111	79.44	79.50	79.56	79.61	79.67	79.72	79.78	79.83	79.89	79.94
112	80.00	80.06	80.11	80.17	80.22	80.28	80.33	80.39	80.44	80.50
113	80.56	80.61	80.67	80.72	80.78	80.83	80.89	80.94	81.00	81.06
114	81.11	81.17	81.22	81.28	81.33	81.39	81.44	81.50	81.56	81.61
−115	−81.67	−81.72	−81.78	−81.83	−81.89	−81.94	−82.00	−82.06	−82.11	−82.17
116	82.22	82.28	82.33	82.39	82.44	82.50	82.56	82.61	82.67	82.72
117	82.78	82.83	82.89	82.94	83.00	83.06	83.11	83.17	83.22	83.28
118	83.33	83.39	83.44	83.50	83.56	83.61	83.67	83.72	83.78	83.83
119	83.89	83.94	84.00	84.06	84.11	84.17	84.22	84.28	84.33	84.39
−120	−84.44	−84.50	−84.56	−84.61	−84.67	−84.72	−84.78	−84.83	−84.89	−84.94

CENTIGRADE TO FAHRENHEIT

Centigrade	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
+100°	+212.00	+212.18	+212.36	+212.54	+212.72	+212.90	+213.08	+213.26	+213.44	+213.62
99	210.20	210.38	210.56	210.74	210.92	211.10	211.28	211.46	211.64	211.82
98	208.40	208.58	208.76	208.94	209.12	209.30	209.48	209.66	209.84	210.02
97	206.60	206.78	206.96	207.14	207.32	207.50	207.68	207.86	208.04	208.22
96	204.80	204.98	205.16	205.34	205.52	205.70	205.88	206.06	206.24	206.42
+95	+203.00	+203.18	+203.36	+203.54	+203.72	+203.90	+204.08	+204.26	+204.44	+204.62
94	201.20	201.38	201.56	201.74	201.92	202.10	202.28	202.46	202.64	202.82
93	199.40	199.58	199.76	199.94	200.12	200.30	200.48	200.66	200.84	201.02
92	197.60	197.78	197.96	198.14	198.32	198.50	198.68	198.86	199.04	199.22
91	195.80	195.98	196.16	196.34	196.52	196.70	196.88	197.06	197.24	197.42
+90	+194.00	+194.18	+194.36	+194.54	+194.72	+194.90	+195.08	+195.26	+195.44	+195.62
89	192.20	192.38	192.56	192.74	192.92	193.10	193.28	193.46	193.64	193.82
88	190.40	190.58	190.76	190.94	191.12	191.30	191.48	191.66	191.84	192.02
87	188.60	188.78	188.96	189.14	189.32	189.50	189.68	189.86	190.04	190.22
86	186.80	186.98	187.16	187.34	187.52	187.70	187.88	188.06	188.24	188.42
+85	+185.00	+185.18	+185.36	+185.54	+185.72	+185.90	+186.08	+186.26	+186.44	+186.62
84	183.20	183.38	183.56	183.74	183.92	184.10	184.28	184.46	184.64	184.82
83	181.40	181.58	181.76	181.94	182.12	182.30	182.48	182.66	182.84	183.02
82	179.60	179.78	178.96	180.14	180.32	180.50	180.68	180.86	181.04	181.22
81	177.80	177.98	178.16	178.34	178.52	178.70	178.88	179.06	179.24	179.42
+80	+176.00	+176.18	+176.36	+176.54	+176.72	+176.90	+177.08	+177.26	+177.44	+177.62
79	174.20	174.38	174.56	174.74	174.92	175.10	175.28	175.46	175.64	175.82
78	172.40	172.58	172.76	172.94	173.12	173.30	173.48	173.66	173.84	174.02
77	170.60	170.78	170.96	171.14	171.32	171.50	171.68	171.86	172.04	172.22
76	168.80	168.98	169.16	169.34	169.52	169.70	169.88	170.06	170.24	170.42
+75	+167.00	+167.18	+167.36	+167.54	+167.72	+167.90	+168.08	+168.26	+168.44	+168.62
74	165.20	165.38	165.56	165.74	165.92	166.10	166.28	166.46	166.64	166.82
73	163.40	163.58	163.76	163.94	164.12	164.30	164.48	164.66	164.84	165.02
72	161.60	161.78	161.96	162.14	162.32	162.50	162.68	162.86	163.04	163.22
71	159.80	159.98	160.16	160.34	160.52	160.70	160.88	161.06	161.24	161.42
+70	+158.00	+158.18	+158.36	+158.54	+158.72	+158.90	+159.08	+159.26	+159.44	+159.62
69	156.20	156.38	156.56	156.74	156.92	157.10	157.28	157.46	157.64	157.82
68	154.40	154.58	154.76	154.94	155.12	155.30	155.48	155.66	155.84	156.02
67	152.60	152.78	152.96	153.14	153.32	153.50	153.68	153.86	154.04	154.22
66	150.80	150.98	151.16	151.34	151.52	151.70	151.88	152.06	152.24	152.42
+65	+149.00	+149.18	+149.36	+149.54	+149.72	+149.90	+150.08	+150.26	+150.44	+150.62
64	147.20	147.38	147.56	147.74	147.92	148.10	148.28	148.46	148.64	148.82
63	145.40	145.58	145.76	145.94	146.12	146.30	146.48	146.66	146.84	147.02
62	143.60	143.78	143.96	144.14	144.32	144.50	144.68	144.86	145.04	145.22
61	141.80	141.98	142.16	142.34	142.52	142.70	142.88	143.06	143.24	143.42
+60	+140.00	+140.18	+140.36	+140.54	+140.72	+140.90	+141.08	+141.26	+141.44	+141.62
59	138.20	138.38	138.56	138.74	138.92	139.10	139.28	139.46	139.64	139.82
58	136.40	136.58	136.76	136.94	137.12	137.30	137.48	137.66	137.84	138.02
57	134.60	134.78	134.96	135.14	135.32	135.50	135.68	135.86	136.04	136.22
56	132.80	132.98	133.16	133.34	133.52	133.70	133.88	134.06	134.24	134.42
+55	+131.00	+131.18	+131.36	+131.54	+131.72	+131.90	+132.08	+132.26	+132.44	+132.62
54	129.20	129.38	129.56	129.74	129.92	130.10	130.28	130.46	130.64	130.82
53	127.40	127.58	127.76	127.94	128.12	128.30	128.48	128.66	128.84	129.02
52	125.60	125.78	125.96	126.14	126.32	126.50	126.68	126.86	127.04	127.22
51	123.80	123.98	124.16	124.34	124.52	124.70	124.88	125.06	125.24	125.42
+50	+122.00	+122.18	+122.36	+122.54	+122.72	+122.90	+123.08	+123.26	+123.44	+123.62

(continued)

CENTIGRADE TO FAHRENHEIT

Centigrade	.0 °F.	.1 °F.	.2 °F.	.3 °F.	.4 °F.	.5 °F.	.6 °F.	.7 °F.	.8 °F.	.9 °F.
+50°	+122.00	+122.18	+122.36	+122.54	+122.72	+122.90	+123.08	+123.26	+123.44	+123.62
49	120.20	120.38	120.56	120.74	120.92	121.10	121.28	121.46	121.64	121.82
48	118.40	118.58	118.76	118.94	119.12	119.30	119.48	119.66	119.84	120.02
47	116.60	116.78	116.96	117.14	117.32	117.50	117.68	117.86	118.04	118.22
46	114.80	114.98	115.16	115.34	115.52	115.70	115.88	116.06	116.24	116.42
+45	+113.00	+113.18	+113.36	+113.54	+113.72	+113.90	+114.08	+114.26	+114.44	+114.62
44	111.20	111.38	111.56	111.74	111.92	112.10	112.28	112.46	112.64	112.82
43	109.40	109.58	109.76	109.94	110.12	110.30	110.48	110.66	110.84	111.02
42	107.60	107.78	107.96	108.14	108.32	108.50	108.68	108.86	109.04	109.22
41	105.80	105.98	106.16	106.34	106.52	106.70	106.88	107.06	107.24	107.42
+40	+104.00	+104.18	+104.36	+104.54	+104.72	+104.90	+105.08	+105.26	+105.44	+105.62
39	102.20	102.38	102.56	102.74	102.92	103.10	103.28	103.46	103.64	103.82
38	100.40	100.58	100.76	100.94	101.12	101.30	101.48	101.66	101.84	102.02
37	98.60	98.78	98.96	99.14	99.32	99.50	99.68	99.86	100.04	100.22
36	96.80	96.98	97.16	97.34	97.52	97.70	97.88	98.06	98.24	98.42
+35	+95.00	+95.18	+95.36	+95.54	+95.72	+95.90	+96.08	+96.26	+96.44	+96.62
34	93.20	93.38	93.56	93.74	93.92	94.10	94.28	94.46	94.64	94.82
33	91.40	91.58	91.76	91.94	92.12	92.30	92.48	92.66	92.84	93.02
32	89.60	89.78	89.96	90.14	90.32	90.50	90.68	90.86	91.04	91.22
31	87.80	87.98	88.16	88.34	88.52	88.70	88.88	89.06	89.24	89.42
+30	+86.00	+86.18	+86.36	+86.54	+86.72	+86.90	+87.08	+87.26	+87.44	+87.62
29	84.20	84.38	84.56	84.74	84.92	85.10	85.28	85.46	85.64	85.82
28	82.40	82.58	82.76	82.94	83.12	83.30	83.48	83.66	83.84	84.02
27	80.60	80.78	80.96	81.14	81.32	81.50	81.68	81.86	82.04	82.22
26	78.80	78.98	79.16	79.34	79.52	79.70	79.88	80.06	80.24	80.42
+25	+77.00	+77.18	+77.36	+77.54	+77.72	+77.90	+78.08	+78.26	+78.44	+78.62
24	75.20	75.38	75.56	75.74	75.92	76.10	76.28	76.46	76.64	76.82
23	73.40	73.58	73.76	73.94	74.12	74.30	74.48	74.66	74.84	75.02
22	71.60	71.78	71.96	72.14	72.32	72.50	72.68	72.86	73.04	73.22
21	69.80	69.98	70.16	70.34	70.52	70.70	70.88	71.06	71.24	71.42
+20	+68.00	+68.18	+68.36	+68.54	+68.72	+68.90	+69.08	+69.26	+69.44	+69.62
19	66.20	66.38	66.56	66.74	66.92	67.10	67.28	67.46	67.64	67.82
18	64.40	64.58	64.76	64.94	65.12	65.30	65.48	65.66	65.84	66.02
17	62.60	62.78	62.96	63.14	63.32	63.50	63.68	63.86	64.04	64.22
16	60.80	60.98	61.16	61.34	61.52	61.70	61.88	62.06	62.24	62.42
+15	+59.00	+59.18	+59.36	+59.54	+59.72	+59.90	+60.08	+60.26	+60.44	+60.62
14	57.20	57.38	57.56	57.74	57.92	58.10	58.28	58.46	58.64	58.82
13	55.40	55.58	55.76	55.94	56.12	56.30	56.48	56.66	56.84	57.02
12	53.60	53.78	53.96	54.14	54.32	54.50	54.68	54.86	55.04	55.22
11	51.80	51.98	52.16	52.34	52.52	52.70	52.88	53.06	53.24	53.42
+10	+50.00	+50.18	+50.36	+50.54	+50.72	+50.90	+51.08	+51.26	+51.44	+51.62
9	48.20	48.38	48.56	48.74	48.92	49.10	49.28	49.46	49.64	49.82
8	46.40	46.58	46.76	46.94	47.12	47.30	47.48	47.66	47.84	48.02
7	44.60	44.78	44.96	45.14	45.32	45.50	45.68	45.86	46.04	46.22
6	42.80	42.98	43.16	43.34	43.52	43.70	43.88	44.06	44.24	44.42
+5	+41.00	+41.18	+41.36	+41.54	+41.72	+41.90	+42.08	+42.26	+42.44	+42.62
4	39.20	39.38	39.56	39.74	39.92	40.10	40.28	40.46	40.64	40.82
3	37.40	37.58	37.76	37.94	38.12	38.30	38.48	38.66	38.84	39.02
2	35.60	35.78	35.96	36.14	36.32	36.50	36.68	36.86	37.04	37.22
1	33.80	33.98	34.16	34.34	34.52	34.70	34.88	35.06	35.24	35.42
+0	+32.00	+32.18	+32.36	+32.54	+32.72	+32.90	+33.08	+33.26	+33.44	+33.62

(*continued*)

CENTIGRADE TO FAHRENHEIT

Centi-grade	.0 °F.	.1 °F.	.2 °F.	.3 °F.	.4 °F.	.5 °F.	.6 °F.	.7 °F.	.8 °F.	.9 °F.
−0°	+32.00	+31.82	+31.64	+31.46	+31.28	+31.10	+30.92	+30.74	+30.56	+30.38
1	30.20	30.02	29.84	29.66	29.48	29.30	29.12	28.94	28.76	28.58
2	28.40	28.22	28.04	27.86	27.68	27.50	27.32	27.14	26.96	26.78
3	26.60	26.42	26.24	26.06	25.88	25.70	25.52	25.34	25.16	24.98
4	24.80	24.62	24.44	24.26	24.08	23.90	23.72	23.54	23.36	23.18
−5	+23.00	+22.82	+22.64	+22.46	+22.28	+22.10	+21.92	+21.74	+21.56	+21.38
6	21.20	21.02	20.84	20.66	20.48	20.30	20.12	19.94	19.76	19.58
7	19.40	19.22	19.04	18.86	18.68	18.50	18.32	18.14	17.96	17.78
8	17.60	17.42	17.24	17.06	16.88	16.70	16.52	16.34	16.16	15.98
9	15.80	15.62	15.44	15.26	15.08	14.90	14.72	14.54	14.36	14.18
−10	+14.00	+13.82	+13.64	+13.46	+13.28	+13.10	+12.92	+12.74	+12.56	+12.38
11	12.20	12.02	11.84	11.66	11.48	11.30	11.12	10.94	10.76	10.58
12	10.40	10.22	10.04	9.86	9.68	9.50	9.32	9.14	8.96	8.78
13	8.60	8.42	8.24	8.06	7.88	7.70	7.52	7.34	7.16	6.98
14	6.80	6.62	6.44	6.26	6.08	5.90	5.72	5.54	5.36	5.18
−15	+5.00	+4.82	+4.64	+4.46	+4.28	+4.10	+3.92	+3.74	+3.56	+3.38
16	+3.20	+3.02	+2.84	+2.66	+2.48	+2.30	+2.12	+1.94	+1.76	+1.58
17	+1.40	+1.22	+1.04	+0.86	+0.68	+0.50	+0.32	+0.14	−0.04	−0.22
18	−0.40	−0.58	−0.76	−0.94	−1.12	−1.30	−1.48	−1.66	−1.84	−2.02
19	−2.20	−2.38	−2.56	−2.74	−2.92	−3.10	−3.28	−3.46	−3.64	−3.82
−20	−4.00	−4.18	−4.36	−4.54	−4.72	−4.90	−5.08	−5.26	−5.44	−5.62
21	5.80	5.98	6.16	6.34	6.52	6.70	6.88	7.06	7.24	7.42
22	7.60	7.78	7.96	8.14	8.32	8.50	8.68	8.86	9.04	9.22
23	9.40	9.58	9.76	9.94	10.12	10.30	10.48	10.66	10.84	11.02
24	11.20	11.38	11.56	11.74	11.92	12.10	12.28	12.46	12.64	12.82
−25	−13.00	−13.18	−13.36	−13.54	−13.72	−13.90	−14.08	−14.26	−14.44	−14.62
26	14.80	14.98	15.16	15.34	15.52	15.70	15.88	16.06	16.24	16.42
27	16.60	16.78	16.96	17.14	17.32	17.50	17.68	17.86	18.04	18.22
28	18.40	18.58	18.76	18.94	19.12	19.30	19.48	19.66	19.84	20.02
29	20.20	20.38	20.56	20.74	20.92	21.10	21.28	21.46	21.64	21.82
−30	−22.00	−22.18	−22.36	−22.54	−22.72	−22.90	−23.08	−23.26	−23.44	−23.62
31	23.80	23.98	24.16	24.34	24.52	24.70	24.88	25.06	25.24	25.42
32	25.60	25.78	25.96	26.14	26.32	26.50	26.68	26.86	27.04	27.22
33	27.40	27.58	27.76	27.94	28.12	28.30	28.48	28.66	28.84	29.02
34	29.20	29.38	29.56	29.74	29.92	30.10	30.28	30.46	30.64	30.82
−35	−31.00	−31.18	−31.36	−31.54	−31.72	−31.90	−32.08	−32.26	−32.44	−32.62
36	32.80	32.98	33.16	33.34	33.52	33.70	33.88	34.06	34.24	34.42
37	34.60	34.78	34.96	35.14	35.32	35.50	35.68	35.86	36.04	36.22
38	36.40	36.58	36.76	36.94	37.12	37.30	37.48	37.66	37.84	38.02
39	38.20	38.38	38.56	38.74	38.92	39.10	39.28	39.46	39.64	39.82
−40	−40.00	−40.18	−40.36	−40.54	−40.72	−40.90	−41.08	−41.26	−41.44	−41.62
41	41.80	41.98	42.16	42.34	42.52	42.70	42.88	43.06	43.24	43.42
42	43.60	43.78	43.96	44.14	44.32	44.50	44.68	44.86	45.04	45.22
43	45.40	45.58	45.76	45.94	46.12	46.30	46.48	46.66	46.84	47.02
44	47.20	47.38	47.56	47.74	47.92	48.10	48.28	48.46	48.64	48.82
−45	−49.00	−49.18	−49.36	−49.54	−49.72	−49.90	−50.08	−50.26	−50.44	−50.62
46	50.80	50.98	51.16	51.34	51.52	51.70	51.88	52.06	52.24	52.42
47	52.60	52.78	52.96	53.14	53.32	53.50	53.68	53.86	54.04	54.22
48	54.40	54.58	54.76	54.94	55.12	55.30	55.48	55.66	55.84	56.02
49	56.20	56.38	56.56	56.74	56.92	57.10	57.28	57.46	57.64	57.82
−50	−58.00	−58.18	−58.36	−58.54	−58.72	−58.90	−59.08	−59.26	−59.44	−59.62

(*continued*)

CENTIGRADE TO FAHRENHEIT

Centigrade	.0 °F.	.1 °F.	.2 °F.	.3 °F.	.4 °F.	.5 °F.	.6 °F.	.7 °F.	.8 °F.	.9 °F.
−50°	−58.00	−58.18	−58.36	−58.54	−58.72	−58.90	−59.08	−59.26	−59.44	−59.62
51	59.80	59.98	60.16	60.34	60.52	60.70	60.88	61.06	61.24	61.42
52	61.60	61.78	61.96	62.14	62.32	62.50	62.68	62.86	63.04	63.22
53	63.40	63.58	63.76	63.94	64.12	64.30	64.48	64.66	64.84	65.02
54	65.20	65.38	65.56	65.74	65.92	66.10	66.28	66.46	66.64	66.82
−55	−67.00	−67.18	−67.36	−67.54	−67.72	−67.90	−68.08	−68.26	−68.44	−68.62
56	68.80	68.98	69.16	69.34	69.52	69.70	69.88	70.06	70.24	70.42
57	70.60	70.78	70.96	71.14	71.32	71.50	71.68	71.86	72.04	72.22
58	72.40	72.58	72.76	72.94	73.12	73.30	73.48	73.66	73.84	74.02
59	74.20	74.38	74.56	74.74	74.92	75.10	75.28	75.46	75.64	75.82
−60	−76.00	−76.18	−76.36	−76.54	−76.72	−76.90	−77.08	−77.26	−77.44	−77.62
61	77.80	77.98	78.16	78.34	78.52	78.70	78.88	79.06	79.84	79.42
62	79.60	79.78	79.96	80.14	80.32	80.50	80.68	80.86	81.04	81.22
63	81.40	81.58	81.76	81.94	82.12	82.30	82.48	82.66	82.84	83.02
64	83.20	83.38	83.56	83.74	83.92	84.10	84.28	84.46	84.64	84.82
−65	−85.00	−85.18	−85.36	−85.54	−85.72	−85.90	−86.08	−86.26	−86.44	−86.62
66	86.80	86.98	87.16	87.34	87.52	87.70	87.88	88.06	88.24	88.42
67	88.60	88.78	88.96	89.14	89.32	89.50	89.68	89.86	90.04	90.22
68	90.40	90.58	90.76	90.94	91.12	91.30	91.48	91.66	91.84	92.02
69	92.20	92.38	92.56	92.74	92.92	93.10	93.28	93.46	93.64	93.82
−70	−94.00	−94.18	−94.36	−94.54	−94.72	−94.90	−95.08	−95.26	−95.44	−95.62
71	95.80	95.98	96.16	96.34	96.52	96.70	96.88	97.06	97.24	97.42
72	97.60	97.78	97.96	98.14	98.32	98.50	98.68	98.86	99.04	99.22
73	99.40	99.58	99.76	99.94	100.12	100.30	100.48	100.66	100.84	101.02
74	101.20	101.38	101.56	101.74	101.92	102.10	102.28	102.46	102.64	102.82
−75	−103.00	−103.18	−103.36	−103.54	−103.72	−103.90	−104.08	−104.26	−104.44	−104.62
76	104.80	104.98	105.16	105.34	105.52	105.70	105.88	106.06	106.24	106.42
77	106.60	106.78	106.96	107.14	107.32	107.50	107.68	107.86	108.04	108.22
78	108.40	108.58	108.76	108.94	109.12	109.30	109.48	109.66	109.84	110.02
79	110.20	110.38	110.56	110.74	110.92	111.10	111.28	111.46	111.64	111.82
−80	−112.00	−112.18	−112.36	−112.54	−112.72	−112.90	−113.08	−113.26	−113.44	−113.62
81	113.80	113.98	114.16	114.34	114.52	114.70	114.88	115.06	115.24	115.42
82	115.60	115.78	115.96	116.14	116.32	116.50	116.68	116.86	117.04	117.22
83	117.40	117.58	117.76	117.94	118.12	118.30	118.48	118.66	118.84	119.02
84	119.20	119.38	119.56	119.74	119.92	120.10	120.28	120.46	120.64	120.82
−85	−121.00	−121.18	−121.36	−121.54	−121.72	−121.90	−122.08	−122.26	−122.44	−122.62
86	122.80	122.98	123.16	123.34	123.52	123.70	123.88	124.06	124.24	124.42
87	124.60	124.78	124.96	125.14	125.32	125.50	125.68	125.86	126.04	126.22
88	126.40	126.58	126.76	126.94	127.12	127.30	127.48	127.66	127.84	128.02
89	128.20	128.38	128.56	128.74	128.92	129.10	129.28	129.46	129.64	129.82
−90	−130.00	−130.18	−130.36	−130.54	−130.72	−130.90	−131.08	−131.26	−131.44	−131.62
91	131.80	131.98	132.16	132.34	132.52	132.70	132.88	133.06	133.24	133.42
92	133.60	133.78	133.96	134.14	134.32	134.50	134.68	134.86	135.04	135.22
93	135.40	135.58	135.76	135.94	136.12	136.30	136.48	136.66	136.84	137.02
94	137.20	137.38	137.56	137.74	137.92	138.10	138.28	138.46	138.64	138.82
−95	−139.00	−139.18	−139.36	−139.54	−139.72	−139.90	−140.08	−140.26	−140.44	−140.62
96	140.80	140.98	141.16	141.34	141.52	141.70	141.88	142.06	142.24	142.42
97	142.60	142.78	142.96	143.14	143.32	143.50	143.68	143.86	144.04	144.22
98	144.40	144.58	144.76	144.94	145.12	145.30	145.48	145.66	145.84	146.02
99	146.20	146.38	146.56	146.74	146.92	147.10	147.28	147.46	147.64	147.82
−100	−148.00	−148.18	−148.36	−148.54	−148.72	−148.90	−149.08	−149.26	−149.44	−149.62

TABLE 5

DIFFERENCES FAHRENHEIT TO DIFFERENCES CENTIGRADE

Fahrenheit	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
0°	0.00	0.06	0.11	0.17	0.22	0.28	0.33	0.39	0.44	0.50
1	0.56	0.61	0.67	0.72	0.78	0.83	0.89	0.94	1.00	1.06
2	1.11	1.17	1.22	1.28	1.33	1.39	1.44	1.50	1.56	1.61
3	1.67	1.72	1.78	1.83	1.89	1.94	2.00	2.06	2.11	2.17
4	2.22	2.28	2.33	2.39	2.44	2.50	2.56	2.61	2.67	2.72
5	2.78	2.83	2.89	2.94	3.00	3.06	3.11	3.17	3.22	3.28
6	3.33	3.39	3.44	3.50	3.56	3.61	3.67	3.72	3.78	3.83
7	3.89	3.94	4.00	4.06	4.11	4.17	4.22	4.28	4.33	4.39
8	4.44	4.50	4.56	4.61	4.67	4.72	4.78	4.83	4.89	4.94
9	5.00	5.06	5.11	5.17	5.22	5.28	5.33	5.39	5.44	5.50
10	5.56	5.61	5.67	5.72	5.78	5.83	5.89	5.94	6.00	6.06
11	6.11	6.17	6.22	6.28	6.33	6.39	6.44	6.50	6.56	6.61
12	6.67	6.72	6.78	6.83	6.89	6.94	7.00	7.06	7.11	7.17
13	7.22	7.28	7.33	7.39	7.44	7.50	7.56	7.61	7.67	7.72
14	7.78	7.83	7.89	7.94	8.00	8.06	8.11	8.17	8.22	8.28
15	8.33	8.39	8.44	8.50	8.56	8.61	8.67	8.72	8.78	8.83
16	8.89	8.94	9.00	9.06	9.11	9.17	9.22	9.28	9.33	9.39
17	9.44	9.50	9.56	9.61	9.67	9.72	9.78	9.83	9.89	9.94
18	10.00	10.06	10.11	10.17	10.22	10.28	10.33	10.39	10.44	10.50
19	10.56	10.61	10.67	10.72	10.78	10.83	10.89	10.94	11.00	11.06
20	11.11	11.17	11.22	11.28	11.33	11.39	11.44	11.50	11.56	11.61

TABLE 6

DIFFERENCES CENTIGRADE TO DIFFERENCES FAHRENHEIT

Centigrade	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
0°	0.00	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62
1	1.80	1.98	2.16	2.34	2.52	2.70	2.88	3.06	3.24	3.42
2	3.60	3.78	3.96	4.14	4.32	4.50	4.68	4.86	5.04	5.22
3	5.40	5.58	5.76	5.94	6.12	6.30	6.48	6.66	6.84	7.02
4	7.20	7.38	7.56	7.74	7.92	8.10	8.28	8.46	8.64	8.82
5	9.00	9.18	9.36	9.54	9.72	9.90	10.08	10.26	10.44	10.62
6	10.80	10.98	11.16	11.34	11.52	11.70	11.88	12.06	12.24	12.42
7	12.60	12.78	12.96	13.14	13.32	13.50	13.68	13.86	14.04	14.22
8	14.40	14.58	14.76	14.94	15.12	15.30	15.48	15.66	15.84	16.02
9	16.20	16.38	16.56	16.74	16.92	17.10	17.28	17.46	17.64	17.82

Table 7

CENTIGRADE DEGREES PER KILOMETER TO FAHRENHEIT DEGREES PER 1000 FEET

$$1\ \frac{°C.}{km.} = 0.54864\ \frac{°F.}{1000\ ft.}$$

°C./km.	.0 °F./1000 ft.	.1 °F./1000 ft.	.2 °F./1000 ft.	.3 °F./1000 ft.	.4 °F./1000 ft.	.5 °F./1000 ft.	.6 °F./1000 ft.	.7 °F./1000 ft.	.8 °F./1000 ft.	.9 °F./1000 ft.
0	0.00	0.05	0.11	0.16	0.22	0.27	0.33	0.38	0.44	0.49
1	0.55	0.60	0.66	0.71	0.77	0.82	0.88	0.93	0.99	1.04
2	1.10	1.15	1.21	1.26	1.32	1.37	1.43	1.48	1.54	1.59
3	1.65	1.70	1.76	1.81	1.87	1.92	1.98	2.03	2.08	2.14
4	2.19	2.25	2.30	2.36	2.41	2.47	2.52	2.58	2.63	2.69
5	2.74	2.80	2.85	2.91	2.96	3.02	3.07	3.13	3.18	3.24
6	3.29	3.35	3.40	3.46	3.51	3.57	3.62	3.68	3.73	3.79
7	3.84	3.90	3.95	4.01	4.06	4.11	4.17	4.22	4.28	4.33
8	4.39	4.44	4.50	4.55	4.61	4.66	4.72	4.77	4.83	4.88
9	4.94	4.99	5.05	5.10	5.16	5.21	5.27	5.32	5.38	5.43

Table 8

FAHRENHEIT DEGREES PER 1000 FEET TO CENTIGRADE DEGREES PER KILOMETER

$$1\ \frac{°F.}{1000\ ft.} = 1.82269\ \frac{°C.}{km.}$$

°F./1000 ft.	.0 °C./km.	.1 °C./km.	.2 °C./km.	.3 °C./km.	.4 °C./km.	.5 °C./km.	.6 °C./km.	.7 °C./km.	.8 °C./km.	.9 °C./km.
0	0.00	0.18	0.36	0.55	0.73	0.91	1.09	1.28	1.46	1.64
1	1.82	2.00	2.19	2.37	2.55	2.73	2.92	3.10	3.28	3.46
2	3.65	3.83	4.01	4.19	4.37	4.56	4.74	4.92	5.10	5.29
3	5.47	5.65	5.83	6.01	6.20	6.38	6.56	6.74	6.93	7.11
4	7.29	7.47	7.66	7.84	8.02	8.20	8.38	8.57	8.75	8.93
5	9.11	9.30	9.48	9.66	9.84	10.02	10.21	10.39	10.57	10.75
6	10.94	11.12	11.30	11.48	11.67	11.85	12.03	12.21	12.39	12.58
7	12.76	12.94	13.12	13.31	13.49	13.67	13.85	14.03	14.22	14.40
8	14.58	14.76	14.95	15.13	15.31	15.49	15.68	15.86	16.04	16.22
9	16.40	16.59	16.77	16.95	17.13	17.32	17.50	17.68	17.86	18.04

TABLE 9

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
0.00	0.00	0.34	0.68	1.02	1.35	1.69	2.03	2.37	2.71	3.05
.10	3.39	3.73	4.06	4.40	4.74	5.08	5.42	5.76	6.10	6.43
.20	6.77	7.11	7.45	7.79	8.13	8.47	8.80	9.14	9.48	9.82
.30	10.16	10.50	10.84	11.18	11.51	11.85	12.19	12.53	12.87	13.21
.40	13.55	13.88	14.22	14.56	14.90	15.24	15.58	15.92	16.25	16.59
0.50	16.93	17.27	17.61	17.95	18.29	18.63	18.96	19.30	19.64	19.98
.60	20.32	20.66	21.00	21.33	21.67	22.01	22.35	22.69	23.03	23.37
.70	23.70	24.04	24.38	24.72	25.06	25.40	25.74	26.08	26.41	26.75
.80	27.09	27.43	27.77	28.11	28.45	28.78	29.12	29.46	29.80	30.14
.90	30.48	30.82	31.15	31.49	31.83	32.17	32.51	32.85	33.19	33.53
1.00	33.86	34.20	34.54	34.88	35.22	35.56	35.90	36.23	36.57	36.91
1.10	37.25	37.59	37.93	38.27	38.60	38.94	39.28	39.62	39.96	40.30
1.20	40.64	40.98	41.31	41.65	41.99	42.33	42.67	43.01	43.35	43.68
1.30	44.02	44.36	44.70	45.04	45.38	45.72	46.05	46.39	46.73	47.07
1.40	47.41	47.75	48.09	48.43	48.76	49.10	49.44	49.78	50.12	50.46
1.50	50.80	51.13	51.47	51.81	52.15	52.49	52.83	53.17	53.50	53.84
1.60	54.18	54.52	54.86	55.20	55.54	55.88	56.21	56.55	56.89	57.23
1.70	57.57	57.91	58.25	58.58	58.92	59.26	59.60	59.94	60.28	60.62
1.80	60.96	61.29	61.63	61.97	62.31	62.65	62.99	63.33	63.66	64.00
1.90	64.34	64.68	65.02	65.36	65.70	66.03	66.37	66.71	67.05	67.39
2.00	67.73	68.07	68.41	68.74	69.08	69.42	69.76	70.10	70.44	70.78
2.10	71.11	71.45	71.79	72.13	72.47	72.81	73.15	73.48	73.82	74.16
2.20	74.50	74.84	75.18	75.52	75.86	76.19	76.53	76.87	77.21	77.55
2.30	77.89	78.23	78.56	78.90	79.24	79.58	79.92	80.26	80.60	80.93
2.40	81.27	81.61	81.95	82.29	82.63	82.97	83.31	83.64	83.98	84.32
2.50	84.66	85.00	85.34	85.68	86.01	86.35	86.69	87.03	87.37	87.71
2.60	88.05	88.38	88.72	89.06	89.40	89.74	90.08	90.42	90.76	91.09
2.70	91.43	91.77	92.11	92.45	92.79	93.13	93.46	93.80	94.14	94.48
2.80	94.82	95.16	95.50	95.83	96.17	96.51	96.85	97.19	97.53	97.87
2.90	98.21	98.54	98.88	99.22	99.56	99.90	100.24	100.58	100.91	101.25
3.00	101.59	101.93	102.27	102.61	102.95	103.28	103.62	103.96	104.30	104.64
3.10	104.98	105.32	105.66	105.99	106.33	106.67	107.01	107.35	107.69	108.03
3.20	108.36	108.70	109.04	109.38	109.72	110.06	110.40	110.73	111.07	111.41
3.30	111.75	112.09	112.43	112.77	113.11	113.44	113.78	114.12	114.46	114.80
3.40	115.14	115.48	115.81	116.15	116.49	116.83	117.17	117.51	117.85	118.18
3.50	118.52	118.86	119.20	119.54	119.88	120.22	120.56	120.89	121.23	121.57
3.60	121.91	122.25	122.59	122.93	123.26	123.60	123.94	124.28	124.62	124.96
3.70	125.30	125.64	125.97	126.31	126.65	126.99	127.33	127.67	128.01	128.34
3.80	128.68	129.02	129.36	129.70	130.04	130.38	130.71	131.05	131.39	131.73
3.90	132.07	132.41	132.75	133.09	133.42	133.76	134.10	134.44	134.78	135.12
4.00	135.46	135.79	136.13	136.47	136.81	137.15	137.49	137.83	138.16	138.50
4.10	138.84	139.18	139.52	139.86	140.20	140.54	140.87	141.21	141.55	141.89
4.20	142.23	142.57	142.91	143.24	143.58	143.92	144.26	144.60	144.94	145.28
4.30	145.61	145.95	146.29	146.63	146.97	147.31	147.65	147.99	148.32	148.66
4.40	149.00	149.34	149.68	150.02	150.36	150.69	151.03	151.37	151.71	152.05
4.50	152.39	152.73	153.06	153.40	153.74	154.08	154.42	154.76	155.10	155.44
4.60	155.77	156.11	156.45	156.79	157.13	157.47	157.81	158.14	158.48	158.82
4.70	159.16	159.50	159.84	160.18	160.51	160.85	161.19	161.53	161.87	162.21
4.80	162.55	162.89	163.22	163.56	163.90	164.24	164.58	164.92	165.26	165.59
4.90	165.93	166.27	166.61	166.95	167.29	167.63	167.96	168.30	168.64	168.98
5.00	169.32	169.66	170.00	170.34	170.67	171.01	171.35	171.69	172.03	172.37

(*continued*)

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
5.00	169.32	169.66	170.00	170.34	170.67	171.01	171.35	171.69	172.03	172.37
5.10	172.71	173.04	173.38	173.72	174.06	174.40	174.74	175.08	175.41	175.75
5.20	176.09	176.43	176.77	177.11	177.45	177.79	178.12	178.46	178.80	179.14
5.30	179.48	179.82	180.16	180.49	180.83	181.17	181.51	181.85	182.19	182.53
5.40	182.87	183.20	183.54	183.88	184.22	184.56	184.90	185.24	185.57	185.91
5.50	186.25	186.59	186.93	187.27	187.61	187.94	188.28	188.62	188.96	189.30
5.60	189.64	189.98	190.32	190.65	190.99	191.33	191.67	192.01	192.35	192.69
5.70	193.02	193.36	193.70	194.04	194.38	194.72	195.06	195.39	195.73	196.07
5.80	196.41	196.75	197.09	197.43	197.77	198.10	198.44	198.78	199.12	199.46
5.90	199.80	200.14	200.47	200.81	201.15	201.49	201.83	202.17	202.51	202.84
6.00	203.18	203.52	203.86	204.20	204.54	204.88	205.22	205.55	205.89	206.23
6.10	206.57	206.91	207.25	207.59	207.92	208.26	208.60	208.94	209.28	209.62
6.20	209.96	210.29	210.63	210.97	211.31	211.65	211.99	212.33	212.67	213.00
6.30	213.34	213.68	214.02	214.36	214.70	215.04	215.37	215.71	216.05	216.39
6.40	216.73	217.07	217.41	217.74	218.08	218.42	218.76	219.10	219.44	219.78
6.50	220.12	220.45	220.79	221.13	221.47	221.81	222.15	222.49	222.82	223.16
6.60	223.50	223.84	224.18	224.52	224.86	225.19	225.53	225.87	226.21	226.55
6.70	226.89	227.23	227.57	227.90	228.24	228.58	228.92	229.26	229.60	229.94
6.80	230.27	230.61	230.95	231.29	231.63	231.97	232.31	232.64	232.98	233.32
6.90	233.66	234.00	234.34	234.68	235.02	235.35	235.69	236.03	236.37	236.71
7.00	237.05	237.39	237.72	238.06	238.40	238.74	239.08	239.42	239.76	240.09
7.10	240.43	240.77	241.11	241.45	241.79	242.13	242.47	242.80	243.14	243.48
7.20	243.82	244.16	244.50	244.84	245.17	245.51	245.85	246.19	246.53	246.87
7.30	247.21	247.55	247.88	248.22	248.56	248.90	249.24	249.58	249.92	250.25
7.40	250.59	250.93	251.27	251.61	251.95	252.29	252.62	252.96	253.30	253.64
7.50	253.98	254.32	254.66	255.00	255.33	255.67	256.01	256.35	256.69	257.03
7.60	257.37	257.70	258.04	258.38	258.72	259.06	259.40	259.74	260.07	260.41
7.70	260.75	261.09	261.43	261.77	262.11	262.45	262.78	263.12	263.46	263.80
7.80	264.14	264.48	264.82	265.15	265.49	265.83	266.17	266.51	266.85	267.19
7.90	267.52	267.86	268.20	268.54	268.88	269.22	269.56	269.90	270.23	270.57
8.00	270.91	271.25	271.59	271.93	272.27	272.60	272.94	273.28	273.62	273.96
8.10	274.30	274.64	274.97	275.31	275.65	275.99	276.33	276.67	277.01	277.35
8.20	277.68	278.02	278.36	278.70	279.04	279.38	279.72	280.05	280.39	280.73
8.30	281.07	281.41	281.75	282.09	282.42	282.76	283.10	283.44	283.78	284.12
8.40	284.46	284.80	285.13	285.47	285.81	286.15	286.49	286.83	287.17	287.50
8.50	287.84	288.18	288.52	288.86	289.20	289.54	289.87	290.21	290.55	290.89
8.60	291.23	291.57	291.91	292.25	292.58	292.92	293.26	293.60	293.94	294.28
8.70	294.62	294.95	295.29	295.63	295.97	296.31	296.65	296.99	297.32	297.66
8.80	298.00	298.34	298.68	299.02	299.36	299.70	300.03	300.37	300.71	301.05
8.90	301.39	301.73	302.07	302.40	302.74	303.08	303.42	303.76	304.10	304.44
9.00	304.78	305.11	305.45	305.79	306.13	306.47	306.81	307.15	307.48	307.82
9.10	308.16	308.50	308.84	309.18	309.52	309.85	310.19	310.53	310.87	311.21
9.20	311.55	311.89	312.23	312.56	312.90	313.24	313.58	313.92	314.26	314.60
9.30	314.93	315.27	315.61	315.95	316.29	316.63	316.97	317.30	317.64	317.98
9.40	318.32	318.66	319.00	319.34	319.68	320.01	320.35	320.69	321.03	321.37
9.50	321.71	322.05	322.38	322.72	323.06	323.40	323.74	324.08	324.42	324.75
9.60	325.09	325.43	325.77	326.11	326.45	326.79	327.13	327.46	327.80	328.14
9.70	328.48	328.82	329.16	329.50	329.83	330.17	330.51	330.85	331.19	331.53
9.80	331.87	332.20	332.54	332.88	333.22	333.56	333.90	334.24	334.58	334.91
9.90	335.25	335.59	335.93	336.27	336.61	336.95	337.28	337.62	337.96	338.30
10.00	338.64	338.98	339.32	339.65	339.99	340.33	340.67	341.01	341.35	341.69

(*continued*)

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
10.00	338.64	338.98	339.32	339.65	339.99	340.33	340.67	341.01	341.35	341.69
10.10	342.03	342.36	342.70	343.04	343.38	343.72	344.06	344.40	344.73	345.07
10.20	345.41	345.75	346.09	346.43	346.77	347.10	347.44	347.78	348.12	348.46
10.30	348.80	349.14	349.48	349.81	350.15	350.49	350.83	351.17	351.51	351.85
10.40	352.18	352.52	352.86	353.20	353.54	353.88	354.22	354.55	354.89	355.23
10.50	355.57	355.91	356.25	356.59	356.93	357.26	357.60	357.94	358.28	358.62
10.60	358.96	359.30	359.63	359.97	360.31	360.65	360.99	361.33	361.67	362.00
10.70	362.34	362.68	363.02	363.36	363.70	364.04	364.38	364.71	365.05	365.39
10.80	365.73	366.07	366.41	366.75	367.08	367.42	367.76	368.10	368.44	368.78
10.90	369.12	369.46	369.79	370.13	370.47	370.81	371.15	371.49	371.83	372.16
11.00	372.50	372.84	373.18	373.52	373.86	374.20	374.53	374.87	375.21	375.55
11.10	375.89	376.23	376.57	376.91	377.24	377.58	377.92	378.26	378.60	378.94
11.20	379.28	379.61	379.95	380.29	380.63	380.97	381.31	381.65	381.98	382.32
11.30	382.66	383.00	383.34	383.68	384.02	384.36	384.69	385.03	385.37	385.71
11.40	386.05	386.39	386.73	387.06	387.40	387.74	388.08	388.42	388.76	389.10
11.50	389.43	389.77	390.11	390.45	390.79	391.13	391.47	391.81	392.14	392.48
11.60	392.82	393.16	393.50	393.84	394.18	394.51	394.85	395.19	395.53	395.87
11.70	396.21	396.55	396.88	397.22	397.56	397.90	398.24	398.58	398.92	399.26
11.80	399.59	399.93	400.27	400.61	400.95	401.29	401.63	401.96	402.30	402.64
11.90	402.98	403.32	403.66	404.00	404.33	404.67	405.01	405.35	405.69	406.03
12.00	406.37	406.71	407.04	407.38	407.72	408.06	408.40	408.74	409.08	409.41
12.10	409.75	410.09	410.43	410.77	411.11	411.45	411.78	412.12	412.46	412.80
12.20	413.14	413.48	413.82	414.16	414.49	414.83	415.17	415.51	415.85	416.19
12.30	416.53	416.86	417.20	417.54	417.88	418.22	418.56	418.90	419.23	419.57
12.40	419.91	420.25	420.59	420.93	421.27	421.61	421.94	422.28	422.62	422.96
12.50	423.30	423.64	423.98	424.31	424.65	424.99	425.33	425.67	426.01	426.35
12.60	426.69	427.02	427.36	427.70	428.04	428.38	428.72	429.06	429.39	429.73
12.70	430.07	430.41	430.75	431.09	431.43	431.76	432.10	432.44	432.78	433.12
12.80	433.46	433.80	434.14	434.47	434.81	435.15	435.49	435.83	436.17	436.51
12.90	436.84	437.18	437.52	437.86	438.20	438.54	438.88	439.21	439.55	439.89
13.00	440.23	440.57	440.91	441.25	441.59	441.92	442.26	442.60	442.94	443.28
13.10	443.62	443.96	444.29	444.63	444.97	445.31	445.65	445.99	446.33	446.66
13.20	447.00	447.34	447.68	448.02	448.36	448.70	449.04	449.37	449.71	450.05
13.30	450.39	450.73	451.07	451.41	451.74	452.08	452.42	452.76	453.10	453.44
13.40	453.78	454.11	454.45	454.79	455.13	455.47	455.81	456.15	456.49	456.82
13.50	457.16	457.50	457.84	458.18	458.52	458.86	459.19	459.53	459.87	460.21
13.60	460.55	460.89	461.23	461.56	461.90	462.24	462.58	462.92	463.26	463.60
13.70	463.94	464.27	464.61	464.95	465.29	465.63	465.97	466.31	466.64	466.98
13.80	467.32	467.66	468.00	468.34	468.68	469.01	469.35	469.69	470.03	470.37
13.90	470.71	471.05	471.39	471.72	472.06	472.40	472.74	473.08	473.42	473.76
14.00	474.09	474.43	474.77	475.11	475.45	475.79	476.13	476.46	476.80	477.14
14.10	477.48	477.82	478.16	478.50	478.84	479.17	479.51	479.85	480.19	480.53
14.20	480.87	481.21	481.54	481.88	482.22	482.56	482.90	483.24	483.58	483.91
14.30	484.25	484.59	484.93	485.27	485.61	485.95	486.29	486.62	486.96	487.30
14.40	487.64	487.98	488.32	488.66	488.99	489.33	489.67	490.01	490.35	490.69
14.50	491.03	491.37	491.70	492.04	492.38	492.72	493.06	493.40	493.74	494.07
14.60	494.41	494.75	495.09	495.43	495.77	496.11	496.44	496.78	497.12	497.46
14.70	497.80	498.14	498.48	498.82	499.15	499.49	499.83	500.17	500.51	500.85
14.80	501.19	501.52	501.86	502.20	502.54	502.88	503.22	503.56	503.89	504.23
14.90	504.57	504.91	505.25	505.59	505.93	506.27	506.60	506.94	507.28	507.62
15.00	507.96	508.30	508.64	508.97	509.31	509.65	509.99	510.33	510.67	511.01

(*continued*)

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
15.00	507.96	508.30	508.64	508.97	509.31	509.65	509.99	510.33	510.67	511.01
15.10	511.34	511.68	512.02	512.36	512.70	513.04	513.38	513.72	514.05	514.39
15.20	514.73	515.07	515.41	515.75	516.09	516.42	516.76	517.10	517.44	517.78
15.30	518.12	518.46	518.79	519.13	519.47	519.81	520.15	520.49	520.83	521.17
15.40	521.50	521.84	522.18	522.52	522.86	523.20	523.54	523.87	524.21	524.55
15.50	524.89	525.23	525.57	525.91	526.24	526.58	526.92	527.26	527.60	527.94
15.60	528.28	528.62	528.95	529.29	529.63	529.97	530.31	530.65	530.99	531.32
15.70	531.66	532.00	532.34	532.68	533.02	533.36	533.69	534.03	534.37	534.71
15.80	535.05	535.39	535.73	536.07	536.40	536.74	537.08	537.42	537.76	538.10
15.90	538.44	538.77	539.11	539.45	539.79	540.13	540.47	540.81	541.14	541.48
16.00	541.82	542.16	542.50	542.84	543.18	543.52	543.85	544.19	544.53	544.87
16.10	545.21	545.55	545.89	546.22	546.56	546.90	547.24	547.58	547.92	548.26
16.20	548.60	548.93	549.27	549.61	549.95	550.29	550.63	550.97	551.30	551.64
16.30	551.98	552.32	552.66	553.00	553.34	553.67	554.01	554.35	554.69	555.03
16.40	555.37	555.71	556.05	556.38	556.72	557.06	557.40	557.74	558.08	558.42
16.50	558.75	559.09	559.43	559.77	560.11	560.45	560.79	561.12	561.46	561.80
16.60	562.14	562.48	562.82	563.16	563.50	563.83	564.17	564.51	564.85	565.19
16.70	565.53	565.87	566.20	566.54	566.88	567.22	567.56	567.90	568.24	568.57
16.80	568.91	569.25	569.59	569.93	570.27	570.61	570.95	571.28	571.62	571.96
16.90	572.30	572.64	572.98	573.32	573.65	573.99	574.33	574.67	575.01	575.35
17.00	575.69	576.02	576.36	576.70	577.04	577.38	577.72	578.06	578.40	578.73
17.10	579.07	579.41	579.75	580.09	580.43	580.77	581.10	581.44	581.78	582.12
17.20	582.46	582.80	583.14	583.47	583.81	584.15	584.49	584.83	585.17	585.51
17.30	585.85	586.18	586.52	586.86	587.20	587.54	587.88	588.22	588.55	588.89
17.40	589.23	589.57	589.91	590.25	590.59	590.92	591.26	591.60	591.94	592.28
17.50	592.62	592.96	593.30	593.63	593.97	594.31	594.65	594.99	595.33	595.67
17.60	596.00	596.34	596.68	597.02	597.36	597.70	598.04	598.37	598.71	599.05
17.70	599.39	599.73	600.07	600.41	600.75	601.08	601.42	601.76	602.10	602.44
17.80	602.78	603.12	603.45	603.79	604.13	604.47	604.81	605.15	605.49	605.82
17.90	606.16	606.50	606.84	607.18	607.52	607.86	608.20	608.53	608.87	609.21
18.00	609.55	609.89	610.23	610.57	610.90	611.24	611.58	611.92	612.26	612.60
18.10	612.94	613.28	613.61	613.95	614.29	614.63	614.97	615.31	615.65	615.98
18.20	616.32	616.66	617.00	617.34	617.68	618.02	618.35	618.69	619.03	619.37
18.30	619.71	620.05	620.39	620.73	621.06	621.40	621.74	622.08	622.42	622.76
18.40	623.10	623.43	623.77	624.11	624.45	624.79	625.13	625.47	625.80	626.14
18.50	626.48	626.82	627.16	627.50	627.84	628.18	628.51	628.85	629.19	629.53
18.60	629.87	630.21	630.55	630.88	631.22	631.56	631.90	632.24	632.58	632.92
18.70	633.25	633.59	633.93	634.27	634.61	634.95	635.29	635.63	635.96	636.30
18.80	636.64	636.98	637.32	637.66	638.00	638.33	638.67	639.01	639.35	639.69
18.90	640.03	640.37	640.70	641.04	641.38	641.72	642.06	642.40	642.74	643.08
19.00	643.41	643.75	644.09	644.43	644.77	645.11	645.45	645.78	646.12	646.46
19.10	646.80	647.14	647.48	647.82	648.15	648.49	648.83	649.17	649.51	649.85
19.20	650.19	650.53	650.86	651.20	651.54	651.88	652.22	652.56	652.90	653.23
19.30	653.57	653.91	654.25	654.59	654.93	655.27	655.60	655.94	656.28	656.62
19.40	656.96	657.30	657.64	657.98	658.31	658.65	658.99	659.33	659.67	660.01
19.50	660.35	660.68	661.02	661.36	661.70	662.04	662.38	662.72	663.05	663.39
19.60	663.73	664.07	664.41	664.75	665.09	665.43	665.76	666.10	666.44	666.78
19.70	667.12	667.46	667.80	668.13	668.47	668.81	669.15	669.49	669.83	670.17
19.80	670.51	670.84	671.18	671.52	671.86	672.20	672.54	672.88	673.21	673.55
19.90	673.89	674.23	674.57	674.91	675.25	675.58	675.92	676.26	676.60	676.94
20.00	677.28	677.62	677.96	678.29	678.63	678.97	679.31	679.65	679.99	680.33

(*continued*)

Proportional parts	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

Table 9 (continued)

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00 mb.	.01 mb.	.02 mb.	.03 mb.	.04 mb.	.05 mb.	.06 mb.	.07 mb.	.08 mb.	.09 mb.
20.00	677.28	677.62	677.96	678.29	678.63	678.97	679.31	679.65	679.99	680.33
20.10	680.66	681.00	681.34	681.68	682.02	682.36	682.70	683.03	683.37	683.71
20.20	684.05	684.39	684.73	685.07	685.41	685.74	686.08	686.42	686.76	687.10
20.30	687.44	687.78	688.11	688.45	688.79	689.13	689.47	689.81	690.15	690.48
20.40	690.82	691.16	691.50	691.84	692.18	692.52	692.86	693.19	693.53	693.87
20.50	694.21	694.55	694.89	695.23	695.56	695.90	696.24	696.58	696.92	697.26
20.60	697.60	697.93	698.27	698.61	698.95	699.29	699.63	699.97	700.31	700.64
20.70	700.98	701.32	701.66	702.00	702.34	702.68	703.01	703.35	703.69	704.03
20.80	704.37	704.71	705.05	705.38	705.72	706.06	706.40	706.74	707.08	707.42
20.90	707.76	708.09	708.43	708.77	709.11	709.45	709.79	710.13	710.46	710.80
21.00	711.14	711.48	711.82	712.16	712.50	712.83	713.17	713.51	713.85	714.19
21.10	714.53	714.87	715.21	715.54	715.88	716.22	716.56	716.90	717.24	717.58
21.20	717.91	718.25	718.59	718.93	719.27	719.61	719.95	720.28	720.62	720.96
21.30	721.30	721.64	721.98	722.32	722.66	722.99	723.33	723.67	724.01	724.35
21.40	724.69	725.03	725.36	725.70	726.04	726.38	726.72	727.06	727.40	727.73
21.50	728.07	728.41	728.75	729.09	729.43	729.77	730.11	730.44	730.78	731.12
21.60	731.46	731.80	732.14	732.48	732.81	733.15	733.49	733.83	734.17	734.51
21.70	734.85	735.19	735.52	735.86	736.20	736.54	736.88	737.22	737.56	737.89
21.80	738.23	738.57	738.91	739.25	739.59	739.93	740.26	740.60	740.94	741.28
21.90	741.62	741.96	742.30	742.64	742.97	743.31	743.65	743.99	744.33	744.67
22.00	745.01	745.34	745.68	746.02	746.36	746.70	747.04	747.38	747.71	748.05
22.10	748.39	748.73	749.07	749.41	749.75	750.09	750.42	750.76	751.10	751.44
22.20	751.78	752.12	752.46	752.79	753.13	753.47	753.81	754.15	754.49	754.83
22.30	755.16	755.50	755.84	756.18	756.52	756.86	757.20	757.54	757.87	758.21
22.40	758.55	758.89	759.23	759.57	759.91	760.24	760.58	760.92	761.26	761.60
22.50	761.94	762.28	762.61	762.95	763.29	763.63	763.97	764.31	764.65	764.99
22.60	765.32	765.66	766.00	766.34	766.68	767.02	767.36	767.69	768.03	768.37
22.70	768.71	769.05	769.39	769.73	770.06	770.40	770.74	771.08	771.42	771.76
22.80	772.10	772.44	772.77	773.11	773.45	773.79	774.13	774.47	774.81	775.14
22.90	775.48	775.82	776.16	776.50	776.84	777.18	777.51	777.85	778.19	778.53
23.00	778.87	779.21	779.55	779.89	780.22	780.56	780.90	781.24	781.58	781.92
23.10	782.26	782.59	782.93	783.27	783.61	783.95	784.29	784.63	784.96	785.30
23.20	785.64	785.98	786.32	786.66	787.00	787.34	787.67	788.01	788.35	788.69
23.30	789.03	789.37	789.71	790.04	790.38	790.72	791.06	791.40	791.74	792.08
23.40	792.42	792.75	793.09	793.43	793.77	794.11	794.45	794.79	795.12	795.46
23.50	795.80	796.14	796.48	796.82	797.16	797.49	797.83	798.17	798.51	798.85
23.60	799.19	799.53	799.87	800.20	800.54	800.88	801.22	801.56	801.90	802.24
23.70	802.57	802.91	803.25	803.59	803.93	804.27	804.61	804.94	805.28	805.62
23.80	805.96	806.30	806.64	806.98	807.32	807.65	807.99	808.33	808.67	809.01
23.90	809.35	809.69	810.02	810.36	810.70	811.04	811.38	811.72	812.06	812.39
24.00	812.73	813.07	813.41	813.75	814.09	814.43	814.77	815.10	815.44	815.78
24.10	816.12	816.46	816.80	817.14	817.47	817.81	818.15	818.49	818.83	819.17
24.20	819.51	819.84	820.18	820.52	820.86	821.20	821.54	821.88	822.22	822.55
24.30	822.89	823.23	823.57	823.91	824.25	824.59	824.92	825.26	825.60	825.94
24.40	826.28	826.62	826.96	827.29	827.63	827.97	828.31	828.65	828.99	829.33
24.50	829.67	830.00	830.34	830.68	831.02	831.36	831.70	832.04	832.37	832.71
24.60	833.05	833.39	833.73	834.07	834.41	834.74	835.08	835.42	835.76	836.10
24.70	836.44	836.78	837.12	837.45	837.79	838.13	838.47	838.81	839.15	839.49
24.80	839.82	840.16	840.50	840.84	841.18	841.52	841.86	842.19	842.53	842.87
24.90	843.21	843.55	843.89	844.23	844.57	844.90	845.24	845.58	845.92	846.26
25.00	846.60	846.94	847.27	847.61	847.95	848.29	848.63	848.97	849.31	849.65

(*continued*)

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00 mb.	.01 mb.	.02 mb.	.03 mb.	.04 mb.	.05 mb.	.06 mb.	.07 mb.	.08 mb.	.09 mb.
25.00	846.60	846.94	847.27	847.61	847.95	848.29	848.63	848.97	849.31	849.65
25.10	849.98	850.32	850.66	851.00	851.34	851.68	852.02	852.35	852.69	853.03
25.20	853.37	853.71	854.05	854.39	854.72	855.06	855.40	855.74	856.08	856.42
25.30	856.76	857.10	857.43	857.77	858.11	858.45	858.79	859.13	859.47	859.80
25.40	860.14	860.48	860.82	861.16	861.50	861.84	862.17	862.51	862.85	863.19
25.50	863.53	863.87	864.21	864.55	864.88	865.22	865.56	865.90	866.24	866.58
25.60	866.92	867.25	867.59	867.93	868.27	868.61	868.95	869.29	869.62	869.96
25.70	870.30	870.64	870.98	871.32	871.66	872.00	872.33	872.67	873.01	873.35
25.80	873.69	874.03	874.37	874.70	875.04	875.38	875.72	876.06	876.40	876.74
25.90	877.07	877.41	877.75	878.09	878.43	878.77	879.11	879.45	879.78	880.12
26.00	880.46	880.80	881.14	881.48	881.82	882.15	882.49	882.83	883.17	883.51
26.10	883.85	884.19	884.52	884.86	885.20	885.54	885.88	886.22	886.56	886.90
26.20	887.23	887.57	887.91	888.25	888.59	888.93	889.27	889.60	889.94	890.28
26.30	890.62	890.96	891.30	891.64	891.97	892.31	892.65	892.99	893.33	893.67
26.40	894.01	894.35	894.68	895.02	895.36	895.70	896.04	896.38	896.72	897.05
26.50	897.39	897.73	898.07	898.41	898.75	899.09	899.42	899.76	900.10	900.44
26.60	900.78	901.12	901.46	901.80	902.13	902.47	902.81	903.15	903.49	903.83
26.70	904.17	904.50	904.84	905.18	905.52	905.86	906.20	906.54	906.87	907.21
26.80	907.55	907.89	908.23	908.57	908.91	909.25	909.58	909.92	910.26	910.60
26.90	910.94	911.28	911.62	911.95	912.29	912.63	912.97	913.31	913.65	913.99
27.00	914.33	914.66	915.00	915.34	915.68	916.02	916.36	916.70	917.03	917.37
27.10	917.71	918.05	918.39	918.73	919.07	919.40	919.74	920.08	920.42	920.76
27.20	921.10	921.44	921.78	922.11	922.45	922.79	923.13	923.47	923.81	924.15
27.30	924.48	924.82	925.16	925.50	925.84	926.18	926.52	926.85	927.19	927.53
27.40	927.87	928.21	928.55	928.89	929.23	929.56	929.90	930.24	930.58	930.92
27.50	931.26	931.60	931.93	932.27	932.61	932.95	933.29	933.63	933.97	934.30
27.60	934.64	934.98	935.32	935.66	936.00	936.34	936.68	937.01	937.35	937.69
27.70	938.03	938.37	938.71	939.05	939.38	939.72	940.06	940.40	940.74	941.08
27.80	941.42	941.75	942.09	942.43	942.77	943.11	943.45	943.79	944.13	944.46
27.90	944.80	945.14	945.48	945.82	946.16	946.50	946.83	947.17	947.51	947.85
28.00	948.19	948.53	948.87	949.20	949.54	949.88	950.22	950.56	950.90	951.24
28.10	951.58	951.91	952.25	952.59	952.93	953.27	953.61	953.95	954.28	954.62
28.20	954.96	955.30	955.64	955.98	956.32	956.65	956.99	957.33	957.67	958.01
28.30	958.35	958.69	959.03	959.36	959.70	960.04	960.38	960.72	961.06	961.40
28.40	961.73	962.07	962.41	962.75	963.09	963.43	963.77	964.10	964.44	964.78
28.50	965.12	965.46	965.80	966.14	966.48	966.81	967.15	967.49	967.83	968.17
28.60	968.51	968.85	969.18	969.52	969.86	970.20	970.54	970.88	971.22	971.56
28.70	971.89	972.23	972.57	972.91	973.25	973.59	973.93	974.26	974.60	974.94
28.80	975.28	975.62	975.96	976.30	976.63	976.97	977.31	977.65	977.99	978.33
28.90	978.67	979.01	979.34	979.68	980.02	980.36	980.70	981.04	981.38	981.71
29.00	982.05	982.39	982.73	983.07	983.41	983.75	984.08	984.42	984.76	985.10
29.10	985.44	985.78	986.12	986.46	986.79	987.13	987.47	987.81	988.15	988.49
29.20	988.83	989.16	989.50	989.84	990.18	990.52	990.86	991.20	991.53	991.87
29.30	992.21	992.55	992.89	993.23	993.57	993.91	994.24	994.58	994.92	995.26
29.40	995.60	995.94	996.28	996.61	996.95	997.29	997.63	997.97	998.31	998.65
29.50	998.98	999.32	999.66	1000.00	1000.34	1000.68	1001.02	1001.36	1001.69	1002.03
29.60	1002.37	1002.71	1003.05	1003.39	1003.73	1004.06	1004.40	1004.74	1005.08	1005.42
29.70	1005.76	1006.10	1006.43	1006.77	1007.11	1007.45	1007.79	1008.13	1008.47	1008.81
29.80	1009.14	1009.48	1009.82	1010.16	1010.50	1010.84	1011.18	1011.51	1011.85	1012.19
29.90	1012.53	1012.87	1013.21	1013.55	1013.88	1014.22	1014.56	1014.90	1015.24	1015.58
30.00	1015.92	1016.26	1016.59	1016.93	1017.27	1017.61	1017.95	1018.29	1018.63	1018.96

(*continued*)

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

INCHES OF MERCURY TO MILLIBARS

1 inch of mercury = 33.86389 millibars.

In. Hg.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
30.00	1015.92	1016.26	1016.59	1016.93	1017.27	1017.61	1017.95	1018.29	1018.63	1018.96
30.10	1019.30	1019.64	1019.98	1020.32	1020.66	1021.00	1021.33	1021.67	1022.01	1022.35
30.20	1022.69	1023.03	1023.37	1023.71	1024.04	1024.38	1024.72	1025.06	1025.40	1025.74
30.30	1026.08	1026.41	1026.75	1027.09	1027.43	1027.77	1028.11	1028.45	1028.78	1029.12
30.40	1029.46	1029.80	1030.14	1030.48	1030.82	1031.16	1031.49	1031.83	1032.17	1032.51
30.50	1032.85	1033.19	1033.53	1033.86	1034.20	1034.54	1034.88	1035.22	1035.56	1035.90
30.60	1036.24	1036.57	1036.91	1037.25	1037.59	1037.93	1038.27	1038.61	1038.94	1039.28
30.70	1039.62	1039.96	1040.30	1040.64	1040.98	1041.31	1041.65	1041.99	1042.33	1042.67
30.80	1043.01	1043.35	1043.69	1044.02	1044.36	1044.70	1045.04	1045.38	1045.72	1046.06
30.90	1046.39	1046.73	1047.07	1047.41	1047.75	1048.09	1048.43	1048.76	1049.10	1049.44
31.00	1049.78	1050.12	1050.46	1050.80	1051.14	1051.47	1051.81	1052.15	1052.49	1052.83
31.10	1053.17	1053.51	1053.84	1054.18	1054.52	1054.86	1055.20	1055.54	1055.88	1056.21
31.20	1056.55	1056.89	1057.23	1057.57	1057.91	1058.25	1058.59	1058.92	1059.26	1059.60
31.30	1059.94	1060.28	1060.62	1060.96	1061.29	1061.63	1061.97	1062.31	1062.65	1062.99
31.40	1063.33	1063.66	1064.00	1064.34	1064.68	1065.02	1065.36	1065.70	1066.04	1066.37
31.50	1066.71	1067.05	1067.39	1067.73	1068.07	1068.41	1068.74	1069.08	1069.42	1069.76
31.60	1070.10	1070.44	1070.78	1071.11	1071.45	1071.79	1072.13	1072.47	1072.81	1073.15
31.70	1073.49	1073.82	1074.16	1074.50	1074.84	1075.18	1075.52	1075.86	1076.19	1076.53
31.80	1076.87	1077.21	1077.55	1077.89	1078.23	1078.56	1078.90	1079.24	1079.58	1079.92
31.90	1080.26	1080.60	1080.94	1081.27	1081.61	1081.95	1082.29	1082.63	1082.97	1083.31

Proportional parts										
	in. Hg.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mb.	.03	.07	.10	.14	.17	.20	.24	.27	.30

TABLE 10

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Milli-bars	0 In. Hg.	1 In. Hg.	2 In. Hg.	3 In. Hg.	4 In. Hg.	5 In. Hg.	6 In. Hg.	7 In. Hg.	8 In. Hg.	9 In. Hg.
0	0.000	0.030	0.059	0.089	0.118	0.148	0.177	0.207	0.236	0.266
10	.295	.325	.354	.384	.413	.443	.472	.502	.532	.561
20	.591	.620	.650	.679	.709	.738	.768	.797	.827	.856
30	.886	.915	.945	.974	1.004	1.034	1.063	1.093	1.122	1.152
40	1.181	1.211	1.240	1.270	1.299	1.329	1.358	1.388	1.417	1.447
50	1.476	1.506	1.536	1.565	1.595	1.624	1.654	1.683	1.713	1.742
60	1.772	1.801	1.831	1.860	1.890	1.919	1.949	1.979	2.008	2.038
70	2.067	2.097	2.126	2.156	2.185	2.215	2.244	2.274	2.303	2.333
80	2.362	2.392	2.421	2.451	2.481	2.510	2.540	2.569	2.599	2.628
90	2.658	2.687	2.717	2.746	2.776	2.805	2.835	2.864	2.894	2.923
100	2.953	2.983	3.012	3.042	3.071	3.101	3.130	3.160	3.189	3.219
110	3.248	3.278	3.307	3.337	3.366	3.396	3.425	3.455	3.485	3.514
120	3.544	3.573	3.603	3.632	3.662	3.691	3.721	3.750	3.780	3.809
130	3.839	3.868	3.898	3.927	3.957	3.987	4.016	4.046	4.075	4.105
140	4.134	4.164	4.193	4.223	4.252	4.282	4.311	4.341	4.370	4.400
150	4.429	4.459	4.489	4.518	4.548	4.577	4.607	4.636	4.666	4.695
160	4.725	4.754	4.784	4.813	4.843	4.872	4.902	4.932	4.961	4.991
170	5.020	5.050	5.079	5.109	5.138	5.168	5.197	5.227	5.256	5.286
180	5.315	5.345	5.374	5.404	5.434	5.463	5.493	5.522	5.552	5.581
190	5.611	5.640	5.670	5.699	5.729	5.758	5.788	5.817	5.847	5.876
200	5.906	5.936	5.965	5.995	6.024	6.054	6.083	6.113	6.142	6.172
210	6.201	6.231	6.260	6.290	6.319	6.349	6.378	6.408	6.438	6.467
220	6.497	6.526	6.556	6.585	6.615	6.644	6.674	6.703	6.733	6.762
230	6.792	6.821	6.851	6.880	6.910	6.940	6.969	6.999	7.028	7.058
240	7.087	7.117	7.146	7.176	7.205	7.235	7.264	7.294	7.323	7.353
250	7.382	7.412	7.442	7.471	7.501	7.530	7.560	7.589	7.619	7.648
260	7.678	7.707	7.737	7.766	7.796	7.825	7.855	7.885	7.914	7.944
270	7.973	8.003	8.032	8.062	8.091	8.121	8.150	8.180	8.209	8.239
280	8.268	8.298	8.327	8.357	8.387	8.416	8.446	8.475	8.505	8.534
290	8.564	8.593	8.623	8.652	8.682	8.711	8.741	8.770	8.800	8.829
300	8.859	8.889	8.918	8.948	8.977	9.007	9.036	9.066	9.095	9.125
310	9.154	9.184	9.213	9.243	9.272	9.302	9.331	9.361	9.391	9.420
320	9.450	9.479	9.509	9.538	9.568	9.597	9.627	9.656	9.686	9.715
330	9.745	9.774	9.804	9.833	9.863	9.893	9.922	9.952	9.981	10.011
340	10.040	10.070	10.099	10.129	10.158	10.188	10.217	10.247	10.276	10.306
350	10.335	10.365	10.395	10.424	10.454	10.483	10.513	10.542	10.572	10.601
360	10.631	10.660	10.690	10.719	10.749	10.778	10.808	10.838	10.867	10.897
370	10.926	10.956	10.985	11.015	11.044	11.074	11.103	11.133	11.162	11.192
380	11.221	11.251	11.280	11.310	11.340	11.369	11.399	11.428	11.458	11.487
390	11.517	11.546	11.576	11.605	11.635	11.664	11.694	11.723	11.753	11.782
400	11.812	11.842	11.871	11.901	11.930	11.960	11.989	12.019	12.048	12.078
410	12.107	12.137	12.166	12.196	12.225	12.255	12.284	12.314	12.344	12.373
420	12.403	12.432	12.462	12.491	12.521	12.550	12.580	12.609	12.639	12.668
430	12.698	12.727	12.757	12.786	12.816	12.846	12.875	12.905	12.934	12.964
440	12.993	13.023	13.052	13.082	13.111	13.141	13.170	13.200	13.229	13.259
450	13.288	13.318	13.348	13.377	13.407	13.436	13.466	13.495	13.525	13.554
460	13.584	13.613	13.643	13.672	13.702	13.731	13.761	13.791	13.820	13.850
470	13.879	13.909	13.938	13.968	13.997	14.027	14.056	14.086	14.115	14.145
480	14.174	14.204	14.233	14.263	14.293	14.322	14.352	14.381	14.411	14.440
490	14.470	14.499	14.529	14.558	14.588	14.617	14.647	14.676	14.706	14.735
500	14.765	14.795	14.824	14.854	14.883	14.913	14.942	14.972	15.001	15.031

(*continued*)

Proportional parts										
	mb.	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in. Hg.	.003	.006	.009	.012	.015	.018	.021	.024	.027

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Milli-bars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
500	14.765	14.768	14.771	14.774	14.777	14.780	14.783	14.786	14.789	14.792
501	14.795	14.797	14.800	14.803	14.806	14.809	14.812	14.815	14.818	14.821
502	14.824	14.827	14.830	14.833	14.836	14.839	14.842	14.845	14.848	14.851
503	14.854	14.857	14.859	14.862	14.865	14.868	14.871	14.874	14.877	14.880
504	14.883	14.886	14.889	14.892	14.895	14.898	14.901	14.904	14.907	14.910
505	14.913	14.916	14.919	14.921	14.924	14.927	14.930	14.933	14.936	14.939
506	14.942	14.945	14.948	14.951	14.954	14.957	14.960	14.963	14.966	14.969
507	14.972	14.975	14.978	14.981	14.984	14.986	14.989	14.992	14.995	14.998
508	15.001	15.004	15.007	15.010	15.013	15.016	15.019	15.022	15.025	15.028
509	15.031	15.034	15.037	15.040	15.043	15.046	15.048	15.051	15.054	15.057
510	15.060	15.063	15.066	15.069	15.072	15.075	15.078	15.081	15.084	15.087
511	15.090	15.093	15.096	15.099	15.102	15.105	15.108	15.110	15.113	15.116
512	15.119	15.122	15.125	15.128	15.131	15.134	15.137	15.140	15.143	15.146
513	15.149	15.152	15.155	15.158	15.161	15.164	15.167	15.170	15.173	15.175
514	15.178	15.181	15.184	15.187	15.190	15.193	15.196	15.199	15.202	15.205
515	15.208	15.211	15.214	15.217	15.220	15.223	15.226	15.229	15.232	15.235
516	15.237	15.240	15.243	15.246	15.249	15.252	15.255	15.258	15.261	15.264
517	15.267	15.270	15.273	15.276	15.279	15.282	15.285	15.288	15.291	15.294
518	15.297	15.299	15.302	15.305	15.308	15.311	15.314	15.317	15.320	15.323
519	15.326	15.329	15.332	15.335	15.338	15.341	15.344	15.347	15.350	15.353
520	15.356	15.359	15.361	15.364	15.367	15.370	15.373	15.376	15.379	15.382
521	15.385	15.388	15.391	15.394	15.397	15.400	15.403	15.406	15.409	15.412
522	15.415	15.418	15.421	15.424	15.426	15.429	15.432	15.435	15.438	15.441
523	15.444	15.447	15.450	15.453	15.456	15.459	15.462	15.465	15.468	15.471
524	15.474	15.477	15.480	15.483	15.486	15.488	15.491	15.494	15.497	15.500
525	15.503	15.506	15.509	15.512	15.515	15.518	15.521	15.524	15.527	15.530
526	15.533	15.536	15.539	15.542	15.545	15.548	15.550	15.553	15.556	15.559
527	15.562	15.565	15.568	15.571	15.574	15.577	15.580	15.583	15.586	15.589
528	15.592	15.595	15.598	15.601	15.604	15.607	15.610	15.613	15.615	15.618
529	15.621	15.624	15.627	15.630	15.633	15.636	15.639	15.642	15.645	15.648
530	15.651	15.654	15.657	15.660	15.663	15.666	15.669	15.672	15.675	15.677
531	15.680	15.683	15.686	15.689	15.692	15.695	15.698	15.701	15.704	15.707
532	15.710	15.713	15.716	15.719	15.722	15.725	15.728	15.731	15.734	15.737
533	15.739	15.742	15.745	15.748	15.751	15.754	15.757	15.760	15.763	15.766
534	15.769	15.772	15.775	15.778	15.781	15.784	15.787	15.790	15.793	15.796
535	15.799	15.801	15.804	15.807	15.810	15.813	15.816	15.819	15.822	15.825
536	15.828	15.831	15.834	15.837	15.840	15.843	15.846	15.849	15.852	15.855
537	15.858	15.861	15.864	15.866	15.869	15.872	15.875	15.878	15.881	15.884
538	15.887	15.890	15.893	15.896	15.899	15.902	15.905	15.908	15.911	15.914
539	15.917	15.920	15.923	15.926	15.928	15.931	15.934	15.937	15.940	15.943
540	15.946	15.949	15.952	15.955	15.958	15.961	15.964	15.967	15.970	15.973
541	15.976	15.979	15.982	15.985	15.988	15.990	15.993	15.996	15.999	16.002
542	16.005	16.008	16.011	16.014	16.017	16.020	16.023	16.026	16.029	16.032
543	16.035	16.038	16.041	16.044	16.047	16.050	16.052	16.055	16.058	16.061
544	16.064	16.067	16.070	16.073	16.076	16.079	16.082	16.085	16.088	16.091
545	16.094	16.097	16.100	16.103	16.106	16.109	16.112	16.115	16.117	16.120
546	16.123	16.126	16.129	16.132	16.135	16.138	16.141	16.144	16.147	16.150
547	16.153	16.156	16.159	16.162	16.165	16.168	16.171	16.174	16.177	16.179
548	16.182	16.185	16.188	16.191	16.194	16.197	16.200	16.203	16.206	16.209
549	16.212	16.215	16.218	16.221	16.224	16.227	16.230	16.233	16.236	16.239
550	16.241	16.244	16.247	16.250	16.253	16.256	16.259	16.262	16.265	16.268

(continued)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.	In. Hg.
550	16.241	16.244	16.247	16.250	16.253	16.256	16.259	16.262	16.265	16.268
551	16.271	16.274	16.277	16.280	16.283	16.286	16.289	16.292	16.295	16.298
552	16.301	16.304	16.306	16.309	16.312	16.315	16.318	16.321	16.324	16.327
553	16.330	16.333	16.336	16.339	16.342	16.345	16.348	16.351	16.354	16.357
554	16.360	16.363	16.366	16.368	16.371	16.374	16.377	16.380	16.383	16.386
555	16.389	16.392	16.395	16.398	16.401	16.404	16.407	16.410	16.413	16.416
556	16.419	16.422	16.425	16.428	16.430	16.433	16.436	16.439	16.442	16.445
557	16.448	16.451	16.454	16.457	16.460	16.463	16.466	16.469	16.472	16.475
558	16.478	16.481	16.484	16.487	16.490	16.492	16.495	16.498	16.501	16.504
559	16.507	16.510	16.513	16.516	16.519	16.522	16.525	16.528	16.531	16.534
560	16.537	16.540	16.543	16.546	16.549	16.552	16.555	16.557	16.560	16.563
561	16.566	16.569	16.572	16.575	16.578	16.581	16.584	16.587	16.590	16.593
562	16.596	16.599	16.602	16.605	16.608	16.611	16.614	16.617	16.619	16.622
563	16.625	16.628	16.631	16.634	16.637	16.640	16.643	16.646	16.649	16.652
564	16.655	16.658	16.661	16.664	16.667	16.670	16.673	16.676	16.679	16.681
565	16.684	16.687	16.690	16.693	16.696	16.699	16.702	16.705	16.708	16.711
566	16.714	16.717	16.720	16.723	16.726	16.729	16.732	16.735	16.738	16.741
567	16.743	16.746	16.749	16.752	16.755	16.758	16.761	16.764	16.767	16.770
568	16.773	16.776	16.779	16.782	16.785	16.788	16.791	16.794	16.797	16.800
569	16.803	16.806	16.808	16.811	16.814	16.817	16.820	16.823	16.826	16.829
570	16.832	16.835	16.838	16.841	16.844	16.847	16.850	16.853	16.856	16.859
571	16.862	16.865	16.868	16.870	16.873	16.876	16.879	16.882	16.885	16.888
572	16.891	16.894	16.897	16.900	16.903	16.906	16.909	16.912	16.915	16.918
573	16.921	16.924	16.927	16.930	16.932	16.935	16.938	16.941	16.944	16.947
574	16.950	16.953	16.956	16.959	16.962	16.965	16.968	16.971	16.974	16.977
575	16.980	16.983	16.986	16.989	16.992	16.995	16.997	17.000	17.003	17.006
576	17.009	17.012	17.015	17.018	17.021	17.024	17.027	17.030	17.033	17.036
577	17.039	17.042	17.045	17.048	17.051	17.054	17.057	17.059	17.062	17.065
578	17.068	17.071	17.074	17.077	17.080	17.083	17.086	17.089	17.092	17.095
579	17.098	17.101	17.104	17.107	17.110	17.113	17.116	17.119	17.121	17.124
580	17.127	17.130	17.133	17.136	17.139	17.142	17.145	17.148	17.151	17.154
581	17.157	17.160	17.163	17.166	17.169	17.172	17.175	17.178	17.181	17.183
582	17.186	17.189	17.192	17.195	17.198	17.201	17.204	17.207	17.210	17.213
583	17.216	17.219	17.222	17.225	17.228	17.231	17.234	17.237	17.240	17.243
584	17.246	17.248	17.251	17.254	17.257	17.260	17.263	17.266	17.269	17.272
585	17.275	17.278	17.281	17.284	17.287	17.290	17.293	17.296	17.299	17.302
586	17.305	17.308	17.310	17.313	17.316	17.319	17.322	17.325	17.328	17.331
587	17.334	17.337	17.340	17.343	17.346	17.349	17.352	17.355	17.358	17.361
588	17.364	17.367	17.370	17.372	17.375	17.378	17.381	17.384	17.387	17.390
589	17.393	17.396	17.399	17.402	17.405	17.408	17.411	17.414	17.417	17.420
590	17.423	17.426	17.429	17.432	17.435	17.437	17.440	17.443	17.446	17.449
591	17.452	17.455	17.458	17.461	17.464	17.467	17.470	17.473	17.476	17.479
592	17.482	17.485	17.488	17.491	17.494	17.497	17.499	17.502	17.505	17.508
593	17.511	17.514	17.517	17.520	17.523	17.526	17.529	17.532	17.535	17.538
594	17.541	17.544	17.547	17.550	17.553	17.556	17.559	17.561	17.564	17.567
595	17.570	17.573	17.576	17.579	17.582	17.585	17.588	17.591	17.594	17.597
596	17.600	17.603	17.606	17.609	17.612	17.615	17.618	17.621	17.623	17.626
597	17.629	17.632	17.635	17.638	17.641	17.644	17.647	17.650	17.653	17.656
598	17.659	17.662	17.665	17.668	17.671	17.674	17.677	17.680	17.683	17.686
599	17.688	17.691	17.694	17.697	17.700	17.703	17.706	17.709	17.712	17.715
600	17.718	17.721	17.724	17.727	17.730	17.733	17.736	17.739	17.742	17.745

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
600	17.718	17.721	17.724	17.727	17.730	17.733	17.736	17.739	17.742	17.745
601	17.748	17.750	17.753	17.756	17.759	17.762	17.765	17.768	17.771	17.774
602	17.777	17.780	17.783	17.786	17.789	17.792	17.795	17.798	17.801	17.804
603	17.807	17.810	17.812	17.815	17.818	17.821	17.824	17.827	17.830	17.833
604	17.836	17.839	17.842	17.845	17.848	17.851	17.854	17.857	17.860	17.863
605	17.866	17.869	17.872	17.874	17.877	17.880	17.883	17.886	17.889	17.892
606	17.895	17.898	17.901	17.904	17.907	17.910	17.913	17.916	17.919	17.922
607	17.925	17.928	17.931	17.934	17.937	17.939	17.942	17.945	17.948	17.951
608	17.954	17.957	17.960	17.963	17.966	17.969	17.972	17.975	17.978	17.981
609	17.984	17.987	17.990	17.993	17.996	17.999	18.001	18.004	18.007	18.010
610	18.013	18.016	18.019	18.022	18.025	18.028	18.031	18.034	18.037	18.040
611	18.043	18.046	18.049	18.052	18.055	18.058	18.061	18.063	18.066	18.069
612	18.072	18.075	18.078	18.081	18.084	18.087	18.090	18.093	18.096	18.099
613	18.102	18.105	18.108	18.111	18.114	18.117	18.120	18.123	18.126	18.128
614	18.131	18.134	18.137	18.140	18.143	18.146	18.149	18.152	18.155	18.158
615	18.161	18.164	18.167	18.170	18.173	18.176	18.179	18.182	18.185	18.188
616	18.190	18.193	18.196	18.199	18.202	18.205	18.208	18.211	18.214	18.217
617	18.220	18.223	18.226	18.229	18.232	18.235	18.238	18.241	18.244	18.247
618	18.250	18.252	18.255	18.258	18.261	18.264	18.267	18.270	18.273	18.276
619	18.279	18.282	18.285	18.288	18.291	18.294	18.297	18.300	18.303	18.306
620	18.309	18.312	18.314	18.317	18.320	18.323	18.326	18.329	18.332	18.335
621	18.338	18.341	18.344	18.347	18.350	18.353	18.356	18.359	18.362	18.365
622	18.368	18.371	18.374	18.377	18.379	18.382	18.385	18.388	18.391	18.394
623	18.397	18.400	18.403	18.406	18.409	18.412	18.415	18.418	18.421	18.424
624	18.427	18.430	18.433	18.436	18.439	18.441	18.444	18.447	18.450	18.453
625	18.456	18.459	18.462	18.465	18.468	18.471	18.474	18.477	18.480	18.483
626	18.486	18.489	18.492	18.495	18.498	18.501	18.503	18.506	18.509	18.512
627	18.515	18.518	18.521	18.524	18.527	18.530	18.533	18.536	18.539	18.542
628	18.545	18.548	18.551	18.554	18.557	18.560	18.563	18.565	18.568	18.571
629	18.574	18.577	18.580	18.583	18.586	18.589	18.592	18.595	18.598	18.601
630	18.604	18.607	18.610	18.613	18.616	18.619	18.622	18.625	18.628	18.630
631	18.633	18.636	18.639	18.642	18.645	18.648	18.651	18.654	18.657	18.660
632	18.663	18.666	18.669	18.672	18.675	18.678	18.681	18.684	18.687	18.690
633	18.692	18.695	18.698	18.701	18.704	18.707	18.710	18.713	18.716	18.719
634	18.722	18.725	18.728	18.731	18.734	18.737	18.740	18.743	18.746	18.749
635	18.752	18.754	18.757	18.760	18.763	18.766	18.769	18.772	18.775	18.778
636	18.781	18.784	18.787	18.790	18.793	18.796	18.799	18.802	18.805	18.808
637	18.811	18.814	18.817	18.819	18.822	18.825	18.828	18.831	18.834	18.837
638	18.840	18.843	18.846	18.849	18.852	18.855	18.858	18.861	18.864	18.867
639	18.870	18.873	18.876	18.879	18.881	18.884	18.887	18.890	18.893	18.896
640	18.899	18.902	18.905	18.908	18.911	18.914	18.917	18.920	18.923	18.926
641	18.929	18.932	18.935	18.938	18.941	18.943	18.946	18.949	18.952	18.955
642	18.958	18.961	18.964	18.967	18.970	18.973	18.976	18.979	18.982	18.985
643	18.988	18.991	18.994	18.997	19.000	19.003	19.005	19.008	19.011	19.014
644	19.017	19.020	19.023	19.026	19.029	19.032	19.035	19.038	19.041	19.044
645	19.047	19.050	19.053	19.056	19.059	19.062	19.065	19.068	19.070	19.073
646	19.076	19.079	19.082	19.085	19.088	19.091	19.094	19.097	19.100	19.103
647	19.106	19.109	19.112	19.115	19.118	19.121	19.124	19.127	19.130	19.132
648	19.135	19.138	19.141	19.144	19.147	19.150	19.153	19.156	19.159	19.162
649	19.165	19.168	19.171	19.174	19.177	19.180	19.183	19.186	19.189	19.192
650	19.194	19.197	19.200	19.203	19.206	19.209	19.212	19.215	19.218	19.221

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
650	19.194	19.197	19.200	19.203	19.206	19.209	19.212	19.215	19.218	19.221
651	19.224	19.227	19.230	19.233	19.236	19.239	19.242	19.245	19.248	19.251
652	19.254	19.256	19.259	19.262	19.265	19.268	19.271	19.274	19.277	19.280
653	19.283	19.286	19.289	19.292	19.295	19.298	19.301	19.304	19.307	19.310
654	19.313	19.316	19.319	19.321	19.324	19.327	19.330	19.333	19.336	19.339
655	19.342	19.345	19.348	19.351	19.354	19.357	19.360	19.363	19.366	19.369
656	19.372	19.375	19.378	19.381	19.383	19.386	19.389	19.392	19.395	19.398
657	19.401	19.404	19.407	19.410	19.413	19.416	19.419	19.422	19.425	19.428
658	19.431	19.434	19.437	19.440	19.443	19.445	19.448	19.451	19.454	19.457
659	19.460	19.463	19.466	19.469	19.472	19.475	19.478	19.481	19.484	19.487
660	19.490	19.493	19.496	19.499	19.502	19.505	19.508	19.510	19.513	19.516
661	19.519	19.522	19.525	19.528	19.531	19.534	19.537	19.540	19.543	19.546
662	19.549	19.552	19.555	19.558	19.561	19.564	19.567	19.570	19.572	19.575
663	19.578	19.581	19.584	19.587	19.590	19.593	19.596	19.599	19.602	19.605
664	19.608	19.611	19.614	19.617	19.620	19.623	19.626	19.629	19.632	19.634
665	19.637	19.640	19.643	19.646	19.649	19.652	19.655	19.658	19.661	19.664
666	19.667	19.670	19.673	19.676	19.679	19.682	19.685	19.688	19.691	19.694
667	19.696	19.699	19.702	19.705	19.708	19.711	19.714	19.717	19.720	19.723
668	19.726	19.729	19.732	19.735	19.738	19.741	19.744	19.747	19.750	19.753
669	19.756	19.759	19.761	19.764	19.767	19.770	19.773	19.776	19.779	19.782
670	19.785	19.788	19.791	19.794	19.797	19.800	19.803	19.806	19.809	19.812
671	19.815	19.818	19.821	19.823	19.826	19.829	19.832	19.835	19.838	19.841
672	19.844	19.847	19.850	19.853	19.856	19.859	19.862	19.865	19.868	19.871
673	19.874	19.877	19.880	19.883	19.885	19.888	19.891	19.894	19.897	19.900
674	19.903	19.906	19.909	19.912	19.915	19.918	19.921	19.924	19.927	19.930
675	19.933	19.936	19.939	19.942	19.945	19.948	19.950	19.953	19.956	19.959
676	19.962	19.965	19.968	19.971	19.974	19.977	19.980	19.983	19.986	19.989
677	19.992	19.995	19.998	20.001	20.004	20.007	20.010	20.012	20.015	20.018
678	20.021	20.024	20.027	20.030	20.033	20.036	20.039	20.042	20.045	20.048
679	20.051	20.054	20.057	20.060	20.063	20.066	20.069	20.072	20.074	20.077
680	20.080	20.083	20.086	20.089	20.092	20.095	20.098	20.101	20.104	20.107
681	20.110	20.113	20.116	20.119	20.122	20.125	20.128	20.131	20.134	20.136
682	20.139	20.142	20.145	20.148	20.151	20.154	20.157	20.160	20.163	20.166
683	20.169	20.172	20.175	20.178	20.181	20.184	20.187	20.190	20.193	20.196
684	20.199	20.201	20.204	20.207	20.210	20.213	20.216	20.219	20.222	20.225
685	20.228	20.231	20.234	20.237	20.240	20.243	20.246	20.249	20.252	20.255
686	20.258	20.261	20.263	20.266	20.269	20.272	20.275	20.278	20.281	20.284
687	20.287	20.290	20.293	20.296	20.299	20.302	20.305	20.308	20.311	20.314
688	20.317	20.320	20.323	20.325	20.328	20.331	20.334	20.337	20.340	20.343
689	20.346	20.349	20.352	20.355	20.358	20.361	20.364	20.367	20.370	20.373
690	20.376	20.379	20.382	20.385	20.387	20.390	20.393	20.396	20.399	20.402
691	20.405	20.408	20.411	20.414	20.417	20.420	20.423	20.426	20.429	20.432
692	20.435	20.438	20.441	20.444	20.447	20.450	20.452	20.455	20.458	20.461
693	20.464	20.467	20.470	20.473	20.476	20.479	20.482	20.485	20.488	20.491
694	20.494	20.497	20.500	20.503	20.506	20.509	20.512	20.514	20.517	20.520
695	20.523	20.526	20.529	20.532	20.535	20.538	20.541	20.544	20.547	20.550
696	20.553	20.556	20.559	20.562	20.565	20.568	20.571	20.574	20.576	20.579
697	20.582	20.585	20.588	20.591	20.594	20.597	20.600	20.603	20.606	20.609
698	20.612	20.615	20.618	20.621	20.624	20.627	20.630	20.633	20.636	20.639
699	20.641	20.644	20.647	20.650	20.653	20.656	20.659	20.662	20.665	20.668
700	20.671	20.674	20.677	20.680	20.683	20.686	20.689	20.692	20.695	20.698

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
700	20.671	20.674	20.677	20.680	20.683	20.686	20.689	20.692	20.695	20.698
701	20.701	20.703	20.706	20.709	20.712	20.715	20.718	20.721	20.724	20.727
702	20.730	20.733	20.736	20.739	20.742	20.745	20.748	20.751	20.754	20.757
703	20.760	20.763	20.765	20.768	20.771	20.774	20.777	20.780	20.783	20.786
704	20.789	20.792	20.795	20.798	20.801	20.804	20.807	20.810	20.813	20.816
705	20.819	20.822	20.825	20.827	20.830	20.833	20.836	20.839	20.842	20.845
706	20.848	20.851	20.854	20.857	20.860	20.863	20.866	20.869	20.872	20.875
707	20.878	20.881	20.884	20.887	20.890	20.892	20.895	20.898	20.901	20.904
708	20.907	20.910	20.913	20.916	20.919	20.922	20.925	20.928	20.931	20.934
709	20.937	20.940	20.943	20.946	20.949	20.952	20.954	20.957	20.960	20.963
710	20.966	20.969	20.972	20.975	20.978	20.981	20.984	20.987	20.990	20.993
711	20.996	20.999	21.002	21.005	21.008	21.011	21.014	21.016	21.019	21.022
712	21.025	21.028	21.031	21.034	21.037	21.040	21.043	21.046	21.049	21.052
713	21.055	21.058	21.061	21.064	21.067	21.070	21.073	21.076	21.078	21.081
714	21.084	21.087	21.090	21.093	21.096	21.099	21.102	21.105	21.108	21.111
715	21.114	21.117	21.120	21.123	21.126	21.129	21.132	21.135	21.138	21.141
716	21.143	21.146	21.149	21.152	21.155	21.158	21.161	21.164	21.167	21.170
717	21.173	21.176	21.179	21.182	21.185	21.188	21.191	21.194	21.197	21.200
718	21.203	21.205	21.208	21.211	21.214	21.217	21.220	21.223	21.226	21.229
719	21.232	21.235	21.238	21.241	21.244	21.247	21.250	21.253	21.256	21.259
720	21.262	21.265	21.267	21.270	21.273	21.276	21.279	21.282	21.285	21.288
721	21.291	21.294	21.297	21.300	21.303	21.306	21.309	21.312	21.315	21.318
722	21.321	21.324	21.327	21.330	21.332	21.335	21.338	21.341	21.344	21.347
723	21.350	21.353	21.356	21.359	21.362	21.365	21.368	21.371	21.374	21.377
724	21.380	21.383	21.386	21.389	21.392	21.394	21.397	21.400	21.403	21.406
725	21.409	21.412	21.415	21.418	21.421	21.424	21.427	21.430	21.433	21.436
726	21.439	21.442	21.445	21.448	21.451	21.454	21.456	21.459	21.462	21.465
727	21.468	21.471	21.474	21.477	21.480	21.483	21.486	21.489	21.492	21.495
728	21.498	21.501	21.504	21.507	21.510	21.513	21.516	21.518	21.521	21.524
729	21.527	21.530	21.533	21.536	21.539	21.542	21.545	21.548	21.551	21.554
730	21.557	21.560	21.563	21.566	21.569	21.572	21.575	21.578	21.581	21.583
731	21.586	21.589	21.592	21.595	21.598	21.601	21.604	21.607	21.610	21.613
732	21.616	21.619	21.622	21.625	21.628	21.631	21.634	21.637	21.640	21.643
733	21.645	21.648	21.651	21.654	21.657	21.660	21.663	21.666	21.669	21.672
734	21.675	21.678	21.681	21.684	21.687	21.690	21.693	21.696	21.699	21.702
735	21.705	21.707	21.710	21.713	21.716	21.719	21.722	21.725	21.728	21.731
736	21.734	21.737	21.740	21.743	21.746	21.749	21.752	21.755	21.758	21.761
737	21.764	21.767	21.770	21.772	21.775	21.778	21.781	21.784	21.787	21.790
738	21.793	21.796	21.799	21.802	21.805	21.808	21.811	21.814	21.817	21.820
739	21.823	21.826	21.829	21.832	21.834	21.837	21.840	21.843	21.846	21.849
740	21.852	21.855	21.858	21.861	21.864	21.867	21.870	21.873	21.876	21.879
741	21.882	21.885	21.888	21.891	21.894	21.896	21.899	21.902	21.905	21.908
742	21.911	21.914	21.917	21.920	21.923	21.926	21.929	21.932	21.935	21.938
743	21.941	21.944	21.947	21.950	21.953	21.956	21.958	21.961	21.964	21.967
744	21.970	21.973	21.976	21.979	21.982	21.985	21.988	21.991	21.994	21.997
745	22.000	22.003	22.006	22.009	22.012	22.015	22.018	22.021	22.023	22.026
746	22.029	22.032	22.035	22.038	22.041	22.044	22.047	22.050	22.053	22.056
747	22.059	22.062	22.065	22.068	22.071	22.074	22.077	22.080	22.083	22.085
748	22.088	22.091	22.094	22.097	22.100	22.103	22.106	22.109	22.112	22.115
749	22.118	22.121	22.124	22.127	22.130	22.133	22.136	22.139	22.142	22.145
750	22.147	22.150	22.153	22.156	22.159	22.162	22.165	22.168	22.171	22.174

(*continued*)

Proportional parts										
mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
750	22.147	22.150	22.153	22.156	22.159	22.162	22.165	22.168	22.171	22.174
751	22.177	22.180	22.183	22.186	22.189	22.192	22.195	22.198	22.201	22.204
752	22.207	22.209	22.212	22.215	22.218	22.221	22.224	22.227	22.230	22.233
753	22.236	22.239	22.242	22.245	22.248	22.251	22.254	22.257	22.260	22.263
754	22.266	22.269	22.272	22.274	22.277	22.280	22.283	22.286	22.289	22.292
755	22.295	22.298	22.301	22.304	22.307	22.310	22.313	22.316	22.319	22.322
756	22.325	22.328	22.331	22.334	22.336	22.339	22.342	22.345	22.348	22.351
757	22.354	22.357	22.360	22.363	22.366	22.369	22.372	22.375	22.378	22.381
758	22.384	22.387	22.390	22.393	22.396	22.398	22.401	22.404	22.407	22.410
759	22.413	22.416	22.419	22.422	22.425	22.428	22.431	22.434	22.437	22.440
760	22.443	22.446	22.449	22.452	22.455	22.458	22.461	22.463	22.466	22.469
761	22.472	22.475	22.478	22.481	22.484	22.487	22.490	22.493	22.496	22.499
762	22.502	22.505	22.508	22.511	22.514	22.517	22.520	22.523	22.525	22.528
763	22.531	22.534	22.537	22.540	22.543	22.546	22.549	22.552	22.555	22.558
764	22.561	22.564	22.567	22.570	22.573	22.576	22.579	22.582	22.585	22.587
765	22.590	22.593	22.596	22.599	22.602	22.605	22.608	22.611	22.614	22.617
766	22.620	22.623	22.626	22.629	22.632	22.635	22.638	22.641	22.644	22.647
767	22.649	22.652	22.655	22.658	22.661	22.664	22.667	22.670	22.673	22.676
768	22.679	22.682	22.685	22.688	22.691	22.694	22.697	22.700	22.703	22.706
769	22.709	22.712	22.714	22.717	22.720	22.723	22.726	22.729	22.732	22.735
770	22.738	22.741	22.744	22.747	22.750	22.753	22.756	22.759	22.762	22.765
771	22.768	22.771	22.774	22.776	22.779	22.782	22.785	22.788	22.791	22.794
772	22.797	22.800	22.803	22.806	22.809	22.812	22.815	22.818	22.821	22.824
773	22.827	22.830	22.833	22.836	22.838	22.841	22.844	22.847	22.850	22.853
774	22.856	22.859	22.862	22.865	22.868	22.871	22.874	22.877	22.880	22.883
775	22.886	22.889	22.892	22.895	22.898	22.900	22.903	22.906	22.909	22.912
776	22.915	22.918	22.921	22.924	22.927	22.930	22.933	22.936	22.939	22.942
777	22.945	22.948	22.951	22.954	22.957	22.960	22.963	22.965	22.968	22.971
778	22.974	22.977	22.980	22.983	22.986	22.989	22.992	22.995	22.998	23.001
779	23.004	23.007	23.010	23.013	23.016	23.019	23.022	23.025	23.027	23.030
780	23.033	23.036	23.039	23.042	23.045	23.048	23.051	23.054	23.057	23.060
781	23.063	23.066	23.069	23.072	23.075	23.078	23.081	23.084	23.087	23.089
782	23.092	23.095	23.098	23.101	23.104	23.107	23.110	23.113	23.116	23.119
783	23.122	23.125	23.128	23.131	23.134	23.137	23.140	23.143	23.146	23.149
784	23.152	23.154	23.157	23.160	23.163	23.166	23.169	23.172	23.175	23.178
785	23.181	23.184	23.187	23.190	23.193	23.196	23.199	23.202	23.205	23.208
786	23.211	23.214	23.216	23.219	23.222	23.225	23.228	23.231	23.234	23.237
787	23.240	23.243	23.246	23.249	23.252	23.255	23.258	23.261	23.264	23.267
788	23.270	23.273	23.276	23.278	23.281	23.284	23.287	23.290	23.293	23.296
789	23.299	23.302	23.305	23.308	23.311	23.314	23.317	23.320	23.323	23.326
790	23.329	23.332	23.335	23.338	23.340	23.343	23.346	23.349	23.352	23.355
791	23.358	23.361	23.364	23.367	23.370	23.373	23.376	23.379	23.382	23.385
792	23.388	23.391	23.394	23.397	23.400	23.403	23.405	23.408	23.411	23.414
793	23.417	23.420	23.423	23.426	23.429	23.432	23.435	23.438	23.441	23.444
794	23.447	23.450	23.453	23.456	23.459	23.462	23.465	23.467	23.470	23.473
795	23.476	23.479	23.482	23.485	23.488	23.491	23.494	23.497	23.500	23.503
796	23.506	23.509	23.512	23.515	23.518	23.521	23.524	23.527	23.529	23.532
797	23.535	23.538	23.541	23.544	23.547	23.550	23.553	23.556	23.559	23.562
798	23.565	23.568	23.571	23.574	23.577	23.580	23.583	23.586	23.589	23.592
799	23.594	23.597	23.600	23.603	23.606	23.609	23.612	23.615	23.618	23.621
800	23.624	23.627	23.630	23.633	23.636	23.639	23.642	23.645	23.648	23.651

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
800	23.624	23.627	23.630	23.633	23.636	23.639	23.642	23.645	23.648	23.651
801	23.654	23.656	23.659	23.662	23.665	23.668	23.671	23.674	23.677	23.680
802	23.683	23.686	23.689	23.692	23.695	23.698	23.701	23.704	23.707	23.710
803	23.713	23.716	23.718	23.721	23.724	23.727	23.730	23.733	23.736	23.739
804	23.742	23.745	23.748	23.751	23.754	23.757	23.760	23.763	23.766	23.769
805	23.772	23.775	23.778	23.780	23.783	23.786	23.789	23.792	23.795	23.798
806	23.801	23.804	23.807	23.810	23.813	23.816	23.819	23.822	23.825	23.828
807	23.831	23.834	23.837	23.840	23.843	23.845	23.848	23.851	23.854	23.857
808	23.860	23.863	23.866	23.869	23.872	23.875	23.878	23.881	23.884	23.887
809	23.890	23.893	23.896	23.899	23.902	23.905	23.907	23.910	23.913	23.916
810	23.919	23.922	23.925	23.928	23.931	23.934	23.937	23.940	23.943	23.946
811	23.949	23.952	23.955	23.958	23.961	23.964	23.967	23.969	23.972	23.975
812	23.978	23.981	23.984	23.987	23.990	23.993	23.996	23.999	24.002	24.005
813	24.008	24.011	24.014	24.017	24.020	24.023	24.026	24.029	24.031	24.034
814	24.037	24.040	24.043	24.046	24.049	24.052	24.055	24.058	24.061	24.064
815	24.067	24.070	24.073	24.076	24.079	24.082	24.085	24.088	24.091	24.094
816	24.096	24.099	24.102	24.105	24.108	24.111	24.114	24.117	24.120	24.123
817	24.126	24.129	24.132	24.135	24.138	24.141	24.144	24.147	24.150	24.153
818	24.156	24.158	24.161	24.164	24.167	24.170	24.173	24.176	24.179	24.182
819	24.185	24.188	24.191	24.194	24.197	24.200	24.203	24.206	24.209	24.212
820	24.215	24.218	24.220	24.223	24.226	24.229	24.232	24.235	24.238	24.241
821	24.244	24.247	24.250	24.253	24.256	24.259	24.262	24.265	24.268	24.271
822	24.274	24.277	24.280	24.283	24.285	24.288	24.291	24.294	24.297	24.300
823	24.303	24.306	24.309	24.312	24.315	24.318	24.321	24.324	24.327	24.330
824	24.333	24.336	24.339	24.342	24.345	24.347	24.350	24.353	24.356	24.359
825	24.362	24.365	24.368	24.371	24.374	24.377	24.380	24.383	24.386	24.389
826	24.392	24.395	24.398	24.401	24.404	24.407	24.409	24.412	24.415	24.418
827	24.421	24.424	24.427	24.430	24.433	24.436	24.439	24.442	24.445	24.448
828	24.451	24.454	24.457	24.460	24.463	24.466	24.469	24.471	24.474	24.477
829	24.480	24.483	24.486	24.489	24.492	24.495	24.498	24.501	24.504	24.507
830	24.510	24.513	24.516	24.519	24.522	24.525	24.528	24.531	24.534	24.536
831	24.539	24.542	24.545	24.548	24.551	24.554	24.557	24.560	24.563	24.566
832	24.569	24.572	24.575	24.578	24.581	24.584	24.587	24.590	24.593	24.596
833	24.598	24.601	24.604	24.607	24.610	24.613	24.616	24.619	24.622	24.625
834	24.628	24.631	24.634	24.637	24.640	24.643	24.646	24.649	24.652	24.655
835	24.658	24.660	24.663	24.666	24.669	24.672	24.675	24.678	24.681	24.684
836	24.687	24.690	24.693	24.696	24.699	24.702	24.705	24.708	24.711	24.714
837	24.717	24.720	24.722	24.725	24.728	24.731	24.734	24.737	24.740	24.743
838	24.746	24.749	24.752	24.755	24.758	24.761	24.764	24.767	24.770	24.773
839	24.776	24.779	24.782	24.785	24.787	24.790	24.793	24.796	24.799	24.802
840	24.805	24.808	24.811	24.814	24.817	24.820	24.823	24.826	24.829	24.832
841	24.835	24.838	24.841	24.844	24.847	24.849	24.852	24.855	24.858	24.861
842	24.864	24.867	24.870	24.873	24.876	24.879	24.882	24.885	24.888	24.891
843	24.894	24.897	24.900	24.903	24.906	24.909	24.911	24.914	24.917	24.920
844	24.923	24.926	24.929	24.932	24.935	24.938	24.941	24.944	24.947	24.950
845	24.953	24.956	24.959	24.962	24.965	24.968	24.971	24.974	24.976	24.979
846	24.982	24.985	24.988	24.991	24.994	24.997	25.000	25.003	25.006	25.009
847	25.012	25.015	25.018	25.021	25.024	25.027	25.030	25.033	25.036	25.038
848	25.041	25.044	25.047	25.050	25.053	25.056	25.059	25.062	25.065	25.068
849	25.071	25.074	25.077	25.080	25.083	25.086	25.089	25.092	25.095	25.098
850	25.100	25.103	25.106	25.109	25.112	25.115	25.118	25.121	25.124	25.127

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
850	25.100	25.103	25.106	25.109	25.112	25.115	25.118	25.121	25.124	25.127
851	25.130	25.133	25.136	25.139	25.142	25.145	25.148	25.151	25.154	25.157
852	25.160	25.162	25.165	25.168	25.171	25.174	25.177	25.180	25.183	25.186
853	25.189	25.192	25.195	25.198	25.201	25.204	25.207	25.210	25.213	25.216
854	25.219	25.222	25.225	25.227	25.230	25.233	25.236	25.239	25.242	25.245
855	25.248	25.251	25.254	25.257	25.260	25.263	25.266	25.269	25.272	25.275
856	25.278	25.281	25.284	25.287	25.289	25.292	25.295	25.298	25.301	25.304
857	25.307	25.310	25.313	25.316	25.319	25.322	25.325	25.328	25.331	25.334
858	25.337	25.340	25.343	25.346	25.349	25.351	25.354	25.357	25.360	25.363
859	25.366	25.369	25.372	25.375	25.378	25.381	25.384	25.387	25.390	25.393
860	25.396	25.399	25.402	25.405	25.408	25.411	25.414	25.416	25.419	25.422
861	25.425	25.428	25.431	25.434	25.437	25.440	25.443	25.446	25.449	25.452
862	25.455	25.458	25.461	25.464	25.467	25.470	25.473	25.476	25.478	25.481
863	25.484	25.487	25.490	25.493	25.496	25.499	25.502	25.505	25.508	25.511
864	25.514	25.517	25.520	25.523	25.526	25.529	25.532	25.535	25.538	25.540
865	25.543	25.546	25.549	25.552	25.555	25.558	25.561	25.564	25.567	25.570
866	25.573	25.576	25.579	25.582	25.585	25.588	25.591	25.594	25.597	25.600
867	25.602	25.605	25.608	25.611	25.614	25.617	25.620	25.623	25.626	25.629
868	25.632	25.635	25.638	25.641	25.644	25.647	25.650	25.653	25.656	25.659
869	25.662	25.665	25.667	25.670	25.673	25.676	25.679	25.682	25.685	25.688
870	25.691	25.694	25.697	25.700	25.703	25.706	25.709	25.712	25.715	25.718
871	25.721	25.724	25.727	25.729	25.732	25.735	25.738	25.741	25.744	25.747
872	25.750	25.753	25.756	25.759	25.762	25.765	25.768	25.771	25.774	25.777
873	25.780	25.783	25.786	25.789	25.791	25.794	25.797	25.800	25.803	25.806
874	25.809	25.812	25.815	25.818	25.821	25.824	25.827	25.830	25.833	25.836
875	25.839	25.842	25.845	25.848	25.851	25.853	25.856	25.859	25.862	25.865
876	25.868	25.871	25.874	25.877	25.880	25.883	25.886	25.889	25.892	25.895
877	25.898	25.901	25.904	25.907	25.910	25.913	25.916	25.918	25.921	25.924
878	25.927	25.930	25.933	25.936	25.939	25.942	25.945	25.948	25.951	25.954
879	25.957	25.960	25.963	25.966	25.969	25.972	25.975	25.978	25.980	25.983
880	25.986	25.989	25.992	25.995	25.998	26.001	26.004	26.007	26.010	26.013
881	26.016	26.019	26.022	26.025	26.028	26.031	26.034	26.037	26.040	26.042
882	26.045	26.048	26.051	26.054	26.057	26.060	26.063	26.066	26.069	26.072
883	26.075	26.078	26.081	26.084	26.087	26.090	26.093	26.096	26.099	26.102
884	26.105	26.107	26.110	26.113	26.116	26.119	26.122	26.125	26.128	26.131
885	26.134	26.137	26.140	26.143	26.146	26.149	26.152	26.155	26.158	26.161
886	26.164	26.167	26.169	26.172	26.175	26.178	26.181	26.184	26.187	26.190
887	26.193	26.196	26.199	26.202	26.205	26.208	26.211	26.214	26.217	26.220
888	26.223	26.226	26.229	26.231	26.234	26.237	26.240	26.243	26.246	26.249
889	26.252	26.255	26.258	26.261	26.264	26.267	26.270	26.273	26.276	26.279
890	26.282	26.285	26.288	26.291	26.293	26.296	26.299	26.302	26.305	26.308
891	26.311	26.314	26.317	26.320	26.323	26.326	26.329	26.332	26.335	26.338
892	26.341	26.344	26.347	26.350	26.353	26.356	26.358	26.361	26.364	26.367
893	26.370	26.373	26.376	26.379	26.382	26.385	26.388	26.391	26.394	26.397
894	26.400	26.403	26.406	26.409	26.412	26.415	26.418	26.420	26.423	26.426
895	26.429	26.432	26.435	26.438	26.441	26.444	26.447	26.450	26.453	26.456
896	26.459	26.462	26.465	26.468	26.471	26.474	26.477	26.480	26.482	26.485
897	26.488	26.491	26.494	26.497	26.500	26.503	26.506	26.509	26.512	26.515
898	26.518	26.521	26.524	26.527	26.530	26.533	26.536	26.539	26.542	26.544
899	26.547	26.550	26.553	26.556	26.559	26.562	26.565	26.568	26.571	26.574
900	26.577	26.580	26.583	26.586	26.589	26.592	26.595	26.598	26.601	26.604

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
900	26.577	26.580	26.583	26.586	26.589	26.592	26.595	26.598	26.601	26.604
901	26.607	26.609	26.612	26.615	26.618	26.621	26.624	26.627	26.630	26.633
902	26.636	26.639	26.642	26.645	26.648	26.651	26.654	26.657	26.660	26.663
903	26.666	26.669	26.671	26.674	26.677	26.680	26.683	26.686	26.689	26.692
904	26.695	26.698	26.701	26.704	26.707	26.710	26.713	26.716	26.719	26.722
905	26.725	26.728	26.731	26.733	26.736	26.739	26.742	26.745	26.748	26.751
906	26.754	26.757	26.760	26.763	26.766	26.769	26.772	26.775	26.778	26.781
907	26.784	26.787	26.790	26.793	26.796	26.798	26.801	26.804	26.807	26.810
908	26.813	26.816	26.819	26.822	26.825	26.828	26.831	26.834	26.837	26.840
909	26.843	26.846	26.849	26.852	26.855	26.858	26.860	26.863	26.866	26.869
910	26.872	26.875	26.878	26.881	26.884	26.887	26.890	26.893	26.896	26.899
911	26.902	26.905	26.908	26.911	26.914	26.917	26.920	26.922	26.925	26.928
912	26.931	26.934	26.937	26.940	26.943	26.946	26.949	26.952	26.955	26.958
913	26.961	26.964	26.967	26.970	26.973	26.976	26.979	26.982	26.984	26.987
914	26.990	26.993	26.996	26.999	27.002	27.005	27.008	27.011	27.014	27.017
915	27.020	27.023	27.026	27.029	27.032	27.035	27.038	27.041	27.044	27.047
916	27.049	27.052	27.055	27.058	27.061	27.064	27.067	27.070	27.073	27.076
917	27.079	27.082	27.085	27.088	27.091	27.094	27.097	27.100	27.103	27.106
918	27.109	27.111	27.114	27.117	27.120	27.123	27.126	27.129	27.132	27.135
919	27.138	27.141	27.144	27.147	27.150	27.153	27.156	27.159	27.162	27.165
920	27.168	27.171	27.173	27.176	27.179	27.182	27.185	27.188	27.191	27.194
921	27.197	27.200	27.203	27.206	27.209	27.212	27.215	27.218	27.221	27.224
922	27.227	27.230	27.233	27.236	27.238	27.241	27.244	27.247	27.250	27.253
923	27.256	27.259	27.262	27.265	27.268	27.271	27.274	27.277	27.280	27.283
924	27.286	27.289	27.292	27.295	27.298	27.300	27.303	27.306	27.309	27.312
925	27.315	27.318	27.321	27.324	27.327	27.330	27.333	27.336	27.339	27.342
926	27.345	27.348	27.351	27.354	27.357	27.360	27.362	27.365	27.368	27.371
927	27.374	27.377	27.380	27.383	27.386	27.389	27.392	27.395	27.398	27.401
928	27.404	27.407	27.410	27.413	27.416	27.419	27.422	27.424	27.427	27.430
929	27.433	27.436	27.439	27.442	27.445	27.448	27.451	27.454	27.457	27.460
930	27.463	27.466	27.469	27.472	27.475	27.478	27.481	27.484	27.487	27.489
931	27.492	27.495	27.498	27.501	27.504	27.507	27.510	27.513	27.516	27.519
932	27.522	27.525	27.528	27.531	27.534	27.537	27.540	27.543	27.546	27.549
933	27.551	27.554	27.557	27.560	27.563	27.566	27.569	27.572	27.575	27.578
934	27.581	27.584	27.587	27.590	27.593	27.596	27.599	27.602	27.605	27.608
935	27.611	27.613	27.616	27.619	27.622	27.625	27.628	27.631	27.634	27.637
936	27.640	27.643	27.646	27.649	27.652	27.655	27.658	27.661	27.664	27.667
937	27.670	27.673	27.675	27.678	27.681	27.684	27.687	27.690	27.693	27.696
938	27.699	27.702	27.705	27.708	27.711	27.714	27.717	27.720	27.723	27.726
939	27.729	27.732	27.735	27.738	27.740	27.743	27.746	27.749	27.752	27.755
940	27.758	27.761	27.764	27.767	27.770	27.773	27.776	27.779	27.782	27.785
941	27.788	27.791	27.794	27.797	27.800	27.802	27.805	27.808	27.811	27.814
942	27.817	27.820	27.823	27.826	27.829	27.832	27.835	27.838	27.841	27.844
943	27.847	27.850	27.853	27.856	27.859	27.862	27.864	27.867	27.870	27.873
944	27.876	27.879	27.882	27.885	27.888	27.891	27.894	27.897	27.900	27.903
945	27.906	27.909	27.912	27.915	27.918	27.921	27.924	27.927	27.929	27.932
946	27.935	27.938	27.941	27.944	27.947	27.950	27.953	27.956	27.959	27.962
947	27.965	27.968	27.971	27.974	27.977	27.980	27.983	27.986	27.989	27.991
948	27.994	27.997	28.000	28.003	28.006	28.009	28.012	28.015	28.018	28.021
949	28.024	28.027	28.030	28.033	28.036	28.039	28.042	28.045	28.048	28.051
950	28.053	28.056	28.059	28.062	28.065	28.068	28.071	28.074	28.077	28.080

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
950	28.053	28.056	28.059	28.062	28.065	28.068	28.071	28.074	28.077	28.080
951	28.083	28.086	28.089	28.092	28.095	28.098	28.101	28.104	28.107	28.110
952	28.113	28.115	28.118	28.121	28.124	28.127	28.130	28.133	28.136	28.139
953	28.142	28.145	28.148	28.151	28.154	28.157	28.160	28.163	28.166	28.169
954	28.172	28.175	28.178	28.180	28.183	28.186	28.189	28.192	28.195	28.198
955	28.201	28.204	28.207	28.210	28.213	28.216	28.219	28.222	28.225	28.228
956	28.231	28.234	28.237	28.240	28.242	28.245	28.248	28.251	28.254	28.257
957	28.260	28.263	28.266	28.269	28.272	28.275	28.278	28.281	28.284	28.287
958	28.290	28.293	28.296	28.299	28.302	28.304	28.307	28.310	28.313	28.316
959	28.319	28.322	28.325	28.328	28.331	28.334	28.337	28.340	28.343	28.346
960	28.349	28.352	28.355	28.358	28.361	28.364	28.366	28.369	28.372	28.375
961	28.378	28.381	28.384	28.387	28.390	28.393	28.396	28.399	28.402	28.405
962	28.408	28.411	28.414	28.417	28.420	28.423	28.426	28.429	28.431	28.434
963	28.437	28.440	28.443	28.446	28.449	28.452	28.455	28.458	28.461	28.464
964	28.467	28.470	28.473	28.476	28.479	28.482	28.485	28.488	28.491	28.493
965	28.496	28.499	28.502	28.505	28.508	28.511	28.514	28.517	28.520	28.523
966	28.526	28.529	28.532	28.535	28.538	28.541	28.544	28.547	28.550	28.553
967	28.555	28.558	28.561	28.564	28.567	28.570	28.573	28.576	28.579	28.582
968	28.585	28.588	28.591	28.594	28.597	28.600	28.603	28.606	28.609	28.612
969	28.615	28.618	28.620	28.623	28.626	28.629	28.632	28.635	28.638	28.641
970	28.644	28.647	28.650	28.653	28.656	28.659	28.662	28.665	28.668	28.671
971	28.674	28.677	28.680	28.682	28.685	28.688	28.691	28.694	28.697	28.700
972	28.703	28.706	28.709	28.712	28.715	28.718	28.721	28.724	28.727	28.730
973	28.733	28.736	28.739	28.742	28.744	28.747	28.750	28.753	28.756	28.759
974	28.762	28.765	28.768	28.771	28.774	28.777	28.780	28.783	28.786	28.789
975	28.792	28.795	28.798	28.801	28.804	28.806	28.809	28.812	28.815	28.818
976	28.821	28.824	28.827	28.830	28.833	28.836	28.839	28.842	28.845	28.848
977	28.851	28.854	28.857	28.860	28.863	28.866	28.869	28.871	28.874	28.877
978	28.880	28.883	28.886	28.889	28.892	28.895	28.898	28.901	28.904	28.907
979	28.910	28.913	28.916	28.919	28.922	28.925	28.928	28.931	28.933	28.936
980	28.939	28.942	28.945	28.948	28.951	28.954	28.957	28.960	28.963	28.966
981	28.969	28.972	28.975	28.978	28.981	28.984	28.987	28.990	28.993	28.995
982	28.998	29.001	29.004	29.007	29.010	29.013	29.016	29.019	29.022	29.025
983	29.028	29.031	29.034	29.037	29.040	29.043	29.046	29.049	29.052	29.055
984	29.058	29.060	29.063	29.066	29.069	29.072	29.075	29.078	29.081	29.084
985	29.087	29.090	29.093	29.096	29.099	29.102	29.105	29.108	29.111	29.114
986	29.117	29.120	29.122	29.125	29.128	29.131	29.134	29.137	29.140	29.143
987	29.146	29.149	29.152	29.155	29.158	29.161	29.164	29.167	29.170	29.173
988	29.176	29.179	29.182	29.184	29.187	29.190	29.193	29.196	29.199	29.202
989	29.205	29.208	29.211	29.214	29.217	29.220	29.223	29.226	29.229	29.232
990	29.235	29.238	29.241	29.244	29.246	29.249	29.252	29.255	29.258	29.261
991	29.264	29.267	29.270	29.273	29.276	29.279	29.282	29.285	29.288	29.291
992	29.294	29.297	29.300	29.303	29.306	29.309	29.311	29.314	29.317	29.320
993	29.323	29.326	29.329	29.332	29.335	29.338	29.341	29.344	29.347	29.350
994	29.353	29.356	29.359	29.362	29.365	29.368	29.371	29.373	29.376	29.379
995	29.382	29.385	29.388	29.391	29.394	29.397	29.400	29.403	29.406	29.409
996	29.412	29.415	29.418	29.421	29.424	29.427	29.430	29.433	29.435	29.438
997	29.441	29.444	29.447	29.450	29.453	29.456	29.459	29.462	29.465	29.468
998	29.471	29.474	29.477	29.480	29.483	29.486	29.489	29.492	29.495	29.497
999	29.500	29.503	29.506	29.509	29.512	29.515	29.518	29.521	29.524	29.527
1000	29.530	29.533	29.536	29.539	29.542	29.545	29.548	29.551	29.554	29.557

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
1000	29.530	29.533	29.536	29.539	29.542	29.545	29.548	29.551	29.554	29.557
1001	29.560	29.562	29.565	29.568	29.571	29.574	29.577	29.580	29.583	29.586
1002	29.589	29.592	29.595	29.598	29.601	29.604	29.607	29.610	29.613	29.616
1003	29.619	29.622	29.624	29.627	29.630	29.633	29.636	29.639	29.642	29.645
1004	29.648	29.651	29.654	29.657	29.660	29.663	29.666	29.669	29.672	29.675
1005	29.678	29.681	29.684	29.686	29.689	29.692	29.695	29.698	29.701	29.704
1006	29.707	29.710	29.713	29.716	29.719	29.722	29.725	29.728	29.731	29.734
1007	29.737	29.740	29.743	29.746	29.749	29.751	29.754	29.757	29.760	29.763
1008	29.766	29.769	29.772	29.775	29.778	29.781	29.784	29.787	29.790	29.793
1009	29.796	29.799	29.802	29.805	29.808	29.811	29.813	29.816	29.819	29.822
1010	29.825	29.828	29.831	29.834	29.837	29.840	29.843	29.846	29.849	29.852
1011	29.855	29.858	29.861	29.864	29.867	29.870	29.873	29.875	29.878	29.881
1012	29.884	29.887	29.890	29.893	29.896	29.899	29.902	29.905	29.908	29.911
1013	29.914	29.917	29.920	29.923	29.926	29.929	29.932	29.935	29.937	29.940
1014	29.943	29.946	29.949	29.952	29.955	29.958	29.961	29.964	29.967	29.970
1015	29.973	29.976	29.979	29.982	29.985	29.988	29.991	29.994	29.997	30.000
1016	30.002	30.005	30.008	30.011	30.014	30.017	30.020	30.023	30.026	30.029
1017	30.032	30.035	30.038	30.041	30.044	30.047	30.050	30.053	30.056	30.059
1018	30.062	30.064	30.067	30.070	30.073	30.076	30.079	30.082	30.085	30.088
1019	30.091	30.094	30.097	30.100	30.103	30.106	30.109	30.112	30.115	30.118
1020	30.121	30.124	30.126	30.129	30.132	30.135	30.138	30.141	30.144	30.147
1021	30.150	30.153	30.156	30.159	30.162	30.165	30.168	30.171	30.174	30.177
1022	30.180	30.183	30.186	30.188	30.191	30.194	30.197	30.200	30.203	30.206
1023	30.209	30.212	30.215	30.218	30.221	30.224	30.227	30.230	30.233	30.236
1024	30.239	30.242	30.245	30.248	30.251	30.253	30.256	30.259	30.262	30.265
1025	30.268	30.271	30.274	30.277	30.280	30.283	30.286	30.289	30.292	30.295
1026	30.298	30.301	30.304	30.307	30.310	30.313	30.315	30.318	30.321	30.324
1027	30.327	30.330	30.333	30.336	30.339	30.342	30.345	30.348	30.351	30.354
1028	30.357	30.360	30.363	30.366	30.369	30.372	30.375	30.377	30.380	30.383
1029	30.386	30.389	30.392	30.395	30.398	30.401	30.404	30.407	30.410	30.413
1030	30.416	30.419	30.422	30.425	30.428	30.431	30.434	30.437	30.440	30.442
1031	30.445	30.448	30.451	30.454	30.457	30.460	30.463	30.466	30.469	30.472
1032	30.475	30.478	30.481	30.484	30.487	30.490	30.493	30.496	30.499	30.502
1033	30.504	30.507	30.510	30.513	30.516	30.519	30.522	30.525	30.528	30.531
1034	30.534	30.537	30.540	30.543	30.546	30.549	30.552	30.555	30.558	30.561
1035	30.564	30.566	30.569	30.572	30.575	30.578	30.581	30.584	30.587	30.590
1036	30.593	30.596	30.599	30.602	30.605	30.608	30.611	30.614	30.617	30.620
1037	30.623	30.626	30.628	30.631	30.634	30.637	30.640	30.643	30.646	30.649
1038	30.652	30.655	30.658	30.661	30.664	30.667	30.670	30.673	30.676	30.679
1039	30.682	30.685	30.688	30.691	30.693	30.696	30.699	30.702	30.705	30.708
1040	30.711	30.714	30.717	30.720	30.723	30.726	30.729	30.732	30.735	30.738
1041	30.741	30.744	30.747	30.750	30.753	30.755	30.758	30.761	30.764	30.767
1042	30.770	30.773	30.776	30.779	30.782	30.785	30.788	30.791	30.794	30.797
1043	30.800	30.803	30.806	30.809	30.812	30.815	30.817	30.820	30.823	30.826
1044	30.829	30.832	30.835	30.838	30.841	30.844	30.847	30.850	30.853	30.856
1045	30.859	30.862	30.865	30.868	30.871	30.874	30.877	30.880	30.882	30.885
1046	30.888	30.891	30.894	30.897	30.900	30.903	30.906	30.909	30.912	30.915
1047	30.918	30.921	30.924	30.927	30.930	30.933	30.936	30.939	30.942	30.944
1048	30.947	30.950	30.953	30.956	30.959	30.962	30.965	30.968	30.971	30.974
1049	30.977	30.980	30.983	30.986	30.989	30.992	30.995	30.998	31.001	31.004
1050	31.006	31.009	31.012	31.015	31.018	31.021	31.024	31.027	31.030	31.033

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

MILLIBARS TO INCHES OF MERCURY

1 millibar = 0.02952998 inch of mercury.

Millibars	.0 In. Hg.	.1 In. Hg.	.2 In. Hg.	.3 In. Hg.	.4 In. Hg.	.5 In. Hg.	.6 In. Hg.	.7 In. Hg.	.8 In. Hg.	.9 In. Hg.
1050	31.006	31.009	31.012	31.015	31.018	31.021	31.024	31.027	31.030	31.033
1051	31.036	31.039	31.042	31.045	31.048	31.051	31.054	31.057	31.060	31.063
1052	31.066	31.068	31.071	31.074	31.077	31.080	31.083	31.086	31.089	31.092
1053	31.095	31.098	31.101	31.104	31.107	31.110	31.113	31.116	31.119	31.122
1054	31.125	31.128	31.131	31.133	31.136	31.139	31.142	31.145	31.148	31.151
1055	31.154	31.157	31.160	31.163	31.166	31.169	31.172	31.175	31.178	31.181
1056	31.184	31.187	31.190	31.193	31.195	31.198	31.201	31.204	31.207	31.210
1057	31.213	31.216	31.219	31.222	31.225	31.228	31.231	31.234	31.237	31.240
1058	31.243	31.246	31.249	31.252	31.255	31.257	31.260	31.263	31.266	31.269
1059	31.272	31.275	31.278	31.281	31.284	31.287	31.290	31.293	31.296	31.299
1060	31.302	31.305	31.308	31.311	31.314	31.317	31.319	31.322	31.325	31.328
1061	31.331	31.334	31.337	31.340	31.343	31.346	31.349	31.352	31.355	31.358
1062	31.361	31.364	31.367	31.370	31.373	31.376	31.379	31.382	31.384	31.387
1063	31.390	31.393	31.396	31.399	31.402	31.405	31.408	31.411	31.414	31.417
1064	31.420	31.423	31.426	31.429	31.432	31.435	31.438	31.441	31.444	31.446
1065	31.449	31.452	31.455	31.458	31.461	31.464	31.467	31.470	31.473	31.476
1066	31.479	31.482	31.485	31.488	31.491	31.494	31.497	31.500	31.503	31.506
1067	31.508	31.511	31.514	31.517	31.520	31.523	31.526	31.529	31.532	31.535
1068	31.538	31.541	31.544	31.547	31.550	31.553	31.556	31.559	31.562	31.565
1069	31.568	31.571	31.573	31.576	31.579	31.582	31.585	31.588	31.591	31.594
1070	31.597	31.600	31.603	31.606	31.609	31.612	31.615	31.618	31.621	31.624
1071	31.627	31.630	31.633	31.635	31.638	31.641	31.644	31.647	31.650	31.653
1072	31.656	31.659	31.662	31.665	31.668	31.671	31.674	31.677	31.680	31.683
1073	31.686	31.689	31.692	31.695	31.697	31.700	31.703	31.706	31.709	31.712
1074	31.715	31.718	31.721	31.724	31.727	31.730	31.733	31.736	31.739	31.742
1075	31.745	31.748	31.751	31.754	31.757	31.759	31.762	31.765	31.768	31.771
1076	31.774	31.777	31.780	31.783	31.786	31.789	31.792	31.795	31.798	31.801
1077	31.804	31.807	31.810	31.813	31.816	31.819	31.822	31.824	31.827	31.830
1078	31.833	31.836	31.839	31.842	31.845	31.848	31.851	31.854	31.857	31.860
1079	31.863	31.866	31.869	31.872	31.875	31.878	31.881	31.884	31.886	31.889
1080	31.892	31.895	31.898	31.901	31.904	31.907	31.910	31.913	31.916	31.919
1081	31.922	31.925	31.928	31.931	31.934	31.937	31.940	31.943	31.946	31.948
1082	31.951	31.954	31.957	31.960	31.963	31.966	31.969	31.972	31.975	31.978
1083	31.981	31.984	31.987	31.990	31.993	31.996	31.999	32.002	32.005	32.008
1084	32.010	32.013	32.016	32.019	32.022	32.025	32.028	32.031	32.034	32.037
1085	32.040	32.043	32.046	32.049	32.052	32.055	32.058	32.061	32.064	32.067
1086	32.070	32.073	32.075	32.078	32.081	32.084	32.087	32.090	32.093	32.096
1087	32.099	32.102	32.105	32.108	32.111	32.114	32.117	32.120	32.123	32.126
1088	32.129	32.132	32.135	32.137	32.140	32.143	32.146	32.149	32.152	32.155
1089	32.158	32.161	32.164	32.167	32.170	32.173	32.176	32.179	32.182	32.185
1090	32.188	32.191	32.194	32.197	32.199	32.202	32.205	32.208	32.211	32.214
1091	32.217	32.220	32.223	32.226	32.229	32.232	32.235	32.238	32.241	32.244
1092	32.247	32.250	32.253	32.256	32.259	32.262	32.264	32.267	32.270	32.273
1093	32.276	32.279	32.282	32.285	32.288	32.291	32.294	32.297	32.300	32.303
1094	32.306	32.309	32.312	32.315	32.318	32.321	32.324	32.326	32.329	32.332
1095	32.335	32.338	32.341	32.344	32.347	32.350	32.353	32.356	32.359	32.362
1096	32.365	32.368	32.371	32.374	32.377	32.380	32.383	32.386	32.388	32.391
1097	32.394	32.397	32.400	32.403	32.406	32.409	32.412	32.415	32.418	32.421
1098	32.424	32.427	32.430	32.433	32.436	32.439	32.442	32.445	32.448	32.450
1099	32.453	32.456	32.459	32.462	32.465	32.468	32.471	32.474	32.477	32.480
1100	32.483	32.486	32.489	32.492	32.495	32.498	32.501	32.504	32.507	32.510

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in. Hg.	.000	.001	.001	.001	.001	.002	.002	.002	.003

TABLE 11

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Milli-meters	0	1	2	3	4	5	6	7	8	9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
0	0.00	1.33	2.67	4.00	5.33	6.67	8.00	9.33	10.67	12.00
10	13.33	14.67	16.00	17.33	18.67	20.00	21.33	22.66	24.00	25.33
20	26.66	28.00	29.33	30.66	32.00	33.33	34.66	36.00	37.33	38.66
30	40.00	41.33	42.66	44.00	45.33	46.66	48.00	49.33	50.66	52.00
40	53.33	54.66	56.00	57.33	58.66	60.00	61.33	62.66	63.99	65.33
50	66.66	67.99	69.33	70.66	71.99	73.33	74.66	75.99	77.33	78.66
60	79.99	81.33	82.66	83.99	85.33	86.66	87.99	89.33	90.66	91.99
70	93.33	94.66	95.99	97.33	98.66	99.99	101.33	102.66	103.99	105.32
80	106.66	107.99	109.32	110.66	111.99	113.32	114.66	115.99	117.32	118.66
90	119.99	121.32	122.66	123.99	125.32	126.66	127.99	129.32	130.66	131.99
100	133.32	134.66	135.99	137.32	138.66	139.99	141.32	142.65	143.99	145.32
110	146.65	147.99	149.32	150.65	151.99	153.32	154.65	155.99	157.32	158.65
120	159.99	161.32	162.65	163.99	165.32	166.65	167.99	169.32	170.65	171.99
130	173.32	174.65	175.99	177.32	178.65	179.99	181.32	182.65	183.98	185.32
140	186.65	187.98	189.32	190.65	191.98	193.32	194.65	195.98	197.32	198.65
150	199.98	201.32	202.65	203.98	205.32	206.65	207.98	209.32	210.65	211.98
160	213.32	214.65	215.98	217.32	218.65	219.98	221.32	222.65	223.98	225.31
170	226.65	227.98	229.31	230.65	231.98	233.31	234.65	235.98	237.31	238.65
180	239.98	241.31	242.65	243.98	245.31	246.65	247.98	249.31	250.65	251.98
190	253.31	254.65	255.98	257.31	258.65	259.98	261.31	262.65	263.98	265.31
200	266.64	267.98	269.31	270.64	271.98	273.31	274.64	275.98	277.31	278.64
210	279.98	281.31	282.64	283.98	285.31	286.64	287.98	289.31	290.64	291.98
220	293.31	294.64	295.98	297.31	298.64	299.98	301.31	302.64	303.98	305.31
230	306.64	307.97	309.31	310.64	311.97	313.31	314.64	315.97	317.31	318.64
240	319.97	321.31	322.64	323.97	325.31	326.64	327.97	329.31	330.64	331.97
250	333.31	334.64	335.97	337.31	338.64	339.97	341.31	342.64	343.97	345.31
260	346.64	347.97	349.30	350.64	351.97	353.30	354.64	355.97	357.30	358.64
270	359.97	361.30	362.64	363.97	365.30	366.64	367.97	369.30	370.64	371.97
280	373.30	374.64	375.97	377.30	378.64	379.97	381.30	382.64	383.97	385.30
290	386.63	387.97	389.30	390.63	391.97	393.30	394.63	395.97	397.30	398.63
300	399.97	401.30	402.63	403.97	405.30	406.63	407.97	409.30	410.63	411.97
310	413.30	414.63	415.97	417.30	418.63	419.97	421.30	422.63	423.97	425.30
320	426.63	427.96	429.30	430.63	431.96	433.30	434.63	435.96	437.30	438.63
330	439.96	441.30	442.63	443.96	445.30	446.63	447.96	449.30	450.63	451.96
340	453.30	454.63	455.96	457.30	458.63	459.96	461.30	462.63	463.96	465.30
350	466.63	467.96	469.29	470.63	471.96	473.29	474.63	475.96	477.29	478.63
360	479.96	481.29	482.63	483.96	485.29	486.63	487.96	489.29	490.63	491.96
370	493.29	494.63	495.96	497.29	498.63	499.96	501.29	502.63	503.96	505.29
380	506.63	507.96	509.29	510.62	511.96	513.29	514.62	515.96	517.29	518.62
390	519.96	521.29	522.62	523.96	525.29	526.62	527.96	529.29	530.62	531.96
400	533.29	534.62	535.96	537.29	538.62	539.96	541.29	542.62	543.96	545.29
410	546.62	547.96	549.29	550.62	551.95	553.29	554.62	555.95	557.29	558.62
420	559.95	561.29	562.62	563.95	565.29	566.62	567.95	569.29	570.62	571.95
430	573.29	574.62	575.95	577.29	578.62	579.95	581.29	582.62	583.95	585.29
440	586.62	587.95	589.29	590.62	591.95	593.28	594.62	595.95	597.28	598.62
450	599.95	601.28	602.62	603.95	605.28	606.62	607.95	609.28	610.62	611.95
460	613.28	614.62	615.95	617.28	618.62	619.95	621.28	622.62	623.95	625.28
470	626.62	627.95	629.28	630.61	631.95	633.28	634.61	635.95	637.28	638.61
480	639.95	641.28	642.61	643.95	645.28	646.61	647.95	649.28	650.61	651.95
490	653.28	654.61	655.95	657.28	658.61	659.95	661.28	662.61	663.95	665.28
500	666.61	667.95	669.28	670.61	671.94	673.28	674.61	675.94	677.28	678.61

(*continued*)

Proportional parts										
	mm. Hg.	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	.13	.27	.40	.53	.67	.80	.93	1.07	1.20

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0 mb.	.1 mb.	.2 mb.	.3 mb.	.4 mb.	.5 mb.	.6 mb.	.7 mb.	.8 mb.	.9 mb.
500	666.61	666.75	666.88	667.01	667.15	667.28	667.41	667.55	667.68	667.81
501	667.95	668.08	668.21	668.35	668.48	668.61	668.75	668.88	669.01	669.15
502	669.28	669.41	669.55	669.68	669.81	669.95	670.08	670.21	670.35	670.48
503	670.61	670.74	670.88	671.01	671.14	671.28	671.41	671.54	671.68	671.81
504	671.94	672.08	672.21	672.34	672.48	672.61	672.74	672.88	673.01	673.14
505	673.28	673.41	673.54	673.68	673.81	673.94	674.08	674.21	674.34	674.48
506	674.61	674.74	674.88	675.01	675.14	675.28	675.41	675.54	675.68	675.81
507	675.94	676.08	676.21	676.34	676.48	676.61	676.74	676.88	677.01	677.14
508	677.28	677.41	677.54	677.68	677.81	677.94	678.08	678.21	678.34	678.48
509	678.61	678.74	678.88	679.01	679.14	679.28	679.41	679.54	679.68	679.81
510	679.94	680.08	680.21	680.34	680.48	680.61	680.74	680.88	681.01	681.14
511	681.28	681.41	681.54	681.68	681.81	681.94	682.08	682.21	682.34	682.48
512	682.61	682.74	682.88	683.01	683.14	683.28	683.41	683.54	683.68	683.81
513	683.94	684.08	684.21	684.34	684.48	684.61	684.74	684.88	685.01	685.14
514	685.28	685.41	685.54	685.68	685.81	685.94	686.08	686.21	686.34	686.48
515	686.61	686.74	686.88	687.01	687.14	687.28	687.41	687.54	687.68	687.81
516	687.94	688.08	688.21	688.34	688.48	688.61	688.74	688.88	689.01	689.14
517	689.28	689.41	689.54	689.68	689.81	689.94	690.08	690.21	690.34	690.48
518	690.61	690.74	690.88	691.01	691.14	691.28	691.41	691.54	691.68	691.81
519	691.94	692.08	692.21	692.34	692.48	692.61	692.74	692.88	693.01	693.14
520	693.28	693.41	693.54	693.68	693.81	693.94	694.08	694.21	694.34	694.48
521	694.61	694.74	694.88	695.01	695.14	695.28	695.41	695.54	695.68	695.81
522	695.94	696.08	696.21	696.34	696.48	696.61	696.74	696.88	697.01	697.14
523	697.28	697.41	697.54	697.68	697.81	697.94	698.08	698.21	698.34	698.48
524	698.61	698.74	698.88	699.01	699.14	699.28	699.41	699.54	699.68	699.81
525	699.94	700.08	700.21	700.34	700.48	700.61	700.74	700.88	701.01	701.14
526	701.28	701.41	701.54	701.68	701.81	701.94	702.08	702.21	702.34	702.48
527	702.61	702.74	702.88	703.01	703.14	703.28	703.41	703.54	703.68	703.81
528	703.94	704.08	704.21	704.34	704.48	704.61	704.74	704.88	705.01	705.14
529	705.28	705.41	705.54	705.68	705.81	705.94	706.08	706.21	706.34	706.48
530	706.61	706.74	706.88	707.01	707.14	707.28	707.41	707.54	707.68	707.81
531	707.94	708.08	708.21	708.34	708.48	708.61	708.74	708.88	709.01	709.14
532	709.28	709.41	709.54	709.68	709.81	709.94	710.08	710.21	710.34	710.48
533	710.61	710.74	710.88	711.01	711.14	711.28	711.41	711.54	711.67	711.81
534	711.94	712.07	712.21	712.34	712.47	712.61	712.74	712.87	713.01	713.14
535	713.27	713.41	713.54	713.67	713.81	713.94	714.07	714.21	714.34	714.47
536	714.61	714.74	714.87	715.01	715.14	715.27	715.41	715.54	715.67	715.81
537	715.94	716.07	716.21	716.34	716.47	716.61	716.74	716.87	717.01	717.14
538	717.27	717.41	717.54	717.67	717.81	717.94	718.07	718.21	718.34	718.47
539	718.61	718.74	718.87	719.01	719.14	719.27	719.41	719.54	719.67	719.81
540	719.94	720.07	720.21	720.34	720.47	720.61	720.74	720.87	721.01	721.14
541	721.27	721.41	721.54	721.67	721.81	721.94	722.07	722.21	722.34	722.47
542	722.61	722.74	722.87	723.01	723.14	723.27	723.41	723.54	723.67	723.81
543	723.94	724.07	724.21	724.34	724.47	724.61	724.74	724.87	725.01	725.14
544	725.27	725.41	725.54	725.67	725.81	725.94	726.07	726.21	726.34	726.47
545	726.61	726.74	726.87	727.01	727.14	727.27	727.41	727.54	727.67	727.81
546	727.94	728.07	728.21	728.34	728.47	728.61	728.74	728.87	729.01	729.14
547	729.27	729.41	729.54	729.67	729.81	729.94	730.07	730.21	730.34	730.47
548	730.61	730.74	730.87	731.01	731.14	731.27	731.41	731.54	731.67	731.81
549	731.94	732.07	732.21	732.34	732.47	732.61	732.74	732.87	733.01	733.14
550	733.27	733.41	733.54	733.67	733.81	733.94	734.07	734.21	734.34	734.47

(*continued*)

Proportional parts										
mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
550	733.27	733.41	733.54	733.67	733.81	733.94	734.07	734.21	734.34	734.47
551	734.61	734.74	734.87	735.01	735.14	735.27	735.41	735.54	735.67	735.81
552	735.94	736.07	736.21	736.34	736.47	736.61	736.74	736.87	737.01	737.14
553	737.27	737.41	737.54	737.67	737.81	737.94	738.07	738.21	738.34	738.47
554	738.61	738.74	738.87	739.01	739.14	739.27	739.41	739.54	739.67	739.81
555	739.94	740.07	740.21	740.34	740.47	740.61	740.74	740.87	741.01	741.14
556	741.27	741.41	741.54	741.67	741.81	741.94	742.07	742.21	742.34	742.47
557	742.61	742.74	742.87	743.01	743.14	743.27	743.41	743.54	743.67	743.81
558	743.94	744.07	744.21	744.34	744.47	744.61	744.74	744.87	745.01	745.14
559	745.27	745.41	745.54	745.67	745.81	745.94	746.07	746.21	746.34	746.47
560	746.61	746.74	746.87	747.01	747.14	747.27	747.41	747.54	747.67	747.81
561	747.94	748.07	748.21	748.34	748.47	748.61	748.74	748.87	749.01	749.14
562	749.27	749.41	749.54	749.67	749.81	749.94	750.07	750.21	750.34	750.47
563	750.61	750.74	750.87	751.01	751.14	751.27	751.41	751.54	751.67	751.81
564	751.94	752.07	752.20	752.34	752.47	752.60	752.74	752.87	753.00	753.14
565	753.27	753.40	753.54	753.67	753.80	753.94	754.07	754.20	754.34	754.47
566	754.60	754.74	754.87	755.00	755.14	755.27	755.40	755.54	755.67	755.80
567	755.94	756.07	756.20	756.34	756.47	756.60	756.74	756.87	757.00	757.14
568	757.27	757.40	757.54	757.67	757.80	757.94	758.07	758.20	758.34	758.47
569	758.60	758.74	758.87	759.00	759.14	759.27	759.40	759.54	759.67	759.80
570	759.94	760.07	760.20	760.34	760.47	760.60	760.74	760.87	761.00	761.14
571	761.27	761.40	761.54	761.67	761.80	761.94	762.07	762.20	762.34	762.47
572	762.60	762.74	762.87	763.00	763.14	763.27	763.40	763.54	763.67	763.80
573	763.94	764.07	764.20	764.34	764.47	764.60	764.74	764.87	765.00	765.14
574	765.27	765.40	765.54	765.67	765.80	765.94	766.07	766.20	766.34	766.47
575	766.60	766.74	766.87	767.00	767.14	767.27	767.40	767.54	767.67	767.80
576	767.94	768.07	768.20	768.34	768.47	768.60	768.74	768.87	769.00	769.14
577	769.27	769.40	769.54	769.67	769.80	769.94	770.07	770.20	770.34	770.47
578	770.60	770.74	770.87	771.00	771.14	771.27	771.40	771.54	771.67	771.80
579	771.94	772.07	772.20	772.34	772.47	772.60	772.74	772.87	773.00	773.14
580	773.27	773.40	773.54	773.67	773.80	773.94	774.07	774.20	774.34	774.47
581	774.60	774.74	774.87	775.00	775.14	775.27	775.40	775.54	775.67	775.80
582	775.94	776.07	776.20	776.34	776.47	776.60	776.74	776.87	777.00	777.14
583	777.27	777.40	777.54	777.67	777.80	777.94	778.07	778.20	778.34	778.47
584	778.60	778.74	778.87	779.00	779.14	779.27	779.40	779.54	779.67	779.80
585	779.94	780.07	780.20	780.34	780.47	780.60	780.74	780.87	781.00	781.14
586	781.27	781.40	781.54	781.67	781.80	781.94	782.07	782.20	782.34	782.47
587	782.60	782.74	782.87	783.00	783.14	783.27	783.40	783.54	783.67	783.80
588	783.94	784.07	784.20	784.34	784.47	784.60	784.74	784.87	785.00	785.14
589	785.27	785.40	785.54	785.67	785.80	785.94	786.07	786.20	786.34	786.47
590	786.60	786.74	786.87	787.00	787.14	787.27	787.40	787.54	787.67	787.80
591	787.94	788.07	788.20	788.34	788.47	788.60	788.74	788.87	789.00	789.14
592	789.27	789.40	789.54	789.67	789.80	789.94	790.07	790.20	790.34	790.47
593	790.60	790.74	790.87	791.00	791.14	791.27	791.40	791.54	791.67	791.80
594	791.94	792.07	792.20	792.34	792.47	792.60	792.73	792.87	793.00	793.13
595	793.27	793.40	793.53	793.67	793.80	793.93	794.07	794.20	794.33	794.47
596	794.60	794.73	794.87	795.00	795.13	795.27	795.40	795.53	795.67	795.80
597	795.93	796.07	796.20	796.33	796.47	796.60	796.73	796.87	797.00	797.13
598	797.27	797.40	797.53	797.67	797.80	797.93	798.07	798.20	798.33	798.47
599	798.60	798.73	798.87	799.00	799.13	799.27	799.40	799.53	799.67	799.80
600	799.93	800.07	800.20	800.33	800.47	800.60	800.73	800.87	801.00	801.13

(continued)

Proportional parts										
mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
600	799.93	800.07	800.20	800.33	800.47	800.60	800.73	800.87	801.00	801.13
601	801.27	801.40	801.53	801.67	801.80	801.93	802.07	802.20	802.33	802.47
602	802.60	802.73	802.87	803.00	803.13	803.27	803.40	803.53	803.67	803.80
603	803.93	804.07	804.20	804.33	804.47	804.60	804.73	804.87	805.00	805.13
604	805.27	805.40	805.53	805.67	805.80	805.93	806.07	806.20	806.33	806.47
605	806.60	806.73	806.87	807.00	807.13	807.27	807.40	807.53	807.67	807.80
606	807.93	808.07	808.20	808.33	808.47	808.60	808.73	808.87	809.00	809.13
607	809.27	809.40	809.53	809.67	809.80	809.93	810.07	810.20	810.33	810.47
608	810.60	810.73	810.87	811.00	811.13	811.27	811.40	811.53	811.67	811.80
609	811.93	812.07	812.20	812.33	812.47	812.60	812.73	812.87	813.00	813.13
610	813.27	813.40	813.53	813.67	813.80	813.93	814.07	814.20	814.33	814.47
611	814.60	814.73	814.87	815.00	815.13	815.27	815.40	815.53	815.67	815.80
612	815.93	816.07	816.20	816.33	816.47	816.60	816.73	816.87	817.00	817.13
613	817.27	817.40	817.53	817.67	817.80	817.93	818.07	818.20	818.33	818.47
614	818.60	818.73	818.87	819.00	819.13	819.27	819.40	819.53	819.67	819.80
615	819.93	820.07	820.20	820.33	820.47	820.60	820.73	820.87	821.00	821.13
616	821.27	821.40	821.53	821.67	821.80	821.93	822.07	822.20	822.33	822.47
617	822.60	822.73	822.87	823.00	823.13	823.27	823.40	823.53	823.67	823.80
618	823.93	824.07	824.20	824.33	824.47	824.60	824.73	824.87	825.00	825.13
619	825.27	825.40	825.53	825.67	825.80	825.93	826.07	826.20	826.33	826.47
620	826.60	826.73	826.87	827.00	827.13	827.27	827.40	827.53	827.67	827.80
621	827.93	828.07	828.20	828.33	828.47	828.60	828.73	828.87	829.00	829.13
622	829.27	829.40	829.53	829.67	829.80	829.93	830.07	830.20	830.33	830.47
623	830.60	830.73	830.87	831.00	831.13	831.27	831.40	831.53	831.67	831.80
624	831.93	832.07	832.20	832.33	832.47	832.60	832.73	832.87	833.00	833.13
625	833.27	833.40	833.53	833.66	833.80	833.93	834.06	834.20	834.33	834.46
626	834.60	834.73	834.86	835.00	835.13	835.26	835.40	835.53	835.66	835.80
627	835.93	836.06	836.20	836.33	836.46	836.60	836.73	836.86	837.00	837.13
628	837.26	837.40	837.53	837.66	837.80	837.93	838.06	838.20	838.33	838.46
629	838.60	838.73	838.86	839.00	839.13	839.26	839.40	839.53	839.66	839.80
630	839.93	840.06	840.20	840.33	840.46	840.60	840.73	840.86	841.00	841.13
631	841.26	841.40	841.53	841.66	841.80	841.93	842.06	842.20	842.33	842.46
632	842.60	842.73	842.86	843.00	843.13	843.26	843.40	843.53	843.66	843.80
633	843.93	844.06	844.20	844.33	844.46	844.60	844.73	844.86	845.00	845.13
634	845.26	845.40	845.53	845.66	845.80	845.93	846.06	846.20	846.33	846.46
635	846.60	846.73	846.86	847.00	847.13	847.26	847.40	847.53	847.66	847.80
636	847.93	848.06	848.20	848.33	848.46	848.60	848.73	848.86	849.00	849.13
637	849.26	849.40	849.53	849.66	849.80	849.93	850.06	850.20	850.33	850.46
638	850.60	850.73	850.86	851.00	851.13	851.26	851.40	851.53	851.66	851.80
639	851.93	852.06	852.20	852.33	852.46	852.60	852.73	852.86	853.00	853.13
640	853.26	853.40	853.53	853.66	853.80	853.93	854.06	854.20	854.33	854.46
641	854.60	854.73	854.86	855.00	855.13	855.26	855.40	855.53	855.66	855.80
642	855.93	856.06	856.20	856.33	856.46	856.60	856.73	856.86	857.00	857.13
643	857.26	857.40	857.53	857.66	857.80	857.93	858.06	858.20	858.33	858.46
644	858.60	858.73	858.86	859.00	859.13	859.26	859.40	859.53	859.66	859.80
645	859.93	860.06	860.20	860.33	860.46	860.60	860.73	860.86	861.00	861.13
646	861.26	861.40	861.53	861.66	861.80	861.93	862.06	862.20	862.33	862.46
647	862.60	862.73	862.86	863.00	863.13	863.26	863.40	863.53	863.66	863.80
648	863.93	864.06	864.20	864.33	864.46	864.60	864.73	864.86	865.00	865.13
649	865.26	865.40	865.53	865.66	865.80	865.93	866.06	866.20	866.33	866.46
650	866.60	866.73	866.86	867.00	867.13	867.26	867.40	867.53	867.66	867.80

(continued)

Proportional parts										
	mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
650	866.60	866.73	866.86	867.00	867.13	867.26	867.40	867.53	867.66	867.80
651	867.93	868.06	868.20	868.33	868.46	868.60	868.73	868.86	869.00	869.13
652	869.26	869.40	869.53	869.66	869.80	869.93	870.06	870.20	870.33	870.46
653	870.60	870.73	870.86	871.00	871.13	871.26	871.40	871.53	871.66	871.80
654	871.93	872.06	872.20	872.33	872.46	872.60	872.73	872.86	873.00	873.13
655	873.26	873.40	873.53	873.66	873.80	873.93	874.06	874.19	874.33	874.46
656	874.59	874.73	874.86	874.99	875.13	875.26	875.39	875.53	875.66	875.79
657	875.93	876.06	876.19	876.33	876.46	876.59	876.73	876.86	876.99	877.13
658	877.26	877.39	877.53	877.66	877.79	877.93	878.06	878.19	878.33	878.46
659	878.59	878.73	878.86	878.99	879.13	879.26	879.39	879.53	879.66	879.79
660	879.93	880.06	880.19	880.33	880.46	880.59	880.73	880.86	880.99	881.13
661	881.26	881.39	881.53	881.66	881.79	881.93	882.06	882.19	882.33	882.46
662	882.59	882.73	882.86	882.99	883.13	883.26	883.39	883.53	883.66	883.79
663	883.93	884.06	884.19	884.33	884.46	884.59	884.73	884.86	884.99	885.13
664	885.26	885.39	885.53	885.66	885.79	885.93	886.06	886.19	886.33	886.46
665	886.59	886.73	886.86	886.99	887.13	887.26	887.39	887.53	887.66	887.79
666	887.93	888.06	888.19	888.33	888.46	888.59	888.73	888.86	888.99	889.13
667	889.26	889.39	889.53	889.66	889.79	889.93	890.06	890.19	890.33	890.46
668	890.59	890.73	890.86	890.99	891.13	891.26	891.39	891.53	891.66	891.79
669	891.93	892.06	892.19	892.33	892.46	892.59	892.73	892.86	892.99	893.13
670	893.26	893.39	893.53	893.66	893.79	893.93	894.06	894.19	894.33	894.46
671	894.59	894.73	894.86	894.99	895.13	895.26	895.39	895.53	895.66	895.79
672	895.93	896.06	896.19	896.33	896.46	896.59	896.73	896.86	896.99	897.13
673	897.26	897.39	897.53	897.66	897.79	897.93	898.06	898.19	898.33	898.46
674	898.59	898.73	898.86	898.99	899.13	899.26	899.39	899.53	899.66	899.79
675	899.93	900.06	900.19	900.33	900.46	900.59	900.73	900.86	900.99	901.13
676	901.26	901.39	901.53	901.66	901.79	901.93	902.06	902.19	902.33	902.46
677	902.59	902.73	902.86	902.99	903.13	903.26	903.39	903.53	903.66	903.79
678	903.93	904.06	904.19	904.33	904.46	904.59	904.73	904.86	904.99	905.13
679	905.26	905.39	905.53	905.66	905.79	905.93	906.06	906.19	906.33	906.46
680	906.59	906.73	906.86	906.99	907.13	907.26	907.39	907.53	907.66	907.79
681	907.93	908.06	908.19	908.33	908.46	908.59	908.73	908.86	908.99	909.13
682	909.26	909.39	909.53	909.66	909.79	909.93	910.06	910.19	910.33	910.46
683	910.59	910.73	910.86	910.99	911.13	911.26	911.39	911.53	911.66	911.79
684	911.93	912.06	912.19	912.33	912.46	912.59	912.73	912.86	912.99	913.13
685	913.26	913.39	913.53	913.66	913.79	913.93	914.06	914.19	914.33	914.46
686	914.59	914.72	914.86	914.99	915.12	915.26	915.39	915.52	915.66	915.79
687	915.92	916.06	916.19	916.32	916.46	916.59	916.72	916.86	916.99	917.12
688	917.26	917.39	917.52	917.66	917.79	917.92	918.06	918.19	918.32	918.46
689	918.59	918.72	918.86	918.99	919.12	919.26	919.39	919.52	919.66	919.79
690	919.92	920.06	920.19	920.32	920.46	920.59	920.72	920.86	920.99	921.12
691	921.26	921.39	921.52	921.66	921.79	921.92	922.06	922.19	922.32	922.46
692	922.59	922.72	922.86	922.99	923.12	923.26	923.39	923.52	923.66	923.79
693	923.92	924.06	924.19	924.32	924.46	924.59	924.72	924.86	924.99	925.12
694	925.26	925.39	925.52	925.66	925.79	925.92	926.06	926.19	926.32	926.46
695	926.59	926.72	926.86	926.99	927.12	927.26	927.39	927.52	927.66	927.79
696	927.92	928.06	928.19	928.32	928.46	928.59	928.72	928.86	928.99	929.12
697	929.26	929.39	929.52	929.66	929.79	929.92	930.06	930.19	930.32	930.46
698	930.59	930.72	930.86	930.99	931.12	931.26	931.39	931.52	931.66	931.79
699	931.92	932.06	932.19	932.32	932.46	932.59	932.72	932.86	932.99	933.12
700	933.26	933.39	933.52	933.66	933.79	933.92	934.06	934.19	934.32	934.46

(*continued*)

Proportional parts										
mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
700	933.26	933.39	933.52	933.66	933.79	933.92	934.06	934.19	934.32	934.46
701	934.59	934.72	934.86	934.99	935.12	935.26	935.39	935.52	935.66	935.79
702	935.92	936.06	936.19	936.32	936.46	936.59	936.72	936.86	936.99	937.12
703	937.26	937.39	937.52	937.66	937.79	937.92	938.06	938.19	938.32	938.46
704	938.59	938.72	938.86	938.99	939.12	939.26	939.39	939.52	939.66	939.79
705	939.92	940.06	940.19	940.32	940.46	940.59	940.72	940.86	940.99	941.12
706	941.26	941.39	941.52	941.66	941.79	941.92	942.06	942.19	942.32	942.46
707	942.59	942.72	942.86	942.99	943.12	943.26	943.39	943.52	943.66	943.79
708	943.92	944.06	944.19	944.32	944.46	944.59	944.72	944.86	944.99	945.12
709	945.26	945.39	945.52	945.66	945.79	945.92	946.06	946.19	946.32	946.46
710	946.59	946.72	946.86	946.99	947.12	947.26	947.39	947.52	947.66	947.79
711	947.92	948.06	948.19	948.32	948.46	948.59	948.72	948.86	948.99	949.12
712	949.26	949.39	949.52	949.66	949.79	949.92	950.06	950.19	950.32	950.46
713	950.59	950.72	950.86	950.99	951.12	951.26	951.39	951.52	951.66	951.79
714	951.92	952.06	952.19	952.32	952.46	952.59	952.72	952.86	952.99	953.12
715	953.26	953.39	953.52	953.66	953.79	953.92	954.06	954.19	954.32	954.46
716	954.59	954.72	954.86	954.99	955.12	955.25	955.39	955.52	955.65	955.79
717	955.92	956.05	956.19	956.32	956.45	956.59	956.72	956.85	956.99	957.12
718	957.25	957.39	957.52	957.65	957.79	957.92	958.05	958.19	958.32	958.45
719	958.59	958.72	958.85	958.99	959.12	959.25	959.39	959.52	959.65	959.79
720	959.92	960.05	960.19	960.32	960.45	960.59	960.72	960.85	960.99	961.12
721	961.25	961.39	961.52	961.65	961.79	961.92	962.05	962.19	962.32	962.45
722	962.59	962.72	962.85	962.99	963.12	963.25	963.39	963.52	963.65	963.79
723	963.92	964.05	964.19	964.32	964.45	964.59	964.72	964.85	964.99	965.12
724	965.25	965.39	965.52	965.65	965.79	965.92	966.05	966.19	966.32	966.45
725	966.59	966.72	966.85	966.99	967.12	967.25	967.39	967.52	967.65	967.79
726	967.92	968.05	968.19	968.32	968.45	968.59	968.72	968.85	968.99	969.12
727	969.25	969.39	969.52	969.65	969.79	969.92	970.05	970.19	970.32	970.45
728	970.59	970.72	970.85	970.99	971.12	971.25	971.39	971.52	971.65	971.79
729	971.92	972.05	972.19	972.32	972.45	972.59	972.72	972.85	972.99	973.12
730	973.25	973.39	973.52	973.65	973.79	973.92	974.05	974.19	974.32	974.45
731	974.59	974.72	974.85	974.99	975.12	975.25	975.39	975.52	975.65	975.79
732	975.92	976.05	976.19	976.32	976.45	976.59	976.72	976.85	976.99	977.12
733	977.25	977.39	977.52	977.65	977.79	977.92	978.05	978.19	978.32	978.45
734	978.59	978.72	978.85	978.99	979.12	979.25	979.39	979.52	979.65	979.79
735	979.92	980.05	980.19	980.32	980.45	980.59	980.72	980.85	980.99	981.12
736	981.25	981.39	981.52	981.65	981.79	981.92	982.05	982.19	982.32	982.45
737	982.59	982.72	982.85	982.99	983.12	983.25	983.39	983.52	983.65	983.79
738	983.92	984.05	984.19	984.32	984.45	984.59	984.72	984.85	984.99	985.12
739	985.25	985.39	985.52	985.65	985.79	985.92	986.05	986.19	986.32	986.45
740	986.59	986.72	986.85	986.99	987.12	987.25	987.39	987.52	987.65	987.79
741	987.92	988.05	988.19	988.32	988.45	988.59	988.72	988.85	988.99	989.12
742	989.25	989.39	989.52	989.65	989.79	989.92	990.05	990.19	990.32	990.45
743	990.59	990.72	990.85	990.99	991.12	991.25	991.39	991.52	991.65	991.79
744	991.92	992.05	992.19	992.32	992.45	992.59	992.72	992.85	992.99	993.12
745	993.25	993.39	993.52	993.65	993.79	993.92	994.05	994.19	994.32	994.45
746	994.59	994.72	994.85	994.99	995.12	995.25	995.39	995.52	995.65	995.79
747	995.92	996.05	996.18	996.32	996.45	996.58	996.72	996.85	996.98	997.12
748	997.25	997.38	997.52	997.65	997.78	997.92	998.05	998.18	998.32	998.45
749	998.58	998.72	998.85	998.98	999.12	999.25	999.38	999.52	999.65	999.78
750	999.92	1000.05	1000.18	1000.32	1000.45	1000.58	1000.72	1000.85	1000.98	1001.12

(*continued*)

Proportional parts										
	mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Millimeters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
750	999.92	1000.05	1000.18	1000.32	1000.45	1000.58	1000.72	1000.85	1000.98	1001.12
751	1001.25	1001.38	1001.52	1001.65	1001.78	1001.92	1002.05	1002.18	1002.32	1002.45
752	1002.58	1002.72	1002.85	1002.98	1003.12	1003.25	1003.38	1003.52	1003.65	1003.78
753	1003.92	1004.05	1004.18	1004.32	1004.45	1004.58	1004.72	1004.85	1004.98	1005.12
754	1005.25	1005.38	1005.52	1005.65	1005.78	1005.92	1006.05	1006.18	1006.32	1006.45
755	1006.58	1006.72	1006.85	1006.98	1007.12	1007.25	1007.38	1007.52	1007.65	1007.78
756	1007.92	1008.05	1008.18	1008.32	1008.45	1008.58	1008.72	1008.85	1008.98	1009.12
757	1009.25	1009.38	1009.52	1009.65	1009.78	1009.92	1010.05	1010.18	1010.32	1010.45
758	1010.58	1010.72	1010.85	1010.98	1011.12	1011.25	1011.38	1011.52	1011.65	1011.78
759	1011.92	1012.05	1012.18	1012.32	1012.45	1012.58	1012.72	1012.85	1012.98	1013.12
760	1013.25	1013.38	1013.52	1013.65	1013.78	1013.92	1014.05	1014.18	1014.32	1014.45
761	1014.58	1014.72	1014.85	1014.98	1015.12	1015.25	1015.38	1015.52	1015.65	1015.78
762	1015.92	1016.05	1016.18	1016.32	1016.45	1016.58	1016.72	1016.85	1016.98	1017.12
763	1017.25	1017.38	1017.52	1017.65	1017.78	1017.92	1018.05	1018.18	1018.32	1018.45
764	1018.58	1018.72	1018.85	1018.98	1019.12	1019.25	1019.38	1019.52	1019.65	1019.78
765	1019.92	1020.05	1020.18	1020.32	1020.45	1020.58	1020.72	1020.85	1020.98	1021.12
766	1021.25	1021.38	1021.52	1021.65	1021.78	1021.92	1022.05	1022.18	1022.32	1022.45
767	1022.58	1022.72	1022.85	1022.98	1023.12	1023.25	1023.38	1023.52	1023.65	1023.78
768	1023.92	1024.05	1024.18	1024.32	1024.45	1024.58	1024.72	1024.85	1024.98	1025.12
769	1025.25	1025.38	1025.52	1025.65	1025.78	1025.92	1026.05	1026.18	1026.32	1026.45
770	1026.58	1026.72	1026.85	1026.98	1027.12	1027.25	1027.38	1027.52	1027.65	1027.78
771	1027.92	1028.05	1028.18	1028.32	1028.45	1028.58	1028.72	1028.85	1028.98	1029.12
772	1029.25	1029.38	1029.52	1029.65	1029.78	1029.92	1030.05	1030.18	1030.32	1030.45
773	1030.58	1030.72	1030.85	1030.98	1031.12	1031.25	1031.38	1031.52	1031.65	1031.78
774	1031.92	1032.05	1032.18	1032.32	1032.45	1032.58	1032.72	1032.85	1032.98	1033.12
775	1033.25	1033.38	1033.52	1033.65	1033.78	1033.92	1034.05	1034.18	1034.32	1034.45
776	1034.58	1034.72	1034.85	1034.98	1035.12	1035.25	1035.38	1035.52	1035.65	1035.78
777	1035.92	1036.05	1036.18	1036.32	1036.45	1036.58	1036.71	1036.85	1036.98	1037.11
778	1037.25	1037.38	1037.51	1037.65	1037.78	1037.91	1038.05	1038.18	1038.31	1038.45
779	1038.58	1038.71	1038.85	1038.98	1039.11	1039.25	1039.38	1039.51	1039.65	1039.78
780	1039.91	1040.05	1040.18	1040.31	1040.45	1040.58	1040.71	1040.85	1040.98	1041.11
781	1041.25	1041.38	1041.51	1041.65	1041.78	1041.91	1042.05	1042.18	1042.31	1042.45
782	1042.58	1042.71	1042.85	1042.98	1043.11	1043.25	1043.38	1043.51	1043.65	1043.78
783	1043.91	1044.05	1044.18	1044.31	1044.45	1044.58	1044.71	1044.85	1044.98	1045.11
784	1045.25	1045.38	1045.51	1045.65	1045.78	1045.91	1046.05	1046.18	1046.31	1046.45
785	1046.58	1046.71	1046.85	1046.98	1047.11	1047.25	1047.38	1047.51	1047.65	1047.78
786	1047.91	1048.05	1048.18	1048.31	1048.45	1048.58	1048.71	1048.85	1048.98	1049.11
787	1049.25	1049.38	1049.51	1049.65	1049.78	1049.91	1050.05	1050.18	1050.31	1050.45
788	1050.58	1050.71	1050.85	1050.98	1051.11	1051.25	1051.38	1051.51	1051.65	1051.78
789	1051.91	1052.05	1052.18	1052.31	1052.45	1052.58	1052.71	1052.85	1052.98	1053.11
790	1053.25	1053.38	1053.51	1053.65	1053.78	1053.91	1054.05	1054.18	1054.31	1054.45
791	1054.58	1054.71	1054.85	1054.98	1055.11	1055.25	1055.38	1055.51	1055.65	1055.78
792	1055.91	1056.05	1056.18	1056.31	1056.45	1056.58	1056.71	1056.85	1056.98	1057.11
793	1057.25	1057.38	1057.51	1057.65	1057.78	1057.91	1058.05	1058.18	1058.31	1058.45
794	1058.58	1058.71	1058.85	1058.98	1059.11	1059.25	1059.38	1059.51	1059.65	1059.78
795	1059.91	1060.05	1060.18	1060.31	1060.45	1060.58	1060.71	1060.85	1060.98	1061.11
796	1061.25	1061.38	1061.51	1061.65	1061.78	1061.91	1062.05	1062.18	1062.31	1062.45
797	1062.58	1062.71	1062.85	1062.98	1063.11	1063.25	1063.38	1063.51	1063.65	1063.78
798	1063.91	1064.05	1064.18	1064.31	1064.45	1064.58	1064.71	1064.85	1064.98	1065.11
799	1065.25	1065.38	1065.51	1065.65	1065.78	1065.91	1066.05	1066.18	1066.31	1066.45
800	1066.58	1066.71	1066.85	1066.98	1067.11	1067.25	1067.38	1067.51	1067.65	1067.78

(continued)

Proportional parts										
	mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIMETERS OF MERCURY TO MILLIBARS

1 millimeter of mercury = 1.333224 millibars.

Milli-meters	.0 mb.	.1 mb.	.2 mb.	.3 mb.	.4 mb.	.5 mb.	.6 mb.	.7 mb.	.8 mb.	.9 mb.
800	1066.58	1066.71	1066.85	1066.98	1067.11	1067.25	1067.38	1067.51	1067.65	1067.78
801	1067.91	1068.05	1068.18	1068.31	1068.45	1068.58	1068.71	1068.85	1068.98	1069.11
802	1069.25	1069.38	1069.51	1069.65	1069.78	1069.91	1070.05	1070.18	1070.31	1070.45
803	1070.58	1070.71	1070.85	1070.98	1071.11	1071.25	1071.38	1071.51	1071.65	1071.78
804	1071.91	1072.05	1072.18	1072.31	1072.45	1072.58	1072.71	1072.85	1072.98	1073.11
805	1073.25	1073.38	1073.51	1073.65	1073.78	1073.91	1074.05	1074.18	1074.31	1074.45
806	1074.58	1074.71	1074.85	1074.98	1075.11	1075.25	1075.38	1075.51	1075.65	1075.78
807	1075.91	1076.05	1076.18	1076.31	1076.45	1076.58	1076.71	1076.85	1076.98	1077.11
808	1077.24	1077.38	1077.51	1077.64	1077.78	1077.91	1078.04	1078.18	1078.31	1078.44
809	1078.58	1078.71	1078.84	1078.98	1079.11	1079.24	1079.38	1079.51	1079.64	1079.78
810	1079.91	1080.04	1080.18	1080.31	1080.44	1080.58	1080.71	1080.84	1080.98	1081.11
811	1081.24	1081.38	1081.51	1081.64	1081.78	1081.91	1082.04	1082.18	1082.31	1082.44
812	1082.58	1082.71	1082.84	1082.98	1083.11	1083.24	1083.38	1083.51	1083.64	1083.78
813	1083.91	1084.04	1084.18	1084.31	1084.44	1084.58	1084.71	1084.84	1084.98	1085.11
814	1085.24	1085.38	1085.51	1085.64	1085.78	1085.91	1086.04	1086.18	1086.31	1086.44
815	1086.58	1086.71	1086.84	1086.98	1087.11	1087.24	1087.38	1087.51	1087.64	1087.78
816	1087.91	1088.04	1088.18	1088.31	1088.44	1088.58	1088.71	1088.84	1088.98	1089.11
817	1089.24	1089.38	1089.51	1089.64	1089.78	1089.91	1090.04	1090.18	1090.31	1090.44
818	1090.58	1090.71	1090.84	1090.98	1091.11	1091.24	1091.38	1091.51	1091.64	1091.78
819	1091.91	1092.04	1092.18	1092.31	1092.44	1092.58	1092.71	1092.84	1092.98	1093.11
820	1093.24	1093.38	1093.51	1093.64	1093.78	1093.91	1094.04	1094.18	1094.31	1094.44
821	1094.58	1094.71	1094.84	1094.98	1095.11	1095.24	1095.38	1095.51	1095.64	1095.78
822	1095.91	1096.04	1096.18	1096.31	1096.44	1096.58	1096.71	1096.84	1096.98	1097.11
823	1097.24	1097.38	1097.51	1097.64	1097.78	1097.91	1098.04	1098.18	1098.31	1098.44
824	1098.58	1098.71	1098.84	1098.98	1099.11	1099.24	1099.38	1099.51	1099.64	1099.78
825	1099.91	1100.04	1100.18	1100.31	1100.44	1100.58	1100.71	1100.84	1100.98	1101.11
826	1101.24	1101.38	1101.51	1101.64	1101.78	1101.91	1102.04	1102.18	1102.31	1102.44
827	1102.58	1102.71	1102.84	1102.98	1103.11	1103.24	1103.38	1103.51	1103.64	1103.78
828	1103.91	1104.04	1104.18	1104.31	1104.44	1104.58	1104.71	1104.84	1104.98	1105.11
829	1105.24	1105.38	1105.51	1105.64	1105.78	1105.91	1106.04	1106.18	1106.31	1106.44
830	1106.58	1106.71	1106.84	1106.98	1107.11	1107.24	1107.38	1107.51	1107.64	1107.78
831	1107.91	1108.04	1108.18	1108.31	1108.44	1108.58	1108.71	1108.84	1108.98	1109.11
832	1109.24	1109.38	1109.51	1109.64	1109.78	1109.91	1110.04	1110.18	1110.31	1110.44
833	1110.58	1110.71	1110.84	1110.98	1111.11	1111.24	1111.38	1111.51	1111.64	1111.78
834	1111.91	1112.04	1112.18	1112.31	1112.44	1112.58	1112.71	1112.84	1112.98	1113.11
835	1113.24	1113.38	1113.51	1113.64	1113.78	1113.91	1114.04	1114.18	1114.31	1114.44
836	1114.58	1114.71	1114.84	1114.98	1115.11	1115.24	1115.38	1115.51	1115.64	1115.78
837	1115.91	1116.04	1116.18	1116.31	1116.44	1116.58	1116.71	1116.84	1116.98	1117.11
838	1117.24	1117.38	1117.51	1117.64	1117.78	1117.91	1118.04	1118.17	1118.31	1118.44
839	1118.57	1118.71	1118.84	1118.97	1119.11	1119.24	1119.37	1119.51	1119.64	1119.77
840	1119.91	1120.04	1120.17	1120.31	1120.44	1120.57	1120.71	1120.84	1120.97	1121.11
841	1121.24	1121.37	1121.51	1121.64	1121.77	1121.91	1122.04	1122.17	1122.31	1122.44
842	1122.57	1122.71	1122.84	1122.97	1123.11	1123.24	1123.37	1123.51	1123.64	1123.77
843	1123.91	1124.04	1124.17	1124.31	1124.44	1124.57	1124.71	1124.84	1124.97	1125.11
844	1125.24	1125.37	1125.51	1125.64	1125.77	1125.91	1126.04	1126.17	1126.31	1126.44
845	1126.57	1126.71	1126.84	1126.97	1127.11	1127.24	1127.37	1127.51	1127.64	1127.77
846	1127.91	1128.04	1128.17	1128.31	1128.44	1128.57	1128.71	1128.84	1128.97	1129.11
847	1129.24	1129.37	1129.51	1129.64	1129.77	1129.91	1130.04	1130.17	1130.31	1130.44
848	1130.57	1130.71	1130.84	1130.97	1131.11	1131.24	1131.37	1131.51	1131.64	1131.77
849	1131.91	1132.04	1132.17	1132.31	1132.44	1132.57	1132.71	1132.84	1132.97	1133.11
850	1133.24	1133.37	1133.51	1133.64	1133.77	1133.91	1134.04	1134.17	1134.31	1134.44

Proportional parts										
	mm. Hg.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	.01	.03	.04	.05	.07	.08	.09	.11	.12

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Milli-bars	0	1	2	3	4	5	6	7	8	9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0	.00	.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75
10	7.50	8.25	9.00	9.75	10.50	11.25	12.00	12.75	13.50	14.25
20	15.00	15.75	16.50	17.25	18.00	18.75	19.50	20.25	21.00	21.75
30	22.50	23.25	24.00	24.75	25.50	26.25	27.00	27.75	28.50	29.25
40	30.00	30.75	31.50	32.25	33.00	33.75	34.50	35.25	36.00	36.75
50	37.50	38.25	39.00	39.75	40.50	41.25	42.00	42.75	43.50	44.25
60	45.00	45.75	46.50	47.25	48.00	48.75	49.50	50.25	51.00	51.75
70	52.50	53.25	54.00	54.75	55.50	56.25	57.00	57.75	58.50	59.25
80	60.00	60.75	61.51	62.26	63.01	63.76	64.51	65.26	66.01	66.76
90	67.51	68.26	69.01	69.76	70.51	71.26	72.01	72.76	73.51	74.26
100	75.01	75.76	76.51	77.26	78.01	78.76	79.51	80.26	81.01	81.76
110	82.51	83.26	84.01	84.76	85.51	86.26	87.01	87.76	88.51	89.26
120	90.01	90.76	91.51	92.26	93.01	93.76	94.51	95.26	96.01	96.76
130	97.51	98.26	99.01	99.76	100.51	101.26	102.01	102.76	103.51	104.26
140	105.01	105.76	106.51	107.26	108.01	108.76	109.51	110.26	111.01	111.76
150	112.51	113.26	114.01	114.76	115.51	116.26	117.01	117.76	118.51	119.26
160	120.01	120.76	121.51	122.26	123.01	123.76	124.51	125.26	126.01	126.76
170	127.51	128.26	129.01	129.76	130.51	131.26	132.01	132.76	133.51	134.26
180	135.01	135.76	136.51	137.26	138.01	138.76	139.51	140.26	141.01	141.76
190	142.51	143.26	144.01	144.76	145.51	146.26	147.01	147.76	148.51	149.26
200	150.01	150.76	151.51	152.26	153.01	153.76	154.51	155.26	156.01	156.76
210	157.51	158.26	159.01	159.76	160.51	161.26	162.01	162.76	163.51	164.26
220	165.01	165.76	166.51	167.26	168.01	168.76	169.51	170.26	171.01	171.76
230	172.51	173.26	174.01	174.76	175.51	176.26	177.01	177.76	178.51	179.26
240	180.01	180.76	181.51	182.26	183.02	183.77	184.52	185.27	186.02	186.77
250	187.52	188.27	189.02	189.77	190.52	191.27	192.02	192.77	193.52	194.27
260	195.02	195.77	196.52	197.27	198.02	198.77	199.52	200.27	201.02	201.77
270	202.52	203.27	204.02	204.77	205.52	206.27	207.02	207.77	208.52	209.27
280	210.02	210.77	211.52	212.27	213.02	213.77	214.52	215.27	216.02	216.77
290	217.52	218.27	219.02	219.77	220.52	221.27	222.02	222.77	223.52	224.27
300	225.02	225.77	226.52	227.27	228.02	228.77	229.52	230.27	231.02	231.77
310	232.52	233.27	234.02	234.77	235.52	236.27	237.02	237.77	238.52	239.27
320	240.02	240.77	241.52	242.27	243.02	243.77	244.52	245.27	246.02	246.77
330	247.52	248.27	249.02	249.77	250.52	251.27	252.02	252.77	253.52	254.27
340	255.02	255.77	256.52	257.27	258.02	258.77	259.52	260.27	261.02	261.77
350	262.52	263.27	264.02	264.77	265.52	266.27	267.02	267.77	268.52	269.27
360	270.02	270.77	271.52	272.27	273.02	273.77	274.52	275.27	276.02	276.77
370	277.52	278.27	279.02	279.77	280.52	281.27	282.02	282.77	283.52	284.27
380	285.02	285.77	286.52	287.27	288.02	288.77	289.52	290.27	291.02	291.77
390	292.52	293.27	294.02	294.77	295.52	296.27	297.02	297.77	298.52	299.27
400	300.02	300.77	301.52	302.27	303.02	303.77	304.53	305.28	306.03	306.78
410	307.53	308.28	309.03	309.78	310.53	311.28	312.03	312.78	313.53	314.28
420	315.03	315.78	316.53	317.28	318.03	318.78	319.53	320.28	321.03	321.78
430	322.53	323.28	324.03	324.78	325.53	326.28	327.03	327.78	328.53	329.28
440	330.03	330.78	331.53	332.28	333.03	333.78	334.53	335.28	336.03	336.78
450	337.53	338.28	339.03	339.78	340.53	341.28	342.03	342.78	343.53	344.28
460	345.03	345.78	346.53	347.28	348.03	348.78	349.53	350.28	351.03	351.78
470	352.53	353.28	354.03	354.78	355.53	356.28	357.03	357.78	358.53	359.28
480	360.03	360.78	361.53	362.28	363.03	363.78	364.53	365.28	366.03	366.78
490	367.53	368.28	369.03	369.78	370.53	371.28	372.03	372.78	373.53	374.28
500	375.03	375.78	376.53	377.28	378.03	378.78	379.53	380.28	381.03	381.78

(continued)

Proportional parts										
	mb.	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm. Hg.	.08	.15	.23	.30	.38	.45	.53	.60	.68

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
500	375.03	375.11	375.18	375.26	375.33	375.41	375.48	375.56	375.63	375.71
501	375.78	375.86	375.93	376.01	376.08	376.16	376.23	376.31	376.38	376.46
502	376.53	376.61	376.68	376.76	376.83	376.91	376.98	377.06	377.13	377.21
503	377.28	377.36	377.43	377.51	377.58	377.66	377.73	377.81	377.88	377.96
504	378.03	378.11	378.18	378.26	378.33	378.41	378.48	378.56	378.63	378.71
505	378.78	378.86	378.93	379.01	379.08	379.16	379.23	379.31	379.38	379.46
506	379.53	379.61	379.68	379.76	379.83	379.91	379.98	380.06	380.13	380.21
507	380.28	380.36	380.43	380.51	380.58	380.66	380.73	380.81	380.88	380.96
508	381.03	381.11	381.18	381.26	381.33	381.41	381.48	381.56	381.63	381.71
509	381.78	381.86	381.93	382.01	382.08	382.16	382.23	382.31	382.38	382.46
510	382.53	382.61	382.68	382.76	382.83	382.91	382.98	383.06	383.13	383.21
511	383.28	383.36	383.43	383.51	383.58	383.66	383.73	383.81	383.88	383.96
512	384.03	384.11	384.18	384.26	384.33	384.41	384.48	384.56	384.63	384.71
513	384.78	384.86	384.93	385.01	385.08	385.16	385.23	385.31	385.38	385.46
514	385.53	385.61	385.68	385.76	385.83	385.91	385.98	386.06	386.13	386.21
515	386.28	386.36	386.43	386.51	386.58	386.66	386.73	386.81	386.88	386.96
516	387.03	387.11	387.18	387.26	387.33	387.41	387.48	387.56	387.63	387.71
517	387.78	387.86	387.93	388.01	388.08	388.16	388.23	388.31	388.38	388.46
518	388.53	388.61	388.68	388.76	388.83	388.91	388.98	389.06	389.13	389.21
519	389.28	389.36	389.43	389.51	389.58	389.66	389.73	389.81	389.88	389.96
520	390.03	390.11	390.18	390.26	390.33	390.41	390.48	390.56	390.63	390.71
521	390.78	390.86	390.93	391.01	391.08	391.16	391.23	391.31	391.38	391.46
522	391.53	391.61	391.68	391.76	391.83	391.91	391.98	392.06	392.13	392.21
523	392.28	392.36	392.43	392.51	392.58	392.66	392.73	392.81	392.88	392.96
524	393.03	393.11	393.18	393.26	393.33	393.41	393.48	393.56	393.63	393.71
525	393.78	393.86	393.93	394.01	394.08	394.16	394.23	394.31	394.38	394.46
526	394.53	394.61	394.68	394.76	394.83	394.91	394.98	395.06	395.13	395.21
527	395.28	395.36	395.43	395.51	395.58	395.66	395.73	395.81	395.88	395.96
528	396.03	396.11	396.18	396.26	396.33	396.41	396.48	396.56	396.63	396.71
529	396.78	396.86	396.93	397.01	397.08	397.16	397.23	397.31	397.38	397.46
530	397.53	397.61	397.68	397.76	397.83	397.91	397.98	398.06	398.13	398.21
531	398.28	398.36	398.43	398.51	398.58	398.66	398.73	398.81	398.88	398.96
532	399.03	399.11	399.18	399.26	399.33	399.41	399.48	399.56	399.63	399.71
533	399.78	399.86	399.93	400.01	400.08	400.16	400.23	400.31	400.38	400.46
534	400.53	400.61	400.68	400.76	400.83	400.91	400.98	401.06	401.13	401.21
535	401.28	401.36	401.43	401.51	401.58	401.66	401.73	401.81	401.88	401.96
536	402.03	402.11	402.18	402.26	402.33	402.41	402.48	402.56	402.63	402.71
537	402.78	402.86	402.93	403.01	403.08	403.16	403.23	403.31	403.38	403.46
538	403.53	403.61	403.68	403.76	403.83	403.91	403.98	404.06	404.13	404.21
539	404.28	404.36	404.43	404.51	404.58	404.66	404.73	404.81	404.88	404.96
540	405.03	405.11	405.18	405.26	405.33	405.41	405.48	405.56	405.63	405.71
541	405.78	405.86	405.93	406.01	406.08	406.16	406.23	406.31	406.38	406.46
542	406.53	406.61	406.68	406.76	406.83	406.91	406.98	407.06	407.13	407.21
543	407.28	407.36	407.43	407.51	407.58	407.66	407.73	407.81	407.88	407.96
544	408.03	408.11	408.18	408.26	408.33	408.41	408.48	408.56	408.63	408.71
545	408.78	408.86	408.93	409.01	409.08	409.16	409.23	409.31	409.38	409.46
546	409.53	409.61	409.68	409.76	409.83	409.91	409.98	410.06	410.13	410.21
547	410.28	410.36	410.43	410.51	410.58	410.66	410.73	410.81	410.88	410.96
548	411.03	411.11	411.18	411.26	411.33	411.41	411.48	411.56	411.63	411.71
549	411.78	411.86	411.93	412.01	412.08	412.16	412.23	412.31	412.38	412.46
550	412.53	412.61	412.68	412.76	412.83	412.91	412.98	413.06	413.13	413.21

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
550	412.53	412.61	412.68	412.76	412.83	412.91	412.98	413.06	413.13	413.21
551	413.28	413.36	413.43	413.51	413.58	413.66	413.73	413.81	413.88	413.96
552	414.03	414.11	414.18	414.26	414.33	414.41	414.48	414.56	414.63	414.71
553	414.78	414.86	414.93	415.01	415.08	415.16	415.23	415.31	415.38	415.46
554	415.53	415.61	415.68	415.76	415.83	415.91	415.98	416.06	416.13	416.21
555	416.28	416.36	416.43	416.51	416.58	416.66	416.73	416.81	416.88	416.96
556	417.03	417.11	417.18	417.26	417.33	417.41	417.48	417.56	417.63	417.71
557	417.78	417.86	417.93	418.01	418.08	418.16	418.23	418.31	418.38	418.46
558	418.53	418.61	418.68	418.76	418.83	418.91	418.98	419.06	419.13	419.21
559	419.28	419.36	419.43	419.51	419.58	419.66	419.73	419.81	419.88	419.96
560	420.03	420.11	420.18	420.26	420.33	420.41	420.48	420.56	420.63	420.71
561	420.78	420.86	420.93	421.01	421.08	421.16	421.23	421.31	421.38	421.46
562	421.53	421.61	421.68	421.76	421.83	421.91	421.98	422.06	422.13	422.21
563	422.28	422.36	422.43	422.51	422.58	422.66	422.73	422.81	422.88	422.96
564	423.03	423.11	423.18	423.26	423.33	423.41	423.48	423.56	423.63	423.71
565	423.78	423.86	423.93	424.01	424.08	424.16	424.23	424.31	424.38	424.46
566	424.53	424.61	424.68	424.76	424.83	424.91	424.98	425.06	425.13	425.21
567	425.28	425.36	425.43	425.51	425.58	425.66	425.73	425.81	425.88	425.96
568	426.03	426.11	426.18	426.26	426.34	426.41	426.49	426.56	426.64	426.71
569	426.79	426.86	426.94	427.01	427.09	427.16	427.24	427.31	427.39	427.46
570	427.54	427.61	427.69	427.76	427.84	427.91	427.99	428.06	428.14	428.21
571	428.29	428.36	428.44	428.51	428.59	428.66	428.74	428.81	428.89	428.96
572	429.04	429.11	429.19	429.26	429.34	429.41	429.49	429.56	429.64	429.71
573	429.79	429.86	429.94	430.01	430.09	430.16	430.24	430.31	430.39	430.46
574	430.54	430.61	430.69	430.76	430.84	430.91	430.99	431.06	431.14	431.21
575	431.29	431.36	431.44	431.51	431.59	431.66	431.74	431.81	431.89	431.96
576	432.04	432.11	432.19	432.26	432.34	432.41	432.49	432.56	432.64	432.71
577	432.79	432.86	432.94	433.01	433.09	433.16	433.24	433.31	433.39	433.46
578	433.54	433.61	433.69	433.76	433.84	433.91	433.99	434.06	434.14	434.21
579	434.29	434.36	434.44	434.51	434.59	434.66	434.74	434.81	434.89	434.96
580	435.04	435.11	435.19	435.26	435.34	435.41	435.49	435.56	435.64	435.71
581	435.79	435.86	435.94	436.01	436.09	436.16	436.24	436.31	436.39	436.46
582	436.54	436.61	436.69	436.76	436.84	436.91	436.99	437.06	437.14	437.21
583	437.29	437.36	437.44	437.51	437.59	437.66	437.74	437.81	437.89	437.96
584	438.04	438.11	438.19	438.26	438.34	438.41	438.49	438.56	438.64	438.71
585	438.79	438.86	438.94	439.01	439.09	439.16	439.24	439.31	439.39	439.46
586	439.54	439.61	439.69	439.76	439.84	439.91	439.99	440.06	440.14	440.21
587	440.29	440.36	440.44	440.51	440.59	440.66	440.74	440.81	440.89	440.96
588	441.04	441.11	441.19	441.26	441.34	441.41	441.49	441.56	441.64	441.71
589	441.79	441.86	441.94	442.01	442.09	442.16	442.24	442.31	442.39	442.46
590	442.54	442.61	442.69	442.76	442.84	442.91	442.99	443.06	443.14	443.21
591	443.29	443.36	443.44	443.51	443.59	443.66	443.74	443.81	443.89	443.96
592	444.04	444.11	444.19	444.26	444.34	444.41	444.49	444.56	444.64	444.71
593	444.79	444.86	444.94	445.01	445.09	445.16	445.24	445.31	445.39	445.46
594	445.54	445.61	445.69	445.76	445.84	445.91	445.99	446.06	446.14	446.21
595	446.29	446.36	446.44	446.51	446.59	446.66	446.74	446.81	446.89	446.96
596	447.04	447.11	447.19	447.26	447.34	447.41	447.49	447.56	447.64	447.71
597	447.79	447.86	447.94	448.01	448.09	448.16	448.24	448.31	448.39	448.46
598	448.54	448.61	448.69	448.76	448.84	448.91	448.99	449.06	449.14	449.21
599	449.29	449.36	449.44	449.51	449.59	449.66	449.74	449.81	449.89	449.96
600	450.04	450.11	450.19	450.26	450.34	450.41	450.49	450.56	450.64	450.71

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
600	450.04	450.11	450.19	450.26	450.34	450.41	450.49	450.56	450.64	450.71
601	450.79	450.86	450.94	451.01	451.09	451.16	451.24	451.31	451.39	451.46
602	451.54	451.61	451.69	451.76	451.84	451.91	451.99	452.06	452.14	452.21
603	452.29	452.36	452.44	452.51	452.59	452.66	452.74	452.81	452.89	452.96
604	453.04	453.11	453.19	453.26	453.34	453.41	453.49	453.56	453.64	453.71
605	453.79	453.86	453.94	454.01	454.09	454.16	454.24	454.31	454.39	454.46
606	454.54	454.61	454.69	454.76	454.84	454.91	454.99	455.06	455.14	455.21
607	455.29	455.36	455.44	455.51	455.59	455.66	455.74	455.81	455.89	455.96
608	456.04	456.11	456.19	456.26	456.34	456.41	456.49	456.56	456.64	456.71
609	456.79	456.86	456.94	457.01	457.09	457.16	457.24	457.31	457.39	457.46
610	457.54	457.61	457.69	457.76	457.84	457.91	457.99	458.06	458.14	458.21
611	458.29	458.36	458.44	458.51	458.59	458.66	458.74	458.81	458.89	458.96
612	459.04	459.11	459.19	459.26	459.34	459.41	459.49	459.56	459.64	459.71
613	459.79	459.86	459.94	460.01	460.09	460.16	460.24	460.31	460.39	460.46
614	460.54	460.61	460.69	460.76	460.84	460.91	460.99	461.06	461.14	461.21
615	461.29	461.36	461.44	461.51	461.59	461.66	461.74	461.81	461.89	461.96
616	462.04	462.11	462.19	462.26	462.34	462.41	462.49	462.56	462.64	462.71
617	462.79	462.86	462.94	463.01	463.09	463.16	463.24	463.31	463.39	463.46
618	463.54	463.61	463.69	463.76	463.84	463.91	463.99	464.06	464.14	464.21
619	464.29	464.36	464.44	464.51	464.59	464.66	464.74	464.81	464.89	464.96
620	465.04	465.11	465.19	465.26	465.34	465.41	465.49	465.56	465.64	465.71
621	465.79	465.86	465.94	466.01	466.09	466.16	466.24	466.31	466.39	466.46
622	466.54	466.61	466.69	466.76	466.84	466.91	466.99	467.06	467.14	467.21
623	467.29	467.36	467.44	467.51	467.59	467.66	467.74	467.81	467.89	467.96
624	468.04	468.11	468.19	468.26	468.34	468.41	468.49	468.56	468.64	468.71
625	468.79	468.86	468.94	469.01	469.09	469.16	469.24	469.31	469.39	469.46
626	469.54	469.61	469.69	469.76	469.84	469.91	469.99	470.06	470.14	470.21
627	470.29	470.36	470.44	470.51	470.59	470.66	470.74	470.81	470.89	470.96
628	471.04	471.11	471.19	471.26	471.34	471.41	471.49	471.56	471.64	471.71
629	471.79	471.86	471.94	472.01	472.09	472.16	472.24	472.31	472.39	472.46
630	472.54	472.61	472.69	472.76	472.84	472.91	472.99	473.06	473.14	473.21
631	473.29	473.36	473.44	473.51	473.59	473.66	473.74	473.81	473.89	473.96
632	474.04	474.11	474.19	474.26	474.34	474.41	474.49	474.56	474.64	474.71
633	474.79	474.86	474.94	475.01	475.09	475.16	475.24	475.31	475.39	475.46
634	475.54	475.61	475.69	475.76	475.84	475.91	475.99	476.06	476.14	476.21
635	476.29	476.36	476.44	476.51	476.59	476.66	476.74	476.81	476.89	476.96
636	477.04	477.11	477.19	477.26	477.34	477.41	477.49	477.56	477.64	477.71
637	477.79	477.86	477.94	478.01	478.09	478.16	478.24	478.31	478.39	478.46
638	478.54	478.61	478.69	478.76	478.84	478.91	478.99	479.06	479.14	479.21
639	479.29	479.36	479.44	479.51	479.59	479.66	479.74	479.81	479.89	479.96
640	480.04	480.11	480.19	480.26	480.34	480.41	480.49	480.56	480.64	480.71
641	480.79	480.86	480.94	481.01	481.09	481.16	481.24	481.31	481.39	481.46
642	481.54	481.61	481.69	481.76	481.84	481.91	481.99	482.06	482.14	482.21
643	482.29	482.36	482.44	482.51	482.59	482.66	482.74	482.81	482.89	482.96
644	483.04	483.11	483.19	483.26	483.34	483.41	483.49	483.56	483.64	483.71
645	483.79	483.86	483.94	484.01	484.09	484.16	484.24	484.31	484.39	484.46
646	484.54	484.61	484.69	484.76	484.84	484.91	484.99	485.06	485.14	485.21
647	485.29	485.36	485.44	485.51	485.59	485.66	485.74	485.81	485.89	485.96
648	486.04	486.11	486.19	486.26	486.34	486.41	486.49	486.56	486.64	486.71
649	486.79	486.86	486.94	487.01	487.09	487.17	487.24	487.32	487.39	487.47
650	487.54	487.62	487.69	487.77	487.84	487.92	487.99	488.07	488.14	488.22

(*continued*)

Proportional parts		.01	.02	.03	.04	.05	.06	.07	.08	.09
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
650	487.54	487.62	487.69	487.77	487.84	487.92	487.99	488.07	488.14	488.22
651	488.29	488.37	488.44	488.52	488.59	488.67	488.74	488.82	488.89	488.97
652	489.04	489.12	489.19	489.27	489.34	489.42	489.49	489.57	489.64	489.72
653	489.79	489.87	489.94	490.02	490.09	490.17	490.24	490.32	490.39	490.47
654	490.54	490.62	490.69	490.77	490.84	490.92	490.99	491.07	491.14	491.22
655	491.29	491.37	491.44	491.52	491.59	491.67	491.74	491.82	491.89	491.97
656	492.04	492.12	492.19	492.27	492.34	492.42	492.49	492.57	492.64	492.72
657	492.79	492.87	492.94	493.02	493.09	493.17	493.24	493.32	493.39	493.47
658	493.54	493.62	493.69	493.77	493.84	493.92	493.99	494.07	494.14	494.22
659	494.29	494.37	494.44	494.52	494.59	494.67	494.74	494.82	494.89	494.97
660	495.04	495.12	495.19	495.27	495.34	495.42	495.49	495.57	495.64	495.72
661	495.79	495.87	495.94	496.02	496.09	496.17	496.24	496.32	496.39	496.47
662	496.54	496.62	496.69	496.77	496.84	496.92	496.99	497.07	497.14	497.22
663	497.29	497.37	497.44	497.52	497.59	497.67	497.74	497.82	497.89	497.97
664	498.04	498.12	498.19	498.27	498.34	498.42	498.49	498.57	498.64	498.72
665	498.79	498.87	498.94	499.02	499.09	499.17	499.24	499.32	499.39	499.47
666	499.54	499.62	499.69	499.77	499.84	499.92	499.99	500.07	500.14	500.22
667	500.29	500.37	500.44	500.52	500.59	500.67	500.74	500.82	500.89	500.97
668	501.04	501.12	501.19	501.27	501.34	501.42	501.49	501.57	501.64	501.72
669	501.79	501.87	501.94	502.02	502.09	502.17	502.24	502.32	502.39	502.47
670	502.54	502.62	502.69	502.77	502.84	502.92	502.99	503.07	503.14	503.22
671	503.29	503.37	503.44	503.52	503.59	503.67	503.74	503.82	503.89	503.97
672	504.04	504.12	504.19	504.27	504.34	504.42	504.49	504.57	504.64	504.72
673	504.79	504.87	504.94	505.02	505.09	505.17	505.24	505.32	505.39	505.47
674	505.54	505.62	505.69	505.77	505.84	505.92	505.99	506.07	506.14	506.22
675	506.29	506.37	506.44	506.52	506.59	506.67	506.74	506.82	506.89	506.97
676	507.04	507.12	507.19	507.27	507.34	507.42	507.49	507.57	507.64	507.72
677	507.79	507.87	507.94	508.02	508.09	508.17	508.24	508.32	508.39	508.47
678	508.54	508.62	508.69	508.77	508.84	508.92	508.99	509.07	509.14	509.22
679	509.29	509.37	509.44	509.52	509.59	509.67	509.74	509.82	509.89	509.97
680	510.04	510.12	510.19	510.27	510.34	510.42	510.49	510.57	510.64	510.72
681	510.79	510.87	510.94	511.02	511.09	511.17	511.24	511.32	511.39	511.47
682	511.54	511.62	511.69	511.77	511.84	511.92	511.99	512.07	512.14	512.22
683	512.29	512.37	512.44	512.52	512.59	512.67	512.74	512.82	512.89	512.97
684	513.04	513.12	513.19	513.27	513.34	513.42	513.49	513.57	513.64	513.72
685	513.79	513.87	513.94	514.02	514.09	514.17	514.24	514.32	514.39	514.47
686	514.54	514.62	514.69	514.77	514.84	514.92	514.99	515.07	515.14	515.22
687	515.29	515.37	515.44	515.52	515.59	515.67	515.74	515.82	515.89	515.97
688	516.04	516.12	516.19	516.27	516.34	516.42	516.49	516.57	516.64	516.72
689	516.79	516.87	516.94	517.02	517.09	517.17	517.24	517.32	517.39	517.47
690	517.54	517.62	517.69	517.77	517.84	517.92	517.99	518.07	518.14	518.22
691	518.29	518.37	518.44	518.52	518.59	518.67	518.74	518.82	518.89	518.97
692	519.04	519.12	519.19	519.27	519.34	519.42	519.49	519.57	519.64	519.72
693	519.79	519.87	519.94	520.02	520.09	520.17	520.24	520.32	520.39	520.47
694	520.54	520.62	520.69	520.77	520.84	520.92	520.99	521.07	521.14	521.22
695	521.29	521.37	521.44	521.52	521.59	521.67	521.74	521.82	521.89	521.97
696	522.04	522.12	522.19	522.27	522.34	522.42	522.49	522.57	522.64	522.72
697	522.79	522.87	522.94	523.02	523.09	523.17	523.24	523.32	523.39	523.47
698	523.54	523.62	523.69	523.77	523.84	523.92	523.99	524.07	524.14	524.22
699	524.29	524.37	524.44	524.52	524.59	524.67	524.74	524.82	524.89	524.97
700	525.04	525.12	525.19	525.27	525.34	525.42	525.49	525.57	525.64	525.72

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
700	525.04	525.12	525.19	525.27	525.34	525.42	525.49	525.57	525.64	525.72
701	525.79	525.87	525.94	526.02	526.09	526.17	526.24	526.32	526.39	526.47
702	526.54	526.62	526.69	526.77	526.84	526.92	526.99	527.07	527.14	527.22
703	527.29	527.37	527.44	527.52	527.59	527.67	527.74	527.82	527.89	527.97
704	528.04	528.12	528.19	528.27	528.34	528.42	528.49	528.57	528.64	528.72
705	528.79	528.87	528.94	529.02	529.09	529.17	529.24	529.32	529.39	529.47
706	529.54	529.62	529.69	529.77	529.84	529.92	529.99	530.07	530.14	530.22
707	530.29	530.37	530.44	530.52	530.59	530.67	530.74	530.82	530.89	530.97
708	531.04	531.12	531.19	531.27	531.34	531.42	531.49	531.57	531.64	531.72
709	531.79	531.87	531.94	532.02	532.09	532.17	532.24	532.32	532.39	532.47
710	532.54	532.62	532.69	532.77	532.84	532.92	532.99	533.07	533.14	533.22
711	533.29	533.37	533.44	533.52	533.59	533.67	533.74	533.82	533.89	533.97
712	534.04	534.12	534.19	534.27	534.34	534.42	534.49	534.57	534.64	534.72
713	534.79	534.87	534.94	535.02	535.09	535.17	535.24	535.32	535.39	535.47
714	535.54	535.62	535.69	535.77	535.84	535.92	535.99	536.07	536.14	536.22
715	536.29	536.37	536.44	536.52	536.59	536.67	536.74	536.82	536.89	536.97
716	537.04	537.12	537.19	537.27	537.34	537.42	537.49	537.57	537.64	537.72
717	537.79	537.87	537.94	538.02	538.09	538.17	538.24	538.32	538.39	538.47
718	538.54	538.62	538.69	538.77	538.84	538.92	538.99	539.07	539.14	539.22
719	539.29	539.37	539.44	539.52	539.59	539.67	539.74	539.82	539.89	539.97
720	540.04	540.12	540.19	540.27	540.34	540.42	540.49	540.57	540.64	540.72
721	540.79	540.87	540.94	541.02	541.09	541.17	541.24	541.32	541.39	541.47
722	541.54	541.62	541.69	541.77	541.84	541.92	541.99	542.07	542.14	542.22
723	542.29	542.37	542.44	542.52	542.59	542.67	542.74	542.82	542.89	542.97
724	543.04	543.12	543.19	543.27	543.34	543.42	543.49	543.57	543.64	543.72
725	543.79	543.87	543.94	544.02	544.09	544.17	544.24	544.32	544.39	544.47
726	544.54	544.62	544.69	544.77	544.84	544.92	544.99	545.07	545.14	545.22
727	545.29	545.37	545.44	545.52	545.59	545.67	545.74	545.82	545.89	545.97
728	546.04	546.12	546.19	546.27	546.34	546.42	546.49	546.57	546.64	546.72
729	546.79	546.87	546.94	547.02	547.09	547.17	547.24	547.32	547.39	547.47
730	547.54	547.62	547.69	547.77	547.84	547.92	548.00	548.07	548.15	548.22
731	548.30	548.37	548.45	548.52	548.60	548.67	548.75	548.82	548.90	548.97
732	549.05	549.12	549.20	549.27	549.35	549.42	549.50	549.57	549.65	549.72
733	549.80	549.87	549.95	550.02	550.10	550.17	550.25	550.32	550.40	550.47
734	550.55	550.62	550.70	550.77	550.85	550.92	551.00	551.07	551.15	551.22
735	551.30	551.37	551.45	551.52	551.60	551.67	551.75	551.82	551.90	551.97
736	552.05	552.12	552.20	552.27	552.35	552.42	552.50	552.57	552.65	552.72
737	552.80	552.87	552.95	553.02	553.10	553.17	553.25	553.32	553.40	553.47
738	553.55	553.62	553.70	553.77	553.85	553.92	554.00	554.07	554.15	554.22
739	554.30	554.37	554.45	554.52	554.60	554.67	554.75	554.82	554.90	554.97
740	555.05	555.12	555.20	555.27	555.35	555.42	555.50	555.57	555.65	555.72
741	555.80	555.87	555.95	556.02	556.10	556.17	556.25	556.32	556.40	556.47
742	556.55	556.62	556.70	556.77	556.85	556.92	557.00	557.07	557.15	557.22
743	557.30	557.37	557.45	557.52	557.60	557.67	557.75	557.82	557.90	557.97
744	558.05	558.12	558.20	558.27	558.35	558.42	558.50	558.57	558.65	558.72
745	558.80	558.87	558.95	559.02	559.10	559.17	559.25	559.32	559.40	559.47
746	559.55	559.62	559.70	559.77	559.85	559.92	560.00	560.07	560.15	560.22
747	560.30	560.37	560.45	560.52	560.60	560.67	560.75	560.82	560.90	560.97
748	561.05	561.12	561.20	561.27	561.35	561.42	561.50	561.57	561.65	561.72
749	561.80	561.87	561.95	562.02	562.10	562.17	562.25	562.32	562.40	562.47
750	562.55	562.62	562.70	562.77	562.85	562.92	563.00	563.07	563.15	563.22

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
750	562.55	562.62	562.70	562.77	562.85	562.92	563.00	563.07	563.15	563.22
751	563.30	563.37	563.45	563.52	563.60	563.67	563.75	563.82	563.90	563.97
752	564.05	564.12	564.20	564.27	564.35	564.42	564.50	564.57	564.65	564.72
753	564.80	564.87	564.95	565.02	565.10	565.17	565.25	565.32	565.40	565.47
754	565.55	565.62	565.70	565.77	565.85	565.92	566.00	566.07	566.15	566.22
755	566.30	566.37	566.45	566.52	566.60	566.67	566.75	566.82	566.90	566.97
756	567.05	567.12	567.20	567.27	567.35	567.42	567.50	567.57	567.65	567.72
757	567.80	567.87	567.95	568.02	568.10	568.17	568.25	568.32	568.40	568.47
758	568.55	568.62	568.70	568.77	568.85	568.92	569.00	569.07	569.15	569.22
759	569.30	569.37	569.45	569.52	569.60	569.67	569.75	569.82	569.90	569.97
760	570.05	570.12	570.20	570.27	570.35	570.42	570.50	570.57	570.65	570.72
761	570.80	570.87	570.95	571.02	571.10	571.17	571.25	571.32	571.40	571.47
762	571.55	571.62	571.70	571.77	571.85	571.92	572.00	572.07	572.15	572.22
763	572.30	572.37	572.45	572.52	572.60	572.67	572.75	572.82	572.90	572.97
764	573.05	573.12	573.20	573.27	573.35	573.42	573.50	573.57	573.65	573.72
765	573.80	573.87	573.95	574.02	574.10	574.17	574.25	574.32	574.40	574.47
766	574.55	574.62	574.70	574.77	574.85	574.92	575.00	575.07	575.15	575.22
767	575.30	575.37	575.45	575.52	575.60	575.67	575.75	575.82	575.90	575.97
768	576.05	576.12	576.20	576.27	576.35	576.42	576.50	576.57	576.65	576.72
769	576.80	576.87	576.95	577.02	577.10	577.17	577.25	577.32	577.40	577.47
770	577.55	577.62	577.70	577.77	577.85	577.92	578.00	578.07	578.15	578.22
771	578.30	578.37	578.45	578.52	578.60	578.67	578.75	578.82	578.90	578.97
772	579.05	579.12	579.20	579.27	579.35	579.42	579.50	579.57	579.65	579.72
773	579.80	579.87	579.95	580.02	580.10	580.17	580.25	580.32	580.40	580.47
774	580.55	580.62	580.70	580.77	580.85	580.92	581.00	581.07	581.15	581.22
775	581.30	581.37	581.45	581.52	581.60	581.67	581.75	581.82	581.90	581.97
776	582.05	582.12	582.20	582.27	582.35	582.42	582.50	582.57	582.65	582.72
777	582.80	582.87	582.95	583.02	583.10	583.17	583.25	583.32	583.40	583.47
778	583.55	583.62	583.70	583.77	583.85	583.92	584.00	584.07	584.15	584.22
779	584.30	584.37	584.45	584.52	584.60	584.67	584.75	584.82	584.90	584.97
780	585.05	585.12	585.20	585.27	585.35	585.42	585.50	585.57	585.65	585.72
781	585.80	585.87	585.95	586.02	586.10	586.17	586.25	586.32	586.40	586.47
782	586.55	586.62	586.70	586.77	586.85	586.92	587.00	587.07	587.15	587.22
783	587.30	587.37	587.45	587.52	587.60	587.67	587.75	587.82	587.90	587.97
784	588.05	588.12	588.20	588.27	588.35	588.42	588.50	588.57	588.65	588.72
785	588.80	588.87	588.95	589.02	589.10	589.17	589.25	589.32	589.40	589.47
786	589.55	589.62	589.70	589.77	589.85	589.92	590.00	590.07	590.15	590.22
787	590.30	590.37	590.45	590.52	590.60	590.67	590.75	590.82	590.90	590.97
788	591.05	591.12	591.20	591.27	591.35	591.42	591.50	591.57	591.65	591.72
789	591.80	591.87	591.95	592.02	592.10	592.17	592.25	592.32	592.40	592.47
790	592.55	592.62	592.70	592.77	592.85	592.92	593.00	593.07	593.15	593.22
791	593.30	593.37	593.45	593.52	593.60	593.67	593.75	593.82	593.90	593.97
792	594.05	594.12	594.20	594.27	594.35	594.42	594.50	594.57	594.65	594.72
793	594.80	594.87	594.95	595.02	595.10	595.17	595.25	595.32	595.40	595.47
794	595.55	595.62	595.70	595.77	595.85	595.92	596.00	596.07	596.15	596.22
795	596.30	596.37	596.45	596.52	596.60	596.67	596.75	596.82	596.90	596.97
796	597.05	597.12	597.20	597.27	597.35	597.42	597.50	597.57	597.65	597.72
797	597.80	597.87	597.95	598.02	598.10	598.17	598.25	598.32	598.40	598.47
798	598.55	598.62	598.70	598.77	598.85	598.92	599.00	599.07	599.15	599.22
799	599.30	599.37	599.45	599.52	599.60	599.67	599.75	599.82	599.90	599.97
800	600.05	600.12	600.20	600.27	600.35	600.42	600.50	600.57	600.65	600.72

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Milli-bars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
800	600.05	600.12	600.20	600.27	600.35	600.42	600.50	600.57	600.65	600.72
801	600.80	600.87	600.95	601.02	601.10	601.17	601.25	601.32	601.40	601.47
802	601.55	601.62	601.70	601.77	601.85	601.92	602.00	602.07	602.15	602.22
803	602.30	602.37	602.45	602.52	602.60	602.67	602.75	602.82	602.90	602.97
804	603.05	603.12	603.20	603.27	603.35	603.42	603.50	603.57	603.65	603.72
805	603.80	603.87	603.95	604.02	604.10	604.17	604.25	604.32	604.40	604.47
806	604.55	604.62	604.70	604.77	604.85	604.92	605.00	605.07	605.15	605.22
807	605.30	605.37	605.45	605.52	605.60	605.67	605.75	605.82	605.90	605.97
808	606.05	606.12	606.20	606.27	606.35	606.42	606.50	606.57	606.65	606.72
809	606.80	606.87	606.95	607.02	607.10	607.17	607.25	607.32	607.40	607.47
810	607.55	607.62	607.70	607.77	607.85	607.92	608.00	608.07	608.15	608.22
811	608.30	608.37	608.45	608.52	608.60	608.67	608.75	608.82	608.90	608.98
812	609.05	609.13	609.20	609.28	609.35	609.43	609.50	609.58	609.65	609.73
813	609.80	609.88	609.95	610.03	610.10	610.18	610.25	610.33	610.40	610.48
814	610.55	610.63	610.70	610.78	610.85	610.93	611.00	611.08	611.15	611.23
815	611.30	611.38	611.45	611.53	611.60	611.68	611.75	611.83	611.90	611.98
816	612.05	612.13	612.20	612.28	612.35	612.43	612.50	612.58	612.65	612.73
817	612.80	612.88	612.95	613.03	613.10	613.18	613.25	613.33	613.40	613.48
818	613.55	613.63	613.70	613.78	613.85	613.93	614.00	614.08	614.15	614.23
819	614.30	614.38	614.45	614.53	614.60	614.68	614.75	614.83	614.90	614.98
820	615.05	615.13	615.20	615.28	615.35	615.43	615.50	615.58	615.65	615.73
821	615.80	615.88	615.95	616.03	616.10	616.18	616.25	616.33	616.40	616.48
822	616.55	616.63	616.70	616.78	616.85	616.93	617.00	617.08	617.15	617.23
823	617.30	617.38	617.45	617.53	617.60	617.68	617.75	617.83	617.90	617.98
824	618.05	618.13	618.20	618.28	618.35	618.43	618.50	618.58	618.65	618.73
825	618.80	618.88	618.95	619.03	619.10	619.18	619.25	619.33	619.40	619.48
826	619.55	619.63	619.70	619.78	619.85	619.93	620.00	620.08	620.15	620.23
827	620.30	620.38	620.45	620.53	620.60	620.68	620.75	620.83	620.90	620.98
828	621.05	621.13	621.20	621.28	621.35	621.43	621.50	621.58	621.65	621.73
829	621.80	621.88	621.95	622.03	622.10	622.18	622.25	622.33	622.40	622.48
830	622.55	622.63	622.70	622.78	622.85	622.93	623.00	623.08	623.15	623.23
831	623.30	623.38	623.45	623.53	623.60	623.68	623.75	623.83	623.90	623.98
832	624.05	624.13	624.20	624.28	624.35	624.43	624.50	624.58	624.65	624.73
833	624.80	624.88	624.95	625.03	625.10	625.18	625.25	625.33	625.40	625.48
834	625.55	625.63	625.70	625.78	625.85	625.93	626.00	626.08	626.15	626.23
835	626.30	626.38	626.45	626.53	626.60	626.68	626.75	626.83	626.90	626.98
836	627.05	627.13	627.20	627.28	627.35	627.43	627.50	627.58	627.65	627.73
837	627.80	627.88	627.95	628.03	628.10	628.18	628.25	628.33	628.40	628.48
838	628.55	628.63	628.70	628.78	628.85	628.93	629.00	629.08	629.15	629.23
839	629.30	629.38	629.45	629.53	629.60	629.68	629.75	629.83	629.90	629.98
840	630.05	630.13	630.20	630.28	630.35	630.43	630.50	630.58	630.65	630.73
841	630.80	630.88	630.95	631.03	631.10	631.18	631.25	631.33	631.40	631.48
842	631.55	631.63	631.70	631.78	631.85	631.93	632.00	632.08	632.15	632.23
843	632.30	632.38	632.45	632.53	632.60	632.68	632.75	632.83	632.90	632.98
844	633.05	633.13	633.20	633.28	633.35	633.43	633.50	633.58	633.65	633.73
845	633.80	633.88	633.95	634.03	634.10	634.18	634.25	634.33	634.40	634.48
846	634.55	634.63	634.70	634.78	634.85	634.93	635.00	635.08	635.15	635.23
847	635.30	635.38	635.45	635.53	635.60	635.68	635.75	635.83	635.90	635.98
848	636.05	636.13	636.20	636.28	636.35	636.43	636.50	636.58	636.65	636.73
849	636.80	636.88	636.95	637.03	637.10	637.18	637.25	637.33	637.40	637.48
850	637.55	637.63	637.70	637.78	637.85	637.93	638.00	638.08	638.15	638.23

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
850	637.55	637.63	637.70	637.78	637.85	637.93	638.00	638.08	638.15	638.23
851	638.30	638.38	638.45	638.53	638.60	638.68	638.75	638.83	638.90	638.98
852	639.05	639.13	639.20	639.28	639.35	639.43	639.50	639.58	639.65	639.73
853	639.80	639.88	639.95	640.03	640.10	640.18	640.25	640.33	640.40	640.48
854	640.55	640.63	640.70	640.78	640.85	640.93	641.00	641.08	641.15	641.23
855	641.30	641.38	641.45	641.53	641.60	641.68	641.75	641.83	641.90	641.98
856	642.05	642.13	642.20	642.28	642.35	642.43	642.50	642.58	642.65	642.73
857	642.80	642.88	642.95	643.03	643.10	643.18	643.25	643.33	643.40	643.48
858	643.55	643.63	643.70	643.78	643.85	643.93	644.00	644.08	644.15	644.23
859	644.30	644.38	644.45	644.53	644.60	644.68	644.75	644.83	644.90	644.98
860	645.05	645.13	645.20	645.28	645.35	645.43	645.50	645.58	645.65	645.73
861	645.80	645.88	645.95	646.03	646.10	646.18	646.25	646.33	646.40	646.48
862	646.55	646.63	646.70	646.78	646.85	646.93	647.00	647.08	647.15	647.23
863	647.30	647.38	647.45	647.53	647.60	647.68	647.75	647.83	647.90	647.98
864	648.05	648.13	648.20	648.28	648.35	648.43	648.50	648.58	648.65	648.73
865	648.80	648.88	648.95	649.03	649.10	649.18	649.25	649.33	649.40	649.48
866	649.55	649.63	649.70	649.78	649.85	649.93	650.00	650.08	650.15	650.23
867	650.30	650.38	650.45	650.53	650.60	650.68	650.75	650.83	650.90	650.98
868	651.05	651.13	651.20	651.28	651.35	651.43	651.50	651.58	651.65	651.73
869	651.80	651.88	651.95	652.03	652.10	652.18	652.25	652.33	652.40	652.48
870	652.55	652.63	652.70	652.78	652.85	652.93	653.00	653.08	653.15	653.23
871	653.30	653.38	653.45	653.53	653.60	653.68	653.75	653.83	653.90	653.98
872	654.05	654.13	654.20	654.28	654.35	654.43	654.50	654.58	654.65	654.73
873	654.80	654.88	654.95	655.03	655.10	655.18	655.25	655.33	655.40	655.48
874	655.55	655.63	655.70	655.78	655.85	655.93	656.00	656.08	656.15	656.23
875	656.30	656.38	656.45	656.53	656.60	656.68	656.75	656.83	656.90	656.98
876	657.05	657.13	657.20	657.28	657.35	657.43	657.50	657.58	657.65	657.73
877	657.80	657.88	657.95	658.03	658.10	658.18	658.25	658.33	658.40	658.48
878	658.55	658.63	658.70	658.78	658.85	658.93	659.00	659.08	659.15	659.23
879	659.30	659.38	659.45	659.53	659.60	659.68	659.75	659.83	659.90	659.98
880	660.05	660.13	660.20	660.28	660.35	660.43	660.50	660.58	660.65	660.73
881	660.80	660.88	660.95	661.03	661.10	661.18	661.25	661.33	661.40	661.48
882	661.55	661.63	661.70	661.78	661.85	661.93	662.00	662.08	662.15	662.23
883	662.30	662.38	662.45	662.53	662.60	662.68	662.75	662.83	662.90	662.98
884	663.05	663.13	663.20	663.28	663.35	663.43	663.50	663.58	663.65	663.73
885	663.80	663.88	663.95	664.03	664.10	664.18	664.25	664.33	664.40	664.48
886	664.55	664.63	664.70	664.78	664.85	664.93	665.00	665.08	665.15	665.23
887	665.30	665.38	665.45	665.53	665.60	665.68	665.75	665.83	665.90	665.98
888	666.05	666.13	666.20	666.28	666.35	666.43	666.50	666.58	666.65	666.73
889	666.80	666.88	666.95	667.03	667.10	667.18	667.25	667.33	667.40	667.48
890	667.55	667.63	667.70	667.78	667.85	667.93	668.00	668.08	668.15	668.23
891	668.30	668.38	668.45	668.53	668.60	668.68	668.75	668.83	668.90	668.98
892	669.05	669.13	669.20	669.28	669.35	669.43	669.50	669.58	669.65	669.73
893	669.81	669.88	669.96	670.03	670.11	670.18	670.26	670.33	670.41	670.48
894	670.56	670.63	670.71	670.78	670.86	670.93	671.01	671.08	671.16	671.23
895	671.31	671.38	671.46	671.53	671.61	671.68	671.76	671.83	671.91	671.98
896	672.06	672.13	672.21	672.28	672.36	672.43	672.51	672.58	672.66	672.73
897	672.81	672.88	672.96	673.03	673.11	673.18	673.26	673.33	673.41	673.48
898	673.56	673.63	673.71	673.78	673.86	673.93	674.01	674.08	674.16	674.23
899	674.31	674.38	674.46	674.53	674.61	674.68	674.76	674.83	674.91	674.98
900	675.06	675.13	675.21	675.28	675.36	675.43	675.51	675.58	675.66	675.73

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
900	675.06	675.13	675.21	675.28	675.36	675.43	675.51	675.58	675.66	675.73
901	675.81	675.88	675.96	676.03	676.11	676.18	676.26	676.33	676.41	676.48
902	676.56	676.63	676.71	676.78	676.86	676.93	677.01	677.08	677.16	677.23
903	677.31	677.38	677.46	677.53	677.61	677.68	677.76	677.83	677.91	677.98
904	678.06	678.13	678.21	678.28	678.36	678.43	678.51	678.58	678.66	678.73
905	678.81	678.88	678.96	679.03	679.11	679.18	679.26	679.33	679.41	679.48
906	679.56	679.63	679.71	679.78	679.86	679.93	680.01	680.08	680.16	680.23
907	680.31	680.38	680.46	680.53	680.61	680.68	680.76	680.83	680.91	680.98
908	681.06	681.13	681.21	681.28	681.36	681.43	681.51	681.58	681.66	681.73
909	681.81	681.88	681.96	682.03	682.11	682.18	682.26	682.33	682.41	682.48
910	682.56	682.63	682.71	682.78	682.86	682.93	683.01	683.08	683.16	683.23
911	683.31	683.38	683.46	683.53	683.61	683.68	683.76	683.83	683.91	683.98
912	684.06	684.13	684.21	684.28	684.36	684.43	684.51	684.58	684.66	684.73
813	684.81	684.88	684.96	685.03	685.11	685.18	685.26	685.33	685.41	685.48
914	685.56	685.63	685.71	685.78	685.86	685.93	686.01	686.08	686.16	686.23
915	686.31	686.38	686.46	686.53	686.61	686.68	686.76	686.83	686.91	686.98
916	687.06	687.13	687.21	687.28	687.36	687.43	687.51	687.58	687.66	687.73
917	687.81	687.88	687.96	688.03	688.11	688.18	688.26	688.33	688.41	688.48
918	688.56	688.63	688.71	688.78	688.86	688.93	689.01	689.08	689.16	689.23
919	689.31	689.38	689.46	689.53	689.61	689.68	689.76	689.83	689.91	689.98
920	690.06	690.13	690.21	690.28	690.36	690.43	690.51	690.58	690.66	690.73
921	690.81	690.88	690.96	691.03	691.11	691.18	691.26	691.33	691.41	691.48
922	691.56	691.63	691.71	691.78	691.86	691.93	692.01	692.08	692.16	692.23
923	692.31	692.38	692.46	692.53	692.61	692.68	692.76	692.83	692.91	692.98
924	693.06	693.13	693.21	693.28	693.36	693.43	693.51	693.58	693.66	693.73
925	693.81	693.88	693.96	694.03	694.11	694.18	694.26	694.33	694.41	694.48
926	694.56	694.63	694.71	694.78	694.86	694.93	695.01	695.08	695.16	695.23
927	695.31	695.38	695.46	695.53	695.61	695.68	695.76	695.83	695.91	695.98
928	696.06	696.13	696.21	696.28	696.36	696.43	696.51	696.58	696.66	696.73
929	696.81	696.88	696.96	697.03	697.11	697.18	697.26	697.33	697.41	697.48
930	697.56	697.63	697.71	697.78	697.86	697.93	698.01	698.08	698.16	698.23
931	698.31	698.38	698.46	698.53	698.61	698.68	698.76	698.83	698.91	698.98
932	699.06	699.13	699.21	699.28	699.36	699.43	699.51	699.58	699.66	699.73
933	699.81	699.88	699.96	700.03	700.11	700.18	700.26	700.33	700.41	700.48
934	700.56	700.63	700.71	700.78	700.86	700.93	701.01	701.08	701.16	701.23
935	701.31	701.38	701.46	701.53	701.61	701.68	701.76	701.83	701.91	701.98
936	702.06	702.13	702.21	702.28	702.36	702.43	702.51	702.58	702.66	702.73
937	702.81	702.88	702.96	703.03	703.11	703.18	703.26	703.33	703.41	703.48
938	703.56	703.63	703.71	703.78	703.86	703.93	704.01	704.08	704.16	704.23
939	704.31	704.38	704.46	704.53	704.61	704.68	704.76	704.83	704.91	704.98
940	705.06	705.13	705.21	705.28	705.36	705.43	705.51	705.58	705.66	705.73
941	705.81	705.88	705.96	706.03	706.11	706.18	706.26	706.33	706.41	706.48
942	706.56	706.63	706.71	706.78	706.86	706.93	707.01	707.08	707.16	707.23
943	707.31	707.38	707.46	707.53	707.61	707.68	707.76	707.83	707.91	707.98
944	708.06	708.13	708.21	708.28	708.36	708.43	708.51	708.58	708.66	708.73
945	708.81	708.88	708.96	709.03	709.11	709.18	709.26	709.33	709.41	709.48
946	709.56	709.63	709.71	709.78	709.86	709.93	710.01	710.08	710.16	710.23
947	710.31	710.38	710.46	710.53	710.61	710.68	710.76	710.83	710.91	710.98
948	711.06	711.13	711.21	711.28	711.36	711.43	711.51	711.58	711.66	711.73
949	711.81	711.88	711.96	712.03	712.11	712.18	712.26	712.33	712.41	712.48
950	712.56	712.63	712.71	712.78	712.86	712.93	713.01	713.08	713.16	713.23

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
950	712.56	712.63	712.71	712.78	712.86	712.93	713.01	713.08	713.16	713.23
951	713.31	713.38	713.46	713.53	713.61	713.68	713.76	713.83	713.91	713.98
952	714.06	714.13	714.21	714.28	714.36	714.43	714.51	714.58	714.66	714.73
953	714.81	714.88	714.96	715.03	715.11	715.18	715.26	715.33	715.41	715.48
954	715.56	715.63	715.71	715.78	715.86	715.93	716.01	716.08	716.16	716.23
955	716.31	716.38	716.46	716.53	716.61	716.68	716.76	716.83	716.91	716.98
956	717.06	717.13	717.21	717.28	717.36	717.43	717.51	717.58	717.66	717.73
957	717.81	717.88	717.96	718.03	718.11	718.18	718.26	718.33	718.41	718.48
958	718.56	718.63	718.71	718.78	718.86	718.93	719.01	719.08	719.16	719.23
959	719.31	719.38	719.46	719.53	719.61	719.68	719.76	719.83	719.91	719.98
960	720.06	720.13	720.21	720.28	720.36	720.43	720.51	720.58	720.66	720.73
961	720.81	720.88	720.96	721.03	721.11	721.18	721.26	721.33	721.41	721.48
962	721.56	721.63	721.71	721.78	721.86	721.93	722.01	722.08	722.16	722.23
963	722.31	722.38	722.46	722.53	722.61	722.68	722.76	722.83	722.91	722.98
964	723.06	723.13	723.21	723.28	723.36	723.43	723.51	723.58	723.66	723.73
965	723.81	723.88	723.96	724.03	724.11	724.18	724.26	724.33	724.41	724.48
966	724.56	724.63	724.71	724.78	724.86	724.93	725.01	725.08	725.16	725.23
967	725.31	725.38	725.46	725.53	725.61	725.68	725.76	725.83	725.91	725.98
968	726.06	726.13	726.21	726.28	726.36	726.43	726.51	726.58	726.66	726.73
969	726.81	726.88	726.96	727.03	727.11	727.18	727.26	727.33	727.41	727.48
970	727.56	727.63	727.71	727.78	727.86	727.93	728.01	728.08	728.16	728.23
971	728.31	728.38	728.46	728.53	728.61	728.68	728.76	728.83	728.91	728.98
972	729.06	729.13	729.21	729.28	729.36	729.43	729.51	729.58	729.66	729.73
973	729.81	729.88	729.96	730.03	730.11	730.18	730.26	730.33	730.41	730.48
974	730.56	730.64	730.71	730.79	730.86	730.94	731.01	731.09	731.16	731.24
975	731.31	731.39	731.46	731.54	731.61	731.69	731.76	731.84	731.91	731.99
976	732.06	732.14	732.21	732.29	732.36	732.44	732.51	732.59	732.66	732.74
977	732.81	732.89	732.96	733.04	733.11	733.19	733.26	733.34	733.41	733.49
978	733.56	733.64	733.71	733.79	733.86	733.94	734.01	734.09	734.16	734.24
979	734.31	734.39	734.46	734.54	734.61	734.69	734.76	734.84	734.91	734.99
980	735.06	735.14	735.21	735.29	735.36	735.44	735.51	735.59	735.66	735.74
981	735.81	735.89	735.96	736.04	736.11	736.19	736.26	736.34	736.41	736.49
982	736.56	736.64	736.71	736.79	736.86	736.94	737.01	737.09	737.16	737.24
983	737.31	737.39	737.46	737.54	737.61	737.69	737.76	737.84	737.91	737.99
984	738.06	738.14	738.21	738.29	738.36	738.44	738.51	738.59	738.66	738.74
985	738.81	738.89	738.96	739.04	739.11	739.19	739.26	739.34	739.41	739.49
986	739.56	739.64	739.71	739.79	739.86	739.94	740.01	740.09	740.16	740.24
987	740.31	740.39	740.46	740.54	740.61	740.69	740.76	740.84	740.91	740.99
988	741.06	741.14	741.21	741.29	741.36	741.44	741.51	741.59	741.66	741.74
989	741.81	741.89	741.96	742.04	742.11	742.19	742.26	742.34	742.41	742.49
990	742.56	742.64	742.71	742.79	742.86	742.94	743.01	743.09	743.16	743.24
991	743.31	743.39	743.46	743.54	743.61	743.69	743.76	743.84	743.91	743.99
992	744.06	744.14	744.21	744.29	744.36	744.44	744.51	744.59	744.66	744.74
993	744.81	744.89	744.96	745.04	745.11	745.19	745.26	745.34	745.41	745.49
994	745.56	745.64	745.71	745.79	745.86	745.94	746.01	746.09	746.16	746.24
995	746.31	746.39	746.46	746.54	746.61	746.69	746.76	746.84	746.91	746.99
996	747.06	747.14	747.21	747.29	747.36	747.44	747.51	747.59	747.66	747.74
997	747.81	747.89	747.96	748.04	748.11	748.19	748.26	748.34	748.41	748.49
998	748.56	748.64	748.71	748.79	748.86	748.94	749.01	749.09	749.16	749.24
999	749.31	749.39	749.46	749.54	749.61	749.69	749.76	749.84	749.91	749.99
1000	750.06	750.14	750.21	750.29	750.36	750.44	750.51	750.59	750.66	750.74

(*continued*)

Proportional parts										
	mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0 mm.	.1 mm.	.2 mm.	.3 mm.	.4 mm.	.5 mm.	.6 mm.	.7 mm.	.8 mm.	.9 mm.
1000	750.06	750.14	750.21	750.29	750.36	750.44	750.51	750.59	750.66	750.74
1001	750.81	750.89	750.96	751.04	751.11	751.19	751.26	751.34	751.41	751.49
1002	751.56	751.64	751.71	751.79	751.86	751.94	752.01	752.09	752.16	752.24
1003	752.31	752.39	752.46	752.54	752.61	752.69	752.76	752.84	752.91	752.99
1004	753.06	753.14	753.21	753.29	753.36	753.44	753.51	753.59	753.66	753.74
1005	753.81	753.89	753.96	754.04	754.11	754.19	754.26	754.34	754.41	754.49
1006	754.56	754.64	754.71	754.79	754.86	754.94	755.01	755.09	755.16	755.24
1007	755.31	755.39	755.46	755.54	755.61	755.69	755.76	755.84	755.91	755.99
1008	756.06	756.14	756.21	756.29	756.36	756.44	756.51	756.59	756.66	756.74
1009	756.81	756.89	756.96	757.04	757.11	757.19	757.26	757.34	757.41	757.49
1010	757.56	757.64	757.71	757.79	757.86	757.94	758.01	758.09	758.16	758.24
1011	758.31	758.39	758.46	758.54	758.61	758.69	758.76	758.84	758.91	758.99
1012	759.06	759.14	759.21	759.29	759.36	759.44	759.51	759.59	759.66	759.74
1013	759.81	759.89	759.96	760.04	760.11	760.19	760.26	760.34	760.41	760.49
1014	760.56	760.64	760.71	760.79	760.86	760.94	761.01	761.09	761.16	761.24
1015	761.31	761.39	761.46	761.54	761.61	761.69	761.76	761.84	761.91	761.99
1016	762.06	762.14	762.21	762.29	762.36	762.44	762.51	762.59	762.66	762.74
1017	762.81	762.89	762.96	763.04	763.11	763.19	763.26	763.34	763.41	763.49
1018	763.56	763.64	763.71	763.79	763.86	763.94	764.01	764.09	764.16	764.24
1019	764.31	764.39	764.46	764.54	764.61	764.69	764.76	764.84	764.91	764.99
1020	765.06	765.14	765.21	765.29	765.36	765.44	765.51	765.59	765.66	765.74
1021	765.81	765.89	765.96	766.04	766.11	766.19	766.26	766.34	766.41	766.49
1022	766.56	766.64	766.71	766.79	766.86	766.94	767.01	767.09	767.16	767.24
1023	767.31	767.39	767.46	767.54	767.61	767.69	767.76	767.84	767.91	767.99
1024	768.06	768.14	768.21	768.29	768.36	768.44	768.51	768.59	768.66	768.74
1025	768.81	768.89	768.96	769.04	769.11	769.19	769.26	769.34	769.41	769.49
1026	769.56	769.64	769.71	769.79	769.86	769.94	770.01	770.09	770.16	770.24
1027	770.31	770.39	770.46	770.54	770.61	770.69	770.76	770.84	770.91	770.99
1028	771.06	771.14	771.21	771.29	771.36	771.44	771.51	771.59	771.66	771.74
1029	771.81	771.89	771.96	772.04	772.11	772.19	772.26	772.34	772.41	772.49
1030	772.56	772.64	772.71	772.79	772.86	772.94	773.01	773.09	773.16	773.24
1031	773.31	773.39	773.46	773.54	773.61	773.69	773.76	773.84	773.91	773.99
1032	774.06	774.14	774.21	774.29	774.36	774.44	774.51	774.59	774.66	774.74
1033	774.81	774.89	774.96	775.04	775.11	775.19	775.26	775.34	775.41	775.49
1034	775.56	775.64	775.71	775.79	775.86	775.94	776.01	776.09	776.16	776.24
1035	776.31	776.39	776.46	776.54	776.61	776.69	776.76	776.84	776.91	776.99
1036	777.06	777.14	777.21	777.29	777.36	777.44	777.51	777.59	777.66	777.74
1037	777.81	777.89	777.96	778.04	778.11	778.19	778.26	778.34	778.41	778.49
1038	778.56	778.64	778.71	778.79	778.86	778.94	779.01	779.09	779.16	779.24
1039	779.31	779.39	779.46	779.54	779.61	779.69	779.76	779.84	779.91	779.99
1040	780.06	780.14	780.21	780.29	780.36	780.44	780.51	780.59	780.66	780.74
1041	780.81	780.89	780.96	781.04	781.11	781.19	781.26	781.34	781.41	781.49
1042	781.56	781.64	781.71	781.79	781.86	781.94	782.01	782.09	782.16	782.24
1043	782.31	782.39	782.46	782.54	782.61	782.69	782.76	782.84	782.91	782.99
1044	783.06	783.14	783.21	783.29	783.36	783.44	783.51	783.59	783.66	783.74
1045	783.81	783.89	783.96	784.04	784.11	784.19	784.26	784.34	784.41	784.49
1046	784.56	784.64	784.71	784.79	784.86	784.94	785.01	785.09	785.16	785.24
1047	785.31	785.39	785.46	785.54	785.61	785.69	785.76	785.84	785.91	785.99
1048	786.06	786.14	786.21	786.29	786.36	786.44	786.51	786.59	786.66	786.74
1049	786.81	786.89	786.96	787.04	787.11	787.19	787.26	787.34	787.41	787.49
1050	787.56	787.64	787.71	787.79	787.86	787.94	788.01	788.09	788.16	788.24

(*continued*)

Proportional parts										
mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

MILLIBARS TO MILLIMETERS OF MERCURY

1 millibar = 0.7500616 millimeter of mercury.

Millibars	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1050	787.56	787.64	787.71	787.79	787.86	787.94	788.01	788.09	788.16	788.24
1051	788.31	788.39	788.46	788.54	788.61	788.69	788.76	788.84	788.91	788.99
1052	789.06	789.14	789.21	789.29	789.36	789.44	789.51	789.59	789.66	789.74
1053	789.81	789.89	789.96	790.04	790.11	790.19	790.26	790.34	790.41	790.49
1054	790.56	790.64	790.71	790.79	790.86	790.94	791.01	791.09	791.16	791.24
1055	791.31	791.39	791.46	791.54	791.62	791.69	791.77	791.84	791.92	791.99
1056	792.07	792.14	792.22	792.29	792.37	792.44	792.52	792.59	792.67	792.74
1057	792.82	792.89	792.97	793.04	793.12	793.19	793.27	793.34	793.42	793.49
1058	793.57	793.64	793.72	793.79	793.87	793.94	794.02	794.09	794.17	794.24
1059	794.32	794.39	794.47	794.54	794.62	794.69	794.77	794.84	794.92	794.99
1060	795.07	795.14	795.22	795.29	795.37	795.44	795.52	795.59	795.67	795.74
1061	795.82	795.89	795.97	796.04	796.12	796.19	796.27	796.34	796.42	796.49
1062	796.57	796.64	796.72	796.79	796.87	796.94	797.02	797.09	797.17	797.24
1063	797.32	797.39	797.47	797.54	797.62	797.69	797.77	797.84	797.92	797.99
1064	798.07	798.14	798.22	798.29	798.37	798.44	798.52	798.59	798.67	798.74
1065	798.82	798.89	798.97	799.04	799.12	799.19	799.27	799.34	799.42	799.49
1066	799.57	799.64	799.72	799.79	799.87	799.94	800.02	800.09	800.17	800.24
1067	800.32	800.39	800.47	800.54	800.62	800.69	800.77	800.84	800.92	800.99
1068	801.07	801.14	801.22	801.29	801.37	801.44	801.52	801.59	801.67	801.74
1069	801.82	801.89	801.97	802.04	802.12	802.19	802.27	802.34	802.42	802.49
1070	802.57	802.64	802.72	802.79	802.87	802.94	803.02	803.09	803.17	803.24
1071	803.32	803.39	803.47	803.54	803.62	803.69	803.77	803.84	803.92	803.99
1072	804.07	804.14	804.22	804.29	804.37	804.44	804.52	804.59	804.67	804.74
1073	804.82	804.89	804.97	805.04	805.12	805.19	805.27	805.34	805.42	805.49
1074	805.57	805.64	805.72	805.79	805.87	805.94	806.02	806.09	806.17	806.24
1075	806.32	806.39	806.47	806.54	806.62	806.69	806.77	806.84	806.92	806.99
1076	807.07	807.14	807.22	807.29	807.37	807.44	807.52	807.59	807.67	807.74
1077	807.82	807.89	807.97	808.04	808.12	808.19	808.27	808.34	808.42	808.49
1078	808.57	808.64	808.72	808.79	808.87	808.94	809.02	809.09	809.17	809.24
1079	809.32	809.39	809.47	809.54	809.62	809.69	809.77	809.84	809.92	809.99
1080	810.07	810.14	810.22	810.29	810.37	810.44	810.52	810.59	810.67	810.74
1081	810.82	810.89	810.97	811.04	811.12	811.19	811.27	811.34	811.42	811.49
1082	811.57	811.64	811.72	811.79	811.87	811.94	812.02	812.09	812.17	812.24
1083	812.32	812.39	812.47	812.54	812.62	812.69	812.77	812.84	812.92	812.99
1084	813.07	813.14	813.22	813.29	813.37	813.44	813.52	813.59	813.67	813.74
1085	813.82	813.89	813.97	814.04	814.12	814.19	814.27	814.34	814.42	814.49
1086	814.57	814.64	814.72	814.79	814.87	814.94	815.02	815.09	815.17	815.24
1087	815.32	815.39	815.47	815.54	815.62	815.69	815.77	815.84	815.92	815.99
1088	816.07	816.14	816.22	816.29	816.37	816.44	816.52	816.59	816.67	816.74
1089	816.82	816.89	816.97	817.04	817.12	817.19	817.27	817.34	817.42	817.49
1090	817.57	817.64	817.72	817.79	817.87	817.94	818.02	818.09	818.17	818.24
1091	818.32	818.39	818.47	818.54	818.62	818.69	818.77	818.84	818.92	818.99
1092	819.07	819.14	819.22	819.29	819.37	819.44	819.52	819.59	819.67	819.74
1093	819.82	819.89	819.97	820.04	820.12	820.19	820.27	820.34	820.42	820.49
1094	820.57	820.64	820.72	820.79	820.87	820.94	821.02	821.09	821.17	821.24
1095	821.32	821.39	821.47	821.54	821.62	821.69	821.77	821.84	821.92	821.99
1096	822.07	822.14	822.22	822.29	822.37	822.44	822.52	822.59	822.67	822.74
1097	822.82	822.89	822.97	823.04	823.12	823.19	823.27	823.34	823.42	823.49
1098	823.57	823.64	823.72	823.79	823.87	823.94	824.02	824.09	824.17	824.24
1099	824.32	824.39	824.47	824.54	824.62	824.69	824.77	824.84	824.92	824.99
1100	825.07	825.14	825.22	825.29	825.37	825.44	825.52	825.59	825.67	825.74

Proportional parts										
mb.	.01	.02	.03	.04	.05	.06	.07	.08	.09
mm. Hg.	.01	.02	.02	.03	.04	.05	.05	.06	.07

TABLE 13

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0.00	0.00	0.25	0.51	0.76	1.02	1.27	1.52	1.78	2.03	2.29
0.10	2.54	2.79	3.05	3.30	3.56	3.81	4.06	4.32	4.57	4.83
0.20	5.08	5.33	5.59	5.84	6.10	6.35	6.60	6.86	7.11	7.37
0.30	7.62	7.87	8.13	8.38	8.64	8.89	9.14	9.40	9.65	9.91
0.40	10.16	10.41	10.67	10.92	11.18	11.43	11.68	11.94	12.19	12.45
0.50	12.70	12.95	13.21	13.46	13.72	13.97	14.22	14.48	14.73	14.99
0.60	15.24	15.49	15.75	16.00	16.26	16.51	16.76	17.02	17.27	17.53
0.70	17.78	18.03	18.29	18.54	18.80	19.05	19.30	19.56	19.81	20.07
0.80	20.32	20.57	20.83	21.08	21.34	21.59	21.84	22.10	22.35	22.61
0.90	22.86	23.11	23.37	23.62	23.88	24.13	24.38	24.64	24.89	25.15
1.00	25.40	25.65	25.91	26.16	26.42	26.67	26.92	27.18	27.43	27.69
1.10	27.94	28.19	28.45	28.70	28.96	29.21	29.46	29.72	29.97	30.23
1.20	30.48	30.73	30.99	31.24	31.50	31.75	32.00	32.26	32.51	32.77
1.30	33.02	33.27	33.53	33.78	34.04	34.29	34.54	34.80	35.05	35.31
1.40	35.56	35.81	36.07	36.32	36.58	36.83	37.08	37.34	37.59	37.85
1.50	38.10	38.35	38.61	38.86	39.12	39.37	39.62	39.88	40.13	40.39
1.60	40.64	40.89	41.15	41.40	41.66	41.91	42.16	42.42	42.67	42.93
1.70	43.18	43.43	43.69	43.94	44.20	44.45	44.70	44.96	45.21	45.47
1.80	45.72	45.97	46.23	46.48	46.74	46.99	47.24	47.50	47.75	48.01
1.90	48.26	48.51	48.77	49.02	49.28	49.53	49.78	50.04	50.29	50.55
2.00	50.80	51.05	51.31	51.56	51.82	52.07	52.32	52.58	52.83	53.09
2.10	53.34	53.59	53.85	54.10	54.36	54.61	54.86	55.12	55.37	55.63
2.20	55.88	56.13	56.39	56.64	56.90	57.15	57.40	57.66	57.91	58.17
2.30	58.42	58.67	58.93	59.18	59.44	59.69	59.94	60.20	60.45	60.71
2.40	60.96	61.21	61.47	61.72	61.98	62.23	62.48	62.74	62.99	63.25
2.50	63.50	63.75	64.01	64.26	64.52	64.77	65.02	65.28	65.53	65.79
2.60	66.04	66.29	66.55	66.80	67.06	67.31	67.56	67.82	68.07	68.33
2.70	68.58	68.83	69.09	69.34	69.60	69.85	70.10	70.36	70.61	70.87
2.80	71.12	71.37	71.63	71.88	72.14	72.39	72.64	72.90	73.15	73.41
2.90	73.66	73.91	74.17	74.42	74.68	74.93	75.18	75.44	75.69	75.95
3.00	76.20	76.45	76.71	76.96	77.22	77.47	77.72	77.98	78.23	78.49
3.10	78.74	78.99	79.25	79.50	79.76	80.01	80.26	80.52	80.77	81.03
3.20	81.28	81.53	81.79	82.04	82.30	82.55	82.80	83.06	83.31	83.57
3.30	83.82	84.07	84.33	84.58	84.84	85.09	85.34	85.60	85.85	86.11
3.40	86.36	86.61	86.87	87.12	87.38	87.63	87.88	88.14	88.39	88.65
3.50	88.90	89.15	89.41	89.66	89.92	90.17	90.42	90.68	90.93	91.19
3.60	91.44	91.69	91.95	92.20	92.46	92.71	92.96	93.22	93.47	93.73
3.70	93.98	94.23	94.49	94.74	95.00	95.25	95.50	95.76	96.01	96.27
3.80	96.52	96.77	97.03	97.28	97.54	97.79	98.04	98.30	98.55	98.81
3.90	99.06	99.31	99.57	99.82	100.08	100.33	100.58	100.84	101.09	101.35
4.00	101.60	101.85	102.11	102.36	102.62	102.87	103.12	103.38	103.63	103.89
4.10	104.14	104.39	104.65	104.90	105.16	105.41	105.66	105.92	106.17	106.43
4.20	106.68	106.93	107.19	107.44	107.70	107.95	108.20	108.46	108.71	108.97
4.30	109.22	109.47	109.73	109.98	110.24	110.49	110.74	111.00	111.25	111.51
4.40	111.76	112.01	112.27	112.52	112.78	113.03	113.28	113.54	113.79	114.05
4.50	114.30	114.55	114.81	115.06	115.32	115.57	115.82	116.08	116.33	116.59
4.60	116.84	117.09	117.35	117.60	117.86	118.11	118.36	118.62	118.87	119.13
4.70	119.38	119.63	119.89	120.14	120.40	120.65	120.90	121.16	121.41	121.67
4.80	121.92	122.17	122.43	122.68	122.94	123.19	123.44	123.70	123.95	124.21
4.90	124.46	124.71	124.97	125.22	125.48	125.73	125.98	126.24	126.49	126.75
5.00	127.00	127.25	127.51	127.76	128.02	128.27	128.52	128.78	129.03	129.29

(*continued*)

Proportional parts										
	in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
5.00	127.00	127.25	127.51	127.76	128.02	128.27	128.52	128.78	129.03	129.29
5.10	129.54	129.79	130.05	130.30	130.56	130.81	131.06	131.32	131.57	131.83
5.20	132.08	132.33	132.59	132.84	133.10	133.35	133.60	133.86	134.11	134.37
5.30	134.62	134.87	135.13	135.38	135.64	135.89	136.14	136.40	136.65	136.91
5.40	137.16	137.41	137.67	137.92	138.18	138.43	138.68	138.94	139.19	139.45
5.50	139.70	139.95	140.21	140.46	140.72	140.97	141.22	141.48	141.73	141.99
5.60	142.24	142.49	142.75	143.00	143.26	143.51	143.76	144.02	144.27	144.53
5.70	144.78	145.03	145.29	145.54	145.80	146.05	146.30	146.56	146.81	147.07
5.80	147.32	147.57	147.83	148.08	148.34	148.59	148.84	149.10	149.35	149.61
5.90	149.86	150.11	150.37	150.62	150.88	151.13	151.38	151.64	151.89	152.15
6.00	152.40	152.65	152.91	153.16	153.42	153.67	153.92	154.18	154.43	154.69
6.10	154.94	155.19	155.45	155.70	155.96	156.21	156.46	156.72	156.97	157.23
6.20	157.48	157.73	157.99	158.24	158.50	158.75	159.00	159.26	159.51	159.77
6.30	160.02	160.27	160.53	160.78	161.04	161.29	161.54	161.80	162.05	162.31
6.40	162.56	162.81	163.07	163.32	163.58	163.83	164.08	164.34	164.59	164.85
6.50	165.10	165.35	165.61	165.86	166.12	166.37	166.62	166.88	167.13	167.39
6.60	167.64	167.89	168.15	168.40	168.66	168.91	169.16	169.42	169.67	169.93
6.70	170.18	170.43	170.69	170.94	171.20	171.45	171.70	171.96	172.21	172.47
6.80	172.72	172.97	173.23	173.48	173.74	173.99	174.24	174.50	174.75	175.01
6.90	175.26	175.51	175.77	176.02	176.28	176.53	176.78	177.04	177.29	177.55
7.00	177.80	178.05	178.31	178.56	178.82	179.07	179.32	179.58	179.83	180.09
7.10	180.34	180.59	180.85	181.10	181.36	181.61	181.86	182.12	182.37	182.63
7.20	182.88	183.13	183.39	183.64	183.90	184.15	184.40	184.66	184.91	185.17
7.30	185.42	185.67	185.93	186.18	186.44	186.69	186.94	187.20	187.45	187.71
7.40	187.96	188.21	188.47	188.72	188.98	189.23	189.48	189.74	189.99	190.25
7.50	190.50	190.75	191.01	191.26	191.52	191.77	192.02	192.28	192.53	192.79
7.60	193.04	193.29	193.55	193.80	194.06	194.31	194.56	194.82	195.07	195.33
7.70	195.58	195.83	196.09	196.34	196.60	196.85	197.10	197.36	197.61	197.87
7.80	198.12	198.37	198.63	198.88	199.14	199.39	199.64	199.90	200.15	200.41
7.90	200.66	200.91	201.17	201.42	201.68	201.93	202.18	202.44	202.69	202.95
8.00	203.20	203.45	203.71	203.96	204.22	204.47	204.72	204.98	205.23	205.49
8.10	205.74	205.99	206.25	206.50	206.76	207.01	207.26	207.52	207.77	208.03
8.20	208.28	208.53	208.79	209.04	209.30	209.55	209.80	210.06	210.31	210.57
8.30	210.82	211.07	211.33	211.58	211.84	212.09	212.34	212.60	212.85	213.11
8.40	213.36	213.61	213.87	214.12	214.38	214.63	214.88	215.14	215.39	215.65
8.50	215.90	216.15	216.41	216.66	216.92	217.17	217.42	217.68	217.93	218.19
8.60	218.44	218.69	218.95	219.20	219.46	219.71	219.96	220.22	220.47	220.73
8.70	220.98	221.23	221.49	221.74	222.00	222.25	222.50	222.76	223.01	223.27
8.80	223.52	223.77	224.03	224.28	224.54	224.79	225.04	225.30	225.55	225.81
8.90	226.06	226.31	226.57	226.82	227.08	227.33	227.58	227.84	228.09	228.35
9.00	228.60	228.85	229.11	229.36	229.62	229.87	230.12	230.38	230.63	230.89
9.10	231.14	231.39	231.65	231.90	232.16	232.41	232.66	232.92	233.17	233.43
9.20	233.68	233.93	234.19	234.44	234.70	234.95	235.20	235.46	235.71	235.97
9.30	236.22	236.47	236.73	236.98	237.24	237.49	237.74	238.00	238.25	238.51
9.40	238.76	239.01	239.27	239.52	239.78	240.03	240.28	240.54	240.79	241.05
9.50	241.30	241.55	241.81	242.06	242.32	242.57	242.82	243.08	243.33	243.59
9.60	243.84	244.09	244.35	244.60	244.86	245.11	245.36	245.62	245.87	246.13
9.70	246.38	246.63	246.89	247.14	247.40	247.65	247.90	248.16	248.41	248.67
9.80	248.92	249.17	249.43	249.68	249.94	250.19	250.44	250.70	250.95	251.21
9.90	251.46	251.71	251.97	252.22	252.48	252.73	252.98	253.24	253.49	253.75
10.00	254.00	254.25	254.51	254.76	255.02	255.27	255.52	255.78	256.03	256.29

(continued)

Proportional parts										
in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00 mm.	0.01 mm.	0.02 mm.	0.03 mm.	0.04 mm.	0.05 mm.	0.06 mm.	0.07 mm.	0.08 mm.	0.09 mm.
10.00	254.00	254.25	254.51	254.76	255.02	255.27	255.52	255.78	256.03	256.29
10.10	256.54	256.79	257.05	257.30	257.56	257.81	258.06	258.32	258.57	258.83
10.20	259.08	259.33	259.59	259.84	260.10	260.35	260.60	260.86	261.11	261.37
10.30	261.62	261.87	262.13	262.38	262.64	262.89	263.14	263.40	263.65	263.91
10.40	264.16	264.41	264.67	264.92	265.18	265.43	265.68	265.94	266.19	266.45
10.50	266.70	266.95	267.21	267.46	267.72	267.97	268.22	268.48	268.73	268.99
10.60	269.24	269.49	269.75	270.00	270.26	270.51	270.76	271.02	271.27	271.53
10.70	271.78	272.03	272.29	272.54	272.80	273.05	273.30	273.56	273.81	274.07
10.80	274.32	274.57	274.83	275.08	275.34	275.59	275.84	276.10	276.35	276.61
10.90	276.86	277.11	277.37	277.62	277.88	278.13	278.38	278.64	278.89	279.15
11.00	279.40	279.65	279.91	280.16	280.42	280.67	280.92	281.18	281.43	281.69
11.10	281.94	282.19	282.45	282.70	282.96	283.21	283.46	283.72	283.97	284.23
11.20	284.48	284.73	284.99	285.24	285.50	285.75	286.00	286.26	286.51	286.77
11.30	287.02	287.27	287.53	287.78	288.04	288.29	288.54	288.80	289.05	289.31
11.40	289.56	289.81	290.07	290.32	290.58	290.83	291.08	291.34	291.59	291.85
11.50	292.10	292.35	292.61	292.86	293.12	293.37	293.62	293.88	294.13	294.39
11.60	294.64	294.89	295.15	295.40	295.66	295.91	296.16	296.42	296.67	296.93
11.70	297.18	297.43	297.69	297.94	298.20	298.45	298.70	298.96	299.21	299.47
11.80	299.72	299.97	300.23	300.48	300.74	300.99	301.24	301.50	301.75	302.01
11.90	302.26	302.51	302.77	303.02	303.28	303.53	303.78	304.04	304.29	304.55
12.00	304.80	305.05	305.31	305.56	305.82	306.07	306.32	306.58	306.83	307.09
12.10	307.34	307.59	307.85	308.10	308.36	308.61	308.86	309.12	309.37	309.63
12.20	309.88	310.13	310.39	310.64	310.90	311.15	311.40	311.66	311.91	312.17
12.30	312.42	312.67	312.93	313.18	313.44	313.69	313.94	314.20	314.45	314.71
12.40	314.96	315.21	315.47	315.72	315.98	316.23	316.48	316.74	316.99	317.25
12.50	317.50	317.75	318.01	318.26	318.52	318.77	319.02	319.28	319.53	319.79
12.60	320.04	320.29	320.55	320.80	321.06	321.31	321.56	321.82	322.07	322.33
12.70	322.58	322.83	323.09	323.34	323.60	323.85	324.10	324.36	324.61	324.87
12.80	325.12	325.37	325.63	325.88	326.14	326.39	326.64	326.90	327.15	327.41
12.90	327.66	327.91	328.17	328.42	328.68	328.93	329.18	329.44	329.69	329.95
13.00	330.20	330.45	330.71	330.96	331.22	331.47	331.72	331.98	332.23	332.49
13.10	332.74	332.99	333.25	333.50	333.76	334.01	334.26	334.52	334.77	335.03
13.20	335.28	335.53	335.79	336.04	336.30	336.55	336.80	337.06	337.31	337.57
13.30	337.82	338.07	338.33	338.58	338.84	339.09	339.34	339.60	339.85	340.11
13.40	340.36	340.61	340.87	341.12	341.38	341.63	341.88	342.14	342.39	342.65
13.50	342.90	343.15	343.41	343.66	343.92	344.17	344.42	344.68	344.93	345.19
13.60	345.44	345.69	345.95	346.20	346.46	346.71	346.96	347.22	347.47	347.73
13.70	347.98	348.23	348.49	348.74	349.00	349.25	349.50	349.76	350.01	350.27
13.80	350.52	350.77	351.03	351.28	351.54	351.79	352.04	352.30	352.55	352.81
13.90	353.06	353.31	353.57	353.82	354.08	354.33	354.58	354.84	355.09	355.35
14.00	355.60	355.85	356.11	356.36	356.62	356.87	357.12	357.38	357.63	357.89
14.10	358.14	358.39	358.65	358.90	359.16	359.41	359.66	359.92	360.17	360.43
14.20	360.68	360.93	361.19	361.44	361.70	361.95	362.20	362.46	362.71	362.97
14.30	363.22	363.47	363.73	363.98	364.24	364.49	364.74	365.00	365.25	365.51
14.40	365.76	366.01	366.27	366.52	366.78	367.03	367.28	367.54	367.79	368.05
14.50	368.30	368.55	368.81	369.06	369.32	369.57	369.82	370.08	370.33	370.59
14.60	370.84	371.09	371.35	371.60	371.86	372.11	372.36	372.62	372.87	373.13
14.70	373.38	373.63	373.89	374.14	374.40	374.65	374.90	375.16	375.41	375.67
14.80	375.92	376.17	376.43	376.68	376.94	377.19	377.44	377.70	377.95	378.21
14.90	378.46	378.71	378.97	379.22	379.48	379.73	379.98	380.24	380.49	380.75
15.00	381.00	381.25	381.51	381.76	382.02	382.27	382.52	382.78	383.03	383.29

(*continued*)

Proportional parts										
	in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
15.00	381.00	381.25	381.51	381.76	382.02	382.27	382.52	382.78	383.03	383.29
15.10	383.54	383.79	384.05	384.30	384.56	384.81	385.06	385.32	385.57	385.83
15.20	386.08	386.33	386.59	386.84	387.10	387.35	387.60	387.86	388.11	388.37
15.30	388.62	388.87	389.13	389.38	389.64	389.89	390.14	390.40	390.65	390.91
15.40	391.16	391.41	391.67	391.92	392.18	392.43	392.68	392.94	393.19	393.45
15.50	393.70	393.95	394.21	394.46	394.72	394.97	395.22	395.48	395.73	395.99
15.60	396.24	396.49	396.75	397.00	397.26	397.51	397.76	398.02	398.27	398.53
15.70	398.78	399.03	399.29	399.54	399.80	400.05	400.30	400.56	400.81	401.07
15.80	401.32	401.57	401.83	402.08	402.34	402.59	402.84	403.10	403.35	403.61
15.90	403.86	404.11	404.37	404.62	404.88	405.13	405.38	405.64	405.89	406.15
16.00	406.40	406.65	406.91	407.16	407.42	407.67	407.92	408.18	408.43	408.69
16.10	408.94	409.19	409.45	409.70	409.96	410.21	410.46	410.72	410.97	411.23
16.20	411.48	411.73	411.99	412.24	412.50	412.75	413.00	413.26	413.51	413.77
16.30	414.02	414.27	414.53	414.78	415.04	415.29	415.54	415.80	416.05	416.31
16.40	416.56	416.81	417.07	417.32	417.58	417.83	418.08	418.34	418.59	418.85
16.50	419.10	419.35	419.61	419.86	420.12	420.37	420.62	420.88	421.13	421.39
16.60	421.64	421.89	422.15	422.40	422.66	422.91	423.16	423.42	423.67	423.93
16.70	424.18	424.43	424.69	424.94	425.20	425.45	425.70	425.96	426.21	426.47
16.80	426.72	426.97	427.23	427.48	427.74	427.99	428.24	428.50	428.75	429.01
16.90	429.26	429.51	429.77	430.02	430.28	430.53	430.78	431.04	431.29	431.55
17.00	431.80	432.05	432.31	432.56	432.82	433.07	433.32	433.58	433.83	434.09
17.10	434.34	434.59	434.85	435.10	435.36	435.61	435.86	436.12	436.37	436.63
17.20	436.88	437.13	437.39	437.64	437.90	438.15	438.40	438.66	438.91	439.17
17.30	439.42	439.67	439.93	440.18	440.44	440.69	440.94	441.20	441.45	441.71
17.40	441.96	442.21	442.47	442.72	442.98	443.23	443.48	443.74	443.99	444.25
17.50	444.50	444.75	445.01	445.26	445.52	445.77	446.02	446.28	446.53	446.79
17.60	447.04	447.29	447.55	447.80	448.06	448.31	448.56	448.82	449.07	449.33
17.70	449.58	449.83	450.09	450.34	450.60	450.85	451.10	451.36	451.61	451.87
17.80	452.12	452.37	452.63	452.88	453.14	453.39	453.64	453.90	454.15	454.41
17.90	454.66	454.91	455.17	455.42	455.68	455.93	456.18	456.44	456.69	456.95
18.00	457.20	457.45	457.71	457.96	458.22	458.47	458.72	458.98	459.23	459.49
18.10	459.74	459.99	460.25	460.50	460.76	461.01	461.26	461.52	461.77	462.03
18.20	462.28	462.53	462.79	463.04	463.30	463.55	463.80	464.06	464.31	464.57
18.30	464.82	465.07	465.33	465.58	465.84	466.09	466.34	466.60	466.85	467.11
18.40	467.36	467.61	467.87	468.12	468.38	468.63	468.88	469.14	469.39	469.65
18.50	469.90	470.15	470.41	470.66	470.92	471.17	471.42	471.68	471.93	472.19
18.60	472.44	472.69	472.95	473.20	473.46	473.71	473.96	474.22	474.47	474.73
18.70	474.98	475.23	475.49	475.74	476.00	476.25	476.50	476.76	477.01	477.27
18.80	477.52	477.77	478.03	478.28	478.54	478.79	479.04	479.30	479.55	479.81
18.90	480.06	480.31	480.57	480.82	481.08	481.33	481.58	481.84	482.09	482.35
19.00	482.60	482.85	483.11	483.36	483.62	483.87	484.12	484.38	484.63	484.89
19.10	485.14	485.39	485.65	485.90	486.16	486.41	486.66	486.92	487.17	487.43
19.20	487.68	487.93	488.19	488.44	488.70	488.95	489.20	489.46	489.71	489.97
19.30	490.22	490.47	490.73	490.98	491.24	491.49	491.74	492.00	492.25	492.51
19.40	492.76	493.01	493.27	493.52	493.78	494.03	494.28	494.54	494.79	495.05
19.50	495.30	495.55	495.81	496.06	496.32	496.57	496.82	497.08	497.33	497.59
19.60	497.84	498.09	498.35	498.60	498.86	499.11	499.36	499.62	499.87	500.13
19.70	500.38	500.63	500.89	501.14	501.40	501.65	501.90	502.16	502.41	502.67
19.80	502.92	503.17	503.43	503.68	503.94	504.19	504.44	504.70	504.95	505.21
19.90	505.46	505.71	505.97	506.22	506.48	506.73	506.98	507.24	507.49	507.75
20.00	508.00	508.25	508.51	508.76	509.02	509.27	509.52	509.78	510.03	510.29

(*continued*)

Proportional parts										
in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

TABLE 13 (CONTINUED)

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
20.00	508.00	508.25	508.51	508.76	509.02	509.27	509.52	509.78	510.03	510.29
20.10	510.54	510.79	511.05	511.30	511.56	511.81	512.06	512.32	512.57	512.83
20.20	513.08	513.33	513.59	513.84	514.10	514.35	514.60	514.86	515.11	515.37
20.30	515.62	515.87	516.13	516.38	516.64	516.89	517.14	517.40	517.65	517.91
20.40	518.16	518.41	518.67	518.92	519.18	519.43	519.68	519.94	520.19	520.45
20.50	520.70	520.95	521.21	521.46	521.72	521.97	522.22	522.48	522.73	522.99
20.60	523.24	523.49	523.75	524.00	524.26	524.51	524.76	525.02	525.27	525.53
20.70	525.78	526.03	526.29	526.54	526.80	527.05	527.30	527.56	527.81	528.07
20.80	528.32	528.57	528.83	529.08	529.34	529.59	529.84	530.10	530.35	530.61
20.90	530.86	531.11	531.37	531.62	531.88	532.13	532.38	532.64	532.89	533.15
21.00	533.40	533.65	533.91	534.16	534.42	534.67	534.92	535.18	535.43	535.69
21.10	535.94	536.19	536.45	536.70	536.96	537.21	537.46	537.72	537.97	538.23
21.20	538.48	538.73	538.99	539.24	539.50	539.75	540.00	540.26	540.51	540.77
21.30	541.02	541.27	541.53	541.78	542.04	542.29	542.54	542.80	543.05	543.31
21.40	543.56	543.81	544.07	544.32	544.58	544.83	545.08	545.34	545.59	545.85
21.50	546.10	546.35	546.61	546.86	547.12	547.37	547.62	547.88	548.13	548.39
21.60	548.64	548.89	549.15	549.40	549.66	549.91	550.16	550.42	550.67	550.93
21.70	551.18	551.43	551.69	551.94	552.20	552.45	552.70	552.96	553.21	553.47
21.80	553.72	553.97	554.23	554.48	554.74	554.99	555.24	555.50	555.75	556.01
21.90	556.26	556.51	556.77	557.02	557.28	557.53	557.78	558.04	558.29	558.55
22.00	558.80	559.05	559.31	559.56	559.82	560.07	560.32	560.58	560.83	561.09
22.10	561.34	561.59	561.85	562.10	562.36	562.61	562.86	563.12	563.37	563.63
22.20	563.88	564.13	564.39	564.64	564.90	565.15	565.40	565.66	565.91	566.17
22.30	566.42	566.67	566.93	567.18	567.44	567.69	567.94	568.20	568.45	568.71
22.40	568.96	569.21	569.47	569.72	569.98	570.23	570.48	570.74	570.99	571.25
22.50	571.50	571.75	572.01	572.26	572.52	572.77	573.02	573.28	573.53	573.79
22.60	574.04	574.29	574.55	574.80	575.06	575.31	575.56	575.82	576.07	576.33
22.70	576.58	576.83	577.09	577.34	577.60	577.85	578.10	578.36	578.61	578.87
22.80	579.12	579.37	579.63	579.88	580.14	580.39	580.64	580.90	581.15	581.41
22.90	581.66	581.91	582.17	582.42	582.68	582.93	583.18	583.44	583.69	583.95
23.00	584.20	584.45	584.71	584.96	585.22	585.47	585.72	585.98	586.23	586.49
23.10	586.74	586.99	587.25	587.50	587.76	588.01	588.26	588.52	588.77	589.03
23.20	589.28	589.53	589.79	590.04	590.30	590.55	590.80	591.06	591.31	591.57
23.30	591.82	592.07	592.33	592.58	592.84	593.09	593.34	593.60	593.85	594.11
23.40	594.36	594.61	594.87	595.12	595.38	595.63	595.88	596.14	596.39	596.65
23.50	596.90	597.15	597.41	597.66	597.92	598.17	598.42	598.68	598.93	599.19
23.60	599.44	599.69	599.95	600.20	600.46	600.71	600.96	601.22	601.47	601.73
23.70	601.98	602.23	602.49	602.74	603.00	603.25	603.50	603.76	604.01	604.27
23.80	604.52	604.77	605.03	605.28	605.54	605.79	606.04	606.30	606.55	606.81
23.90	607.06	607.31	607.57	607.82	608.08	608.33	608.58	608.84	609.09	609.35
24.00	609.60	609.85	610.11	610.36	610.62	610.87	611.12	611.38	611.63	611.89
24.10	612.14	612.39	612.65	612.90	613.16	613.41	613.66	613.92	614.17	614.43
24.20	614.68	614.93	615.19	615.44	615.70	615.95	616.20	616.46	616.71	616.97
24.30	617.22	617.47	617.73	617.98	618.24	618.49	618.74	619.00	619.25	619.51
24.40	619.76	620.01	620.27	620.52	620.78	621.03	621.28	621.54	621.79	622.05
24.50	622.30	622.55	622.81	623.06	623.32	623.57	623.82	624.08	624.33	624.59
24.60	624.84	625.09	625.35	625.60	625.86	626.11	626.36	626.62	626.87	627.13
24.70	627.38	627.63	627.89	628.14	628.40	628.65	628.90	629.16	629.41	629.67
24.80	629.92	630.17	630.43	630.68	630.94	631.19	631.44	631.70	631.95	632.21
24.90	632.46	632.71	632.97	633.22	633.48	633.73	633.98	634.24	634.49	634.75
25.00	635.00	635.25	635.51	635.76	636.02	636.27	636.52	636.78	637.03	637.29

(*continued*)

Proportional parts										
	in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
25.00	635.00	635.25	635.51	635.76	636.02	636.27	636.52	636.78	637.03	637.29
25.10	637.54	637.79	638.05	638.30	638.56	638.81	639.06	639.32	639.57	639.83
25.20	640.08	640.33	640.59	640.84	641.10	641.35	641.60	641.86	642.11	642.37
25.30	642.62	642.87	643.13	643.38	643.64	643.89	644.14	644.40	644.65	644.91
25.40	645.16	645.41	645.67	645.92	646.18	646.43	646.68	646.94	647.19	647.45
25.50	647.70	647.95	648.21	648.46	648.72	648.97	649.22	649.48	649.73	649.99
25.60	650.24	650.49	650.75	651.00	651.26	651.51	651.76	652.02	652.27	652.53
25.70	652.78	653.03	653.29	653.54	653.80	654.05	654.30	654.56	654.81	655.07
25.80	655.32	655.57	655.83	656.08	656.34	656.59	656.84	657.10	657.35	657.61
25.90	657.86	658.11	658.37	658.62	658.88	659.13	659.38	659.64	659.89	660.15
26.00	660.40	660.65	660.91	661.16	661.42	661.67	661.92	662.18	662.43	662.69
26.10	662.94	663.19	663.45	663.70	663.96	664.21	664.46	664.72	664.97	665.23
26.20	665.48	665.73	665.99	666.24	666.50	666.75	667.00	667.26	667.51	667.77
26.30	668.02	668.27	668.53	668.78	669.04	669.29	669.54	669.80	670.05	670.31
26.40	670.56	670.81	671.07	671.32	671.58	671.83	672.08	672.34	672.59	672.85
26.50	673.10	673.35	673.61	673.86	674.12	674.37	674.62	674.88	675.13	675.39
26.60	675.64	675.89	676.15	676.40	676.66	676.91	677.16	677.42	677.67	677.93
26.70	678.18	678.43	678.69	678.94	679.20	679.45	679.70	679.96	680.21	680.47
26.80	680.72	680.97	681.23	681.48	681.74	681.99	682.24	682.50	682.75	683.01
26.90	683.26	683.51	683.77	684.02	684.28	684.53	684.78	685.04	685.29	685.55
27.00	685.80	686.05	686.31	686.56	686.82	687.07	687.32	687.58	687.83	688.09
27.10	688.34	688.59	688.85	689.10	689.36	689.61	689.86	690.12	690.37	690.63
27.20	690.88	691.13	691.39	691.64	691.90	692.15	692.40	692.66	692.91	693.17
27.30	693.42	693.67	693.93	694.18	694.44	694.69	694.94	695.20	695.45	695.71
27.40	695.96	696.21	696.47	696.72	696.98	697.23	697.48	697.74	697.99	698.25
27.50	698.50	698.75	699.01	699.26	699.52	699.77	700.02	700.28	700.53	700.79
27.60	701.04	701.29	701.55	701.80	702.06	702.31	702.56	702.82	703.07	703.33
27.70	703.58	703.83	704.09	704.34	704.60	704.85	705.10	705.36	705.61	705.87
27.80	706.12	706.37	706.63	706.88	707.14	707.39	707.64	707.90	708.15	708.41
27.90	708.66	708.91	709.17	709.42	709.68	709.93	710.18	710.44	710.69	710.95
28.00	711.20	711.45	711.71	711.96	712.22	712.47	712.72	712.98	713.23	713.49
28.10	713.74	713.99	714.25	714.50	714.76	715.01	715.26	715.52	715.77	716.03
28.20	716.28	716.53	716.79	717.04	717.30	717.55	717.80	718.06	718.31	718.57
28.30	718.82	719.07	719.33	719.58	719.84	720.09	720.34	720.60	720.85	721.11
28.40	721.36	721.61	721.87	722.12	722.38	722.63	722.88	723.14	723.39	723.65
28.50	723.90	724.15	724.41	724.66	724.92	725.17	725.42	725.68	725.93	726.19
28.60	726.44	726.69	726.95	727.20	727.46	727.71	727.96	728.22	728.47	728.73
28.70	728.98	729.23	729.49	729.74	730.00	730.25	730.50	730.76	731.01	731.27
28.80	731.52	731.77	732.03	732.28	732.54	732.79	733.04	733.30	733.55	733.81
28.90	734.06	734.31	734.57	734.82	735.08	735.33	735.58	735.84	736.09	736.35
29.00	736.60	736.85	737.11	737.36	737.62	737.87	738.12	738.38	738.63	738.89
29.10	739.14	739.39	739.65	739.90	740.16	740.41	740.66	740.92	741.17	741.43
29.20	741.68	741.93	742.19	742.44	742.70	742.95	743.20	743.46	743.71	743.97
29.30	744.22	744.47	744.73	744.98	745.24	745.49	745.74	746.00	746.25	746.51
29.40	746.76	747.01	747.27	747.52	747.78	748.03	748.28	748.54	748.79	749.05
29.50	749.30	749.55	749.81	750.06	750.32	750.57	750.82	751.08	751.33	751.59
29.60	751.84	752.09	752.35	752.60	752.86	753.11	753.36	753.62	753.87	754.13
29.70	754.38	754.63	754.89	755.14	755.40	755.65	755.90	756.16	756.41	756.67
29.80	756.92	757.17	757.43	757.68	757.94	758.19	758.44	758.70	758.95	759.21
29.90	759.46	759.71	759.97	760.22	760.48	760.73	760.98	761.24	761.49	761.75
30.00	762.00	762.25	762.51	762.76	763.02	763.27	763.52	763.78	764.03	764.29

(*continued*)

Proportional parts										
	in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

TABLE 13 (CONCLUDED)

INCHES TO MILLIMETERS

1 inch = 25.4 millimeters

Inches	0.00 mm.	0.01 mm.	0.02 mm.	0.03 mm.	0.04 mm.	0.05 mm.	0.06 mm.	0.07 mm.	0.08 mm.	0.09 mm.
30.00	762.00	762.25	762.51	762.76	763.02	763.27	763.52	763.78	764.03	764.29
30.10	764.54	764.79	765.05	765.30	765.56	765.81	766.06	766.32	766.57	766.83
30.20	767.08	767.33	767.59	767.84	768.10	768.35	768.60	768.86	769.11	769.37
30.30	769.62	769.87	770.13	770.38	770.64	770.89	771.14	771.40	771.65	771.91
30.40	772.16	772.41	772.67	772.92	773.18	773.43	773.68	773.94	774.19	774.45
30.50	774.70	774.95	775.21	775.46	775.72	775.97	776.22	776.48	776.73	776.99
30.60	777.24	777.49	777.75	778.00	778.26	778.51	778.76	779.02	779.27	779.53
30.70	779.78	780.03	780.29	780.54	780.80	781.05	781.30	781.56	781.81	782.07
30.80	782.32	782.57	782.83	783.08	783.34	783.59	783.84	784.10	784.35	784.61
30.90	784.86	785.11	785.37	785.62	785.88	786.13	786.38	786.64	786.89	787.15
31.00	787.40	787.65	787.91	788.16	788.42	788.67	788.92	789.18	789.43	789.69
31.10	789.94	790.19	790.45	790.70	790.96	791.21	791.46	791.72	791.97	792.23
31.20	792.48	792.73	792.99	793.24	793.50	793.75	794.00	794.26	794.51	794.77
31.30	795.02	795.27	795.53	795.78	796.04	796.29	796.54	796.80	797.05	797.31
31.40	797.56	797.81	798.07	798.32	798.58	798.83	799.08	799.34	799.59	799.85
31.50	800.10	800.35	800.61	800.86	801.12	801.37	801.62	801.88	802.13	802.39
31.60	802.64	802.89	803.15	803.40	803.66	803.91	804.16	804.42	804.67	804.93
31.70	805.18	805.43	805.69	805.94	806.20	806.45	806.70	806.96	807.21	807.47
31.80	807.72	807.97	808.23	808.48	808.74	808.99	809.24	809.50	809.75	810.01
31.90	810.26	810.51	810.77	811.02	811.28	811.53	811.78	812.04	812.29	812.55

Proportional parts	in.	.001	.002	.003	.004	.005	.006	.007	.008	.009
	mm.	.03	.05	.08	.10	.13	.15	.18	.20	.23

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Millimeters	0	1	2	3	4	5	6	7	8	9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0	.000	.039	.079	.118	.157	.197	.236	.276	.315	.354
10	.394	.433	.472	.512	.551	.591	.630	.669	.709	.748
20	.787	.827	.866	.906	.945	.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.535
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.031	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898
100	3.937	3.976	4.016	4.055	4.094	4.134	4.173	4.213	4.252	4.291
110	4.331	4.370	4.409	4.449	4.488	4.528	4.567	4.606	4.646	4.685
120	4.724	4.764	4.803	4.843	4.882	4.921	4.961	5.000	5.039	5.079
130	5.118	5.157	5.197	5.236	5.276	5.315	5.354	5.394	5.433	5.472
140	5.512	5.551	5.591	5.630	5.669	5.709	5.748	5.787	5.827	5.866
150	5.906	5.945	5.984	6.024	6.063	6.102	6.142	6.181	6.220	6.260
160	6.299	6.339	6.378	6.417	6.457	6.496	6.535	6.575	6.614	6.654
170	6.693	6.732	6.772	6.811	6.850	6.890	6.929	6.969	7.008	7.047
180	7.087	7.126	7.165	7.205	7.244	7.283	7.323	7.362	7.402	7.441
190	7.480	7.520	7.559	7.598	7.638	7.677	7.717	7.756	7.795	7.835
200	7.874	7.913	7.953	7.992	8.031	8.071	8.110	8.150	8.189	8.228
210	8.268	8.307	8.346	8.386	8.425	8.465	8.504	8.543	8.583	8.622
220	8.661	8.701	8.740	8.780	8.819	8.858	8.898	8.937	8.976	9.016
230	9.055	9.094	9.134	9.173	9.213	9.252	9.291	9.331	9.370	9.409
240	9.449	9.488	9.528	9.567	9.606	9.646	9.685	9.724	9.764	9.803
250	9.843	9.882	9.921	9.961	10.000	10.039	10.079	10.118	10.157	10.197
260	10.236	10.276	10.315	10.354	10.394	10.433	10.472	10.512	10.551	10.591
270	10.630	10.669	10.709	10.748	10.787	10.827	10.866	10.906	10.945	10.984
280	11.024	11.063	11.102	11.142	11.181	11.220	11.260	11.299	11.339	11.378
290	11.417	11.457	11.496	11.535	11.575	11.614	11.654	11.693	11.732	11.772
300	11.811	11.850	11.890	11.929	11.969	12.008	12.047	12.087	12.126	12.165
310	12.205	12.244	12.283	12.323	12.362	12.402	12.441	12.480	12.520	12.559
320	12.598	12.638	12.677	12.717	12.756	12.795	12.835	12.874	12.913	12.953
330	12.992	13.031	13.071	13.110	13.150	13.189	13.228	13.268	13.307	13.346
340	13.386	13.425	13.465	13.504	13.543	13.583	13.622	13.661	13.701	13.740
350	13.780	13.819	13.858	13.898	13.937	13.976	14.016	14.055	14.094	14.134
360	14.173	14.213	14.252	14.291	14.331	14.370	14.409	14.449	14.488	14.528
370	14.567	14.606	14.646	14.685	14.724	14.764	14.803	14.843	14.882	14.921
380	14.961	15.000	15.039	15.079	15.118	15.157	15.197	15.236	15.276	15.315
390	15.354	15.394	15.433	15.472	15.512	15.551	15.591	15.630	15.669	15.709
400	15.748	15.787	15.827	15.866	15.906	15.945	15.984	16.024	16.063	16.102

(*continued*)

Proportional parts										
mm.	.1	.2	.3	.4	.5	.6	.7	.8	.9
in.	.004	.008	.012	.016	.020	.024	.028	.031	.035

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
400	15.748	15.752	15.756	15.760	15.764	15.768	15.772	15.776	15.780	15.783
401	15.787	15.791	15.795	15.799	15.803	15.807	15.811	15.815	15.819	15.823
402	15.827	15.831	15.835	15.839	15.843	15.846	15.850	15.854	15.858	15.862
403	15.866	15.870	15.874	15.878	15.882	15.886	15.890	15.894	15.898	15.902
404	15.906	15.909	15.913	15.917	15.921	15.925	15.929	15.933	15.937	15.941
405	15.945	15.949	15.953	15.957	15.961	15.965	15.969	15.972	15.976	15.980
406	15.984	15.988	15.992	15.996	16.000	16.004	16.008	16.012	16.016	16.020
407	16.024	16.028	16.031	16.035	16.039	16.043	16.047	16.051	16.055	16.059
408	16.063	16.067	16.071	16.075	16.079	16.083	16.087	16.091	16.094	16.098
409	16.102	16.106	16.110	16.114	16.118	16.122	16.126	16.130	16.134	16.138
410	16.142	16.146	16.150	16.154	16.157	16.161	16.165	16.169	16.173	16.177
411	16.181	16.185	16.189	16.193	16.197	16.201	16.205	16.209	16.213	16.217
412	16.220	16.224	16.228	16.232	16.236	16.240	16.244	16.248	16.252	16.256
413	16.260	16.264	16.268	16.272	16.276	16.280	16.283	16.287	16.291	16.295
414	16.299	16.303	16.307	16.311	16.315	16.319	16.323	16.327	16.331	16.335
415	16.339	16.343	16.346	16.350	16.354	16.358	16.362	16.366	16.370	16.374
416	16.378	16.382	16.386	16.390	16.394	16.398	16.402	16.406	16.409	16.413
417	16.417	16.421	16.425	16.429	16.433	16.437	16.441	16.445	16.449	16.453
418	16.457	16.461	16.465	16.469	16.472	16.476	16.480	16.484	16.488	16.492
419	16.496	16.500	16.504	16.508	16.512	16.516	16.520	16.524	16.528	16.531
420	16.535	16.539	16.543	16.547	16.551	16.555	16.559	16.563	16.567	16.571
421	16.575	16.579	16.583	16.587	16.591	16.594	16.598	16.602	16.606	16.610
422	16.614	16.618	16.622	16.626	16.630	16.634	16.638	16.642	16.646	16.650
423	16.654	16.657	16.661	16.665	16.669	16.673	16.677	16.681	16.685	16.689
424	16.693	16.697	16.701	16.705	16.709	16.713	16.717	16.720	16.724	16.728
425	16.732	16.736	16.740	16.744	16.748	16.752	16.756	16.760	16.764	16.768
426	16.772	16.776	16.780	16.783	16.787	16.791	16.795	16.799	16.803	16.807
427	16.811	16.815	16.819	16.823	16.827	16.831	16.835	16.839	16.843	16.846
428	16.850	16.854	16.858	16.862	16.866	16.870	16.874	16.878	16.882	16.886
429	16.890	16.894	16.898	16.902	16.906	16.909	16.913	16.917	16.921	16.925
430	16.929	16.933	16.937	16.941	16.945	16.949	16.953	16.957	16.961	16.965
431	16.969	16.972	16.976	16.980	16.984	16.988	16.992	16.996	17.000	17.004
432	17.008	17.012	17.016	17.020	17.024	17.028	17.031	17.035	17.039	17.043
433	17.047	17.051	17.055	17.059	17.063	17.067	17.071	17.075	17.079	17.083
434	17.087	17.091	17.094	17.098	17.102	17.106	17.110	17.114	17.118	17.122
435	17.126	17.130	17.134	17.138	17.142	17.146	17.150	17.154	17.157	17.161
436	17.165	17.169	17.173	17.177	17.181	17.185	17.189	17.193	17.197	17.201
437	17.205	17.209	17.213	17.217	17.220	17.224	17.228	17.232	17.236	17.240
438	17.244	17.248	17.252	17.256	17.260	17.264	17.268	17.272	17.276	17.280
439	17.283	17.287	17.291	17.295	17.299	17.303	17.307	17.311	17.315	17.319
440	17.323	17.327	17.331	17.335	17.339	17.343	17.346	17.350	17.354	17.358
441	17.362	17.366	17.370	17.374	17.378	17.382	17.386	17.390	17.394	17.398
442	17.402	17.406	17.409	17.413	17.417	17.421	17.425	17.429	17.433	17.437
443	17.441	17.445	17.449	17.453	17.457	17.461	17.465	17.469	17.472	17.476
444	17.480	17.484	17.488	17.492	17.496	17.500	17.504	17.508	17.512	17.516
445	17.520	17.524	17.528	17.531	17.535	17.539	17.543	17.547	17.551	17.555
446	17.559	17.563	17.567	17.571	17.575	17.579	17.583	17.587	17.591	17.594
447	17.598	17.602	17.606	17.610	17.614	17.618	17.622	17.626	17.630	17.634
448	17.638	17.642	17.646	17.650	17.654	17.657	17.661	17.665	17.669	17.673
449	17.677	17.681	17.685	17.689	17.693	17.697	17.701	17.705	17.709	17.713
450	17.717	17.720	17.724	17.728	17.732	17.736	17.740	17.744	17.748	17.752

(continued)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

TABLE 14 (CONTINUED)

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
450	17.717	17.720	17.724	17.728	17.732	17.736	17.740	17.744	17.748	17.752
451	17.756	17.760	17.764	17.768	17.772	17.776	17.780	17.783	17.787	17.791
452	17.795	17.799	17.803	17.807	17.811	17.815	17.819	17.823	17.827	17.831
453	17.835	17.839	17.843	17.846	17.850	17.854	17.858	17.862	17.866	17.870
454	17.874	17.878	17.882	17.886	17.890	17.894	17.898	17.902	17.906	17.909
455	17.913	17.917	17.921	17.925	17.929	17.933	17.937	17.941	17.945	17.949
456	17.953	17.957	17.961	17.965	17.969	17.972	17.976	17.980	17.984	17.988
457	17.992	17.996	18.000	18.004	18.008	18.012	18.016	18.020	18.024	18.028
458	18.031	18.035	18.039	18.043	18.047	18.051	18.055	18.059	18.063	18.067
459	18.071	18.075	18.079	18.083	18.087	18.091	18.094	18.098	18.102	18.106
460	18.110	18.114	18.118	18.122	18.126	18.130	18.134	18.138	18.142	18.146
461	18.150	18.154	18.157	18.161	18.165	18.169	18.173	18.177	18.181	18.185
462	18.189	18.193	18.197	18.201	18.205	18.209	18.213	18.217	18.220	18.224
463	18.228	18.232	18.236	18.240	18.244	18.248	18.252	18.256	18.260	18.264
464	18.268	18.272	18.276	18.280	18.283	18.287	18.291	18.295	18.299	18.303
465	18.307	18.311	18.315	18.319	18.323	18.327	18.331	18.335	18.339	18.343
466	18.346	18.350	18.354	18.358	18.362	18.366	18.370	18.374	18.378	18.382
467	18.386	18.390	18.394	18.398	18.402	18.406	18.409	18.413	18.417	18.421
468	18.425	18.429	18.433	18.437	18.441	18.445	18.449	18.453	18.457	18.461
469	18.465	18.469	18.472	18.476	18.480	18.484	18.488	18.492	18.496	18.500
470	18.504	18.508	18.512	18.516	18.520	18.524	18.528	18.531	18.535	18.539
471	18.543	18.547	18.551	18.555	18.559	18.563	18.567	18.571	18.575	18.579
472	18.583	18.587	18.591	18.594	18.598	18.602	18.606	18.610	18.614	18.618
473	18.622	18.626	18.630	18.634	18.638	18.642	18.646	18.650	18.654	18.657
474	18.661	18.665	18.669	18.673	18.677	18.681	18.685	18.689	18.693	18.697
475	18.701	18.705	18.709	18.713	18.717	18.720	18.724	18.728	18.732	18.736
476	18.740	18.744	18.748	18.752	18.756	18.760	18.764	18.768	18.772	18.776
477	18.780	18.783	18.787	18.791	18.795	18.799	18.803	18.807	18.811	18.815
478	18.819	18.823	18.827	18.831	18.835	18.839	18.843	18.846	18.850	18.854
479	18.858	18.862	18.866	18.870	18.874	18.878	18.882	18.886	18.890	18.894
480	18.898	18.902	18.906	18.909	18.913	18.917	18.921	18.925	18.929	18.933
481	18.937	18.941	18.945	18.949	18.953	18.957	18.961	18.965	18.969	18.972
482	18.976	18.980	18.984	18.988	18.992	18.996	19.000	19.004	19.008	19.012
483	19.016	19.020	19.024	19.028	19.031	19.035	19.039	19.043	19.047	19.051
484	19.055	19.059	19.063	19.067	19.071	19.075	19.079	19.083	19.087	19.091
485	19.094	19.098	19.102	19.106	19.110	19.114	19.118	19.122	19.126	19.130
486	19.134	19.138	19.142	19.146	19.150	19.154	19.157	19.161	19.165	19.169
487	19.173	19.177	19.181	19.185	19.189	19.193	19.197	19.201	19.205	19.209
488	19.213	19.217	19.220	19.224	19.228	19.232	19.236	19.240	19.244	19.248
489	19.252	19.256	19.260	19.264	19.268	19.272	19.276	19.280	19.283	19.287
490	19.291	19.295	19.299	19.303	19.307	19.311	19.315	19.319	19.323	19.327
491	19.331	19.335	19.339	19.343	19.346	19.350	19.354	19.358	19.362	19.366
492	19.370	19.374	19.378	19.382	19.386	19.390	19.394	19.398	19.402	19.406
493	19.409	19.413	19.417	19.421	19.425	19.429	19.433	19.437	19.441	19.445
494	19.449	19.453	19.457	19.461	19.465	19.469	19.472	19.476	19.480	19.484
495	19.488	19.492	19.496	19.500	19.504	19.508	19.512	19.516	19.520	19.524
496	19.528	19.531	19.535	19.539	19.543	19.547	19.551	19.555	19.559	19.563
497	19.567	19.571	19.575	19.579	19.583	19.587	19.591	19.594	19.598	19.602
498	19.606	19.610	19.614	19.618	19.622	19.626	19.630	19.634	19.638	19.642
499	19.646	19.650	19.654	19.657	19.661	19.665	19.669	19.673	19.677	19.681
500	19.685	19.689	19.693	19.697	19.701	19.705	19.709	19.713	19.717	19.720

(*continued*)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
500	19.685	19.689	19.693	19.697	19.701	19.705	19.709	19.713	19.717	19.720
501	19.724	19.728	19.732	19.736	19.740	19.744	19.748	19.752	19.756	19.760
502	19.764	19.768	19.772	19.776	19.780	19.783	19.787	19.791	19.795	19.799
503	19.803	19.807	19.811	19.815	19.819	19.823	19.827	19.831	19.835	19.839
504	19.843	19.846	19.850	19.854	19.858	19.862	19.866	19.870	19.874	19.878
505	19.882	19.886	19.890	19.894	19.898	19.902	19.906	19.909	19.913	19.917
506	19.921	19.925	19.929	19.933	19.937	19.941	19.945	19.949	19.953	19.957
507	19.961	19.965	19.969	19.972	19.976	19.980	19.984	19.988	19.992	19.996
508	20.000	20.004	20.008	20.012	20.016	20.020	20.024	20.028	20.031	20.035
509	20.039	20.043	20.047	20.051	20.055	20.059	20.063	20.067	20.071	20.075
510	20.079	20.083	20.087	20.091	20.094	20.098	20.102	20.106	20.110	20.114
511	20.118	20.122	20.126	20.130	20.134	20.138	20.142	20.146	20.150	20.154
512	20.157	20.161	20.165	20.169	20.173	20.177	20.181	20.185	20.189	20.193
513	20.197	20.201	20.205	20.209	20.213	20.217	20.220	20.224	20.228	20.232
514	20.236	20.240	20.244	20.248	20.252	20.256	20.260	20.264	20.268	20.272
515	20.276	20.280	20.283	20.287	20.291	20.295	20.299	20.303	20.307	20.311
516	20.315	20.319	20.323	20.327	20.331	20.335	20.339	20.343	20.346	20.350
517	20.354	20.358	20.362	20.366	20.370	20.374	20.378	20.382	20.386	20.390
518	20.394	20.398	20.402	20.406	20.409	20.413	20.417	20.421	20.425	20.429
519	20.433	20.437	20.441	20.445	20.449	20.453	20.457	20.461	20.465	20.469
520	20.472	20.476	20.480	20.484	20.488	20.492	20.496	20.500	20.504	20.508
521	20.512	20.516	20.520	20.524	20.528	20.531	20.535	20.539	20.543	20.547
522	20.551	20.555	20.559	20.563	20.567	20.571	20.575	20.579	20.583	20.587
523	20.591	20.594	20.598	20.602	20.606	20.610	20.614	20.618	20.622	20.626
524	20.630	20.634	20.638	20.642	20.646	20.650	20.654	20.657	20.661	20.665
525	20.669	20.673	20.677	20.681	20.685	20.689	20.693	20.697	20.701	20.705
526	20.709	20.713	20.717	20.720	20.724	20.728	20.732	20.736	20.740	20.744
527	20.748	20.752	20.756	20.760	20.764	20.768	20.772	20.776	20.780	20.783
528	20.787	20.791	20.795	20.799	20.803	20.807	20.811	20.815	20.819	20.823
529	20.827	20.831	20.835	20.839	20.843	20.846	20.850	20.854	20.858	20.862
530	20.866	20.870	20.874	20.878	20.882	20.886	20.890	20.894	20.898	20.902
531	20.906	20.909	20.913	20.917	20.921	20.925	20.929	20.933	20.937	20.941
532	20.945	20.949	20.953	20.957	20.961	20.965	20.969	20.972	20.976	20.980
533	20.984	20.988	20.992	20.996	21.000	21.004	21.008	21.012	21.016	21.020
534	21.024	21.028	21.031	21.035	21.039	21.043	21.047	21.051	21.055	21.059
535	21.063	21.067	21.071	21.075	21.079	21.083	21.087	21.091	21.094	21.098
536	21.102	21.106	21.110	21.114	21.118	21.122	21.126	21.130	21.134	21.138
537	21.142	21.146	21.150	21.154	21.157	21.161	21.165	21.169	21.173	21.177
538	21.181	21.185	21.189	21.193	21.197	21.201	21.205	21.209	21.213	21.217
539	21.220	21.224	21.228	21.232	21.236	21.240	21.244	21.248	21.252	21.256
540	21.260	21.264	21.268	21.272	21.276	21.280	21.283	21.287	21.291	21.295
541	21.299	21.303	21.307	21.311	21.315	21.319	21.323	21.327	21.331	21.335
542	21.339	21.343	21.346	21.350	21.354	21.358	21.362	21.366	21.370	21.374
543	21.378	21.382	21.386	21.390	21.394	21.398	21.402	21.406	21.409	21.413
544	21.417	21.421	21.425	21.429	21.433	21.437	21.441	21.445	21.449	21.453
545	21.457	21.461	21.465	21.469	21.472	21.476	21.480	21.484	21.488	21.492
546	21.496	21.500	21.504	21.508	21.512	21.516	21.520	21.524	21.528	21.531
547	21.535	21.539	21.543	21.547	21.551	21.555	21.559	21.563	21.567	21.571
548	21.575	21.579	21.583	21.587	21.591	21.594	21.598	21.602	21.606	21.610
549	21.614	21.618	21.622	21.626	21.630	21.634	21.638	21.642	21.646	21.650
550	21.654	21.657	21.661	21.665	21.669	21.673	21.677	21.681	21.685	21.689

(*continued*)

Proportional parts										
mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
550	21.654	21.657	21.661	21.665	21.669	21.673	21.677	21.681	21.685	21.689
551	21.693	21.697	21.701	21.705	21.709	21.713	21.717	21.720	21.724	21.728
552	21.732	21.736	21.740	21.744	21.748	21.752	21.756	21.760	21.764	21.768
553	21.772	21.776	21.780	21.783	21.787	21.791	21.795	21.799	21.803	21.807
554	21.811	21.815	21.819	21.823	21.827	21.831	21.835	21.839	21.843	21.846
555	21.850	21.854	21.858	21.862	21.866	21.870	21.874	21.878	21.882	21.886
556	21.890	21.894	21.898	21.902	21.906	21.909	21.913	21.917	21.921	21.925
557	21.929	21.933	21.937	21.941	21.945	21.949	21.953	21.957	21.961	21.965
558	21.969	21.972	21.976	21.980	21.984	21.988	21.992	21.996	22.000	22.004
559	22.008	22.012	22.016	22.020	22.024	22.028	22.031	22.035	22.039	22.043
560	22.047	22.051	22.055	22.059	22.063	22.067	22.071	22.075	22.079	22.083
561	22.087	22.091	22.094	22.098	22.102	22.106	22.110	22.114	22.118	22.122
562	22.126	22.130	22.134	22.138	22.142	22.146	22.150	22.154	22.157	22.161
563	22.165	22.169	22.173	22.177	22.181	22.185	22.189	22.193	22.197	22.201
564	22.205	22.209	22.213	22.217	22.220	22.224	22.228	22.232	22.236	22.240
565	22.244	22.248	22.252	22.256	22.260	22.264	22.268	22.272	22.276	22.280
566	22.283	22.287	22.291	22.295	22.299	22.303	22.307	22.311	22.315	22.319
567	22.323	22.327	22.331	22.335	22.339	22.343	22.346	22.350	22.354	22.358
568	22.362	22.366	22.370	22.374	22.378	22.382	22.386	22.390	22.394	22.398
569	22.402	22.406	22.409	22.413	22.417	22.421	22.425	22.429	22.433	22.437
570	22.441	22.445	22.449	22.453	22.457	22.461	22.465	22.469	22.472	22.476
571	22.480	22.484	22.488	22.492	22.496	22.500	22.504	22.508	22.512	22.516
572	22.520	22.524	22.528	22.531	22.535	22.539	22.543	22.547	22.551	22.555
573	22.559	22.563	22.567	22.571	22.575	22.579	22.583	22.587	22.591	22.594
574	22.598	22.602	22.606	22.610	22.614	22.618	22.622	22.626	22.630	22.634
575	22.638	22.642	22.646	22.650	22.654	22.657	22.661	22.665	22.669	22.673
576	22.677	22.681	22.685	22.689	22.693	22.697	22.701	22.705	22.709	22.713
577	22.717	22.720	22.724	22.728	22.732	22.736	22.740	22.744	22.748	22.752
578	22.756	22.760	22.764	22.768	22.772	22.776	22.780	22.783	22.787	22.791
579	22.795	22.799	22.803	22.807	22.811	22.815	22.819	22.823	22.827	22.831
580	22.835	22.839	22.843	22.846	22.850	22.854	22.858	22.862	22.866	22.870
581	22.874	22.878	22.882	22.886	22.890	22.894	22.898	22.902	22.906	22.909
582	22.913	22.917	22.921	22.925	22.929	22.933	22.937	22.941	22.945	22.949
583	22.953	22.957	22.961	22.965	22.969	22.972	22.976	22.980	22.984	22.988
584	22.992	22.996	23.000	23.004	23.008	23.012	23.016	23.020	23.024	23.028
585	23.031	23.035	23.039	23.043	23.047	23.051	23.055	23.059	23.063	23.067
586	23.071	23.075	23.079	23.083	23.087	23.091	23.094	23.098	23.102	23.106
587	23.110	23.114	23.118	23.122	23.126	23.130	23.134	23.138	23.142	23.146
588	23.150	23.154	23.157	23.161	23.165	23.169	23.173	23.177	23.181	23.185
589	23.189	23.193	23.197	23.201	23.205	23.209	23.213	23.217	23.220	23.224
590	23.228	23.232	23.236	23.240	23.244	23.248	23.252	23.256	23.260	23.264
591	23.268	23.272	23.276	23.280	23.283	23.287	23.291	23.295	23.299	23.303
592	23.307	23.311	23.315	23.319	23.323	23.327	23.331	23.335	23.339	23.343
593	23.346	23.350	23.354	23.358	23.362	23.366	23.370	23.374	23.378	23.382
594	23.386	23.390	23.394	23.398	23.402	23.406	23.409	23.413	23.417	23.421
595	23.425	23.429	23.433	23.437	23.441	23.445	23.449	23.453	23.457	23.461
596	23.465	23.469	23.472	23.476	23.480	23.484	23.488	23.492	23.496	23.500
597	23.504	23.508	23.512	23.516	23.520	23.524	23.528	23.531	23.535	23.539
598	23.543	23.547	23.551	23.556	23.559	23.563	23.567	23.571	23.575	23.579
599	23.583	23.587	23.591	23.594	23.598	23.602	23.606	23.610	23.614	23.618
600	23.622	23.626	23.630	23.634	23.638	23.642	23.646	23.650	23.654	23.657

(*continued*)

Proportional parts	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
600	23.622	23.626	23.630	23.634	23.638	23.642	23.646	23.650	23.654	23.657
601	23.661	23.665	23.669	23.673	23.677	23.681	23.685	23.689	23.693	23.697
602	23.701	23.705	23.709	23.713	23.717	23.720	23.724	23.728	23.732	23.736
603	23.740	23.744	23.748	23.752	23.756	23.760	23.764	23.768	23.772	23.776
604	23.780	23.783	23.787	23.791	23.795	23.799	23.803	23.807	23.811	23.815
605	23.819	23.823	23.827	23.831	23.835	23.839	23.843	23.846	23.850	23.854
606	23.858	23.862	23.866	23.870	23.874	23.878	23.882	23.886	23.890	23.894
607	23.898	23.902	23.906	23.909	23.913	23.917	23.921	23.925	23.929	23.933
608	23.937	23.941	23.945	23.949	23.953	23.957	23.961	23.965	23.969	23.972
609	23.976	23.980	23.984	23.988	23.992	23.996	24.000	24.004	24.008	24.012
610	24.016	24.020	24.024	24.028	24.031	24.035	24.039	24.043	24.047	24.051
611	24.055	24.059	24.063	24.067	24.071	24.075	24.079	24.083	24.087	24.091
612	24.094	24.098	24.102	24.106	24.110	24.114	24.118	24.122	24.126	24.130
613	24.134	24.138	24.142	24.146	24.150	24.154	24.157	24.161	24.165	24.169
614	24.173	24.177	24.181	24.185	24.189	24.193	24.197	24.201	24.205	24.209
615	24.213	24.217	24.220	24.224	24.228	24.232	24.236	24.240	24.244	24.248
616	24.252	24.256	24.260	24.264	24.268	24.272	24.276	24.280	24.283	24.287
617	24.291	24.295	24.299	24.303	24.307	24.311	24.315	24.319	24.323	24.327
618	24.331	24.335	24.339	24.343	24.346	24.350	24.354	24.358	24.362	24.366
619	24.370	24.374	24.378	24.382	24.386	24.390	24.394	24.398	24.402	24.406
620	24.409	24.413	24.417	24.421	24.425	24.429	24.433	24.437	24.441	24.445
621	24.449	24.453	24.457	24.461	24.465	24.469	24.472	24.476	24.480	24.484
622	24.488	24.492	24.496	24.500	24.504	24.508	24.512	24.516	24.520	24.524
623	24.528	24.531	24.535	24.539	24.543	24.547	24.551	24.555	24.559	24.563
624	24.567	24.571	24.575	24.579	24.583	24.587	24.591	24.594	24.598	24.602
625	24.606	24.610	24.614	24.618	24.622	24.626	24.630	24.634	24.638	24.642
626	24.646	24.650	24.654	24.657	24.661	24.665	24.669	24.673	24.677	24.681
627	24.685	24.689	24.693	24.697	24.701	24.705	24.709	24.713	24.717	24.720
628	24.724	24.728	24.732	24.736	24.740	24.744	24.748	24.752	24.756	24.760
629	24.764	24.768	24.772	24.776	24.780	24.783	24.787	24.791	24.795	24.799
630	24.803	24.807	24.811	24.815	24.819	24.823	24.827	24.831	24.835	24.839
631	24.843	24.846	24.850	24.854	24.858	24.862	24.866	24.870	24.874	24.878
632	24.882	24.886	24.890	24.894	24.898	24.902	24.906	24.909	24.913	24.917
633	24.921	24.925	24.929	24.933	24.937	24.941	24.945	24.949	24.953	24.957
634	24.961	24.965	24.969	24.972	24.976	24.980	24.984	24.988	24.992	24.996
635	25.000	25.004	25.008	25.012	25.016	25.020	25.024	25.028	25.031	25.035
636	25.039	25.043	25.047	25.051	25.055	25.059	25.063	25.067	25.071	25.075
637	25.079	25.083	25.087	25.091	25.094	25.098	25.102	25.106	25.110	25.114
638	25.118	25.122	25.126	25.130	25.134	25.138	25.142	25.146	25.150	25.154
639	25.157	25.161	25.165	25.169	25.173	25.177	25.181	25.185	25.189	25.193
640	25.197	25.201	25.205	25.209	25.213	25.217	25.220	25.224	25.228	25.232
641	25.236	25.240	25.244	25.248	25.252	25.256	25.260	25.264	25.268	25.272
642	25.276	25.280	25.283	25.287	25.291	25.295	25.299	25.303	25.307	25.311
643	25.315	25.319	25.323	25.327	25.331	25.335	25.339	25.343	25.346	25.350
644	25.354	25.358	25.362	25.366	25.370	25.374	25.378	25.382	25.386	25.390
645	25.394	25.398	25.402	25.406	25.409	25.413	25.417	25.421	25.425	25.429
646	25.433	25.437	25.441	25.445	25.449	25.453	25.457	25.461	25.465	25.469
647	25.472	25.476	25.480	25.484	25.488	25.492	25.496	25.500	25.504	25.508
648	25.512	25.516	25.520	25.524	25.528	25.531	25.535	25.539	25.543	25.547
649	25.551	25.555	25.559	25.563	25.567	25.571	25.575	25.579	25.583	25.587
650	25.591	25.594	25.598	25.602	25.606	25.610	25.614	25.618	25.622	25.626

(*continued*)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
650	25.591	25.594	25.598	25.602	25.606	25.610	25.614	25.618	25.622	25.626
651	25.630	25.634	25.638	25.642	25.646	25.650	25.654	25.657	25.661	25.665
652	25.669	25.673	25.677	25.681	25.685	25.689	25.693	25.697	25.701	25.705
653	25.709	25.713	25.717	25.720	25.724	25.728	25.732	25.736	25.740	25.744
654	25.748	25.752	25.756	25.760	25.764	25.768	25.772	25.776	25.780	25.783
655	25.787	25.791	25.795	25.799	25.803	25.807	25.811	25.815	25.819	25.823
656	25.827	25.831	25.835	25.839	25.843	25.846	25.850	25.854	25.858	25.862
657	25.866	25.870	25.874	25.878	25.882	25.886	25.890	25.894	25.898	25.902
658	25.906	25.909	25.913	25.917	25.921	25.925	25.929	25.933	25.937	25.941
659	25.945	25.949	25.953	25.957	25.961	25.965	25.969	25.972	25.976	25.980
660	25.984	25.988	25.992	25.996	26.000	26.004	26.008	26.012	26.016	26.020
661	26.024	26.028	26.031	26.035	26.039	26.043	26.047	26.051	26.055	26.059
662	26.063	26.067	26.071	26.075	26.079	26.083	26.087	26.091	26.094	26.098
663	26.102	26.106	26.110	26.114	26.118	26.122	26.126	26.130	26.134	26.138
664	26.142	26.146	26.150	26.154	26.157	26.161	26.165	26.169	26.173	26.177
665	26.181	26.185	26.189	26.193	26.197	26.201	26.205	26.209	26.213	26.217
666	26.220	26.224	26.228	26.232	26.236	26.240	26.244	26.248	26.252	26.256
667	26.260	26.264	26.268	26.272	26.276	26.280	26.283	26.287	26.291	26.295
668	26.299	26.303	26.307	26.311	26.315	26.319	26.323	26.327	26.331	26.335
669	26.339	26.343	26.346	26.350	26.354	26.358	26.362	26.366	26.370	26.374
670	26.378	26.382	26.386	26.390	26.394	26.398	26.402	26.406	26.409	26.413
671	26.417	26.421	26.425	26.429	26.433	26.437	26.441	26.445	26.449	26.453
672	26.457	26.461	26.465	26.469	26.472	26.476	26.480	26.484	26.488	26.492
673	26.496	26.500	26.504	26.508	26.512	26.516	26.520	26.524	26.528	26.531
674	26.535	26.539	26.543	26.547	26.551	26.555	26.559	26.563	26.567	26.571
675	26.575	26.579	26.583	26.587	26.591	26.594	26.598	26.602	26.606	26.610
676	26.614	26.618	26.622	26.626	26.630	26.634	26.638	26.642	26.646	26.650
677	26.654	26.657	26.661	26.665	26.669	26.673	26.677	26.681	26.685	26.689
678	26.693	26.697	26.701	26.705	26.709	26.713	26.717	26.720	26.724	26.728
679	26.732	26.736	26.740	26.744	26.748	26.752	26.756	26.760	26.764	26.768
680	26.772	26.776	26.780	26.783	26.787	26.791	26.795	26.799	26.803	26.807
681	26.811	26.815	26.819	26.823	26.827	26.831	26.835	26.839	26.843	26.846
682	26.850	26.854	26.858	26.862	26.866	26.870	26.874	26.878	26.882	26.886
683	26.890	26.894	26.898	26.902	26.906	26.909	26.913	26.917	26.921	26.925
684	26.929	26.933	26.937	26.941	26.945	26.949	26.953	26.957	26.961	26.965
685	26.969	26.972	26.976	26.980	26.984	26.988	26.992	26.996	27.000	27.004
686	27.008	27.012	27.016	27.020	27.024	27.028	27.031	27.035	27.039	27.043
687	27.047	27.051	27.055	27.059	27.063	27.067	27.071	27.075	27.079	27.083
688	27.087	27.091	27.094	27.098	27.102	27.106	27.110	27.114	27.118	27.122
689	27.126	27.130	27.134	27.138	27.142	27.146	27.150	27.154	27.157	27.161
690	27.165	27.169	27.173	27.177	27.181	27.185	27.189	27.193	27.197	27.201
691	27.205	27.209	27.213	27.217	27.220	27.224	27.228	27.232	27.236	27.240
692	27.244	27.248	27.252	27.256	27.260	27.264	27.268	27.272	27.276	27.280
693	27.283	27.287	27.291	27.295	27.299	27.303	27.307	27.311	27.315	27.319
694	27.323	27.327	27.331	27.335	27.339	27.343	27.346	27.350	27.354	27.358
695	27.362	27.366	27.370	27.374	27.378	27.382	27.386	27.390	27.394	27.398
696	27.402	27.406	27.409	27.413	27.417	27.421	27.425	27.429	27.433	27.437
697	27.441	27.445	27.449	27.453	27.457	27.461	27.465	27.469	27.472	27.476
698	27.480	27.484	27.488	27.492	27.496	27.500	27.504	27.508	27.512	27.516
699	27.520	27.524	27.528	27.531	27.535	27.539	27.543	27.547	27.551	27.555
700	27.559	27.563	27.567	27.571	27.575	27.579	27.583	27.587	27.591	27.594

(continued)

Proportional parts		.01	.02	.03	.04	.05	.06	.07	.08	.09
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
700	27.559	27.563	27.567	27.571	27.575	27.579	27.583	27.587	27.591	27.594
701	27.598	27.602	27.606	27.610	27.614	27.618	27.622	27.626	27.630	27.634
702	27.638	27.642	27.646	27.650	27.654	27.657	27.661	27.665	27.669	27.673
703	27.677	27.681	27.685	27.689	27.693	27.697	27.701	27.705	27.709	27.713
704	27.717	27.720	27.724	27.728	27.732	27.736	27.740	27.744	27.748	27.752
705	27.756	27.760	27.764	27.768	27.772	27.776	27.780	27.783	27.787	27.791
706	27.795	27.799	27.803	27.807	27.811	27.815	27.819	27.823	27.827	27.831
707	27.835	27.839	27.843	27.846	27.850	27.854	27.858	27.862	27.866	27.870
708	27.874	27.878	27.882	27.886	27.890	27.894	27.898	27.902	27.906	27.909
709	27.913	27.917	27.921	27.925	27.929	27.933	27.937	27.941	27.945	27.949
710	27.953	27.957	27.961	27.965	27.969	27.972	27.976	27.980	27.984	27.988
711	27.992	27.996	28.000	28.004	28.008	28.012	28.016	28.020	28.024	28.028
712	28.031	28.035	28.039	28.043	28.047	28.051	28.055	28.059	28.063	28.067
713	28.071	28.075	28.079	28.083	28.087	28.091	28.094	28.098	28.102	28.106
714	28.110	28.114	28.118	28.122	28.126	28.130	28.134	28.138	28.142	28.146
715	28.150	28.154	28.157	28.161	28.165	28.169	28.173	28.177	28.181	28.185
716	28.189	28.193	28.197	28.201	28.205	28.209	28.213	28.217	28.220	28.224
717	28.228	28.232	28.236	28.240	28.244	28.248	28.252	28.256	28.260	28.264
718	28.268	28.272	28.276	28.280	28.283	28.287	28.291	28.295	28.299	28.303
719	28.307	28.311	28.315	28.319	28.323	28.327	28.331	28.335	28.339	28.343
720	28.346	28.350	28.354	28.358	28.362	28.366	28.370	28.374	28.378	28.382
721	28.386	28.390	28.394	28.398	28.402	28.406	28.409	28.413	28.417	28.421
722	28.425	28.429	28.433	28.437	28.441	28.445	28.449	28.453	28.457	28.461
723	28.465	28.469	28.472	28.476	28.480	28.484	28.488	28.492	28.496	28.500
724	28.504	28.508	28.512	28.516	28.520	28.524	28.528	28.531	28.535	28.539
725	28.543	28.547	28.551	28.555	28.559	28.563	28.567	28.571	28.575	28.579
726	28.583	28.587	28.591	28.594	28.598	28.602	28.606	28.610	28.614	28.618
727	28.622	28.626	28.630	28.634	28.638	28.642	28.646	28.650	28.654	28.657
728	28.661	28.665	28.669	28.673	28.677	28.681	28.685	28.689	28.693	28.697
729	28.701	28.705	28.709	28.713	28.717	28.720	28.724	28.728	28.732	28.736
730	28.740	28.744	28.748	28.752	28.756	28.760	28.764	28.768	28.772	28.776
731	28.780	28.783	28.787	28.791	28.795	28.799	28.803	28.807	28.811	28.815
732	28.819	28.823	28.827	28.831	28.835	28.839	28.843	28.846	28.850	28.854
733	28.858	28.862	28.866	28.870	28.874	28.878	28.882	28.886	28.890	28.894
734	28.898	28.902	28.906	28.909	28.913	28.917	28.921	28.925	28.929	28.933
735	28.937	28.941	28.945	28.949	28.953	28.957	28.961	28.965	28.969	28.972
736	28.976	28.980	28.984	28.988	28.992	28.996	29.000	29.004	29.008	29.012
737	29.016	29.020	29.024	29.028	29.031	29.035	29.039	29.043	29.047	29.051
738	29.055	29.059	29.063	29.067	29.071	29.075	29.079	29.083	29.087	29.091
739	29.094	29.098	29.102	29.106	29.110	29.114	29.118	29.122	29.126	29.130
740	29.134	29.138	29.142	29.146	29.150	29.154	29.157	29.161	29.165	29.169
741	29.173	29.177	29.181	29.185	29.189	29.193	29.197	29.201	29.205	29.209
742	29.213	29.217	29.220	29.224	29.228	29.232	29.236	29.240	29.244	29.248
743	29.252	29.256	29.260	29.264	29.268	29.272	29.276	29.280	29.283	29.287
744	29.291	29.295	29.299	29.303	29.307	29.311	29.315	29.319	29.323	29.327
745	29.331	29.335	29.339	29.343	29.346	29.350	29.354	29.358	29.362	29.366
746	29.370	29.374	29.378	29.382	29.386	29.390	29.394	29.398	29.402	29.406
747	29.409	29.413	29.417	29.421	29.425	29.429	29.433	29.437	29.441	29.445
748	29.449	29.453	29.457	29.461	29.465	29.469	29.472	29.476	29.480	29.484
749	29.488	29.492	29.496	29.500	29.504	29.508	29.512	29.516	29.520	29.524
750	29.528	29.531	29.535	29.539	29.543	29.547	29.551	29.555	29.559	29.563

(*continued*)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
750	29.528	29.531	29.535	29.539	29.543	29.547	29.551	29.555	29.559	29.563
751	29.567	29.571	29.575	29.579	29.583	29.587	29.591	29.594	29.598	29.602
752	29.606	29.610	29.614	29.618	29.622	29.626	29.630	29.634	29.638	29.642
753	29.646	29.650	29.654	29.657	29.661	29.665	29.669	29.673	29.677	29.681
754	29.685	29.689	29.693	29.697	29.701	29.705	29.709	29.713	29.717	29.720
755	29.724	29.728	29.732	29.736	29.740	29.744	29.748	29.752	29.756	29.760
756	29.764	29.768	29.772	29.776	29.780	29.783	29.787	29.791	29.795	29.799
757	29.803	29.807	29.811	29.815	29.819	29.823	29.827	29.831	29.835	29.839
758	29.843	29.846	29.850	29.854	29.858	29.862	29.866	29.870	29.874	29.878
759	29.882	29.886	29.890	29.894	29.898	29.902	29.906	29.909	29.913	29.917
760	29.921	29.925	29.929	29.933	29.937	29.941	29.945	29.949	29.953	29.957
761	29.961	29.965	29.969	29.972	29.976	29.980	29.984	29.988	29.992	29.996
762	30.000	30.004	30.008	30.012	30.016	30.020	30.024	30.028	30.031	30.035
763	30.039	30.043	30.047	30.051	30.055	30.059	30.063	30.067	30.071	30.075
764	30.079	30.083	30.087	30.091	30.094	30.098	30.102	30.106	30.110	30.114
765	30.118	30.122	30.126	30.130	30.134	30.138	30.142	30.146	30.150	30.154
766	30.157	30.161	30.165	30.169	30.173	30.177	30.181	30.185	30.189	30.193
767	30.197	30.201	30.205	30.209	30.213	30.217	30.220	30.224	30.228	30.232
768	30.236	30.240	30.244	30.248	30.252	30.256	30.260	30.264	30.268	30.272
769	30.276	30.280	30.283	30.287	30.291	30.295	30.299	30.303	30.307	30.311
770	30.315	30.319	30.323	30.327	30.331	30.335	30.339	30.343	30.346	30.350
771	30.354	30.358	30.362	30.366	30.370	30.374	30.378	30.382	30.386	30.390
772	30.394	30.398	30.402	30.406	30.409	30.413	30.417	30.421	30.425	30.429
773	30.433	30.437	30.441	30.445	30.449	30.453	30.457	30.461	30.465	30.469
774	30.472	30.476	30.480	30.484	30.488	30.492	30.496	30.500	30.504	30.508
775	30.512	30.516	30.520	30.524	30.528	30.531	30.535	30.539	30.543	30.547
776	30.551	30.555	30.559	30.563	30.567	30.571	30.575	30.579	30.583	30.587
777	30.591	30.594	30.598	30.602	30.606	30.610	30.614	30.618	30.622	30.626
778	30.630	30.634	30.638	30.642	30.646	30.650	30.654	30.657	30.661	30.665
779	30.669	30.673	30.677	30.681	30.685	30.689	30.693	30.697	30.701	30.705
780	30.709	30.713	30.717	30.720	30.724	30.728	30.732	30.736	30.740	30.744
781	30.748	30.752	30.756	30.760	30.764	30.768	30.772	30.776	30.780	30.783
782	30.787	30.791	30.795	30.799	30.803	30.807	30.811	30.815	30.819	30.823
783	30.827	30.831	30.835	30.839	30.843	30.846	30.850	30.854	30.858	30.862
784	30.866	30.870	30.874	30.878	30.882	30.886	30.890	30.894	30.898	30.902
785	30.906	30.909	30.913	30.917	30.921	30.925	30.929	30.933	30.937	30.941
786	30.945	30.949	30.953	30.957	30.961	30.965	30.969	30.972	30.976	30.980
787	30.984	30.988	30.992	30.996	31.000	31.004	31.008	31.012	31.016	31.020
788	31.024	31.028	31.031	31.035	31.039	31.043	31.047	31.051	31.055	31.059
789	31.063	31.067	31.071	31.075	31.079	31.083	31.087	31.091	31.094	31.098
790	31.102	31.106	31.110	31.114	31.118	31.122	31.126	31.130	31.134	31.138
791	31.142	31.146	31.150	31.154	31.157	31.161	31.165	31.169	31.173	31.177
792	31.181	31.185	31.189	31.193	31.197	31.201	31.205	31.209	31.213	31.217
793	31.220	31.224	31.228	31.232	31.236	31.240	31.244	31.248	31.252	31.256
794	31.260	31.264	31.268	31.272	31.276	31.280	31.283	31.287	31.291	31.295
795	31.299	31.303	31.307	31.311	31.315	31.319	31.323	31.327	31.331	31.335
796	31.339	31.343	31.346	31.350	31.354	31.358	31.362	31.366	31.370	31.374
797	31.378	31.382	31.386	31.390	31.394	31.398	31.402	31.406	31.409	31.413
798	31.417	31.421	31.425	31.429	31.433	31.437	31.441	31.445	31.449	31.453
799	31.457	31.461	31.465	31.469	31.472	31.476	31.480	31.484	31.488	31.492
800	31.496	31.500	31.504	31.508	31.512	31.516	31.520	31.524	31.528	31.531

(*continued*)

Proportional parts	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

Table 14 (continued)

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Millimeters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
800	31.496	31.500	31.504	31.508	31.512	31.516	31.520	31.524	31.528	31.531
801	31.535	31.539	31.543	31.547	31.551	31.555	31.559	31.563	31.567	31.571
802	31.575	31.579	31.583	31.587	31.591	31.594	31.598	31.602	31.606	31.610
803	31.614	31.618	31.622	31.626	31.630	31.634	31.638	31.642	31.646	31.650
804	31.654	31.657	31.661	31.665	31.669	31.673	31.677	31.681	31.685	31.689
805	31.693	31.697	31.701	31.705	31.709	31.713	31.717	31.720	31.724	31.728
806	31.732	31.736	31.740	31.744	31.748	31.752	31.756	31.760	31.764	31.768
807	31.772	31.776	31.780	31.783	31.787	31.791	31.795	31.799	31.803	31.807
808	31.811	31.815	31.819	31.823	31.827	31.831	31.835	31.839	31.843	31.846
809	31.850	31.854	31.858	31.862	31.866	31.870	31.874	31.878	31.882	31.886
810	31.890	31.894	31.898	31.902	31.906	31.909	31.913	31.917	31.921	31.925
811	31.929	31.933	31.937	31.941	31.945	31.949	31.953	31.957	31.961	31.965
812	31.969	31.972	31.976	31.980	31.984	31.988	31.992	31.996	32.000	32.004
813	32.008	32.012	32.016	32.020	32.024	32.028	32.031	32.035	32.039	32.043
814	32.047	32.051	32.055	32.059	32.063	32.067	32.071	32.075	32.079	32.083
815	32.087	32.091	32.094	32.098	32.102	32.106	32.110	32.114	32.118	32.122
816	32.126	32.130	32.134	32.138	32.142	32.146	32.150	32.154	32.157	32.161
817	32.165	32.169	32.173	32.177	32.181	32.185	32.189	32.193	32.197	32.201
818	32.205	32.209	32.213	32.217	32.220	32.224	32.228	32.232	32.236	32.240
819	32.244	32.248	32.252	32.256	32.260	32.264	32.268	32.272	32.276	32.280
820	32.283	32.287	32.291	32.295	32.299	32.303	32.307	32.311	32.315	32.319
821	32.323	32.327	32.331	32.335	32.339	32.343	32.346	32.350	32.354	32.358
822	32.362	32.366	32.370	32.374	32.378	32.382	32.386	32.390	32.394	32.398
823	32.402	32.406	32.409	32.413	32.417	32.421	32.425	32.429	32.433	32.437
824	32.441	32.445	32.449	32.453	32.457	32.461	32.465	32.469	32.472	32.476
825	32.480	32.484	32.488	32.492	32.496	32.500	32.504	32.508	32.512	32.516
826	32.520	32.524	32.528	32.531	32.535	32.539	32.543	32.547	32.551	32.555
827	32.559	32.563	32.567	32.571	32.575	32.579	32.583	32.587	32.591	32.594
828	32.598	32.602	32.606	32.610	32.614	32.618	32.622	32.626	32.630	32.634
829	32.638	32.642	32.646	32.650	32.654	32.657	32.661	32.665	32.669	32.673
830	32.677	32.681	32.685	32.689	32.693	32.697	32.701	32.705	32.709	32.713
831	32.717	32.720	32.724	32.728	32.732	32.736	32.740	32.744	32.748	32.752
832	32.756	32.760	32.764	32.768	32.772	32.776	32.780	32.783	32.787	32.791
833	32.795	32.799	32.803	32.807	32.811	32.815	32.819	32.823	32.827	32.831
834	32.835	32.839	32.843	32.846	32.850	32.854	32.858	32.862	32.866	32.870
835	32.874	32.878	32.882	32.886	32.890	32.894	32.898	32.902	32.906	32.909
836	32.913	32.917	32.921	32.925	32.929	32.933	32.937	32.941	32.945	32.949
837	32.953	32.957	32.961	32.965	32.969	32.972	32.976	32.980	32.984	32.988
838	32.992	32.996	33.000	33.004	33.008	33.012	33.016	33.020	33.024	33.028
839	33.031	33.035	33.039	33.043	33.047	33.051	33.055	33.059	33.063	33.067
840	33.071	33.075	33.079	33.083	33.087	33.091	33.094	33.098	33.102	33.106
841	33.110	33.114	33.118	33.122	33.126	33.130	33.134	33.138	33.142	33.146
842	33.150	33.154	33.157	33.161	33.165	33.169	33.173	33.177	33.181	33.185
843	33.189	33.193	33.197	33.201	33.205	33.209	33.213	33.217	33.220	33.224
840	33.228	33.232	33.236	33.240	33.244	33.248	33.252	33.256	33.260	33.264
845	33.268	33.272	33.276	33.280	33.283	33.287	33.291	33.295	33.299	33.303
846	33.307	33.311	33.315	33.319	33.323	33.327	33.331	33.335	33.339	33.343
847	33.346	33.350	33.354	33.358	33.362	33.366	33.370	33.374	33.378	33.382
848	33.386	33.390	33.394	33.398	33.402	33.406	33.409	33.413	33.417	33.421
849	33.425	33.429	33.433	33.437	33.441	33.445	33.449	33.453	33.457	33.461
850	33.465	33.469	33.472	33.476	33.480	33.484	33.488	33.492	33.496	33.500

(continued)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
850	33.465	33.469	33.472	33.476	33.480	33.484	33.488	33.492	33.496	33.500
851	33.504	33.508	33.512	33.516	33.520	33.524	33.528	33.531	33.535	33.539
852	33.543	33.547	33.551	33.555	33.559	33.563	33.567	33.571	33.575	33.579
853	33.583	33.587	33.591	33.594	33.598	33.602	33.606	33.610	33.614	33.618
854	33.622	33.626	33.630	33.634	33.638	33.642	33.646	33.650	33.654	33.657
855	33.661	33.665	33.669	33.673	33.677	33.681	33.685	33.689	33.693	33.697
856	33.701	33.705	33.709	33.713	33.717	33.720	33.724	33.728	33.732	33.736
857	33.740	33.744	33.748	33.752	33.756	33.760	33.764	33.768	33.772	33.776
858	33.780	33.783	33.787	33.791	33.795	33.799	33.803	33.807	33.811	33.815
859	33.819	33.823	33.827	33.831	33.835	33.839	33.843	33.846	33.850	33.854
860	33.858	33.862	33.866	33.870	33.874	33.878	33.882	33.886	33.890	33.894
861	33.898	33.902	33.906	33.909	33.913	33.917	33.921	33.925	33.929	33.933
862	33.937	33.941	33.945	33.949	33.953	33.957	33.961	33.965	33.969	33.972
863	33.976	33.980	33.984	33.988	33.992	33.996	34.000	34.004	34.008	34.012
864	34.016	34.020	34.024	34.028	34.031	34.035	34.039	34.043	34.047	34.051
865	34.055	34.059	34.063	34.067	34.071	34.075	34.079	34.083	34.087	34.091
866	34.094	34.098	34.102	34.106	34.110	34.114	34.118	34.122	34.126	34.130
867	34.134	34.138	34.142	34.146	34.150	34.154	34.157	34.161	34.165	34.169
868	34.173	34.177	34.181	34.185	34.189	34.193	34.197	34.201	34.205	34.209
869	34.213	34.217	34.220	34.224	34.228	34.232	34.236	34.240	34.244	34.248
870	34.252	34.256	34.260	34.264	34.268	34.272	34.276	34.280	34.283	34.287
871	34.291	34.295	34.299	34.303	34.307	34.311	34.315	34.319	34.323	34.327
872	34.331	34.335	34.339	34.343	34.346	34.350	34.354	34.358	34.362	34.366
873	34.370	34.374	34.378	34.382	34.386	34.390	34.394	34.398	34.402	34.406
874	34.409	34.413	34.417	34.421	34.425	34.429	34.433	34.437	34.441	34.445
875	34.449	34.453	34.457	34.461	34.465	34.469	34.472	34.476	34.480	34.484
876	34.488	34.492	34.496	34.500	34.504	34.508	34.512	34.516	34.520	34.524
877	34.528	34.531	34.535	34.539	34.543	34.547	34.551	34.555	34.559	34.563
878	34.567	34.571	34.575	34.579	34.583	34.587	34.591	34.594	34.598	34.602
879	34.606	34.610	34.614	34.618	34.622	34.626	34.630	34.634	34.638	34.642
880	34.646	34.650	34.654	34.657	34.661	34.665	34.669	34.673	34.677	34.681
881	34.685	34.689	34.693	34.697	34.701	34.705	34.709	34.713	34.717	34.720
882	34.724	34.728	34.732	34.736	34.740	34.744	34.748	34.752	34.756	34.760
883	34.764	34.768	34.772	34.776	34.780	34.783	34.787	34.791	34.795	34.799
884	34.803	34.807	34.811	34.815	34.819	34.823	34.827	34.831	34.835	34.839
885	34.843	34.846	34.850	34.854	34.858	34.862	34.866	34.870	34.874	34.878
886	34.882	34.886	34.890	34.894	34.898	34.902	34.906	34.909	34.913	34.917
887	34.921	34.925	34.929	34.933	34.937	34.941	34.945	34.949	34.953	34.957
888	34.961	34.965	34.969	34.972	34.976	34.980	34.984	34.988	34.992	34.996
889	35.000	35.004	35.008	35.012	35.016	35.020	35.024	35.028	35.031	35.035
890	35.039	35.043	35.047	35.051	35.055	35.059	35.063	35.067	35.071	35.075
891	35.079	35.083	35.087	35.091	35.094	35.098	35.102	35.106	35.110	35.114
892	35.118	35.122	35.126	35.130	35.134	35.138	35.142	35.146	35.150	35.154
893	35.157	35.161	35.165	35.169	35.173	35.177	35.181	35.185	35.189	35.193
894	35.197	35.201	35.205	35.209	35.213	35.217	35.220	35.224	35.228	35.232
895	35.236	35.240	35.244	35.248	35.252	35.256	35.260	35.264	35.268	35.272
896	35.276	35.280	35.283	35.287	35.291	35.295	35.299	35.303	35.307	35.311
897	35.315	35.319	35.323	35.327	35.331	35.335	35.339	35.343	35.346	35.350
898	35.354	35.358	35.362	35.366	35.370	35.374	35.378	35.382	35.386	35.390
899	35.394	35.398	35.402	35.406	35.409	35.413	35.417	35.421	35.425	35.429
900	35.433	35.437	35.441	35.445	35.449	35.453	35.457	35.461	36.465	35.469

(*continued*)

Proportional parts	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

TABLE 14 (CONTINUED)

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0 in.	.1 in.	.2 in.	.3 in.	.4 in.	.5 in.	.6 in.	.7 in.	.8 in.	.9 in.
900	35.433	35.437	35.441	35.445	35.449	35.453	35.457	35.461	35.465	35.469
901	35.472	35.476	35.480	35.484	35.488	35.492	35.496	35.500	35.504	35.508
902	35.512	35.516	35.520	35.524	35.528	35.531	35.535	35.539	35.543	35.547
903	35.551	35.555	35.559	35.563	35.567	35.571	35.575	35.579	35.583	35.587
904	35.591	35.594	35.598	35.602	35.606	35.610	35.614	35.618	35.622	35.626
905	35.630	35.634	35.638	35.642	35.646	35.650	35.654	35.657	35.661	35.665
906	35.669	35.673	35.677	35.681	35.685	35.689	35.693	35.697	35.701	35.705
907	35.709	35.713	35.717	35.720	35.724	35.728	35.732	35.736	35.740	35.744
908	35.748	35.752	35.756	35.760	35.764	35.768	35.772	35.776	35.780	35.783
909	35.787	35.791	35.795	35.799	35.803	35.807	35.811	35.815	35.819	35.823
910	35.827	35.831	35.835	35.839	35.843	35.846	35.850	35.854	35.858	35.862
911	35.866	35.870	35.874	35.878	35.882	35.886	35.890	35.894	35.898	35.902
912	35.906	35.909	35.913	35.917	35.921	35.925	35.929	35.933	35.937	35.941
913	35.945	35.949	35.953	35.957	35.961	35.965	35.969	35.972	35.976	35.980
914	35.984	35.988	35.992	35.996	36.000	36.004	36.008	36.012	36.016	36.020
915	36.024	36.028	36.031	36.035	36.039	36.043	36.047	36.051	36.055	36.059
916	36.063	36.067	36.071	36.075	36.079	36.083	36.087	36.091	36.094	36.098
917	36.102	36.106	36.110	36.114	36.118	36.122	36.126	36.130	36.134	36.138
918	36.142	36.146	36.150	36.154	36.157	36.161	36.165	36.169	36.173	36.177
919	36.181	36.185	36.189	36.193	36.197	36.201	36.205	36.209	36.213	36.217
920	36.220	36.224	36.228	36.232	36.236	36.240	36.244	36.248	36.252	36.256
921	36.260	36.264	36.268	36.272	36.276	36.280	36.283	36.287	36.291	36.295
922	36.299	36.303	36.307	36.311	36.315	36.319	36.323	36.327	36.331	36.335
923	36.339	36.343	36.346	36.350	36.354	36.358	36.362	36.366	36.370	36.374
924	36.378	36.382	36.386	36.390	36.394	36.398	36.402	36.406	36.409	36.413
925	36.417	36.421	36.425	36.429	36.433	36.437	36.441	36.445	36.449	36.453
926	36.457	36.461	36.465	36.469	36.472	36.476	36.480	36.484	36.488	36.492
927	36.496	36.500	36.504	36.508	36.512	36.516	36.520	36.524	36.528	36.531
928	36.535	36.539	36.543	36.547	36.551	36.555	36.559	36.563	36.567	36.571
929	36.575	36.579	36.583	36.587	36.591	36.594	36.598	36.602	36.606	36.610
930	36.614	36.618	36.622	36.626	36.630	36.634	36.638	36.642	36.646	36.650
931	36.654	36.657	36.661	36.665	36.669	36.673	36.677	36.681	36.685	36.689
932	36.693	36.697	36.701	36.705	36.709	36.713	36.717	36.720	36.724	36.728
933	36.732	36.736	36.740	36.744	36.748	36.752	36.756	36.760	36.764	36.768
934	36.772	36.776	36.780	36.783	36.787	36.791	36.795	36.799	36.803	36.807
935	36.811	36.815	36.819	36.823	36.827	36.831	36.835	36.839	36.843	36.846
936	36.850	36.854	36.858	36.862	36.866	36.870	36.874	36.878	36.882	36.886
937	36.890	36.894	36.898	36.902	36.906	36.909	36.913	36.917	36.921	36.925
938	36.929	36.933	36.937	36.941	36.945	36.949	36.953	36.957	36.961	36.965
939	36.969	36.972	36.976	36.980	36.984	36.988	36.992	36.996	37.000	37.004
940	37.008	37.012	37.016	37.020	37.024	37.028	37.031	37.035	37.039	37.043
941	37.047	37.051	37.055	37.059	37.063	37.067	37.071	37.075	37.079	37.083
942	37.087	37.091	37.094	37.098	37.102	37.106	37.110	37.114	37.118	37.122
943	37.126	37.130	37.134	37.138	37.142	37.146	37.150	37.154	37.157	37.161
944	37.165	37.169	37.173	37.177	37.181	37.185	37.189	37.193	37.197	37.201
945	37.205	37.209	37.213	37.217	37.220	37.224	37.228	37.232	37.236	37.240
946	37.244	37.248	37.252	37.256	37.260	37.264	37.268	37.272	37.276	37.280
947	37.283	37.287	37.291	37.295	37.299	37.303	37.307	37.311	37.315	37.319
948	37.323	37.327	37.331	37.335	37.339	37.343	37.346	37.350	37.354	37.358
949	37.362	37.366	37.370	37.374	37.378	37.382	37.386	37.390	37.394	37.398
950	37.402	37.406	37.409	37.413	37.417	37.421	37.425	37.429	37.433	37.437

(*continued*)

Proportional parts										
	mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

MILLIMETERS TO INCHES

1 millimeter = 0.039370079 inches

Milli-meters	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
950	37.402	37.406	37.409	37.413	37.417	37.421	37.425	37.429	37.433	37.437
951	37.441	37.445	37.449	37.453	37.457	37.461	37.465	37.469	37.472	37.476
952	37.480	37.484	37.488	37.492	37.496	37.500	37.504	37.508	37.512	37.516
953	37.520	37.524	37.528	37.531	37.535	37.539	37.543	37.547	37.551	37.555
954	37.559	37.563	37.567	37.571	37.575	37.579	37.583	37.587	37.591	37.594
955	37.598	37.602	37.606	37.610	37.614	37.618	37.622	37.626	37.630	37.634
956	37.638	37.642	37.646	37.650	37.654	37.657	37.661	37.665	37.669	37.673
957	37.677	37.681	37.685	37.689	37.693	37.697	37.701	37.705	37.709	37.713
958	37.717	37.720	37.724	37.728	37.732	37.736	37.740	37.744	37.748	37.752
959	37.756	37.760	37.764	37.768	37.772	37.776	37.780	37.783	37.787	37.791
960	37.795	37.799	37.803	37.807	37.811	37.815	37.819	37.823	37.827	37.831
961	37.835	37.839	37.843	37.846	37.850	37.854	37.858	37.862	37.866	37.870
962	37.874	37.878	37.882	37.886	37.890	37.894	37.898	37.902	37.906	37.909
963	37.913	37.917	37.921	37.925	37.929	37.933	37.937	37.941	37.945	37.949
964	37.953	37.957	37.961	37.965	37.969	37.972	37.976	37.980	37.984	37.988
965	37.992	37.996	38.000	38.004	38.008	38.012	38.016	38.020	38.024	38.028
966	38.031	38.035	38.039	38.043	38.047	38.051	38.055	38.059	38.063	38.067
967	38.071	38.075	38.079	38.083	38.087	38.091	38.094	38.098	38.102	38.106
968	38.110	38.114	38.118	38.122	38.126	38.130	38.134	38.138	38.142	38.146
969	38.150	38.154	38.157	38.161	38.165	38.169	38.173	38.177	38.181	38.185
970	38.189	38.193	38.197	38.201	38.205	38.209	38.213	38.217	38.220	38.224
971	38.228	38.232	38.236	38.240	38.244	38.248	38.252	38.256	38.260	38.264
972	38.268	38.272	38.276	38.280	38.283	38.287	38.291	38.295	38.299	38.303
973	38.307	38.311	38.315	38.319	38.323	38.327	38.331	38.335	38.339	38.343
974	38.346	38.350	38.354	38.358	38.362	38.366	38.370	38.374	38.378	38.382
975	38.386	38.390	38.394	38.398	38.402	38.406	38.409	38.413	38.417	38.421
976	38.425	38.429	38.433	38.437	38.441	38.445	38.449	38.453	38.457	38.461
977	38.465	38.469	38.472	38.476	38.480	38.484	38.488	38.492	38.496	38.500
978	38.504	38.508	38.512	38.516	38.520	38.524	38.528	38.531	38.535	38.539
979	38.543	38.547	38.551	38.555	38.559	38.563	38.567	38.571	38.575	38.579
980	38.583	38.587	38.591	38.594	38.598	38.602	38.606	38.610	38.614	38.618
981	38.622	38.626	38.630	38.634	38.638	38.642	38.646	38.650	38.654	38.657
982	38.661	38.665	38.669	38.673	38.677	38.681	38.685	38.689	38.693	38.697
983	38.701	38.705	38.709	38.713	38.717	38.720	38.724	38.728	38.732	38.736
984	38.740	38.744	38.748	38.752	38.756	38.760	38.764	38.768	38.772	38.776
985	38.780	38.783	38.787	38.791	38.795	38.799	38.803	38.807	38.811	38.815
986	38.819	38.823	38.827	38.831	38.835	38.839	38.843	38.846	38.850	38.854
987	38.858	38.862	38.866	38.870	38.874	38.878	38.882	38.886	38.890	38.894
988	38.898	38.902	38.906	38.909	38.913	38.917	38.921	38.925	38.929	38.933
989	38.937	38.941	38.945	38.949	38.953	38.957	38.961	38.965	38.969	38.972
990	38.976	38.980	38.984	38.988	38.992	38.996	39.000	39.004	39.008	39.012
991	39.016	39.020	39.024	39.028	39.031	39.035	39.039	39.043	39.047	39.051
992	39.055	39.059	39.063	39.067	39.071	39.075	39.079	39.083	39.087	39.091
993	39.094	39.098	39.102	39.106	39.110	39.114	39.118	39.122	39.126	39.130
994	39.134	39.138	39.142	39.146	39.150	39.154	39.157	39.161	39.165	39.169
995	39.173	39.177	39.181	39.185	39.189	39.193	39.197	39.201	39.205	39.209
996	39.213	39.217	39.220	39.224	39.228	39.232	39.236	39.240	39.244	39.248
997	39.252	39.256	39.260	39.264	39.268	39.272	39.276	39.280	39.283	39.287
998	39.291	39.295	39.299	39.303	39.307	39.311	39.315	39.319	39.323	39.327
999	39.331	39.335	39.339	39.343	39.346	39.350	39.354	39.358	39.362	39.366
1000	39.370	39.374	39.378	39.382	39.386	39.390	39.394	39.398	39.402	39.406

Proportional parts										
mm.	.01	.02	.03	.04	.05	.06	.07	.08	.09
in.	.000	.001	.001	.002	.002	.002	.003	.003	.004

TABLE 15

FEET TO METERS

1 foot = 0.3048 meters

Feet	0	10	20	30	40	50	60	70	80	90
	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
0	0.00	3.05	6.10	9.14	12.19	15.24	18.29	21.34	24.38	27.43
100	30.48	33.53	36.58	39.62	42.67	45.72	48.77	51.82	54.86	57.91
200	60.96	64.01	67.06	70.10	73.15	76.20	79.25	82.30	85.34	88.39
300	91.44	94.49	97.54	100.58	103.63	106.68	109.73	112.78	115.82	118.87
400	121.92	124.97	128.02	131.06	134.11	137.16	140.21	143.26	146.30	149.35
500	152.40	155.45	158.50	161.54	164.59	167.64	170.69	173.74	176.78	179.83
600	182.88	185.93	188.98	192.02	195.07	198.12	201.17	204.22	207.26	210.31
700	213.36	216.41	219.46	222.50	225.55	228.60	231.65	234.70	237.74	240.79
800	243.84	246.89	249.94	252.98	256.03	259.08	262.13	265.18	268.22	271.27
900	274.32	277.37	280.42	283.46	286.51	289.56	292.61	295.66	298.70	301.75
1000	304.80	307.85	310.90	313.94	316.99	320.04	323.09	326.14	329.18	332.23
1100	335.28	338.33	341.38	344.42	347.47	350.52	353.57	356.62	359.66	362.71
1200	365.76	368.81	371.86	374.90	377.95	381.00	384.05	387.10	390.14	393.19
1300	396.24	399.29	402.34	405.38	408.43	411.48	414.53	417.58	420.62	423.67
1400	426.72	429.77	432.82	435.86	438.91	441.96	445.01	448.06	451.10	454.15
1500	457.20	460.25	463.30	466.34	469.39	472.44	475.49	478.54	481.58	484.63
1600	487.68	490.73	493.78	496.82	499.87	502.92	505.97	509.02	512.06	515.11
1700	518.16	521.21	524.26	527.30	530.35	533.40	536.45	539.50	542.54	545.59
1800	548.64	551.69	554.74	557.78	560.83	563.88	566.93	569.98	573.02	576.07
1900	579.12	582.17	585.22	588.26	591.31	594.36	597.41	600.46	603.50	606.55
2000	609.60	612.65	615.70	618.74	621.79	624.84	627.89	630.94	633.98	637.03
2100	640.08	643.13	646.18	649.22	652.27	655.32	658.37	661.42	664.46	667.51
2200	670.56	673.61	676.66	679.70	682.75	685.80	688.85	691.90	694.94	697.99
2300	701.04	704.09	707.14	710.18	713.23	716.28	719.33	722.38	725.42	728.47
2400	731.52	734.57	737.62	740.66	743.71	746.76	749.81	752.86	755.90	758.95
2500	762.00	765.05	768.10	771.14	774.19	777.24	780.29	783.34	786.38	789.43
2600	792.48	795.53	798.58	801.62	804.67	807.72	810.77	813.82	816.86	819.91
2700	822.96	826.01	829.06	832.10	835.15	838.20	841.25	844.30	847.34	850.39
2800	853.44	856.49	859.54	862.58	865.63	868.68	871.73	874.78	877.82	880.87
2900	883.92	886.97	890.02	893.06	896.11	899.16	902.21	905.26	908.30	911.35
3000	914.40	917.45	920.50	923.54	926.59	929.64	932.69	935.74	938.78	941.83
3100	944.88	947.93	950.98	954.02	957.07	960.12	963.17	966.22	969.26	972.31
3200	975.36	978.41	981.46	984.50	987.55	990.60	993.65	996.70	999.74	1002.79
3300	1005.84	1008.89	1011.94	1014.98	1018.03	1021.08	1024.13	1027.18	1030.22	1033.27
3400	1036.32	1039.37	1042.42	1045.46	1048.51	1051.56	1054.61	1057.66	1060.70	1063.75
3500	1066.80	1069.85	1072.90	1075.94	1078.99	1082.04	1085.09	1088.14	1091.18	1094.23
3600	1097.28	1100.33	1103.38	1106.42	1109.47	1112.52	1115.57	1118.62	1121.66	1124.71
3700	1127.76	1130.81	1133.86	1136.90	1139.95	1143.00	1146.05	1149.10	1152.14	1155.19
3800	1158.24	1161.29	1164.34	1167.38	1170.43	1173.48	1176.53	1179.58	1182.62	1185.67
3900	1188.72	1191.77	1194.82	1197.86	1200.91	1203.96	1207.01	1210.06	1213.10	1216.15
4000	1219.20	1222.25	1225.30	1228.34	1231.39	1234.44	1237.49	1240.54	1243.58	1246.63
4100	1249.68	1252.73	1255.78	1258.82	1261.87	1264.92	1267.97	1271.02	1274.06	1277.11
4200	1280.16	1283.21	1286.26	1289.30	1292.35	1295.40	1298.45	1301.50	1304.54	1307.59
4300	1310.64	1313.69	1316.74	1319.78	1322.83	1325.88	1328.93	1331.98	1335.02	1338.07
4400	1341.12	1344.17	1347.22	1350.26	1353.31	1356.36	1359.41	1362.46	1365.50	1368.55
4500	1371.60	1374.65	1377.70	1380.74	1383.79	1386.84	1389.89	1392.94	1395.98	1399.03
4600	1402.08	1405.13	1408.18	1411.22	1414.27	1417.32	1420.37	1423.42	1426.46	1429.51
4700	1432.56	1435.61	1438.66	1441.70	1444.75	1447.80	1450.85	1453.90	1456.94	1459.99
4800	1463.04	1466.09	1469.14	1472.18	1475.23	1478.28	1481.33	1484.38	1487.42	1490.47
4900	1493.52	1496.57	1499.62	1502.66	1505.71	1508.76	1511.81	1514.86	1517.90	1520.95
5000	1524.00	1527.05	1530.10	1533.14	1536.19	1539.24	1542.29	1545.34	1548.38	1551.43

(continued)

Proportional parts										
ft.	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	
m.	.30	.61	.91	1.22	1.52	1.83	2.13	2.44	2.74	

FEET TO METERS

1 foot = 0.3048 meters

Feet	0	10	20	30	40	50	60	70	80	90
	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
5000	1524.00	1527.05	1530.10	1533.14	1536.19	1539.24	1542.29	1545.34	1548.38	1551.43
5100	1554.48	1557.53	1560.58	1563.62	1566.67	1569.72	1572.77	1575.82	1578.86	1581.91
5200	1584.96	1588.01	1591.06	1594.10	1597.15	1600.20	1603.25	1606.30	1609.34	1612.39
5300	1615.44	1618.49	1621.54	1624.58	1627.63	1630.68	1633.73	1636.78	1639.82	1642.87
5400	1645.92	1648.97	1652.02	1655.06	1658.11	1661.16	1664.21	1667.26	1670.30	1673.35
5500	1676.40	1679.45	1682.50	1685.54	1688.59	1691.64	1694.69	1697.74	1700.78	1703.83
5600	1706.88	1709.93	1712.98	1716.02	1719.07	1722.12	1725.17	1728.22	1731.26	1734.31
5700	1737.36	1740.41	1743.46	1746.50	1749.55	1752.60	1755.65	1758.70	1761.74	1764.79
5800	1767.84	1770.89	1773.94	1776.98	1780.03	1783.08	1786.13	1789.18	1792.22	1795.27
5900	1798.32	1801.37	1804.42	1807.46	1810.51	1813.56	1816.61	1819.66	1822.70	1825.75
6000	1828.80	1831.85	1834.90	1837.94	1840.99	1844.04	1847.09	1850.14	1853.18	1856.23
6100	1859.28	1862.33	1865.38	1868.42	1871.47	1874.52	1877.57	1880.62	1883.66	1886.71
6200	1889.76	1892.81	1895.86	1898.90	1901.95	1905.00	1908.05	1911.10	1914.14	1917.19
6300	1920.24	1923.29	1926.34	1929.38	1932.43	1935.48	1938.53	1941.58	1944.62	1947.67
6400	1950.72	1953.77	1956.82	1959.86	1962.91	1965.96	1969.01	1972.06	1975.10	1978.15
6500	1981.20	1984.25	1987.30	1990.34	1993.39	1996.44	1999.49	2002.54	2005.58	2008.63
6600	2011.68	2014.73	2017.78	2020.82	2023.87	2026.92	2029.97	2033.02	2036.06	2039.11
6700	2042.16	2045.21	2048.26	2051.30	2054.35	2057.40	2060.45	2063.50	2066.54	2069.59
6800	2072.64	2075.69	2078.74	2081.78	2084.83	2087.88	2090.93	2093.98	2097.02	2100.07
6900	2103.12	2106.17	2109.22	2112.26	2115.31	2118.36	2121.41	2124.46	2127.50	2130.55
7000	2133.60	2136.65	2139.70	2142.74	2145.79	2148.84	2151.89	2154.94	2157.98	2161.03
7100	2164.08	2167.13	2170.18	2173.22	2176.27	2179.32	2182.37	2185.42	2188.46	2191.51
7200	2194.56	2197.61	2200.66	2203.70	2206.75	2209.80	2212.85	2215.90	2218.94	2221.99
7300	2225.04	2228.09	2231.14	2234.18	2237.23	2240.28	2243.33	2246.38	2249.42	2252.47
7400	2255.52	2258.57	2261.62	2264.66	2267.71	2270.76	2273.81	2276.86	2279.90	2282.95
7500	2286.00	2289.05	2292.10	2295.14	2298.19	2301.24	2304.29	2307.34	2310.38	2313.43
7600	2316.48	2319.53	2322.58	2325.62	2328.67	2331.72	2334.77	2337.82	2340.86	2343.91
7700	2346.96	2350.01	2353.06	2356.10	2359.15	2362.20	2365.25	2368.30	2371.34	2374.39
7800	2377.44	2380.49	2383.54	2386.58	2389.63	2392.68	2395.73	2398.78	2401.82	2404.87
7900	2407.92	2410.97	2414.02	2417.06	2420.11	2423.16	2426.21	2429.26	2432.30	2435.35
8000	2438.40	2441.45	2444.50	2447.54	2450.59	2453.64	2456.69	2459.74	2462.78	2465.83
8100	2468.88	2471.93	2474.98	2478.02	2481.07	2484.12	2487.17	2490.22	2493.26	2496.31
8200	2499.36	2502.41	2505.46	2508.50	2511.55	2514.60	2517.65	2520.70	2523.74	2526.79
8300	2529.84	2532.89	2535.94	2538.98	2542.03	2545.08	2548.13	2551.18	2554.22	2557.27
8400	2560.32	2563.37	2566.42	2569.46	2572.51	2575.56	2578.61	2581.66	2584.70	2587.75
8500	2590.80	2593.85	2596.90	2599.94	2602.99	2606.04	2609.09	2612.14	2615.18	2618.23
8600	2621.28	2624.33	2627.38	2630.42	2633.47	2636.52	2639.57	2642.62	2645.66	2648.71
8700	2651.76	2654.81	2657.86	2660.90	2663.95	2667.00	2670.05	2673.10	2676.14	2679.19
8800	2682.24	2685.29	2688.34	2691.38	2694.43	2697.48	2700.53	2703.58	2706.62	2709.67
8900	2712.72	2715.77	2718.82	2721.86	2724.91	2727.96	2731.01	2734.06	2737.10	2740.15
9000	2743.20	2746.25	2749.30	2752.34	2755.39	2758.44	2761.49	2764.54	2767.58	2770.63
9100	2773.68	2776.73	2779.78	2782.82	2785.87	2788.92	2791.97	2795.02	2798.06	2801.11
9200	2804.16	2807.21	2810.26	2813.30	2816.35	2819.40	2822.45	2825.50	2828.54	2831.59
9300	2834.64	2837.69	2840.74	2843.78	2846.83	2849.88	2852.93	2855.98	2859.02	2862.07
9400	2865.12	2868.17	2871.22	2874.26	2877.31	2880.36	2883.41	2886.46	2889.50	2892.55
9500	2895.60	2898.65	2901.70	2904.74	2907.79	2910.84	2913.89	2916.94	2919.98	2923.03
9600	2926.08	2929.13	2932.18	2935.22	2938.27	2941.32	2944.37	2947.42	2950.46	2953.51
9700	2956.56	2959.61	2962.66	2965.70	2968.75	2971.80	2974.85	2977.90	2980.94	2983.99
9800	2987.04	2990.09	2993.14	2996.18	2999.23	3002.28	3005.33	3008.38	3011.42	3014.47
9900	3017.52	3020.57	3023.62	3026.66	3029.71	3032.76	3035.81	3038.86	3041.90	3044.95
10000	3048.00	3051.05	3054.10	3057.14	3060.19	3063.24	3066.29	3069.34	3072.38	3075.43

Proportional parts										
	ft.	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
	m.	.30	.61	.91	1.22	1.52	1.83	2.13	2.44	2.74

TABLE 16

METERS TO FEET

1 meter = 3.2808399 feet

Meters	0	10	20	30	40	50	60	70	80	90
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
0	00.0	32.8	65.6	98.4	131.2	164.0	196.9	229.7	262.5	295.3
100	328.1	360.9	393.7	426.5	459.3	492.1	524.9	557.7	590.6	623.4
200	656.2	689.0	721.8	754.6	787.4	820.2	853.0	885.8	918.6	951.4
300	984.3	1017.1	1049.9	1082.7	1115.5	1148.3	1181.1	1213.9	1246.7	1279.5
400	1312.3	1345.1	1378.0	1410.8	1443.6	1476.4	1509.2	1542.0	1574.8	1607.6
500	1640.4	1673.2	1706.0	1738.8	1771.7	1804.5	1837.3	1870.1	1902.9	1935.7
600	1968.5	2001.3	2034.1	2066.9	2099.7	2132.5	2165.4	2198.2	2231.0	2263.8
700	2296.6	2329.4	2362.2	2395.0	2427.8	2460.6	2493.4	2526.2	2559.1	2591.9
800	2624.7	2657.5	2690.3	2723.1	2755.9	2788.7	2821.5	2854.3	2887.1	2919.9
900	2952.8	2985.6	3018.4	3051.2	3084.0	3116.8	3149.6	3182.4	3215.2	3248.0
1000	3280.8	3313.6	3346.5	3379.3	3412.1	3444.9	3477.7	3510.5	3543.3	3576.1
1100	3608.9	3641.7	3674.5	3707.3	3740.2	3773.0	3805.8	3838.6	3871.4	3904.2
1200	3937.0	3969.8	4002.6	4035.4	4068.2	4101.0	4133.9	4166.7	4199.5	4232.3
1300	4265.1	4297.9	4330.7	4363.5	4396.3	4429.1	4461.9	4494.8	4527.6	4560.4
1400	4593.2	4626.0	4658.8	4691.6	4724.4	4757.2	4790.0	4822.8	4855.6	4888.5
1500	4921.3	4954.1	4986.9	5019.7	5052.5	5085.3	5118.1	5150.9	5183.7	5216.5
1600	5249.3	5282.2	5315.0	5347.8	5380.6	5413.4	5446.2	5479.0	5511.8	5544.6
1700	5577.4	5610.2	5643.0	5675.9	5708.7	5741.5	5774.3	5807.1	5839.9	5872.7
1800	5905.5	5938.3	5971.1	6003.9	6036.7	6069.6	6102.4	6135.2	6168.0	6200.8
1900	6233.6	6266.4	6299.2	6332.0	6364.8	6397.6	6430.4	6463.3	6496.1	6528.9
2000	6561.7	6594.5	6627.3	6660.1	6692.9	6725.7	6758.5	6791.3	6824.1	6857.0
2100	6889.8	6922.6	6955.4	6988.2	7021.0	7053.8	7086.6	7119.4	7152.2	7185.0
2200	7217.8	7250.7	7283.5	7316.3	7349.1	7381.9	7414.7	7447.5	7480.3	7513.1
2300	7545.9	7578.7	7611.5	7644.4	7677.2	7710.0	7742.8	7775.6	7808.4	7841.2
2400	7874.0	7906.8	7939.6	7972.4	8005.2	8038.1	8070.9	8103.7	8136.5	8169.3
2500	8202.1	8234.9	8267.7	8300.5	8333.3	8366.1	8399.0	8431.8	8464.6	8497.4
2600	8530.2	8563.0	8595.8	8628.6	8661.4	8694.2	8727.0	8759.8	8792.7	8825.5
2700	8858.3	8891.1	8923.9	8956.7	8989.5	9022.3	9055.1	9087.9	9120.7	9153.5
2800	9186.4	9219.2	9252.0	9284.8	9317.6	9350.4	9383.2	9416.0	9448.8	9481.6
2900	9514.4	9547.2	9580.1	9612.9	9645.7	9678.5	9711.3	9744.1	9776.9	9809.7
3000	9842.5	9875.3	9908.1	9940.9	9973.8	10006.6	10039.4	10072.2	10105.0	10137.8
3100	10170.6	10203.4	10236.2	10269.0	10301.8	10334.6	10367.5	10400.3	10433.1	10465.9
3200	10498.7	10531.5	10564.3	10597.1	10629.9	10662.7	10695.5	10728.3	10761.2	10794.0
3300	10826.8	10859.6	10892.4	10925.2	10958.0	10990.8	11023.6	11056.4	11089.2	11122.0
3400	11154.9	11187.7	11220.5	11253.3	11286.1	11318.9	11351.7	11384.5	11417.3	11450.1
3500	11482.9	11515.7	11548.6	11581.4	11614.2	11647.0	11679.8	11712.6	11745.4	11778.2
3600	11811.0	11843.8	11876.6	11909.4	11942.3	11975.1	12007.9	12040.7	12073.5	12106.3
3700	12139.1	12171.9	12204.7	12237.5	12270.3	12303.1	12336.0	12368.8	12401.6	12434.4
3800	12467.2	12500.0	12532.8	12565.6	12598.4	12631.2	12664.0	12696.9	12729.7	12762.5
3900	12795.3	12828.1	12860.9	12893.7	12926.5	12959.3	12992.1	13024.9	13057.7	13090.6
4000	13123.4	13156.2	13189.0	13221.8	13254.6	13287.4	13320.2	13353.0	13385.8	13418.6
4100	13451.4	13484.3	13517.1	13549.9	13582.7	13615.5	13648.3	13681.1	13713.9	13746.7
4200	13779.5	13812.3	13845.1	13878.0	13910.8	13943.6	13976.4	14009.2	14042.0	14074.8
4300	14107.6	14140.4	14173.2	14206.0	14238.8	14271.7	14304.5	14337.3	14370.1	14402.9
4400	14435.7	14468.5	14501.3	14534.1	14566.9	14599.7	14632.5	14665.4	14698.2	14731.0
4500	14763.8	14796.6	14829.4	14862.2	14895.0	14927.8	14960.6	14993.4	15026.2	15059.1
4600	15091.9	15124.7	15157.5	15190.3	15223.1	15255.9	15288.7	15321.5	15354.3	15387.1
4700	15419.9	15452.8	15485.6	15518.4	15551.2	15584.0	15616.8	15649.6	15682.4	15715.2
4800	15748.0	15780.8	15813.6	15846.5	15879.3	15912.1	15944.9	15977.7	16010.5	16043.3
4900	16076.1	16108.9	16141.7	16174.5	16207.3	16240.2	16273.0	16305.8	16338.6	16371.4
5000	16404.2	16437.0	16469.8	16502.6	16535.4	16568.2	16601.0	16633.9	16666.7	16699.5

(*continued*)

Proportional parts										
	m.	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
	ft.	3.3	6.6	9.8	13.1	16.4	19.7	23.0	26.2	29.5

METERS TO FEET

1 meter = 3.2808399 feet

Meters	0 ft.	10 ft.	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.
5000	16404.2	16437.0	16469.8	16502.6	16535.4	16568.2	16601.0	16633.9	16666.7	16699.5
5100	16732.3	16765.1	16797.9	16830.7	16863.5	16896.3	16929.1	16961.9	16994.8	17027.6
5200	17060.4	17093.2	17126.0	17158.8	17191.6	17224.4	17257.2	17290.0	17322.8	17355.6
5300	17388.5	17421.3	17454.1	17486.9	17519.7	17552.5	17585.3	17618.1	17650.9	17683.7
5400	17716.5	17749.3	17782.2	17815.0	17847.8	17880.6	17913.4	17946.2	17979.0	18011.8
5500	18044.6	18077.4	18110.2	18143.0	18175.9	18208.7	18241.5	18274.3	18307.1	18339.9
5600	18372.7	18405.5	18438.3	18471.1	18503.9	18536.7	18569.6	18602.4	18635.2	18668.0
5700	18700.8	18733.6	18766.4	18799.2	18832.0	18864.8	18897.6	18930.4	18963.3	18996.1
5800	19028.9	19061.7	19094.5	19127.3	19160.1	19192.9	19225.7	19258.5	19291.3	19324.1
5900	19357.0	19389.8	19422.6	19455.4	19488.2	19521.0	19553.8	19586.6	19619.4	19652.2
6000	19685.0	19717.8	19750.7	19783.5	19816.3	19849.1	19881.9	19914.7	19947.5	19980.3
6100	20013.1	20045.9	20078.7	20111.5	20144.4	20177.2	20210.0	20242.8	20275.6	20308.4
6200	20341.2	20374.0	20406.8	20439.6	20472.4	20505.2	20538.1	20570.9	20603.7	20636.5
6300	20669.3	20702.1	20734.9	20767.7	20800.5	20833.3	20866.1	20899.0	20931.8	20964.6
6400	20997.4	21030.2	21063.0	21095.8	21128.6	21161.4	21194.2	21227.0	21259.8	21292.7
6500	21325.5	21358.3	21391.1	21423.9	21456.7	21489.5	21522.3	21555.1	21587.9	21620.7
6600	21653.5	21686.4	21719.2	21752.0	21784.8	21817.6	21850.4	21883.2	21916.0	21948.8
6700	21981.6	22014.4	22047.2	22080.1	22112.9	22145.7	22178.5	22211.3	22244.1	22276.9
6800	22309.7	22342.5	22375.3	22408.1	22440.9	22473.8	22506.6	22539.4	22572.2	22605.0
6900	22637.8	22670.6	22703.4	22736.2	22769.0	22801.8	22834.6	22867.5	22900.3	22933.1
7000	22965.9	22998.7	23031.5	23064.3	23097.1	23129.9	23162.7	23195.5	23228.3	23261.2
7100	23294.0	23326.8	23359.6	23392.4	23425.2	23458.0	23490.8	23523.6	23556.4	23589.2
7200	23622.0	23654.9	23687.7	23720.5	23753.3	23786.1	23818.9	23851.7	23884.5	23917.3
7300	23950.1	23982.9	24015.7	24048.6	24081.4	24114.2	24147.0	24179.8	24212.6	24245.4
7400	24278.2	24311.0	24343.8	24376.6	24409.4	24442.3	24475.1	24507.9	24540.7	24573.5
7500	24606.3	24639.1	24671.9	24704.7	24737.5	24770.3	24803.1	24836.0	24868.8	24901.6
7600	24934.4	24967.2	25000.0	25032.8	25065.6	25098.4	25131.2	25164.0	25196.9	25229.7
7700	25262.5	25295.3	25328.1	25360.9	25393.7	25426.5	25459.3	25492.1	25524.9	25557.7
7800	25590.6	25623.4	25656.2	25689.0	25721.8	25754.6	25787.4	25820.2	25853.0	25885.8
7900	25918.6	25951.4	25984.3	26017.1	26049.9	26082.7	26115.5	26148.3	26181.1	26213.9
8000	26246.7	26279.5	26312.3	26345.1	26378.0	26410.8	26443.6	26476.4	26509.2	26542.0
8100	26574.8	26607.6	26640.4	26673.2	26706.0	26738.8	26771.7	26804.5	26837.3	26870.1
8200	26902.9	26935.7	26968.5	27001.3	27034.1	27066.9	27099.7	27132.5	27165.4	27198.2
8300	27231.0	27263.8	27296.6	27329.4	27362.2	27395.0	27427.8	27460.6	27493.4	27526.2
8400	27559.1	27591.9	27624.7	27657.5	27690.3	27723.1	27755.9	27788.7	27821.5	27854.3
8500	27887.1	27919.9	27952.8	27985.6	28018.4	28051.2	28084.0	28116.8	28149.6	28182.4
8600	28215.2	28248.0	28280.8	28313.6	28346.5	28379.3	28412.1	28444.9	28477.7	28510.5
8700	28543.3	28576.1	28608.9	28641.7	28674.5	28707.3	28740.2	28773.0	28805.8	28838.6
8800	28871.4	28904.2	28937.0	28969.8	29002.6	29035.4	29068.2	29101.0	29133.9	29166.7
8900	29199.5	29232.3	29265.1	29297.9	29330.7	29363.5	29396.3	29429.1	29461.9	29494.8
9000	29527.6	29560.4	29593.2	29626.0	29658.8	29691.6	29724.4	29757.2	29790.0	29822.8
9100	29855.6	29888.5	29921.3	29954.1	29986.9	30019.7	30052.5	30085.3	30118.1	30150.9
9200	30183.7	30216.5	30249.3	30282.2	30315.0	30347.8	30380.6	30413.4	30446.2	30479.0
9300	30511.8	30544.6	30577.4	30610.2	30643.0	30675.9	30708.7	30741.5	30774.3	30807.1
9400	30839.9	30872.7	30905.5	30938.3	30971.1	31003.9	31036.7	31069.6	31102.4	31135.2
9500	31168.0	31200.8	31233.6	31266.4	31299.2	31332.0	31364.8	31397.6	31430.4	31463.3
9600	31496.1	31528.9	31561.7	31594.5	31627.3	31660.1	31692.9	31725.7	31758.5	31791.3
9700	31824.1	31857.0	31889.8	31922.6	31955.4	31988.2	32021.0	32053.8	32086.6	32119.4
9800	32152.2	32185.0	32217.8	32250.7	32283.5	32316.3	32349.1	32381.9	32414.7	32447.5
9900	32480.3	32513.1	32545.9	32578.7	32611.5	32644.4	32677.2	32710.0	32742.8	32775.6
10000	32808.4	32841.2	32874.0	32906.8	32939.6	32972.4	33005.2	33038.1	33070.9	33103.7

Proportional parts										
	m.	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
	ft.	3.3	6.6	9.8	13.1	16.4	19.7	23.0	26.2	29.5

Table 17

STATUTE MILES TO KILOMETERS

1 statute mile = 1.609344 kilometers

Statute miles	0	1	2	3	4	5	6	7	8	9
	km.	km.	km.	km.	km.	km.	km.	km.	km.	km.
0	0	1.6	3.2	4.8	6.4	8.0	9.7	11.3	12.9	14.5
10	16.1	17.7	19.3	20.9	22.5	24.1	25.7	27.4	29.0	30.6
20	32.2	33.8	35.4	37.0	38.6	40.2	41.8	43.5	45.1	46.7
30	48.3	49.9	51.5	53.1	54.7	56.3	57.9	59.5	61.2	62.8
40	64.4	66.0	67.6	69.2	70.8	72.4	74.0	75.6	77.2	78.9
50	80.5	82.1	83.7	85.3	86.9	88.5	90.1	91.7	93.3	95.0
60	96.6	98.2	99.8	101.4	103.0	104.6	106.2	107.8	109.4	111.0
70	112.7	114.3	115.9	117.5	119.1	120.7	122.3	123.9	125.5	127.1
80	128.7	130.4	132.0	133.6	135.2	136.8	138.4	140.0	141.6	143.2
90	144.8	146.5	148.1	149.7	151.3	152.9	154.5	156.1	157.7	159.3
100	160.9	162.5	164.2	165.8	167.4	169.0	170.6	172.2	173.8	175.4
110	177.0	178.6	180.2	181.9	183.5	185.1	186.7	188.3	189.9	191.5
120	193.1	194.7	196.3	197.9	199.6	201.2	202.8	204.4	206.0	207.6
130	209.2	210.8	212.4	214.0	215.7	217.3	218.9	220.5	222.1	223.7
140	225.3	226.9	228.5	230.1	231.7	233.4	235.0	236.6	238.2	239.8
150	241.4	243.0	244.6	246.2	247.8	249.4	251.1	252.7	254.3	255.9
160	257.5	259.1	260.7	262.3	263.9	265.5	267.2	268.8	270.4	272.0
170	273.6	275.2	276.8	278.4	280.0	281.6	283.2	284.9	286.5	288.1
180	289.7	291.3	292.9	294.5	296.1	297.7	299.3	300.9	302.6	304.2
190	305.8	307.4	309.0	310.6	312.2	313.8	315.4	317.0	318.7	320.3
200	321.9	323.5	325.1	326.7	328.3	329.9	331.5	333.1	334.7	336.4
210	338.0	339.6	341.2	342.8	344.4	346.0	347.6	349.2	350.8	352.4
220	354.1	355.7	357.3	358.9	360.5	362.1	363.7	365.3	366.9	368.5
230	370.1	371.8	373.4	375.0	376.6	378.2	379.8	381.4	383.0	384.6
240	386.2	387.9	389.5	391.1	392.7	394.3	395.9	397.5	399.1	400.7
250	402.3	403.9	405.6	407.2	408.8	410.4	412.0	413.6	415.2	416.8
260	418.4	420.0	421.6	423.3	424.9	426.5	428.1	429.7	431.3	432.9
270	434.5	436.1	437.7	439.4	441.0	442.6	444.2	445.8	447.4	449.0
280	450.6	452.2	453.8	455.4	457.1	458.7	460.3	461.9	463.5	465.1
290	466.7	468.3	469.9	471.5	473.1	474.8	476.4	478.0	479.6	481.2
300	482.8	484.4	486.0	487.6	489.2	490.8	492.5	494.1	495.7	497.3
310	498.9	500.5	502.1	503.7	505.3	506.9	508.6	510.2	511.8	513.4
320	515.0	516.6	518.2	519.8	521.4	523.0	524.6	526.3	527.9	529.5
330	531.1	532.7	534.3	535.9	537.5	539.1	540.7	542.3	544.0	545.6
340	547.2	548.8	550.4	552.0	553.6	555.2	556.8	558.4	560.1	561.7
350	563.3	564.9	566.5	568.1	569.7	571.3	572.9	574.5	576.1	577.8
360	579.4	581.0	582.6	584.2	585.8	587.4	589.0	590.6	592.2	593.8
370	595.5	597.1	598.7	600.3	601.9	603.5	605.1	606.7	608.3	609.9
380	611.6	613.2	614.8	616.4	618.0	619.6	621.2	622.8	624.4	626.0
390	627.6	629.3	630.9	632.5	634.1	635.7	637.3	638.9	640.5	642.1
400	643.7	645.3	647.0	648.6	650.2	651.8	653.4	655.0	656.6	658.2
410	659.8	661.4	663.0	664.7	666.3	667.9	669.5	671.1	672.7	674.3
420	675.9	677.5	679.1	680.8	682.4	684.0	685.6	687.2	688.8	690.4
430	692.0	693.6	695.2	696.8	698.5	700.1	701.7	703.3	704.9	706.5
440	708.1	709.7	711.3	712.9	714.5	716.2	717.8	719.4	721.0	722.6
450	724.2	725.8	727.4	729.0	730.6	732.3	733.9	735.5	737.1	738.7
460	740.3	741.9	743.5	745.1	746.7	748.3	750.0	751.6	753.2	754.8
470	756.4	758.0	759.6	761.2	762.8	764.4	766.0	767.7	769.3	770.9
480	772.5	774.1	775.7	777.3	778.9	780.5	782.1	783.8	785.4	787.0
490	788.6	790.2	791.8	793.4	795.0	796.6	798.2	799.8	801.5	803.1
500	804.7	806.3	807.9	809.5	811.1	812.7	814.3	815.9	817.5	819.2
510	820.8	822.4	824.0	825.6	827.2	828.8	830.4	832.0	833.6	835.2
520	836.9	838.5	840.1	841.7	843.3	844.9	846.5	848.1	849.7	851.3
530	853.0	854.6	856.2	857.8	859.4	861.0	862.6	864.2	865.8	867.4
540	869.0	870.7	872.3	873.9	875.5	877.1	878.7	880.3	881.9	883.5
550	885.1	886.7	888.4	890.0	891.6	893.2	894.8	896.4	898.0	899.6

(continued)

STATUTE MILES TO KILOMETERS

1 statute mile = 1.609344 kilometers

Statute miles	0	1	2	3	4	5	6	7	8	9
	km.	km.	km.	km.	km.	km.	km.	km.	km.	km.
550	885.1	886.7	888.4	890.0	891.6	893.2	894.8	896.4	898.0	899.6
560	901.2	902.8	904.5	906.1	907.7	909.3	910.9	912.5	914.1	915.7
570	917.3	918.9	920.5	922.2	923.8	925.4	927.0	928.6	930.2	931.8
580	933.4	935.0	936.6	938.2	939.9	941.5	943.1	944.7	946.3	947.9
590	949.5	951.1	952.7	954.3	956.0	957.6	959.2	960.8	962.4	964.0
600	965.6	967.2	968.8	970.4	972.0	973.7	975.3	976.9	978.5	980.1
610	981.7	983.3	984.9	986.5	988.1	989.7	991.4	993.0	994.6	996.2
620	997.8	999.4	1001.0	1002.6	1004.2	1005.8	1007.4	1009.1	1010.7	1012.3
630	1013.9	1015.5	1017.1	1018.7	1020.3	1021.9	1023.5	1025.2	1026.8	1028.4
640	1030.0	1031.6	1033.2	1034.8	1036.4	1038.0	1039.6	1041.2	1042.9	1044.5
650	1046.1	1047.7	1049.3	1050.9	1052.5	1054.1	1055.7	1057.3	1058.9	1060.6
660	1062.2	1063.8	1065.4	1067.0	1068.6	1070.2	1071.8	1073.4	1075.0	1076.7
670	1078.3	1079.9	1081.5	1083.1	1084.7	1086.3	1087.9	1089.5	1091.1	1092.7
680	1094.4	1096.0	1097.6	1099.2	1100.8	1102.4	1104.0	1105.6	1107.2	1108.8
690	1110.4	1112.1	1113.7	1115.3	1116.9	1118.5	1120.1	1121.7	1123.3	1124.9
700	1126.5	1128.2	1129.8	1131.4	1133.0	1134.6	1136.2	1137.8	1139.4	1141.0
710	1142.6	1144.2	1145.9	1147.5	1149.1	1150.7	1152.3	1153.9	1155.5	1157.1
720	1158.7	1160.3	1161.9	1163.6	1165.2	1166.8	1168.4	1170.0	1171.6	1173.2
730	1174.8	1176.4	1178.0	1179.6	1181.3	1182.9	1184.5	1186.1	1187.7	1189.3
740	1190.9	1192.5	1194.1	1195.7	1197.4	1199.0	1200.6	1202.2	1203.8	1205.4
750	1207.0	1208.6	1210.2	1211.8	1213.4	1215.1	1216.7	1218.3	1219.9	1221.5
760	1223.1	1224.7	1226.3	1227.9	1229.5	1231.1	1232.8	1234.4	1236.0	1237.6
770	1239.2	1240.8	1242.4	1244.0	1245.6	1247.2	1248.9	1250.5	1252.1	1253.7
780	1255.3	1256.9	1258.5	1260.1	1261.7	1263.3	1264.9	1266.6	1268.2	1269.8
790	1271.4	1273.0	1274.6	1276.2	1277.8	1279.4	1281.0	1282.6	1284.3	1285.9
800	1287.5	1289.1	1290.7	1292.3	1293.9	1295.5	1297.1	1298.7	1300.3	1302.0
810	1303.6	1305.2	1306.8	1308.4	1310.0	1311.6	1313.2	1314.8	1316.4	1318.1
820	1319.7	1321.3	1322.9	1324.5	1326.1	1327.7	1329.3	1330.9	1332.5	1334.1
830	1335.8	1337.4	1339.0	1340.6	1342.2	1343.8	1345.4	1347.0	1348.6	1350.2
840	1351.8	1353.5	1355.1	1356.7	1358.3	1359.9	1361.5	1363.1	1364.7	1366.3
850	1367.9	1369.6	1371.2	1372.8	1374.4	1376.0	1377.6	1379.2	1380.8	1382.4
860	1384.0	1385.6	1387.3	1388.9	1390.5	1392.1	1393.7	1395.3	1396.9	1398.5
870	1400.1	1401.7	1403.3	1405.0	1406.6	1408.2	1409.8	1411.4	1413.0	1414.6
880	1416.2	1417.8	1419.4	1421.1	1422.7	1424.3	1425.9	1427.5	1429.1	1430.7
890	1432.3	1433.9	1435.5	1437.1	1438.8	1440.4	1442.0	1443.6	1445.2	1446.8
900	1448.4	1450.0	1451.6	1453.2	1454.8	1456.5	1458.1	1459.7	1461.3	1462.9
910	1464.5	1466.1	1467.7	1469.3	1470.9	1472.5	1474.2	1475.8	1477.4	1479.0
920	1480.6	1482.2	1483.8	1485.4	1487.0	1488.6	1490.3	1491.9	1493.5	1495.1
930	1496.7	1498.3	1499.9	1501.5	1503.1	1504.7	1506.3	1508.0	1509.6	1511.2
940	1512.8	1514.4	1516.0	1517.6	1519.2	1520.8	1522.4	1524.0	1525.7	1527.3
950	1528.9	1530.5	1532.1	1533.7	1535.3	1536.9	1538.5	1540.1	1541.8	1543.4
960	1545.0	1546.6	1548.2	1549.8	1551.4	1553.0	1554.6	1556.2	1557.8	1559.5
970	1561.1	1562.7	1564.3	1565.9	1567.5	1569.1	1570.7	1572.3	1573.9	1575.5
980	1577.2	1578.8	1580.4	1582.0	1583.6	1585.2	1586.8	1588.4	1590.0	1591.6
990	1593.3	1594.9	1596.5	1598.1	1599.7	1601.3	1602.9	1604.5	1606.1	1607.7
1000	1609.3	1611.0	1612.6	1614.2	1615.8	1617.4	1619.0	1620.6	1622.2	1623.8

miles	km.	miles	km.	miles	km.	miles	km.
1000	1609.3	6000	9656.1	11000	17702.8	16000	25749.5
2000	3218.7	7000	11265.4	12000	19312.1	17000	27358.8
3000	4828.0	8000	12874.8	13000	20921.5	18000	28968.2
4000	6437.4	9000	14484.1	14000	22530.8	19000	30577.5
5000	8046.7	10000	16093.4	15000	24140.2	20000	32186.9

Table 18

KILOMETERS TO STATUTE MILES

1 kilometer = 0.62137119 statute miles

Kilo-meters	0 miles	1 miles	2 miles	3 miles	4 miles	5 miles	6 miles	7 miles	8 miles	9 miles
0	0.0	0.6	1.2	1.9	2.5	3.1	3.7	4.3	5.0	5.6
10	6.2	6.8	7.5	8.1	8.7	9.3	9.9	10.6	11.2	11.8
20	12.4	13.0	13.7	14.3	14.9	15.5	16.2	16.8	17.4	18.0
30	18.6	19.3	19.9	20.5	21.1	21.7	22.4	23.0	23.6	24.2
40	24.9	25.5	26.1	26.7	27.3	28.0	28.6	29.2	29.8	30.4
50	31.1	31.7	32.3	32.9	33.6	34.2	34.8	35.4	36.0	36.7
60	37.3	37.9	38.5	39.1	39.8	40.4	41.0	41.6	42.3	42.9
70	43.5	44.1	44.7	45.4	46.0	46.6	47.2	47.8	48.5	49.1
80	49.7	50.3	51.0	51.6	52.2	52.8	53.4	54.1	54.7	55.3
90	55.9	56.5	57.2	57.8	58.4	59.0	59.7	60.3	60.9	61.5
100	62.1	62.8	63.4	64.0	64.6	65.2	65.9	66.5	67.1	67.7
110	68.4	69.0	69.6	70.2	70.8	71.5	72.1	72.7	73.3	73.9
120	74.6	75.2	75.8	76.4	77.1	77.7	78.3	78.9	79.5	80.2
130	80.8	81.4	82.0	82.6	83.3	83.9	84.5	85.1	85.7	86.4
140	87.0	87.6	88.2	88.9	89.5	90.1	90.7	91.3	92.0	92.6
150	93.2	93.8	94.4	95.1	95.7	96.3	96.9	97.6	98.2	98.8
160	99.4	100.0	100.7	101.3	101.9	102.5	103.1	103.8	104.4	105.0
170	105.6	106.3	106.9	107.5	108.1	108.7	109.4	110.0	110.6	111.2
180	111.8	112.5	113.1	113.7	114.3	115.0	115.6	116.2	116.8	117.4
190	118.1	118.7	119.3	119.9	120.5	121.2	121.8	122.4	123.0	123.7
200	124.3	124.9	125.5	126.1	126.8	127.4	128.0	128.6	129.2	129.9
210	130.5	131.1	131.7	132.4	133.0	133.6	134.2	134.8	135.5	136.1
220	136.7	137.3	137.9	138.6	139.2	139.8	140.4	141.1	141.7	142.3
230	142.9	143.5	144.2	144.8	145.4	146.0	146.6	147.3	147.9	148.5
240	149.1	149.8	150.4	151.0	151.6	152.2	152.9	153.5	154.1	154.7
250	155.3	156.0	156.6	157.2	157.8	158.4	159.1	159.7	160.3	160.9
260	161.6	162.2	162.8	163.4	164.0	164.7	165.3	165.9	166.5	167.1
270	167.8	168.4	169.0	169.6	170.3	170.9	171.5	172.1	172.7	173.4
280	174.0	174.6	175.2	175.8	176.5	177.1	177.7	178.3	179.0	179.6
290	180.2	180.8	181.4	182.1	182.7	183.3	183.9	184.5	185.2	185.8
300	186.4	187.0	187.7	188.3	188.9	189.5	190.1	190.8	191.4	192.0
310	192.6	193.2	193.9	194.5	195.1	195.7	196.4	197.0	197.6	198.2
320	198.8	199.5	200.1	200.7	201.3	201.9	202.6	203.2	203.8	204.4
330	205.1	205.7	206.3	206.9	207.5	208.2	208.8	209.4	210.0	210.6
340	211.3	211.9	212.5	213.1	213.8	214.4	215.0	215.6	216.2	216.9
350	217.5	218.1	218.7	219.3	220.0	220.6	221.2	221.8	222.5	223.1
360	223.7	224.3	224.9	225.6	226.2	226.8	227.4	228.0	228.7	229.3
370	229.9	230.5	231.2	231.8	232.4	233.0	233.6	234.3	234.9	235.5
380	236.1	236.7	237.4	238.0	238.6	239.2	239.8	240.5	241.1	241.7
390	242.3	243.0	243.6	244.2	244.8	245.4	246.1	246.7	247.3	247.9
400	248.5	249.2	249.8	250.4	251.0	251.7	252.3	252.9	253.5	254.1
410	254.8	255.4	256.0	256.6	257.2	257.9	258.5	259.1	259.7	260.4
420	261.0	261.6	262.2	262.8	263.5	264.1	264.7	265.3	265.9	266.6
430	267.2	267.8	268.4	269.1	269.7	270.3	270.9	271.5	272.2	272.8
440	273.4	274.0	274.6	275.3	275.9	276.5	277.1	277.8	278.4	279.0
450	279.6	280.2	280.9	281.5	282.1	282.7	283.3	284.0	284.6	285.2
460	285.8	286.5	287.1	287.7	288.3	288.9	289.6	290.2	290.8	291.4
470	292.0	292.7	293.3	293.9	294.5	295.2	295.8	296.4	297.0	297.6
480	298.3	298.9	299.5	300.1	300.7	301.4	302.0	302.6	303.2	303.9
490	304.5	305.1	305.7	306.3	307.0	307.6	308.2	308.8	309.4	310.1
500	310.7	311.3	311.9	312.5	313.2	313.8	314.4	315.0	315.7	316.3
510	316.9	317.5	318.1	318.8	319.4	320.0	320.6	321.2	321.9	322.5
520	323.1	323.7	324.4	325.0	325.6	326.2	326.8	327.5	328.1	328.7
530	329.3	329.9	330.6	331.2	331.8	332.4	333.1	333.7	334.3	334.9
540	335.5	336.2	336.8	337.4	338.0	338.6	339.3	339.9	340.5	341.1

(*continued*)

KILOMETERS TO STATUTE MILES

1 kilometer = 0.62137119 statute miles

Kilo-meters	0 miles	1 miles	2 miles	3 miles	4 miles	5 miles	6 miles	7 miles	8 miles	9 miles
550	341.8	342.4	343.0	343.6	344.2	344.9	345.5	346.1	346.7	347.3
560	348.0	348.6	349.2	349.8	350.5	351.1	351.7	352.3	352.9	353.6
570	354.2	354.8	355.4	356.0	356.7	357.3	357.9	358.5	359.2	359.8
580	360.4	361.0	361.6	362.3	362.9	363.5	364.1	364.7	365.4	366.0
590	366.6	367.2	367.9	368.5	369.1	369.7	370.3	371.0	371.6	372.2
600	372.8	373.4	374.1	374.7	375.3	375.9	376.6	377.2	377.8	378.4
610	379.0	379.7	380.3	380.9	381.5	382.1	382.8	383.4	384.0	384.6
620	385.3	385.9	386.5	387.1	387.7	388.4	389.0	389.6	390.2	390.8
630	391.5	392.1	392.7	393.3	393.9	394.6	395.2	395.8	396.4	397.1
640	397.7	398.3	398.9	399.5	400.2	400.8	401.4	402.0	402.6	403.3
650	403.9	404.5	405.1	405.8	406.4	407.0	407.6	408.2	408.9	409.5
660	410.1	410.7	411.3	412.0	412.6	413.2	413.8	414.5	415.1	415.7
670	416.3	416.9	417.6	418.2	418.8	419.4	420.0	420.7	421.3	421.9
680	422.5	423.2	423.8	424.4	425.0	425.6	426.3	426.9	427.5	428.1
690	428.7	429.4	430.0	430.6	431.2	431.9	432.5	433.1	433.7	434.3
700	435.0	435.6	436.2	436.8	437.4	438.1	438.7	439.3	439.9	440.6
710	441.2	441.8	442.4	443.0	443.7	444.3	444.9	445.5	446.1	446.8
720	447.4	448.0	448.6	449.3	449.9	450.5	451.1	451.7	452.4	453.0
730	453.6	454.2	454.8	455.5	456.1	456.7	457.3	458.0	458.6	459.2
740	459.8	460.4	461.1	461.7	462.3	462.9	463.5	464.2	464.8	465.4
750	466.0	466.6	467.3	467.9	468.5	469.1	469.8	470.4	471.0	471.6
760	472.2	472.9	473.5	474.1	474.7	475.3	476.0	476.6	477.2	477.8
770	478.5	479.1	479.7	480.3	480.9	481.6	482.2	482.8	483.4	484.0
780	484.7	485.3	485.9	486.5	487.2	487.8	488.4	489.0	489.6	490.3
790	490.9	491.5	492.1	492.7	493.4	494.0	494.6	495.2	495.9	496.5
800	497.1	497.7	498.3	499.0	499.6	500.2	500.8	501.4	502.1	502.7
810	503.3	503.9	504.6	505.2	505.8	506.4	507.0	507.7	508.3	508.9
820	509.5	510.1	510.8	511.4	512.0	512.6	513.3	513.9	514.5	515.1
830	515.7	516.4	517.0	517.6	518.2	518.8	519.5	520.1	520.7	521.3
840	522.0	522.6	523.2	523.8	524.4	525.1	525.7	526.3	526.9	527.5
850	528.2	528.8	529.4	530.0	530.7	531.3	531.9	532.5	533.1	533.8
860	534.4	535.0	535.6	536.2	536.9	537.5	538.1	538.7	539.4	540.0
870	540.6	541.2	541.8	542.5	543.1	543.7	544.3	544.9	545.6	546.2
880	546.8	547.4	548.0	548.7	549.3	549.9	550.5	551.2	551.8	552.4
890	553.0	553.6	554.3	554.9	555.5	556.1	556.7	557.4	558.0	558.6
900	559.2	559.9	560.5	561.1	561.7	562.3	563.0	563.6	564.2	564.8
910	565.4	566.1	566.7	567.3	567.9	568.6	569.2	569.8	570.4	571.0
920	571.7	572.3	572.9	573.5	574.1	574.8	575.4	576.0	576.6	577.3
930	577.9	578.5	579.1	579.7	580.4	581.0	581.6	582.2	582.8	583.5
940	584.1	584.7	585.3	586.0	586.6	587.2	587.8	588.4	589.1	589.7
950	590.3	590.9	591.5	592.2	592.8	593.4	594.0	594.7	595.3	595.9
960	596.5	597.1	597.8	598.4	599.0	599.6	600.2	600.9	601.5	602.1
970	602.7	603.4	604.0	604.6	605.2	605.8	606.5	607.1	607.7	608.3
980	608.9	609.6	610.2	610.8	611.4	612.1	612.7	613.3	613.9	614.5
990	615.2	615.8	616.4	617.0	617.6	618.3	618.9	619.5	620.1	620.7
1000	621.4	622.0	622.6	623.2	623.9	624.5	625.1	625.7	626.3	627.0

km.	miles	km.	miles	km.	miles	km.	miles
1000	621.4	6000	3728.2	11000	6835.1	16000	9941.9
2000	1242.7	7000	4349.6	12000	7456.5	17000	10563.3
3000	1864.1	8000	4971.0	13000	8077.8	18000	11184.7
4000	2485.5	9000	5592.3	14000	8699.2	19000	11806.1
5000	3106.9	10000	6213.7	15000	9320.6	20000	12427.4

Table 19

NAUTICAL MILES TO STATUTE MILES

1 nautical mile = 1.151556 statute miles

Nautical miles	0	1	2	3	4	5	6	7	8	9
	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.	st. mi.
0	0	1.152	2.303	3.455	4.606	5.758	6.909	8.061	9.212	10.364
10	11.516	12.667	13.819	14.970	16.122	17.273	18.425	19.576	20.728	21.880
20	23.031	24.183	25.334	26.486	27.637	28.789	29.940	31.092	32.244	33.395
30	34.547	35.698	36.850	38.001	39.153	40.304	41.456	42.608	43.759	44.911
40	46.062	47.214	48.365	49.517	50.668	51.820	52.972	54.123	55.275	56.426
50	57.578	58.729	59.881	61.032	62.184	63.336	64.487	65.639	66.790	67.942
60	69.093	70.245	71.396	72.548	73.700	74.851	76.003	77.154	78.306	79.457
70	80.609	81.760	82.912	84.064	85.215	86.367	87.518	88.670	89.821	90.973
80	92.124	93.276	94.428	95.579	96.731	97.882	99.034	100.185	101.337	102.488
90	103.640	104.792	105.943	107.095	108.246	109.398	110.549	111.701	112.852	114.004

Table 20

STATUTE MILES TO NAUTICAL MILES

1 statute mile = 0.868390 nautical miles

Statute miles	0	1	2	3	4	5	6	7	8	9
	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.
0	0	.868	1.737	2.605	3.474	4.342	5.210	6.079	6.947	7.816
10	8.684	9.552	10.421	11.289	12.157	13.026	13.894	14.763	15.631	16.499
20	17.368	18.236	19.105	19.973	20.841	21.710	22.578	23.447	24.315	25.183
30	26.052	26.920	27.788	28.657	29.525	30.394	31.262	32.130	32.999	33.867
40	34.736	35.604	36.472	37.341	38.209	39.078	39.946	40.814	41.683	42.551
50	43.420	44.288	45.156	46.025	46.893	47.761	48.630	49.498	50.367	51.235
60	52.103	52.972	53.840	54.709	55.577	56.445	57.314	58.182	59.051	59.919
70	60.787	61.656	62.524	63.392	64.261	65.129	65.998	66.866	67.734	68.603
80	69.471	70.340	71.208	72.076	72.945	73.813	74.682	75.550	76.418	77.287
90	78.155	79.023	79.892	80.760	81.629	82.497	83.365	84.234	85.102	85.971

TABLE 21

NAUTICAL MILES TO KILOMETERS

1 nautical mile = 1.85325 kilometers

Nautical miles	0	1	2	3	4	5	6	7	8	9
	km.	km.	km.	km.	km.	km.	km.	km.	km.	km.
0	0	1.853	3.706	5.560	7.413	9.266	11.119	12.973	14.826	16.679
10	18.532	20.386	22.239	24.092	25.945	27.799	29.652	31.505	33.358	35.212
20	37.065	38.918	40.771	42.625	44.478	46.331	48.184	50.038	51.891	53.744
30	55.597	57.451	59.304	61.157	63.010	64.864	66.717	68.570	70.423	72.277
40	74.130	75.983	77.836	79.690	81.543	83.396	85.249	87.103	88.956	90.809
50	92.662	94.516	96.369	98.222	100.075	101.929	103.782	105.635	107.488	109.342
60	111.195	113.048	114.901	116.755	118.608	120.461	122.314	124.168	126.021	127.874
70	129.727	131.581	133.434	135.287	137.140	138.994	140.847	142.700	144.553	146.407
80	148.260	150.113	151.966	153.820	155.673	157.526	159.379	161.233	163.086	164.939
90	166.792	168.646	170.499	172.352	174.205	176.059	177.912	179.765	181.618	183.472

TABLE 22

KILOMETERS TO NAUTICAL MILES

1 kilometer = 0.5395926 nautical miles

Kilometers	0	1	2	3	4	5	6	7	8	9
	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.	n. mi.
0	0	.540	1.079	1.619	2.158	2.698	3.238	3.777	4.317	4.856
10	5.396	5.936	6.475	7.015	7.554	8.094	8.633	9.173	9.713	10.252
20	10.792	11.331	11.871	12.411	12.950	13.490	14.029	14.569	15.109	15.648
30	16.188	16.727	17.267	17.807	18.346	18.886	19.425	19.965	20.505	21.044
40	21.584	22.123	22.663	23.202	23.742	24.282	24.821	25.361	25.900	26.440
50	26.980	27.519	28.059	28.598	29.138	29.678	30.217	30.757	31.296	31.836
60	32.376	32.915	33.455	33.994	34.534	35.074	35.613	36.153	36.692	37.232
70	37.771	38.311	38.851	39.390	39.930	40.469	41.009	41.549	42.088	42.628
80	43.167	43.707	44.247	44.786	45.326	45.865	46.405	46.945	47.484	48.024
90	48.563	49.103	49.643	50.182	50.722	51.261	51.801	52.340	52.880	53.420

Table 23

DAYS TO DECIMALS OF A YEAR AND ANGLE

1 tropical (mean) year = 365.2422 days = 360°

Day of month * Common year	Day of month * Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle	Day of month Common year	Day of month Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle
Jan. 1.0	Jan. 1.0	0.0	0.0000	0° 00′	Feb. 19.0	Feb. 19.0	49.0	0.1342	48° 18′
2.0	2.0	1.0	0.0027	0 59	20.0	20.0	50.0	0.1369	49 17
3.0	3.0	2.0	0.0055	1 58	21.0	21.0	51.0	0.1396	50 16
4.0	4.0	3.0	0.0082	2 57	22.0	22.0	52.0	0.1424	51 15
5.0	5.0	4.0	0.0110	3 57	23.0	23.0	53.0	0.1451	52 14
6.0	6.0	5.0	0.0137	4 56	24.0	24.0	54.0	0.1478	53 14
7.0	7.0	6.0	0.0164	5 55	25.0	25.0	55.0	0.1506	54 13
8.0	8.0	7.0	0.0192	6 54	26.0	26.0	56.0	0.1533	55 12
9.0	9.0	8.0	0.0219	7 53	27.0	27.0	57.0	0.1561	56 11
10.0	10.0	9.0	0.0246	8 52	28.0	28.0	58.0	0.1588	57 10
11.0	11.0	10.0	0.0274	9 51	Mar. 1.0	29.0	59.0	0.1615	58 9
12.0	12.0	11.0	0.0301	10 51	2.0	Mar. 1.0	60.0	0.1643	59 8
13.0	13.0	12.0	0.0329	11 50	3.0	2.0	61.0	0.1670	60 7
14.0	14.0	13.0	0.0356	12 49	4.0	3.0	62.0	0.1698	61 7
15.0	15.0	14.0	0.0383	13 48	5.0	4.0	63.0	0.1725	62 6
16.0	16.0	15.0	0.0411	14 47	6.0	5.0	64.0	0.1752	63 5
17.0	17.0	16.0	0.0438	15 46	7.0	6.0	65.0	0.1780	64 4
18.0	18.0	17.0	0.0465	16 45	8.0	7.0	66.0	0.1807	65 3
19.0	19.0	18.0	0.0493	17 45	9.0	8.0	67.0	0.1834	66 2
20.0	20.0	19.0	0.0520	18 44	10.0	9.0	68.0	0.1862	67 1
21.0	21.0	20.0	0.0548	19 43	11.0	10.0	69.0	0.1889	68 1
22.0	22.0	21.0	0.0575	20 42	12.0	11.0	70.0	0.1917	69 0
23.0	23.0	22.0	0.0602	21 41	13.0	12.0	71.0	0.1944	69 59
24.0	24.0	23.0	0.0630	22 40	14.0	13.0	72.0	0.1971	70 58
25.0	25.0	24.0	0.0657	23 39	15.0	14.0	73.0	0.1999	71 57
26.0	26.0	25.0	0.0684	24 38	16.0	15.0	74.0	0.2026	72 56
27.0	27.0	26.0	0.0712	25 38	17.0	16.0	75.0	0.2053	73 55
28.0	28.0	27.0	0.0739	26 37	18.0	17.0	76.0	0.2081	74 55
29.0	29.0	28.0	0.0767	27 36	19.0	18.0	77.0	0.2108	75 54
30.0	30.0	29.0	0.0794	28 35	20.0	19.0	78.0	0.2136	76 53
31.0	31.0	30.0	0.0821	29 34	21.0	20.0	79.0	0.2163	77 52
Feb. 1.0	Feb. 1.0	31.0	0.0849	30 33	22.0	21.0	80.0	0.2190	78 51
2.0	2.0	32.0	0.0876	31 32	23.0	22.0	81.0	0.2218	79 50
3.0	3.0	33.0	0.0904	32 32	24.0	23.0	82.0	0.2245	80 49
4.0	4.0	34.0	0.0931	33 31	25.0	24.0	83.0	0.2272	81 49
5.0	5.0	35.0	0.0958	34 30	26.0	25.0	84.0	0.2300	82 48
6.0	6.0	36.0	0.0986	35 29	27.0	26.0	85.0	0.2327	83 47
7.0	7.0	37.0	0.1013	36 28	28.0	27.0	86.0	0.2355	84 46
8.0	8.0	38.0	0.1040	37 27	29.0	28.0	87.0	0.2382	85 45
9.0	9.0	39.0	0.1068	38 26	30.0	29.0	88.0	0.2409	86 44
10.0	10.0	40.0	0.1095	39 26	31.0	30.0	89.0	0.2437	87 43
11.0	11.0	41.0	0.1123	40 25	Apr. 1.0	31.0	90.0	0.2464	88 42
12.0	12.0	42.0	0.1150	41 24	2.0	Apr. 1.0	91.0	0.2491	89 42
13.0	13.0	43.0	0.1177	42 23	3.0	2.0	92.0	0.2519	90 41
14.0	14.0	44.0	0.1205	43 22	4.0	3.0	93.0	0.2546	91 40
15.0	15.0	45.0	0.1232	44 21	5.0	4.0	94.0	0.2574	92 39
16.0	16.0	46.0	0.1259	45 20	6.0	5.0	95.0	0.2601	93 38
17.0	17.0	47.0	0.1287	46 20	7.0	6.0	96.0	0.2628	94 37
18.0	18.0	48.0	0.1314	47 19	8.0	7.0	97.0	0.2656	95 36

(continued)

* NOTE.—The notation Jan. 1.0 indicates the beginning of the first day of January; Jan. 2.0 the beginning of the second day; etc.

DAYS TO DECIMALS OF A YEAR AND ANGLE

1 tropical (mean) year = 365.2422 days = 360°

Day of month: Common year	Day of month: Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle	Day of month: Common year	Day of month: Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle
Apr. 9.0	Apr. 8.0	98.0	0.2683	96° 36′	May 28.0	May 27.0	147.0	0.4025	144° 53′
10.0	9.0	99.0	0.2711	97 35	29.0	28.0	148.0	0.4052	145 53
11.0	10.0	100.0	0.2738	98 34	30.0	29.0	149.0	0.4079	146 52
12.0	11.0	101.0	0.2765	99 33	31.0	30.0	150.0	0.4107	147 51
13.0	12.0	102.0	0.2793	100 32	June 1.0	31.0	151.0	0.4134	148 50
14.0	13.0	103.0	0.2820	101 31	2.0	June 1.0	152.0	0.4162	149 49
15.0	14.0	104.0	0.2847	102 30	3.0	2.0	153.0	0.4189	150 48
16.0	15.0	105.0	0.2875	103 30	4.0	3.0	154.0	0.4216	151 47
17.0	16.0	106.0	0.2902	104 29	5.0	4.0	155.0	0.4244	152 46
18.0	17.0	107.0	0.2930	105 28	6.0	5.0	156.0	0.4271	153 46
19.0	18.0	108.0	0.2957	106 27	7.0	6.0	157.0	0.4299	154 45
20.0	19.0	109.0	0.2984	107 26	8.0	7.0	158.0	0.4326	155 44
21.0	20.0	110.0	0.3012	108 25	9.0	8.0	159.0	0.4353	156 43
22.0	21.0	111.0	0.3039	109 24	10.0	9.0	160.0	0.4381	157 42
23.0	22.0	112.0	0.3066	110 24	11.0	10.0	161.0	0.4408	158 41
24.0	23.0	113.0	0.3094	111 23	12.0	11.0	162.0	0.4435	159 40
25.0	24.0	114.0	0.3121	112 22	13.0	12.0	163.0	0.4463	160 40
26.0	25.0	115.0	0.3149	113 21	14.0	13.0	164.0	0.4490	161 39
27.0	26.0	116.0	0.3176	114 20	15.0	14.0	165.0	0.4518	162 38
28.0	27.0	117.0	0.3203	115 19	16.0	15.0	166.0	0.4545	163 37
29.0	28.0	118.0	0.3231	116 18	17.0	16.0	167.0	0.4572	164 36
30.0	29.0	119.0	0.3258	117 18	18.0	17.0	168.0	0.4600	165 35
May 1.0	30.0	120.0	0.3285	118 17	19.0	18.0	169.0	0.4627	166 34
2.0	May 1.0	121.0	0.3313	119 16	20.0	19.0	170.0	0.4654	167 34
3.0	2.0	122.0	0.3340	120 15	21.0	20.0	171.0	0.4682	168 33
4.0	3.0	123.0	0.3368	121 14	22.0	21.0	172.0	0.4709	169 32
5.0	4.0	124.0	0.3395	122 13	23.0	22.0	173.0	0.4737	170 31
6.0	5.0	125.0	0.3422	123 12	24.0	23.0	174.0	0.4764	171 30
7.0	6.0	126.0	0.3450	124 12	25.0	24.0	175.0	0.4791	172 29
8.0	7.0	127.0	0.3477	125 11	26.0	25.0	176.0	0.4819	173 28
9.0	8.0	128.0	0.3505	126 10	27.0	26.0	177.0	0.4846	174 28
10.0	9.0	129.0	0.3532	127 9	28.0	27.0	178.0	0.4873	175 27
11.0	10.0	130.0	0.3559	128 8	29.0	28.0	179.0	0.4901	176 26
12.0	11.0	131.0	0.3587	129 7	30.0	29.0	180.0	0.4928	177 25
13.0	12.0	132.0	0.3614	130 6	July 1.0	30.0	181.0	0.4956	178 24
14.0	13.0	133.0	0.3641	131 5	2.0	July 1.0	182.0	0.4983	179 23
15.0	14.0	134.0	0.3669	132 5	3.0	2.0	183.0	0.5010	180 22
16.0	15.0	135.0	0.3696	133 4	4.0	3.0	184.0	0.5038	181 22
17.0	16.0	136.0	0.3724	134 3	5.0	4.0	185.0	0.5065	182 21
18.0	17.0	137.0	0.3751	135 2	6.0	5.0	186.0	0.5093	183 20
19.0	18.0	138.0	0.3778	136 1	7.0	6.0	187.0	0.5120	184 19
20.0	19.0	139.0	0.3806	137 0	8.0	7.0	188.0	0.5147	185 18
21.0	20.0	140.0	0.3833	137 59	9.0	8.0	189.0	0.5175	186 17
22.0	21.0	141.0	0.3860	138 59	10.0	9.0	190.0	0.5202	187 16
23.0	22.0	142.0	0.3888	139 58	11.0	10.0	191.0	0.5229	188 16
24.0	23.0	143.0	0.3915	140 57	12.0	11.0	192.0	0.5257	189 15
25.0	24.0	144.0	0.3943	141 56	13.0	12.0	193.0	0.5284	190 14
26.0	25.0	145.0	0.3970	142 55	14.0	13.0	194.0	0.5312	191 13
27.0	26.0	146.0	0.3997	143 54	15.0	14.0	195.0	0.5339	192 12

(*continued*)

TABLE 23 (CONTINUED)

DAYS TO DECIMALS OF A YEAR AND ANGLE

1 tropical (mean) year = 365.2422 days = 360°

Day of month, Common year	Day of month, Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle	Day of month, Common year	Day of month, Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle
July 16.0	July 15.0	196.0	0.5366	193° 11′	Sept. 3.0	Sept. 2.0	245.0	0.6708	241° 29′
17.0	16.0	197.0	0.5394	194 10	4.0	3.0	246.0	0.6735	242 28
18.0	17.0	198.0	0.5421	195 9	5.0	4.0	247.0	0.6763	243 27
19.0	18.0	199.0	0.5448	196 9	6.0	5.0	248.0	0.6790	244 26
20.0	19.0	200.0	0.5476	197 8	7.0	6.0	249.0	0.6817	245 26
21.0	20.0	201.0	0.5503	198 7	8.0	7.0	250.0	0.6845	246 25
22.0	21.0	202.0	0.5531	199 6	9.0	8.0	251.0	0.6872	247 24
23.0	22.0	203.0	0.5558	200 5	10.0	9.0	252.0	0.6900	248 23
24.0	23.0	204.0	0.5585	201 4	11.0	10.0	253.0	0.6927	249 22
25.0	24.0	205.0	0.5613	202 3	12.0	11.0	254.0	0.6954	250 21
26.0	25.0	206.0	0.5640	203 3	13.0	12.0	255.0	0.6982	251 20
27.0	26.0	207.0	0.5667	204 2	14.0	13.0	256.0	0.7009	252 20
28.0	27.0	208.0	0.5695	205 1	15.0	14.0	257.0	0.7036	253 19
29.0	28.0	209.0	0.5722	206 0	16.0	15.0	258.0	0.7064	254 18
30.0	29.0	210.0	0.5750	206 59	17.0	16.0	259.0	0.7091	255 17
31.0	30.0	211.0	0.5777	207 58	18.0	17.0	260.0	0.7119	256 16
Aug. 1.0	31.0	212.0	0.5804	208 57	19.0	18.0	261.0	0.7146	257 15
2.0	Aug. 1.0	213.0	0.5832	209 57	20.0	19.0	262.0	0.7173	258 14
3.0	2.0	214.0	0.5859	210 56	21.0	20.0	263.0	0.7201	259 14
4.0	3.0	215.0	0.5887	211 55	22.0	21.0	264.0	0.7228	260 13
5.0	4.0	216.0	0.5914	212 54	23.0	22.0	265.0	0.7255	261 12
6.0	5.0	217.0	0.5941	213 53	24.0	23.0	266.0	0.7283	262 11
7.0	6.0	218.0	0.5969	214 52	25.0	24.0	267.0	0.7310	263 10
8.0	7.0	219.0	0.5996	215 51	26.0	25.0	268.0	0.7338	264 9
9.0	8.0	220.0	0.6023	216 51	27.0	26.0	269.0	0.7365	265 8
10.0	9.0	221.0	0.6051	217 50	28.0	27.0	270.0	0.7392	266 8
11.0	10.0	222.0	0.6078	218 49	29.0	28.0	271.0	0.7420	267 7
12.0	11.0	223.0	0.6106	219 48	30.0	29.0	272.0	0.7447	268 6
13.0	12.0	224.0	0.6133	220 47	Oct. 1.0	30.0	273.0	0.7474	269 5
14.0	13.0	225.0	0.6160	221 46	2.0	Oct. 1.0	274.0	0.7502	270 4
15.0	14.0	226.0	0.6188	222 45	3.0	2.0	275.0	0.7529	271 3
16.0	15.0	227.0	0.6215	223 45	4.0	3.0	276.0	0.7557	272 2
17.0	16.0	228.0	0.6242	224 44	5.0	4.0	277.0	0.7584	273 1
18.0	17.0	229.0	0.6270	225 43	6.0	5.0	278.0	0.7611	274 1
19.0	18.0	230.0	0.6297	226 42	7.0	6.0	279.0	0.7639	275 0
20.0	19.0	231.0	0.6325	227 41	8.0	7.0	280.0	0.7666	275 59
21.0	20.0	232.0	0.6352	228 40	9.0	8.0	281.0	0.7694	276 58
22.0	21.0	233.0	0.6379	229 39	10.0	9.0	282.0	0.7721	277 57
23.0	22.0	234.0	0.6407	230 38	11.0	10.0	283.0	0.7748	278 56
24.0	23.0	235.0	0.6434	231 38	12.0	11.0	284.0	0.7776	279 55
25.0	24.0	236.0	0.6461	232 37	13.0	12.0	285.0	0.7803	280 55
26.0	25.0	237.0	0.6489	233 36	14.0	13.0	286.0	0.7830	281 54
27.0	26.0	238.0	0.6516	234 35	15.0	14.0	287.0	0.7858	282 53
28.0	27.0	239.0	0.6544	235 34	16.0	15.0	288.0	0.7885	283 52
29.0	28.0	240.0	0.6571	236 33	17.0	16.0	289.0	0.7913	284 51
30.0	29.0	241.0	0.6598	237 32	18.0	17.0	290.0	0.7940	285 50
31.0	30.0	242.0	0.6626	238 32	19.0	18.0	291.0	0.7967	286 49
Sept. 1.0	31.0	243.0	0.6653	239 31	20.0	19.0	292.0	0.7995	287 49
2.0	Sept. 1.0	244.0	0.6680	240 30	21.0	20.0	293.0	0.8022	288 48

(continued)

DAYS TO DECIMALS OF A YEAR AND ANGLE

1 tropical (mean) year = 365.2422 days = 360°

Day of month: Common year	Day of month: Leap year	Days since Jan. 1.0	Tropical years since Jan. 1.0	Angle
Oct. 22.0	Oct. 21.0	294.0	0.8049	289° 47′
23.0	22.0	295.0	0.8077	290 46
24.0	23.0	296.0	0.8104	291 45
25.0	24.0	297.0	0.8132	292 44
26.0	25.0	298.0	0.8159	293 43
27.0	26.0	299.0	0.8186	294 42
28.0	27.0	300.0	0.8214	295 42
29.0	28.0	301.0	0.8241	296 41
30.0	29.0	302.0	0.8268	297 40
31.0	30.0	303.0	0.8296	298 39
Nov. 1.0	31.0	304.0	0.8323	299 38
2.0	Nov. 1.0	305.0	0.8351	300 37
3.0	2.0	306.0	0.8378	301 36
4.0	3.0	307.0	0.8405	302 36
5.0	4.0	308.0	0.8433	303 35
6.0	5.0	309.0	0.8460	304 34
7.0	6.0	310.0	0.8488	305 33
8.0	7.0	311.0	0.8515	306 32
9.0	8.0	312.0	0.8542	307 31
10.0	9.0	313.0	0.8570	308 30
11.0	10.0	314.0	0.8597	309 30
12.0	11.0	315.0	0.8624	310 29
13.0	12.0	316.0	0.8652	311 28
14.0	13.0	317.0	0.8679	312 27
15.0	14.0	318.0	0.8707	313 26
16.0	15.0	319.0	0.8734	314 25
17.0	16.0	320.0	0.8761	315 24
18.0	17.0	321.0	0.8789	316 24
19.0	18.0	322.0	0.8816	317 23
20.0	19.0	323.0	0.8843	318 22
21.0	20.0	324.0	0.8871	319 21
22.0	21.0	325.0	0.8898	320 20
23.0	22.0	326.0	0.8926	321 19
24.0	23.0	327.0	0.8953	322 18
25.0	24.0	328.0	0.8980	323 18
26.0	25.0	329.0	0.9008	324 17
27.0	26.0	330.0	0.9035	325 16
28.0	27.0	331.0	0.9062	326 15
29.0	28.0	332.0	0.9090	327 14
30.0	29.0	333.0	0.9117	328 13
Dec. 1.0	30.0	334.0	0.9145	329 12
2.0	Dec. 1.0	335.0	0.9172	330 12
3.0	2.0	336.0	0.9199	331 11
4.0	3.0	337.0	0.9227	332 10
5.0	4.0	338.0	0.9254	333 9
6.0	5.0	339.0	0.9282	334 8
7.0	6.0	340.0	0.9309	335 7
8.0	7.0	341.0	0.9336	336 6
9.0	8.0	342.0	0.9364	337 5
Dec. 10.0	Dec. 9.0	343.0	0.9391	338° 5′
11.0	10.0	344.0	0.9418	339 4
12.0	11.0	345.0	0.9446	340 3
13.0	12.0	346.0	0.9473	341 2
14.0	13.0	347.0	0.9501	342 1
15.0	14.0	348.0	0.9528	343 0
16.0	15.0	349.0	0.9555	343 59
17.0	16.0	350.0	0.9583	344 59
18.0	17.0	351.0	0.9610	345 58
19.0	18.0	352.0	0.9637	346 57
20.0	19.0	353.0	0.9665	347 56
21.0	20.0	354.0	0.9692	348 55
22.0	21.0	355.0	0.9720	349 54
23.0	22.0	356.0	0.9747	350 53
24.0	23.0	357.0	0.9774	351 53
25.0	24.0	358.0	0.9802	352 52
26.0	25.0	359.0	0.9829	353 51
27.0	26.0	360.0	0.9856	354 50
28.0	27.0	361.0	0.9884	355 49
29.0	28.0	362.0	0.9911	356 48
30.0	29.0	363.0	0.9939	357 47
31.0	30.0	364.0	0.9966	358 47
Jan. 1.0	31.0	365.0	0.9993	359 46
2.0	Jan. 1.0	366.0	1.0021	360 45

Conversion for hours

Hours	Dec. of a year	Angle
1	.0001	2′
2	.0002	5
3	.0003	7
4	.0005	10
5	.0006	12
6	.0007	15
7	.0008	17
8	.0009	20
9	.0010	22
10	.0011	25
11	.0013	27
12	.0014	30
13	.0015	32
14	.0016	34
15	.0017	37
16	.0018	39
17	.0019	42
18	.0021	44
19	.0022	47
20	.0023	49
21	.0024	52
22	.0025	54
23	.0026	57
24	.0027	59

Table 24

TIME TO ARC

1 hour = 15 degrees of arc

Min. of time	Arc	Min. of time	Arc	Min. of time	Arc	Sec. of time	Arc	Sec. of time	Arc	Sec. of time	Arc
1	0° 15′	21	5° 15′	41	10° 15′	1	0′ 15″	21	5′ 15″	41	10′ 15″
2	0 30	22	5 30	42	10 30	2	0 30	22	5 30	42	10 30
3	0 45	23	5 45	43	10 45	3	0 45	23	5 45	43	10 45
4	1 0	24	6 0	44	11 0	4	1 0	24	6 0	44	11 0
5	1 15	25	6 15	45	11 15	5	1 15	25	6 15	45	11 15
6	1 30	26	6 30	46	11 30	6	1 30	26	6 30	46	11 30
7	1 45	27	6 45	47	11 45	7	1 45	27	6 45	47	11 45
8	2 0	28	7 0	48	12 0	8	2 0	28	7 0	48	12 0
9	2 15	29	7 15	49	12 15	9	2 15	29	7 15	49	12 15
10	2 30	30	7 30	50	12 30	10	2 30	30	7 30	50	12 30
11	2 45	31	7 45	51	12 45	11	2 45	31	7 45	51	12 45
12	3 0	32	8 0	52	13 0	12	3 0	32	8 0	52	13 0
13	3 15	33	8 15	53	13 15	13	3 15	33	8 15	53	13 15
14	3 30	34	8 30	54	13 30	14	3 30	34	8 30	54	13 30
15	3 45	35	8 45	55	13 45	15	3 45	35	8 45	55	13 45
16	4 0	36	9 0	56	14 0	15	4 0	36	9 0	56	14 0
17	4 15	37	9 15	57	14 15	17	4 15	37	9 15	57	14 15
18	4 30	38	9 30	58	14 30	18	4 30	38	9 30	58	14 30
19	4 45	39	9 45	59	14 45	19	4 45	39	9 45	59	14 45
20	5 0	40	10 0	60	15 0	20	5 0	40	10 0	60	15 0

Table 25

HOURS, MINUTES, AND SECONDS TO DECIMALS OF A DAY

Hours	Day	Min.	Day	Min.	Day	Sec.	Day	Sec.	Day
1	0.041 667	1	0.000 694	31	0.021 528	1	0.000 012	31	0.000 359
2	.083 333	2	.001 389	32	.022 222	2	.000 023	32	.000 370
3	.125 000	3	.002 083	33	.022 917	3	.000.035	33	.000 382
4	.166 667	4	.002 778	34	.023 611	4	.000 046	34	.000 394
5	0.208 333	5	0.003 472	35	0.024 305	5	0.000 058	35	0.000 405
6	.250 000	6	.004 167	36	.025 000	6	.000 069	36	.000 417
7	.291 667	7	.004 861	37	.025 694	7	.000 081	37	.000 428
8	.333 333	8	.005 556	38	.026 389	8	.000 093	38	.000 440
9	.375 000	9	.006 250	39	.027 083	9	.000 104	39	.000 451
10	0.416 667	10	0.006 944	40	0.027 778	10	0.000 116	40	0.000 463
11	.458 333	11	.007 639	41	.028 472	11	.000 127	41	.000 475
12	.500 000	12	.008 333	42	.029 167	12	.000 139	42	.000 486
13	.541 667	13	.009 028	43	.029 861	13	.000 150	43	.000 498
14	.583 333	14	.009 722	44	.030 556	14	.000 162	44	.000 509
15	0.625 000	15	0.010 417	45	0.031 250	15	0.000 174	45	0.000 521
16	.666 667	16	.011 111	46	.031 944	16	.000 185	46	.000 532
17	.708 333	17	.011 806	47	.032 639	17	.000 197	47	.000 544
18	.750 000	18	.012 500	48	.033 333	18	.000 208	48	.000 556
19	.791 667	19	.013 194	49	.034 028	19	.000 220	49	.000 567
20	0.833 333	20	0.013 889	50	0.034 722	20	0.000 231	50	0.000 579
21	.875 000	21	.014 583	51	.035 417	21	.000 243	51	.000 590
22	.916 667	22	.015 278	52	.036 111	22	.000 255	52	.000 602
23	.958 333	23	.015 972	53	.036 806	23	.000 266	53	.000 613
24	1.000 000	24	.016 667	54	.037 500	24	.000 278	54	.000 625
		25	0.017 361	55	0.038 194	25	0.000 289	55	0.000 637
		26	.018 056	56	.038 889	26	.000 301	56	.000 648
		27	.018 750	57	.039 583	27	.000 313	57	.000 660
		28	.019 444	58	.040 278	28	.000 324	58	.000 671
		29	.020 139	59	.040 972	29	.000 336	59	.000 683
		30	0.020 833	60	0.041 667	30	0.000 347	60	.000 694

Table 26

DECIMALS OF A DAY TO HOURS, MINUTES, AND SECONDS

Days	Hr.	Min.	Sec.	Days	Min.	Sec.	Days	Sec.
0.01		14	24	0.0001		8.64	0.000001	0.09
.02		28	48	2		17.28	2	0.17
.03		43	12	3		25.92	3	0.26
.04		57	36	4		34.56	4	0.35
0.05	1	12	0	0.0005		43.20	0.000005	0.43
.06	1	26	24	6		51.84	6	0.52
.07	1	40	48	7	1	0.48	7	0.60
.08	1	55	12	8	1	9.12	8	0.69
.09	2	9	36	9	1	17.76	9	0.78
0.10	2	24	0	0.0010	1	26.40	0.000010	0.86
.20	4	48	0	20	2	52.80	20	1.73
.30	7	12	0	30	4	19.20	30	2.59
.40	9	36	0	40	5	45.60	40	3.46
0.50	12	0	0	0.0050	7	12.00	0.000050	4.32
.60	14	24	0	60	8	38.40	60	5.18
.70	16	48	0	70	10	4.80	70	6.05
.80	19	12	0	80	11	31.20	80	6.91
.90	21	36	0	90	12	57.60	90	7.78

Table 27

MINUTES AND SECONDS TO DECIMALS OF AN HOUR

Min.	Decimals of an hour	Min.	Decimals of an hour	Sec.	Decimals of an hour	Sec.	Decimals of an hour
1	0.016 667	31	0.516 667	1	0.000 278	31	0.008 611
2	.033 333	32	.533 333	2	.000 556	32	.008 889
3	.050 000	33	.550 000	3	.000 833	33	.009 167
4	.066 667	34	.566 667	4	.001 111	34	.009 444
5	0.083 333	35	0.583 333	5	0.001 389	35	0.009 722
6	.100 000	36	.600 000	6	.001 667	36	.010 000
7	.116 667	37	.616 667	7	.001 944	37	.010 278
8	.133 333	38	.633 333	8	.002 222	38	.010 556
9	.150 000	39	.650 000	9	.002 500	39	.010 833
10	0.166 667	40	0.666 667	10	0.002 778	40	0.011 111
11	.183 333	41	.683 333	11	.003 056	41	.011 389
12	.200 000	42	.700 000	12	.003 333	42	.011 667
13	.216 667	43	.716 667	13	.003 611	43	.011 944
14	.233 333	44	.733 333	14	.003 889	44	.012 222
15	0.250 000	45	0.750 000	15	0.004 167	45	0.012 500
16	.266 667	46	.766 667	16	.004 444	46	.012 778
17	.283 333	47	.783 333	17	.004 722	47	.013 056
18	.300 000	48	.800 000	18	.005 000	48	.013 333
19	.316 667	49	.816 667	19	.005 278	49	.013 611
20	0.333 333	50	0.833 333	20	0.005 556	50	0.013 889
21	.350 000	51	.850 000	21	.005 833	51	.014 167
22	.366 667	52	.866 667	22	.006 111	52	.014 444
23	.383 333	53	.883 333	23	.006 389	53	.014 722
24	.400 000	54	.900 000	24	.006 667	54	.015 000
25	0.416 667	55	0.916 667	25	0.006 944	55	0.015 278
26	.433 333	56	.933 333	26	.007 222	56	.015 556
27	.450 000	57	.950 000	27	.007 500	57	.015 833
28	.466 667	58	.966 667	28	.007 778	58	.016 111
29	.483 333	59	.983 333	29	.008 056	59	.016 389
30	0.500 000	60	1.000 000	30	0.008 333	60	0.016 667

Table 28

AVOIRDUPOIS POUNDS AND OUNCES TO KILOGRAMS

1 avoirdupois pound = 0.4535923 kilogram
1 avoirdupois ounce = 0.0283495 kilogram

Pounds	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
0	0.0000	0.0454	0.0907	0.1361	0.1814	0.2268	0.2722	0.3175	0.3629	0.4082
1	0.4536	0.4990	0.5443	0.5897	0.6350	0.6804	0.7257	0.7711	0.8165	0.8618
2	0.9072	0.9525	0.9979	1.0433	1.0886	1.1340	1.1793	1.2247	1.2701	1.3154
3	1.3608	1.4061	1.4515	1.4969	1.5422	1.5876	1.6329	1.6783	1.7237	1.7690
4	1.8144	1.8597	1.9051	1.9504	1.9958	2.0412	2.0865	2.1319	2.1772	2.2226
5	2.2680	2.3133	2.3587	2.4040	2.4494	2.4948	2.5401	2.5855	2.6308	2.6762
6	2.7216	2.7669	2.8123	2.8576	2.9030	2.9483	2.9937	3.0391	3.0844	3.1298
7	3.1751	3.2205	3.2659	3.3112	3.3566	3.4019	3.4473	3.4927	3.5380	3.5834
8	3.6287	3.6741	3.7195	3.7648	3.8102	3.8555	3.9009	3.9463	3.9916	4.0370
9	4.0823	4.1277	4.1730	4.2184	4.2638	4.3091	4.3545	4.3998	4.4452	4.4906

Ounces	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
0	0.0000	0.0028	0.0057	0.0085	0.0113	0.0142	0.0170	0.0198	0.0227	0.0255
1	.0283	.0312	.0340	.0369	.0397	.0425	.0454	.0482	.0510	.0539
2	.0567	.0595	.0624	.0652	.0680	.0709	.0737	.0765	.0794	.0822
3	.0850	.0879	.0907	.0936	.0964	.0992	.1021	.1049	.1077	.1106
4	.1134	.1162	.1191	.1219	.1247	.1276	.1304	.1332	.1361	.1389
5	0.1417	0.1446	0.1474	0.1503	0.1531	0.1559	0.1588	0.1616	0.1644	0.1673
6	.1701	.1729	.1758	.1786	.1814	.1843	.1871	.1899	.1928	.1956
7	.1984	.2013	.2041	.2070	.2098	.2126	.2155	.2183	.2211	.2240
8	.2268	.2296	.2325	.2353	.2381	.2410	.2438	.2466	.2495	.2523
9	.2551	.2580	.2608	.2637	.2665	.2693	.2722	.2750	.2778	.2807
10	0.2835	0.2863	0.2892	0.2920	0.2948	0.2977	0.3005	0.3033	0.3062	0.3090
11	.3118	.3147	.3175	.3203	.3232	.3260	.3289	.3317	.3345	.3374
12	.3402	.3430	.3459	.3487	.3515	.3544	.3572	.3600	.3629	.3657
13	.3685	.3714	.3742	.3770	.3799	.3827	.3856	.3884	.3912	.3941
14	.3969	.3997	.4026	.4054	.4082	.4111	.4139	.4167	.4196	.4224
15	0.4252	0.4281	0.4309	0.4337	0.4366	0.4394	0.4423	0.4451	0.4479	0.4508

Table 29

KILOGRAMS TO AVOIRDUPOIS POUNDS AND OUNCES

1 kilogram = 2.204623 avoirdupois pounds

Kilograms	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.	av. lbs.
0	0.000	0.220	0.441	0.661	0.882	1.102	1.323	1.543	1.764	1.984
1	2.205	2.425	2.646	2.866	3.086	3.307	3.527	3.748	3.968	4.189
2	4.409	4.630	4.850	5.071	5.291	5.512	5.732	5.952	6.173	6.393
3	6.614	6.834	7.055	7.275	7.496	7.716	7.937	8.157	8.378	8.598
4	8.818	9.039	9.259	9.480	9.700	9.921	10.141	10.362	10.582	10.803
5	11.023	11.244	11.464	11.685	11.905	12.125	12.346	12.566	12.787	13.007
6	13.228	13.448	13.669	13.889	14.110	14.330	14.551	14.771	14.991	15.212
7	15.432	15.653	15.873	16.094	16.314	16.535	16.755	16.976	17.196	17.417
8	17.637	17.857	18.078	18.298	18.519	18.739	18.960	19.180	19.401	19.621
9	19.842	20.062	20.283	20.503	20.723	20.944	21.164	21.385	21.605	21.826

Tenths of a kilogram to ounces

kg.	oz.	kg.	oz.
0.1	3.5274	0.6	21.1644
.2	7.0548	.7	24.6918
.3	10.5822	.8	28.2192
.4	14.1096	.9	31.7466
.5	17.6370	1.0	35.2740

Hundredths of a kilogram to decimals of a pound and to ounces

kg.	av. lbs.	oz.	kg.	av. lbs.	oz.
0.01	0.022 =	0.35	0.06	0.132 =	2.12
.02	.044 =	0.71	.07	.154 =	2.47
.03	.066 =	1.06	.08	.176 =	2.82
.04	.088 =	1.41	.09	.198 =	3.17
.05	.110 =	1.76	.10	.220 =	3.53

Table 30

GRAINS TO GRAMS

1 grain = 0.06479890 gram

Grains	0	1	2	3	4	5	6	7	8	9
	grams	grams	grams	grams	grams	grams	grams	grams	grams	grams
0	0.0000	0.0648	0.1296	0.1944	0.2592	0.3240	0.3888	0.4536	0.5184	0.5832
10	0.6480	0.7128	0.7776	0.8424	0.9072	0.9720	1.0368	1.1016	1.1664	1.2312
20	1.2960	1.3608	1.4256	1.4904	1.5552	1.6200	1.6848	1.7496	1.8144	1.8792
30	1.9440	2.0088	2.0736	2.1384	2.2032	2.2680	2.3328	2.3976	2.4624	2.5272
40	2.5920	2.6568	2.7216	2.7864	2.8512	2.9160	2.9807	3.0455	3.1103	3.1751
50	3.2399	3.3047	3.3695	3.4343	3.4991	3.5639	3.6287	3.6935	3.7583	3.8231
60	3.8879	3.9527	4.0175	4.0823	4.1471	4.2119	4.2767	4.3415	4.4063	4.4711
70	4.5359	4.6007	4.6655	4.7303	4.7951	4.8599	4.9247	4.9895	5.0543	5.1191
80	5.1839	5.2487	5.3135	5.3783	5.4431	5.5079	5.5727	5.6375	5.7023	5.7671
90	5.8319	5.8967	5.9615	6.0263	6.0911	6.1559	6.2207	6.2855	6.3503	6.4151

Tenths of a grain				Hundredths of a grain			
grain	gram	grain	gram	grain	gram	grain	gram
0.1	0.0065	0.6	0.0389	0.01	0.0006	0.06	0.0039
.2	.0130	.7	.0454	.02	.0013	.07	.0045
.3	.0194	.8	.0518	.03	.0019	.08	.0052
.4	.0259	.9	.0583	.04	.0026	.09	.0058
.5	.0324	1.0	.0648	.05	.0032	.10	.0065

Table 31

GRAMS TO GRAINS

1 gram = 15.432361 grains

Grams	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	grains	grains	grains	grains	grains	grains	grains	grains	grains	grains
0	0.00	1.54	3.09	4.63	6.17	7.72	9.26	10.80	12.35	13.89
1	15.43	16.98	18.52	20.06	21.61	23.15	24.69	26.24	27.78	29.32
2	30.86	32.41	33.95	35.49	37.04	38.58	40.12	41.67	43.21	44.75
3	46.30	47.84	49.38	50.93	52.47	54.01	55.56	57.10	58.64	60.19
4	61.73	63.27	64.82	66.36	67.90	69.45	70.99	72.53	74.08	75.62
5	77.16	78.71	80.25	81.79	83.33	84.88	86.42	87.96	89.51	91.05
6	92.59	94.14	95.68	97.22	98.77	100.31	101.85	103.40	104.94	106.48
7	108.03	109.57	111.11	112.66	114.20	115.74	117.29	118.83	120.37	121.92
8	123.46	125.00	126.55	128.09	129.63	131.18	132.72	134.26	135.80	137.35
9	138.89	140.43	141.98	143.52	145.06	146.61	148.15	149.69	151.24	152.78

	0	1	2	3	4	5	6	7	8	9
	grains	grains	grains	grains	grains	grains	grains	grains	grains	grains
0	0.00	15.43	30.86	46.30	61.73	77.16	92.59	108.03	123.46	138.89
10	154.32	169.76	185.19	200.62	216.05	231.49	246.92	262.35	277.78	293.21
20	308.65	324.08	339.51	354.94	370.38	385.81	401.24	416.67	432.11	447.54
30	462.97	478.40	493.84	509.27	524.70	540.13	555.56	571.00	586.43	601.86
40	617.29	632.73	648.16	663.59	679.02	694.46	709.89	725.32	740.75	756.19
50	771.62	787.05	802.48	817.92	833.35	848.78	864.21	879.64	895.08	910.51
60	925.94	941.37	956.81	972.24	987.67	1003.10	1018.54	1033.97	1049.40	1064.83
70	1080.27	1095.70	1111.13	1126.56	1141.99	1157.43	1172.86	1188.29	1203.72	1219.16
80	1234.59	1250.02	1265.45	1280.89	1296.32	1311.75	1327.18	1342.62	1358.05	1373.48
90	1388.91	1404.34	1419.78	1435.21	1450.64	1466.07	1481.51	1496.94	1512.37	1527.80

gram	grain	gram	grain	gram	grain	gram	grain
0.01	0.154	0.06	0.926	0.001	0.015	0.006	0.093
.02	.309	.07	1.080	.002	.031	.007	.108
.03	.463	.08	1.235	.003	.046	.008	.123
.04	.617	.09	1.389	.004	.062	.009	.139
.05	.772	.10	1.543	.005	.077	.010	.154

MILES PER HOUR TO KNOTS, METERS PER SECOND, FEET PER SECOND, KILOMETERS PER HOUR, FEET PER MINUTE

Miles per hour	Knots	Meters per second	Feet per second	Kilometers per hour	Feet per minute	Miles per hour	Knots	Meters per second	Feet per second	Kilometers per hour	Feet per minute
1	0.9	0.4	1.5	1.6	88	56	48.6	25.0	82.1	90.1	4928
2	1.7	0.9	2.9	3.2	176	57	49.5	25.5	83.6	91.7	5016
3	2.6	1.3	4.4	4.8	264	58	50.4	25.9	85.1	93.3	5104
4	3.5	1.8	5.9	6.4	352	59	51.2	26.4	86.5	95.0	5192
5	4.3	2.2	7.3	8.0	440	60	52.1	26.8	88.0	96.6	5280
6	5.2	2.7	8.8	9.7	528	61	53.0	27.3	89.5	98.2	5368
7	6.1	3.1	10.3	11.3	616	62	53.8	27.7	90.9	99.8	5456
8	6.9	3.6	11.7	12.9	704	63	54.7	28.2	92.4	101.4	5544
9	7.8	4.0	13.2	14.5	792	64	55.6	28.6	93.9	103.0	5632
10	8.7	4.5	14.7	16.1	880	65	56.4	29.1	95.3	104.6	5720
11	9.6	4.9	16.1	17.7	968	66	57.3	29.5	96.8	106.2	5808
12	10.4	5.4	17.6	19.3	1056	67	58.2	30.0	98.3	107.8	5896
13	11.3	5.8	19.1	20.9	1144	68	59.1	30.4	99.7	109.4	5984
14	12.2	6.3	20.5	22.5	1232	69	59.9	30.8	101.2	111.0	6072
15	13.0	6.7	22.0	24.1	1320	70	60.8	31.3	102.7	112.7	6160
16	13.9	7.2	23.5	25.7	1408	71	61.7	31.7	104.1	114.3	6248
17	14.8	7.6	24.9	27.4	1496	72	62.5	32.2	105.6	115.9	6336
18	15.6	8.0	26.4	29.0	1584	73	63.4	32.6	107.1	117.5	6424
19	16.5	8.5	27.9	30.6	1672	74	64.3	33.1	108.5	119.1	6512
20	17.4	8.9	29.3	32.2	1760	75	65.1	33.5	110.0	120.7	6600
21	18.2	9.4	30.8	33.8	1848	76	66.0	34.0	111.5	122.3	6688
22	19.1	9.8	32.3	35.4	1936	77	66.9	34.4	112.9	123.9	6776
23	20.0	10.3	33.7	37.0	2024	78	67.7	34.9	114.4	125.5	6864
24	20.8	10.7	35.2	38.6	2112	79	68.6	35.3	115.9	127.1	6952
25	21.7	11.2	36.7	40.2	2200	80	69.5	35.8	117.3	128.7	7040
26	22.6	11.6	38.1	41.8	2288	81	70.3	36.2	118.8	130.4	7128
27	23.4	12.1	39.6	43.5	2376	82	71.2	36.7	120.3	132.0	7216
28	24.3	12.5	41.1	45.1	2464	83	72.1	37.1	121.7	133.6	7304
29	25.2	13.0	42.5	46.7	2552	84	72.9	37.6	123.2	135.2	7392
30	26.1	13.4	44.0	48.3	2640	85	73.8	38.0	124.7	136.8	7480
31	26.9	13.9	45.5	49.9	2728	86	74.7	38.4	126.1	138.4	7568
32	27.8	14.3	46.9	51.5	2816	87	75.5	38.9	127.6	140.0	7656
33	28.7	14.8	48.4	53.1	2904	88	76.4	39.3	129.1	141.6	7744
34	29.5	15.2	49.9	54.7	2992	89	77.3	39.8	130.5	143.2	7832
35	30.4	15.6	51.3	56.3	3080	90	78.2	40.2	132.0	144.8	7920
36	31.3	16.1	52.8	57.9	3168	91	79.0	40.7	133.5	146.5	8008
37	32.1	16.5	54.3	59.5	3256	92	79.9	41.1	134.9	148.1	8096
38	33.0	17.0	55.7	61.2	3344	93	80.8	41.6	136.4	149.7	8184
39	33.9	17.4	57.2	62.8	3432	94	81.6	42.0	137.9	151.3	8272
40	34.7	17.9	58.7	64.4	3520	95	82.5	42.5	139.3	152.9	8360
41	35.6	18.3	60.1	66.0	3608	96	83.4	42.9	140.8	154.5	8448
42	36.5	18.8	61.6	67.6	3696	97	84.2	43.4	142.3	156.1	8536
43	37.3	19.2	63.1	69.2	3784	98	85.1	43.8	143.7	157.7	8624
44	38.2	19.7	64.5	70.8	3872	99	86.0	44.3	145.2	159.3	8712
45	39.1	20.1	66.0	72.4	3960	100	86.8	44.7	146.7	160.9	8800
46	39.9	20.6	67.5	74.0	4048	101	87.7	45.2	148.1	162.5	8888
47	40.8	21.0	68.9	75.6	4136	102	88.6	45.6	149.6	164.2	8976
48	41.7	21.5	70.4	77.2	4224	103	89.4	46.0	151.1	165.8	9064
49	42.6	21.9	71.9	78.9	4312	104	90.3	46.5	152.5	167.4	9152
50	43.4	22.4	73.3	80.5	4400	105	91.2	46.9	154.0	169.0	9240
51	44.3	22.8	74.8	82.1	4488	106	92.0	47.4	155.5	170.6	9328
52	45.2	23.2	76.3	83.7	4576	107	92.9	47.8	156.9	172.2	9416
53	46.0	23.7	77.7	85.3	4664	108	93.8	48.3	158.4	173.8	9504
54	46.9	24.1	79.2	86.9	4752	109	94.7	48.7	159.9	175.4	9592
55	47.8	24.6	80.7	88.5	4840	110	95.5	49.2	161.3	177.0	9680

(*continued*)

MILES PER HOUR TO KNOTS, METERS PER SECOND, FEET PER SECOND, KILOMETERS PER HOUR, FEET PER MINUTE

Miles per hour	Knots	Meters per second	Feet per second	Kilo-meters per hour	Miles per hour	Knots	Meters per second	Feet per second	Kilo-meters per hour
111	96.4	49.6	162.8	178.6	166	144.2	74.2	243.5	267.2
112	97.3	50.1	164.3	180.2	167	145.0	74.7	244.9	268.8
113	98.1	50.5	165.7	181.9	168	145.9	75.1	246.4	270.4
114	99.0	51.0	167.2	183.5	169	146.8	75.5	247.9	272.0
115	99.9	51.4	168.7	185.1	170	147.6	76.0	249.3	273.6
116	100.7	51.9	170.1	186.7	171	148.5	76.4	250.8	275.2
117	101.6	52.3	171.6	188.3	172	149.4	76.9	252.3	276.8
118	102.5	52.8	173.1	189.9	173	150.2	77.3	253.7	278.4
119	103.3	53.2	174.5	191.5	174	151.1	77.8	255.2	280.0
120	104.2	53.6	176.0	193.1	175	152.0	78.2	256.7	281.6
121	105.1	54.1	177.5	194.7	176	152.8	78.7	258.1	283.2
122	105.9	54.5	178.9	196.3	177	153.7	79.1	259.6	284.9
123	106.8	55.0	180.4	197.9	178	154.6	79.6	261.1	286.5
124	107.7	55.4	181.9	199.6	179	155.4	80.0	262.5	288.1
125	108.5	55.9	183.3	201.2	180	156.3	80.5	264.0	289.7
126	109.4	56.3	184.8	202.8	181	157.2	80.9	265.5	291.3
127	110.3	56.8	186.3	204.4	182	158.0	81.4	266.9	292.9
128	111.2	57.2	187.7	206.0	183	158.9	81.8	268.4	294.5
129	112.0	57.7	189.2	207.6	184	159.8	82.3	269.9	296.1
130	112.9	58.1	190.7	209.2	185	160.7	82.7	271.3	297.7
131	113.8	58.6	192.1	210.8	186	161.5	83.1	272.8	299.3
132	114.6	59.0	193.6	212.4	187	162.4	83.6	274.3	300.9
133	115.5	59.5	195.1	214.0	188	163.3	84.0	275.7	302.6
134	116.4	59.9	196.5	215.7	189	164.1	84.5	277.2	304.2
135	117.2	60.4	198.0	217.3	190	165.0	84.9	278.7	305.8
136	118.1	60.8	199.5	218.9	191	165.9	85.4	280.1	307.4
137	119.0	61.2	200.9	220.5	192	166.7	85.8	281.6	309.0
138	119.8	61.7	202.4	222.1	193	167.6	86.3	283.1	310.6
139	120.7	62.1	203.9	223.7	194	168.5	86.7	284.5	312.2
140	121.6	62.6	205.3	225.3	195	169.3	87.2	286.0	313.8
141	122.4	63.0	206.8	226.9	196	170.2	87.6	287.5	315.4
142	123.3	63.5	208.3	228.5	197	171.1	88.1	288.9	317.0
143	124.2	63.9	209.7	230.1	198	171.9	88.5	290.4	318.7
144	125.0	64.4	211.2	231.7	199	172.8	89.0	291.9	320.3
145	125.9	64.8	212.7	233.4	200	173.7	89.4	293.3	321.9
146	126.8	65.3	214.1	235.0	210	182.4	93.9	308.0	338.0
147	127.7	65.7	215.6	236.6	220	191.0	98.3	322.7	354.1
148	128.5	66.2	217.1	238.2	230	199.7	102.8	337.3	370.1
149	129.4	66.6	218.5	239.8	240	208.4	107.3	352.0	386.2
150	130.3	67.1	220.0	241.4	250	217.1	111.8	366.7	402.3
151	131.1	67.5	221.5	243.0	260	225.8	116.2	381.3	418.4
152	132.0	68.0	222.9	244.6	270	234.5	120.7	396.0	434.5
153	132.9	68.4	224.4	246.2	280	243.1	125.2	410.7	450.6
154	133.7	68.8	225.9	247.8	290	251.8	129.6	425.3	466.7
155	134.6	69.3	227.3	249.4	300	260.5	134.1	440.0	482.8
156	135.5	69.7	228.8	251.1	310	269.2	138.6	454.7	498.9
157	136.3	70.2	230.3	252.7	320	277.9	143.1	469.3	515.0
158	137.2	70.6	231.7	254.3	330	286.6	147.5	484.0	531.1
159	138.1	71.1	233.2	255.9	340	295.3	152.0	498.7	547.2
160	138.9	71.5	234.7	257.5	350	303.9	156.5	513.3	563.3
161	139.8	72.0	236.1	259.1	360	312.6	160.9	528.0	579.4
162	140.7	72.4	237.6	260.7	370	321.3	165.4	542.7	595.5
163	141.5	72.9	239.1	262.3	380	330.0	169.9	557.3	611.6
164	142.4	73.3	240.5	263.9	390	338.7	174.3	572.0	627.6
165	143.3	73.8	242.0	265.5	400	347.4	178.8	586.7	643.7

METERS PER SECOND TO MILES PER HOUR, FEET PER SECOND, KILOMETERS PER HOUR, KNOTS, FEET PER MINUTE

Meters per second	Miles per hour	Feet per second	Kilometers per hour	Knots	Feet per minute	Meters per second	Miles per hour	Feet per second	Kilometers per hour	Knots	Feet per minute
1	2.2	3.3	3.6	1.9	197	56	125.3	183.7	201.6	108.8	11024
2	4.5	6.6	7.2	3.9	394	57	127.5	187.0	205.2	110.7	11220
3	6.7	9.8	10.8	5.8	591	58	129.7	190.3	208.8	112.7	11417
4	8.9	13.1	14.4	7.8	787	59	132.0	193.6	212.4	114.6	11614
5	11.2	16.4	18.0	9.7	984	60	134.2	196.9	216.0	116.6	11811
6	13.4	19.7	21.6	11.7	1181	61	136.5	200.1	219.6	118.5	12008
7	15.7	23.0	25.2	13.6	1378	62	138.7	203.4	223.2	120.4	12205
8	17.9	26.2	28.8	15.5	1575	63	140.9	206.7	226.8	122.4	12402
9	20.1	29.5	32.4	17.5	1772	64	143.2	210.0	230.4	124.3	12598
10	22.4	32.8	36.0	19.4	1969	65	145.4	213.3	234.0	126.3	12795
11	24.6	36.1	39.6	21.4	2165	66	147.6	216.5	237.6	128.2	12992
12	26.8	39.4	43.2	23.3	2362	67	149.9	219.8	241.2	130.1	13189
13	29.1	42.7	46.8	25.3	2559	68	152.1	223.1	244.8	132.1	13386
14	31.3	45.9	50.4	27.2	2756	69	154.3	226.4	248.4	134.0	13583
15	33.6	49.2	54.0	29.1	2953	70	156.6	229.7	252.0	136.0	13780
16	35.8	52.5	57.6	31.1	3150	71	158.8	232.9	255.6	137.9	13976
17	38.0	55.8	61.2	33.0	3346	72	161.1	236.2	259.2	139.9	14173
18	40.3	59.1	64.8	35.0	3543	73	163.3	239.5	262.8	141.8	14370
19	42.5	62.3	68.4	36.9	3740	74	165.5	242.8	266.4	143.7	14567
20	44.7	65.6	72.0	38.9	3937	75	167.8	246.1	270.0	145.7	14764
21	47.0	68.9	75.6	40.8	4134	76	170.0	249.3	273.6	147.6	14961
22	49.2	72.2	79.2	42.7	4331	77	172.2	252.6	277.2	149.6	15157
23	51.4	75.5	82.8	44.7	4528	78	174.5	255.9	280.8	151.5	15354
24	53.7	78.7	86.4	46.6	4724	79	176.7	259.2	284.4	153.5	15551
25	55.9	82.0	90.0	48.6	4921	80	179.0	262.5	288.0	155.4	15748
26	58.2	85.3	93.6	50.5	5118	81	181.2	265.7	291.6	157.3	15945
27	60.4	88.6	97.2	52.4	5315	82	183.4	269.0	295.2	159.3	16142
28	62.6	91.9	100.8	54.4	5512	83	185.7	272.3	298.8	161.2	16339
29	64.9	95.1	104.4	56.3	5709	84	187.9	275.6	302.4	163.2	16535
30	67.1	98.4	108.0	58.3	5906	85	190.1	278.9	306.0	165.1	16732
31	69.3	101.7	111.6	60.2	6102	86	192.4	282.2	309.6	167.1	16929
32	71.6	105.0	115.2	62.2	6299	87	194.6	285.4	313.2	169.0	17126
33	73.8	108.3	118.8	64.1	6496	88	196.9	288.7	316.8	170.9	17323
34	76.1	111.5	122.4	66.0	6693	89	199.1	292.0	320.4	172.9	17520
35	78.3	114.8	126.0	68.0	6890	90	201.3	295.3	324.0	174.8	17717
36	80.5	118.1	129.6	69.9	7087	91	203.6	298.6	327.6	176.8	17913
37	82.8	121.4	133.2	71.9	7283	92	205.8	301.8	331.2	178.7	18110
38	85.0	124.7	136.8	73.8	7480	93	208.0	305.1	334.8	180.7	18307
39	87.2	128.0	140.4	75.8	7677	94	210.3	308.4	338.4	182.6	18504
40	89.5	131.2	144.0	77.7	7874	95	212.5	311.7	342.0	184.5	18701
41	91.7	134.5	147.6	79.6	8071	96	214.7	315.0	345.6	186.5	18898
42	94.0	137.8	151.2	81.6	8268	97	217.0	318.2	349.2	188.4	19094
43	96.2	141.1	154.8	83.5	8465	98	219.2	321.5	352.8	190.4	19291
44	98.4	144.4	158.4	85.5	8661	99	221.5	324.8	356.4	192.3	19488
45	100.7	147.6	162.0	87.4	8858	100	223.7	328.1	360.0	194.3	19685
46	102.9	150.9	165.6	89.4	9055	110	246.1	360.9	396.0	213.7	19882
47	105.1	154.2	169.2	91.3	9252	120	268.4	393.7	432.0	233.1	20079
48	107.4	157.5	172.8	93.2	9449	130	290.8	426.5	468.0	252.5	20276
49	109.6	160.8	176.4	95.2	9646	140	313.2	459.3	504.0	272.0	20472
50	111.8	164.0	180.0	97.1	9843	150	335.5	492.1	540.0	291.4	20669
51	114.1	167.3	183.6	99.1	10039	160	357.9	524.9	576.0	310.8	20866
52	116.3	170.6	187.2	101.0	10236	170	380.3	557.7	612.0	330.2	21063
53	118.6	173.9	190.8	103.0	10433	180	402.6	590.6	648.0	349.7	21260
54	120.8	177.2	194.4	104.9	10630	190	425.0	623.4	684.0	369.1	21457
55	123.0	180.4	198.0	106.8	10827	200	447.4	656.2	720.0	388.5	21654

KILOMETERS PER HOUR TO KNOTS, MILES PER HOUR, METERS PER SECOND, FEET PER SECOND

Kilometers per hour	Knots	Miles per hour	Meters per second	Feet per second	Kilometers per hour	Knots	Miles per hour	Meters per second	Feet per second
1	0.5	0.6	0.3	0.9	56	30.2	34.8	15.6	51.0
2	1.1	1.2	0.6	1.8	57	30.8	35.4	15.8	51.9
3	1.6	1.9	0.8	2.7	58	31.3	36.0	16.1	52.9
4	2.2	2.5	1.1	3.6	59	31.8	36.7	16.4	53.8
5	2.7	3.1	1.4	4.6	60	32.4	37.3	16.7	54.7
6	3.2	3.7	1.7	5.5	61	32.9	37.9	16.9	55.6
7	3.8	4.3	1.9	6.4	62	33.5	38.5	17.2	56.5
8	4.3	5.0	2.2	7.3	63	34.0	39.1	17.5	57.4
9	4.9	5.6	2.5	8.2	64	34.5	39.8	17.8	58.3
10	5.4	6.2	2.8	9.1	65	35.1	40.4	18.1	59.2
11	5.9	6.8	3.1	10.0	66	35.6	41.0	18.3	60.1
12	6.5	7.5	3.3	10.9	67	36.2	41.6	18.6	61.1
13	7.0	8.1	3.6	11.8	68	36.7	42.3	18.9	62.0
14	7.6	8.7	3.9	12.8	69	37.2	42.9	19.2	62.9
15	8.1	9.3	4.2	13.7	70	37.8	43.5	19.4	63.8
16	8.6	9.9	4.4	14.6	71	38.3	44.1	19.7	64.7
17	9.2	10.6	4.7	15.5	72	38.9	44.7	20.0	65.6
18	9.7	11.2	5.0	16.4	73	39.4	45.4	20.3	66.5
19	10.3	11.8	5.3	17.3	74	39.9	46.0	20.6	67.4
20	10.8	12.4	5.6	18.2	75	40.5	46.6	20.8	68.4
21	11.3	13.0	5.8	19.1	76	41.0	47.2	21.1	69.3
22	11.9	13.7	6.1	20.0	77	41.5	47.8	21.4	70.2
23	12.4	14.3	6.4	21.0	78	42.1	48.5	21.7	71.1
24	13.0	14.9	6.7	21.9	79	42.6	49.1	21.9	72.0
25	13.5	15.5	6.9	22.8	80	43.2	49.7	22.2	72.9
26	14.0	16.2	7.2	23.7	81	43.7	50.3	22.5	73.8
27	14.6	16.8	7.5	24.6	82	44.2	51.0	22.8	74.7
28	15.1	17.4	7.8	25.5	83	44.8	51.6	23.1	75.6
29	15.6	18.0	8.1	26.4	84	45.3	52.2	23.3	76.6
30	16.2	18.6	8.3	27.3	85	45.9	52.8	23.6	77.5
31	16.7	19.3	8.6	28.3	86	46.4	53.4	23.9	78.4
32	17.3	19.9	8.9	29.2	87	46.9	54.1	24.2	79.3
33	17.8	20.5	9.2	30.1	88	47.5	54.7	24.4	80.2
34	18.3	21.1	9.4	31.0	89	48.0	55.3	24.7	81.1
35	18.9	21.7	9.7	31.9	90	48.6	55.9	25.0	82.0
36	19.4	22.4	10.0	32.8	91	49.1	56.5	25.3	82.9
37	20.0	23.0	10.3	33.7	92	49.6	57.2	25.6	83.8
38	20.5	23.6	10.6	34.6	93	50.2	57.8	25.8	84.8
39	21.0	24.2	10.8	35.5	94	50.7	58.4	26.1	85.7
40	21.6	24.9	11.1	36.5	95	51.3	59.0	26.4	86.6
41	22.1	25.5	11.4	37.4	96	51.8	59.7	26.7	87.5
42	22.7	26.1	11.7	38.3	97	52.3	60.3	26.9	88.4
43	23.2	26.7	11.9	39.2	98	52.9	60.9	27.2	89.3
44	23.7	27.3	12.2	40.1	99	53.4	61.5	27.5	90.2
45	24.3	28.0	12.5	41.0	100	54.0	62.1	27.8	91.1
46	24.8	28.6	12.8	41.9	101	54.5	62.8	28.1	92.0
47	25.4	29.2	13.1	42.8	102	55.0	63.4	28.3	93.0
48	25.9	29.8	13.3	43.7	103	55.6	64.0	28.6	93.9
49	26.4	30.4	13.6	44.7	104	56.1	64.6	28.9	94.8
50	27.0	31.1	13.9	45.6	105	56.7	65.2	29.2	95.7
51	27.5	31.7	14.2	46.5	106	57.2	65.9	29.4	96.6
52	28.1	32.3	14.4	47.4	107	57.7	66.5	29.7	97.5
53	28.6	32.9	14.7	48.3	108	58.3	67.1	30.0	98.4
54	29.1	33.6	15.0	49.2	109	58.8	67.7	30.3	99.3
55	29.7	34.2	15.3	50.1	110	59.4	68.4	30.6	100.2

(*continued*)

KILOMETERS PER HOUR TO KNOTS, MILES PER HOUR, METERS PER SECOND, FEET PER SECOND

Kilometers per hour	Knots	Miles per hour	Meters per second	Feet per second	Kilometers per hour	Knots	Miles per hour	Meters per second	Feet per second
111	59.9	69.0	30.8	101.2	166	89.6	103.1	46.1	151.3
112	60.4	69.6	31.1	102.1	167	90.1	103.8	46.4	152.2
113	61.0	70.2	31.4	103.0	168	90.7	104.4	46.7	153.1
114	61.5	70.8	31.7	103.9	169	91.2	105.0	46.9	154.0
115	62.1	71.5	31.9	104.8	170	91.7	105.6	47.2	154.9
116	62.6	72.1	32.2	105.7	171	92.3	106.3	47.5	155.8
117	63.1	72.7	32.5	106.6	172	92.8	106.9	47.8	156.8
118	63.7	73.3	32.8	107.5	173	93.3	107.5	48.1	157.7
119	64.2	73.9	33.1	108.4	174	93.9	108.1	48.3	158.6
120	64.8	74.6	33.3	109.4	175	94.4	108.7	48.6	159.5
121	65.3	75.2	33.6	110.3	176	95.0	109.4	48.9	160.4
122	65.8	75.8	33.9	111.2	177	95.5	110.0	49.2	161.3
123	66.4	76.4	34.2	112.1	178	96.0	110.6	49.4	162.2
124	66.9	77.1	34.4	113.0	179	96.6	111.2	49.7	163.1
125	67.4	77.7	34.7	113.9	180	97.1	111.8	50.0	164.0
126	68.0	78.3	35.0	114.8	181	97.7	112.5	50.3	165.0
127	68.5	78.9	35.3	115.7	182	98.2	113.1	50.6	165.9
128	69.1	79.5	35.6	116.7	183	98.7	113.7	50.8	166.8
129	69.6	80.2	35.8	117.6	184	99.3	114.3	51.1	167.7
130	70.1	80.8	36.1	118.5	185	99.8	115.0	51.4	168.6
131	70.7	81.4	36.4	119.4	186	100.4	115.6	51.7	169.5
132	71.2	82.0	36.7	120.3	187	100.9	116.2	51.9	170.4
133	71.8	82.6	36.9	121.2	188	101.4	116.8	52.2	171.3
134	72.3	83.3	37.2	122.1	189	102.0	117.4	52.5	172.2
135	72.8	83.9	37.5	123.0	190	102.5	118.1	52.8	173.2
136	73.4	84.5	37.8	123.9	191	103.1	118.7	53.1	174.1
137	73.9	85.1	38.1	124.9	192	103.6	119.3	53.3	175.0
138	74.5	85.7	38.3	125.8	193	104.1	119.9	53.6	175.9
139	75.0	86.4	38.6	126.7	194	104.7	120.5	53.9	176.8
140	75.5	87.0	38.9	127.6	195	105.2	121.2	54.2	177.7
141	76.1	87.6	39.2	128.5	196	105.8	121.8	54.4	178.6
142	76.6	88.2	39.4	129.4	197	106.3	122.4	54.7	179.5
143	77.2	88.9	39.7	130.3	198	106.8	123.0	55.0	180.4
144	77.7	89.5	40.0	131.2	199	107.4	123.7	55.3	181.4
145	78.2	90.1	40.3	132.1	200	107.9	124.3	55.6	182.3
146	78.8	90.7	40.6	133.1	210	113.3	130.5	58.3	191.4
147	79.3	91.3	40.8	134.0	220	118.7	136.7	61.1	200.5
148	79.9	92.0	41.1	134.9	230	124.1	142.9	63.9	209.6
149	80.4	92.6	41.4	135.8	240	129.5	149.1	66.7	218.7
150	80.9	93.2	41.7	136.7	250	134.9	155.3	69.4	227.8
151	81.5	93.8	41.9	137.6	260	140.3	161.6	72.2	236.9
152	82.0	94.4	42.2	138.5	270	145.7	167.8	75.0	246.1
153	82.6	95.1	42.5	139.4	280	151.1	174.0	77.8	255.2
154	83.1	95.7	42.8	140.3	290	156.5	180.2	80.6	264.3
155	83.6	96.3	43.1	141.3	300	161.9	186.4	83.3	273.4
156	84.2	96.9	43.3	142.2	310	167.3	192.6	86.1	282.5
157	84.7	97.6	43.6	143.1	320	172.7	198.8	88.9	291.6
158	85.3	98.2	43.9	144.0	330	178.1	205.1	91.7	300.7
159	85.8	98.8	44.2	144.9	340	183.5	211.3	94.4	309.9
160	86.3	99.4	44.4	145.8	350	188.9	217.5	97.2	319.0
161	86.9	100.0	44.7	146.7	360	194.3	223.7	100.0	328.1
162	87.4	100.7	45.0	147.6	370	199.6	229.9	102.8	337.2
163	88.0	101.3	45.3	148.5	380	205.0	236.1	105.6	346.3
164	88.5	101.9	45.6	149.5	390	210.4	242.3	108.3	355.4
165	89.0	102.5	45.8	150.4	400	215.8	248.5	111.1	364.5

KNOTS TO MILES PER HOUR, METERS PER SECOND, FEET PER SECOND, KILOMETERS PER HOUR, FEET PER MINUTE

Knots	Miles per hour	Meters per second	Feet per second	Kilo-meters per hour	Feet per minute
1	1.2	0.5	1.7	1.9	101
2	2.3	1.0	3.4	3.7	203
3	3.5	1.5	5.1	5.6	304
4	4.6	2.1	6.8	7.4	405
5	5.8	2.6	8.4	9.3	507
6	6.9	3.1	10.1	11.1	608
7	8.1	3.6	11.8	13.0	709
8	9.2	4.1	13.5	14.8	811
9	10.4	4.6	15.2	16.7	912
10	11.5	5.1	16.9	18.5	1013
11	12.7	5.7	18.6	20.4	1115
12	13.8	6.2	20.3	22.2	1216
13	15.0	6.7	22.0	24.1	1317
14	16.1	7.2	23.6	25.9	1419
15	17.3	7.7	25.3	27.8	1520
16	18.4	8.2	27.0	29.7	1621
17	19.6	8.8	28.7	31.5	1723
18	20.7	9.3	30.4	33.4	1824
19	21.9	9.8	32.1	35.2	1925
20	23.0	10.3	33.8	37.1	2027
21	24.2	10.8	35.5	38.9	2128
22	25.3	11.3	37.2	40.8	2229
23	26.5	11.8	38.8	42.6	2331
24	27.6	12.4	40.5	44.5	2432
25	28.8	12.9	42.2	46.3	2533
26	29.9	13.4	43.9	48.2	2635
27	31.1	13.9	45.6	50.0	2736
28	32.2	14.4	47.3	51.9	2837
29	33.4	14.9	49.0	53.7	2939
30	34.5	15.4	50.7	55.6	3040
31	35.7	16.0	52.4	57.5	3141
32	36.8	16.5	54.0	59.3	3243
33	38.0	17.0	55.7	61.2	3344
34	39.2	17.5	57.4	63.0	3445
35	40.3	18.0	59.1	64.9	3547
36	41.5	18.5	60.8	66.7	3648
37	42.6	19.0	62.5	68.6	3749
38	43.8	19.6	64.2	70.4	3851
39	44.9	20.1	65.9	72.3	3952
40	46.1	20.6	67.6	74.1	4053
41	47.2	21.1	69.2	76.0	4155
42	48.4	21.6	70.9	77.8	4256
43	49.5	22.1	72.6	79.7	4357
44	50.7	22.7	74.3	81.5	4459
45	51.8	23.2	76.0	83.4	4560
46	53.0	23.7	77.7	85.2	4662
47	54.1	24.2	79.4	87.1	4763
48	55.3	24.7	81.1	89.0	4864
49	56.4	25.2	82.8	90.8	4966
50	57.6	25.7	84.4	92.7	5067
51	58.7	26.3	86.1	94.5	5168
52	59.9	26.8	87.8	96.4	5270
53	61.0	27.3	89.5	98.2	5371
54	62.2	27.8	91.2	100.1	5472
55	63.3	28.3	92.9	101.9	5574
56	64.5	28.8	94.6	103.8	5675
57	65.6	29.3	96.3	105.6	5776
58	66.8	29.9	98.0	107.5	5878
59	67.9	30.4	99.6	109.3	5979
60	69.1	30.9	101.3	111.2	6080
61	70.2	31.4	103.0	113.0	6182
62	71.4	31.9	104.7	114.9	6283
63	72.5	32.4	106.4	116.8	6384
64	73.7	32.9	108.1	118.6	6486
65	74.9	33.5	109.8	120.5	6587
66	76.0	34.0	111.5	122.3	6688
67	77.2	34.5	113.2	124.2	6790
68	78.3	35.0	114.8	126.0	6891
69	79.5	35.5	116.5	127.9	6992
70	80.6	36.0	118.2	129.7	7094
71	81.8	36.6	119.9	131.6	7195
72	82.9	37.1	121.6	133.4	7296
73	84.1	37.6	123.3	135.3	7398
74	85.2	38.1	125.0	137.1	7499
75	86.4	38.6	126.7	139.0	7600
76	87.5	39.1	128.4	140.8	7702
77	88.7	39.6	130.0	142.7	7803
78	89.8	40.2	131.7	144.6	7904
79	91.0	40.7	133.4	146.4	8006
80	92.1	41.2	135.1	148.3	8107
81	93.3	41.7	136.8	150.1	8208
82	94.4	42.2	138.5	152.0	8310
83	95.6	42.7	140.2	153.8	8411
84	96.7	43.2	141.9	155.7	8512
85	97.9	43.8	143.6	157.5	8614
86	99.0	44.3	145.2	159.4	8715
87	100.2	44.8	146.9	161.2	8816
88	101.3	45.3	148.6	163.1	8918
89	102.5	45.8	150.3	164.9	9019
90	103.6	46.3	152.0	166.8	9120
91	104.8	46.8	153.7	168.6	9222
92	105.9	47.4	155.4	170.5	9323
93	107.1	47.9	157.1	172.4	9424
94	108.2	48.4	158.8	174.2	9526
95	109.4	48.9	160.5	176.1	9627
96	110.5	49.4	162.1	177.9	9728
97	111.7	49.9	163.8	179.8	9830
98	112.9	50.4	165.5	181.6	9931
99	114.0	51.0	167.2	183.5	10032
100	115.2	51.5	168.9	185.3	10134
101	116.3	52.0	170.6	187.2	10235
102	117.5	52.5	172.3	189.0	10336
103	118.6	53.0	174.0	190.9	10438
104	119.8	53.5	175.7	192.7	10539
105	120.9	54.1	177.3	194.6	10640
106	122.1	54.6	179.0	196.4	10742
107	123.2	55.1	180.7	198.3	10843
108	124.4	55.6	182.4	200.2	10944
109	125.5	56.1	184.1	202.0	11046
110	126.7	56.6	185.8	203.9	11147

(continued)

KNOTS TO MILES PER HOUR, METERS PER SECOND, FEET PER SECOND, KILOMETERS PER HOUR, FEET PER MINUTE

Knots	Miles per hour	Meters per second	Feet per second	Kilo-meters per hour	Knots	Miles per hour	Meters per second	Feet per second	Kilo-meters per hour
111	127.8	57.1	187.5	205.7	166	191.2	85.5	280.4	307.6
112	129.0	57.7	189.2	207.6	167	192.3	86.0	282.1	309.5
113	130.1	58.2	190.9	209.4	168	193.5	86.5	283.7	311.3
114	131.3	58.7	192.5	211.3	169	194.6	87.0	285.4	313.2
115	132.4	59.2	194.2	213.1	170	195.8	87.5	287.1	315.1
116	133.6	59.7	195.9	215.0	171	196.9	88.0	288.8	316.9
117	134.7	60.2	197.6	216.8	172	198.1	88.5	290.5	318.8
118	135.9	60.7	199.3	218.7	173	199.2	89.1	292.2	320.6
119	137.0	61.3	201.0	220.5	174	200.4	89.6	293.9	322.5
120	138.2	61.8	202.7	222.4	175	201.5	90.1	295.6	324.3
121	139.3	62.3	204.4	224.2	176	202.7	90.6	297.3	326.2
122	140.5	62.8	206.1	226.1	177	203.8	91.1	298.9	328.0
123	141.6	63.3	207.7	227.9	178	205.0	91.6	300.6	329.9
124	142.8	63.8	209.4	229.8	179	206.1	92.1	302.3	331.7
125	143.9	64.3	211.1	231.7	180	207.3	92.7	304.0	333.6
126	145.1	64.9	212.8	233.5	181	208.4	93.2	305.7	335.4
127	146.2	65.4	214.5	235.4	182	209.6	93.7	307.4	337.3
128	147.4	65.9	216.2	237.2	183	210.7	94.2	309.1	339.1
129	148.6	66.4	217.9	239.1	184	211.9	94.7	310.8	341.0
130	149.7	66.9	219.6	240.9	185	213.0	95.2	312.5	342.9
131	150.9	67.4	221.3	242.8	186	214.2	95.8	314.1	344.7
132	152.0	68.0	222.9	244.6	187	215.3	96.3	315.8	346.6
133	153.2	68.5	224.6	246.5	188	216.5	96.8	317.5	348.4
134	154.3	69.0	226.3	248.3	189	217.6	97.3	319.2	350.3
135	155.5	69.5	228.0	250.2	190	218.8	97.8	320.9	352.1
136	156.6	70.0	229.7	252.0	191	219.9	98.3	322.6	354.0
137	157.8	70.5	231.4	253.9	192	221.1	98.8	324.3	355.8
138	158.9	71.0	233.1	255.7	193	222.3	99.4	326.0	357.7
139	160.1	71.6	234.8	257.6	194	223.4	99.9	327.7	359.5
140	161.2	72.1	236.5	259.5	195	224.6	100.4	329.3	361.4
141	162.4	72.6	238.1	261.3	196	225.7	100.9	331.0	363.2
142	163.5	73.1	239.8	263.2	197	226.9	101.4	332.7	365.1
143	164.7	73.6	241.5	265.0	198	228.0	101.9	334.4	366.9
144	165.8	74.1	243.2	266.9	199	229.2	102.4	336.1	368.8
145	167.0	74.6	244.9	268.7	200	230.3	103.0	337.8	370.6
146	168.1	75.2	246.6	270.6	210	241.8	108.1	354.7	389.2
147	169.3	75.7	248.3	272.4	220	253.3	113.3	371.6	407.7
148	170.4	76.2	250.0	274.3	230	264.9	118.4	388.5	426.2
149	171.6	76.7	251.7	276.1	240	276.4	123.6	405.3	444.8
150	172.7	77.2	253.3	278.0	250	287.9	128.7	422.2	463.3
151	173.9	77.7	255.0	279.8	260	299.4	133.8	439.1	481.8
152	175.0	78.2	256.7	281.7	270	310.9	139.0	456.0	500.4
153	176.2	78.8	258.4	283.5	280	322.4	144.1	472.9	518.9
154	177.3	79.3	260.1	285.4	290	334.0	149.3	489.8	537.4
155	178.5	79.8	261.8	287.3	300	345.5	154.4	506.7	556.0
156	179.6	80.3	263.5	289.1	310	357.0	159.6	523.6	574.5
157	180.8	80.8	265.2	291.0	320	368.5	164.7	540.5	593.0
158	181.9	81.3	266.9	292.8	330	380.0	169.9	557.4	611.6
159	183.1	81.9	268.5	294.7	340	391.5	175.0	574.2	630.1
160	184.2	82.4	270.2	296.5	350	403.0	180.2	591.1	648.6
161	185.4	82.9	271.9	298.4	360	414.6	185.3	608.0	667.2
162	186.6	83.4	273.6	300.2	370	426.1	190.5	624.9	685.7
163	187.7	83.9	275.3	302.1	380	437.6	195.6	641.8	704.2
164	188.9	84.4	277.0	303.9	390	449.1	200.8	658.7	722.8
165	190.0	84.9	278.7	305.8	400	460.6	205.9	675.6	741.3

Section II

WIND AND DYNAMICAL TABLES

BEAUFORT WIND SCALE

In 1806 Admiral Sir F. Beaufort devised a scale for recording wind force at sea based on the effect of the wind on a full-rigged man-of-war of that era. In 1838 this scale was adopted by the British Admiralty and with but minor changes had come into general use among mariners for specifying the state of the wind at sea. The International Meteorological Committee (Utrecht, 1874) adopted the Beaufort scale for international use in weather telegraphy, and it now has become the chief scale for specifying the force of the wind and is used in all parts of the world, both on land and on sea.

Since the original Beaufort scale described a state of the atmosphere as manifested by the effects of the wind near the surface, there did not exist originally a set of wind speeds corresponding to the various numbers of the scale. A number of efforts were made to obtain appropriate speed equivalents but it was found difficult to reach agreement on this matter because the effect of wind variation with height was neglected. The International Meteorological Committee (London, 1921) requested Dr. G. C. Simpson of the British Meteorological Office to investigate the matter and in 1926 Dr. Simpson proposed a set of speed equivalents which were to apply to anemometers exposed 6 meters above the ground.[1] This scale was adopted by the Committee in Vienna (1926). However, the British Meteorological Office continued to use a scale proposed by Dr. Simpson in 1906[2] and applicable to an anemometer at a height of about 10 meters above the ground, as did the U. S. Weather Bureau. This scale was based on the empirical equation $V = 0.836\ B^{3/2}$ where V is the wind speed in meters per second and B the Beaufort force.

In 1946 the International Meteorological Committee meeting in Paris extended the original Beaufort scale to higher values and redefined the speed equivalents to apply to an anemometer at 10 meters above the ground. Up to force 11 these values are consistent with the values for a height of 6 meters adopted in Vienna (1926) and are identical with those proposed by Dr. Simpson in 1906.

Table 36 gives the speed equivalents of the Paris (1946) resolution and also the "descriptive terms" and "specifications for use on land" from the Meteorological Observers Handbook (London, 1939).

	Mean wind speeds at 10 m.*				Limits of wind speed at 10 m.*			
Force	Knots	Meters per second	Kilometers per hour	Miles per hour	Knots	Meters per second	Kilometers per hour	Miles per hour
0	0	0	0	0	<1	0 - 0.2	<1	<1
1	2	0.9	3	2	1- 3	0.3- 1.5	1- 5	1- 3
2	5	2.4	9	5	4- 6	1.6- 3.3	6- 11	4- 7
3	9	4.4	16	10	7- 10	3.4- 5.4	12- 19	8- 12
4	13	6.7	24	15	11- 16	5.5- 7.9	20- 28	13- 18
5	18	9.3	34	21	17- 21	8.0-10.7	29- 38	19- 24
6	24	12.3	44	28	22- 27	10.8-13.8	39- 49	25- 31
7	30	15.5	55	35	28- 33	13.9-17.1	50- 61	32- 38
8	37	18.9	68	42	34- 40	17.2-20.7	62- 74	39- 46
9	44	22.6	82	50	41- 47	20.8-24.4	75- 88	47- 54
10	52	26.4	96	59	48- 55	24.5-28.4	89-102	55- 63
11	60	30.5	110	68	56- 63	28.5-32.6	103-117	64- 72
12	68	34.8	125	78	64- 71	32.7-36.9	118-133	73- 82
13	76	39.2	141	88	72- 80	37.0-41.4	134-149	83- 92
14	85	43.8	158	98	81- 89	41.5-46.1	150-166	93-103
15	94	48.6	175	109	90- 99	46.2-50.9	167-183	104-114
16	104	53.5	193	120	100-108	51.0-56.0	184-201	115-125
17	114	58.6	211	131	109-118	56.1-61.2	202-220	126-136

Force	Description of wind †	Specifications for use on land †
0	Calm	Calm, smoke rises vertically.
1	Light air	Direction of wind shown by smoke drift, but not by wind vanes.
2	Light breeze	Wind felt on face; leaves rustle; ordinary vane moved by wind.
3	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	Moderate breeze	Raises dust and loose paper; small branches are moved.
5	Fresh breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	Strong breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	Moderate gale	Whole trees in motion; inconvenience felt when walking against wind.
8	Fresh gale	Breaks twigs off trees; generally impedes progress.
9	Strong gale	Slight structural damage occurs (chimney pots and slate removed).
10	Whole gale	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	Storm	Very rarely experienced, accompanied by widespread damage.
12 or above	Hurricane	

* Resolution 9, International Meteorological Committee, Paris, 1946.

† Meteorological Office, The Meteorological Observers Handbook, London, 1939.

[1] Simpson, G. C., The velocity equivalents of the Beaufort scale. Professional Notes No. 44. Air Ministry, Meteorological Office, London, 1926. See also Anemometers and the Beaufort scale of wind force, Meteorol. Mag., vol. 67, pp. 278-83, January 1933. Kuhlbrodt, E., Ann. d. Hydr. & Marit. Meteorol. Zweites Köppen-Heft, pp. 14-23, 1936.

[2] Simpson, G. C., Meteorological Office, Publ. No. 180, London, 1906.

GEOSTROPHIC WIND, CONSTANT PRESSURE SURFACE

100 geopotential meter contours

The scalar equation for the geostrophic wind on a constant pressure surface is

$$V_g = \frac{1}{f}\frac{\partial \Phi}{\partial n}$$

where Φ is the geopotential in a constant-pressure surface, n is distance measured in the horizontal direction, f is the coriolis parameter, and V_g is the component of the geostrophic wind normal to the direction in which n is measured.

On a constant pressure surface with contours drawn for intervals of 100 geopotential meters (gpm.) this reduces to

$$V_g(\text{knots}) = \frac{0.017120}{f\Delta n}$$

(*continued on next page*)

Contour spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	10° knots	15° knots	20° knots	25° knots	30° knots	35° knots	40° knots	45° knots
1.0	111	69	60	676.0	453.5	343.2	277.8	234.8	204.7	182.6	166.0
1.1	122	76	66	614.6	412.3	312.0	252.5	213.4	186.1	166.0	150.9
1.2	133	83	72	563.3	378.0	286.0	231.5	195.6	170.5	152.2	138.3
1.3	145	90	78	520.0	348.9	264.0	213.7	180.6	157.4	140.5	127.7
1.4	156	97	84	482.9	324.0	245.2	198.4	167.7	146.2	130.4	118.6
1.5	167	104	90	450.7	302.4	228.8	185.2	156.5	136.4	121.7	110.7
1.6	178	111	96	422.5	283.5	214.5	173.6	146.7	127.9	114.1	103.8
1.7	189	117	102	397.7	266.8	201.9	163.4	138.1	120.4	107.4	97.7
1.8	200	124	108	375.6	252.0	190.7	154.3	130.4	113.7	101.5	92.2
1.9	211	131	114	355.8	238.7	180.6	146.2	123.6	107.7	96.1	87.4
2.0	222	138	120	338.0	226.8	171.6	138.9	117.4	102.3	91.3	83.0
2.1	234	145	126	321.9	216.0	163.4	132.3	111.8	97.5	87.0	79.1
2.2	245	152	132	307.3	206.2	156.0	126.3	106.7	93.0	83.0	75.5
2.3	256	159	138	293.9	197.2	149.2	120.8	102.1	89.0	79.4	72.2
2.4	267	166	144	281.7	189.0	143.0	115.7	97.8	85.3	76.1	69.2
2.5	278	173	150	270.4	181.4	137.3	111.1	93.9	81.9	73.0	66.4
2.6	289	180	156	260.0	174.4	132.0	106.8	90.3	78.7	70.2	63.9
2.7	300	187	162	250.4	168.0	127.1	102.9	87.0	75.8	67.6	61.5
2.8	311	193	168	241.4	162.0	122.6	99.2	83.8	73.1	65.2	59.3
2.9	322	200	174	233.1	156.4	118.4	95.8	81.0	70.6	63.0	57.2
3.0	334	207	180	225.3	151.2	114.4	92.6	78.3	68.2	60.9	55.3
3.2	356	221	192	211.3	141.7	107.3	86.8	73.4	64.0	57.1	51.9
3.4	378	235	204	198.8	133.4	100.9	81.7	69.1	60.2	53.7	48.8
3.6	400	249	216	187.8	126.0	95.3	77.2	65.2	56.8	50.7	46.1
3.8	423	263	228	177.9	119.4	90.3	73.1	61.8	53.9	48.1	43.7
4.0	445	276	240	169.0	113.4	85.8	69.4	58.7	51.2	45.7	41.5
4.2	467	290	252	161.0	108.0	81.7	66.1	55.9	48.7	43.5	39.5
4.4	489	304	264	153.6	103.1	78.0	63.1	53.4	46.5	41.5	37.7
4.6	511	318	276	147.0	98.6	74.6	60.4	51.0	44.5	39.7	36.1
4.8	534	332	288	140.8	94.5	71.5	57.9	48.9	42.6	38.0	34.6
5.0	556	345	300	135.2	90.7	68.6	55.6	47.0	40.9	36.5	33.2
5.5	612	380	330	122.9	82.5	62.4	50.5	42.7	37.2	33.2	30.2
6.0	667	415	360	112.7	75.6	57.2	46.3	39.1	34.1	30.4	27.7
6.5	723	449	390	104.0	69.8	52.8	42.7	36.1	31.5	28.1	25.5
7.0	778	484	420	96.6	64.8	49.0	39.7	33.5	29.2	26.1	23.7
8.0	890	553	480	84.5	56.7	42.9	34.7	29.3	25.6	22.8	20.8
9.0	1001	622	540	75.1	50.4	38.1	30.9	26.1	22.7	20.3	18.4
10.0	1112	691	600	67.6	45.4	34.3	27.8	23.5	20.5	18.3	16.6

(To convert knots to other measures of speed see Table 35.)

(*continued*)

GEOSTROPHIC WIND, CONSTANT PRESSURE SURFACE

100 geopotential meter contours

where Δn is the contour spacing measured in degrees of latitude (i.e., one unit of Δn has the length of one degree of latitude at the place for which the contour spacing is measured). Table 37 gives values of V_g in knots as a function of Δn and latitude with auxiliary columns giving equivalents of Δn in kilometers, statute miles, and nautical miles. If the latter are measured by a map scale true at some other latitude the value should be corrected to the latitude at which the measurements are taken (see Table 165).

Since the geostrophic wind is inversely proportional to the contour spacing and directly proportional to the contour interval ($\Delta\Phi$ gpm.), values of V_g for 1/10 of the indicated spacing may be found by multiplying the tabular values by 10, etc., and for contour intervals that are multiples or submultiples of 100 gpm. by multiplying the tabular values by $\Delta\Phi/100$ (e.g., for 200 gpm. contours multiply by 2, for 50 gpm. contours multiply by ½, etc.).

Contour spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	50° knots	55° knots	60° knots	65° knots	70° knots	75° knots	80° knots	85° knots
1.0	111	69	60	153.2	143.3	135.5	129.5	124.9	121.5	119.2	117.8
1.1	122	76	66	139.3	130.3	123.2	117.7	113.6	110.5	108.4	107.1
1.2	133	83	72	127.7	119.4	113.0	107.9	104.1	101.3	99.3	98.2
1.3	145	90	78	117.9	110.2	104.3	99.6	96.1	93.5	91.7	90.6
1.4	156	97	84	109.5	102.4	96.8	92.5	89.2	86.8	85.1	84.2
1.5	167	104	90	102.2	95.5	90.4	86.3	83.3	81.0	79.5	78.6
1.6	178	111	96	95.8	89.6	84.7	81.0	78.1	76.0	74.5	73.6
1.7	189	117	102	90.1	84.3	79.7	76.2	73.5	71.5	70.1	69.3
1.8	200	124	108	85.1	79.6	75.3	72.0	69.4	67.5	66.2	65.5
1.9	211	131	114	80.7	75.4	71.3	68.2	65.7	64.0	62.7	62.0
2.0	222	138	120	76.6	71.7	67.8	64.8	62.5	60.8	59.6	58.9
2.1	234	145	126	73.0	68.2	64.5	61.7	59.5	57.9	56.8	56.1
2.2	245	152	132	69.7	65.1	61.6	58.9	56.8	55.2	54.2	53.6
2.3	256	159	138	66.6	62.3	58.9	56.3	54.3	52.8	51.8	51.2
2.4	267	166	144	63.8	59.7	56.5	54.0	52.1	50.6	49.7	49.1
2.5	278	173	150	61.3	57.3	54.2	51.8	50.0	48.6	47.7	47.1
2.6	289	180	156	58.9	55.1	52.1	49.8	48.0	46.7	45.8	45.3
2.7	300	187	162	56.8	53.1	50.2	48.0	46.3	45.0	44.1	43.6
2.8	311	193	168	54.7	51.2	48.4	46.3	44.6	43.4	42.6	42.1
2.9	322	200	174	52.8	49.4	46.7	44.7	43.1	41.9	41.1	40.6
3.0	334	207	180	51.1	47.8	45.2	43.2	41.6	40.5	39.7	39.3
3.2	356	221	192	47.9	44.8	42.4	40.5	39.0	38.0	37.2	36.8
3.4	378	235	204	45.1	42.1	39.9	38.1	36.7	35.7	35.1	34.7
3.6	400	249	216	42.6	39.8	37.7	36.0	34.7	33.8	33.1	32.7
3.8	423	263	228	40.3	37.7	35.7	34.1	32.9	32.0	31.4	31.0
4.0	445	276	240	38.3	35.8	33.9	32.4	31.2	30.4	29.8	29.5
4.2	467	290	252	36.5	34.1	32.3	30.8	29.7	28.9	28.4	28.1
4.4	489	304	264	34.8	32.6	30.8	29.4	28.4	27.6	27.1	26.8
4.6	511	318	276	33.3	31.2	29.5	28.2	27.2	26.4	25.9	25.6
4.8	534	332	288	31.9	29.9	28.2	27.0	26.0	25.3	24.8	24.5
5.0	556	345	300	30.6	28.7	27.1	25.9	25.0	24.3	23.8	23.6
5.5	612	380	330	27.9	26.1	24.6	23.5	22.7	22.1	21.7	21.4
6.0	667	415	360	25.5	23.9	22.6	21.6	20.8	20.3	19.9	19.6
6.5	723	449	390	23.6	22.0	20.9	19.9	19.2	18.7	18.3	18.1
7.0	778	484	420	21.9	20.5	19.4	18.5	17.8	17.4	17.0	16.8
8.0	890	553	480	19.2	17.9	16.9	16.2	15.6	15.2	14.9	14.7
9.0	1001	622	540	17.0	15.9	15.1	14.4	13.9	13.5	13.2	13.1
10.0	1112	691	600	15.3	14.3	13.6	13.0	12.5	12.2	11.9	11.8

(To convert knots to other measures of speed see Table 35.)

GEOSTROPHIC WIND, CONSTANT PRESSURE SURFACE

200 geopotential foot contours

The scalar equation for the geostrophic wind on a constant pressure surface is

$$V_g = \frac{1}{f}\frac{\partial\Phi}{\partial n}$$

where Φ is the geopotential in a constant pressure surface, n is distance measured in the horizontal direction, f is the coriolis parameter, and V_g is the component of the geostrophic wind normal to the direction in which n is measured.

On a constant pressure surface with contours drawn for intervals of 200 geopotential feet (gpft.) this reduces to

$$V_g(\text{knots}) = \frac{0.010436}{f\Delta n}$$

(*continued on next page*)

Contour spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	10° knots	15° knots	20° knots	25° knots	30° knots	35° knots	40° knots	45° knots
1.0	111	69	60	412.1	276.5	209.2	169.3	143.1	124.8	111.3	101.2
1.1	122	76	66	374.6	251.3	190.2	153.9	130.1	113.4	101.2	92.0
1.2	133	83	72	343.4	230.4	174.3	141.1	119.3	104.0	92.8	84.3
1.3	145	90	78	317.0	212.7	160.9	130.2	110.1	96.0	85.6	77.8
1.4	156	97	84	294.3	197.5	149.4	120.9	102.2	89.1	79.5	72.3
1.5	167	104	90	274.7	184.3	139.5	112.9	95.4	83.2	74.2	67.5
1.6	178	111	96	257.6	172.8	130.8	105.8	89.4	78.0	69.6	63.2
1.7	189	117	102	242.4	162.6	123.1	99.6	84.2	73.4	65.5	59.5
1.8	200	124	108	228.9	153.6	116.2	94.1	79.5	69.3	61.8	56.2
1.9	211	131	114	216.9	145.5	110.1	89.1	75.3	65.7	58.6	53.3
2.0	222	138	120	206.0	138.2	104.6	84.7	71.6	62.4	55.7	50.6
2.1	234	145	126	196.2	131.7	99.6	80.6	68.1	59.4	53.0	48.2
2.2	245	152	132	187.3	125.7	95.1	77.0	65.1	56.7	50.6	46.0
2.3	256	159	138	179.2	120.2	91.0	73.6	62.2	54.2	48.4	44.0
2.4	267	166	144	171.7	115.2	87.2	70.5	59.6	52.0	46.4	42.2
2.5	278	173	150	164.8	110.6	83.7	67.7	57.2	49.9	44.5	40.5
2.6	289	180	156	158.5	106.3	80.5	65.1	55.0	48.0	42.8	38.9
2.7	300	187	162	152.6	102.4	77.5	62.7	53.0	46.2	41.2	37.5
2.8	311	193	168	147.2	98.7	74.7	60.5	51.1	44.6	39.8	36.1
2.9	322	200	174	142.1	95.3	72.1	58.4	49.4	43.0	38.4	34.9
3.0	334	207	180	137.4	92.2	69.7	56.4	47.7	41.6	37.1	33.7
3.2	356	221	192	128.8	86.4	65.4	52.9	44.7	39.0	34.8	31.6
3.4	378	235	204	121.2	81.3	61.5	49.8	42.1	36.7	32.7	29.8
3.6	400	249	216	114.5	76.8	58.1	47.0	39.8	34.7	30.9	28.1
3.8	423	263	228	108.4	72.8	55.1	44.6	37.7	32.8	29.3	26.6
4.0	445	276	240	103.0	69.1	52.3	42.3	35.8	31.2	27.8	25.3
4.2	467	290	252	98.1	65.8	49.8	40.3	34.1	29.7	26.5	24.1
4.4	489	304	264	93.7	62.8	47.5	38.5	32.5	28.4	25.3	23.0
4.6	511	318	276	89.6	60.1	45.5	36.8	31.1	27.1	24.2	22.0
4.8	534	332	288	85.8	57.6	43.6	35.3	29.8	26.0	23.2	21.1
5.0	556	345	300	82.4	55.3	41.8	33.9	28.6	25.0	22.3	20.2
5.5	612	380	330	74.9	50.3	38.0	30.8	26.0	22.7	20.2	18.4
6.0	667	415	360	68.7	46.1	34.9	28.2	23.9	20.8	18.6	16.9
6.5	723	449	390	63.4	42.5	32.2	26.0	22.0	19.2	17.1	15.6
7.0	778	484	420	58.9	39.5	29.9	24.2	20.4	17.8	15.9	14.5
8.0	890	553	480	51.5	34.6	26.2	21.2	17.9	15.6	13.9	12.6
9.0	1001	622	540	45.8	30.7	23.2	18.8	15.9	13.9	12.4	11.2
10.0	1112	691	600	41.2	27.6	20.9	16.9	14.3	12.5	11.1	10.1

(To convert knots to other measures of speed see Table 35.)

(*continued*)

GEOSTROPHIC WIND, CONSTANT PRESSURE SURFACE

200 geopotential foot contours

where Δn is the contour spacing measured in degrees of latitude (i.e., one unit of Δn has the length of one degree of latitude at the place for which the contour spacing is measured). Table 38 gives values of V_g in knots as a function of Δn and latitude with auxiliary columns giving equivalents of Δn in kilometers, statute miles, and nautical miles. If the latter are measured by a map scale true at some other latitude the value should be corrected to the latitude at which the measurements are taken (see Table 165).

Since the geostrophic wind is inversely proportional to the contour spacing and directly proportional to the contour interval ($\Delta\Phi$ gpft.), values of V_g for 1/10 of the indicated spacing may be found by multiplying the tabular values by 10, etc., and for contour intervals that are multiples or submultiples of 200 gpft. by multiplying the tabular values by $\Delta\Phi/200$ (e.g., for 400 gpft. contours multiply by 2, for 100 gpft. contours multiply by $\frac{1}{2}$, etc.).

Contour spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	50° knots	55° knots	60° knots	65° knots	70° knots	75° knots	80° knots	85° knots
1.0	111	69	60	93.4	87.4	82.6	79.0	76.1	74.1	72.7	71.8
1.1	122	76	66	84.9	79.4	75.1	71.8	69.2	67.3	66.1	65.3
1.2	133	83	72	77.8	72.8	68.9	65.8	63.5	61.7	60.6	59.9
1.3	145	90	78	71.9	67.2	63.6	60.7	58.6	57.0	55.9	55.3
1.4	156	97	84	66.7	62.4	59.0	56.4	54.4	52.9	51.9	51.3
1.5	167	104	90	62.3	58.2	55.1	52.6	50.8	49.4	48.4	47.9
1.6	178	111	96	58.4	54.6	51.6	49.3	47.6	46.3	45.4	44.9
1.7	189	117	102	54.9	51.4	48.6	46.4	44.8	43.6	42.7	42.3
1.8	200	124	108	51.9	48.5	45.9	43.9	42.3	41.2	40.4	39.9
1.9	211	131	114	49.2	46.0	43.5	41.6	40.1	39.0	38.2	37.8
2.0	222	138	120	46.7	43.7	41.3	39.5	38.1	37.0	36.3	35.9
2.1	234	145	126	44.5	41.6	39.3	37.6	36.3	35.3	34.6	34.2
2.2	245	152	132	42.5	39.7	37.6	35.9	34.6	33.7	33.0	32.7
2.3	256	159	138	40.6	38.0	35.9	34.3	33.1	32.2	31.6	31.2
2.4	267	166	144	38.9	36.4	34.4	32.9	31.7	30.9	30.3	29.9
2.5	278	173	150	37.4	34.9	33.1	31.6	30.5	29.6	29.1	28.7
2.6	289	180	156	35.9	33.6	31.8	30.4	29.3	28.5	27.9	27.6
2.7	300	187	162	34.6	32.4	30.6	29.2	28.2	27.4	26.9	26.6
2.8	311	193	168	33.4	31.2	29.5	28.2	27.2	26.5	26.0	25.7
2.9	322	200	174	32.2	30.1	28.5	27.2	26.3	25.5	25.1	24.8
3.0	334	207	180	31.1	29.1	27.5	26.3	25.4	24.7	24.2	23.9
3.2	356	221	192	29.2	27.3	25.8	24.7	23.8	23.2	22.7	22.4
3.4	378	235	204	27.5	25.7	24.3	23.2	22.4	21.8	21.4	21.1
3.6	400	249	216	25.9	24.3	23.0	21.9	21.2	20.6	20.2	20.0
3.8	423	263	228	24.6	23.0	21.7	20.8	20.0	19.5	19.1	18.9
4.0	445	276	240	23.4	21.8	20.7	19.7	19.0	18.5	18.2	18.0
4.2	467	290	252	22.2	20.8	19.7	18.8	18.1	17.6	17.3	17.1
4.4	489	304	264	21.2	19.9	18.8	17.9	17.3	16.8	16.5	16.3
4.6	511	318	276	20.3	19.0	18.0	17.2	16.6	16.1	15.8	15.6
4.8	534	332	288	19.5	18.2	17.2	16.4	15.9	15.4	15.1	15.0
5.0	556	345	300	18.7	17.5	16.5	15.8	15.2	14.8	14.5	14.4
5.5	612	380	330	17.0	15.9	15.0	14.4	13.8	13.5	13.2	13.1
6.0	667	415	360	15.6	14.6	13.8	13.2	12.7	12.3	12.1	12.0
6.5	723	449	390	14.4	13.4	12.7	12.1	11.7	11.4	11.2	11.1
7.0	778	484	420	13.3	12.5	11.8	11.3	10.9	10.6	10.4	10.3
8.0	890	553	480	11.7	10.9	10.3	9.9	9.5	9.3	9.1	9.0
9.0	1001	622	540	10.4	9.7	9.2	8.8	8.5	8.2	8.1	8.0
10.0	1112	691	600	9.3	8.7	8.3	7.9	7.6	7.4	7.3	7.2

(To convert knots to other measures of speed see Table 35.)

Table 39

GEOSTROPHIC WIND, CONSTANT LEVEL SURFACE

Three millibar isobars, air density 1 kg. m.$^{-3}$

The scalar equation for the geostrophic wind on a constant level surface is

$$V_g = \frac{1}{f\rho}\frac{\partial p}{\partial n}$$

where p is the pressure on a constant level surface, n is distance measured in the surface, f is the coriolis parameter, ρ is the density of the air, and V_g is the component of the geostrophic wind normal to the direction in which n is measured.

On a constant level surface with a 3 millibar isobaric interval and an air density of 1 kg. m.$^{-3}$ (0.001 gm. cm.$^{-3}$) this reduces to

$$V_g(\text{knots}) = \frac{0.0052409}{f\Delta n}$$

(*continued on next page*)

Isobar spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	10° knots	15° knots	20° knots	25° knots	30° knots	35° knots	40° knots	45° knots
1.0	111	69	60	206.9	138.8	105.1	85.0	71.9	62.7	55.9	50.8
1.1	122	76	66	188.1	126.2	95.5	77.3	65.3	57.0	50.8	46.2
1.2	133	83	72	172.5	115.7	87.6	70.9	59.9	52.2	46.6	42.3
1.3	145	90	78	159.2	106.8	80.8	65.4	55.3	48.2	43.0	39.1
1.4	156	97	84	147.8	99.2	75.0	60.7	51.3	44.8	39.9	36.3
1.5	167	104	90	138.0	92.6	70.0	56.7	47.9	41.8	37.3	33.9
1.6	178	111	96	129.3	86.8	65.7	53.1	44.9	39.2	34.9	31.8
1.7	189	117	102	121.7	81.7	61.8	50.0	42.3	36.9	32.9	29.9
1.8	200	124	108	115.0	77.1	58.4	47.2	39.9	34.8	31.1	28.2
1.9	211	131	114	108.9	73.1	55.3	44.8	37.8	33.0	29.4	26.7
2.0	222	138	120	103.5	69.4	52.5	42.5	35.9	31.3	28.0	25.4
2.1	234	145	126	98.5	66.1	50.0	40.5	34.2	29.8	26.6	24.2
2.2	245	152	132	94.1	63.1	47.8	38.7	32.7	28.5	25.4	23.1
2.3	256	159	138	90.0	60.4	45.7	37.0	31.2	27.2	24.3	22.1
2.4	267	166	144	86.2	57.9	43.8	35.4	29.9	26.1	23.3	21.2
2.5	278	173	150	82.8	55.5	42.0	34.0	28.7	25.1	22.4	20.3
2.6	289	180	156	79.6	53.4	40.4	32.7	27.6	24.1	21.5	19.5
2.7	300	187	162	76.6	51.4	38.9	31.5	26.6	23.2	20.7	18.8
2.8	311	193	168	73.9	49.6	37.5	30.4	25.7	22.4	20.0	18.1
2.9	322	200	174	71.4	47.9	36.2	29.3	24.8	21.6	19.3	17.5
3.0	334	207	180	69.0	46.3	35.0	28.3	24.0	20.9	18.6	16.9
3.2	356	221	192	64.7	43.4	32.8	26.6	22.5	19.6	17.5	15.9
3.4	378	235	204	60.9	40.8	30.9	25.0	21.1	18.4	16.4	14.9
3.6	400	249	216	57.5	38.6	29.2	23.6	20.0	17.4	15.5	14.1
3.8	423	263	228	54.5	36.5	27.6	22.4	18.9	16.5	14.7	13.4
4.0	445	276	240	51.7	34.7	26.3	21.3	18.0	15.7	14.0	12.7
4.2	467	290	252	49.3	33.1	25.0	20.2	17.1	14.9	13.3	12.1
4.4	489	304	264	47.0	31.6	23.9	19.3	16.3	14.2	12.7	11.5
4.6	511	318	276	45.0	30.2	22.8	18.5	15.6	13.6	12.2	11.0
4.8	534	332	288	43.1	28.9	21.9	17.7	15.0	13.1	11.6	10.6
5.0	556	345	300	41.4	27.8	21.0	17.0	14.4	12.5	11.2	10.2
5.5	612	380	330	37.6	25.2	19.1	15.5	13.1	11.4	10.2	9.2
6.0	667	415	360	34.5	23.1	17.5	14.2	12.0	10.4	9.3	8.5
6.5	723	449	390	31.8	21.4	16.2	13.1	11.1	9.6	8.6	7.8
7.0	778	484	420	29.6	19.8	15.0	12.1	10.3	9.0	8.0	7.3
8.0	890	553	480	25.9	17.4	13.1	10.6	9.0	7.8	7.0	6.4
9.0	1001	622	540	23.0	15.4	11.7	9.4	8.0	7.0	6.2	5.6
10.0	1112	691	600	20.7	13.9	10.5	8.5	7.2	6.3	5.6	5.1

(To convert knots to other measures of speed see Table 35.)

(*continued*)

GEOSTROPHIC WIND, CONSTANT LEVEL SURFACE

Three millibar isobars, air density 1 kg. m.$^{-3}$

where Δn is the isobar spacing measured in degrees of latitude (i.e., one unit of Δn has the length of one degree of latitude at the place for which the isobar spacing is measured). Table 39 gives values of V_g in knots as a function of Δn with auxiliary columns giving equivalents of Δn in kilometers, statute miles, and nautical miles. If the latter are measured by a map scale true at some other latitude the value should be corrected to the latitude at which the measurements are taken (see Table 165).

Since the geostrophic wind is inversely proportional to the isobar spacing and the density ρ, and directly proportional to the isobaric interval (Δp mb.), values of V_g for 1/10 of the indicated spacing may be found by multiplying the tabular values by 10, etc., and for isobaric intervals other than 3 mb. by multiplying the tabular values by $\Delta p/3$. The density ρ_0 of 1 kg. m.$^{-3}$ (0.001 gm. cm.$^{-3}$) used in the computations is the average density at about 2 km. above sea level; for V_g at other levels multiply the tabular values by ρ_0/ρ (if the density is expressed in kg. m.$^{-3}$, simply divide the tabular value by the density).

Isobar spacing				Latitude							
Degrees of Latitude	Kilometers	Statute miles	Nautical miles	50° knots	55° knots	60° knots	65° knots	70° knots	75° knots	80° knots	85° knots
1.0	111	69	60	46.9	43.9	41.5	39.7	38.2	37.2	36.5	36.1
1.1	122	76	66	42.6	39.9	37.7	36.0	34.8	33.8	33.2	32.8
1.2	133	83	72	39.1	36.6	34.6	33.0	31.9	31.0	30.4	30.1
1.3	145	90	78	36.1	33.7	31.9	30.5	29.4	28.6	28.1	27.7
1.4	156	97	84	33.5	31.3	29.6	28.3	27.3	26.6	26.1	25.8
1.5	167	104	90	31.3	29.2	27.7	26.4	25.5	24.8	24.3	24.0
1.6	178	111	96	29.3	27.4	25.9	24.8	23.9	23.3	22.8	22.5
1.7	189	117	102	27.6	25.8	24.4	23.3	22.5	21.9	21.5	21.2
1.8	200	124	108	26.1	24.4	23.1	22.0	21.2	20.7	20.3	20.0
1.9	211	131	114	24.7	23.1	21.8	20.9	20.1	19.6	19.2	19.0
2.0	222	138	120	23.5	21.9	20.7	19.8	19.1	18.6	18.2	18.0
2.1	234	145	126	22.3	20.9	19.8	18.9	18.2	17.7	17.4	17.2
2.2	245	152	132	21.3	19.9	18.9	18.0	17.4	16.9	16.6	16.4
2.3	256	159	138	20.4	19.1	18.0	17.2	16.6	16.2	15.9	15.7
2.4	267	166	144	19.5	18.3	17.3	16.5	15.9	15.5	15.2	15.0
2.5	278	173	150	18.8	17.5	16.6	15.9	15.3	14.9	14.6	14.4
2.6	289	180	156	18.0	16.9	16.0	15.3	14.7	14.3	14.0	13.9
2.7	300	187	162	17.4	16.2	15.4	14.7	14.2	13.8	13.5	13.4
2.8	311	193	168	16.8	15.7	14.8	14.2	13.7	13.3	13.0	12.9
2.9	322	200	174	16.2	15.1	14.3	13.7	13.2	12.8	12.6	12.4
3.0	334	207	180	15.6	14.6	13.8	13.2	12.7	12.4	12.2	12.0
3.2	356	221	192	14.7	13.7	13.0	12.4	12.0	11.6	11.4	11.3
3.4	378	235	204	13.8	12.9	12.2	11.7	11.2	10.9	10.7	10.6
3.6	400	249	216	13.0	12.2	11.5	11.0	10.6	10.3	10.1	10.0
3.8	423	263	228	12.3	11.5	10.9	10.4	10.1	9.8	9.6	9.5
4.0	445	276	240	11.7	11.0	10.4	9.9	9.6	9.3	9.1	9.0
4.2	467	290	252	11.2	10.4	9.9	9.4	9.1	8.9	8.7	8.6
4.4	489	304	264	10.7	10.0	9.4	9.0	8.7	8.5	8.3	8.2
4.6	511	318	276	10.2	9.5	9.0	8.6	8.3	8.1	7.9	7.8
4.8	534	332	288	9.8	9.1	8.6	8.3	8.0	7.8	7.6	7.5
5.0	556	345	300	9.4	8.8	8.3	7.9	7.6	7.4	7.3	7.2
5.5	612	380	330	8.5	8.0	7.5	7.2	7.0	6.8	6.6	6.6
6.0	667	415	360	7.8	7.3	6.9	6.6	6.4	6.2	6.1	6.0
6.5	723	449	390	7.2	6.7	6.4	6.1	5.9	5.7	5.6	5.5
7.0	778	484	420	6.7	6.3	5.9	5.7	5.5	5.3	5.2	5.2
8.0	890	553	480	5.9	5.5	5.2	5.0	4.8	4.7	4.6	4.5
9.0	1001	622	540	5.2	4.9	4.6	4.4	4.2	4.1	4.1	4.0
10.0	1112	691	600	4.7	4.4	4.1	4.0	3.8	3.7	3.6	3.6

(To convert knots to other measures of speed see Table 35.)

GRADIENT WIND

The equation for the gradient wind speed V in cgs units is,

$$V = \frac{rf}{2}\left(-1 + \sqrt{1 + \frac{4V_g}{rf}}\right), \qquad (1)$$

where

r = "radius of curvature" of the trajectory = R tan α (see Table 166),
f = Coriolis parameter $2\omega \sin \phi$ (ω = angular velocity of rotation of the earth, ϕ = latitude),
V_g = geostrophic wind speed (see Tables 37-39).

Equation (1) can be rewritten in the following form

$$V = \frac{3600\,rf}{2}\left(-1 + \sqrt{1 + \frac{4V_g}{3600\,rf}}\right) \qquad (2)$$

for any of the following consistent combinations of units:

a. V and V_g in miles per hour, r in statute miles,
b. " " " " knots, r in nautical miles,
c. " " " " kilometers per hour, r in kilometers.

V is a function of the parameter rf and of the geostrophic wind speed V_g only. In applying equations (1) and (2) the following sign convention is necessary: for cyclonic curvature $rf > 0$, for anticyclonic curvature $rf < 0$.

Table 40 A gives values of the parameter rf as a function of latitude, ϕ, and r. Table 40 B gives values of V for cyclonic curvature and Table 40 C for anticyclonic curvature as a function of the parameter rf and the geostrophic wind speed V_g.

To find the gradient wind speed at a given point:

1. Determine the latitude ϕ and the value r of the trajectory. (Table 166 indicates a method for finding r on a polar stereographic map projection; for other projections an estimate must be made.)
2. From Table 40 A find the parameter rf. (This parameter is linear in r so that values for other radii than those given may be readily determined from the table, e.g., if $r = 2300$, add the values for $r = 2000$ and $r = 300$.)
3. Determine the geostrophic wind speed V_g at the given point (see Tables 37-39). (V_g and r must be in one of the consistent combinations of units given above.)
4. Enter Table 40 B (cyclonic case) or Table 40 C (anticyclonic case) with the arguments rf and V_g. The corresponding tabular value is the gradient wind V in the same units as V_g.

(*continued*)

Table 40 (continued)

GRADIENT WIND

Table 40 A.—Values of the parameter rf

Radius of curvature r	Latitude 10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°
100	0.002	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.013	0.014	0.014	0.014	0.015	0.015
200	.005	.008	.010	.012	.015	.017	.019	.021	.022	.024	.025	.026	.027	.028	.029	.029	.029
300	.008	.011	.015	.018	.022	.025	.028	.031	.034	.036	.038	.040	.041	.042	.043	.044	.044
400	.010	.015	.020	.025	.029	.033	.037	.041	.045	.048	.051	.053	.055	.056	.057	.058	.058
500	.013	.019	.025	.031	.036	.042	.047	.052	.056	.060	.063	.066	.069	.070	.072	.073	.073
600	0.015	0.023	0.030	0.037	0.044	0.050	0.056	0.062	0.067	0.072	0.076	0.079	0.082	0.085	0.086	0.087	0.088
700	.018	.026	.035	.043	.051	.059	.066	.072	.078	.084	.088	.093	.096	.099	.101	.102	.102
800	.020	.030	.040	.049	.058	.067	.075	.083	.089	.096	.101	.106	.110	.113	.115	.116	.117
900	.023	.034	.045	.055	.066	.075	.084	.093	.101	.108	.114	.119	.123	.127	.129	.131	.131
1000	.025	.038	.050	.062	.073	.084	.094	.103	.112	.119	.126	.132	.137	.141	.144	.145	.146
1100	0.028	0.042	0.055	0.068	0.080	0.092	0.103	0.113	0.123	0.131	0.139	0.145	0.151	0.155	0.158	0.160	0.160
1200	.030	.045	.060	.074	.088	.100	.112	.124	.134	.143	.152	.159	.164	.169	.172	.174	.175
1300	.033	.049	.065	.080	.095	.109	.122	.134	.145	.155	.164	.172	.178	.183	.187	.189	.190
1400	.035	.053	.070	.086	.102	.117	.131	.144	.156	.167	.177	.185	.192	.197	.201	.203	.204
1500	.038	.057	.075	.092	.109	.126	.141	.155	.168	.179	.189	.198	.206	.211	.215	.218	.219
1600	0.041	0.060	0.080	0.099	0.117	0.134	0.150	0.165	0.179	0.191	0.202	0.211	0.219	0.225	0.230	0.232	0.233
1700	.043	.064	.085	.105	.124	.142	.159	.175	.190	.203	.215	.225	.233	.239	.244	.247	.248
1800	.046	.068	.090	.111	.131	.151	.169	.186	.201	.215	.227	.238	.247	.254	.259	.262	.263
1900	.048	.072	.095	.117	.139	.159	.178	.196	.212	.227	.240	.251	.260	.268	.273	.276	.277
2000	.051	.075	.100	.123	.146	.167	.187	.206	.223	.239	.253	.264	.274	.282	.287	.291	.292
2500	0.063	0.094	0.125	0.154	0.182	0.209	0.234	0.258	0.279	0.299	0.316	0.330	0.343	0.352	0.359	0.363	0.365
3000	.076	.113	.150	.185	.219	.251	.281	.309	.335	.358	.379	.397	.411	.423	.431	.436	.438

(*continued*)

TABLE 40 (CONTINUED)

GRADIENT WIND

TABLE 40 B.—Cyclonic curvature

V_0 \ rf	.002	.004	.006	.008	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.30	.40	.50	.60
5	3	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	6	7	7	8	8	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
15	7	9	10	11	11	13	13	14	14	14	14	14	14	14	14	14	15	15	15	15	15	15	15	15	15	15	15	15
20	9	11	13	14	14	16	17	18	18	18	19	19	19	19	19	19	19	19	19	19	19	19	20	20	20	20	20	20
25	10	13	15	16	17	20	21	22	22	23	23	23	23	24	24	24	24	24	24	24	24	24	24	24	24	25	25	25
30	12	15	17	18	20	23	24	26	26	27	27	27	29	28	28	28	28	28	28	29	29	29	29	29	29	29	30	30
35	13	16	19	20	22	26	28	29	30	31	31	32	32	32	32	33	33	33	33	33	33	33	33	33	34	34	34	34
40	14	18	20	22	24	28	31	33	34	34	35	36	36	36	37	37	37	37	37	38	38	38	38	38	39	39	39	39
45	15	19	22	24	26	31	34	36	37	38	39	40	40	40	41	41	41	42	42	42	42	42	42	42	43	44	44	44
50	16	21	24	26	28	34	37	39	41	42	43	43	44	44	45	45	46	46	46	46	46	47	47	47	48	48	49	49
60	18	23	27	30	32	39	43	46	48	49	50	51	52	52	53	53	54	54	54	55	55	55	56	56	57	58	58	58
70	19	25	28	33	35	44	48	52	54	56	57	58	59	60	61	61	62	62	63	63	63	64	64	64	66	67	68	68
80	21	28	32	36	39	48	54	57	60	62	64	65	66	67	68	69	70	70	71	71	72	72	72	73	75	76	77	77
90	22	30	35	38	42	52	58	63	66	68	70	72	73	75	76	76	77	78	78	79	80	80	80	81	84	85	86	86
100	24	31	37	41	45	56	63	68	72	74	77	79	80	82	83	84	85	86	86	87	88	88	88	89	92	94	95	96
120	26	35	41	46	50	64	72	78	82	86	89	91	93	95	96	98	99	100	101	102	103	104	104	105	109	111	113	114
140	28	38	45	51	55	71	80	87	92	97	100	103	106	108	110	111	113	114	115	116	117	118	119	120	125	129	130	132
160	30	41	49	55	60	77	88	96	102	107	111	114	117	120	122	124	126	128	129	130	132	133	134	135	142	145	148	150
180	33	44	52	59	64	83	96	104	111	117	122	125	129	132	134	137	139	141	142	144	145	147	148	149	157	162	165	167
200	34	47	56	63	69	89	102	112	120	126	131	136	140	143	146	149	151	153	155	157	159	160	162	163	172	178	182	184
220	36	50	59	66	73	95	109	120	128	135	141	146	150	154	157	160	163	166	168	170	172	174	175	177	187	194	198	201
240	38	52	62	70	77	100	116	127	136	144	150	156	160	165	168	172	175	178	180	182	184	186	188	190	202	209	214	218
260	40	54	65	73	80	106	122	134	144	152	159	165	170	175	179	183	186	189	192	194	197	199	201	203	217	225	230	235
280	41	57	68	77	84	110	128	141	152	161	168	174	180	185	189	193	197	200	203	206	209	211	213	216	231	240	246	251
300	43	59	70	80	88	115	134	148	159	168	176	183	189	195	199	204	208	211	215	218	220	223	226	228	245	255	262	267
340	46	63	76	86	94	125	145	161	173	184	193	200	207	214	219	224	228	233	236	240	243	246	249	252	272	284	292	299
380	49	67	80	91	100	133	156	173	187	198	208	217	224	231	238	243	248	253	257	261	265	269	272	275	298	312	322	330
420	52	71	85	96	106	142	166	184	199	212	223	232	241	249	255	262	267	273	278	282	286	290	294	297	323	340	351	360
460	54	74	90	102	112	150	175	195	212	225	237	247	257	265	272	279	286	292	297	302	307	311	315	319	348	367	380	390
500	56	78	94	106	117	157	185	206	223	238	251	262	272	281	289	297	304	310	316	321	326	331	336	340	372	393	408	419

(continued)

TABLE 40 (CONCLUDED)

GRADIENT WIND

TABLE 40 C.—Anticyclonic curvature

V_g \ rf	.006	.007	.008	.009	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.30	.40	.50	.60
5	8	7	6	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10						12	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
15						21	18	17	16	16	16	16	16	16	16	16	16	16	15	15	15	15	15	15	15	15	15	15
20							26	24	23	22	22	22	21	21	21	21	21	21	21	21	21	21	21	21	20	20	20	20
25							39	32	30	29	28	28	27	27	27	27	26	26	26	26	26	26	26	26	26	25	25	25
30								43	38	36	35	34	34	33	33	32	32	32	32	32	32	32	31	31	31	31	30	30
35								60	48	44	42	41	40	39	39	38	38	38	38	37	37	37	37	37	36	36	36	36
40									60	53	50	48	47	46	45	45	44	44	44	43	43	43	43	42	42	41	41	41
45										64	59	56	54	53	52	51	50	50	50	49	49	49	48	48	47	46	46	46
50										79	69	64	62	60	59	58	57	56	56	55	55	55	54	54	52	52	52	51
60											98	85	80	76	74	72	71	70	69	68	67	67	66	66	63	63	62	62
70												120	102	95	91	88	86	84	83	82	81	80	79	79	75	74	73	72
80													144	120	111	106	102	100	98	96	95	94	92	92	87	85	84	83
90															138	128	122	117	114	112	110	108	107	105	99	96	95	94
100																157	145	138	132	129	126	124	122	120	112	108	106	105
120																		197	180	170	164	159	155	152	138	132	129	128
140																				240	217	205	196	190	165	157	153	151
160																						288	255	240	195	183	178	174
180																									228	211	203	198
200																									265	240	229	223
220																									308	271	257	249
240																									360	304	285	275
260																									436	340	315	302
280																										381	347	331
300																										426	380	360
340																										550	455	423
380																											545	492
420																											668	571
460																												664
500																												786

NOTE.—The critical value of V in the anticyclonic case is defined as that value of V for which the radical in equation (2) is equal to zero.

Values of V are tabulated only when they are less than the critical value. For imaginary values of equation (2) no gradient wind can be specified; if such a condition existed, the wind would not flow along the isobars. At the critical value of V, the following apply:

$$V_{critical} = 2V_g$$

$$(rf)_{critical} = -\frac{V_g}{900}$$

TABLE 41

CORIOLIS PARAMETER AND LATITUDINAL VARIATION

Latitude	$2\omega \sin \phi$ sec.$^{-1}$	$\beta = (2\omega \cos \phi)/R$ cm.$^{-1}$ sec.$^{-1}$	Latitude	$2\omega \sin \phi$ sec.$^{-1}$	$\beta = (2\omega \cos \phi)/R$ cm.$^{-1}$ sec.$^{-1}$
0°	0	2.289×10^{-13}	50°	1.1172×10^{-4}	1.471×10^{-13}
5	0.1271×10^{-4}	2.280	55	1.1947	1.313
10	.2533	2.254	60	1.2630	1.145
15	.3775	2.211	65	1.3218	0.967
20	.4988	2.151	70	1.3705	.783
25	0.6164×10^{-4}	2.075×10^{-13}	75	1.4087×10^{-4}	0.593×10^{-13}
30	.7292	1.982	80	1.4363	.398
35	.8365	1.875	85	1.4529	.199
40	.9375	1.754	90	1.4584	0
45	1.0313	1.619			

$2\omega \sin \phi$ = coriolis parameter.
ϕ = latitude.
ω = angular velocity of the earth = 7.292116×10^{-5} rad. sec.$^{-1}$
R = radius of the earth = 6.371229×10^{6} m. (mean radius of the International ellipsoid).
$\beta = (2\omega \cos \phi)/R$ = rate at which the coriolis parameter increases northward.*

NOTE.—$2\omega \cos \phi = 2\omega \sin (90-\phi)$.

* Rossby, C.-G., Journn. Mar. Res., vol. 2, pp. 38-55, 1939.

TABLE 42

INERTIAL MOTION

The radius of curvature of the path of a particle moving horizontally with a velocity u and acted upon only by the apparent forces due to the rotation of the earth is $u/2\omega \sin \phi$. As $u \rightarrow 0$ the inertia circle approaches a point and the limiting period T required for the particle to rotate about this inertia circle centered at latitude ϕ is one-half the length of the pendulum day, i.e., T = sidereal day/2 sin ϕ = 23.93447/2 sin ϕ hours.

Lat.	Period (½ pendulum day) hours	Radius of curvature — Wind speed—meters per second: 5 km.	10 km.	15 km.	20 km.	25 km.	30 km.	35 km.	40 km.	50 km.	60 km.	70 km.	80 km.	90 km.	100 km.
5°	137.3	393	787	1180	1574	1967	2360	2754	3147	3934	4721	5507	6294	7081	7868
10	68.91	197	395	592	790	987	1184	1382	1579	1974	2369	2764	3158	3553	3948
15	46.24	132	265	397	530	662	795	927	1060	1325	1589	1854	2119	2384	2649
20	34.99	100	200	301	401	501	601	702	802	1002	1203	1403	1604	1804	2005
25	28.32	81.1	162	243	324	406	487	568	649	811	973	1136	1298	1460	1622
30	23.93	68.6	137	206	274	343	411	480	549	686	823	960	1097	1234	1371
35	20.86	59.8	120	179	239	299	359	418	478	598	717	837	956	1076	1195
40	18.62	53.3	107	160	213	267	320	373	427	533	640	747	853	960	1067
45	16.92	48.5	97.0	145	194	242	291	339	388	485	582	679	776	873	970
50	15.62	44.8	89.5	134	179	224	269	313	358	448	537	627	716	806	895
55	14.61	41.9	83.7	126	167	209	251	293	335	419	502	586	670	753	837
60	13.82	39.6	79.2	119	158	198	238	277	317	396	475	554	633	713	792
65	13.20	37.8	75.7	113	151	189	227	265	303	378	454	530	605	681	757
70	12.74	36.5	73.0	109	146	182	219	255	292	365	438	511	584	657	730
75	12.39	35.5	71.0	106	142	177	213	248	284	355	426	497	568	639	710
80	12.15	34.8	69.6	104	139	174	209	244	278	348	418	487	557	627	696
85	12.01	34.4	68.8	103	138	172	206	241	275	344	413	482	551	619	688
90	11.97	34.3	68.6	103	137	171	206	240	274	343	411	480	549	617	686

ROSSBY'S LONG-WAVE FORMULA

Rossby[1] has shown that in the case of sinusoidal perturbations on a zonal current in an ideal, frictionless, homogeneous, and incompressible atmosphere in horizontal motion, the relation between the velocity of the undisturbed zonal current U and the phase velocity of the perturbation c is given by:

$$U - c = \frac{\beta L^2}{4\pi^2}$$

where β is the rate at which the coriolis parameter increases northward (assumed to be constant with latitude for a given zonal current) and L is the wave length of the perturbation. L is most conveniently measured in terms of degrees of longitude at the latitude in question.[2] Similarly the resulting $\beta L^2/(4\pi^2)$ is measured in terms of degrees of longitude per 24 hours; a supplemental column also gives the result in meters per second.

Latitude	Wave length—degrees of longitude											
	10		15		20		25		30		35	
	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹
10°	0.5	0.7	1.2	1.5	2.2	2.7	3.4	4.3	4.9	6.2	6.6	8.4
20	0.5	0.6	1.1	1.3	2.0	2.4	3.1	3.7	4.4	5.4	6.0	7.3
30	0.4	0.5	0.9	1.1	1.7	1.9	2.6	2.9	3.8	4.2	5.1	5.7
40	0.3	0.3	0.7	0.7	1.3	1.3	2.0	2.0	3.0	2.9	4.0	4.0
50	0.2	0.2	0.5	0.4	0.9	0.8	1.4	1.2	2.1	1.7	2.8	2.3
60	0.1	0.1	0.3	0.2	0.6	0.4	0.9	0.6	1.3	0.8	1.7	1.1
70	0.1	0.0	0.1	0.1	0.3	0.1	0.4	0.2	0.6	0.3	0.8	0.4
80	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.2	0.0

Latitude	Wave length—degrees of longitude											
	40		45		50		55		60		65	
	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹
10°	8.7	11.0	11.0	13.9	13.5	17.2	16.4	20.8	19.5	24.7	22.9	29.0
20	7.9	9.5	10.0	12.1	12.3	14.9	14.9	18.0	17.7	21.5	20.8	25.2
30	6.7	7.5	8.5	9.5	10.5	11.7	12.7	14.1	15.1	16.8	17.7	19.7
40	5.2	5.2	6.6	6.6	8.2	8.1	9.9	9.8	11.8	11.7	13.8	13.7
50	3.7	3.1	4.7	3.9	5.8	4.8	7.0	5.8	8.3	6.9	9.8	8.1
60	2.2	1.4	2.8	1.8	3.5	2.3	4.2	2.7	5.0	3.3	5.9	3.8
70	1.0	0.5	1.3	0.6	1.6	0.7	2.0	0.9	2.4	1.0	2.8	1.2
80	0.3	0.1	0.3	0.1	0.4	0.1	0.5	0.1	0.6	0.1	0.7	0.2

Latitude	Wave length—degrees of longitude											
	70		75		80		85		90		100	
	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹
10°	26.5	33.6	30.4	38.6	34.6	43.9	39.1	49.6	43.8	55.6	54.1	68.6
20	24.1	29.2	27.7	33.6	31.5	38.2	35.6	43.1	39.9	48.3	49.3	59.7
30	20.5	22.9	23.5	26.3	26.8	29.9	30.2	33.8	33.9	37.9	41.9	46.7
40	16.1	15.9	18.4	18.2	21.0	20.7	23.7	23.4	26.6	26.2	32.8	32.4
50	11.3	9.4	13.0	10.8	14.8	12.3	16.7	13.8	18.7	15.5	23.1	19.2
60	6.9	4.4	7.9	5.1	8.9	5.8	10.1	6.5	11.3	7.3	14.0	9.0
70	3.2	1.4	3.7	1.6	4.2	1.9	4.7	2.1	5.3	2.3	6.6	2.9
80	0.8	0.2	1.0	0.2	1.1	0.2	1.2	0.3	1.4	0.3	1.7	0.4

Latitude	Wave length—degrees of longitude											
	110		120		130		140		160		180	
	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹	°long. 24 hr.	m. sec.⁻¹
10°	65.4	83.0	77.9	98.8	91.4	116.0	106.0	134.5	138.5	175.7	175.3	222.4
20	59.6	72.2	70.9	85.9	83.2	100.8	96.5	116.9	126.1	152.7	159.6	193.3
30	50.7	56.6	60.3	67.3	70.7	79.0	82.0	91.6	107.2	119.6	135.6	151.4
40	39.7	39.2	47.2	46.7	55.4	54.8	64.2	63.5	83.9	83.0	106.2	105.0
50	27.9	23.2	33.2	27.6	39.0	32.4	45.2	37.5	59.1	49.0	74.8	62.1
60	16.9	10.9	20.1	13.0	23.6	15.3	27.4	17.7	35.8	23.1	45.3	29.3
70	7.9	3.5	9.4	4.2	11.1	4.9	12.8	5.7	16.8	7.4	21.2	9.4
80	2.0	0.5	2.4	0.5	2.9	0.6	3.3	0.7	4.3	1.0	5.5	1.2

[1] Rossby, C.-G., Journ. Mar. Res., vol. 2, pp. 38-55, 1939.
[2] The length of a degree of longitude at various latitudes is given in Table 163.

Section III

BAROMETRIC AND HYPSOMETRIC TABLES

Table 44

CAPILLARY CORRECTION FOR MERCURIAL BAROMETERS[1]

Table 44 is adopted from Glazebrook[2] and gives the depression of the top of the meniscus of the mercury column in barometer and other glass tubes, based on a surface tension of mercury, in vacuo, in contact with glass of 0.444 gram per centimeter. It should be noted that little information is available concerning the surface tension of mercury in the average barometer tube. Its value is likely to differ from the value given, owing to impurities in the mercury and variations in the composition and cleanliness of the glass.

Height of meniscus	Bore of tube—millimeters															
	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0.1	1.3	0.5	0.3	0.18	0.11	0.08	0.06	0.05	0.03	0.02	0.01	0.01				
0.2	2.5	1.1	0.6	0.36	0.23	0.16	0.12	0.09	0.06	0.03	0.02	0.01	0.01	0.01		
0.3	3.5	1.6	0.8	0.54	0.35	0.24	0.18	0.14	0.09	0.05	0.03	0.02	0.01	0.01		
0.4	4.4	2.1	1.1	0.73	0.47	0.33	0.24	0.18	0.12	0.07	0.04	0.02	0.02	0.01	0.01	
0.5	5.2	2.5	1.4	0.90	0.59	0.41	0.30	0.23	0.15	0.08	0.05	0.03	0.02	0.02	0.01	
0.6	5.9	2.9	1.7	1.06	0.71	0.48	0.35	0.27	0.18	0.10	0.06	0.04	0.03	0.02	0.01	
0.7		3.2	1.9	1.20	0.81	0.56	0.41	0.31	0.21	0.11	0.07	0.04	0.03	0.02	0.01	
0.8		3.4	2.1	1.34	0.91	0.63	0.46	0.35	0.24	0.13	0.08	0.05	0.04	0.02	0.01	
0.9		3.6	2.2	1.45	0.99	0.70	0.51	0.38	0.27	0.15	0.09	0.06	0.04	0.03	0.01	0.01
1.0		3.7	2.4	1.55	1.08	0.76	0.55	0.41	0.30	0.16	0.10	0.06	0.04	0.03	0.02	0.01
1.1			2.5	1.66	1.15	0.81	0.59	0.44	0.33	0.18	0.10	0.07	0.05	0.03	0.02	0.01
1.2			2.6	1.76	1.21	0.86	0.63	0.47	0.35	0.20	0.11	0.07	0.05	0.04	0.02	0.01
1.3					1.26	0.91	0.67	0.50	0.37	0.21	0.12	0.08	0.06	0.04	0.02	0.01
1.4					1.30	0.96	0.70	0.53	0.40	0.22	0.13	0.09	0.06	0.04	0.02	0.01
1.5					1.34	1.00	0.74	0.55	0.42	0.24	0.14	0.09	0.07	0.05	0.02	0.01
1.6					1.37	1.03	0.77	0.57	0.44	0.25	0.15	0.10	0.07	0.05	0.02	0.01
1.7					1.40	1.06	0.80	0.59	0.46	0.26	0.16	0.10	0.07	0.05	0.02	0.01
1.8					1.43	1.08	0.82	0.61	0.47	0.27	0.17	0.11	0.08	0.06	0.03	0.01
1.9					1.46	1.10	0.84	0.63	0.48	0.28	0.18	0.12	0.08	0.06	0.03	0.01
2.0					1.48	1.12	0.85	0.64	0.49	0.29	0.19	0.12	0.09	0.06	0.03	0.01

[1] In the practice of most meteorological services, including the U. S. Weather Bureau, the capillary correction is included in the corrections furnished with the barometer as determined by comparison with a "standard" barometer. The corrections given in Table 44 should not be applied in such cases.

[2] Glazebrook, R., Dictionary of applied physics, vol. 3, p. 159, Macmillan and Co., Ltd., London, 1923.

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

The indicated height of the mercurial column in a barometer or manometer varies not only with changes of atmospheric pressure, but also with variations of the temperature of the mercury and of the scale. It is evident therefore that if the height of the barometric column is to be a true relative measure of atmospheric pressure, the observed readings must be reduced to the values they would have if the mercury and brass scale were maintained at a constant standard temperature. This reduction is known as the reduction for temperature, and combines both the correction for the expansion of the mercury and that for the expansion of the scale, on the assumption that the attached thermometer gives the temperature both of the mercury and of the scale.

The freezing point of water is universally adopted as the standard temperature of the mercury, to which all readings are to be reduced. The temperature to which the scale is reduced is the normal or standard temperature of the adopted standard of length. For English scales, which depend upon the English yard, this is 62° Fahrenheit. For metric scales, which depend upon the meter, it is 0° centigrade. As thus reduced, observations made with English and metric barometers become perfectly comparable when converted by the ordinary tables or linear conversion, inches to millimeters and millimeters to inches (Tables 13 and 14), for these conversions refer to the meter at 0° centigrade and the English yard at 62° Fahrenheit.

Professor Marvin [1] has pointed out the necessity of caution in conversion of metric and English barometer readings.

Example:

Attached thermometer, 25.4° C.
Barometer reading, 762.15 mm.

If the temperature is converted to Fahrenheit, 77.7°, and the reading to 30.006 in., the temperature correction according to Table 45 would be −0.133 inch and the reduced reading 29.873. *This would be erroneous.* The correct conversion is found by taking the correction corresponding to 25.4° C. and 762 mm., i.e., −3.15 mm., which gives a corrected reading of 759 mm., and converted into inches gives 29.882 which is the correct result.

Professor Marvin further remarks that circumstances sometimes arise in which a centigrade thermometer may be used to determine the temperature of an English barometer, or a Fahrenheit attached thermometer may be used with a metric scale. In all such cases the temperature must be brought into the same system of units as the observed-scale reading before corrections can be applied, and the observed reading must then be corrected for temperature before any conversion can be made.

With aneroid barometers corrections for temperature and instrumental error must be determined for each instrument.

The general formula for reducing Fortin-type mercurial barometers with brass scales to the standard temperature is

$$C = -B\frac{m(t - t_{hg}) - l(t - t_s)}{1 + m(t - t_{hg})} \qquad (1)$$

where

C = correction for temperature,
B = observed height of the barometric column,
t = temperature of the attached thermometer,
t_{hg} = standard temperature of the mercury,
m = coefficient of expansion of mercury,
l = coefficient of linear expansion of brass,
t_s = standard temperature of the scale.

See below for application to fixed-cistern barometers.

The accepted determination of the coefficient of expansion of mercury is that given by Broch's reduction of Regnault's experiments

$$m = 10^{-9}\,(181792 + 0.175t + 0.035116t^2)\ {}^\circ\mathrm{C.}^{-1} \qquad (2)$$

As a sufficiently accurate approximation, the intermediate value $m = 0.0001818$ has been adopted uniformly for all temperatures in conformity with the usage of the International Meteorological Tables.

Various specimens of brass scales made of alloys of different composition show differences in their coefficients of expansion amounting to 8 and sometimes 10 percent of the total amount. For the sake of uniformity with the International Meteorological Tables, the value $l = 0.0000184$ has been used in the present volume.

[1] Marvin, C. F., Month. Weath. Rev., vol. 26, p. 302, 1898.

(*Continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Millimeter or millibar barometers.—For millimeter or millibar barometers (Fortin type) the formula for reducing observed readings to the standard temperature, 0° C., becomes

$$C = -B\frac{(m-l)t}{1+mt} \qquad (3)$$

in which C and B are expressed in the same units and t is in centigrade degrees.

For temperatures above 0° centigrade the correction is *negative,* and hence is to be subtracted from the observed readings.

For temperatures below 0° centigrade the correction is *positive,* and from 0° C. down to − 20° C. the numerical values thereof, for ordinary barometric work, do not materially differ from the values for the corresponding temperatures above 0° C. Thus the correction for − 9° C. is *numerically* the same as for + 9° C. and is taken from the table. In physical work of extreme precision, the numerical values given for positive temperatures may be used for temperatures below 0° C. by applying to them the following corrections:

Corrections to be applied to the tabular values of Table 46 in order to use them when the temperature of the attached thermometer is below 0° centigrade

Temperature °C.	Pressure—mm. or mb. 450	500	550	600	650	700	750	800
− 1°	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
− 9	.00	.00	.00	.00	.00	.00	.00	.00
−10	0.00	0.00	0.00	0.00	0.00	+0.01	+0.01	+0.01
−11	.00	.00	.00	.00	+0.01	.01	.01	.01
−12	.00	.00	.00	+0.01	.01	.01	.01	.01
−13	.00	.00	+0.01	.01	.01	.01	.01	.01
−14	.00	+0.01	.01	.01	.01	.01	.01	.01
−15	+0.01	+0.01	+0.01	+0.01	+0.01	+0.01	+0.01	+0.01
−16	.01	.01	.01	.01	.01	.01	.01	.01
−17	.01	.01	.01	.01	.01	.01	.01	.02
−18	.01	.01	.01	.01	.01	.01	.01	.02
−19	.01	.01	.01	.01	.01	.01	.02	.02
−20	+0.01	+0.01	+0.01	+0.01	+0.01	+0.02	+0.02	+0.02
−21	.01	.01	.01	.02	.02	.02	.02	.02
−22	.01	.01	.02	.02	.02	.02	.02	.02
−23	.01	.02	.02	.02	.02	.02	.02	.02
−24	.01	.02	.02	.02	.02	.02	.02	.03

English barometers.—For English barometers (Fortin type) the formula for reducing observed readings to a standard temperature becomes

$$C = -B\frac{m(t-32°)-l(t-62°)}{1+m(t-32°)} \qquad (4)$$

where

C = correction for temperature in inches,
B = observed height of the barometer in inches,
t = temperature of attached thermometer in degrees Fahrenheit,
$m = 0.0001818 \times \frac{5}{9} = 0.000101,$
$l = 0.0000184 \times \frac{5}{9} = 0.0000102.$

The combined reduction of the mercury to the freezing point and of the scale to 62° Fahrenheit brings the point of no correction to approximately 28.5° Fahrenheit. For temperatures above 28.5° Fahrenheit, the correction is subtractive, and for temperatures below 28.5° Fahrenheit, the correction is additive, as indicated by the signs (+) and (−) inserted throughout the table.

(*Continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Fixed-cistern barometers.[2]—Many commercial millimeter and millibar mercurial barometers make use of a cistern of relatively large cross section in which the level of the mercury changes by an amount which is small compared with the change of level in the tube. Readings are made on the mercury level in the tube only, and the level in the cistern inferred from that in the tube.

The temperature correction for these barometers is usually somewhat larger than for the Fortin-type barometers. If all dimensions and materials of the barometer are known, it might be possible to calculate this correction. It is usually preferable to determine the temperature correction experimentally by calibrations at two or more temperatures. It has been found to be possible to obtain sufficient accuracy by using the temperature correction tables prepared for the Fortin barometer by entering them with the quantity $B + k$ where B is the height of the mercury column above the level in the cistern and k is a quantity characteristic of the design of the barometer.

In the absence of a temperature test the cistern constant k of a barometer with a metal cistern can be estimated with an uncertainty of 20 percent by the formula

$$k = \frac{3V}{4A} \qquad (5)$$

where

V = total volume of mercury in the barometer,
A = sum of the horizontal cross-section area of the cistern and of the horizontal cross-section area of the tube at the top of the mercury column.

Both A and V are to be measured in terms of the units of the barometer scale itself.

The gravity correction for these barometers is the same as for the Fortin barometer.

The scale interval of these barometers is often modified so that there will be no correction when the instrument is at some specified temperature and gravity. In this case the correction to be applied is the difference between the usual correction for the ambient temperature and gravity and that for the temperature and gravity for which the barometer is calibrated.

Table 46 has been extended to 1200 units in order that the method outlined above may be used for fixed-cistern millibar barometers.

U-shaped manometers.—The corrections for temperature given in Tables 45 and 46 are equally applicable to U-shaped mercurial manometers having brass scales calibrated in metric or English units respectively. In this case the "height of the mercury column" is the difference in height between the two arms of the manometer. Tables 45 and 46 are extended to include corrections for the smaller heights usually encountered in working with manometers.

[2] National Bureau of Standards, private communication, April 7, 1949.

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer	Height of the mercury column—inches									
	1	2	3	4	5	6	7	8	9	10
°F.	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
0	+0.003	+0.005	+0.008	+0.010	+0.013	+0.016	+0.018	+0.021	+0.023	+0.026
2	+0.002	+0.005	+0.007	+0.010	+0.012	+0.015	+0.017	+0.019	+0.022	+0.024
4	.002	.004	.007	.009	.011	.013	.016	.018	.020	.022
6	.002	.004	.006	.008	.010	.012	.015	.017	.019	.021
8	.002	.004	.006	.008	.009	.011	.013	.015	.017	.019
10	.002	.003	.005	.007	.008	.010	.012	.014	.015	.017
12	+0.002	+0.003	+0.005	+0.006	+0.008	+0.009	+0.011	+0.012	+0.014	+0.015
14	.001	.003	.004	.005	.007	.008	.009	.011	.012	.013
16	.001	.002	.003	.005	.006	.007	.008	.009	.010	.012
18	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
20	.001	.002	.002	.003	.004	.005	.006	.006	.007	.008
22	+0.001	+0.001	+0.002	+0.002	+0.003	+0.004	+0.004	+0.005	+0.005	+0.006
24	.000	.001	.001	.002	.002	.002	.003	.003	.004	.004
26	.000	+.001	+.001	+.001	+.001	+.001	+.002	.002	.002	.003
28	.000	.000	.000	.000	.000	.000	.000	+.001	+.001	+.001
30	.000	.000	.000	−.001	−.001	−.001	−.001	−.001	−.001	−.001
32	0.000	−0.001	−0.001	−0.001	−0.002	−0.002	−0.002	−0.003	−0.003	−0.003
34	−.001	.001	.002	.002	.003	.003	.004	.004	.005	.005
36	.001	.001	.002	.003	.003	.004	.005	.005	.006	.007
38	.001	.002	.003	.003	.004	.005	.006	.007	.008	.008
40	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
42	−0.001	−0.002	−0.004	−0.005	−0.006	−0.007	−0.009	−0.010	−0.011	−0.012
44	.001	.003	.004	.006	.007	.008	.010	.011	.012	.014
46	.002	.003	.005	.006	.008	.009	.011	.013	.014	.016
48	.002	.004	.005	.007	.009	.011	.012	.014	.016	.018
50	.002	.004	.006	.008	.010	.012	.014	.016	.018	.019
52	−0.002	−0.004	−0.006	−0.008	−0.011	−0.013	−0.015	−0.017	−0.019	−0.021
54	.002	.005	.007	.009	.011	.014	.016	.018	.021	.023
56	.002	.005	.007	.010	.012	.015	.017	.020	.022	.025
58	.003	.005	.008	.011	.013	.016	.019	.021	.024	.027
60	.003	.006	.008	.011	.014	.017	.020	.023	.025	.028
62	−0.003	−0.006	−0.009	−0.012	−0.015	−0.018	−0.021	−0.024	−0.027	−0.030
64	.003	.006	.010	.013	.016	.019	.022	.026	.029	.032
66	.003	.007	.010	.014	.017	.020	.024	.027	.031	.034
68	.004	.007	.011	.014	.018	.021	.025	.028	.032	.036
70	.004	.007	.011	.015	.019	.022	.026	.030	.034	.037
72	−0.004	−0.008	−0.012	−0.016	−0.020	−0.024	−0.027	−0.031	−0.035	−0.039
74	.004	.008	.012	.016	.020	.025	.029	.033	.037	.041
76	.004	.009	.013	.017	.021	.026	.030	.034	.038	.043
78	.004	.009	.013	.018	.022	.027	.031	.036	.040	.045
80	.005	.009	.014	.019	.023	.028	.032	.037	.042	.046
82	−0.005	−0.010	−0.014	−0.019	−0.024	−0.029	−0.034	−0.039	−0.043	−0.048
84	.005	.010	.015	.020	.025	.030	.035	.040	.045	.050
86	.005	.010	.016	.021	.026	.031	.036	.042	.047	.052
88	.005	.011	.016	.021	.027	.032	.037	.043	.048	.053
90	.006	.011	.017	.022	.028	.033	.039	.044	.050	.055
92	−0.006	−0.011	−0.017	−0.023	−0.029	−0.034	−0.040	−0.046	−0.052	−0.057
94	.006	.012	.018	.024	.030	.035	.041	.047	.053	.059
96	.006	.012	.018	.024	.030	.036	.043	.049	.055	.061
98	.006	.013	.019	.025	.031	.038	.044	.050	.056	.063
100	.006	.013	.019	.026	.032	.039	.045	.051	.058	.064

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 11 inch	12 inch	13 inch	14 inch	15 inch	16 inch	17 inch	18 inch	19 inch	20 inch
0	+0.029	+0.031	+0.034	+0.037	+0.039	+0.042	+0.044	+0.047	+0.050	+0.052
2	+0.027	+0.029	+0.031	+0.034	+0.036	+0.039	+0.041	+0.044	+0.046	+0.049
4	.025	.027	.029	.031	.033	.036	.038	.040	.043	.045
6	.023	.025	.027	.029	.031	.033	.035	.037	.039	.041
8	.021	.023	.025	.026	.028	.030	.032	.034	.036	.038
10	.019	.020	.022	.024	.025	.027	.029	.031	.032	.034
12	+0.017	+0.018	+0.020	+0.021	+0.023	+0.024	+0.026	+0.027	+0.029	+0.030
14	.015	.016	.017	.018	.020	.021	.023	.024	.025	.027
16	.013	.014	.015	.016	.017	.019	.020	.021	.022	.023
18	.011	.012	.013	.014	.015	.016	.016	.017	.018	.019
20	.009	.009	.010	.011	.012	.013	.013	.014	.015	.016
22	+0.007	+0.007	+0.008	+0.008	+0.009	+0.010	+0.010	+0.011	+0.011	+0.012
24	.005	.005	.006	.006	.006	.007	.007	.008	.008	.008
26	.003	.003	.003	.004	.004	.004	.004	.004	.005	.005
28	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001	+.001
30	−0.001	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
32	−0.003	−0.004	−0.004	−0.004	−0.005	−0.005	−0.005	−0.006	−0.006	−0.006
34	.005	.006	.007	.007	.008	.008	.008	.009	.009	.010
36	.007	.008	.009	.009	.010	.011	.011	.012	.013	.013
38	.009	.010	.011	.012	.013	.014	.014	.015	.016	.017
40	.011	.012	.013	.015	.016	.017	.018	.019	.020	.021
42	−0.013	−0.015	−0.016	−0.017	−0.018	−0.020	−0.021	−0.022	−0.023	−0.024
44	.015	.017	.018	.019	.021	.022	.024	.025	.026	.028
46	.017	.019	.020	.022	.024	.025	.027	.028	.030	.031
48	.019	.021	.023	.025	.026	.028	.030	.032	.033	.035
50	.021	.023	.025	.027	.029	.031	.033	.035	.037	.039
52	−0.023	−0.025	−0.027	−0.030	−0.032	−0.034	−0.036	−0.038	−0.040	−0.042
54	.025	.028	.030	.032	.034	.037	.039	.041	.044	.046
56	.027	.030	.032	.035	.037	.040	.042	.045	.047	.050
58	.029	.032	.035	.037	.040	.043	.045	.048	.051	.053
60	.031	.034	.037	.040	.042	.045	.048	.051	.054	.057
62	−0.033	−0.036	−0.039	−0.042	−0.045	−0.048	−0.051	−0.054	−0.057	−0.060
64	.035	.038	.042	.045	.048	.051	.054	.058	.061	.064
66	.037	.041	.044	.048	.051	.054	.057	.061	.064	.068
68	.039	.043	.046	.050	.053	.057	.061	.064	.068	.071
70	.041	.045	.049	.052	.056	.060	.064	.067	.071	.075
72	−0.043	−0.047	−0.051	−0.055	−0.059	−0.063	−0.067	−0.071	−0.075	−0.078
74	.045	.049	.053	.057	.061	.065	.070	.074	.078	.082
76	.047	.051	.056	.060	.064	.068	.073	.077	.081	.086
78	.049	.054	.058	.062	.067	.071	.076	.080	.085	.089
80	.051	.056	.060	.065	.070	.074	.079	.084	.088	.093
82	−0.053	−0.058	−0.063	−0.067	−0.072	−0.077	−0.082	−0.087	−0.092	−0.096
84	.055	.060	.065	.070	.075	.080	.085	.090	.095	.100
86	.057	.062	.067	.073	.078	.083	.088	.093	.098	.104
88	.059	.064	.070	.075	.080	.086	.091	.096	.102	.107
90	.061	.066	.072	.078	.083	.089	.094	.100	.105	.111
92	−0.063	−0.069	−0.074	−0.080	−0.086	−0.092	−0.097	−0.103	−0.109	−0.114
94	.065	.071	.077	.083	.089	.095	.100	.106	.112	.118
96	.067	.073	.079	.085	.091	.097	.103	.109	.115	.122
98	.069	.075	.081	.088	.094	.100	.106	.113	.119	.125
100	.071	.077	.084	.090	.097	.103	.109	.116	.122	.129

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	19.0 inch	19.5 inch	20.0 inch	20.5 inch	21.0 inch	21.5 inch	22.0 inch	22.5 inch	23.0 inch	23.5 inch
	Height of the mercury column—inches									
0.0	+0.050	+0.051	+0.052	+0.053	+0.055	+0.056	+0.057	+0.059	+0.060	+0.061
.5	+0.049	+0.050	+0.051	+0.053	+0.054	+0.055	+0.056	+0.058	+0.059	+0.060
1.0	.048	.049	.050	.052	.053	.054	.055	.057	.058	.059
1.5	.047	.048	.049	.051	.052	.053	.054	.056	.057	.058
2.0	.046	.047	.049	.050	.051	.052	.053	.055	.056	.057
2.5	.045	.046	.048	.049	.050	.051	.052	.054	.055	.056
3.0	+0.044	+0.046	+0.047	+0.048	+0.049	+0.050	+0.051	+0.053	+0.054	+0.055
3.5	.043	.045	.046	.047	.048	.049	.050	.051	.053	.054
4.0	.043	.044	.045	.046	.047	.048	.049	.050	.052	.053
4.5	.042	.043	.044	.045	.046	.047	.048	.049	.051	.052
5.0	.041	.042	.043	.044	.045	.046	.047	.048	.049	.051
5.5	+0.040	+0.041	+0.042	+0.043	+0.044	+0.045	+0.046	+0.047	+0.048	+0.049
6.0	.039	.040	.041	.042	.043	.044	.045	.046	.047	.048
6.5	.038	.039	.040	.041	.042	.043	.044	.045	.046	.047
7.0	.037	.038	.039	.040	.041	.042	.043	.044	.045	.046
7.5	.037	.038	.038	.039	.040	.041	.042	.043	.044	.045
8.0	+0.036	+0.037	+0.038	+0.038	+0.039	+0.040	+0.041	+0.042	+0.043	+0.044
8.5	.035	.036	.037	.038	.038	.039	.040	.041	.042	.043
9.0	.034	.035	.036	.037	.038	.038	.039	.040	.041	.042
9.5	.033	.034	.035	.036	.037	.037	.038	.039	.040	.041
10.0	.032	.033	.034	.035	.036	.036	.037	.038	.039	.040
10.5	+0.031	+0.032	+0.033	+0.034	+0.035	+0.035	+0.036	+0.037	+0.038	+0.039
11.0	.030	.031	.032	.033	.034	.034	.035	.036	.037	.038
11.5	.030	.030	.031	.032	.033	.034	.034	.035	.036	.037
12.0	.029	.030	.030	.031	.032	.033	.033	.034	.035	.036
12.5	.028	.029	.029	.030	.031	.032	.032	.033	.034	.034
13.0	+0.027	+0.028	+0.028	+0.029	+0.030	+0.031	+0.031	+0.032	+0.033	+0.033
13.5	.026	.027	.028	.028	.029	.030	.030	.031	.032	.032
14.0	.025	.026	.027	.027	.028	.029	.029	.030	.031	.031
14.5	.024	.025	.026	.026	.027	.028	.028	.029	.030	.030
15.0	.024	.024	.025	.025	.026	.027	.027	.028	.029	.029
15.5	+0.023	+0.023	+0.024	+0.024	+0.025	+0.026	+0.026	+0.027	+0.027	+0.028
16.0	.022	.023	.023	.024	.024	.025	.025	.026	.026	.027
16.5	.021	.022	.022	.023	.023	.024	.024	.025	.025	.026
17.0	.020	.021	.021	.022	.022	.023	.023	.024	.024	.025
17.5	.019	.020	.020	.021	.021	.022	.022	.023	.023	.024
18.0	+0.018	+0.019	+0.019	+0.020	+0.020	+0.021	+0.021	+0.022	+0.022	+0.023
18.5	.017	.018	.018	.019	.019	.020	.020	.021	.021	.022
19.0	.017	.017	.018	.018	.018	.019	.019	.020	.020	.021
19.5	.016	.016	.017	.017	.017	.018	.018	.019	.019	.020
20.0	.015	.015	.016	.016	.016	.017	.017	.018	.018	.018
20.5	+0.014	+0.014	+0.015	+0.015	+0.016	+0.016	+0.016	+0.017	+0.017	+0.017
21.0	.013	.014	.014	.014	.015	.015	.015	.016	.016	.016
21.5	.012	.013	.013	.013	.014	.014	.014	.015	.015	.015
22.0	.011	.012	.012	.012	.013	.013	.013	.014	.014	.014
22.5	.011	.011	.011	.011	.012	.012	.012	.013	.013	.013
23.0	+0.010	+0.010	+0.010	+0.010	+0.011	+0.011	+0.011	+0.012	+0.012	+0.012
23.5	.009	.009	.009	.010	.010	.010	.010	.011	.011	.011
24.0	.008	.008	.008	.009	.009	.009	.009	.010	.010	.010
24.5	.007	.007	.008	.008	.008	.008	.008	.009	.009	.009
25.0	.006	.006	.007	.007	.007	.007	.007	.007	.008	.008

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 19.0 inch	19.5 inch	20.0 inch	20.5 inch	21.0 inch	21.5 inch	22.0 inch	22.5 inch	23.0 inch	23.5 inch
25.5	+0.005	+0.006	+0.006	+0.006	+0.006	+0.006	+0.006	+0.006	+0.007	+0.007
26.0	.005	.005	.005	.005	.005	.005	.005	.005	.005	.006
26.5	.004	.004	.004	.004	.004	.004	.004	.004	.004	.005
27.0	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
27.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
28.0	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001
28.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.0	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
29.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
30.0	.002	.002	.002	.003	.003	.003	.003	.003	.003	.003
30.5	−0.003	−0.003	−0.003	−0.003	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004
31.0	.004	.004	.004	.004	.005	.005	.005	.005	.005	.005
31.5	.005	.005	.005	.005	.005	.006	.006	.006	.006	.006
32.0	.006	.006	.006	.006	.006	.007	.007	.007	.007	.007
32.5	.007	.007	.007	.007	.007	.008	.008	.008	.008	.008
33.0	−0.008	−0.008	−0.008	−0.008	−0.008	−0.009	−0.009	−0.009	−0.009	−0.009
33.5	.008	.009	.009	.009	.009	.010	.010	.010	.010	.010
34.0	.009	.010	.010	.010	.010	.010	.011	.011	.011	.011
34.5	.010	.010	.011	.011	.011	.011	.012	.012	.012	.013
35.0	.011	.011	.012	.012	.012	.012	.013	.013	.013	.014
35.5	−0.012	−0.012	−0.012	−0.013	−0.013	−0.013	−0.014	−0.014	−0.014	−0.015
36.0	.013	.013	.013	.014	.014	.014	.015	.015	.015	.016
36.5	.014	.014	.014	.015	.015	.015	.016	.016	.016	.017
37.0	.014	.015	.015	.016	.016	.016	.017	.017	.017	.018
37.5	.015	.016	.016	.017	.017	.017	.018	.018	.019	.019
38.0	−0.016	−0.017	−0.017	−0.017	−0.018	−0.018	−0.019	−0.019	−0.020	−0.020
38.5	.017	.017	.018	.018	.019	.019	.020	.020	.021	.021
39.0	.018	.018	.019	.019	.020	.020	.021	.021	.022	.022
39.5	.019	.019	.020	.020	.021	.021	.022	.022	.023	.023
40.0	.020	.020	.021	.021	.022	.022	.023	.023	.024	.024
40.5	−0.020	−0.021	−0.022	−0.022	−0.023	−0.023	−0.024	−0.024	−0.025	−0.025
41.0	.021	.022	.022	.023	.024	.024	.025	.025	.026	.026
41.5	.022	.023	.023	.024	.025	.025	.026	.026	.027	.027
42.0	.023	.024	.024	.025	.025	.026	.027	.027	.028	.029
42.5	.024	.025	.025	.026	.026	.027	.028	.028	.029	.030
43.0	−0.025	−0.025	−0.026	−0.027	−0.027	−0.028	−0.029	−0.029	−0.030	−0.031
43.5	.026	.026	.027	.028	.028	.029	.030	.030	.031	.032
44.0	.026	.027	.028	.029	.029	.030	.031	.031	.032	.033
44.5	.027	.028	.029	.030	.030	.031	.032	.032	.033	.034
45.0	.028	.029	.030	.030	.031	.032	.033	.033	.034	.035
45.5	−0.029	−0.030	−0.031	−0.031	−0.032	−0.033	−0.034	−0.034	−0.035	−0.036
46.0	.030	.031	.031	.032	.033	.034	.035	.035	.036	.037
46.5	.031	.032	.032	.033	.034	.035	.036	.036	.037	.038
47.0	.032	.032	.033	.034	.035	.036	.037	.037	.038	.039
47.5	.033	.033	.034	.035	.036	.037	.038	.038	.039	.040
48.0	−0.033	−0.034	−0.035	−0.036	−0.037	−0.038	−0.039	−0.040	−0.040	−0.041
48.5	.034	.035	.036	.037	.038	.039	.040	.041	.041	.042
49.0	.035	.036	.037	.038	.039	.040	.041	.042	.042	.043
49.5	.036	.037	.038	.039	.040	.041	.042	.043	.044	.044
50.0	.037	.038	.039	.040	.041	.042	.043	.044	.045	.046

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	19.0 inch	19.5 inch	20.0 inch	20.5 inch	21.0 inch	21.5 inch	22.0 inch	22.5 inch	23.0 inch	23.5 inch
50.5	−0.038	−0.039	−0.040	−0.041	−0.042	−0.043	−0.044	−0.045	−0.046	−0.047
51.0	.039	.040	.041	.042	.043	.044	.045	.046	.047	.048
51.5	.039	.040	.041	.042	.044	.045	.046	.047	.048	.049
52.0	.040	.041	.042	.043	.044	.046	.047	.048	.049	.050
52.5	.041	.042	.043	.044	.045	.047	.048	.049	.050	.051
53.0	−0.042	−0.043	−0.044	−0.045	−0.046	−0.047	−0.049	−0.050	−0.051	−0.052
53.5	.043	.044	.045	.046	.047	.048	.050	.051	.052	.053
54.0	.044	.045	.046	.047	.048	.049	.051	.052	.053	.054
54.5	.045	.046	.047	.048	.049	.050	.052	.053	.054	.055
55.0	.045	.047	.048	.049	.050	.051	.053	.054	.055	.056
55.5	−0.046	−0.047	−0.049	−0.050	−0.051	−0.052	−0.054	−0.055	−0.056	−0.057
56.0	.047	.048	.050	.051	.052	.053	.055	.056	.057	.058
56.5	.048	.049	.050	.052	.053	.054	.056	.057	.058	.059
57.0	.049	.050	.051	.053	.054	.055	.057	.058	.059	.060
57.5	.050	.051	.052	.054	.055	.056	.058	.059	.060	.061
58.0	−0.051	−0.052	−0.053	−0.055	−0.056	−0.057	−0.059	−0.060	−0.061	−0.063
58.5	.051	.053	.054	.055	.057	.058	.060	.061	.062	.064
59.0	.052	.054	.055	.056	.058	.059	.061	.062	.063	.065
59.5	.053	.055	.056	.057	.059	.060	.061	.063	.064	.066
60.0	.054	.055	.057	.058	.060	.061	.062	.064	.065	.067
60.5	−0.055	−0.056	−0.058	−0.059	−0.061	−0.062	−0.063	−0.065	−0.066	−0.068
61.0	.056	.057	.059	.060	.062	.063	.064	.066	.067	.069
61.5	.057	.058	.060	.061	.062	.064	.065	.067	.068	.070
62.0	.057	.059	.060	.062	.063	.065	.066	.068	.069	.071
62.5	.058	.060	.061	.063	.064	.066	.067	.069	.071	.072
63.0	−0.059	−0.061	−0.062	−0.064	−0.065	−0.067	−0.068	−0.070	−0.072	−0.073
63.5	.060	.062	.063	.065	.066	.068	.069	.071	.073	.074
64.0	.061	.062	.064	.066	.067	.069	.070	.072	.074	.075
64.5	.062	.063	.065	.067	.068	.070	.071	.073	.075	.076
65.0	.063	.064	.066	.067	.069	.071	.072	.074	.076	.077
65.5	−0.063	−0.065	−0.067	−0.068	−0.070	−0.072	−0.073	−0.075	−0.077	−0.078
66.0	.064	.066	.068	.069	.071	.073	.074	.076	.078	.079
66.5	.065	.067	.069	.070	.072	.074	.075	.077	.079	.081
67.0	.066	.068	.069	.071	.073	.075	.076	.078	.080	.082
67.5	.067	.069	.070	.072	.074	.076	.077	.079	.081	.083
68.0	−0.068	−0.069	−0.071	−0.073	−0.075	−0.077	−0.078	−0.080	−0.082	−0.084
68.5	.069	.070	.072	.074	.076	.078	.079	.081	.083	.085
69.0	.069	.071	.073	.075	.077	.079	.080	.082	.084	.086
69.5	.070	.072	.074	.076	.078	.079	.081	.083	.085	.087
70.0	.071	.073	.075	.077	.079	.080	.082	.084	.086	.088
70.5	−0.072	−0.074	−0.076	−0.078	−0.080	−0.081	−0.083	−0.085	−0.087	−0.089
71.0	.073	.075	.077	.079	.080	.082	.084	.086	.088	.090
71.5	.074	.076	.078	.079	.081	.083	.085	.087	.089	.091
72.0	.075	.076	.078	.080	.082	.084	.086	.088	.090	.092
72.5	.075	.077	.079	.081	.083	.085	.087	.089	.091	.093
73.0	−0.076	−0.078	−0.080	−0.082	−0.084	−0.086	−0.088	−0.090	−0.092	−0.094
73.5	.077	.079	.081	.083	.085	.087	.089	.091	.093	.095
74.0	.078	.080	.082	.084	.086	.088	.090	.092	.094	.096
74.5	.079	.081	.083	.085	.087	.089	.091	.093	.095	.097
75.0	.080	.082	.084	.086	.088	.090	.092	.094	.096	.099

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 19.0 inch	19.5 inch	20.0 inch	20.5 inch	21.0 inch	21.5 inch	22.0 inch	22.5 inch	23.0 inch	23.5 inch
75.5	−0.081	−0.083	−0.085	−0.087	−0.089	−0.091	−0.093	−0.095	−0.097	−0.100
76.0	.081	.084	.086	.088	.090	.092	.094	.096	.098	.101
76.5	.082	.084	.087	.089	.091	.093	.095	.097	.100	.102
77.0	.083	.085	.087	.090	.092	.094	.096	.098	.101	.103
77.5	.084	.086	.088	.091	.093	.095	.097	.099	.102	.104
78.0	−0.085	−0.087	−0.089	−0.091	−0.094	−0.096	−0.098	−0.100	−0.103	−0.105
78.5	.086	.088	.090	.092	.095	.097	.099	.101	.104	.106
79.0	.086	.089	.091	.093	.096	.098	.100	.102	.105	.107
79.5	.087	.090	.092	.094	.097	.099	.101	.103	.106	.108
80.0	.088	.091	.093	.095	.097	.100	.102	.104	.107	.109
80.5	−0.089	−0.091	−0.094	−0.096	−0.098	−0.101	−0.103	−0.105	−0.108	−0.110
81.0	.090	.092	.095	.097	.099	.102	.104	.106	.109	.111
81.5	.091	.093	.096	.098	.100	.103	.105	.107	.110	.112
82.0	.092	.094	.096	.099	.101	.104	.106	.108	.111	.113
82.5	.092	.095	.097	.100	.102	.105	.107	.109	.112	.114
83.0	−0.093	−0.096	−0.098	−0.101	−0.103	−0.106	−0.108	−0.111	−0.113	−0.115
83.5	.094	.097	.099	.102	.104	.107	.109	.112	.114	.117
84.0	.095	.098	.100	.103	.105	.108	.110	.113	.115	.118
84.5	.096	.098	.101	.103	.106	.108	.111	.114	.116	.119
85.0	.097	.099	.102	.104	.107	.109	.112	.115	.117	.120
85.5	−0.098	−0.100	−0.103	−0.105	−0.108	−0.110	−0.113	−0.116	−0.118	−0.121
86.0	.098	.101	.104	.106	.109	.111	.114	.117	.119	.122
86.5	.099	.102	.105	.107	.110	.112	.115	.118	.120	.123
87.0	.100	.103	.105	.108	.111	.113	.116	.119	.121	.124
87.5	.101	.104	.106	.109	.112	.114	.117	.120	.122	.125
88.0	−0.102	−0.105	−0.107	−0.110	−0.113	−0.115	−0.118	−0.121	−0.123	−0.126
88.5	.103	.105	.108	.111	.114	.116	.119	.122	.124	.127
89.0	.104	.106	.109	.112	.114	.117	.120	.123	.125	.128
89.5	.104	.107	.110	.113	.115	.118	.121	.124	.126	.129
90.0	.105	.108	.111	.114	.116	.119	.122	.125	.127	.130
90.5	−0.106	−0.109	−0.112	−0.114	−0.117	−0.120	−0.123	−0.126	−0.128	−0.131
91.0	.107	.110	.113	.115	.118	.121	.124	.127	.129	.132
91.5	.108	.111	.113	.116	.119	.122	.125	.128	.131	.133
92.0	.109	.112	.114	.117	.120	.123	.126	.129	.132	.134
92.5	.110	.112	.115	.118	.121	.124	.127	.130	.133	.135
93.0	−0.110	−0.113	−0.116	−0.119	−0.122	−0.125	−0.128	−0.131	−0.134	−0.137
93.5	.111	.114	.117	.120	.123	.126	.129	.132	.135	.138
94.0	.112	.115	.118	.121	.124	.127	.130	.133	.136	.139
94.5	.113	.116	.119	.122	.125	.128	.131	.134	.137	.140
95.0	.114	.117	.120	.123	.126	.129	.132	.135	.138	.141
95.5	−0.115	−0.118	−0.121	−0.124	−0.127	−0.130	−0.133	−0.136	−0.139	−0.142
96.0	.115	.119	.122	.125	.128	.131	.134	.137	.140	.143
96.5	.116	.119	.122	.126	.129	.132	.135	.138	.141	.144
97.0	.117	.120	.123	.126	.130	.133	.136	.139	.142	.145
97.5	.118	.121	.124	.127	.130	.134	.137	.140	.143	.146
98.0	−0.119	−0.122	−0.125	−0.128	−0.131	−0.135	−0.138	−0.141	−0.144	−0.147
98.5	.120	.123	.126	.129	.132	.135	.139	.142	.145	.148
99.0	.121	.124	.127	.130	.133	.136	.140	.143	.146	.149
99.5	.121	.125	.128	.131	.134	.137	.141	.144	.147	.150
100.0	.122	.126	.129	.132	.135	.138	.142	.145	.148	.151

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	24.0 inch	24.2 inch	24.4 inch	24.6 inch	24.8 inch	25.0 inch	25.2 inch	25.4 inch	25.6 inch	25.8 inch
0.0	+0.063	+0.063	+0.064	+0.064	+0.065	+0.065	+0.066	+0.066	+0.067	+0.067
+0.5	+0.061	+0.062	+0.063	+0.063	+0.064	+0.064	+0.065	+0.065	+0.066	+0.066
1.0	.060	.061	.061	.062	.062	.063	.063	.064	.064	.065
1.5	.059	.060	.060	.061	.061	.062	.062	.063	.063	.064
2.0	.058	.059	.059	.060	.060	.061	.061	.062	.062	.063
2.5	.057	.058	.058	.059	.059	.059	.060	.060	.061	.061
3.0	+0.056	+0.056	+0.057	+0.057	+0.058	+0.058	+0.059	+0.059	+0.060	+0.060
3.5	.055	.055	.056	.056	.057	.057	.058	.058	.059	.059
4.0	.054	.054	.055	.055	.056	.056	.057	.057	.057	.058
4.5	.053	.053	.054	.054	.054	.055	.055	.056	.056	.057
5.0	.052	.052	.052	.053	.053	.054	.054	.055	.055	.056
5.5	+0.051	+0.051	+0.051	+0.052	+0.052	+0.053	+0.053	+0.053	+0.054	+0.054
6.0	.049	.050	.050	.051	.051	.052	.052	.052	.053	.053
6.5	.048	.049	.049	.050	.050	.050	.051	.051	.052	.052
7.0	.047	.048	.048	.048	.049	.049	.050	.050	.050	.051
7.5	.046	.047	.047	.047	.048	.048	.048	.049	.049	.050
8.0	+0.045	+0.045	+0.046	+0.046	+0.047	+0.047	+0.047	+0.048	+0.048	+0.048
8.5	.044	.044	.045	.045	.045	.046	.046	.047	.047	.047
9.0	.043	.043	.044	.044	.044	.045	.045	.045	.046	.046
9.5	.042	.042	.042	.043	.043	.044	.044	.044	.045	.045
10.0	.041	.041	.041	.042	.042	.042	.043	.043	.043	.044
10.5	+0.040	+0.040	+0.040	+0.041	+0.041	+0.041	+0.042	+0.042	+0.042	+0.043
11.0	.039	.039	.039	.039	.040	.040	.040	.041	.041	.041
11.5	.037	.038	.038	.038	.039	.039	.039	.040	.040	.040
12.0	.036	.037	.037	.037	.038	.038	.038	.038	.039	.039
12.5	.035	.036	.036	.036	.036	.037	.037	.037	.038	.038
13.0	+0.034	+0.034	+0.035	+0.035	+0.035	+0.036	+0.036	+0.036	+0.036	+0.037
13.5	.033	.033	.034	.034	.034	.034	.035	.035	.035	.036
14.0	.032	.032	.032	.033	.033	.033	.034	.034	.034	.034
14.5	.031	.031	.031	.032	.032	.032	.032	.033	.033	.033
15.0	.030	.030	.030	.030	.031	.031	.031	.031	.032	.032
15.5	+0.029	+0.029	+0.029	+0.029	+0.030	+0.030	+0.030	+0.030	+0.031	+0.031
16.0	.028	.028	.028	.028	.028	.029	.029	.029	.029	.030
16.5	.026	.027	.027	.027	.027	.028	.028	.028	.028	.028
17.0	.025	.026	.026	.026	.026	.026	.027	.027	.027	.027
17.5	.024	.024	.025	.025	.025	.025	.026	.026	.026	.026
18.0	+0.023	+0.023	+0.024	+0.024	+0.024	+0.024	+0.024	+0.025	+0.025	+0.025
18.5	.022	.022	.022	.023	.023	.023	.023	.023	.024	.024
19.0	.021	.021	.021	.022	.022	.022	.022	.022	.022	.023
19.5	.020	.020	.020	.020	.021	.021	.021	.021	.021	.021
20.0	.019	.019	.019	.019	.019	.020	.020	.020	.020	.020
20.5	+0.018	+0.018	+0.018	+0.018	+0.018	+0.018	+0.019	+0.019	+0.019	+0.019
21.0	.017	.017	.017	.017	.017	.017	.017	.018	.018	.018
21.5	.016	.016	.016	.016	.016	.016	.016	.016	.017	.017
22.0	.014	.015	.015	.015	.015	.015	.015	.015	.015	.016
22.5	.013	.013	.014	.014	.014	.014	.014	.014	.014	.014
23.0	+0.012	+0.012	+0.012	+0.013	+0.013	+0.013	+0.013	+0.013	+0.013	+0.013
23.5	.011	.011	.011	.011	.012	.012	.012	.012	.012	.012
24.0	.010	.010	.010	.010	.010	.011	.011	.011	.011	.011
24.5	.009	.009	.009	.009	.009	.009	.009	.010	.010	.010
25.0	.008	.008	.008	.008	.008	.008	.008	.008	.008	.009

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	24.0 inch	24.2 inch	24.4 inch	24.6 inch	24.8 inch	25.0 inch	25.2 inch	25.4 inch	25.6 inch	25.8 inch
25.5	+0.007	+0.007	+0.007	+0.007	+0.007	+0.007	+0.007	+0.007	+0.007	+0.007
26.0	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
26.5	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005
27.0	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004
27.5	.002	.002	.003	.003	.003	.003	.003	.003	.003	.003
28.0	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001
28.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.0	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
29.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
30.0	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
30.5	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004
31.0	.005	.005	.005	.005	.005	.005	.005	.005	.006	.006
31.5	.006	.006	.006	.006	.006	.007	.007	.007	.007	.007
32.0	.007	.007	.007	.008	.008	.008	.008	.008	.008	.008
32.5	.008	.009	.009	.009	.009	.009	.009	.009	.009	.009
33.0	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010	−0.010
33.5	.011	.011	.011	.011	.011	.011	.011	.011	.011	.011
34.0	.012	.012	.012	.012	.012	.012	.012	.012	.012	.013
34.5	.013	.013	.013	.013	.013	.013	.013	.014	.014	.014
35.0	.014	.014	.014	.014	.014	.014	.015	.015	.015	.015
35.5	−0.015	−0.015	−0.015	−0.015	−0.015	−0.016	−0.016	−0.016	−0.016	−0.016
36.0	.016	.016	.016	.016	.017	.017	.017	.017	.017	.017
36.5	.017	.017	.017	.018	.018	.018	.018	.018	.018	.018
37.0	.018	.018	.019	.019	.019	.019	.019	.019	.019	.019
37.5	.019	.019	.020	.020	.020	.020	.020	.020	.021	.021
38.0	−0.020	−0.021	−0.021	−0.021	−0.021	−0.021	−0.021	−0.022	−0.022	−0.022
38.5	.021	.022	.022	.022	.022	.022	.023	.023	.023	.023
39.0	.023	.023	.023	.023	.023	.024	.024	.024	.024	.024
39.5	.024	.024	.024	.024	.024	.025	.025	.025	.025	.025
40.0	.025	.025	.025	.025	.026	.026	.026	.026	.026	.027
40.5	−0.026	−0.026	−0.026	−0.026	−0.027	−0.027	−0.027	−0.027	−0.028	−0.028
41.0	.027	.027	.027	.028	.028	.028	.028	.029	.029	.029
41.5	.028	.028	.028	.029	.029	.029	.029	.030	.030	.030
42.0	.029	.029	.030	.030	.030	.030	.031	.031	.031	.031
42.5	.030	.030	.031	.031	.031	.031	.032	.032	.032	.032
43.0	−0.031	−0.032	−0.032	−0.032	−0.032	−0.033	−0.033	−0.033	−0.033	−0.034
43.5	.032	.033	.033	.033	.033	.034	.034	.034	.035	.035
44.0	.033	.034	.034	.034	.035	.035	.035	.035	.036	.036
44.5	.035	.035	.035	.035	.036	.036	.036	.037	.037	.037
45.0	.036	.036	.036	.037	.037	.037	.037	.038	.038	.038
45.5	−0.037	−0.037	−0.037	−0.038	−0.038	−0.038	−0.039	−0.039	−0.039	−0.039
46.0	.038	.038	.038	.039	.039	.039	.040	.040	.040	.041
46.5	.039	.039	.040	.040	.040	.041	.041	.041	.041	.042
47.0	.040	.040	.041	.041	.041	.042	.042	.042	.043	.043
47.5	.041	.041	.042	.042	.042	.043	.043	.043	.044	.044
48.0	−0.042	−0.042	−0.043	−0.043	−0.044	−0.044	−0.044	−0.045	−0.045	−0.045
48.5	.043	.044	.044	.044	.045	.045	.045	.046	.046	.046
49.0	.044	.045	.045	.045	.046	.046	.047	.047	.047	.048
49.5	.045	.046	.046	.047	.047	.047	.048	.048	.048	.049
50.0	.046	.047	.047	.048	.048	.048	.049	.049	.050	.050

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	24.0 inch	24.2 inch	24.4 inch	24.6 inch	24.8 inch	25.0 inch	25.2 inch	25.4 inch	25.6 inch	25.8 inch
	Height of the mercury column—inches									
50.5	−0.048	−0.048	−0.048	−0.049	−0.049	−0.050	−0.050	−0.050	−0.051	−0.051
51.0	.049	.049	.049	.050	.050	.051	.051	.051	.052	.052
51.5	.050	.050	.051	.051	.051	.052	.052	.053	.053	.053
52.0	.051	.051	.052	.052	.053	.053	.053	.054	.054	.055
52.5	.052	.052	.053	.053	.054	.054	.055	.055	.055	.056
53.0	−0.053	−0.053	−0.054	−0.054	−0.055	−0.055	−0.056	−0.056	−0.057	−0.057
53.5	.054	.055	.055	.055	.056	.056	.057	.057	.058	.058
54.0	.055	.056	.056	.057	.057	.057	.058	.058	.059	.059
54.5	.056	.057	.057	.058	.058	.059	.059	.060	.060	.060
55.0	.057	.058	.058	.059	.059	.060	.060	.061	.061	.062
55.5	−0.058	−0.059	−0.059	−0.060	−0.060	−0.061	−0.061	−0.062	−0.062	−0.063
56.0	.060	.060	.060	.061	.061	.062	.062	.063	.063	.064
56.5	.061	.061	.062	.062	.063	.063	.064	.064	.065	.065
57.0	.062	.062	.063	.063	.064	.064	.065	.065	.066	.066
57.5	.063	.063	.064	.064	.065	.065	.066	.066	.067	.067
58.0	−0.064	−0.064	−0.065	−0.065	−0.066	−0.066	−0.067	−0.068	−0.068	−0.069
58.5	.065	.065	.066	.067	.067	.068	.068	.069	.069	.070
59.0	.066	.067	.067	.068	.068	.069	.069	.070	.070	.071
59.5	.067	.068	.068	.069	.069	.070	.070	.071	.072	.072
60.0	.068	.069	.069	.070	.070	.071	.072	.072	.073	.073
60.5	−0.069	−0.070	−0.070	−0.071	−0.072	−0.072	−0.073	−0.073	−0.074	−0.074
61.0	.070	.071	.072	.072	.073	.073	.074	.074	.075	.076
61.5	.071	.072	.073	.073	.074	.074	.075	.076	.076	.077
62.0	.073	.073	.074	.074	.075	.076	.076	.077	.077	.078
62.5	.074	.074	.075	.075	.076	.077	.077	.078	.078	.079
63.0	−0.075	−0.075	−0.076	−0.077	−0.077	−0.078	−0.078	−0.079	−0.080	−0.080
63.5	.076	.076	.077	.078	.078	.079	.080	.080	.081	.081
64.0	.077	.077	.078	.079	.079	.080	.081	.081	.082	.082
64.5	.078	.079	.079	.080	.081	.081	.082	.082	.083	.084
65.0	.079	.080	.080	.081	.082	.082	.083	.084	.084	.085
65.5	−0.080	−0.081	−0.081	−0.082	−0.083	−0.083	−0.084	−0.085	−0.085	−0.086
66.0	.081	.082	.083	.083	.084	.085	.085	.086	.087	.087
66.5	.082	.083	.084	.084	.085	.086	.086	.087	.088	.088
67.0	.083	.084	.085	.085	.086	.087	.087	.088	.089	.090
67.5	.084	.085	.086	.087	.087	.088	.089	.089	.090	.091
68.0	−0.085	−0.086	−0.087	−0.088	−0.088	−0.089	−0.090	−0.090	−0.091	−0.092
68.5	.087	.087	.088	.089	.089	.090	.091	.092	.092	.093
69.0	.088	.088	.089	.090	.091	.091	.092	.093	.093	.094
69.5	.089	.089	.090	.091	.092	.092	.093	.094	.095	.095
70.0	.090	.091	.091	.092	.093	.094	.094	.095	.096	.097
70.5	−0.091	−0.092	−0.092	−0.093	−0.094	−0.095	−0.095	−0.096	−0.097	−0.098
71.0	.092	.093	.094	.094	.095	.096	.097	.097	.098	.099
71.5	.093	.094	.095	.095	.096	.097	.098	.098	.099	.100
72.0	.094	.095	.096	.096	.097	.098	.099	.100	.100	.101
72.5	.095	.096	.097	.098	.098	.099	.100	.101	.102	.102
73.0	−0.096	−0.097	−0.098	−0.099	−0.100	−0.100	−0.101	−0.102	−0.103	−0.104
73.5	.097	.098	.099	.100	.101	.101	.102	.103	.104	.105
74.0	.098	.099	.100	.101	.102	.103	.103	.104	.105	.106
74.5	.100	.100	.101	.102	.103	.104	.105	.105	.106	.107
75.0	.101	.101	.102	.103	.104	.105	.106	.106	.107	.108

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	24.0 inch	24.2 inch	24.4 inch	24.6 inch	24.8 inch	25.0 inch	25.2 inch	25.4 inch	25.6 inch	25.8 inch
	Height of the mercury column—inches									
75.5	−0.102	−0.103	−0.103	−0.104	−0.105	−0.106	−0.107	−0.108	−0.108	−0.109
76.0	.103	.104	.104	.105	.106	.107	.108	.109	.110	.110
76.5	.104	.105	.106	.106	.107	.108	.109	.110	.111	.112
77.0	.105	.106	.107	.108	.108	.109	.110	.111	.112	.113
77.5	.106	.107	.108	.109	.110	.110	.111	.112	.113	.114
78.0	−0.107	−0.108	−0.109	−0.110	−0.111	−0.112	−0.112	−0.113	−0.114	−0.115
78.5	.108	.109	.110	.111	.112	.113	.114	.114	.115	.116
79.0	.109	.110	.111	.112	.113	.114	.115	.116	.117	.117
79.5	.110	.111	.112	.113	.114	.115	.116	.117	.118	.119
80.0	.111	.112	.113	.114	.115	.116	.117	.118	.119	.120
80.5	−0.112	−0.113	−0.114	−0.115	−0.116	−0.117	−0.118	−0.119	−0.120	−0.121
81.0	.114	.115	.115	.116	.117	.118	.119	.120	.121	.122
81.5	.115	.116	.117	.118	.118	.119	.120	.121	.122	.123
82.0	.116	.117	.118	.119	.120	.121	.122	.122	.123	.124
82.5	.117	.118	.119	.120	.121	.122	.123	.124	.125	.126
83.0	−0.118	−0.119	−0.120	−0.121	−0.122	−0.123	−0.124	−0.125	−0.126	−0.127
83.5	.119	.120	.121	.122	.123	.124	.125	.126	.127	.128
84.0	.120	.121	.122	.123	.124	.125	.126	.127	.128	.129
84.5	.121	.122	.123	.124	.125	.126	.127	.128	.129	.130
85.0	.122	.123	.124	.125	.126	.127	.128	.129	.130	.131
85.5	−0.123	−0.124	−0.125	−0.126	−0.127	−0.128	−0.129	−0.130	−0.131	−0.133
86.0	.124	.125	.126	.127	.128	.130	.131	.132	.133	.134
86.5	.125	.126	.128	.129	.130	.131	.132	.133	.134	.135
87.0	.126	.128	.129	.130	.131	.132	.133	.134	.135	.136
87.5	.128	.129	.130	.131	.132	.133	.134	.135	.136	.137
88.0	−0.129	−0.130	−0.131	−0.132	−0.133	−0.134	−0.135	−0.136	−0.137	−0.138
88.5	.130	.131	.132	.133	.134	.135	.136	.137	.138	.139
89.0	.131	.132	.133	.134	.135	.136	.137	.138	.140	.141
89.5	.132	.133	.134	.135	.136	.137	.138	.140	.141	.142
90.0	.133	.134	.135	.136	.137	.138	.140	.141	.142	.143
90.5	−0.134	−0.135	−0.136	−0.137	−0.139	−0.140	−0.141	−0.142	−0.143	−0.144
91.0	.135	.136	.137	.138	.140	.141	.142	.143	.144	.145
91.5	.136	.137	.138	.140	.141	.142	.143	.144	.145	.146
92.0	.137	.138	.140	.141	.142	.143	.144	.145	.146	.148
92.5	.138	.139	.141	.142	.143	.144	.145	.146	.148	.149
93.0	−0.139	−0.141	−0.142	−0.143	−0.144	−0.145	−0.146	−0.148	−0.149	−0.150
93.5	.140	.142	.143	.144	.145	.146	.148	.149	.150	.151
94.0	.142	.143	.144	.145	.146	.147	.149	.150	.151	.152
94.5	.143	.144	.145	.146	.147	.149	.150	.151	.152	.153
95.0	.144	.145	.146	.147	.149	.150	.151	.152	.153	.154
95.5	−0.145	−0.146	−0.147	−0.148	−0.150	−0.151	−0.152	−0.153	−0.154	−0.156
96.0	.146	.147	.148	.150	.151	.152	.153	.154	.156	.157
96.5	.147	.148	.149	.151	.152	.153	.154	.156	.157	.158
97.0	.148	.149	.150	.152	.153	.154	.155	.157	.158	.159
97.5	.149	.150	.152	.153	.154	.155	.157	.158	.159	.160
98.0	−0.150	−0.151	−0.153	−0.154	−0.155	−0.156	−0.158	−0.159	−0.160	−0.161
98.5	.151	.153	.154	.155	.156	.158	.159	.160	.161	.163
99.0	.152	.154	.155	.156	.157	.159	.160	.161	.162	.164
99.5	.153	.155	.156	.157	.159	.160	.161	.162	.164	.165
100.0	.154	.156	.157	.158	.160	.161	.162	.163	.165	.166

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 26.0 inch	26.2 inch	26.4 inch	26.6 inch	26.8 inch	27.0 inch	27.2 inch	27.4 inch	27.6 inch	27.8 inch
0.0	+0.068	+0.068	+0.069	+0.069	+0.070	+0.070	+0.071	+0.071	+0.072	+0.072
+0.5	+0.067	+0.067	+0.068	+0.068	+0.069	+0.069	+0.070	+0.070	+0.071	+0.071
1.0	.065	.066	.066	.067	.067	.068	.068	.069	.069	.070
1.5	.064	.065	.065	.066	.066	.067	.067	.068	.068	.069
2.0	.063	.064	.064	.065	.065	.065	.066	.066	.067	.067
2.5	.062	.062	.063	.063	.064	.064	.065	.065	.066	.066
3.0	+0.061	+0.061	+0.062	+0.062	+0.063	+0.063	+0.063	+0.064	+0.064	+0.065
3.5	.059	.060	.060	.061	.061	.062	.062	.063	.063	.064
4.0	.058	.059	.059	.060	.060	.061	.061	.061	.062	.062
4.5	.057	.058	.058	.058	.059	.059	.060	.060	.061	.061
5.0	.056	.056	.057	.057	.058	.058	.059	.059	.059	.060
5.5	+0.055	+0.055	+0.056	+0.056	+0.056	+0.057	+0.057	+0.058	+0.058	+0.059
6.0	.054	.054	.054	.055	.055	.056	.056	.056	.057	.057
6.5	.052	.053	.053	.054	.054	.054	.055	.055	.056	.056
7.0	.051	.052	.052	.052	.053	.053	.054	.054	.054	.055
7.5	.050	.050	.051	.051	.052	.052	.052	.053	.053	.053
8.0	+0.049	+0.049	+0.050	+0.050	+0.050	+0.051	+0.051	+0.051	+0.052	+0.052
8.5	.048	.048	.048	.049	.049	.049	.050	.050	.051	.051
9.0	.046	.047	.047	.048	.048	.048	.049	.049	.049	.050
9.5	.045	.046	.046	.046	.047	.047	.047	.048	.048	.048
10.0	.044	.044	.045	.045	.045	.046	.046	.046	.047	.047
10.5	+0.043	+0.043	+0.044	+0.044	+0.044	+0.045	+0.045	+0.045	+0.046	+0.046
11.0	.042	.042	.042	.043	.043	.043	.044	.044	.044	.045
11.5	.041	.041	.041	.041	.042	.042	.042	.043	.043	.043
12.0	.039	.040	.040	.040	.041	.041	.041	.041	.042	.042
12.5	.038	.038	.039	.039	.039	.040	.040	.040	.040	.041
13.0	+0.037	+0.037	+0.038	+0.038	+0.038	+0.038	+0.039	+0.039	+0.039	+0.040
13.5	.036	.036	.036	.037	.037	.037	.037	.038	.038	.038
14.0	.035	.035	.035	.035	.036	.036	.036	.036	.037	.037
14.5	.033	.034	.034	.034	.034	.035	.035	.035	.035	.036
15.0	.032	.032	.033	.033	.033	.033	.034	.034	.034	.034
15.5	+0.031	+0.031	+0.032	+0.032	+0.032	+0.032	+0.032	+0.033	+0.033	+0.033
16.0	.030	.030	.030	.031	.031	.031	.031	.031	.032	.032
16.5	.029	.029	.029	.029	.030	.030	.030	.030	.030	.031
17.0	.027	.028	.028	.028	.028	.029	.029	.029	.029	.029
17.5	.026	.027	.027	.027	.027	.027	.028	.028	.028	.028
18.0	+0.025	+0.025	+0.026	+0.026	+0.026	+0.026	+0.026	+0.026	+0.027	+0.027
18.5	.024	.024	.024	.024	.025	.025	.025	.025	.025	.026
19.0	.023	.023	.023	.023	.023	.024	.024	.024	.024	.024
19.5	.022	.022	.022	.022	.022	.022	.023	.023	.023	.023
20.0	.020	.021	.021	.021	.021	.021	.021	.021	.022	.022
20.5	+0.019	+0.019	+0.020	+0.020	+0.020	+0.020	+0.020	+0.020	+0.020	+0.021
21.0	.018	.018	.018	.018	.019	.019	.019	.019	.019	.019
21.5	.017	.017	.017	.017	.017	.017	.018	.018	.018	.018
22.0	.016	.016	.016	.016	.016	.016	.016	.017	.017	.017
22.5	.014	.015	.015	.015	.015	.015	.015	.015	.015	.015
23.0	+0.013	+0.013	+0.014	+0.014	+0.014	+0.014	+0.014	+0.014	+0.014	+0.014
23.5	.012	.012	.012	.012	.012	.013	.013	.013	.013	.013
24.0	.011	.011	.011	.011	.011	.011	0.11	.012	.012	.012
24.5	.010	.010	.010	.010	.010	.010	.010	.010	.010	.110
25.0	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer	Height of the mercury column—inches									
°F.	26.0 inch	26.2 inch	26.4 inch	26.6 inch	26.8 inch	27.0 inch	27.2 inch	27.4 inch	27.6 inch	27.8 inch
25.5	+0.007	+0.007	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008
26.0	.006	.006	.006	.006	.006	.006	.006	.007	.007	.007
26.5	.005	.005	.005	.005	.005	.005	.005	.005	.005	.005
27.0	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004
27.5	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
28.0	+0.001	+0.001	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002
28.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.0	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
29.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
30.0	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
30.5	−0.004	−0.004	−0.004	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005
31.0	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
31.5	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
32.0	.008	.008	.008	.008	.008	.008	.008	.008	.008	.009
32.5	.009	.009	.009	.009	.009	.009	.010	.010	.010	.010
33.0	−0.010	−0.010	−0.010	−0.011	−0.011	−0.011	−0.011	−0.011	−0.011	−0.011
33.5	.011	.012	.012	.012	.012	.012	.012	.012	.012	.012
34.0	.013	.013	.013	.013	.013	.013	.013	.013	.013	.014
34.5	.014	.014	.014	.014	.014	.014	.014	.015	.015	.015
35.0	.015	.015	.015	.015	.015	.016	.016	.016	.016	.016
35.5	−0.016	−0.016	−0.016	−0.017	−0.017	−0.017	−0.017	−0.017	−0.017	−0.017
36.0	.017	.018	.018	.018	.018	.018	.018	.018	.018	.019
36.5	.019	.019	.019	.019	.019	.019	.019	.020	.020	.020
37.0	.020	.020	.020	.020	.020	.021	.021	.021	.021	.021
37.5	.021	.021	.021	.021	.022	.022	.022	.022	.022	.022
38.0	−0.022	−0.022	−0.022	−0.023	−0.023	−0.023	−0.023	−0.023	−0.023	−0.024
38.5	.023	.023	.024	.024	.024	.024	.024	.025	.025	.025
39.0	.024	.025	.025	.025	.025	.025	.026	.026	.026	.026
39.5	.026	.026	.026	.026	.026	.027	.027	.027	.027	.027
40.0	.027	.027	.027	.027	.028	.028	.028	.028	.028	.029
40.5	−0.028	−0.028	−0.028	−0.029	−0.029	−0.029	−0.029	−0.030	−0.030	−0.030
41.0	.029	.029	.030	.030	.030	.030	.031	.031	.031	.031
41.5	.030	.031	.031	.031	.031	.032	.032	.032	.032	.032
42.0	.032	.032	.032	.032	.033	.033	.033	.033	.033	.034
42.5	.033	.033	.033	.033	.034	.034	.034	.034	.035	.035
43.0	−0.034	−0.034	−0.034	−0.035	−0.035	−0.035	−0.035	−0.036	−0.036	−0.036
43.5	.035	.035	.036	.036	.036	.036	.037	.037	.037	.037
44.0	.036	.037	.037	.037	.037	.038	.038	.038	.038	.039
44.5	.037	.038	.038	.038	.039	.039	.039	.039	.040	.040
45.0	.039	.039	.039	.039	.040	.040	.040	.041	.041	.041
45.5	−0.040	−0.040	−0.040	−0.041	−0.041	−0.041	−0.042	−0.042	−0.042	−0.043
46.0	.041	.041	.042	.042	.042	.043	.043	.043	.043	.044
46.5	.042	.042	.043	.043	.043	.044	.044	.044	.045	.045
47.0	.043	.044	.044	.044	.045	.045	.045	.046	.046	.046
47.5	.045	.045	.045	.046	.046	.046	.047	.047	.047	.048
48.0	−0.046	−0.046	−0.046	−0.047	−0.047	−0.047	−0.048	−0.048	−0.048	−0.049
48.5	.047	.047	.048	.048	.048	.049	.049	.049	.050	.050
49.0	.048	.048	.049	.049	.049	.050	.050	.051	.051	.051
49.5	.049	.050	.050	.050	.051	.051	.051	.052	.052	.053
50.0	.050	.051	.051	.052	.052	.052	.053	.053	.053	.054

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached ther-mometer °F.	Height of the mercury column—inches									
	26.0 inch	26.2 inch	26.4 inch	26.6 inch	26.8 inch	27.0 inch	27.2 inch	27.4 inch	27.6 inch	27.8 inch
50.5	−0.052	−0.052	−0.052	−0.053	−0.053	−0.054	−0.054	−0.054	−0.055	−0.055
51.0	.053	.053	.054	.054	.054	.055	.055	.056	.056	.056
51.5	.054	.054	.055	.055	.056	.056	.056	.057	.057	.058
52.0	.055	.055	.056	.056	.057	.057	.058	.058	.058	.059
52.5	.056	.057	.057	.058	.058	.058	.059	.059	.060	.060
53.0	−0.057	−0.058	−0.058	−0.059	−0.059	−0.060	−0.060	−0.061	−0.061	−0.061
53.5	.059	.059	.059	.060	.060	.061	.061	.062	.062	.063
54.0	.060	.060	.061	.061	.062	.062	.063	.063	.063	.064
54.5	.061	.061	.062	.062	.063	.063	.064	.064	.065	.065
55.0	.062	.063	.063	.064	.064	.064	.065	.065	.066	.066
55.5	−0.063	−0.064	−0.064	−0.065	−0.065	−0.066	−0.066	−0.067	−0.067	−0.068
56.0	.064	.065	.065	.066	.066	.067	.067	.068	.068	.069
56.5	.066	.066	.067	.067	.068	.068	.069	.069	.070	.070
57.0	.067	.067	.068	.068	.069	.069	.070	.070	.071	.071
57.5	.068	.069	.069	.070	.070	.071	.071	.072	.072	.073
58.0	−0.069	−0.070	−0.070	−0.071	−0.071	−0.072	−0.072	−0.073	−0.073	−0.074
58.5	.070	.071	.071	.072	.072	.073	.074	.074	.075	.075
59.0	.072	.072	.073	.073	.074	.074	.075	.075	.076	.076
59.5	.073	.073	.074	.074	.075	.075	.076	.077	.077	.078
60.0	.074	.074	.075	.076	.076	.077	.077	.078	.078	.079
60.5	−0.075	−0.076	−0.076	−0.077	−0.077	−0.078	−0.078	−0.079	−0.080	−0.080
61.0	.076	.077	.077	.078	.079	.079	.080	.080	.081	.081
61.5	.077	.078	.079	.079	.080	.080	.081	.082	.082	.083
62.0	.079	.079	.080	.080	.081	.082	.082	.083	.083	.084
62.5	.080	.080	.081	.082	.082	.083	.083	.084	.085	.085
63.0	−0.081	−0.082	−0.082	−0.083	−0.083	−0.084	−0.085	−0.085	−0.086	−0.086
63.5	.082	.083	.083	.084	.085	.085	.086	.086	.087	.088
64.0	.083	.084	.085	.085	.086	.086	.087	.088	.088	.089
64.5	.084	.085	.086	.086	.087	.088	.088	.089	.090	.090
65.0	.086	.086	.087	.088	.088	.089	.090	.090	.091	.092
65.5	−0.087	−0.087	−0.088	−0.089	−0.089	−0.090	−0.091	−0.091	−0.092	−0.093
66.0	.088	.089	.089	.090	.091	.091	.092	.093	.093	.094
66.5	.089	.090	.090	.091	.092	.093	.093	.094	.095	.095
67.0	.090	.091	.092	.092	.093	.094	.094	.095	.096	.097
67.5	.092	.092	.093	.094	.094	.095	.096	.096	.097	.098
68.0	−0.093	−0.093	−0.094	−0.095	−0.095	−0.096	−0.097	−0.098	−0.098	−0.099
68.5	.094	.095	.095	.096	.097	.097	.098	.099	.100	.100
69.0	.095	.096	.096	.097	.098	.099	.099	.100	.101	.102
69.5	.096	.097	.098	.098	.099	.100	.101	.101	.102	.103
70.0	.097	.098	.099	.100	.100	.101	.102	.103	.103	.104
70.5	−0.098	−0.099	−0.100	−0.101	−0.101	−0.102	−0.103	−0.104	−0.105	−0.105
71.0	.100	.100	.101	.102	.103	.103	.104	.105	.106	.107
71.5	.101	.102	.102	.103	.104	.105	.105	.106	.107	.108
72.0	.102	.103	.104	.104	.105	.106	.107	.107	.108	.109
72.5	.103	.104	.105	.106	.106	.107	.108	.109	.109	.110
73.0	−0.104	−0.105	−0.106	−0.107	−0.108	−0.108	−0.109	−0.110	−0.111	−0.112
73.5	.105	.106	.107	.108	.109	.110	.110	.111	.112	.113
74.0	.107	.107	.108	.109	.110	.111	.112	.112	.113	.114
74.5	.108	.109	.109	.110	.111	.112	.113	.114	.114	.115
75.0	.109	.110	.111	.112	.112	.113	.114	.115	.116	.117

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 26.0 inch	26.2 inch	26.4 inch	26.6 inch	26.8 inch	27.0 inch	27.2 inch	27.4 inch	27.6 inch	27.8 inch
75.5	−0.110	−0.111	−0.112	−0.113	−0.114	−0.114	−0.115	−0.116	−0.117	−0.118
76.0	.111	.112	.113	.114	.115	.116	.116	.117	.118	.119
76.5	.113	.113	.114	.115	.116	.117	.118	.119	.119	.120
77.0	.114	.115	.115	.116	.117	.118	.119	.120	.121	.122
77.5	.115	.116	.117	.117	.118	.119	.120	.121	.122	.123
78.0	−0.116	−0.117	−0.118	−0.119	−0.120	−0.120	−0.121	−0.122	−0.123	−0.124
78.5	.117	.118	.119	.120	.121	.122	.123	.123	.124	.125
79.0	.118	.119	.120	.121	.122	.123	.124	.125	.126	.127
79.5	.120	.120	.121	.122	.123	.124	.125	.126	.127	.128
80.0	.121	.122	.123	.123	.124	.125	.126	.127	.128	.129
80.5	−0.122	−0.123	−0.124	−0.125	−0.126	−0.127	−0.127	−0.128	−0.129	−0.130
81.0	.123	.124	.125	.126	.127	.128	.129	.130	.131	.132
81.5	.124	.125	.126	.127	.128	.129	.130	.131	.132	.133
82.0	.125	.126	.127	.128	.129	.130	.131	.132	.133	.134
82.5	.127	.128	.128	.129	.130	.131	.132	.133	.134	.135
83.0	−0.128	−0.129	−0.130	−0.131	−0.132	−0.133	−0.134	−0.135	−0.136	−0.137
83.5	.129	.130	.131	.132	.133	.134	.135	.136	.137	.138
84.0	.130	.131	.132	.133	.134	.135	.136	.137	.138	.139
84.5	.131	.132	.133	.134	.135	.136	.137	.138	.139	.140
85.0	.132	.133	.134	.135	.136	.137	.138	.139	.141	.142
85.5	−0.134	−0.135	−0.136	−0.137	−0.138	−0.139	−0.140	−0.141	−0.142	−0.143
86.0	.135	.136	.137	.138	.139	.140	.141	.142	.143	.144
86.5	.136	.137	.138	.139	.140	.141	.142	.143	.144	.145
87.0	.137	.138	.139	.140	.141	.142	.143	.144	.145	.147
87.5	.138	.139	.140	.141	.142	.144	.145	.146	.147	.148
88.0	−0.139	−0.140	−0.142	−0.143	−0.144	−0.145	−0.146	−0.147	−0.148	−0.149
88.5	.141	.142	.143	.144	.145	.146	.147	.148	.149	.150
89.0	.142	.143	.144	.145	.146	.147	.148	.149	.150	.152
89.5	.143	.144	.145	.146	.147	.148	.149	.151	.152	.153
90.0	.144	.145	.146	.147	.148	.150	.151	.152	.153	.154
90.5	−0.145	−0.146	−0.147	−0.149	−0.150	−0.151	−0.152	−0.153	−0.154	−0.155
91.0	.146	.147	.149	.150	.151	.152	.153	.154	.155	.157
91.5	.148	.149	.150	.151	.152	.153	.154	.155	.157	.158
92.0	.149	.150	.151	.152	.153	.154	.156	.157	.158	.159
92.5	.150	.151	.152	.153	.154	.156	.157	.158	.159	.160
93.0	−0.151	−0.152	−0.153	−0.155	−0.156	−0.157	−0.158	−0.159	−0.160	−0.161
93.5	.152	.153	.155	.156	.157	.158	.159	.160	.162	.163
94.0	.153	.155	.156	.157	.158	.159	.160	.162	.163	.164
94.5	.155	.156	.157	.158	.159	.160	.162	.163	.164	.165
95.0	.156	.157	.158	.159	.160	.162	.163	.164	.165	.166
95.5	−0.157	−0.158	−0.159	−0.160	−0.162	−0.163	−0.164	−0.165	−0.167	−0.168
96.0	.158	.159	.160	.162	.163	.164	.165	.167	.168	.169
96.5	.159	.160	.162	.163	.164	.165	.167	.168	.169	.170
97.0	.160	.162	.163	.164	.165	.167	.168	.169	.170	.171
97.5	.162	.163	.164	.165	.166	.168	.169	.170	.171	.173
98.0	−0.163	−0.164	−0.165	−0.166	−0.168	−0.169	−0.170	−0.171	−0.173	−0.174
98.5	.164	.165	.166	.168	.169	.170	.171	.173	.174	.175
99.0	.165	.166	.168	.169	.170	.171	.173	.174	.175	.176
99.5	.166	.167	.169	.170	.171	.173	.174	.175	.176	.178
100.0	.167	.169	.170	.171	.172	.174	.175	.176	.178	.179

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	26.0 inch	26.2 inch	26.4 inch	26.6 inch	26.8 inch	27.0 inch	27.2 inch	27.4 inch	27.6 inch	27.8 inch
100.0	−0.167	−0.169	−0.170	−0.171	−0.172	−0.174	−0.175	−0.176	−0.178	−0.179
100.5	.168	.170	.171	.172	.174	.175	.176	.178	.179	.180
101.0	.170	.171	.172	.174	.175	.176	.177	.179	.180	.181
101.5	.171	.172	.173	.175	.176	.177	.179	.180	.181	.183
102.0	.172	.173	.175	.176	.177	.179	.180	.181	.183	.184
102.5	−0.173	−0.174	−0.176	−0.177	−0.178	−0.180	−0.181	−0.182	−0.184	−0.185
103.0	.174	.176	.177	.178	.180	.181	.182	.184	.185	.186
103.5	.175	.177	.178	.180	.181	.182	.184	.185	.186	.188
104.0	.177	.178	.179	.181	.182	.183	.185	.186	.187	.189
104.5	.178	.179	.181	.182	.183	.185	.186	.187	.189	.190
105.0	−0.179	−0.180	−0.182	−0.183	−0.184	−0.186	−0.187	−0.189	−0.190	−0.191
105.5	.180	.182	.183	.184	.186	.187	.188	.190	.191	.193
106.0	.181	.183	.184	.185	.187	.188	.190	.191	.192	.194
106.5	.182	.184	.185	.187	.188	.189	.191	.192	.194	.195
107.0	.184	.185	.186	.188	.189	.191	.192	.193	.195	.196
107.5	−0.185	−0.186	−0.188	−0.189	−0.190	−0.192	−0.193	−0.195	−0.196	−0.198
108.0	.186	.187	.189	.190	.192	.193	.195	.196	.197	.199
108.5	.187	.189	.190	.191	.193	.194	.196	.197	.199	.200
109.0	.188	.190	.191	.193	.194	.196	.197	.198	.200	.201
109.5	.189	.191	.192	.194	.195	.197	.198	.200	.201	.203
110.0	−0.191	−0.192	−0.194	−0.195	−0.196	−0.198	−0.199	−0.201	−0.202	−0.204
110.5	.192	.193	.195	.196	.198	.199	.201	.202	.204	.205
111.0	.193	.194	.196	.197	.199	.200	.202	.203	.205	.206
111.5	.194	.196	.197	.199	.200	.202	.203	.205	.206	.207
112.0	.195	.197	.198	.200	.201	.203	.204	.206	.207	.209
112.5	−0.196	−0.198	−0.199	−0.201	−0.202	−0.204	−0.205	−0.207	−0.208	−0.210
113.0	.198	.199	.201	.202	.204	.205	.207	.208	.210	.211
113.5	.199	.200	.202	.203	.205	.206	.208	.209	.211	.212
114.0	.200	.201	.203	.204	.206	.208	.209	.211	.212	.214
114.5	.201	.203	.204	.206	.207	.209	.210	.212	.213	.215
115.0	−0.202	−0.204	−0.205	−0.207	−0.208	−0.210	−0.212	−0.213	−0.215	−0.216
115.5	.203	.205	.206	.208	.210	.211	.213	.214	.216	.217
116.0	.205	.206	.208	.209	.211	.212	.214	.216	.217	.219
116.5	.206	.207	.209	.210	.212	.214	.215	.217	.218	.220
117.0	.207	.208	.210	.212	.213	.215	.216	.218	.220	.221
117.5	−0.208	−0.210	−0.211	−0.213	−0.214	−0.216	−0.218	−0.219	−0.221	−0.222
118.0	.209	.211	.212	.214	.216	.217	.219	.220	.222	.224
118.5	.210	.212	.214	.215	.217	.218	.220	.222	.223	.225
119.0	.211	.213	.215	.216	.218	.220	.221	.223	.224	.226
119.5	.213	.214	.216	.218	.219	.221	.222	.224	.226	.227
120.0	−0.214	−0.215	−0.217	−0.219	−0.220	−0.222	−0.224	−0.225	−0.227	−0.229

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer	Height of the mercury column—inches									
	28.0	28.2	28.4	28.6	28.8	29.0	29.2	29.4	29.6	29.8
°F.	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
0.0	+0.073	+0.074	+0.074	+0.075	+0.075	+0.076	+0.076	+0.077	+0.077	+0.078
+0.5	+0.072	+0.072	+0.073	+0.073	+0.074	+0.074	+0.075	+0.075	+0.076	+0.076
1.0	.070	.071	.071	.072	.072	.073	.073	.074	.074	.075
1.5	.069	.070	.070	.071	.071	.072	.072	.073	.073	.074
2.0	.068	.068	.069	.069	.070	.070	.071	.071	.072	.072
2.5	.067	.067	.068	.068	.069	.069	.069	.070	.070	.071
3.0	+0.065	+0.066	+0.066	+0.067	+0.067	+0.068	+0.068	+0.069	+0.069	+0.070
3.5	.064	.065	.065	.065	.066	.066	.067	.067	.068	.068
4.0	.063	.063	.064	.064	.065	.065	.065	.066	.066	.067
4.5	.062	.062	.062	.063	.063	.064	.064	.065	.065	.065
5.0	.060	.061	.061	.062	.062	.062	.063	.063	.064	.064
5.5	+0.059	+0.059	+0.060	+0.060	+0.061	+0.061	+0.062	+0.062	+0.062	+0.063
6.0	.058	.058	.059	.059	.059	.060	.060	.061	.061	.061
6.5	.056	.057	.057	.058	.058	.058	.059	.059	.060	.060
7.0	.055	.056	.056	.056	.057	.057	.057	.058	.058	.059
7.5	.054	.054	.055	.055	.055	.056	.056	.057	.057	.057
8.0	+0.053	+0.053	+0.053	+0.054	+0.054	+0.054	+0.055	+0.055	+0.056	+0.056
8.5	.051	.052	.052	.052	.053	.053	.053	.054	.054	.055
9.0	.050	.050	.051	.051	.051	.052	.052	.053	.053	.053
9.5	.049	.049	.049	.050	.050	.050	.051	.051	.052	.052
10.0	.047	.048	.048	.048	.049	.049	.050	.050	.050	.051
10.5	+0.046	+0.047	+0.047	+0.047	+0.048	+0.048	+0.048	+0.049	+0.049	+0.049
11.0	.045	.045	.046	.046	.046	.047	.047	.047	.047	.048
11.5	.044	.044	.044	.045	.045	.045	.046	.046	.046	.046
12.0	.042	.043	.043	.043	.044	.044	.044	.044	.045	.045
12.5	.041	.041	.042	.042	.042	.043	.043	.043	.043	.044
13.0	+0.040	+0.040	+0.040	+0.041	+0.041	+0.041	+0.042	+0.042	+0.042	+0.042
13.5	.039	.039	.039	.039	.040	.040	.040	.040	.041	.041
14.0	.037	.038	.038	.038	.038	.039	.039	.039	.039	.040
14.5	.036	.036	.037	.037	.037	.037	.038	.038	.038	.038
15.0	.035	.035	.035	.035	.036	.036	.036	.036	.037	.037
15.5	+0.033	+0.034	+0.034	+0.034	+0.034	+0.035	+0.035	+0.035	+0.035	+0.036
16.0	.032	.032	.033	.033	.033	.033	.034	.034	.034	.034
16.5	.031	.031	.031	.032	.032	.032	.032	.032	.033	.033
17.0	.030	.030	.030	.030	.030	.031	.031	.031	.031	.032
17.5	.028	.029	.029	.029	.029	.029	.030	.030	.030	.030
18.0	+0.027	+0.027	+0.027	+0.028	+0.028	+0.028	+0.028	+0.028	+0.029	+0.029
18.5	.026	.026	.026	.026	.027	.027	.027	.027	.027	.027
19.0	.025	.025	.025	.025	.025	.025	.026	.026	.026	.026
19.5	.023	.023	.024	.024	.024	.024	.024	.024	.025	.025
20.0	.022	.022	.022	.022	.023	.023	.023	.023	.023	.023
20.5	+0.021	+0.021	+0.021	+0.021	+0.021	+0.021	+0.022	+0.022	+0.022	+0.022
21.0	.019	.020	.020	.020	.020	.020	.020	.020	.021	.021
21.5	.018	.018	.018	.019	.019	.019	.019	.019	.019	.019
22.0	.017	.017	.017	.017	.017	.017	.018	.018	.018	.018
22.5	.016	.016	.016	.016	.016	.016	.016	.016	.016	.017
23.0	+0.014	+0.014	+0.015	+0.015	+0.015	+0.015	+0.015	+0.015	+0.015	+0.015
23.5	.013	.013	.013	.013	.013	.014	.014	.014	.014	.014
24.0	.012	.012	.012	.012	.012	.012	.012	.012	.012	.013
24.5	.011	.011	.011	.011	.011	.011	.011	.011	.011	.011
25.0	.009	.009	.009	.009	.009	.010	.010	.010	.010	.010

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 28.0 inch	28.2 inch	28.4 inch	28.6 inch	28.8 inch	29.0 inch	29.2 inch	29.4 inch	29.6 inch	29.8 inch
25.5	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008	+0.008
26.0	.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
26.5	.005	.005	.005	.006	.006	.006	.006	.006	.006	.006
27.0	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004
27.5	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
28.0	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002
28.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.0	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
29.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
30.0	.003	.004	.004	.004	.004	.004	.004	.004	.004	.004
30.5	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005
31.0	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
31.5	.007	.007	.007	.007	.008	.008	.008	.008	.008	.008
32.0	.009	.009	.009	.009	.009	.009	.009	.009	.009	.009
32.5	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010
33.0	−0.011	−0.011	−0.011	−0.011	−0.011	−0.012	−0.012	−0.012	−0.012	−0.012
33.5	.012	.012	.013	.013	.013	.013	.013	.013	.013	.013
34.0	.014	.014	.014	.014	.014	.014	.014	.014	.014	.015
34.5	.015	.015	.015	.015	.015	.015	.016	.016	.016	.016
35.0	.016	.016	.016	.017	.017	.017	.017	.017	.017	.017
35.5	−0.017	−0.018	−0.018	−0.018	−0.018	−0.018	−0.018	−0.018	−0.018	−0.019
36.0	.019	.019	.019	.019	.019	.019	.020	.020	.020	.020
36.5	.020	.020	.020	.020	.021	.021	.021	.021	.021	.021
37.0	.021	.021	.022	.022	.022	.022	.022	.022	.022	.023
37.5	.023	.023	.023	.023	.023	.023	.024	.024	.024	.024
38.0	−0.024	−0.024	−0.024	−0.024	−0.024	−0.025	−0.025	−0.025	−0.025	−0.025
38.5	.025	.025	.025	.026	.026	.026	.026	.026	.027	.027
39.0	.026	.027	.027	.027	.027	.027	.027	.028	.028	.028
39.5	.028	.028	.028	.028	.028	.029	.029	.029	.029	.029
40.0	.029	.029	.029	.030	.030	.030	.030	.030	.031	.031
40.5	−0.030	−0.030	−0.031	−0.031	−0.031	−0.031	−0.031	−0.032	−0.032	−0.032
41.0	.031	.032	.032	.032	.032	.033	.033	.033	.033	.033
41.5	.033	.033	.033	.033	.034	.034	.034	.034	.035	.035
42.0	.034	.034	.034	.035	.035	.035	.035	.036	.036	.036
42.5	.035	.035	.036	.036	.036	.036	.037	.037	.037	.037
43.0	−0.036	−0.037	−0.037	−0.037	−0.038	−0.038	−0.038	−0.038	−0.039	−0.039
43.5	.038	.038	.038	.039	.039	.039	.039	.040	.040	.040
44.0	.039	.039	.040	.040	.040	.040	.041	.041	.041	.042
44.5	.040	.041	.041	.041	.041	.042	.042	.042	.043	.043
45.0	.042	.042	.042	.042	.043	.043	.043	.044	.044	.044
45.5	−0.043	−0.043	−0.043	−0.044	−0.044	−0.044	−0.045	−0.045	−0.045	−0.046
46.0	.044	.044	.045	.045	.045	.046	.046	.046	.047	.047
46.5	.045	.046	.046	.046	.047	.047	.047	.048	.048	.048
47.0	.047	.047	.047	.048	.048	.048	.049	.049	.049	.050
47.5	.048	.048	.049	.049	.049	.050	.050	.050	.051	.051
48.0	−0.049	−0.050	−0.050	−0.050	−0.051	−0.051	−0.051	−0.052	−0.052	−0.052
48.5	.050	.051	.051	.052	.052	.052	.053	.053	.053	.054
49.0	.052	.052	.052	.053	.053	.054	.054	.054	.055	.055
49.5	.053	.053	.054	.054	.054	.055	.055	.056	.056	.056
50.0	.054	.055	.055	.055	.056	.056	.057	.057	.057	.058

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 28.0 inch	28.2 inch	28.4 inch	28.6 inch	28.8 inch	29.0 inch	29.2 inch	29.4 inch	29.6 inch	29.8 inch
50.5	−0.055	−0.056	−0.056	−0.057	−0.057	−0.057	−0.058	−0.058	−0.059	−0.059
51.0	.057	.057	.058	.058	.058	.059	.059	.060	.060	.060
51.5	.058	.058	.059	.059	.060	.060	.061	.061	.061	.062
52.0	.059	.060	.060	.061	.061	.061	.062	.062	.063	.063
52.5	.061	.061	.061	.062	.062	.063	.063	.064	.064	.064
53.0	−0.062	−0.062	−0.063	−0.063	−0.064	−0.064	−0.064	−0.065	−0.065	−0.066
53.5	.063	.064	.064	.064	.065	.065	.066	.066	.067	.067
54.0	.064	.065	.065	.066	.066	.067	.067	.068	.068	.068
54.5	.066	.066	.067	.067	.067	.068	.068	.069	.069	.070
55.0	.067	.067	.068	.068	.069	.069	.070	.070	.071	.071
55.5	−0.068	−0.069	−0.069	−0.070	−0.070	−0.071	−0.071	−0.072	−0.072	−0.073
56.0	.069	.070	.070	.071	.071	.072	.072	.073	.073	.074
56.5	.071	.071	.072	.072	.073	.073	0.74	.074	0.75	.075
57.0	.072	.072	.073	.073	.074	.075	.075	.076	.076	.077
57.5	.073	.074	.074	.075	.075	.076	.076	.077	.077	.078
58.0	−0.074	−0.075	−0.076	−0.076	−0.077	−0.077	−0.078	−0.078	−0.079	−0.079
58.5	.076	.076	.077	.077	.078	.078	.079	.080	.080	.081
59.0	.077	.078	.078	.079	.079	.080	.080	.081	.081	.082
59.5	.078	.079	.079	.080	.081	.081	.082	.082	.083	.083
60.0	.080	.080	.081	.081	.082	.082	.083	.084	.084	.085
60.5	−0.081	−0.081	−0.082	−0.083	−0.083	−0.084	−0.084	−0.085	−0.085	−0.086
61.0	.082	.083	.083	.084	.084	.085	.086	.086	.087	.087
61.5	.083	.084	.085	.085	.086	.086	.087	.087	.088	.089
62.0	.085	.085	.086	.086	.087	.088	.088	.089	.089	.090
62.5	.086	.086	.087	.088	.088	.089	.090	.090	.091	.091
63.0	−0.087	−0.088	−0.088	−0.089	−0.090	−0.090	−0.091	−0.091	−0.092	−0.093
63.5	.088	.089	.090	.090	.091	.092	.092	.093	.093	.094
64.0	.090	.090	.091	.092	.092	.093	.093	.094	.095	.095
64.5	.091	.092	.092	.093	.093	.094	.095	.095	.096	.097
65.0	.092	.093	.093	.094	.095	.095	.096	.097	.097	.098
65.5	−0.093	−0.094	−0.095	−0.095	−0.096	−0.097	−0.097	−0.098	−0.099	−0.099
66.0	.095	.095	.096	.097	.097	.098	.099	.099	.100	.101
66.5	.096	.097	.097	.098	.099	.099	.100	.101	.101	.102
67.0	.097	.098	.099	.099	.100	.101	.101	.102	.103	.103
67.5	.098	.099	.100	.101	.101	.102	.103	.103	.104	.105
68.0	−0.100	−0.100	−0.101	−0.102	−0.103	−0.103	−0.104	−0.105	−0.105	−0.106
68.5	.101	.102	.102	.103	.104	.105	.105	.106	.107	.107
69.0	.102	.103	.104	.104	.105	.106	.107	.107	.108	.109
69.5	.104	.104	.105	.106	.106	.107	.108	.109	.109	.110
70.0	.105	.106	.106	.107	.108	.109	.109	.110	.111	.112
70.5	−0.106	−0.107	−0.108	−0.108	−0.109	−0.110	−0.111	−0.111	−0.112	−0.113
71.0	.107	.108	.109	.110	.110	.111	.112	.113	.113	.114
71.5	.109	.109	.110	.111	.112	.112	.113	.114	.115	.116
72.0	.110	.111	.111	.112	.113	.114	.115	.115	.116	.117
72.5	.111	.112	.113	.113	.114	.115	.116	.117	.117	.118
73.0	−0.112	−0.113	−0.114	−0.115	−0.116	−0.116	−0.117	−0.118	−0.119	−0.120
73.5	.114	.114	.115	.116	.117	.118	.118	.119	.120	.121
74.0	.115	.116	.117	.117	.118	.119	.120	.121	.121	.122
74.5	.116	.117	.118	.119	.119	.120	.121	.122	.123	.124
75.0	.117	.118	.119	.120	.121	.122	.122	.123	.124	.125

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 28.0 inch	28.2 inch	28.4 inch	28.6 inch	28.8 inch	29.0 inch	29.2 inch	29.4 inch	29.6 inch	29.8 inch
75.5	−0.119	−0.119	−0.120	−0.121	−0.122	−0.123	−0.124	−0.125	−0.125	−0.126
76.0	.120	.121	.122	.122	.123	.124	.125	.126	.127	.128
76.5	.121	.122	.123	.124	.125	.125	.126	.127	.128	.129
77.0	.122	.123	.124	.125	.126	.127	.128	.129	.129	.130
77.5	.124	.125	.125	.126	.127	.128	.129	.130	.131	.132
78.0	−0.125	−0.126	−0.127	−0.128	−0.129	−0.129	−0.130	−0.131	−0.132	−0.133
78.5	.126	.127	.128	.129	.130	.131	.132	.133	.133	.134
79.0	.127	.128	.129	.130	.131	.132	.133	.134	.135	.136
79.5	.129	.130	.131	.131	.132	.133	.134	.135	.136	.137
80.0	.130	.131	.132	.133	.134	.135	.136	.136	.137	.138
80.5	−0.131	−0.132	−0.133	−0.134	−0.135	−0.136	−0.137	−0.138	−0.139	−0.140
81.0	.132	.133	.134	.135	.136	.137	.138	.139	.140	.141
81.5	.134	.135	.136	.137	.138	.139	.139	.140	.141	.142
82.0	.135	.136	.137	.138	.139	.140	.141	.142	.143	.144
82.5	.136	.137	.138	.139	.140	.141	.142	.143	.144	.145
83.0	−0.138	−0.139	−0.139	−0.140	−0.141	−0.142	−0.143	−0.144	−0.145	−0.146
83.5	.139	.140	.141	.142	.143	.144	.145	.146	.147	.148
84.0	.140	.141	.142	.143	.144	.145	.146	.147	.148	.149
84.5	.141	.142	.143	.144	.145	.146	.147	.148	.149	.150
85.0	.143	.144	.145	.146	.147	.148	.149	.150	.151	.152
85.5	−0.144	−0.145	−0.146	−0.147	−0.148	−0.149	−0.150	−0.151	−0.152	−0.153
86.0	.145	.146	.147	.148	.149	.150	.151	.152	.153	.154
86.5	.146	.147	.148	.149	.151	.152	.153	.154	.155	.156
87.0	.148	.149	.150	.151	.152	.153	.154	.155	.156	.157
87.5	.149	.150	.151	.152	.153	.154	.155	.156	.157	.158
88.0	−0.150	−0.151	−0.152	−0.153	−0.154	−0.155	−0.157	−0.158	−0.159	−0.160
88.5	.151	.152	.154	.155	.156	.157	.158	.159	.160	.161
89.0	.153	.154	.155	.156	.157	.158	.159	.160	.161	.162
89.5	.154	.155	.156	.157	.158	.159	.160	.162	.163	.164
90.0	.155	.156	.157	.158	.160	.161	.162	.163	.164	.165
90.5	−0.156	−0.157	−0.159	−0.160	−0.161	−0.162	−0.163	−0.164	−0.165	−0.166
91.0	.158	.159	.160	.161	.162	.163	.164	.166	.167	.168
91.5	.159	.160	.161	.162	.163	.165	.166	.167	.168	.169
92.0	.160	.161	.162	.164	.165	.166	.167	.168	.169	.170
92.5	.161	.163	.164	.165	.166	.167	.168	.169	.171	.172
93.0	−0.163	−0.164	−0.165	−0.166	−0.167	−0.168	−0.170	−0.171	−0.172	−0.173
93.5	.164	.165	.166	.167	.169	.170	.171	.172	.173	.174
94.0	.165	.166	.168	.169	.170	.171	.172	.173	.175	.176
94.5	.166	.168	.169	.170	.171	.172	.174	.175	.176	.177
95.0	.168	.169	.170	.171	.172	.174	.175	.176	.177	.178
95.5	−0.169	−0.170	−0.171	−0.173	−0.174	−0.175	−0.176	−0.177	−0.179	−0.180
96.0	.170	.171	.173	.174	.175	.176	.177	.179	.180	.181
96.5	.171	.173	.174	.175	.176	.178	.179	.180	.181	.182
97.0	.173	.174	.175	.176	.178	.179	.180	.181	.183	.184
97.5	.174	.175	.176	.178	.179	.180	.181	.183	.184	.185
98.0	−0.175	−0.176	−0.178	−0.179	−0.180	−0.181	−0.183	−0.184	−0.185	−0.186
98.5	.176	.178	.179	.180	.181	.183	.184	.185	.187	.188
99.0	.178	.179	.180	.182	.183	.184	.185	.187	.188	.189
99.5	.179	.180	.182	.183	.184	.185	.187	.188	.189	.190
100.0	.180	.182	.183	.184	.185	.187	.188	.189	.191	.192

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 28.0 inch	28.2 inch	28.4 inch	28.6 inch	28.8 inch	29.0 inch	29.2 inch	29.4 inch	29.6 inch	29.8 inch
100.0	−0.180	−0.182	−0.183	−0.184	−0.185	−0.187	−0.188	−0.189	−0.191	−0.192
100.5	.181	.183	.184	.185	.187	.188	.189	.191	.192	.193
101.0	.183	.184	.185	.187	.188	.189	.191	.192	.193	.194
101.5	.184	.185	.187	.188	.189	.191	.192	.193	.194	.196
102.0	.185	.187	.188	.189	.191	.192	.193	.194	.196	.197
102.5	−0.186	−0.188	−0.189	−0.190	−0.192	−0.193	−0.194	−0.196	−0.197	−0.198
103.0	.188	.189	.190	.192	.193	.194	.196	.197	.198	.200
103.5	.189	.190	.192	.193	.194	.196	.197	.198	.200	.201
104.0	.190	.192	.193	.194	.196	.197	.198	.200	.201	.202
104.5	.191	.193	.194	.196	.197	.198	.200	.201	.202	.204
105.0	−0.193	−0.194	−0.195	−0.197	−0.198	−0.200	−0.201	−0.202	−0.204	−0.205
105.5	.194	.195	.197	.198	.200	.201	.202	.204	.205	.206
106.0	.195	.197	.198	.199	.201	.202	.204	.205	.206	.208
106.5	.196	.198	.199	.201	.202	.203	.205	.206	.208	.209
107.0	.198	.199	.201	.202	.203	.205	.206	.208	.209	.210
107.5	−0.199	−0.200	−0.202	−0.203	−0.205	−0.206	−0.208	−0.209	−0.210	−0.212
108.0	.200	.202	.203	.205	.206	.207	.209	.210	.212	.213
108.5	.202	.203	.204	.206	.207	.209	.210	.212	.213	.214
109.0	.203	.204	.206	.207	.209	.210	.211	.213	.214	.216
109.5	.204	.205	.207	.208	.210	.211	.213	.214	.216	.217
110.0	−0.205	−0.207	−0.208	−0.210	−0.211	−0.213	−0.214	−0.216	−0.217	−0.218
110.5	.206	.208	.209	.211	.212	.214	.215	.217	.218	.220
111.0	.208	.209	.211	.212	.214	.215	.217	.218	.220	.221
111.5	.209	.210	.212	.213	.215	.216	.218	.219	.221	.222
112.0	.210	.212	.213	.215	.216	.218	.219	.221	.222	.224
112.5	−0.212	−0.213	−0.215	−0.216	−0.218	−0.219	−0.221	−0.222	−0.224	−0.225
113.0	.213	.214	.216	.217	.219	.220	.222	.223	.225	.226
113.5	.214	.216	.217	.219	.220	.222	.223	.225	.226	.228
114.0	.215	.217	.218	.220	.221	.223	.224	.226	.228	.229
114.5	.217	.218	.220	.221	.223	.224	.226	.227	.229	.230
115.0	−0.218	−0.219	−0.221	−0.222	−0.224	−0.226	−0.227	−0.229	−0.230	−0.232
115.5	.219	.221	.222	.224	.225	.227	.228	.230	.232	.233
116.0	.220	.222	.223	.225	.227	.228	.230	.231	.233	.234
116.5	.222	.223	.225	.226	.228	.229	.231	.233	.234	.236
117.0	.223	.224	.226	.228	.229	.231	.232	.234	.235	.237
117.5	−0.224	−0.226	−0.227	−0.229	−0.230	−0.232	−0.234	−0.235	−0.237	−0.238
118.0	.225	.227	.228	.230	.232	.233	.235	.236	.238	.240
118.5	.227	.228	.230	.231	.233	.235	.236	.238	.239	.241
119.0	.228	.229	.231	.233	.234	.236	.237	.239	.241	.242
119.5	.229	.231	.232	.234	.236	.237	.239	.240	.242	.244
120.0	−0.230	−0.232	−0.234	−0.235	−0.237	−0.238	−0.240	−0.242	−0.243	−0.245

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer	Height of the mercury column—inches									
	29.8	30.0	30.2	30.4	30.6	30.8	31.0	31.2	31.4	31.6
°F.	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
0.0	+0.078	+0.078	+0.079	+0.079	+0.080	+0.080	+0.081	+0.081	+0.082	+0.082
0.5	+0.076	+0.077	+0.077	+0.078	+0.078	+0.079	+0.079	+0.080	+0.080	+0.081
1.0	.075	.076	.076	.077	.077	.078	.078	.079	.079	.080
1.5	.074	.074	.075	.075	.076	.076	.077	.077	.078	.078
2.0	.072	.073	.073	.074	.074	.075	.075	.076	.076	.077
2.5	.071	.071	.072	.072	.073	.073	.074	.074	.075	.075
3.0	+0.070	+0.070	+0.070	+0.071	+0.071	+0.072	+0.072	+0.073	+0.073	+0.074
3.5	.068	.069	.069	.070	.070	.070	.071	.071	.072	.072
4.0	.067	.067	.068	.068	.069	.069	.070	.070	.070	.071
4.5	.065	.066	.066	.067	.067	.068	.068	.069	.069	.069
5.0	.064	.065	.065	.065	.066	.066	.067	.067	.068	.068
5.5	+0.063	+0.063	+0.064	+0.064	+0.064	+0.065	+0.065	+0.066	+0.066	+0.067
6.0	.061	.062	.062	.063	.063	.063	.064	.064	.065	.065
6.5	.060	.060	.061	.061	.062	.062	.062	.063	.063	.064
7.0	.059	.059	.059	.060	.060	.061	.061	.061	.062	.062
7.5	.057	.058	.058	.058	.059	.059	.060	.060	.060	.061
8.0	+0.056	+0.056	+0.057	+0.057	+0.057	+0.058	+0.058	+0.059	+0.059	+0.059
8.5	.055	.055	.055	.056	.056	.056	.057	.057	.058	.058
9.0	.053	.054	.054	.054	.055	.055	.055	.056	.056	.056
9.5	.052	.052	.053	.053	.053	.054	.054	.054	.055	.055
10.0	.051	.051	.051	.052	.052	.052	.053	.053	.053	.054
10.5	+0.049	+0.049	+0.050	+0.050	+0.050	+0.051	+0.051	+0.051	+0.052	+0.052
11.0	.048	.048	.048	.049	.049	.049	.050	.050	.050	.051
11.5	.046	.047	.047	.047	.048	.048	.048	.049	.049	.049
12.0	.045	.045	.046	.046	.046	.047	.047	.047	.048	.048
12.5	.044	.044	.044	.045	.045	.045	.045	.046	.046	.046
13.0	+0.042	+0.043	+0.043	+0.043	+0.044	+0.044	+0.044	+0.044	+0.045	+0.045
13.5	.041	.041	.042	.042	.042	.042	.043	.043	.043	.043
14.0	.040	.040	.040	.040	.041	.041	.041	.042	.042	.042
14.5	.038	.039	.039	.039	.039	.040	.040	.040	.040	.041
15.0	.037	.037	.037	.038	.038	.038	.038	.039	.039	.039
15.5	+0.036	+0.036	+0.036	+0.036	+0.037	+0.037	+0.037	+0.037	+0.037	+0.038
16.0	.034	.034	.035	.035	.035	.035	.036	.036	.036	.036
16.5	.033	.033	.033	.034	.034	.034	.034	.034	.035	.035
17.0	.032	.032	.032	.032	.032	.033	.033	.033	.033	.033
17.5	.030	.030	.031	.031	.031	.031	.031	.032	.032	.032
18.0	+0.029	+0.029	+0.029	+0.029	+0.030	+0.030	+0.030	+0.030	+0.030	+0.031
18.5	.027	.028	.028	.028	.028	.028	.029	.029	.029	.029
19.0	.026	.026	.026	.027	.027	.027	.027	.027	.027	.028
19.5	.025	.025	.025	.025	.025	.026	.026	.026	.026	.026
20.0	.023	.024	.024	.024	.024	.024	.024	.024	.025	.025
20.5	+0.022	+0.022	+0.022	+0.022	+0.023	+0.023	+0.023	+0.023	+0.023	+0.023
21.0	.021	.021	.021	.021	.021	.021	.022	.022	.022	.022
21.5	.019	.019	.020	.020	.020	.020	.020	.020	.020	.020
22.0	.018	.018	.018	.018	.018	.019	.019	.019	.019	.019
22.5	.017	.017	.017	.017	.017	.017	.017	.017	.017	.018
23.0	+0.015	+0.015	+0.015	+0.016	+0.016	+0.016	+0.016	+0.016	+0.016	+0.016
23.5	.014	.014	.014	.014	.014	.014	.014	.015	.015	.015
24.0	.013	.013	.013	.013	.013	.013	.013	.013	.013	.013
24.5	.011	.011	.011	.011	.011	.012	.012	.012	.012	.012
25.0	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	29.8 inch	30.0 inch	30.2 inch	30.4 inch	30.6 inch	30.8 inch	31.0 inch	31.2 inch	31.4 inch	31.6 inch
25.5	+0.008	+0.009	+0.009	+0.009	+0.009	+0.009	+0.009	+0.009	+0.009	+0.009
26.0	.007	.007	.007	.007	.007	.007	.007	.007	.008	.008
26.5	.006	.006	.006	.006	.006	.006	.006	.006	.006	.006
27.0	.004	.004	.004	.005	.005	.005	.005	.005	.005	.005
27.5	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003
28.0	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002
28.5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29.0	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
29.5	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
30.0	.004	.004	.004	.004	.004	.004	.004	.004	.004	.004
30.5	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005	−0.005
31.0	.006	.006	.006	.007	.007	.007	.007	.007	.007	.007
31.5	.008	.008	.008	.008	.008	.008	.008	.008	.008	.008
32.0	.009	.009	.009	.009	.009	.009	.009	.010	.010	.010
32.5	.010	.011	.011	.011	.011	.011	.011	.011	.011	.011
33.0	−0.012	−0.012	−0.012	−0.012	−0.012	−0.012	−0.012	−0.012	−0.012	−0.013
33.5	.013	.013	.013	.013	.014	.014	.014	.014	.014	.014
34.0	.015	.015	.015	.015	.015	.015	.015	.015	.015	.015
34.5	.016	.016	.016	.016	.016	.016	.017	.017	.017	.017
35.0	.017	.017	.017	.018	.018	.018	.018	.018	.018	.018
35.5	−0.019	−0.019	−0.019	−0.019	−0.019	−0.019	−0.019	−0.019	−0.020	−0.020
36.0	.020	.020	.020	.020	.020	.021	.021	.021	.021	.021
36.5	.021	.021	.022	.022	.022	.022	.022	.022	.022	.023
37.0	.023	.023	.023	.023	.023	.023	.024	.024	.024	.024
37.5	.024	.024	.024	.024	.025	.025	.025	.025	.025	.025
38.0	−0.025	−0.026	−0.026	−0.026	−0.026	−0.026	−0.026	−0.027	−0.027	−0.027
38.5	.027	.027	.027	.027	.027	.028	.028	.028	.028	.028
39.0	.028	.028	.028	.029	.029	.029	.029	.029	.030	.030
39.5	.029	.030	.030	.030	.030	.030	.031	.031	.031	.031
40.0	.031	.031	.031	.031	.032	.032	.032	.032	.032	.033
40.5	−0.032	−0.032	−0.033	−0.033	−0.033	−0.033	−0.033	−0.034	−0.034	−0.034
41.0	.033	.034	.034	.034	.034	.035	.035	.035	.035	.035
41.5	.035	.035	.035	.035	.036	.036	.036	.036	.037	.037
42.0	.036	.036	.037	.037	.037	.037	.038	.038	.038	.038
42.5	.037	.038	.038	.038	.038	.039	.039	.039	.040	.040
43.0	−0.039	−0.039	−0.039	−0.040	−0.040	−0.040	−0.040	−0.041	−0.041	−0.041
43.5	.040	.040	.041	.041	.041	.042	.042	.042	.042	.043
44.0	.042	.042	.042	.042	.043	.043	.043	.043	.044	.044
44.5	.043	.043	.043	.044	.044	.044	.045	.045	.045	.045
45.0	.044	.045	.045	.045	.045	.046	.046	.046	.047	.047
45.5	−0.046	−0.046	−0.046	−0.047	−0.047	−0.047	−0.047	−0.048	−0.048	−0.048
46.0	.047	.047	.048	.048	.048	.049	.049	.049	.049	.050
46.5	.048	.049	.049	.049	.050	.050	.050	.051	.051	.051
47.0	.050	.050	.050	.051	.051	.051	.052	.052	.052	.053
47.5	.051	.051	.052	.052	.052	.053	.053	.053	.054	.054
48.0	−0.052	−0.053	−0.053	−0.053	−0.054	−0.054	−0.054	−0.055	−0.055	−0.055
48.5	.054	.054	.054	.055	.055	.055	.056	.056	.057	.057
49.0	.055	.055	.056	.056	.057	.057	.057	.058	.058	.058
49.5	.056	.057	.057	.058	.058	.058	.059	.059	.059	.060
50.0	.058	.058	.058	.059	.059	.060	.060	.060	.061	.061

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches 29.8 inch	30.0 inch	30.2 inch	30.4 inch	30.6 inch	30.8 inch	31.0 inch	31.2 inch	31.4 inch	31.6 inch
50.5	−0.059	−0.059	−0.060	−0.060	−0.061	−0.061	−0.061	−0.062	−0.062	−0.063
51.0	.060	.061	.061	.062	.062	.062	.063	.063	.064	.064
51.5	.062	.062	.063	.063	.063	.064	.064	.065	.065	.065
52.0	.063	.064	.064	.064	.065	.065	.066	.066	.066	.067
52.5	.064	.065	.065	.066	.066	.067	.067	.067	.068	.068
53.0	−0.066	−0.066	−0.067	−0.067	−0.068	−0.068	−0.068	−0.069	−0.069	−0.070
53.5	.067	.068	.068	.069	.069	.069	.070	.070	.071	.071
54.0	.068	.069	.069	.070	.070	.071	.071	.072	.072	.073
54.5	.070	.070	.071	.071	.072	.072	.073	.073	.074	.074
55.0	.071	.072	.072	.073	.073	.074	.074	.075	.075	.075
55.5	−0.073	−0.073	−0.074	−0.074	−0.074	−0.075	−0.075	−0.076	−0.076	−0.077
56.0	.074	.074	.075	.075	.076	.076	.077	.077	.078	.078
56.5	.075	.076	.076	.077	.077	.078	.078	.079	.079	.080
57.0	.077	.077	.078	.078	.079	.079	.080	.080	.081	.081
57.5	.078	.078	.079	.079	.080	.081	.081	.082	.082	.083
58.0	−0.079	−0.080	−0.080	−0.081	−0.081	−0.082	−0.082	−0.083	−0.084	−0.084
58.5	.081	.081	.082	.082	.083	.083	.084	.084	.085	.085
59.0	.082	.083	.083	.084	.084	.085	.085	.086	.086	.087
59.5	.083	.084	.084	.085	.086	.086	.087	.087	.088	.088
60.0	.085	.085	.086	.086	.087	.087	.088	.089	.089	.090
60.5	−0.086	−0.087	−0.087	−0.088	−0.088	−0.089	−0.089	−0.090	−0.091	−0.091
61.0	.087	.088	.089	.089	.090	.090	.091	.091	.092	.093
61.5	.089	.089	.090	.090	.091	.092	.092	.093	.093	.094
62.0	.090	.091	.091	.092	.092	.093	.094	.094	.095	.095
62.5	.091	.092	.093	.093	.094	.094	.095	.096	.096	.097
63.0	−0.093	−0.093	−0.094	−0.095	−0.095	−0.096	−0.096	−0.097	−0.098	−0.098
63.5	.094	.095	.095	.096	.097	.097	.098	.098	.099	.100
64.0	.095	.096	.097	.097	.098	.099	.099	.100	.101	.101
64.5	.097	.097	.098	.099	.099	.100	.101	.101	.102	.103
65.0	.098	.099	.099	.100	.101	.101	.102	.103	.103	.104
65.5	−0.099	−0.100	−0.101	−0.101	−0.102	−0.103	−0.103	−0.104	−0.105	−0.105
66.0	.101	.101	.102	.103	.103	.104	.105	.106	.106	.107
66.5	.102	.103	.103	.104	.105	.106	.106	.107	.108	.108
67.0	.103	.104	.105	.106	.106	.107	.108	.108	.109	.110
67.5	.105	.106	.106	.107	.108	.108	.109	.110	.110	.111
68.0	−0.106	−0.107	−0.108	−0.108	−0.109	−0.110	−0.110	−0.111	−0.112	−0.113
68.5	.107	.108	.109	.110	.110	.111	.112	.113	.113	.114
69.0	.109	.110	.110	.111	.112	.112	.113	.114	.115	.115
69.5	.110	.111	.112	.112	.113	.114	.115	.115	.116	.117
70.0	.112	.112	.113	.114	.115	.115	.116	.117	.117	.118
70.5	−0.113	−0.114	−0.114	−0.115	−0.116	−0.117	−0.117	−0.118	−0.119	−0.120
71.0	.114	.115	.116	.116	.117	.118	.119	.120	.120	.121
71.5	.116	.116	.117	.118	.119	.119	.120	.121	.122	.123
72.0	.117	.118	.118	.119	.120	.121	.122	.122	.123	.124
72.5	.118	.119	.120	.121	.121	.122	.123	.124	.125	.125
73.0	−0.120	−0.120	−0.121	−0.122	−0.123	−0.124	−0.124	−0.125	−0.126	−0.127
73.5	.121	.122	.123	.123	.124	.125	.126	.127	.127	.128
74.0	.122	.123	.124	.125	.126	.126	.127	.128	.129	.130
74.5	.124	.124	.125	.126	.127	.128	.129	.129	.130	.131
75.0	.125	.126	.127	.127	.128	.129	.130	.131	.132	.132

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer °F.	Height of the mercury column—inches									
	29.8 inch	30.0 inch	30.2 inch	30.4 inch	30.6 inch	30.8 inch	31.0 inch	31.2 inch	31.4 inch	31.6 inch
75.5	−0.126	−0.127	−0.128	−0.129	−0.130	−0.131	−0.131	−0.132	−0.133	−0.134
76.0	.128	.128	.129	.130	.131	.132	.133	.134	.134	.135
76.5	.129	.130	.131	.132	.132	.133	.134	.135	.136	.137
77.0	.130	.131	.132	.133	.134	.135	.136	.136	.137	.138
77.5	.132	.133	.133	.134	.135	.136	.137	.138	.139	.140
78.0	−0.133	−0.134	−0.135	−0.136	−0.137	−0.137	−0.138	−0.139	−0.140	−0.141
78.5	.134	.135	.136	.137	.138	.139	.140	.141	.142	.142
79.0	.136	.137	.137	.138	.139	.140	.141	.142	.143	.144
79.5	.137	.138	.139	.140	.141	.142	.143	.143	.144	.145
80.0	.138	.139	.140	.141	.142	.143	.144	.145	.146	.147
80.5	−0.140	−0.141	−0.142	−0.142	−0.143	−0.144	−0.145	−0.146	−0.147	−0.148
81.0	.141	.142	.143	.144	.145	.146	.147	.148	.149	.150
81.5	.142	.143	.144	.145	.146	.147	.148	.149	.150	.151
82.0	.144	.145	.146	.147	.148	.149	.149	.150	.151	.152
82.5	.145	.146	.147	.148	.149	.150	.151	.152	.153	.154
83.0	−0.146	−0.147	−0.148	−0.149	−0.150	−0.151	−0.152	−0.153	−0.154	−0.155
83.5	.148	.149	.150	.151	.152	.153	.154	.155	.156	.157
84.0	.149	.150	.151	.152	.153	.154	.155	.156	.157	.158
84.5	.150	.151	.152	.153	.154	.155	.156	.157	.158	.159
85.0	.152	.153	.154	.155	.156	.157	.158	.159	.160	.161
85.5	−0.153	−0.154	−0.155	−0.156	−0.157	−0.158	−0.159	−0.160	−0.161	−0.162
86.0	.154	.155	.156	.158	.159	.160	.161	.162	.163	.164
86.5	.156	.157	.158	.159	.160	.161	.162	.163	.164	.165
87.0	.157	.158	.159	.160	.161	.162	.163	.164	.166	.167
87.5	.158	.159	.161	.162	.163	.164	.165	.166	.167	.168
88.0	−0.160	−0.161	−0.162	−0.163	−0.164	−0.165	−0.166	−0.167	−0.168	−0.169
88.5	.161	.162	.163	.164	.165	.166	.168	.169	.170	.171
89.0	.162	.164	.165	.166	.167	.168	.169	.170	.171	.172
89.5	.164	.165	.166	.167	.168	.169	.170	.171	.173	.174
90.0	.165	.166	.167	.168	.170	.171	.172	.173	.174	.175
90.5	−0.166	−0.168	−0.169	−0.170	−0.171	−0.172	−0.173	−0.174	−0.175	−0.176
91.0	.168	.169	.170	.171	.172	.173	.175	.176	.177	.178
91.5	.169	.170	.171	.173	.174	.175	.176	.177	.178	.179
92.0	.170	.172	.173	.174	.175	.176	.177	.178	.180	.181
92.5	.172	.173	.174	.175	.176	.178	.179	.180	.181	.182
93.0	−0.173	−0.174	−0.175	−0.177	−0.178	−0.179	−0.180	−0.181	−0.182	−0.184
93.5	.174	.176	.177	.178	.179	.180	.181	.183	.184	.185
94.0	.176	.177	.178	.179	.180	.182	.183	.184	.185	.186
94.5	.177	.178	.179	.181	.182	.183	.184	.185	.187	.188
95.0	.178	.180	.181	.182	.183	.184	.186	.187	.188	.189
95.5	−0.180	−0.181	−0.182	−0.183	−0.185	−0.186	−0.187	−0.188	−0.189	−0.191
96.0	.181	.182	.184	.185	.186	.187	.188	.190	.191	.192
96.5	.182	.184	.185	.186	.187	.189	.190	.191	.192	.193
97.0	.184	.185	.186	.187	.189	.190	.191	.192	.194	.195
97.5	.185	.186	.188	.189	.190	.191	.193	.194	.195	.196
98.0	−0.186	−0.188	−0.189	−0.190	−0.191	−0.193	−0.194	−0.195	−0.196	−0.198
98.5	.188	.189	.190	.192	.193	.194	.195	.197	.198	.199
99.0	.189	.190	.192	.193	.194	.195	.197	.198	.199	.201
99.5	.190	.192	.193	.194	.196	.197	.198	.199	.201	.202
100.0	.192	.193	.194	.196	.197	.198	.200	.201	.202	.203

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

English units

Attached thermometer	Height of the mercury column—inches									
	29.8	30.0	30.2	30.4	30.6	30.8	31.0	31.2	31.4	31.6
°F.	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch
100.0	−0.192	−0.193	−0.194	−0.196	−0.197	−0.198	−0.200	−0.201	−0.202	−0.203
100.5	.193	.194	.196	.197	.198	.200	.201	.202	.203	.205
101.0	.194	.196	.197	.198	.200	.201	.202	.204	.205	.206
101.5	.196	.197	.198	.200	.201	.202	.204	.205	.206	.208
102.0	.197	.198	.200	.201	.202	.204	.205	.206	.208	.209
102.5	−0.198	−0.200	−0.201	−0.202	−0.204	−0.205	−0.206	−0.208	−0.209	−0.210
103.0	.200	.201	.202	.204	.205	.206	.208	.209	.211	.212
103.5	.201	.202	.204	.205	.207	.208	.209	.211	.212	.213
104.0	.202	.204	.205	.207	.208	.209	.211	.212	.213	.215
104.5	.204	.205	.207	.208	.209	.211	.212	.213	.215	.216
105.0	−0.205	−0.206	−0.208	−0.209	−0.211	−0.212	−0.213	−0.215	−0.216	−0.218
105.5	.206	.208	.209	.211	.212	.213	.215	.216	.218	.219
106.0	.208	.209	.211	.212	.213	.215	.216	.218	.219	.220
106.5	.209	.211	.212	.213	.215	.216	.218	.219	.220	.222
107.0	.210	.212	.213	.215	.216	.218	.219	.220	.222	.223
107.5	−0.212	−0.213	−0.215	−0.216	−0.217	−0.219	−0.220	−0.222	−0.223	−0.225
108.0	.213	.215	.216	.217	.219	.220	.222	.223	.225	.226
108.5	.214	.216	.217	.219	.220	.222	.223	.225	.226	.227
109.0	.216	.217	.219	.220	.222	.223	.224	.226	.227	.229
109.5	.217	.219	.220	.221	.223	.224	.226	.227	.229	.230
110.0	−0.218	−0.220	−0.221	−0.223	−0.224	−0.226	−0.227	−0.229	−0.230	−0.232
110.5	.220	.221	.223	.224	.226	.227	.229	.230	.232	.233
111.0	.221	.223	.224	.226	.227	.229	.230	.232	.233	.234
111.5	.222	.224	.225	.227	.228	.230	.231	.233	.234	.236
112.0	.224	.225	.227	.228	.230	.231	.233	.234	.236	.237
112.5	−0.225	−0.227	−0.228	−0.230	−0.231	−0.233	−0.234	−0.236	−0.237	−0.239
113.0	.226	.228	.229	.231	.232	.234	.236	.237	.239	.240
113.5	.228	.229	.231	.232	.234	.235	.237	.238	.240	.242
114.0	.229	.231	.232	.234	.235	.237	.238	.240	.241	.243
114.5	.230	.232	.234	.235	.237	.238	.240	.241	.243	.244
115.0	−0.232	−0.233	−0.235	−0.236	−0.238	−0.240	−0.241	−0.243	−0.244	−0.246
115.5	.233	.235	.236	.238	.239	.241	.242	.244	.246	.247
116.0	.234	.236	.238	.239	.241	.242	.244	.245	.247	.249
116.5	.236	.237	.239	.240	.242	.244	.245	.247	.248	.250
117.0	.237	.239	.240	.242	.243	.245	.247	.248	.250	.251
117.5	−0.238	−0.240	−0.242	−0.243	−0.245	−0.246	−0.248	−0.250	−0.251	−0.253
118.0	.240	.241	.243	.245	.246	.248	.249	.251	.253	.254
118.5	.241	.243	.244	.246	.248	.249	.251	.252	.254	.256
119.0	.242	.244	.246	.247	.249	.250	.252	.254	.255	.257
119.5	.244	.245	.247	.249	.250	.252	.254	.255	.257	.258
120.0	−0.245	−0.247	−0.248	−0.250	−0.252	−0.253	−0.255	−0.257	−0.258	−0.260

TABLE 46

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column—mm. or mb.											
	20	40	60	80	100	120	140	160	180	200	220	240
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0	.0	.0	.1	.1	.1	.1	.1
3	.0	.0	.0	.0	.0	.1	.1	.1	.1	.1	.1	.1
4	.0	.0	.0	.1	.1	.1	.1	.1	.1	.1	.1	.2
5	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
6	.0	.0	.1	.1	.1	.1	.1	.2	.2	.2	.2	.2
7	.0	.0	.1	.1	.1	.1	.2	.2	.2	.2	.3	.3
8	.0	.1	.1	.1	.1	.2	.2	.2	.2	.3	.3	.3
9	.0	.1	.1	.1	.1	.2	.2	.2	.3	.3	.3	.4
10	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
11	.0	.1	.1	.1	.2	.2	.3	.3	.3	.4	.4	.4
12	.0	.1	.1	.2	.2	.2	.3	.3	.4	.4	.4	.5
13	.0	.1	.1	.2	.2	.3	.3	.3	.4	.4	.5	.5
14	.0	.1	.1	.2	.2	.3	.3	.4	.4	.5	.5	.5
15	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6
16	.1	.1	.2	.2	.3	.3	.4	.4	.5	.5	.6	.6
17	.1	.1	.2	.2	.3	.3	.4	.4	.5	.6	.6	.7
18	.1	.1	.2	.2	.3	.4	.4	.5	.5	.6	.6	.7
19	.1	.1	.2	.2	.3	.4	.4	.5	.6	.6	.7	.7
20	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8
21	.1	.1	.2	.3	.3	.4	.5	.5	.6	.7	.8	.8
22	.1	.1	.2	.3	.4	.4	.5	.6	.6	.7	.8	.9
23	.1	.1	.2	.3	.4	.4	.5	.6	.7	.7	.8	.9
24	.1	.2	.2	.3	.4	.5	.5	.6	.7	.8	.9	.9
25	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0
26	.1	.2	.3	.3	.4	.5	.6	.7	.8	.8	.9	1.0
27	.1	.2	.3	.4	.4	.5	.6	.7	.8	.9	1.0	1.1
28	.1	.2	.3	.4	.5	.5	.6	.7	.8	.9	1.0	1.1
29	.1	.2	.3	.4	.5	.6	.7	.8	.8	.9	1.0	1.1
30	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2
31	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2
32	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0	1.1	1.2
33	.1	.2	.3	.4	.5	.6	.8	.9	1.0	1.1	1.2	1.3
34	.1	.2	.3	.4	.6	.7	.8	.9	1.0	1.1	1.2	1.3

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column—mm. or mb. 260	280	300	320	340	360	380	400	420	440	460	480	500
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	.0	.0	.0	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
2	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.2	.2	.2
3	.1	.1	.1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
4	.2	.2	.2	.2	.2	.2	.2	.3	.3	.3	.3	.3	.3
5	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4
6	.3	.3	.3	.3	.3	.4	.4	.4	.4	.4	.5	.5	.5
7	.3	.3	.3	.4	.4	.4	.4	.5	.5	.5	.5	.5	.6
8	.3	.4	.4	.4	.4	.5	.5	.5	.5	.6	.6	.6	.7
9	.4	.4	.4	.5	.5	.5	.6	.6	.6	.6	.7	.7	.7
10	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
11	.5	.5	.5	.6	.6	.6	.7	.7	.8	.8	.8	.9	.9
12	.5	.5	.6	.6	.7	.7	.7	.8	.8	.9	.9	.9	1.0
13	.5	.6	.6	.7	.7	.8	.8	.8	.9	.9	1.0	1.0	1.1
14	.6	.6	.7	.7	.8	.8	.9	.9	1.0	1.0	1.0	1.1	1.1
15	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2
16	.7	.7	.8	.8	.9	.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3
17	.7	.8	.8	.9	.9	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4
18	.8	.8	.9	.9	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.5
19	.8	.9	.9	1.0	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5
20	0.8	0.9	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.6
21	.9	1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7
22	.9	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.6	1.7	1.8
23	1.0	1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9
24	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	1.9
25	1.1	1.1	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.0
26	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8	1.9	1.9	2.0	2.1
27	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2
28	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3
29	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4
30	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.4
31	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5
32	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6
33	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.4	2.5	2.6	2.7
34	1.4	1.5	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.7	2.8

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above / below 0°C., the correction is to be subtracted / added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column—mm. or mb.												
	440	450	460	470	480	490	500	510	520	530	540	550	560
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	.07	.07	.08	.08	.08	.08	.08	.08	.08	.09	.09	.09	.09
2	.14	.15	.15	.15	.16	.16	.16	.17	.17	.17	.18	.18	.18
3	.22	.22	.23	.23	.24	.24	.24	.25	.25	.26	.26	.27	.27
4	.29	.29	.30	.31	.31	.32	.33	.33	.34	.35	.35	.36	.37
5	0.36	0.37	0.38	0.38	0.39	0.40	0.41	0.42	0.42	0.43	0.44	0.45	0.46
6	.43	.44	.45	.46	.47	.48	.49	.50	.51	.52	.53	.54	.55
7	.50	.51	.53	.54	.55	.56	.57	.58	.59	.61	.62	.63	.64
8	.57	.59	.60	.61	.63	.64	.65	.67	.68	.69	.70	.72	.73
9	.65	.66	.68	.69	.70	.72	.73	.75	.76	.78	.79	.81	.82
10	0.72	0.73	0.75	0.77	0.78	0.80	0.82	0.83	0.85	0.86	0.88	0.90	0.91
11	.79	.81	.83	.84	.86	.88	.90	.91	.93	.95	.97	.99	1.00
12	.86	.88	.90	.92	.94	.96	.98	1.00	1.02	1.04	1.06	1.08	1.10
13	.93	.95	.97	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.17	1.19
14	1.00	1.03	1.05	1.07	1.10	1.12	1.14	1.16	1.19	1.21	1.23	1.25	1.28
15	1.08	1.10	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30	1.32	1.34	1.37
16	1.15	1.17	1.20	1.23	1.25	1.28	1.30	1.33	1.36	1.38	1.41	1.43	1.46
17	1.22	1.25	1.27	1.30	1.33	1.36	1.38	1.41	1.44	1.47	1.50	1.52	1.55
18	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.52	1.55	1.58	1.61	1.64
19	1.36	1.39	1.42	1.45	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.73
20	1.43	1.47	1.50	1.53	1.56	1.60	1.63	1.66	1.69	1.73	1.76	1.79	1.82
21	1.50	1.54	1.57	1.61	1.64	1.67	1.71	1.74	1.78	1.81	1.85	1.88	1.91
22	1.58	1.61	1.65	1.68	1.72	1.75	1.79	1.83	1.86	1.90	1.93	1.97	2.01
23	1.65	1.68	1.72	1.76	1.80	1.83	1.87	1.91	1.95	1.98	2.02	2.06	2.10
24	1.72	1.76	1.80	1.84	1.87	1.91	1.95	1.99	2.03	2.07	2.11	2.15	2.19
25	1.79	1.83	1.87	1.91	1.95	1.99	2.03	2.07	2.11	2.16	2.20	2.24	2.28
26	1.86	1.90	1.95	1.99	2.03	2.07	2.11	2.16	2.20	2.24	2.28	2.33	2.37
27	1.93	1.98	2.02	2.06	2.11	2.15	2.20	2.24	2.28	2.33	2.37	2.41	2.46
28	2.00	2.05	2.09	2.14	2.18	2.23	2.28	2.32	2.37	2.41	2.46	2.50	2.55
29	2.07	2.12	2.17	2.22	2.26	2.31	2.36	2.40	2.45	2.50	2.55	2.59	2.64
30	2.15	2.19	2.24	2.29	2.34	2.39	2.44	2.49	2.54	2.58	2.63	2.68	2.73
31	2.22	2.27	2.32	2.37	2.42	2.47	2.52	2.57	2.62	2.67	2.72	2.77	2.82
32	2.29	2.34	2.39	2.44	2.50	2.55	2.60	2.65	2.70	2.76	2.81	2.86	2.91
33	2.36	2.41	2.47	2.52	2.57	2.63	2.68	2.73	2.79	2.84	2.89	2.95	3.00
34	2.43	2.48	2.54	2.60	2.65	2.71	2.76	2.82	2.87	2.93	2.98	3.04	3.09
35	2.50	2.56	2.61	2.67	2.73	2.78	2.84	2.90	2.96	3.01	3.07	3.13	3.18

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 560 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 570 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.05	0.07	0.00	0.02	0.04	0.06	0.07
1	.09	.11	.13	.15	.16	.09	.11	.13	.15	.17
2	.18	.20	.22	.24	.26	.19	.20	.22	.24	.26
3	.27	.29	.31	.33	.35	.28	.30	.32	.34	.35
4	.37	.38	.40	.42	.44	.37	.39	.41	.43	.45
5	0.46	0.48	.049	0.51	0.53	0.47	0.48	0.50	0.52	0.54
6	.55	.57	.58	.60	.62	.56	.58	.60	.61	.63
7	.64	.66	.68	.69	.71	.65	.67	.69	.71	.73
8	.73	.75	.77	.79	.80	.74	.76	.78	.80	.82
9	.82	.84	.86	.88	.90	.84	.86	.87	.89	.91
10	0.91	0.93	0.95	0.97	0.99	0.93	0.95	0.97	0.99	1.00
11	1.00	1.02	1.04	1.06	1.08	1.02	1.04	1.06	1.08	1.10
12	1.10	1.11	1.13	1.15	1.17	1.12	1.13	1.15	1.17	1.19
13	1.19	1.20	1.22	1.24	1.26	1.21	1.23	1.25	1.26	1.28
14	1.28	1.30	1.31	1.33	1.35	1.30	1.32	1.34	1.36	1.37
15	1.37	1.39	1.41	1.42	1.44	1.39	1.41	1.43	1.45	1.47
16	1.46	1.48	1.50	1.51	1.53	1.49	1.50	1.52	1.54	1.56
17	1.55	1.57	1.59	1.61	1.62	1.58	1.60	1.62	1.63	1.65
18	1.64	1.66	1.68	1.70	1.71	1.67	1.69	1.71	1.73	1.75
19	1.73	1.75	1.77	1.79	1.81	1.76	1.78	1.80	1.82	1.84
20	1.82	1.84	1.86	1.88	1.90	1.86	1.87	1.89	1.91	1.93
21	1.91	1.93	1.95	1.97	1.99	1.95	1.97	1.99	2.00	2.02
22	2.01	2.02	2.04	2.06	2.08	2.04	2.06	2.08	2.10	2.11
23	2.10	2.11	2.13	2.15	2.17	2.13	2.15	2.17	2.19	2.21
24	2.19	2.20	2.22	2.24	2.26	2.23	2.24	2.26	2.28	2.30
25	2.28	2.30	2.31	2.33	2.35	2.32	2.34	2.35	2.37	2.39
26	2.37	2.39	2.40	2.42	2.44	2.41	2.43	2.45	2.47	2.48
27	2.46	2.48	2.49	2.51	2.53	2.50	2.52	2.54	2.56	2.58
28	2.55	2.57	2.59	2.60	2.62	2.59	2.61	2.63	2.65	2.67
29	2.64	2.66	2.68	2.69	2.71	2.69	2.71	2.72	2.74	2.76
30	2.73	2.75	2.77	2.78	2.80	2.78	2.80	2.82	2.83	2.85
31	2.82	2.84	2.86	2.87	2.89	2.87	2.89	2.91	2.93	2.94
32	2.91	2.93	2.95	2.97	2.98	2.96	2.98	3.00	3.02	3.04
33	3.00	3.02	3.04	3.06	3.07	3.06	3.07	3.09	3.11	3.13
34	3.09	3.11	3.13	3.15	3.16	3.15	3.17	3.18	3.20	3.22
35	3.18	3.20	3.22	3.24	3.25	3.24	3.26	3.28	3.29	3.31
36	3.27	3.29	3.31	3.33	3.34	3.33	3.35	3.37	3.39	3.40
37	3.36	3.38	3.40	3.42	3.44	3.42	3.44	3.46	3.48	3.50
38	3.45	3.47	3.49	3.51	3.53	3.52	3.53	3.55	3.57	3.59
39	3.54	3.56	3.58	3.60	3.62	3.61	3.63	3.64	3.66	3.68
40	3.63	3.65	3.67	3.69	3.71	3.70	3.72	3.74	3.75	3.77
41	3.72	3.74	3.76	3.78	3.80	3.79	3.81	3.83	3.85	3.86
42	3.81	3.83	3.85	3.87	3.89	3.88	3.90	3.92	3.94	3.96
43	3.90	3.92	3.94	3.96	3.98	3.97	3.99	4.01	4.03	4.05
44	3.99	4.01	4.03	4.05	4.07	4.07	4.08	4.10	4.12	4.14
45	4.08	4.10	4.12	4.14	4.16	4.16	4.18	4.19	4.21	4.23

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 580 mm. or mb.					Height of the mercury column 590 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.06	0.08	0.00	0.02	0.04	0.06	0.08
1	.09	.11	.13	.15	.17	.10	.12	.13	.15	.17
2	.19	.21	.23	.25	.27	.19	.21	.23	.25	.27
3	.28	.30	.32	.34	.36	.29	.31	.33	.35	.37
4	.38	.40	.42	.44	.45	.39	.40	.42	.44	.46
5	0.47	0.49	0.51	0.53	0.55	0.48	0.50	0.52	0.54	0.56
6	.57	.59	.61	.62	.64	.58	.60	.62	.64	.65
7	.66	.68	.70	.72	.74	.67	.69	.71	.73	.75
8	.76	.78	.79	.81	.83	.77	.79	.81	.83	.85
9	.85	.87	.89	.91	.93	.87	.89	.90	.92	.94
10	0.95	0.96	0.98	1.00	1.02	0.96	0.98	1.00	1.02	1.04
11	1.04	1.06	1.08	1.10	1.12	1.06	1.08	1.10	1.12	1.14
12	1.13	1.15	1.17	1.19	1.21	1.15	1.17	1.19	1.21	1.23
13	1.23	1.25	1.27	1.29	1.30	1.25	1.27	1.29	1.31	1.33
14	1.32	1.34	1.36	1.38	1.40	1.35	1.37	1.38	1.40	1.42
15	1.42	1.44	1.46	1.47	1.49	1.44	1.46	1.48	1.50	1.52
16	1.51	1.53	1.55	1.57	1.59	1.54	1.56	1.58	1.60	1.61
17	1.61	1.62	1.64	1.66	1.68	1.63	1.65	1.67	1.69	1.71
18	1.70	1.72	1.74	1.76	1.78	1.73	1.75	1.77	1.79	1.81
19	1.79	1.81	1.83	1.85	1.87	1.83	1.84	1.86	1.88	1.90
20	1.89	1.91	1.93	1.95	1.96	1.92	1.94	1.96	1.98	2.00
21	1.98	2.00	2.02	2.04	2.06	2.02	2.04	2.06	2.07	2.09
22	2.08	2.10	2.11	2.13	2.15	2.11	2.13	2.15	2.17	2.19
23	2.17	2.19	2.21	2.23	2.25	2.21	2.23	2.25	2.27	2.28
24	2.26	2.28	2.30	2.32	2.34	2.30	2.32	2.34	2.36	2.38
25	2.36	2.38	2.40	2.41	2.43	2.40	2.42	2.44	2.46	2.48
26	2.45	2.47	2.49	2.51	2.53	2.49	2.51	2.53	2.55	2.57
27	2.55	2.57	2.58	2.60	2.62	2.59	2.61	2.63	2.65	2.67
28	2.64	2.66	2.68	2.70	2.72	2.69	2.70	2.72	2.74	2.76
29	2.73	2.75	2.77	2.79	2.81	2.78	2.80	2.82	2.84	2.86
30	2.83	2.85	2.87	2.88	2.90	2.88	2.90	2.91	2.93	2.95
31	2.92	2.94	2.96	2.98	3.00	2.97	2.99	3.01	3.03	3.05
32	3.02	3.03	3.05	3.07	3.09	3.07	3.09	3.11	3.12	3.14
33	3.11	3.13	3.15	3.16	3.18	3.16	3.18	3.20	3.22	3.24
34	3.20	3.22	3.24	3.26	3.28	3.26	3.28	3.30	3.31	3.33
35	3.30	3.31	3.33	3.35	3.37	3.35	3.37	3.39	3.41	3.43
36	3.39	3.41	3.43	3.45	3.46	3.45	3.47	3.49	3.51	3.52
37	3.48	3.50	3.52	3.54	3.56	3.54	3.56	3.58	3.60	3.62
38	3.58	3.60	3.61	3.63	3.65	3.64	3.66	3.68	3.70	3.71
39	3.67	3.69	3.71	3.73	3.75	3.73	3.75	3.77	3.79	3.81
40	3.76	3.78	3.80	3.82	3.84	3.83	3.85	3.87	3.89	3.90
41	3.86	3.88	3.89	3.91	3.93	3.92	3.94	3.96	3.98	4.00
42	3.95	3.97	3.99	4.01	4.02	4.02	4.04	4.06	4.08	4.09
43	4.04	4.06	4.08	4.10	4.12	4.11	4.13	4.15	4.17	4.19
44	4.14	4.16	4.17	4.19	4.21	4.21	4.23	4.25	4.27	4.28
45	4.23	4.25	4.27	4.29	4.30	4.30	4.32	4.34	4.36	4.38

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137)

(Correction in same units as height of mercury column.)

Attached ther-mometer °C.	Height of the mercury column 600 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 610 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.06	0.08	0.00	0.02	0.04	0.06	0.08
1	.10	.12	.14	.16	.18	.10	.12	.14	.16	.18
2	.20	.22	.24	.25	.27	.20	.22	.24	.26	.28
3	.29	.31	.33	.35	.37	.30	.32	.34	.36	.38
4	.39	.41	.43	.45	.47	.40	.42	.44	.46	.48
5	0.49	0.51	0.53	0.55	0.57	0.50	0.52	0.54	0.56	0.58
6	.59	.61	.63	.65	.67	.60	.62	.64	.66	.68
7	.69	.70	.72	.74	.76	.70	.72	.74	.76	.78
8	.78	.80	.82	.84	.86	.80	.82	.84	.86	.88
9	.88	.90	.92	.94	.96	.90	.92	.94	.96	.98
10	0.98	1.00	1.02	1.04	1.06	0.99	1.01	1.03	1.05	1.07
11	1.08	1.10	1.12	1.13	1.15	1.09	1.11	1.13	1.15	1.17
12	1.17	1.19	1.21	1.23	1.25	1.19	1.21	1.23	1.25	1.27
13	1.27	1.29	1.31	1.33	1.35	1.29	1.31	1.33	1.35	1.37
14	1.37	1.39	1.41	1.43	1.45	1.39	1.41	1.43	1.45	1.47
15	1.47	1.49	1.51	1.53	1.54	1.49	1.51	1.53	1.55	1.57
16	1.56	1.58	1.60	1.62	1.64	1.59	1.61	1.63	1.65	1.67
17	1.66	1.68	1.70	1.72	1.74	1.69	1.71	1.73	1.75	1.77
18	1.76	1.78	1.80	1.82	1.84	1.79	1.81	1.83	1.85	1.87
19	1.86	1.88	1.90	1.91	1.93	1.89	1.91	1.93	1.95	1.97
20	1.95	1.97	1.99	2.01	2.03	1.99	2.01	2.03	2.05	2.07
21	2.05	2.07	2.09	2.11	2.13	2.09	2.10	2.12	2.14	2.16
22	2.15	2.17	2.19	2.21	2.23	2.18	2.20	2.22	2.24	2.26
23	2.25	2.26	2.28	2.30	2.32	2.28	2.30	2.32	2.34	2.36
24	2.34	2.36	2.38	2.40	2.42	2.38	2.40	2.42	2.44	2.46
25	2.44	2.46	2.48	2.50	2.52	2.48	2.50	2.52	2.54	2.56
26	2.54	2.56	2.58	2.60	2.61	2.58	2.60	2.62	2.64	2.66
27	2.63	2.65	2.67	2.69	2.71	2.68	2.70	2.72	2.74	2.76
28	2.73	2.75	2.77	2.79	2.81	2.78	2.80	2.82	2.84	2.86
29	2.83	2.85	2.87	2.89	2.91	2.88	2.90	2.91	2.93	2.95
30	2.93	2.94	2.96	2.98	3.00	2.97	2.99	3.01	3.03	3.05
31	3.02	3.04	3.06	3.08	3.10	3.07	3.09	3.11	3.13	3.15
32	3.12	3.14	3.16	3.18	3.20	3.17	3.19	3.21	3.23	3.25
33	3.22	3.24	3.25	3.27	3.29	3.27	3.29	3.31	3.33	3.35
34	3.31	3.33	3.35	3.37	3.39	3.37	3.39	3.41	3.43	3.45
35	3.41	3.43	3.45	3.47	3.49	3.47	3.49	3.51	3.53	3.55
36	3.51	3.53	3.55	3.56	3.58	3.56	3.58	3.60	3.62	3.64
37	3.60	3.62	3.64	3.66	3.68	3.66	3.68	3.70	3.72	3.74
38	3.70	3.72	3.74	3.76	3.78	3.76	3.78	3.80	3.82	3.84
39	3.80	3.82	3.84	3.85	3.87	3.86	3.88	3.90	3.92	3.94
40	3.89	3.91	3.93	3.95	3.97	3.96	3.98	4.00	4.02	4.04
41	3.99	4.01	4.03	4.05	4.07	4.06	4.08	4.10	4.12	4.14
42	4.09	4.11	4.12	4.14	4.16	4.15	4.17	4.19	4.21	4.23
43	4.18	4.20	4.22	4.24	4.26	4.25	4.27	4.29	4.31	4.33
44	4.28	4.30	4.32	4.34	4.36	4.35	4.37	4.39	4.41	4.43
45	4.38	4.40	4.41	4.43	4.45	4.45	4.47	4.49	4.51	4.53

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached ther-mometer °C.	Height of the mercury column 620 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 630 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.06	0.08	0.00	0.02	0.04	0.06	0.08
1	.10	.12	.14	.16	.18	.10	.12	.14	.16	.19
2	.20	.22	.24	.26	.28	.21	.23	.25	.27	.29
3	.30	.32	.34	.36	.38	.31	.33	.35	.37	.39
4	.40	.43	.45	.47	.49	.41	.43	.45	.47	.49
5	0.51	0.53	0.55	0.57	0.59	0.51	0.53	0.56	0.58	0.60
6	.61	.63	.65	.67	.69	.62	.64	.66	.68	.70
7	.71	.73	.75	.77	.79	.72	.74	.76	.78	.80
8	.81	.83	.85	.87	.89	.82	.84	.86	.88	.90
9	.91	.93	.95	.97	.99	.92	.95	.97	.99	1.01
10	1.01	1.03	1.05	1.07	1.09	1.03	1.05	1.07	1.09	1.11
11	1.11	1.13	1.15	1.17	1.19	1.13	1.15	1.17	1.19	1.21
12	1.21	1.23	1.25	1.27	1.29	1.23	1.25	1.27	1.29	1.31
13	1.31	1.33	1.35	1.37	1.39	1.34	1.36	1.38	1.40	1.42
14	1.41	1.43	1.46	1.48	1.50	1.44	1.46	1.48	1.50	1.52
15	1.52	1.54	1.56	1.58	1.60	1.54	1.56	1.58	1.60	1.62
16	1.62	1.64	1.66	1.68	1.70	1.64	1.66	1.68	1.70	1.72
17	1.72	1.74	1.76	1.78	1.80	1.74	1.77	1.79	1.81	1.83
18	1.82	1.84	1.86	1.88	1.90	1.85	1.87	1.89	1.91	1.93
19	1.92	1.94	1.96	1.98	2.00	1.95	1.97	1.99	2.01	2.03
20	2.02	2.04	2.06	2.08	2.10	2.05	2.07	2.09	2.11	2.13
21	2.12	2.14	2.16	2.18	2.20	2.15	2.17	2.19	2.21	2.24
22	2.22	2.24	2.26	2.28	2.30	2.26	2.28	2.30	2.32	2.34
23	2.32	2.34	2.36	2.38	2.40	2.36	2.38	2.40	2.42	2.44
24	2.42	2.44	2.46	2.48	2.50	2.46	2.48	2.50	2.52	2.54
25	2.52	2.54	2.56	2.58	2.60	2.56	2.58	2.60	2.62	2.64
26	2.62	2.64	2.66	2.68	2.70	2.66	2.68	2.70	2.73	2.75
27	2.72	2.74	2.76	2.78	2.80	2.77	2.79	2.81	2.83	2.85
28	2.82	2.84	2.86	2.88	2.90	2.87	2.89	2.91	2.93	2.95
29	2.92	2.94	2.96	2.98	3.00	2.97	2.99	3.01	3.03	3.05
30	3.02	3.04	3.06	3.08	3.10	3.07	3.09	3.11	3.13	3.15
31	3.12	3.14	3.16	3.18	3.20	3.17	3.19	3.21	3.23	3.25
32	3.22	3.24	3.26	3.28	3.30	3.28	3.30	3.32	3.34	3.36
33	3.32	3.34	3.36	3.38	3.40	3.38	3.40	3.42	3.44	3.46
34	3.42	3.44	3.46	3.48	3.50	3.48	3.50	3.52	3.54	3.56
35	3.52	3.54	3.56	3.58	3.60	3.58	3.60	3.62	3.64	3.66
36	3.62	3.64	3.66	3.68	3.70	3.68	3.70	3.72	3.74	3.76
37	3.72	3.74	3.76	3.78	3.80	3.78	3.80	3.82	3.84	3.86
38	3.82	3.84	3.86	3.88	3.90	3.89	3.91	3.93	3.95	3.97
39	3.92	3.94	3.96	3.98	4.00	3.99	4.01	4.03	4.05	4.07
40	4.02	4.04	4.06	4.08	4.10	4.09	4.11	4.13	4.15	4.17
41	4.12	4.14	4.16	4.18	4.20	4.19	4.21	4.23	4.25	4.27
42	4.22	4.24	4.26	4.28	4.30	4.29	4.31	4.33	4.35	4.37
43	4.32	4.34	4.36	4.38	4.40	4.39	4.41	4.43	4.45	4.47
44	4.42	4.44	4.46	4.48	4.50	4.49	4.51	4.53	4.55	4.58
45	4.52	4.54	4.56	4.58	4.60	4.59	4.62	4.64	4.66	4.68

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 640 mm. or mb.					Height of the mercury column 650 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.06	0.08	0.00	0.02	0.04	0.06	0.08
1	.10	.13	.15	.17	.19	.11	.13	.15	.17	.19
2	.21	.23	.25	.27	.29	.21	.23	.25	.28	.30
3	.31	.33	.36	.38	.40	.32	.34	.36	.38	.40
4	.42	.44	.46	.48	.50	.42	.45	.47	.49	.51
5	0.52	0.54	0.56	0.59	0.61	0.53	0.55	0.57	0.59	0.62
6	.63	.65	.67	.69	.71	.64	.66	.68	.70	.72
7	.73	.75	.77	.79	.81	.74	.76	.78	.81	.83
8	.84	.86	.88	.90	.92	.85	.87	.89	.91	.93
9	.94	.96	.98	1.00	1.02	.95	.98	1.00	1.02	1.04
10	1.04	1.06	1.09	1.11	1.13	1.06	1.08	1.10	1.12	1.14
11	1.15	1.17	1.19	1.21	1.23	1.17	1.19	1.21	1.23	1.25
12	1.25	1.27	1.29	1.31	1.34	1.27	1.29	1.31	1.34	1.36
13	1.36	1.38	1.40	1.42	1.44	1.38	1.40	1.42	1.44	1.46
14	1.46	1.48	1.50	1.52	1.54	1.48	1.50	1.53	1.55	1.57
15	1.56	1.59	1.61	1.63	1.65	1.59	1.61	1.63	1.65	1.67
16	1.67	1.69	1.71	1.73	1.75	1.69	1.72	1.74	1.76	1.78
17	1.77	1.79	1.81	1.83	1.86	1.80	1.82	1.84	1.86	1.88
18	1.88	1.90	1.92	1.94	1.96	1.91	1.93	1.95	1.97	1.99
19	1.98	2.00	2.02	2.04	2.06	2.01	2.03	2.05	2.07	2.10
20	2.08	2.10	2.13	2.15	2.17	2.12	2.14	2.16	2.18	2.20
21	2.19	2.21	2.23	2.25	2.27	2.22	2.24	2.26	2.29	2.31
22	2.29	2.31	2.33	2.35	2.37	2.33	2.35	2.37	2.39	2.41
23	2.40	2.42	2.44	2.46	2.48	2.43	2.45	2.47	2.50	2.52
24	2.50	2.52	2.54	2.56	2.58	2.54	2.56	2.58	2.60	2.62
25	2.60	2.62	2.64	2.66	2.69	2.64	2.66	2.69	2.71	2.73
26	2.71	2.73	2.75	2.77	2.79	2.75	2.77	2.79	2.81	2.83
27	2.81	2.83	2.85	2.87	2.89	2.85	2.87	2.90	2.92	2.94
28	2.91	2.93	2.95	2.98	3.00	2.96	2.98	3.00	3.02	3.04
29	3.02	3.04	3.06	3.08	3.10	3.06	3.08	3.11	3.13	3.15
30	3.12	3.14	3.16	3.18	3.20	3.17	3.19	3.21	3.23	3.25
31	3.22	3.24	3.27	3.29	3.31	3.27	3.30	3.32	3.34	3.36
32	3.33	3.35	3.37	3.39	3.41	3.38	3.40	3.42	3.44	3.46
33	3.43	3.45	3.47	3.49	3.51	3.48	3.51	3.53	3.55	3.57
34	3.53	3.55	3.58	3.60	3.62	3.59	3.61	3.63	3.65	3.67
35	3.64	3.66	3.68	3.70	3.72	3.69	3.71	3.74	3.76	3.78
36	3.74	3.76	3.78	3.80	3.82	3.80	3.82	3.84	3.86	3.88
37	3.84	3.86	3.88	3.91	3.93	3.90	3.92	3.95	3.97	3.99
38	3.95	3.97	3.99	4.01	4.03	4.01	4.03	4.05	4.07	4.09
39	4.05	4.07	4.09	4.11	4.13	4.11	4.13	4.15	4.18	4.20
40	4.15	4.17	4.19	4.21	4.24	4.22	4.24	4.26	4.28	4.30
41	4.26	4.28	4.30	4.32	4.34	4.32	4.34	4.36	4.38	4.41
42	4.36	4.38	4.40	4.42	4.44	4.43	4.45	4.47	4.49	4.51
43	4.46	4.48	4.50	4.52	4.54	4.53	4.55	4.57	4.59	4.62
44	4.57	4.59	4.61	4.63	4.65	4.64	4.66	4.68	4.70	4.72
45	4.67	4.69	4.71	4.73	4.75	4.74	4.76	4.78	4.80	4.82

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 660 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 670 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.06	0.09	0.00	0.02	0.04	0.07	0.09
1	.11	.13	.15	.17	.19	.11	.13	.15	.18	.20
2	.22	.24	.26	.28	.30	.22	.24	.26	.28	.31
3	.32	.34	.37	.39	.41	.33	.35	.37	.39	.42
4	.43	.45	.47	.50	.52	.44	.46	.48	.50	.53
5	0.54	0.56	0.58	0.60	0.62	0.55	0.57	0.59	0.61	0.63
6	.65	.67	.69	.71	.73	.66	.68	.70	.72	.74
7	.75	.78	.80	.82	.84	.77	.79	.81	.83	.85
8	.86	.88	.90	.93	.95	.87	.90	.92	.94	.96
9	.97	.99	1.01	1.03	1.05	.98	1.01	1.03	1.05	1.07
10	1.08	1.10	1.12	1.14	1.16	1.09	1.11	1.14	1.16	1.18
11	1.18	1.21	1.23	1.25	1.27	1.20	1.22	1.25	1.27	1.29
12	1.29	1.31	1.33	1.36	1.38	1.31	1.33	1.35	1.38	1.40
13	1.40	1.42	1.44	1.46	1.48	1.42	1.44	1.46	1.49	1.51
14	1.51	1.53	1.55	1.57	1.59	1.53	1.55	1.57	1.59	1.62
15	1.61	1.63	1.66	1.68	1.70	1.64	1.66	1.68	1.70	1.72
16	1.72	1.74	1.76	1.78	1.81	1.75	1.77	1.79	1.81	1.83
17	1.83	1.85	1.87	1.89	1.91	1.86	1.88	1.90	1.92	1.94
18	1.93	1.96	1.98	2.00	2.02	1.96	1.99	2.01	2.03	2.05
19	2.04	2.06	2.08	2.11	2.13	2.07	2.09	2.12	2.14	2.16
20	2.15	2.17	2.19	2.21	2.23	2.18	2.20	2.23	2.25	2.27
21	2.26	2.28	2.30	2.32	2.34	2.29	2.31	2.33	2.36	2.38
22	2.36	2.38	2.41	2.43	2.45	2.40	2.42	2.44	2.46	2.49
23	2.47	2.49	2.51	2.53	2.56	2.51	2.53	2.55	2.57	2.59
24	2.58	2.60	2.62	2.64	2.66	2.62	2.64	2.66	2.68	2.70
25	2.68	2.71	2.73	2.75	2.77	2.72	2.75	2.77	2.79	2.81
26	2.79	2.81	2.83	2.85	2.88	2.83	2.85	2.88	2.90	2.92
27	2.90	2.92	2.94	2.96	2.98	2.94	2.96	2.98	3.01	3.03
28	3.00	3.03	3.05	3.07	3.09	3.05	3.07	3.09	3.11	3.14
29	3.11	3.13	3.15	3.18	3.20	3.16	3.18	3.20	3.22	3.24
30	3.22	3.24	3.26	3.28	3.30	3.27	3.29	3.31	3.33	3.35
31	3.32	3.35	3.37	3.39	3.41	3.37	3.40	3.42	3.44	3.46
32	3.43	3.45	3.47	3.49	3.52	3.48	3.50	3.53	3.55	3.57
33	3.54	3.56	3.58	3.60	3.62	3.59	3.61	3.63	3.66	3.68
34	3.64	3.67	3.69	3.71	3.73	3.70	3.72	3.74	3.76	3.79
35	3.75	3.77	3.79	3.81	3.84	3.81	3.83	3.85	3.87	3.89
36	3.86	3.88	3.90	3.92	3.94	3.92	3.94	3.96	3.98	4.00
37	3.96	3.98	4.01	4.03	4.05	4.02	4.04	4.07	4.09	4.11
38	4.07	4.09	4.11	4.13	4.15	4.13	4.15	4.17	4.20	4.22
39	4.18	4.20	4.22	4.24	4.26	4.24	4.26	4.28	4.30	4.33
40	4.28	4.30	4.33	4.35	4.37	4.35	4.37	4.39	4.41	4.43
41	4.39	4.41	4.43	4.45	4.47	4.46	4.48	4.50	4.52	4.54
42	4.50	4.52	4.54	4.56	4.58	4.56	4.58	4.61	4.63	4.65
43	4.60	4.62	4.64	4.66	4.69	4.67	4.69	4.71	4.74	4.76
44	4.71	4.73	4.75	4.77	4.79	4.78	4.80	4.82	4.84	4.87
45	4.81	4.84	4.86	4.88	4.90	4.89	4.91	4.93	4.95	4.97

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 680 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 690 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.04	0.07	0.09	0.00	0.02	0.05	0.07	0.09
1	.11	.13	.16	.18	.20	.11	.14	.16	.18	.20
2	.22	.24	.27	.29	.31	.23	.25	.27	.29	.32
3	.33	.36	.38	.40	.42	.34	.36	.38	.41	.43
4	.44	.47	.49	.51	.53	.45	.47	.50	.52	.54
5	0.56	0.58	0.60	0.62	0.64	0.56	0.59	0.61	0.63	0.65
6	.67	.69	.71	.73	.75	.68	.70	.72	.74	.77
7	.78	.80	.82	.84	.87	.79	.81	.83	.86	.88
8	.89	.91	.93	.95	.98	.90	.92	.95	.97	.99
9	1.00	1.02	1.04	1.06	1.09	1.01	1.04	1.06	1.08	1.10
10	1.11	1.13	1.15	1.18	1.20	1.13	1.15	1.17	1.19	1.22
11	1.22	1.24	1.26	1.29	1.31	1.24	1.26	1.28	1.31	1.33
12	1.33	1.35	1.37	1.40	1.42	1.35	1.37	1.39	1.42	1.44
13	1.44	1.46	1.49	1.51	1.53	1.46	1.48	1.51	1.53	1.55
14	1.55	1.57	1.60	1.62	1.64	1.57	1.60	1.62	1.64	1.66
15	1.66	1.68	1.71	1.73	1.75	1.69	1.71	1.73	1.75	1.78
16	1.77	1.79	1.82	1.84	1.86	1.80	1.82	1.84	1.87	1.89
17	1.88	1.91	1.93	1.95	1.97	1.91	1.93	1.96	1.98	2.00
18	1.99	2.02	2.04	2.06	2.08	2.02	2.05	2.07	2.09	2.11
19	2.10	2.13	2.15	2.17	2.19	2.13	2.16	2.18	2.20	2.22
20	2.21	2.24	2.26	2.28	2.30	2.25	2.27	2.29	2.31	2.34
21	2.32	2.35	2.37	2.39	2.41	2.36	2.38	2.40	2.43	2.45
22	2.43	2.46	2.48	2.50	2.52	2.47	2.49	2.52	2.54	2.56
23	2.54	2.57	2.59	2.61	2.63	2.58	2.60	2.63	2.65	2.67
24	2.66	2.68	2.70	2.72	2.74	2.69	2.72	2.74	2.76	2.78
25	2.77	2.79	2.81	2.83	2.85	2.81	2.83	2.85	2.87	2.90
26	2.88	2.90	2.92	2.94	2.96	2.92	2.94	2.96	2.99	3.01
27	2.99	3.01	3.03	3.05	3.07	3.03	3.05	3.07	3.10	3.12
28	3.10	3.12	3.14	3.16	3.18	3.14	3.16	3.19	3.21	3.23
29	3.21	3.23	3.25	3.27	3.29	3.25	3.27	3.30	3.32	3.34
30	3.32	3.34	3.36	3.38	3.40	3.36	3.39	3.41	3.43	3.45
31	3.43	3.45	3.47	3.49	3.51	3.48	3.50	3.52	3.54	3.56
32	3.54	3.56	3.58	3.60	3.62	3.59	3.61	3.63	3.65	3.68
33	3.64	3.67	3.69	3.71	3.73	3.70	3.72	3.74	3.77	3.79
34	3.75	3.78	3.80	3.82	3.84	3.81	3.83	3.85	3.88	3.90
35	3.86	3.89	3.91	3.93	3.95	3.92	3.94	3.97	3.99	4.01
36	3.97	4.00	4.02	4.04	4.06	4.03	4.05	4.08	4.10	4.12
37	4.08	4.11	4.13	4.15	4.17	4.14	4.17	4.19	4.21	4.23
38	4.19	4.22	4.24	4.26	4.28	4.26	4.28	4.30	4.32	4.34
39	4.30	4.32	4.35	4.37	4.39	4.37	4.39	4.41	4.43	4.46
40	4.41	4.43	4.46	4.48	4.50	4.48	4.50	4.52	4.54	4.57
41	4.52	4.54	4.57	4.59	4.61	4.59	4.61	4.63	4.65	4.68
42	4.63	4.65	4.68	4.70	4.72	4.70	4.72	4.74	4.77	4.79
43	4.74	4.76	4.78	4.81	4.83	4.81	4.83	4.85	4.88	4.90
44	4.85	4.87	4.89	4.92	4.94	4.92	4.94	4.97	4.99	5.01
45	4.96	4.98	5.00	5.03	5.05	5.03	5.05	5.08	5.10	5.12

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer C.	Height of the mercury column 700 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 710 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.05	0.07	0.09	0.00	0.02	0.05	0.07	0.09
1	.11	.14	.16	.18	.21	.12	.14	.16	.19	.21
2	.23	.25	.27	.30	.32	.23	.26	.28	.30	.32
3	.34	.37	.39	.41	.43	.35	.37	.39	.42	.44
4	.46	.48	.50	.53	.55	.46	.49	.51	.53	.56
5	0.57	0.59	0.62	0.64	0.66	0.58	0.60	0.63	0.65	0.67
6	.69	.71	.73	.75	.78	.70	.72	.74	.76	.79
7	.80	.82	.85	.87	.89	.81	.83	.86	.88	.90
8	.91	.94	.96	.98	1.00	.93	.95	.97	1.00	1.02
9	1.03	1.05	1.07	1.10	1.12	1.04	1.07	1.09	1.11	1.13
10	1.14	1.16	1.19	1.21	1.23	1.16	1.18	1.20	1.23	1.25
11	1.26	1.28	1.30	1.32	1.35	1.27	1.30	1.32	1.34	1.37
12	1.37	1.39	1.42	1.44	1.46	1.39	1.41	1.44	1.46	1.48
13	1.48	1.51	1.53	1.55	1.57	1.50	1.53	1.55	1.57	1.60
14	1.60	1.62	1.64	1.67	1.69	1.62	1.64	1.67	1.69	1.71
15	1.71	1.73	1.76	1.78	1.80	1.74	1.76	1.78	1.80	1.83
16	1.82	1.85	1.87	1.89	1.92	1.85	1.87	1.90	1.92	1.94
17	1.94	1.96	1.98	2.01	2.03	1.97	1.99	2.01	2.04	2.06
18	2.05	2.07	2.10	2.12	2.14	2.08	2.10	2.13	2.15	2.17
19	2.17	2.19	2.21	2.23	2.26	2.20	2.22	2.24	2.27	2.29
20	2.28	2.30	2.32	2.35	2.37	2.31	2.33	2.36	2.38	2.40
21	2.39	2.42	2.44	2.46	2.48	2.43	2.45	2.47	2.50	2.52
22	2.51	2.53	2.55	2.57	2.60	2.54	2.57	2.59	2.61	2.63
23	2.62	2.64	2.67	2.69	2.71	2.66	2.68	2.70	2.73	2.75
24	2.73	2.76	2.78	2.80	2.82	2.77	2.80	2.82	2.84	2.86
25	2.85	2.87	2.89	2.91	2.94	2.89	2.91	2.93	2.96	2.98
26	2.96	2.98	3.01	3.03	3.05	3.00	3.03	3.05	3.07	3.09
27	3.07	3.10	3.12	3.14	3.16	3.12	3.14	3.16	3.19	3.21
28	3.19	3.21	3.23	3.25	3.28	3.23	3.25	3.28	3.30	3.32
29	3.30	3.32	3.34	3.37	3.39	3.35	3.37	3.39	3.42	3.44
30	3.41	3.44	3.46	3.48	3.50	3.46	3.48	3.51	3.53	3.55
31	3.53	3.55	3.57	3.59	3.62	3.58	3.60	3.62	3.65	3.67
32	3.64	3.66	3.68	3.71	3.73	3.69	3.71	3.74	3.76	3.78
33	3.75	3.77	3.80	3.82	3.84	3.81	3.83	3.85	3.87	3.90
34	3.87	3.89	3.91	3.93	3.96	3.92	3.94	3.97	3.99	4.01
35	3.98	4.00	4.02	4.05	4.07	4.03	4.06	4.08	4.10	4.13
36	4.09	4.11	4.14	4.16	4.18	4.15	4.17	4.20	4.22	4.24
37	4.20	4.23	4.25	4.27	4.29	4.26	4.29	4.31	4.33	4.36
38	4.32	4.34	4.36	4.38	4.41	4.38	4.40	4.42	4.45	4.47
39	4.43	4.45	4.47	4.50	4.52	4.49	4.52	4.54	4.56	4.58
40	4.54	4.56	4.59	4.61	4.63	4.61	4.63	4.65	4.68	4.70
41	4.66	4.68	4.70	4.72	4.75	4.72	4.74	4.77	4.79	4.81
42	4.77	4.79	4.81	4.84	4.86	4.84	4.86	4.88	4.90	4.93
43	4.88	4.90	4.93	4.95	4.97	4.95	4.97	5.00	5.02	5.04
44	4.99	5.02	5.04	5.06	5.08	5.06	5.09	5.11	5.13	5.16
45	5.11	5.13	5.15	5.17	5.20	5.18	5.20	5.22	5.25	5.27

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 720 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 730 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.05	0.07	0.09	0.00	0.02	0.05	0.07	0.10
1	.12	.14	.16	.19	.21	.12	.14	.17	.19	.21
2	.24	.26	.28	.31	.33	.24	.26	.29	.31	.33
3	.35	.38	.40	.42	.45	.36	.38	.41	.43	.45
4	.47	.49	.52	.54	.56	.48	.50	.52	.55	.57
5	0.59	0.61	0.63	0.66	0.68	0.60	0.62	0.64	0.67	0.69
6	.71	.73	.75	.78	.80	.71	.74	.76	.79	.81
7	.82	.85	.87	.89	.92	.83	.86	.88	.91	.93
8	.94	.96	.99	1.01	1.03	.95	.98	1.00	1.02	1.05
9	1.06	1.08	1.10	1.13	1.15	1.07	1.10	1.12	1.14	1.17
10	1.17	1.20	1.22	1.24	1.27	1.19	1.21	1.24	1.26	1.29
11	1.29	1.31	1.34	1.36	1.39	1.31	1.33	1.36	1.38	1.40
12	1.41	1.43	1.46	1.48	1.50	1.43	1.45	1.48	1.50	1.52
13	1.53	1.55	1.57	1.60	1.62	1.55	1.57	1.59	1.62	1.64
14	1.64	1.67	1.69	1.71	1.74	1.67	1.69	1.71	1.74	1.76
15	1.76	1.78	1.81	1.83	1.85	1.78	1.81	1.83	1.86	1.88
16	1.88	1.90	1.92	1.95	1.97	1.90	1.93	1.95	1.97	2.00
17	1.99	2.02	2.04	2.06	2.09	2.02	2.05	2.07	2.09	2.12
18	2.11	2.13	2.16	2.18	2.20	2.14	2.16	2.19	2.21	2.23
19	2.23	2.25	2.27	2.30	2.32	2.26	2.28	2.31	2.33	2.35
20	2.34	2.37	2.39	2.41	2.44	2.38	2.40	2.42	2.45	2.47
21	2.46	2.48	2.51	2.53	2.55	2.50	2.52	2.54	2.57	2.59
22	2.58	2.60	2.62	2.65	2.67	2.61	2.64	2.66	2.68	2.71
23	2.69	2.72	2.74	2.76	2.79	2.73	2.76	2.78	2.80	2.83
24	2.81	2.83	2.86	2.88	2.90	2.85	2.87	2.90	2.92	2.94
25	2.93	2.95	2.97	3.00	3.02	2.97	2.99	3.02	3.04	3.06
26	3.04	3.07	3.09	3.11	3.14	3.09	3.11	3.13	3.16	3.18
27	3.16	3.18	3.21	3.23	3.25	3.20	3.23	3.25	3.28	3.30
28	3.28	3.30	3.32	3.35	3.37	3.32	3.35	3.37	3.39	3.42
29	3.39	3.42	3.44	3.46	3.49	3.44	3.46	3.49	3.51	3.54
30	3.51	3.53	3.56	3.58	3.60	3.56	3.58	3.61	3.63	3.65
31	3.63	3.65	3.67	3.70	3.72	3.68	3.70	3.72	3.75	3.77
32	3.74	3.77	3.79	3.81	3.84	3.79	3.82	3.84	3.87	3.89
33	3.86	3.88	3.91	3.93	3.95	3.91	3.94	3.96	3.98	4.01
34	3.98	4.00	4.02	4.05	4.07	4.03	4.05	4.08	4.10	4.12
35	4.09	4.11	4.14	4.16	4.18	4.15	4.17	4.20	4.22	4.24
36	4.21	4.23	4.25	4.28	4.30	4.27	4.29	4.31	4.34	4.36
37	4.32	4.35	4.37	4.39	4.42	4.38	4.41	4.43	4.45	4.48
38	4.44	4.46	4.49	4.51	4.53	4.50	4.53	4.55	4.57	4.60
39	4.56	4.58	4.60	4.63	4.65	4.62	4.64	4.67	4.69	4.71
40	4.67	4.70	4.72	4.74	4.76	4.74	4.76	4.78	4.81	4.83
41	4.79	4.81	4.83	4.86	4.88	4.85	4.88	4.90	4.92	4.95
42	4.90	4.93	4.95	4.97	5.00	4.97	5.00	5.02	5.04	5.07
43	5.02	5.04	5.07	5.09	5.11	5.09	5.11	5.14	5.16	5.18
44	5.14	5.16	5.18	5.20	5.23	5.21	5.23	5.25	5.28	5.30
45	5.25	5.27	5.30	5.32	5.34	5.32	5.35	5.37	5.39	5.42

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 740 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 750 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.05	0.07	0.10	0.00	0.02	0.05	0.07	0.10
1	.12	.15	.17	.19	.22	.12	.15	.17	.20	.22
2	.24	.27	.29	.31	.34	.25	.27	.29	.32	.34
3	.36	.39	.41	.44	.46	.37	.39	.42	.44	.47
4	.48	.51	.53	.56	.58	.49	.51	.54	.56	.59
5	0.60	0.63	0.65	0.68	0.70	0.61	0.64	0.66	0.69	0.71
6	.72	.75	.77	.80	.82	.73	.76	.78	.81	.83
7	.85	.87	.89	.92	.94	.86	.88	.91	.93	.95
8	.97	.99	1.01	1.04	1.06	.98	1.00	1.03	1.05	1.08
9	1.09	1.11	1.13	1.16	1.18	1.10	1.13	1.15	1.17	1.20
10	1.21	1.23	1.26	1.28	1.30	1.22	1.25	1.27	1.30	1.32
11	1.33	1.35	1.38	1.40	1.42	1.35	1.37	1.39	1.42	1.44
12	1.45	1.47	1.50	1.52	1.54	1.47	1.49	1.52	1.54	1.56
13	1.57	1.59	1.62	1.64	1.66	1.59	1.61	1.64	1.66	1.69
14	1.69	1.71	1.74	1.76	1.78	1.71	1.74	1.76	1.78	1.81
15	1.81	1.83	1.86	1.88	1.90	1.83	1.86	1.88	1.91	1.93
16	1.93	1.95	1.98	2.00	2.03	1.96	1.98	2.00	2.03	2.05
17	2.05	2.07	2.10	2.12	2.15	2.08	2.10	2.13	2.15	2.17
18	2.17	2.19	2.22	2.24	2.27	2.20	2.22	2.25	2.27	2.30
19	2.29	2.31	2.34	2.36	2.39	2.32	2.34	2.37	2.39	2.42
20	2.41	2.43	2.46	2.48	2.51	2.44	2.47	2.49	2.52	2.54
21	2.53	2.55	2.58	2.60	2.63	2.56	2.59	2.61	2.64	2.66
22	2.65	2.67	2.70	2.72	2.75	2.69	2.71	2.73	2.76	2.78
23	2.77	2.79	2.82	2.84	2.87	2.81	2.83	2.86	2.88	2.90
24	2.89	2.91	2.94	2.96	2.99	2.93	2.95	2.98	3.00	3.03
25	3.01	3.03	3.06	3.08	3.11	3.05	3.07	3.10	3.12	3.15
26	3.13	3.15	3.18	3.20	3.22	3.17	3.20	3.22	3.24	3.27
27	3.25	3.27	3.30	3.32	3.34	3.29	3.32	3.34	3.37	3.39
28	3.37	3.39	3.42	3.44	3.46	3.41	3.44	3.46	3.49	3.51
29	3.49	3.51	3.54	3.56	3.58	3.54	3.56	3.58	3.61	3.63
30	3.61	3.63	3.66	3.68	3.70	3.66	3.68	3.71	3.73	3.75
31	3.73	3.75	3.78	3.80	3.82	3.78	3.80	3.83	3.85	3.87
32	3.85	3.87	3.89	3.92	3.94	3.90	3.92	3.95	3.97	4.00
33	3.97	3.99	4.01	4.04	4.06	4.02	4.04	4.07	4.09	4.12
34	4.09	4.11	4.13	4.16	4.18	4.14	4.17	4.19	4.21	4.24
35	4.21	4.23	4.25	4.28	4.30	4.26	4.29	4.31	4.33	4.36
36	4.32	4.35	4.37	4.40	4.42	4.38	4.41	4.43	4.46	4.48
37	4.44	4.47	4.49	4.52	4.54	4.50	4.53	4.55	4.58	4.60
38	4.56	4.59	4.61	4.63	4.66	4.63	4.65	4.67	4.70	4.72
39	4.68	4.71	4.73	4.75	4.78	4.75	4.77	4.79	4.82	4.84
40	4.80	4.83	4.85	4.87	4.90	4.87	4.89	4.92	4.94	4.96
41	4.92	4.94	4.97	4.99	5.02	4.99	5.01	5.04	5.06	5.08
42	5.04	5.06	5.09	5.11	5.13	5.11	5.13	5.16	5.18	5.20
43	5.16	5.18	5.21	5.23	5.25	5.23	5.25	5.28	5.30	5.32
44	5.28	5.30	5.33	5.35	5.37	5.35	5.37	5.40	5.42	5.45
45	5.40	5.42	5.44	5.47	5.49	5.47	5.49	5.52	5.54	5.57

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above / below 0°C., the correction is to be subtracted / added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 760 mm. or mb.					Height of the mercury column 770 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.02	0.05	0.07	0.10	0.00	0.03	0.05	0.08	0.10
1	.12	.15	.17	.20	.22	.13	.15	.18	.20	.23
2	.25	.27	.30	.32	.35	.25	.28	.30	.33	.35
3	.37	.40	.42	.45	.47	.38	.40	.43	.45	.48
4	.50	.52	.55	.57	.60	.50	.53	.55	.58	.60
5	0.62	0.65	0.67	0.69	0.72	0.63	0.65	0.68	0.70	0.73
6	.74	.77	.79	.82	.84	.75	.78	.80	.83	.85
7	.87	.89	.92	.94	.97	.88	.90	.93	.95	.98
8	.99	1.02	1.04	1.07	1.09	1.01	1.03	1.06	1.08	1.11
9	1.12	1.14	1.17	1.19	1.21	1.13	1.16	1.18	1.21	1.23
10	1.24	1.26	1.29	1.31	1.34	1.26	1.28	1.31	1.33	1.36
11	1.36	1.39	1.41	1.44	1.46	1.38	1.41	1.43	1.46	1.48
12	1.49	1.51	1.54	1.56	1.59	1.51	1.53	1.56	1.58	1.61
13	1.61	1.64	1.66	1.68	1.71	1.63	1.66	1.68	1.71	1.73
14	1.73	1.76	1.78	1.81	1.83	1.76	1.78	1.81	1.83	1.86
15	1.86	1.88	1.91	1.93	1.96	1.88	1.91	1.93	1.96	1.98
16	1.98	2.01	2.03	2.06	2.08	2.01	2.03	2.06	2.08	2.11
17	2.10	2.13	2.15	2.18	2.20	2.13	2.16	2.18	2.21	2.23
18	2.23	2.25	2.28	2.30	2.33	2.26	2.28	2.31	2.33	2.36
19	2.35	2.38	2.40	2.43	2.45	2.38	2.41	2.43	2.46	2.48
20	2.47	2.50	2.52	2.55	2.57	2.51	2.53	2.56	2.58	2.61
21	2.60	2.62	2.65	2.67	2.70	2.63	2.66	2.68	2.71	2.73
22	2.72	2.75	2.77	2.80	2.82	2.76	2.78	2.81	2.83	2.86
23	2.84	2.87	2.89	2.92	2.94	2.88	2.91	2.93	2.96	2.98
24	2.97	2.99	3.02	3.04	3.07	3.01	3.03	3.06	3.08	3.11
25	3.09	3.12	3.14	3.16	3.19	3.13	3.16	3.18	3.21	3.23
26	3.21	3.24	3.26	3.29	3.31	3.26	3.28	3.31	3.33	3.36
27	3.34	3.36	3.39	3.41	3.43	3.38	3.41	3.43	3.46	3.48
28	3.46	3.48	3.51	3.53	3.56	3.51	3.53	3.56	3.58	3.60
29	3.58	3.61	3.63	3.66	3.68	3.63	3.65	3.68	3.70	3.73
30	3.71	3.73	3.75	3.78	3.80	3.75	3.78	3.80	3.83	3.85
31	3.83	3.85	3.88	3.90	3.93	3.88	3.90	3.93	3.95	3.98
32	3.95	3.98	4.00	4.02	4.05	4.00	4.03	4.05	4.08	4.10
33	4.07	4.10	4.12	4.15	4.17	4.13	4.15	4.18	4.20	4.23
34	4.20	4.22	4.25	4.27	4.29	4.25	4.28	4.30	4.33	4.35
35	4.32	4.34	4.37	4.39	4.42	4.38	4.40	4.43	4.45	4.48
36	4.44	4.47	4.49	4.52	4.54	4.50	4.52	4.55	4.57	4.60
37	4.56	4.59	4.61	4.64	4.66	4.62	4.65	4.67	4.70	4.72
38	4.69	4.71	4.74	4.76	4.78	4.75	4.77	4.80	4.82	4.85
39	4.81	4.83	4.86	4.88	4.91	4.87	4.90	4.92	4.95	4.97
40	4.93	4.96	4.98	5.00	5.03	5.00	5.02	5.05	5.07	5.10
41	5.05	5.08	5.10	5.13	5.15	5.12	5.15	5.17	5.19	5.22
42	5.18	5.20	5.22	5.25	5.27	5.24	5.27	5.29	5.32	5.34
43	5.30	5.32	5.35	5.37	5.40	5.37	5.39	5.42	5.44	5.47
44	5.42	5.45	5.47	5.49	5.52	5.49	5.52	5.54	5.57	5.59
45	5.54	5.57	5.59	5.62	5.64	5.62	5.64	5.66	5.69	5.72

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137)

(Correction in same units as height of mercury column.)

Attached thermometer °C.	780 mm. or mb. 0.0	0.2	0.4	0.6	0.8	790 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.05	0.08	0.10	0.00	0.03	0.05	0.08	0.10
1	.13	.15	.18	.20	.23	.13	.15	.18	.21	.23
2	.25	.28	.31	.33	.36	.26	.28	.31	.34	.36
3	.38	.41	.43	.46	.48	.39	.41	.44	.46	.49
4	.51	.53	.56	.59	.61	.52	.54	.57	.59	.62
5	0.64	0.66	0.69	0.71	0.74	0.64	0.67	0.70	0.72	0.75
6	.76	.79	.81	.84	.87	.77	.80	.83	.85	.88
7	.89	.92	.94	.97	.99	.90	.93	.95	.98	1.01
8	1.02	1.04	1.07	1.09	1.12	1.03	1.06	1.08	1.11	1.13
9	1.15	1.17	1.20	1.22	1.25	1.16	1.19	1.21	1.24	1.26
10	1.27	1.30	1.32	1.35	1.37	1.29	1.31	1.34	1.37	1.39
11	1.40	1.42	1.45	1.48	1.50	1.42	1.44	1.47	1.49	1.52
12	1.53	1.55	1.58	1.60	1.63	1.55	1.57	1.60	1.62	1.65
13	1.65	1.68	1.70	1.73	1.75	1.67	1.70	1.73	1.75	1.78
14	1.78	1.81	1.83	1.86	1.88	1.80	1.83	1.85	1.88	1.91
15	1.91	1.93	1.96	1.98	2.01	1.93	1.96	1.98	2.01	2.03
16	2.03	2.06	2.08	2.11	2.13	2.06	2.09	2.11	2.14	2.16
17	2.16	2.19	2.21	2.24	2.26	2.19	2.21	2.24	2.26	2.29
18	2.29	2.31	2.34	2.36	2.39	2.32	2.34	2.37	2.39	2.42
19	2.41	2.44	2.46	2.49	2.51	2.44	2.47	2.50	2.52	2.55
20	2.54	2.57	2.59	2.62	2.64	2.57	2.60	2.62	2.65	2.67
21	2.67	2.69	2.72	2.74	2.77	2.70	2.73	2.75	2.78	2.80
22	2.79	2.82	2.84	2.87	2.89	2.83	2.85	2.88	2.91	2.93
23	2.92	2.94	2.97	3.00	3.02	2.96	2.98	3.01	3.03	3.06
24	3.05	3.07	3.10	3.12	3.15	3.08	3.11	3.14	3.16	3.19
25	3.17	3.20	3.22	3.25	3.27	3.21	3.24	3.26	3.29	3.31
26	3.30	3.32	3.35	3.37	3.40	3.34	3.37	3.39	3.42	3.44
27	3.42	3.45	3.47	3.50	3.53	3.47	3.49	3.52	3.54	3.57
28	3.55	3.58	3.60	3.63	3.65	3.60	3.62	3.65	3.67	3.70
29	3.68	3.70	3.73	3.75	3.78	3.72	3.75	3.77	3.80	3.83
30	3.80	3.83	3.85	3.88	3.90	3.85	3.88	3.90	3.93	3.95
31	3.93	3.95	3.98	4.00	4.03	3.98	4.00	4.03	4.06	4.08
32	4.05	4.08	4.11	4.13	4.16	4.11	4.13	4.16	4.18	4.21
33	4.18	4.21	4.23	4.26	4.28	4.23	4.26	4.29	4.31	4.34
34	4.31	4.33	4.36	4.38	4.41	4.36	4.39	4.41	4.44	4.46
35	4.43	4.46	4.48	4.51	4.53	4.49	4.51	4.54	4.57	4.59
36	4.56	4.58	4.61	4.63	4.66	4.62	4.64	4.67	4.69	4.72
37	4.68	4.71	4.73	4.76	4.78	4.74	4.77	4.80	4.82	4.85
38	4.81	4.84	4.86	4.89	4.91	4.87	4.90	4.92	4.95	4.97
39	4.94	4.96	4.99	5.01	5.04	5.00	5.02	5.05	5.07	5.10
40	5.06	5.09	5.11	5.14	5.16	5.13	5.15	5.18	5.20	5.23
41	5.19	5.21	5.24	5.26	5.29	5.25	5.28	5.30	5.33	5.36
42	5.31	5.34	5.36	5.39	5.41	5.38	5.41	5.43	5.46	5.48
43	5.44	5.46	5.49	5.51	5.54	5.51	5.53	5.56	5.58	5.61
44	5.56	5.59	5.61	5.64	5.66	5.64	5.66	5.69	5.71	5.74
45	5.69	5.71	5.74	5.76	5.79	5.76	5.79	5.81	5.84	5.86

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 800 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 810 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.05	0.08	0.10	0.00	0.03	0.05	0.08	0.11
1	.13	.16	.18	.21	.24	.13	.16	.19	.21	.24
2	.26	.29	.31	.34	.37	.26	.29	.32	.34	.37
3	.39	.42	.44	.47	.50	.40	.42	.45	.48	.50
4	.52	.55	.57	.60	.63	.53	.56	.58	.61	.64
5	0.65	0.68	0.70	0.73	0.76	0.66	0.69	0.71	0.74	0.77
6	.78	.81	.84	.86	.89	.79	.82	.85	.87	.90
7	.91	.94	.97	.99	1.02	.93	.95	.98	1.00	1.03
8	1.04	1.07	1.10	1.12	1.15	1.06	1.08	1.11	1.14	1.16
9	1.17	1.20	1.23	1.25	1.28	1.19	1.22	1.24	1.27	1.29
10	1.30	1.33	1.36	1.38	1.41	1.32	1.35	1.37	1.40	1.43
11	1.44	1.46	1.49	1.51	1.54	1.45	1.48	1.51	1.53	1.56
12	1.56	1.59	1.62	1.64	1.67	1.58	1.61	1.64	1.66	1.69
13	1.70	1.72	1.75	1.77	1.80	1.72	1.74	1.77	1.80	1.82
14	1.83	1.85	1.88	1.90	1.93	1.85	1.87	1.90	1.93	1.95
15	1.96	1.98	2.01	2.03	2.06	1.98	2.01	2.03	2.06	2.08
16	2.09	2.11	2.14	2.16	2.19	2.11	2.14	2.16	2.19	2.22
17	2.22	2.24	2.27	2.29	2.32	2.24	2.27	2.30	2.32	2.35
18	2.35	2.37	2.40	2.42	2.45	2.37	2.40	2.43	2.45	2.48
19	2.48	2.50	2.53	2.55	2.58	2.51	2.53	2.56	2.58	2.61
20	2.60	2.63	2.66	2.68	2.71	2.64	2.66	2.69	2.72	2.74
21	2.73	2.76	2.79	2.81	2.84	2.77	2.80	2.82	2.85	2.87
22	2.86	2.89	2.92	2.94	2.97	2.90	2.93	2.95	2.98	3.01
23	2.99	3.02	3.05	3.07	3.10	3.03	3.06	3.08	3.11	3.14
24	3.12	3.15	3.18	3.20	3.23	3.16	3.19	3.21	3.24	3.27
25	3.25	3.28	3.30	3.33	3.36	3.29	3.32	3.35	3.37	3.40
26	3.38	3.41	3.43	3.46	3.49	3.43	3.45	3.48	3.50	3.53
27	3.51	3.54	3.56	3.59	3.62	3.56	3.58	3.61	3.63	3.66
28	3.64	3.67	3.69	3.72	3.75	3.69	3.71	3.74	3.77	3.79
29	3.77	3.80	3.82	3.85	3.87	3.82	3.84	3.87	3.90	3.92
30	3.90	3.93	3.95	3.98	4.00	3.95	3.98	4.00	4.03	4.05
31	4.03	4.06	4.08	4.11	4.13	4.08	4.11	4.13	4.16	4.18
32	4.16	4.18	4.21	4.24	4.26	4.21	4.24	4.26	4.29	4.32
33	4.29	4.31	4.34	4.37	4.39	4.34	4.37	4.39	4.42	4.45
34	4.42	4.44	4.47	4.49	4.52	4.47	4.50	4.52	4.55	4.58
35	4.55	4.57	4.60	4.62	4.65	4.60	4.63	4.66	4.68	4.71
36	4.68	4.70	4.73	4.75	4.78	4.73	4.76	4.79	4.81	4.84
37	4.80	4.83	4.86	4.88	4.91	4.86	4.89	4.92	4.94	4.97
38	4.93	4.96	4.98	5.01	5.04	5.00	5.02	5.05	5.07	5.10
39	5.06	5.09	5.11	5.14	5.17	5.13	5.15	5.18	5.20	5.23
40	5.19	5.22	5.24	5.27	5.29	5.26	5.28	5.31	5.33	5.36
41	5.32	5.35	5.37	5.40	5.42	5.39	5.41	5.44	5.46	5.49
42	5.45	5.47	5.50	5.53	5.55	5.52	5.54	5.57	5.60	5.62
43	5.58	5.60	5.63	5.65	5.68	5.65	5.67	5.70	5.73	5.75
44	5.71	5.73	5.76	5.78	5.81	5.78	5.80	5.83	5.86	5.88
45	5.83	5.86	5.89	5.91	5.94	5.91	5.93	5.96	5.99	6.01

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 820 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 830 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.05	0.08	0.11	0.00	0.03	0.05	0.08	0.11
1	.13	.16	.19	.21	.24	.14	.16	.19	.22	.24
2	.27	.29	.32	.35	.37	.27	.30	.33	.35	.38
3	.40	.43	.46	.48	.51	.41	.43	.46	.49	.51
4	.54	.56	.59	.62	.64	.54	.57	.60	.62	.65
5	0.67	0.70	0.72	0.75	0.78	0.68	0.70	0.73	0.76	0.79
6	.80	.83	.86	.88	.91	.81	.84	.87	.89	.92
7	.94	.96	.99	1.02	1.04	.95	.98	1.00	1.03	1.06
8	1.07	1.10	1.12	1.15	1.18	1.08	1.11	1.14	1.16	1.19
9	1.20	1.23	1.26	1.28	1.31	1.22	1.25	1.27	1.30	1.33
10	1.34	1.36	1.39	1.42	1.44	1.35	1.38	1.41	1.44	1.46
11	1.47	1.50	1.52	1.55	1.58	1.49	1.52	1.54	1.57	1.60
12	1.60	1.63	1.66	1.68	1.71	1.62	1.65	1.68	1.70	1.73
13	1.74	1.76	1.79	1.82	1.84	1.76	1.79	1.81	1.84	1.87
14	1.87	1.90	1.92	1.95	1.98	1.89	1.92	1.95	1.97	2.00
15	2.00	2.03	2.06	2.08	2.11	2.03	2.06	2.08	2.11	2.14
16	2.14	2.16	2.19	2.22	2.24	2.16	2.19	2.22	2.24	2.27
17	2.27	2.30	2.32	2.35	2.38	2.30	2.33	2.35	2.38	2.41
18	2.40	2.43	2.46	2.48	2.51	2.43	2.46	2.49	2.51	2.54
19	2.54	2.56	2.59	2.62	2.64	2.57	2.59	2.62	2.65	2.68
20	2.67	2.70	2.72	2.75	2.78	2.70	2.73	2.76	2.78	2.81
21	2.80	2.83	2.86	2.88	2.91	2.84	2.86	2.89	2.92	2.94
22	2.94	2.96	2.99	3.02	3.04	2.97	3.00	3.03	3.05	3.08
23	3.07	3.10	3.12	3.15	3.18	3.11	3.13	3.16	3.19	3.21
24	3.20	3.23	3.25	3.28	3.31	3.24	3.27	3.29	3.32	3.35
25	3.33	3.36	3.39	3.41	3.44	3.38	3.40	3.43	3.46	3.48
26	3.47	3.49	3.52	3.55	3.57	3.51	3.54	3.56	3.59	3.62
27	3.60	3.63	3.65	3.68	3.71	3.64	3.67	3.70	3.72	3.75
28	3.73	3.76	3.79	3.81	3.84	3.78	3.80	3.83	3.86	3.89
29	3.87	3.89	3.92	3.95	3.97	3.91	3.94	3.97	3.99	4.02
30	4.00	4.02	4.05	4.08	4.10	4.05	4.07	4.10	4.13	4.15
31	4.13	4.16	4.18	4.21	4.24	4.18	4.21	4.23	4.26	4.29
32	4.26	4.29	4.32	4.34	4.37	4.32	4.34	4.37	4.40	4.42
33	4.40	4.42	4.45	4.47	4.50	4.45	4.48	4.50	4.53	4.56
34	4.53	4.55	4.58	4.61	4.63	4.58	4.61	4.64	4.66	4.69
35	4.66	4.69	4.71	4.74	4.77	4.72	4.74	4.77	4.80	4.82
36	4.79	4.82	4.85	4.87	4.90	4.85	4.88	4.90	4.93	4.96
37	4.92	4.95	4.98	5.00	5.03	4.98	5.01	5.04	5.06	5.09
38	5.06	5.08	5.11	5.14	5.16	5.12	5.15	5.17	5.20	5.22
39	5.19	5.22	5.24	5.27	5.29	5.25	5.28	5.31	5.33	5.36
40	5.32	5.35	5.37	5.40	5.43	5.39	5.41	5.44	5.47	5.49
41	5.45	5.48	5.51	5.53	5.56	5.52	5.55	5.57	5.60	5.63
42	5.59	5.61	5.64	5.66	5.69	5.65	5.68	5.71	5.73	5.76
43	5.72	5.74	5.77	5.80	5.82	5.79	5.81	5.84	5.87	5.89
44	5.85	5.88	5.90	5.93	5.95	5.92	5.95	5.97	6.00	6.03
45	5.98	6.01	6.03	6.06	6.09	6.05	6.08	6.11	6.13	6.16

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 840 mm. or mb					Height of the mercury column 850 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.05	0.08	0.11	0.00	0.03	0.06	0.08	0.11
1	.14	.16	.19	.22	.25	.14	.17	.19	.22	.25
2	.27	.30	.33	.36	.38	.28	.31	.33	.36	.39
3	.41	.44	.47	.49	.52	.42	.44	.47	.50	.53
4	.55	.58	.60	.63	.66	.56	.58	.61	.64	.67
5	0.69	0.71	0.74	0.77	0.80	0.69	0.72	0.75	0.78	0.80
6	.82	.85	.88	.90	.93	.83	.86	.89	.92	.94
7	.96	.99	1.01	1.04	1.07	.97	1.00	1.03	1.05	1.08
8	1.10	1.12	1.15	1.18	1.21	1.11	1.14	1.17	1.19	1.22
9	1.23	1.26	1.29	1.32	1.34	1.25	1.28	1.30	1.33	1.36
10	1.37	1.40	1.42	1.45	1.48	1.39	1.41	1.44	1.47	1.50
11	1.51	1.53	1.56	1.59	1.62	1.52	1.55	1.58	1.61	1.64
12	1.64	1.67	1.70	1.73	1.75	1.66	1.69	1.72	1.75	1.77
13	1.78	1.81	1.83	1.86	1.89	1.80	1.83	1.86	1.88	1.91
14	1.92	1.94	1.97	2.00	2.03	1.94	1.97	1.99	2.02	2.05
15	2.05	2.08	2.11	2.14	2.16	2.08	2.11	2.13	2.16	2.19
16	2.19	2.22	2.24	2.27	2.30	2.22	2.24	2.27	2.30	2.33
17	2.33	2.35	2.38	2.41	2.44	2.35	2.38	2.41	2.44	2.46
18	2.46	2.49	2.52	2.54	2.57	2.49	2.52	2.55	2.57	2.60
19	2.60	2.63	2.65	2.68	2.71	2.63	2.66	2.69	2.71	2.74
20	2.74	2.76	2.79	2.82	2.84	2.77	2.80	2.82	2.85	2.88
21	2.87	2.90	2.93	2.95	2.98	2.91	2.93	2.96	2.99	3.02
22	3.01	3.03	3.06	3.09	3.12	3.04	3.07	3.10	3.13	3.15
23	3.14	3.17	3.20	3.23	3.25	3.18	3.21	3.24	3.26	3.29
24	3.28	3.31	3.33	3.36	3.39	3.32	3.35	3.37	3.40	3.43
25	3.42	3.44	3.47	3.50	3.52	3.46	3.48	3.51	3.54	3.57
26	3.55	3.58	3.61	3.63	3.66	3.59	3.62	3.65	3.68	3.70
27	3.69	3.72	3.74	3.77	3.80	3.73	3.76	3.79	3.81	3.84
28	3.82	3.85	3.88	3.91	3.93	3.87	3.90	3.92	3.95	3.98
29	3.96	3.99	4.01	4.04	4.07	4.01	4.03	4.06	4.09	4.12
30	4.10	4.12	4.15	4.18	4.20	4.14	4.17	4.20	4.23	4.25
31	4.23	4.26	4.29	4.31	4.34	4.28	4.31	4.34	4.36	4.39
32	4.37	4.39	4.42	4.45	4.48	4.42	4.45	4.47	4.50	4.53
33	4.50	4.53	4.56	4.58	4.61	4.56	4.58	4.61	4.64	4.67
34	4.64	4.67	4.69	4.72	4.75	4.69	4.72	4.75	4.78	4.80
35	4.77	4.80	4.83	4.85	4.88	4.83	4.86	4.89	4.91	4.94
36	4.91	4.94	4.96	4.99	5.02	4.97	4.99	5.02	5.05	5.08
37	5.05	5.07	5.10	5.13	5.15	5.11	5.13	5.16	5.19	5.21
38	5.18	5.21	5.23	5.26	5.29	5.24	5.27	5.30	5.32	5.35
39	5.32	5.34	5.37	5.40	5.42	5.38	5.41	5.43	5.46	5.49
40	5.45	5.48	5.51	5.53	5.56	5.52	5.54	5.57	5.60	5.63
41	5.59	5.61	5.64	5.67	5.69	5.65	5.68	5.71	5.73	5.76
42	5.72	5.75	5.78	5.80	5.83	5.79	5.82	5.84	5.87	5.90
43	5.86	5.88	5.91	5.94	5.96	5.93	5.95	5.98	6.01	6.04
44	5.99	6.02	6.05	6.07	6.10	6.06	6.09	6.12	6.14	6.17
45	6.13	6.15	6.18	6.21	6.23	6.20	6.23	6.25	6.28	6.31

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 860 mm. or mb.					Height of the mercury column 870 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.08	0.11	0.00	0.03	0.06	0.09	0.11
1	.14	.17	.20	.22	.25	.14	.17	.20	.23	.26
2	.28	.31	.34	.37	.39	.28	.31	.34	.37	.40
3	.42	.45	.48	.51	.53	.43	.46	.48	.51	.54
4	.56	.59	.62	.65	.67	.57	.60	.62	.65	.68
5	0.70	0.73	0.76	0.79	0.81	0.71	0.74	0.77	0.80	0.82
6	.84	.87	.90	.93	.95	.85	.88	.91	.94	.97
7	.98	1.01	1.04	1.07	1.09	.99	1.02	1.05	1.08	1.11
8	1.12	1.15	1.18	1.21	1.23	1.14	1.16	1.19	1.22	1.25
9	1.26	1.29	1.32	1.35	1.37	1.28	1.31	1.33	1.36	1.39
10	1.40	1.43	1.46	1.49	1.51	1.42	1.45	1.48	1.50	1.53
11	1.54	1.57	1.60	1.63	1.65	1.56	1.59	1.62	1.65	1.67
12	1.68	1.71	1.74	1.77	1.79	1.70	1.73	1.76	1.79	1.82
13	1.82	1.85	1.88	1.91	1.93	1.84	1.87	1.90	1.93	1.96
14	1.96	1.99	2.02	2.05	2.07	1.99	2.01	2.04	2.07	2.10
15	2.10	2.13	2.16	2.19	2.21	2.13	2.15	2.18	2.21	2.24
16	2.24	2.27	2.30	2.33	2.35	2.27	2.30	2.32	2.35	2.38
17	2.38	2.41	2.44	2.47	2.49	2.41	2.44	2.47	2.49	2.52
18	2.52	2.55	2.58	2.60	2.63	2.55	2.58	2.61	2.64	2.66
19	2.66	2.69	2.72	2.74	2.77	2.69	2.72	2.75	2.78	2.80
20	2.80	2.83	2.86	2.88	2.91	2.83	2.86	2.89	2.92	2.95
21	2.94	2.97	3.00	3.02	3.05	2.97	3.00	3.03	3.06	3.09
22	3.08	3.11	3.13	3.16	3.19	3.11	3.14	3.17	3.20	3.23
23	3.22	3.25	3.27	3.30	3.33	3.26	3.28	3.31	3.34	3.37
24	3.36	3.39	3.41	3.44	3.47	3.40	3.43	3.45	3.48	3.51
25	3.50	3.53	3.55	3.58	3.61	3.54	3.57	3.59	3.62	3.65
26	3.64	3.66	3.69	3.72	3.75	3.68	3.71	3.73	3.76	3.79
27	3.78	3.80	3.83	3.86	3.89	3.82	3.85	3.88	3.90	3.93
28	3.91	3.94	3.97	4.00	4.03	3.96	3.99	4.02	4.04	4.07
29	4.05	4.08	4.11	4.14	4.16	4.10	4.13	4.16	4.19	4.21
30	4.19	4.22	4.25	4.28	4.30	4.24	4.27	4.30	4.33	4.35
31	4.33	4.36	4.39	4.42	4.44	4.38	4.41	4.44	4.47	4.49
32	4.47	4.50	4.53	4.55	4.58	4.52	4.55	4.58	4.61	4.64
33	4.61	4.64	4.66	4.69	4.72	4.66	4.69	4.72	4.75	4.78
34	4.75	4.78	4.80	4.83	4.86	4.80	4.83	4.86	4.89	4.92
35	4.89	4.91	4.94	4.97	5.00	4.94	4.97	5.00	5.03	5.06
36	5.03	5.05	5.08	5.11	5.14	5.08	5.11	5.14	5.17	5.20
37	5.17	5.19	5.22	5.25	5.28	5.23	5.25	5.28	5.31	5.34
38	5.30	5.33	5.36	5.39	5.41	5.37	5.39	5.42	5.45	5.48
39	5.44	5.47	5.50	5.52	5.55	5.51	5.53	5.56	5.59	5.62
40	5.58	5.61	5.64	5.66	5.69	5.65	5.67	5.70	5.73	5.76
41	5.72	5.75	5.77	5.80	5.83	5.79	5.81	5.84	5.87	5.90
42	5.86	5.88	5.91	5.94	5.97	5.93	5.95	5.98	6.01	6.04
43	6.00	6.02	6.05	6.08	6.11	6.07	6.09	6.12	6.15	6.18
44	6.13	6.16	6.19	6.22	6.25	6.21	6.23	6.26	6.29	6.32
45	6.27	6.30	6.33	6.36	6.38	6.35	6.37	6.40	6.43	6.46

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 880 mm. or mb.					Height of the mercury column 890 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.09	0.12	0.00	0.03	0.06	0.09	0.12
1	.14	.17	.20	.23	.26	.15	.17	.20	.23	.26
2	.29	.32	.34	.37	.40	.29	.32	.35	.38	.41
3	.43	.46	.49	.52	.55	.44	.47	.49	.52	.55
4	.57	.60	.63	.66	.69	.58	.61	.64	.67	.70
5	0.72	0.75	0.78	0.80	0.83	0.73	0.76	0.78	0.81	0.84
6	.86	.89	.92	.95	.98	.87	.90	.93	.96	.99
7	1.00	1.03	1.06	1.09	1.12	1.02	1.05	1.08	1.10	1.13
8	1.15	1.18	1.21	1.23	1.26	1.16	1.19	1.22	1.25	1.28
9	1.29	1.32	1.35	1.38	1.41	1.31	1.34	1.36	1.39	1.42
10	1.44	1.46	1.49	1.52	1.55	1.45	1.48	1.51	1.54	1.57
11	1.58	1.61	1.64	1.66	1.69	1.60	1.63	1.65	1.68	1.71
12	1.72	1.75	1.78	1.81	1.84	1.74	1.77	1.80	1.83	1.86
13	1.86	1.89	1.92	1.95	1.98	1.89	1.92	1.94	1.97	2.00
14	2.01	2.04	2.07	2.09	2.12	2.03	2.06	2.09	2.12	2.15
15	2.15	2.18	2.21	2.24	2.27	2.18	2.20	2.23	2.26	2.29
16	2.29	2.32	2.35	2.38	2.41	2.32	2.35	2.38	2.41	2.44
17	2.44	2.47	2.49	2.52	2.55	2.46	2.49	2.52	2.55	2.58
18	2.58	2.61	2.64	2.67	2.69	2.61	2.64	2.67	2.70	2.73
19	2.72	2.75	2.78	2.81	2.84	2.75	2.78	2.81	2.84	2.87
20	2.87	2.89	2.92	2.95	2.98	2.90	2.93	2.96	2.99	3.01
21	3.01	3.04	3.07	3.09	3.12	3.04	3.07	3.10	3.13	3.16
22	3.15	3.18	3.21	3.24	3.26	3.19	3.22	3.24	3.27	3.30
23	3.29	3.32	3.35	3.38	3.41	3.33	3.36	3.39	3.42	3.45
24	3.44	3.46	3.49	3.52	3.55	3.47	3.50	3.53	3.56	3.59
25	3.58	3.61	3.64	3.66	3.69	3.62	3.65	3.68	3.71	3.73
26	3.72	3.75	3.78	3.81	3.84	3.76	3.79	3.82	3.85	3.88
27	3.86	3.89	3.92	3.95	3.98	3.91	3.94	3.96	3.99	4.02
28	4.01	4.03	4.06	4.09	4.12	4.05	4.08	4.11	4.14	4.17
29	4.15	4.18	4.21	4.23	4.26	4.20	4.22	4.25	4.28	4.31
30	4.29	4.32	4.35	4.38	4.40	4.34	4.37	4.40	4.43	4.45
31	4.43	4.46	4.49	4.52	4.55	4.48	4.51	4.54	4.57	4.60
32	4.58	4.60	4.63	4.66	4.69	4.63	4.66	4.68	4.71	4.74
33	4.72	4.75	4.77	4.80	4.83	4.77	4.80	4.83	4.86	4.89
34	4.86	4.89	4.92	4.94	4.97	4.91	4.94	4.97	5.00	5.03
35	5.00	5.03	5.06	5.09	5.11	5.06	5.09	5.12	5.14	5.17
36	5.14	5.17	5.20	5.23	5.26	5.20	5.23	5.26	5.29	5.32
37	5.29	5.31	5.34	5.37	5.40	5.35	5.37	5.40	5.43	5.46
38	5.43	5.46	5.48	5.51	5.54	5.49	5.52	5.55	5.57	5.60
39	5.57	5.60	5.62	5.65	5.68	5.63	5.66	5.69	5.72	5.75
40	5.71	5.74	5.77	5.79	5.82	5.78	5.80	5.83	5.86	5.89
41	5.85	5.88	5.91	5.94	5.97	5.92	5.95	5.98	6.00	6.03
42	5.99	6.02	6.05	6.08	6.11	6.06	6.09	6.12	6.15	6.18
43	6.14	6.16	6.19	6.22	6.25	6.21	6.23	6.26	6.29	6.32
44	6.28	6.31	6.33	6.36	6.39	6.35	6.38	6.41	6.43	6.46
45	6.42	6.45	6.47	6.50	6.53	6.49	6.52	6.55	6.58	6.61

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 900 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 910 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.09	0.12	0.00	0.03	0.06	0.09	0.12
1	.15	.18	.21	.23	.26	.15	.18	.21	.24	.27
2	.29	.32	.35	.38	.41	.30	.33	.36	.39	.42
3	.44	.47	.50	.53	.56	.45	.48	.51	.54	.56
4	.59	.62	.65	.68	.71	.59	.62	.65	.68	.71
5	0.73	0.76	0.79	0.82	0.85	0.74	0.77	0.80	0.83	0.86
6	.88	.91	.94	.97	1.00	.89	.92	.95	.98	1.01
7	1.03	1.06	1.09	1.12	1.15	1.04	1.07	1.10	1.13	1.16
8	1.17	1.20	1.23	1.26	1.29	1.19	1.22	1.25	1.28	1.31
9	1.32	1.35	1.38	1.41	1.44	1.34	1.37	1.40	1.43	1.45
10	1.47	1.50	1.53	1.56	1.58	1.48	1.51	1.54	1.57	1.60
11	1.61	1.64	1.67	1.70	1.73	1.63	1.66	1.69	1.72	1.75
12	1.76	1.79	1.82	1.85	1.88	1.78	1.81	1.84	1.87	1.90
13	1.91	1.94	1.97	2.00	2.02	1.93	1.96	1.99	2.02	2.05
14	2.05	2.08	2.11	2.14	2.17	2.08	2.11	2.14	2.16	2.19
15	2.20	2.23	2.26	2.29	2.32	2.22	2.25	2.28	2.31	2.34
16	2.35	2.38	2.40	2.43	2.46	2.37	2.40	2.43	2.46	2.49
17	2.49	2.52	2.55	2.58	2.61	2.52	2.55	2.58	2.61	2.64
18	2.64	2.67	2.70	2.73	2.76	2.67	2.70	2.73	2.76	2.79
19	2.78	2.81	2.84	2.87	2.90	2.82	2.84	2.87	2.90	2.93
20	2.93	2.96	2.99	3.02	3.05	2.96	2.99	3.02	3.05	3.08
21	3.08	3.11	3.13	3.16	3.19	3.11	3.14	3.17	3.20	3.23
22	3.22	3.25	3.28	3.31	3.34	3.26	3.29	3.32	3.35	3.38
23	3.37	3.40	3.43	3.46	3.48	3.41	3.44	3.46	3.49	3.52
24	3.51	3.54	3.57	3.60	3.63	3.55	3.58	3.61	3.64	3.67
25	3.66	3.69	3.72	3.75	3.78	3.70	3.73	3.76	3.79	3.82
26	3.81	3.83	3.86	3.89	3.92	3.85	3.88	3.91	3.94	3.97
27	3.95	3.98	4.01	4.04	4.07	3.99	4.02	4.05	4.08	4.11
28	4.10	4.13	4.16	4.18	4.21	4.14	4.17	4.20	4.23	4.26
29	4.24	4.27	4.30	4.33	4.36	4.29	4.32	4.35	4.38	4.41
30	4.39	4.42	4.45	4.47	4.50	4.44	4.47	4.50	5.52	4.55
31	4.53	4.56	4.59	4.62	4.65	4.58	4.61	4.64	4.67	4.70
32	4.68	4.71	4.74	4.77	4.80	4.73	4.76	4.79	4.82	4.85
33	4.82	4.85	4.88	4.91	4.94	4.88	4.91	4.94	4.97	4.99
34	4.97	5.00	5.03	5.06	5.09	5.02	5.05	5.08	5.11	5.14
35	5.11	5.14	5.17	5.20	5.23	5.17	5.20	5.23	5.26	5.29
36	5.26	5.29	5.32	5.35	5.38	5.32	5.35	5.38	5.41	5.44
37	5.41	5.43	5.46	5.49	5.52	5.47	5.49	5.52	5.55	5.58
38	5.55	5.58	5.61	5.64	5.67	5.61	5.64	5.67	5.70	5.73
39	5.70	5.72	5.75	5.78	5.81	5.76	5.79	5.82	5.85	5.88
40	5.84	5.87	5.90	5.93	5.96	5.90	5.93	5.96	5.99	6.02
41	5.98	6.01	6.04	6.07	6.10	6.05	6.08	6.11	6.14	6.17
42	6.13	6.16	6.19	6.22	6.25	6.20	6.23	6.26	6.29	6.31
43	6.27	6.30	6.33	6.36	6.39	6.34	6.37	6.40	6.43	6.46
44	6.42	6.45	6.48	6.51	6.54	6.49	6.52	6.55	6.58	6.61
45	6.56	6.59	6.62	6.65	6.68	6.64	6.67	6.69	6.72	6.75

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above / below 0°C., the correction is to be subtracted / added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 920 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 930 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.09	0.12	0.00	0.03	0.06	0.09	0.12
1	.15	.18	.21	.24	.27	.15	.18	.21	.24	.27
2	.30	.33	.36	.39	.42	.30	.33	.36	.40	.43
3	.45	.48	.51	.54	.57	.46	.49	.52	.55	.58
4	.60	.63	.66	.69	.72	.61	.64	.67	.70	.73
5	0.75	0.78	0.81	0.84	0.87	0.76	0.79	0.82	0.85	0.88
6	.90	.93	.96	.99	1.02	.91	.94	.97	1.00	1.03
7	1.05	1.08	1.11	1.14	1.17	1.06	1.09	1.12	1.15	1.18
8	1.20	1.23	1.26	1.29	1.32	1.21	1.24	1.28	1.30	1.34
9	1.35	1.38	1.41	1.44	1.47	1.37	1.40	1.43	1.46	1.49
10	1.50	1.53	1.56	1.59	1.62	1.52	1.55	1.58	1.61	1.64
11	1.65	1.68	1.71	1.74	1.77	1.67	1.70	1.73	1.76	1.79
12	1.80	1.83	1.86	1.89	1.92	1.82	1.85	1.88	1.91	1.94
13	1.95	1.98	2.01	2.04	2.07	1.97	2.00	2.03	2.06	2.09
14	2.10	2.13	2.16	2.19	2.22	2.12	2.15	2.18	2.21	2.24
15	2.25	2.28	2.31	2.34	2.37	2.27	2.30	2.33	2.36	2.39
16	2.40	2.43	2.46	2.49	2.52	2.42	2.45	2.48	2.51	2.55
17	2.55	2.58	2.61	2.64	2.67	2.58	2.61	2.64	2.67	2.70
18	2.70	2.73	2.76	2.79	2.82	2.73	2.76	2.79	2.82	2.85
19	2.85	2.88	2.91	2.94	2.97	2.88	2.91	2.94	2.97	3.00
20	3.00	3.03	3.06	3.09	3.12	3.03	3.06	3.09	3.12	3.15
21	3.14	3.17	3.20	3.23	3.26	3.18	3.21	3.24	3.27	3.30
22	3.29	3.32	3.35	3.38	3.41	3.33	3.36	3.39	3.42	3.45
23	3.44	3.47	3.50	3.53	3.56	3.48	3.51	3.54	3.57	3.60
24	3.59	3.62	3.65	3.68	3.71	3.63	3.66	3.69	3.72	3.75
25	3.74	3.77	3.80	3.83	3.86	3.78	3.81	3.84	3.87	3.90
26	3.89	3.92	3.95	3.98	4.01	3.93	3.96	3.99	4.02	4.05
27	4.04	4.07	4.10	4.13	4.16	4.08	4.11	4.14	4.17	4.20
28	4.19	4.22	4.25	4.28	4.31	4.23	4.26	4.29	4.32	4.35
29	4.34	4.37	4.40	4.43	4.46	4.38	4.41	4.44	4.47	4.50
30	4.49	4.52	4.54	4.57	4.60	4.53	4.56	4.59	4.62	4.65
31	4.63	4.66	4.69	4.72	4.75	4.68	4.71	4.74	4.77	4.80
32	4.78	4.81	4.84	4.87	4.90	4.83	4.86	4.89	4.92	4.96
33	4.93	4.96	4.99	5.02	5.05	4.98	5.02	5.04	5.08	5.10
34	5.08	5.11	5.14	5.17	5.20	5.13	5.17	5.19	5.22	5.26
35	5.23	5.26	5.29	5.32	5.35	5.29	5.31	5.35	5.37	5.41
36	5.38	5.41	5.44	5.47	5.50	5.43	5.46	5.50	5.53	5.55
37	5.53	5.55	5.58	5.61	5.64	5.59	5.61	5.65	5.67	5.70
38	5.67	5.70	5.73	5.76	5.79	5.74	5.77	5.79	5.82	5.85
39	5.82	5.85	5.88	5.91	5.94	5.89	5.91	5.94	5.97	6.00
40	5.97	6.00	6.03	6.06	6.09	6.03	6.06	6.09	6.12	6.15
41	6.12	6.15	6.18	6.21	6.24	6.18	6.21	6.24	6.27	6.30
42	6.27	6.30	6.32	6.35	6.38	6.33	6.36	6.39	6.42	6.45
43	6.41	6.44	6.47	6.50	6.53	6.48	6.51	6.54	6.57	6.60
44	6.56	6.59	6.62	6.65	6.68	6.63	6.66	6.69	6.72	6.75
45	6.71	6.74	6.77	6.80	6.83	6.78	6.81	6.84	6.87	6.90

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 940 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 950 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.09	0.12	0.00	0.03	0.06	0.09	0.12
1	.15	.18	.22	.25	.28	.15	.19	.22	.25	.28
2	.31	.34	.37	.40	.43	.31	.34	.37	.40	.43
3	.46	.49	.52	.55	.58	.47	.50	.53	.56	.59
4	.61	.64	.67	.71	.74	.62	.65	.68	.71	.74
5	0.77	0.80	0.83	0.86	0.89	0.78	0.81	0.84	0.87	0.90
6	.92	.95	.98	1.01	1.04	.93	.96	.99	1.02	1.05
7	1.07	1.10	1.14	1.17	1.20	1.08	1.12	1.15	1.18	1.21
8	1.23	1.26	1.29	1.32	1.35	1.24	1.27	1.30	1.33	1.36
9	1.38	1.41	1.44	1.47	1.50	1.39	1.43	1.46	1.49	1.52
10	1.53	1.56	1.59	1.63	1.66	1.55	1.58	1.61	1.64	1.67
11	1.69	1.72	1.75	1.78	1.81	1.70	1.73	1.77	1.80	1.83
12	1.84	1.87	1.90	1.93	1.96	1.86	1.89	1.92	1.95	1.98
13	1.99	2.02	2.05	2.08	2.11	2.01	2.04	2.07	2.11	2.14
14	2.15	2.18	2.21	2.24	2.27	2.17	2.20	2.23	2.26	2.29
15	2.30	2.33	2.36	2.39	2.42	2.32	2.35	2.38	2.41	2.45
16	2.45	2.48	2.51	2.54	2.57	2.48	2.51	2.54	2.57	2.60
17	2.60	2.63	2.66	2.69	2.73	2.63	2.66	2.69	2.72	2.75
18	2.76	2.79	2.82	2.85	2.88	2.79	2.82	2.85	2.88	2.91
19	2.91	2.94	2.97	3.00	3.03	2.94	2.97	3.00	3.03	3.06
20	3.06	3.09	3.12	3.15	3.18	3.09	3.12	3.15	3.19	3.22
21	3.21	3.24	3.27	3.31	3.34	3.25	3.28	3.31	3.34	3.37
22	3.37	3.40	3.43	3.46	3.49	3.40	3.43	3.46	3.49	3.52
23	3.52	3.55	3.58	3.61	3.64	3.55	3.59	3.62	3.65	3.68
24	3.67	3.70	3.73	3.76	3.79	3.71	3.74	3.77	3.80	3.83
25	3.82	3.85	3.88	3.91	3.94	3.86	3.89	3.92	3.95	3.99
26	3.98	4.01	4.04	4.07	4.10	4.02	4.05	4.08	4.11	4.14
27	4.13	4.16	4.19	4.22	4.25	4.17	4.20	4.23	4.26	4.29
28	4.28	4.31	4.34	4.37	4.40	4.32	4.35	4.39	4.42	4.45
29	4.43	4.46	4.49	4.52	4.55	4.48	4.51	4.54	4.57	4.60
30	4.58	4.61	4.64	4.67	4.70	4.63	4.66	4.69	4.72	4.75
31	4.73	4.76	4.80	4.83	4.86	4.79	4.82	4.85	4.88	4.91
32	4.89	4.92	4.95	4.98	5.01	4.94	4.97	5.00	5.03	5.06
33	5.04	5.07	5.10	5.13	5.16	5.09	5.12	5.15	5.18	5.21
34	5.19	5.22	5.25	5.28	5.31	5.24	5.28	5.31	5.34	5.37
35	5.34	5.37	5.40	5.43	5.46	5.40	5.43	5.46	5.49	5.52
36	5.49	5.52	5.55	5.58	5.61	5.55	5.58	5.61	5.64	5.67
37	5.65	5.67	5.71	5.74	5.77	5.71	5.74	5.77	5.80	5.83
38	5.80	5.83	5.86	5.89	5.92	5.86	5.89	5.92	5.95	5.98
39	5.95	5.98	6.01	6.04	6.07	6.01	6.04	6.07	6.10	6.13
40	6.10	6.13	6.16	6.19	6.22	6.16	6.19	6.23	6.26	6.29
41	6.25	6.28	6.31	6.34	6.37	6.32	6.35	6.38	6.41	6.44
42	6.40	6.43	6.46	6.49	6.52	6.47	6.50	6.53	6.56	6.59
43	6.55	6.58	6.61	6.64	6.67	6.62	6.65	6.68	6.71	6.74
44	6.71	6.74	6.77	6.80	6.83	6.78	6.81	6.84	6.87	6.90
45	6.86	6.89	6.92	6.95	6.98	6.93	6.96	6.99	7.02	7.05

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 960 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 970 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.09	0.13	0.00	0.03	0.06	0.10	0.13
1	.16	.19	.22	.25	.28	.16	.19	.22	.25	.29
2	.31	.34	.38	.41	.44	.32	.35	.38	.41	.44
3	.47	.50	.53	.56	.60	.48	.51	.54	.57	.60
4	.63	.66	.69	.72	.75	.63	.67	.70	.73	.76
5	0.78	0.82	0.85	0.88	0.91	0.79	0.82	0.85	0.89	0.92
6	.94	.97	1.00	1.03	1.07	.95	.98	1.01	1.04	1.08
7	1.10	1.13	1.16	1.19	1.22	1.11	1.14	1.17	1.20	1.23
8	1.25	1.28	1.32	1.35	1.38	1.27	1.30	1.33	1.36	1.39
9	1.41	1.44	1.47	1.50	1.53	1.42	1.46	1.49	1.52	1.55
10	1.57	1.60	1.63	1.66	1.69	1.58	1.61	1.65	1.68	1.71
11	1.72	1.75	1.78	1.82	1.85	1.74	1.77	1.80	1.83	1.87
12	1.88	1.91	1.94	1.97	2.00	1.90	1.93	1.96	1.99	2.02
13	2.03	2.07	2.10	2.13	2.16	2.06	2.09	2.12	2.15	2.18
14	2.19	2.22	2.25	2.28	2.32	2.21	2.24	2.28	2.31	2.34
15	2.35	2.38	2.41	2.44	2.47	2.37	2.40	2.43	2.47	2.50
16	2.50	2.53	2.57	2.60	2.63	2.53	2.56	2.59	2.62	2.65
17	2.66	2.69	2.72	2.75	2.78	2.69	2.72	2.75	2.78	2.81
18	2.81	2.85	2.88	2.91	2.94	2.84	2.88	2.91	2.94	2.97
19	2.97	3.00	3.03	3.06	3.10	3.00	3.03	3.06	3.10	3.13
20	3.13	3.16	3.19	3.22	3.25	3.16	3.19	3.22	3.25	3.28
21	3.28	3.31	3.34	3.38	3.41	3.32	3.35	3.38	3.41	3.44
22	3.44	3.47	3.50	3.53	3.56	3.47	3.50	3.54	3.57	3.60
23	3.59	3.62	3.65	3.69	3.72	3.63	3.66	3.69	3.72	3.76
24	3.75	3.78	3.81	3.84	3.87	3.79	3.82	3.85	3.88	3.91
25	3.90	3.94	3.97	4.00	4.03	3.94	3.98	4.01	4.04	4.07
26	4.06	4.09	4.12	4.15	4.18	4.10	4.13	4.16	4.20	4.23
27	4.21	4.25	4.28	4.31	4.34	4.26	4.29	4.32	4.35	4.38
28	4.37	4.40	4.43	4.46	4.49	4.42	4.45	4.48	4.51	4.54
29	4.53	4.56	4.59	4.62	4.65	4.57	4.60	4.64	4.67	4.70
30	4.68	4.71	4.74	4.77	4.80	4.73	4.76	4.79	4.82	4.85
31	4.84	4.87	4.90	4.93	4.96	4.89	4.92	4.95	4.98	5.01
32	4.99	5.02	5.05	5.08	5.11	5.04	5.07	5.11	5.14	5.17
33	5.15	5.18	5.21	5.24	5.27	5.20	5.23	5.26	5.29	5.32
34	5.30	5.33	5.36	5.39	5.42	5.36	5.39	5.42	5.45	5.48
35	5.46	5.49	5.52	5.55	5.58	5.51	5.54	5.58	5.61	5.64
36	5.61	5.64	5.67	5.70	5.73	5.67	5.70	5.73	5.76	5.79
37	5.77	5.80	5.83	5.86	5.89	5.83	5.86	5.89	5.92	5.95
38	5.92	5.95	5.98	6.01	6.04	5.98	6.01	6.04	6.08	6.11
39	6.07	6.11	6.14	6.17	6.20	6.14	6.17	6.20	6.23	6.26
40	6.23	6.26	6.29	6.32	6.35	6.29	6.33	6.36	6.39	6.42
41	6.38	6.41	6.45	6.48	6.51	6.45	6.48	6.51	6.54	6.58
42	6.54	6.57	6.60	6.63	6.66	6.61	6.64	6.67	6.70	6.73
43	6.69	6.72	6.75	6.79	6.82	6.76	6.79	6.82	6.86	6.89
44	6.85	6.88	6.91	6.94	6.97	6.92	6.95	6.98	7.01	7.04
45	7.00	7.03	7.06	7.09	7.13	7.07	7.11	7.14	7.17	7.20

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 980 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 990 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.10	0.13	0.00	0.03	0.06	0.10	0.13
1	.16	.19	.22	.26	.29	.16	.19	.23	.26	.29
2	.32	.35	.38	.42	.45	.32	.36	.39	.42	.45
3	.48	.51	.54	.58	.61	.49	.52	.55	.58	.61
4	.64	.67	.70	.74	.77	.65	.68	.71	.74	.78
5	0.80	0.83	0.86	0.90	0.93	0.81	0.84	0.87	0.90	0.94
6	.96	.99	1.02	1.06	1.09	.97	1.00	1.03	1.07	1.10
7	1.12	1.15	1.18	1.22	1.25	1.13	1.16	1.20	1.23	1.26
8	1.28	1.31	1.34	1.37	1.41	1.29	1.32	1.36	1.39	1.42
9	1.44	1.47	1.50	1.53	1.57	1.45	1.49	1.52	1.55	1.58
10	1.60	1.63	1.66	1.69	1.73	1.61	1.65	1.68	1.71	1.74
11	1.76	1.79	1.82	1.85	1.89	1.78	1.81	1.84	1.87	1.90
12	1.92	1.95	1.98	2.01	2.05	1.94	1.97	2.00	2.03	2.07
13	2.08	2.11	2.14	2.17	2.20	2.10	2.13	2.16	2.19	2.23
14	2.24	2.27	2.30	2.33	2.36	2.26	2.29	2.32	2.36	2.39
15	2.40	2.43	2.46	2.49	2.52	2.42	2.45	2.48	2.52	2.55
16	2.55	2.59	2.62	2.65	2.68	2.58	2.61	2.65	2.68	2.71
17	2.71	2.75	2.78	2.81	2.84	2.74	2.77	2.81	2.84	2.87
18	2.87	2.90	2.94	2.97	3.00	2.90	2.93	2.97	3.00	3.03
19	3.03	3.06	3.10	3.13	3.16	3.06	3.09	3.13	3.16	3.19
20	3.19	3.22	3.25	3.29	3.32	3.22	3.26	3.29	3.32	3.35
21	3.35	3.38	3.41	3.45	3.48	3.38	3.42	3.45	3.48	3.51
22	3.51	3.54	3.57	3.60	3.64	3.54	3.58	3.61	3.64	3.67
23	3.67	3.70	3.73	3.76	3.79	3.70	3.74	3.77	3.80	3.83
24	3.83	3.86	3.89	3.92	3.95	3.86	3.90	3.93	3.96	3.99
25	3.99	4.02	4.05	4.08	4.11	4.03	4.06	4.09	4.12	4.15
26	4.14	4.18	4.21	4.24	4.27	4.19	4.22	4.25	4.28	4.31
27	4.30	4.33	4.37	4.40	4.43	4.35	4.38	4.41	4.44	4.47
28	4.46	4.49	4.52	4.56	4.59	4.51	4.54	4.57	4.60	4.64
29	4.62	4.65	4.68	4.71	4.75	4.67	4.70	4.73	4.76	4.79
30	4.78	4.81	4.84	4.87	4.90	4.83	4.86	4.89	4.92	4.95
31	4.94	4.97	5.00	5.03	5.06	4.99	5.02	5.05	5.08	5.11
32	5.10	5.13	5.16	5.19	5.22	5.15	5.18	5.21	5.24	5.27
33	5.25	5.29	5.32	5.35	5.38	5.31	5.34	5.37	5.40	5.43
34	5.41	5.44	5.47	5.51	5.54	5.47	5.50	5.53	5.56	5.59
35	5.57	5.60	5.63	5.66	5.70	5.63	5.66	5.69	5.72	5.75
36	5.73	5.76	5.79	5.82	5.85	5.79	5.82	5.85	5.88	5.91
37	5.89	5.92	5.95	5.98	6.01	5.95	5.98	6.01	6.04	6.07
38	6.04	6.08	6.11	6.14	6.17	6.11	6.14	6.17	6.20	6.23
39	6.20	6.23	6.26	6.30	6.33	6.26	6.30	6.33	6.36	6.39
40	6.36	6.39	6.42	6.45	6.49	6.42	6.46	6.49	6.52	6.55
41	6.52	6.55	6.58	6.61	6.64	6.58	6.62	6.65	6.68	6.71
42	6.67	6.71	6.74	6.77	6.80	6.74	6.77	6.81	6.84	6.87
43	6.83	6.86	6.90	6.93	6.96	6.90	6.93	6.97	7.00	7.03
44	6.99	7.02	7.05	7.08	7.12	7.06	7.09	7.13	7.16	7.19
45	7.15	7.18	7.21	7.24	7.27	7.22	7.25	7.28	7.32	7.35

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1000 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1010 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.06	0.10	0.13	0.00	0.03	0.07	0.10	0.13
1	.16	.20	.23	.26	.29	.16	.20	.23	.26	.30
2	.33	.36	.39	.42	.46	.33	.36	.40	.43	.46
3	.49	.52	.56	.59	.62	.49	.53	.56	.59	.63
4	.65	.69	.72	.75	.78	.66	.69	.73	.76	.79
5	0.82	0.85	0.88	0.91	0.95	0.82	0.86	0.89	0.92	0.96
6	.98	1.01	1.04	1.08	1.11	.99	1.02	1.06	1.09	1.12
7	1.14	1.18	1.21	1.24	1.27	1.15	1.19	1.22	1.25	1.29
8	1.30	1.34	1.37	1.40	1.44	1.32	1.35	1.38	1.42	1.45
9	1.47	1.50	1.53	1.57	1.60	1.48	1.52	1.55	1.58	1.61
10	1.63	1.66	1.70	1.73	1.76	1.65	1.68	1.71	1.75	1.78
11	1.79	1.83	1.86	1.89	1.92	1.81	1.84	1.88	1.91	1.94
12	1.96	1.99	2.02	2.05	2.09	1.98	2.01	2.04	2.07	2.11
13	2.12	2.15	2.18	2.22	2.25	2.14	2.17	2.21	2.24	2.27
14	2.28	2.31	2.35	2.38	2.41	2.30	2.34	2.37	2.40	2.44
15	2.44	2.48	2.51	2.54	2.57	2.47	2.50	2.53	2.57	2.60
16	2.61	2.64	2.67	2.70	2.74	2.63	2.67	2.70	2.73	2.76
17	2.77	2.80	2.83	2.87	2.90	2.80	2.83	2.86	2.90	2.93
18	2.93	2.96	3.00	3.03	3.06	2.96	2.99	3.03	3.06	3.09
19	3.09	3.13	3.16	3.19	3.22	3.12	3.16	3.19	3.22	3.26
20	3.26	3.29	3.32	3.35	3.39	3.29	3.32	3.35	3.39	3.42
21	3.42	3.45	3.48	3.52	3.55	3.45	3.49	3.52	3.55	3.58
22	3.58	3.61	3.64	3.68	3.71	3.62	3.65	3.68	3.71	3.75
23	3.74	3.78	3.81	3.84	3.87	3.78	3.81	3.85	3.88	3.91
24	3.90	3.94	3.97	4.00	4.03	3.94	3.98	4.01	4.04	4.07
25	4.07	4.10	4.13	4.16	4.20	4.11	4.14	4.17	4.20	4.24
26	4.23	4.26	4.29	4.33	4.36	4.27	4.30	4.34	4.37	4.40
27	4.39	4.42	4.46	4.49	4.52	4.43	4.47	4.50	4.53	4.56
28	4.55	4.58	4.62	4.65	4.68	4.60	4.63	4.66	4.70	4.73
29	4.71	4.75	4.78	4.81	4.84	4.76	4.79	4.83	4.86	4.89
30	4.88	4.91	4.94	4.97	5.00	4.92	4.96	4.99	5.02	5.06
31	5.04	5.07	5.10	5.13	5.17	5.09	5.12	5.15	5.19	5.22
32	5.20	5.23	5.26	5.30	5.33	5.25	5.28	5.32	5.35	5.38
33	5.36	5.39	5.42	5.46	5.49	5.41	5.45	5.48	5.51	5.54
34	5.52	5.55	5.59	5.62	5.65	5.58	5.61	5.64	5.67	5.71
35	5.68	5.72	5.75	5.78	5.81	5.74	5.77	5.81	5.84	5.87
36	5.84	5.88	5.91	5.94	5.97	5.90	5.93	5.97	6.00	6.03
37	6.01	6.04	6.07	6.10	6.13	6.07	6.10	6.13	6.16	6.20
38	6.17	6.20	6.23	6.26	6.30	6.23	6.26	6.29	6.33	6.36
39	6.33	6.36	6.39	6.42	6.46	6.39	6.42	6.46	6.49	6.52
40	6.49	6.52	6.55	6.58	6.62	6.55	6.59	6.62	6.65	6.68
41	6.65	6.68	6.71	6.75	6.78	6.72	6.75	6.78	6.81	6.85
42	6.81	6.84	6.88	6.91	6.94	6.88	6.91	6.94	6.98	7.01
43	6.97	7.00	7.04	7.07	7.10	7.04	7.07	7.11	7.14	7.17
44	7.13	7.16	7.20	7.23	7.26	7.20	7.24	7.27	7.30	7.33
45	7.29	7.33	7.36	7.39	7.42	7.37	7.40	7.43	7.46	7.50

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1020 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1030 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.07	0.10	0.13	0.00	0.03	0.07	0.10	0.13
1	.17	.20	.23	.27	.30	.17	.20	.24	.27	.30
2	.33	.37	.40	.43	.47	.34	.37	.40	.44	.47
3	.50	.53	.57	.60	.63	.50	.54	.57	.61	.64
4	.67	.70	.73	.77	.80	.67	.71	.74	.77	.81
5	0.83	0.87	0.90	0.93	0.97	0.84	0.87	0.91	0.94	0.98
6	1.00	1.03	1.07	1.10	1.13	1.01	1.04	1.08	1.11	1.14
7	1.16	1.20	1.23	1.26	1.30	1.18	1.21	1.24	1.28	1.31
8	1.33	1.36	1.40	1.43	1.46	1.34	1.38	1.41	1.45	1.48
9	1.50	1.53	1.56	1.60	1.63	1.51	1.55	1.58	1.61	1.65
10	1.66	1.70	1.73	1.76	1.80	1.68	1.71	1.75	1.78	1.81
11	1.83	1.86	1.90	1.93	1.96	1.85	1.88	1.91	1.95	1.98
12	2.00	2.03	2.06	2.10	2.13	2.01	2.05	2.08	2.12	2.15
13	2.16	2.20	2.23	2.26	2.29	2.18	2.22	2.25	2.28	2.32
14	2.33	2.36	2.39	2.43	2.46	2.35	2.38	2.42	2.45	2.48
15	2.49	2.53	2.56	2.59	2.63	2.52	2.55	2.58	2.62	2.65
16	2.66	2.69	2.73	2.76	2.79	2.69	2.72	2.75	2.79	2.82
17	2.82	2.86	2.89	2.92	2.96	2.85	2.89	2.92	2.95	2.99
18	2.99	3.02	3.06	3.09	3.12	3.02	3.05	3.09	3.12	3.15
19	3.16	3.19	3.22	3.25	3.29	3.19	3.22	3.25	3.29	3.32
20	3.32	3.35	3.39	3.42	3.45	3.35	3.39	3.42	3.45	3.49
21	3.49	3.52	3.55	3.59	3.62	3.52	3.55	3.59	3.62	3.65
22	3.65	3.69	3.72	3.75	3.78	3.69	3.72	3.75	3.79	3.82
23	3.82	3.85	3.88	3.92	3.95	3.85	3.89	3.92	3.96	3.99
24	3.98	4.02	4.05	4.08	4.11	4.02	4.06	4.09	4.12	4.16
25	4.15	4.18	4.21	4.25	4.28	4.19	4.22	4.25	4.29	4.32
26	4.31	4.35	4.38	4.41	4.45	4.36	4.39	4.42	4.46	4.49
27	4.48	4.51	4.54	4.58	4.61	4.52	4.56	4.59	4.62	4.65
28	4.64	4.68	4.71	4.74	4.78	4.69	4.72	4.76	4.79	4.82
29	4.81	4.84	4.87	4.91	4.94	4.86	4.89	4.92	4.96	4.99
30	4.97	5.01	5.04	5.07	5.11	5.02	5.06	5.09	5.12	5.16
31	5.14	5.17	5.20	5.24	5.27	5.19	5.22	5.26	5.29	5.32
32	5.30	5.34	5.37	5.40	5.43	5.35	5.39	5.42	5.45	5.49
33	5.47	5.50	5.53	5.57	5.60	5.52	5.55	5.59	5.62	5.65
34	5.63	5.67	5.70	5.73	5.76	5.69	5.72	5.75	5.79	5.82
35	5.80	5.83	5.86	5.89	5.93	5.85	5.89	5.92	5.95	5.99
36	5.96	5.99	6.03	6.06	6.09	6.02	6.05	6.09	6.12	6.15
37	6.13	6.16	6.19	6.22	6.26	6.19	6.22	6.25	6.29	6.32
38	6.29	6.32	6.36	6.39	6.42	6.35	6.38	6.42	6.45	6.48
39	6.45	6.49	6.52	6.55	6.59	6.52	6.55	6.58	6.62	6.65
40	6.62	6.65	6.69	6.72	6.75	6.68	6.72	6.75	6.78	6.82
41	6.78	6.82	6.85	6.88	6.91	6.85	6.88	6.92	6.95	6.98
42	6.95	6.98	7.01	7.05	7.08	7.02	7.05	7.08	7.12	7.15
43	7.11	7.14	7.18	7.21	7.24	7.18	7.21	7.25	7.28	7.31
44	7.28	7.31	7.34	7.37	7.41	7.35	7.38	7.41	7.45	7.48
45	7.44	7.47	7.50	7.54	7.57	7.51	7.55	7.58	7.61	7.64

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1040 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1050 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.07	0.10	0.14	0.00	0.03	0.07	0.10	0.14
1	.17	.20	.24	.27	.31	.17	.21	.24	.27	.31
2	.34	.37	.41	.44	.48	.34	.38	.41	.45	.48
3	.51	.54	.58	.61	.64	.51	.55	.58	.62	.65
4	.68	.71	.75	.78	.82	.69	.72	.75	.79	.82
5	0.85	0.88	0.92	0.95	0.98	0.86	0.89	0.93	0.96	0.99
6	1.02	1.05	1.09	1.12	1.15	1.03	1.06	1.10	1.13	1.17
7	1.19	1.22	1.26	1.29	1.32	1.20	1.23	1.27	1.30	1.34
8	1.36	1.39	1.43	1.46	1.49	1.37	1.40	1.44	1.47	1.51
9	1.53	1.56	1.59	1.63	1.66	1.54	1.58	1.61	1.64	1.68
10	1.70	1.73	1.76	1.80	1.83	1.71	1.75	1.78	1.82	1.85
11	1.87	1.90	1.93	1.97	2.00	1.88	1.92	1.95	1.99	2.02
12	2.03	2.07	2.10	2.14	2.17	2.05	2.09	2.12	2.16	2.19
13	2.20	2.24	2.27	2.31	2.34	2.22	2.26	2.29	2.33	2.36
14	2.37	2.41	2.44	2.47	2.51	2.40	2.43	2.46	2.50	2.53
15	2.54	2.58	2.61	2.64	2.68	2.57	2.60	2.63	2.67	2.70
16	2.71	2.74	2.78	2.81	2.85	2.74	2.77	2.81	2.84	2.87
17	2.88	2.91	2.95	2.98	3.01	2.91	2.94	2.98	3.01	3.04
18	3.05	3.08	3.12	3.15	3.18	3.08	3.11	3.15	3.18	3.22
19	3.22	3.25	3.29	3.32	3.35	3.25	3.28	3.32	3.35	3.39
20	3.39	3.42	3.45	3.49	3.52	3.42	3.45	3.49	3.52	3.56
21	3.55	3.59	3.62	3.66	3.69	3.59	3.62	3.66	3.69	3.73
22	3.72	3.76	3.79	3.83	3.86	3.76	3.79	3.83	3.86	3.90
23	3.89	3.93	3.96	3.99	4.03	3.93	3.96	4.00	4.03	4.07
24	4.06	4.09	4.13	4.16	4.20	4.10	4.13	4.17	4.20	4.24
25	4.23	4.26	4.30	4.33	4.36	4.27	4.30	4.34	4.37	4.41
26	4.40	4.43	4.46	4.50	4.53	4.44	4.47	4.51	4.54	4.58
27	4.57	4.60	4.63	4.67	4.70	4.61	4.64	4.68	4.71	4.74
28	4.73	4.77	4.80	4.83	4.87	4.78	4.81	4.85	4.88	4.92
29	4.90	4.94	4.97	5.00	5.04	4.95	4.98	5.02	5.05	5.09
30	5.07	5.10	5.14	5.17	5.21	5.12	5.15	5.19	5.22	5.26
31	5.24	5.27	5.31	5.34	5.37	5.29	5.32	5.36	5.39	5.42
32	5.41	5.44	5.47	5.51	5.54	5.46	5.49	5.53	5.56	5.59
33	5.57	5.61	5.64	5.68	5.71	5.63	5.66	5.70	5.73	5.76
34	5.74	5.78	5.81	5.84	5.88	5.80	5.83	5.87	5.90	5.93
35	5.91	5.94	5.98	6.01	6.04	5.97	6.00	6.04	6.07	6.10
36	6.08	6.11	6.15	6.18	6.21	6.14	6.17	6.20	6.24	6.27
37	6.25	6.28	6.31	6.35	6.38	6.31	6.34	6.37	6.41	6.44
38	6.41	6.45	6.48	6.51	6.55	6.48	6.51	6.54	6.58	6.61
39	6.58	6.61	6.65	6.68	6.72	6.64	6.68	6.71	6.75	6.78
40	6.75	6.78	6.82	6.85	6.88	6.81	6.85	6.88	6.91	6.95
41	6.92	6.95	6.98	7.02	7.05	6.98	7.02	7.05	7.08	7.12
42	7.08	7.12	7.15	7.18	7.22	7.15	7.19	7.22	7.25	7.29
43	7.25	7.28	7.32	7.35	7.38	7.32	7.35	7.39	7.42	7.46
44	7.42	7.45	7.48	7.52	7.55	7.49	7.52	7.56	7.59	7.63
45	7.59	7.62	7.65	7.69	7.72	7.66	7.69	7.73	7.76	7.79

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1060 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1070 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.03	0.07	0.10	0.14	0.00	0.04	0.07	0.10	0.14
1	.17	.21	.24	.28	.31	.17	.21	.25	.28	.31
2	.35	.38	.42	.45	.48	.35	.38	.42	.45	.49
3	.52	.55	.59	.62	.66	.52	.56	.59	.63	.66
4	.69	.73	.76	.80	.83	.70	.73	.77	.80	.84
5	0.86	0.90	0.93	0.97	1.00	.87	.91	.94	.98	1.01
6	1.04	1.07	1.11	1.14	1.18	1.05	1.08	1.12	1.15	1.19
7	1.21	1.25	1.28	1.31	1.35	1.22	1.26	1.29	1.33	1.36
8	1.38	1.42	1.45	1.49	1.52	1.40	1.43	1.47	1.50	1.54
9	1.56	1.59	1.62	1.66	1.69	1.57	1.61	1.64	1.68	1.71
10	1.73	1.76	1.80	1.83	1.87	1.75	1.78	1.81	1.85	1.88
11	1.90	1.94	1.97	2.00	2.04	1.92	1.95	1.99	2.02	2.06
12	2.07	2.11	2.14	2.18	2.21	2.09	2.13	2.16	2.20	2.23
13	2.25	2.28	2.32	2.35	2.38	2.27	2.30	2.34	2.37	2.41
14	2.42	2.45	2.49	2.52	2.56	2.44	2.48	2.51	2.55	2.58
15	2.59	2.63	2.66	2.69	2.73	2.62	2.65	2.68	2.72	2.75
16	2.76	2.80	2.83	2.87	2.90	2.79	2.82	2.86	2.89	2.93
17	2.94	2.97	3.00	3.04	3.07	2.96	3.00	3.03	3.07	3.10
18	3.11	3.14	3.18	3.21	3.25	3.14	3.17	3.21	3.24	3.28
19	3.28	3.31	3.35	3.38	3.42	3.31	3.34	3.38	3.41	3.45
20	3.45	3.49	3.52	3.56	3.59	3.48	3.52	3.55	3.59	3.62
21	3.62	3.66	3.69	3.73	3.76	3.66	3.69	3.73	3.76	3.80
22	3.79	3.83	3.86	3.90	3.93	3.83	3.87	3.90	3.94	3.97
23	3.97	4.00	4.04	4.07	4.10	4.00	4.04	4.07	4.11	4.14
24	4.14	4.17	4.21	4.24	4.28	4.18	4.21	4.25	4.28	4.32
25	4.31	4.34	4.38	4.41	4.45	4.35	4.39	4.42	4.45	4.49
26	4.48	4.52	4.55	4.59	4.62	4.53	4.56	4.59	4.63	4.66
27	4.65	4.69	4.72	4.76	4.79	4.70	4.73	4.77	4.80	4.84
28	4.83	4.86	4.89	4.93	4.96	4.87	4.90	4.94	4.97	5.01
29	5.00	5.03	5.07	5.10	5.13	5.04	5.08	5.11	5.15	5.18
30	5.17	5.20	5.24	5.27	5.31	5.22	5.25	5.29	5.32	5.36
31	5.34	5.37	5.41	5.44	5.48	5.39	5.42	5.46	5.49	5.53
32	5.51	5.54	5.58	5.61	5.65	5.56	5.60	5.63	5.67	5.70
33	5.68	5.72	5.75	5.78	5.82	5.74	5.77	5.80	5.84	5.87
34	5.85	5.89	5.92	5.96	5.99	5.91	5.94	5.98	6.01	6.05
35	6.02	6.06	6.09	6.13	6.16	6.08	6.12	6.15	6.18	6.22
36	6.19	6.23	6.26	6.30	6.33	6.25	6.29	6.32	6.36	6.39
37	6.37	6.40	6.43	6.47	6.50	6.43	6.46	6.49	6.53	6.56
38	6.54	6.57	6.60	6.64	6.67	6.60	6.63	6.67	6.70	6.74
39	6.71	6.74	6.78	6.81	6.84	6.77	6.81	6.84	6.87	6.91
40	6.88	6.91	6.95	6.98	7.02	6.94	6.98	7.01	7.05	7.08
41	7.05	7.08	7.12	7.15	7.19	7.12	7.15	7.18	7.22	7.25
42	7.22	7.25	7.29	7.32	7.36	7.29	7.32	7.36	7.39	7.42
43	7.39	7.42	7.46	7.49	7.53	7.46	7.49	7.53	7.56	7.60
44	7.56	7.59	7.63	7.66	7.70	7.63	7.67	7.70	7.74	7.77
45	7.73	7.77	7.80	7.83	7.87	7.80	7.84	7.87	7.91	7.94

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1080 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1090 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.07	0.11	0.14	0.00	0.04	0.07	0.11	0.14
1	.18	.21	.25	.28	.32	.18	.21	.25	.28	.32
2	.35	.39	.42	.46	.49	.36	.39	.43	.46	.50
3	.53	.56	.60	.64	.67	.53	.57	.60	.64	.68
4	.71	.74	.78	.81	.85	.71	.75	.78	.82	.85
5	0.88	0.92	0.95	0.99	1.02	0.89	0.93	0.96	1.00	1.03
6	1.06	1.09	1.13	1.16	1.20	1.07	1.10	1.14	1.17	1.21
7	1.23	1.27	1.30	1.34	1.37	1.24	1.28	1.32	1.35	1.39
8	1.41	1.45	1.48	1.52	1.55	1.42	1.46	1.49	1.53	1.57
9	1.59	1.62	1.66	1.69	1.73	1.60	1.64	1.67	1.71	1.74
10	1.76	1.80	1.83	1.87	1.90	1.78	1.81	1.85	1.88	1.92
11	1.94	1.97	2.01	2.04	2.08	1.96	1.99	2.03	2.06	2.10
12	2.11	2.15	2.18	2.22	2.25	2.13	2.17	2.20	2.24	2.27
13	2.29	2.32	2.36	2.39	2.43	2.31	2.35	2.38	2.42	2.45
14	2.46	2.50	2.53	2.57	2.60	2.49	2.52	2.56	2.59	2.63
15	2.64	2.68	2.71	2.75	2.78	2.66	2.70	2.73	2.77	2.81
16	2.82	2.85	2.89	2.92	2.96	2.84	2.88	2.91	2.95	2.98
17	2.99	3.03	3.06	3.10	3.13	3.02	3.05	3.09	3.13	3.16
18	3.17	3.20	3.24	3.27	3.31	3.20	3.23	3.27	3.30	3.34
19	3.34	3.38	3.41	3.45	3.48	3.37	3.41	3.44	3.48	3.51
20	3.52	3.55	3.59	3.62	3.66	3.55	3.59	3.62	3.66	3.69
21	3.69	3.73	3.76	3.80	3.83	3.73	3.76	3.80	3.83	3.87
22	3.87	3.90	3.94	3.97	4.01	3.90	3.94	3.97	4.01	4.04
23	4.04	4.08	4.11	4.15	4.18	4.08	4.11	4.15	4.19	4.22
24	4.22	4.25	4.29	4.32	4.36	4.26	4.29	4.33	4.36	4.40
25	4.39	4.43	4.46	4.50	4.53	4.43	4.47	4.50	4.54	4.57
26	4.57	4.60	4.64	4.67	4.71	4.61	4.64	4.68	4.72	4.75
27	4.74	4.78	4.81	4.85	4.88	4.79	4.82	4.86	4.89	4.93
28	4.92	4.95	4.99	5.02	5.06	4.96	5.00	5.03	5.07	5.10
29	5.09	5.13	5.16	5.20	5.23	5.14	5.17	5.21	5.24	5.28
30	5.26	5.30	5.34	5.37	5.41	5.31	5.35	5.38	5.42	5.46
31	5.44	5.47	5.51	5.54	5.58	5.49	5.53	5.56	5.60	5.63
32	5.61	5.65	5.68	5.72	5.75	5.67	5.70	5.74	5.77	5.81
33	5.79	5.82	5.86	5.89	5.93	5.84	5.88	5.91	5.95	5.98
34	5.96	6.00	6.03	6.07	6.10	6.02	6.05	6.09	6.12	6.16
35	6.14	6.17	6.21	6.24	6.28	6.19	6.23	6.27	6.30	6.34
36	6.31	6.35	6.38	6.42	6.45	6.37	6.40	6.44	6.48	6.51
37	6.49	6.52	6.56	6.59	6.62	6.55	6.58	6.62	6.65	6.69
38	6.66	6.69	6.73	6.76	6.80	6.72	6.76	6.79	6.83	6.86
39	6.83	6.87	6.90	6.94	6.97	6.90	6.93	6.97	7.00	7.04
40	7.01	7.04	7.08	7.11	7.15	7.07	7.11	7.14	7.18	7.21
41	7.18	7.22	7.25	7.29	7.32	7.25	7.28	7.32	7.35	7.39
42	7.36	7.39	7.42	7.46	7.49	7.42	7.46	7.49	7.53	7.56
43	7.53	7.56	7.60	7.63	7.67	7.60	7.63	7.67	7.70	7.74
44	7.70	7.74	7.77	7.81	7.84	7.77	7.81	7.84	7.88	7.92
45	7.88	7.91	7.95	7.98	8.02	7.95	7.99	8.02	8.06	8.09

(continued)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1100 mm. or mb.					Height of the mercury column 1110 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.07	0.11	0.14	0.00	0.04	0.07	0.11	0.15
1	.18	.22	.25	.29	.32	.18	.22	.25	.29	.33
2	.36	.39	.43	.47	.50	.36	.40	.44	.47	.51
3	.54	.58	.61	.65	.68	.54	.58	.62	.65	.69
4	.72	.75	.79	.83	.86	.72	.76	.80	.83	.87
5	0.90	0.93	0.97	1.01	1.04	0.91	0.94	0.98	1.01	1.05
6	1.08	1.11	1.15	1.18	1.22	1.09	1.12	1.16	1.20	1.23
7	1.26	1.29	1.33	1.36	1.40	1.27	1.30	1.34	1.38	1.41
8	1.44	1.47	1.51	1.54	1.58	1.45	1.49	1.52	1.56	1.59
9	1.61	1.65	1.69	1.72	1.76	1.63	1.67	1.70	1.74	1.77
10	1.79	1.83	1.87	1.90	1.94	1.81	1.85	1.88	1.92	1.95
11	1.97	2.01	2.04	2.08	2.12	1.99	2.03	2.06	2.10	2.14
12	2.15	2.19	2.22	2.26	2.30	2.17	2.21	2.24	2.28	2.32
13	2.33	2.37	2.40	2.44	2.47	2.35	2.39	2.42	2.46	2.50
14	2.51	2.55	2.58	2.62	2.65	2.53	2.57	2.61	2.64	2.68
15	2.69	2.72	2.76	2.80	2.83	2.71	2.75	2.78	2.82	2.86
16	2.87	2.90	2.94	2.97	3.01	2.89	2.93	2.97	3.00	3.04
17	3.05	3.08	3.12	3.15	3.19	3.07	3.11	3.15	3.18	3.22
18	3.23	3.26	3.30	3.33	3.37	3.25	3.29	3.33	3.36	3.40
19	3.40	3.44	3.47	3.51	3.55	3.43	3.47	3.51	3.54	3.58
20	3.58	3.62	3.65	3.69	3.72	3.61	3.65	3.69	3.72	3.76
21	3.76	3.80	3.83	3.87	3.90	3.79	3.83	3.87	3.90	3.94
22	3.94	3.97	4.01	4.05	4.08	3.97	4.01	4.05	4.08	4.12
23	4.12	4.15	4.19	4.22	4.26	4.15	4.19	4.23	4.26	4.30
24	4.29	4.33	4.37	4.40	4.44	4.33	4.37	4.41	4.44	4.48
25	4.47	4.51	4.54	4.58	4.62	4.51	4.55	4.59	4.62	4.66
26	4.65	4.69	4.72	4.76	4.79	4.69	4.73	4.77	4.80	4.84
27	4.83	4.87	4.90	4.94	4.97	4.87	4.91	4.95	4.98	5.02
28	5.01	5.04	5.08	5.11	5.15	5.05	5.09	5.12	5.16	5.20
29	5.19	5.22	5.26	5.29	5.33	5.23	5.27	5.30	5.34	5.38
30	5.36	5.40	5.43	5.47	5.51	5.41	5.45	5.48	5.52	5.56
31	5.54	5.58	5.61	5.65	5.68	5.59	5.63	5.66	5.70	5.73
32	5.72	5.75	5.79	5.83	5.86	5.77	5.81	5.84	5.88	5.91
33	5.90	5.93	5.97	6.00	6.04	5.95	5.99	6.02	6.06	6.09
34	6.07	6.11	6.14	6.18	6.22	6.13	6.16	6.20	6.24	6.27
35	6.25	6.29	6.32	6.36	6.39	6.31	6.34	6.38	6.41	6.45
36	6.43	6.46	6.50	6.54	6.57	6.49	6.52	6.56	6.59	6.63
37	6.61	6.64	6.68	6.71	6.75	6.67	6.70	6.74	6.77	6.81
38	6.78	6.82	6.85	6.89	6.92	6.85	6.88	6.92	6.95	6.99
39	6.96	7.00	7.03	7.07	7.10	7.02	7.06	7.10	7.13	7.17
40	7.14	7.17	7.21	7.24	7.28	7.20	7.24	7.27	7.31	7.35
41	7.32	7.35	7.39	7.42	7.46	7.38	7.42	7.45	7.49	7.52
42	7.49	7.53	7.56	7.60	7.63	7.56	7.60	7.63	7.67	7.70
43	7.67	7.70	7.74	7.77	7.81	7.74	7.77	7.81	7.85	7.88
44	7.85	7.88	7.92	7.95	7.99	7.92	7.95	7.99	8.02	8.06
45	8.02	8.06	8.09	8.13	8.16	8.10	8.13	8.17	8.20	8.24

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1120 mm. or mb.					Height of the mercury column 1130 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.07	0.11	0.15	0.00	0.04	0.07	0.11	0.15
1	.18	.22	.26	.29	.33	.18	.22	.26	.29	.33
2	.37	.40	.44	.48	.51	.37	.41	.44	.48	.52
3	.55	.59	.62	.66	.69	.55	.59	.63	.66	.70
4	.73	.77	.80	.84	.88	.74	.78	.81	.85	.89
5	0.91	0.95	0.99	1.02	1.06	0.92	0.96	1.00	1.03	1.07
6	1.10	1.13	1.17	1.21	1.24	1.11	1.14	1.18	1.22	1.25
7	1.28	1.32	1.35	1.39	1.43	1.29	1.33	1.37	1.40	1.44
8	1.46	1.50	1.54	1.57	1.61	1.47	1.51	1.55	1.59	1.62
9	1.64	1.68	1.72	1.75	1.79	1.66	1.70	1.73	1.77	1.81
10	1.83	1.86	1.90	1.94	1.97	1.84	1.88	1.92	1.95	1.99
11	2.01	2.05	2.08	2.12	2.15	2.03	2.06	2.10	2.14	2.17
12	2.19	2.23	2.26	2.30	2.34	2.21	2.25	2.28	2.32	2.36
13	2.37	2.41	2.45	2.48	2.52	2.39	2.43	2.47	2.51	2.54
14	2.56	2.59	2.63	2.66	2.70	2.58	2.61	2.65	2.69	2.73
15	2.74	2.77	2.81	2.85	2.88	2.76	2.80	2.84	2.87	2.91
16	2.92	2.96	2.99	3.03	3.07	2.95	2.98	3.02	3.06	3.09
17	3.10	3.14	3.17	3.21	3.25	3.13	3.17	3.20	3.24	3.28
18	3.28	3.32	3.36	3.39	3.43	3.31	3.35	3.39	3.42	3.46
19	3.47	3.50	3.54	3.57	3.61	3.50	3.53	3.57	3.61	3.64
20	3.65	3.68	3.72	3.76	3.79	3.68	3.72	3.75	3.79	3.83
21	3.83	3.87	3.90	3.94	3.97	3.86	3.90	3.94	3.97	4.01
22	4.01	4.05	4.08	4.12	4.16	4.05	4.08	4.12	4.16	4.19
23	4.19	4.23	4.26	4.30	4.34	4.23	4.27	4.30	4.34	4.38
24	4.37	4.41	4.45	4.48	4.52	4.41	4.45	4.48	4.52	4.56
25	4.56	4.59	4.63	4.66	4.70	4.60	4.63	4.67	4.70	4.74
26	4.74	4.77	4.81	4.85	4.88	4.78	4.81	4.85	4.89	4.92
27	4.92	4.95	4.99	5.03	5.06	4.96	5.00	5.03	5.07	5.11
28	5.10	5.13	5.17	5.21	5.24	5.14	5.18	5.22	5.25	5.29
29	5.28	5.32	5.35	5.39	5.42	5.33	5.36	5.40	5.44	5.47
30	5.46	5.50	5.53	5.57	5.61	5.51	5.55	5.58	5.62	5.66
31	5.64	5.68	5.71	5.75	5.79	5.69	5.73	5.77	5.80	5.84
32	5.82	5.86	5.89	5.93	5.97	5.87	5.91	5.95	5.98	6.02
33	6.00	6.04	6.07	6.11	6.15	6.06	6.09	6.13	6.17	6.20
34	6.18	6.22	6.26	6.29	6.33	6.24	6.28	6.31	6.35	6.39
35	6.36	6.40	6.44	6.47	6.51	6.42	6.46	6.50	6.53	6.57
36	6.55	6.58	6.62	6.65	6.69	6.60	6.64	6.68	6.71	6.75
37	6.73	6.76	6.80	6.83	6.87	6.79	6.82	6.86	6.90	6.93
38	6.91	6.94	6.98	7.01	7.05	6.97	7.00	7.04	7.08	7.11
39	7.09	7.12	7.16	7.19	7.23	7.15	7.19	7.22	7.26	7.30
40	7.27	7.30	7.34	7.38	7.41	7.33	7.37	7.41	7.44	7.48
41	7.45	7.48	7.52	7.56	7.59	7.51	7.55	7.59	7.62	7.66
42	7.63	7.66	7.70	7.74	7.77	7.70	7.73	7.77	7.81	7.84
43	7.81	7.84	7.88	7.92	7.95	7.88	7.91	7.95	7.99	8.02
44	7.99	8.02	8.06	8.10	8.13	8.06	8.10	8.13	8.17	8.21
45	8.17	8.20	8.24	8.28	8.31	8.24	8.28	8.31	8.35	8.39

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1140 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1150 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.07	0.11	0.15	0.00	0.04	0.07	0.11	0.15
1	.19	.22	.26	.30	.34	.19	.23	.26	.30	.34
2	.37	.41	.45	.48	.52	.38	.41	.45	.49	.53
3	.56	.60	.63	.67	.71	.56	.60	.64	.68	.71
4	.74	.78	.82	.86	.89	.75	.79	.83	.86	.90
5	0.93	0.97	1.00	1.04	1.08	0.94	0.98	1.01	1.05	1.09
6	1.12	1.15	1.19	1.23	1.27	1.13	1.16	1.20	1.24	1.28
7	1.30	1.34	1.38	1.41	1.45	1.31	1.35	1.39	1.43	1.46
8	1.49	1.53	1.56	1.60	1.64	1.50	1.54	1.58	1.61	1.65
9	1.67	1.71	1.75	1.79	1.82	1.69	1.73	1.76	1.80	1.84
10	1.86	1.90	1.93	1.97	2.01	1.88	1.91	1.95	1.99	2.03
11	2.05	2.08	2.12	2.16	2.19	2.06	2.10	2.14	2.17	2.21
12	2.23	2.27	2.31	2.34	2.38	2.25	2.29	2.33	2.36	2.40
13	2.42	2.45	2.49	2.53	2.56	2.44	2.47	2.51	2.55	2.59
14	2.60	2.64	2.68	2.71	2.75	2.62	2.66	2.70	2.74	2.77
15	2.79	2.82	2.86	2.90	2.93	2.81	2.85	2.89	2.92	2.96
16	2.97	3.01	3.05	3.08	3.12	3.00	3.03	3.07	3.11	3.15
17	3.16	3.19	3.23	3.27	3.30	3.18	3.22	3.26	3.30	3.33
18	3.34	3.38	3.42	3.45	3.49	3.37	3.41	3.45	3.48	3.52
19	3.53	3.56	3.60	3.64	3.68	3.56	3.59	3.63	3.67	3.71
20	3.71	3.75	3.79	3.82	3.86	3.74	3.78	3.82	3.86	3.89
21	3.90	3.93	3.97	4.01	4.04	3.93	3.97	4.01	4.04	4.08
22	4.08	4.12	4.16	4.19	4.23	4.12	4.15	4.19	4.23	4.27
23	4.27	4.30	4.34	4.38	4.41	4.30	4.34	4.38	4.42	4.45
24	4.45	4.49	4.52	4.56	4.60	4.49	4.53	4.56	4.60	4.64
25	4.64	4.67	4.71	4.75	4.78	4.68	4.71	4.75	4.79	4.83
26	4.82	4.86	4.89	4.93	4.97	4.86	4.90	4.94	4.97	5.01
27	5.00	5.04	5.08	5.12	5.15	5.05	5.09	5.12	5.16	5.20
28	5.19	5.23	5.26	5.30	5.34	5.23	5.27	5.31	5.35	5.38
29	5.37	5.41	5.45	5.48	5.52	5.42	5.46	5.50	5.53	5.57
30	5.56	5.60	5.63	5.67	5.71	5.61	5.64	5.68	5.72	5.76
31	5.74	5.78	5.82	5.85	5.89	5.79	5.83	5.87	5.90	5.94
32	5.93	5.96	6.00	6.04	6.07	5.98	6.02	6.05	6.09	6.13
33	6.11	6.15	6.18	6.22	6.26	6.16	6.20	6.24	6.28	6.31
34	6.29	6.33	6.37	6.40	6.44	6.35	6.39	6.42	6.46	6.50
35	6.48	6.52	6.55	6.59	6.63	6.54	6.57	6.61	6.65	6.68
36	6.66	6.70	6.74	6.77	6.81	6.72	6.76	6.80	6.83	6.87
37	6.85	6.88	6.92	6.96	6.99	6.91	6.94	6.98	7.02	7.05
38	7.03	7.07	7.10	7.14	7.18	7.09	7.13	7.17	7.20	7.24
39	7.21	7.25	7.29	7.32	7.36	7.28	7.31	7.35	7.39	7.43
40	7.40	7.43	7.47	7.51	7.54	7.46	7.50	7.54	7.57	7.61
41	7.58	7.62	7.65	7.69	7.73	7.65	7.68	7.72	7.76	7.80
42	7.76	7.80	7.84	7.88	7.91	7.83	7.87	7.91	7.94	7.98
43	7.95	7.98	8.02	8.06	8.09	8.02	8.05	8.09	8.13	8.16
44	8.13	8.17	8.20	8.24	8.28	8.20	8.24	8.28	8.31	8.35
45	8.31	8.35	8.39	8.42	8.46	8.39	8.42	8.46	8.50	8.54

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1160 mm. or mb.					Height of the mercury column 1170 mm. or mb.				
	0.0	0.2	0.4	0.6	0.8	0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.08	0.11	0.15	0.00	0.04	0.08	0.11	0.15
1	.19	.23	.27	.30	.34	.19	.23	.27	.31	.34
2	.38	.42	.45	.49	.53	.38	.42	.46	.50	.53
3	.57	.61	.64	.68	.72	.57	.61	.65	.69	.73
4	.76	.80	.83	.87	.91	.76	.80	.84	.88	.92
5	0.95	0.98	1.02	1.06	1.10	0.95	0.99	1.03	1.07	1.11
6	1.14	1.17	1.21	1.25	1.29	1.15	1.18	1.22	1.26	1.30
7	1.32	1.36	1.40	1.44	1.48	1.34	1.37	1.41	1.45	1.49
8	1.51	1.55	1.59	1.63	1.67	1.53	1.57	1.60	1.64	1.68
9	1.70	1.74	1.78	1.82	1.85	1.72	1.76	1.79	1.83	1.87
10	1.89	1.93	1.97	2.01	2.04	1.91	1.95	1.98	2.02	2.06
11	2.08	2.12	2.16	2.19	2.23	2.10	2.14	2.18	2.21	2.25
12	2.27	2.31	2.35	2.38	2.42	2.29	2.33	2.37	2.40	2.44
13	2.46	2.50	2.53	2.57	2.61	2.48	2.52	2.56	2.59	2.63
14	2.65	2.68	2.72	2.76	2.80	2.67	2.71	2.75	2.78	2.82
15	2.84	2.87	2.91	2.95	2.99	2.86	2.90	2.94	2.97	3.01
16	3.02	3.06	3.10	3.14	3.17	3.05	3.09	3.13	3.16	3.20
17	3.21	3.25	3.29	3.33	3.36	3.24	3.28	3.32	3.35	3.39
18	3.40	3.44	3.48	3.51	3.55	3.43	3.47	3.51	3.54	3.58
19	3.59	3.63	3.66	3.70	3.74	3.62	3.66	3.70	3.73	3.77
20	3.78	3.82	3.85	3.89	3.93	3.81	3.85	3.89	3.92	3.96
21	3.96	4.00	4.04	4.08	4.12	4.00	4.04	4.08	4.11	4.15
22	4.15	4.19	4.23	4.27	4.30	4.19	4.23	4.26	4.30	4.34
23	4.34	4.38	4.42	4.45	4.49	4.38	4.42	4.45	4.49	4.53
24	4.53	4.57	4.60	4.64	4.68	4.57	4.61	4.64	4.68	4.72
25	4.72	4.75	4.79	4.83	4.87	4.76	4.80	4.83	4.87	4.91
26	4.91	4.94	4.98	5.02	5.06	4.95	4.99	5.02	5.06	5.10
27	5.09	5.13	5.17	5.20	5.24	5.14	5.17	5.21	5.25	5.29
28	5.28	5.32	5.36	5.39	5.43	5.33	5.36	5.40	5.44	5.48
29	5.47	5.51	5.54	5.58	5.62	5.52	5.55	5.59	5.63	5.67
30	5.66	5.69	5.73	5.77	5.81	5.70	5.74	5.78	5.82	5.86
31	5.84	5.88	5.92	5.96	5.99	5.89	5.93	5.97	6.01	6.04
32	6.03	6.07	6.11	6.14	6.18	6.08	6.12	6.16	6.20	6.23
33	6.22	6.26	6.29	6.33	6.37	6.27	6.31	6.35	6.38	6.42
34	6.40	6.44	6.48	6.52	6.56	6.46	6.50	6.54	6.57	6.61
35	6.59	6.63	6.67	6.70	6.74	6.65	6.69	6.73	6.76	6.80
36	6.78	6.82	6.85	6.89	6.93	6.84	6.87	6.91	6.95	6.99
37	6.97	7.00	7.04	7.08	7.12	7.03	7.06	7.10	7.14	7.18
38	7.15	7.19	7.23	7.27	7.30	7.22	7.25	7.29	7.33	7.37
39	7.34	7.38	7.41	7.45	7.49	7.40	7.44	7.48	7.52	7.55
40	7.53	7.56	7.60	7.64	7.68	7.59	7.63	7.67	7.70	7.74
41	7.71	7.75	7.79	7.83	7.86	7.78	7.82	7.86	7.89	7.93
42	7.90	7.94	7.98	8.01	8.05	7.97	8.01	8.04	8.08	8.12
43	8.09	8.12	8.16	8.20	8.24	8.16	8.19	8.23	8.27	8.31
44	8.27	8.31	8.35	8.39	8.42	8.35	8.38	8.42	8.46	8.50
45	8.46	8.50	8.53	8.57	8.61	8.53	8.57	8.61	8.65	8.68

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1180 mm. or mb. 0.0	0.2	0.4	0.6	0.8	Height of the mercury column 1190 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.08	0.12	0.15	0.00	0.04	0.08	0.12	0.16
1	.19	.23	.27	.31	.35	.19	.23	.27	.31	.35
2	.39	.42	.46	.50	.54	.39	.43	.47	.51	.54
3	.58	.62	.65	.69	.73	.58	.62	.66	.70	.74
4	.77	.81	.85	.89	.93	.78	.82	.85	.89	.93
5	0.96	1.00	1.04	1.08	1.12	0.97	1.01	1.05	1.09	1.13
6	1.16	1.19	1.23	1.27	1.31	1.17	1.20	1.24	1.28	1.32
7	1.35	1.39	1.43	1.46	1.50	1.36	1.40	1.44	1.48	1.51
8	1.54	1.58	1.62	1.66	1.69	1.55	1.59	1.63	1.67	1.71
9	1.73	1.77	1.81	1.85	1.89	1.75	1.79	1.82	1.86	1.90
10	1.92	1.96	2.00	2.04	2.08	1.94	1.98	2.02	2.06	2.10
11	2.12	2.15	2.19	2.23	2.27	2.13	2.17	2.21	2.25	2.29
12	2.31	2.35	2.39	2.42	2.46	2.33	2.37	2.41	2.44	2.48
13	2.50	2.54	2.58	2.62	2.65	2.52	2.56	2.60	2.64	2.68
14	2.69	2.73	2.77	2.81	2.85	2.72	2.75	2.79	2.83	2.87
15	2.88	2.92	2.96	3.00	3.04	2.91	2.95	2.99	3.02	3.06
16	3.08	3.11	3.15	3.19	3.23	3.10	3.14	3.18	3.22	3.26
17	3.27	3.31	3.34	3.38	3.42	3.30	3.33	3.37	3.41	3.45
18	3.46	3.50	3.54	3.57	3.61	3.49	3.53	3.57	3.60	3.64
19	3.65	3.69	3.73	3.77	3.80	3.68	3.72	3.76	3.80	3.84
20	3.84	3.88	3.92	3.96	4.00	3.87	3.91	3.95	3.99	4.03
21	4.03	4.07	4.11	4.15	4.19	4.07	4.11	4.14	4.18	4.22
22	4.22	4.26	4.30	4.34	4.38	4.26	4.30	4.34	4.38	4.41
23	4.42	4.45	4.49	4.53	4.57	4.45	4.49	4.53	4.57	4.61
24	4.61	4.65	4.68	4.72	4.76	4.65	4.69	4.72	4.76	4.80
25	4.80	4.84	4.87	4.91	4.95	4.84	4.88	4.92	4.95	4.99
26	4.99	5.03	5.07	5.10	5.14	5.03	5.07	5.11	5.15	5.19
27	5.18	5.22	5.26	5.29	5.33	5.22	5.26	5.30	5.34	5.38
28	5.37	5.41	5.45	5.49	5.52	5.42	5.45	5.49	5.53	5.57
29	5.56	5.60	5.64	5.68	5.71	5.61	5.65	5.69	5.73	5.76
30	5.75	5.79	5.83	5.87	5.91	5.80	5.84	5.88	5.92	5.96
31	5.94	5.98	6.02	6.06	6.10	5.99	6.03	6.07	6.11	6.15
32	6.13	6.17	6.21	6.25	6.29	6.19	6.22	6.26	6.30	6.34
33	6.32	6.36	6.40	6.44	6.48	6.38	6.42	6.45	6.49	6.53
34	6.51	6.55	6.59	6.63	6.67	6.57	6.61	6.65	6.69	6.72
35	6.71	6.74	6.78	6.82	6.86	6.76	6.80	6.84	6.88	6.92
36	6.90	6.93	6.97	7.01	7.05	6.95	6.99	7.03	7.07	7.11
37	7.09	7.12	7.16	7.20	7.24	7.15	7.18	7.22	7.26	7.30
38	7.28	7.31	7.35	7.39	7.43	7.34	7.38	7.41	7.45	7.49
39	7.47	7.50	7.54	7.58	7.62	7.53	7.57	7.61	7.64	7.68
40	7.66	7.69	7.73	7.77	7.81	7.72	7.76	7.80	7.84	7.88
41	7.85	7.88	7.92	7.96	8.00	7.91	7.95	7.99	8.03	8.07
42	8.04	8.07	8.11	8.15	8.19	8.11	8.14	8.18	8.22	8.26
43	8.23	8.26	8.30	8.34	8.38	8.30	8.33	8.37	8.41	8.45
44	8.42	8.45	8.49	8.53	8.57	8.49	8.53	8.56	8.60	8.64
45	8.61	8.64	8.68	8.72	8.76	8.68	8.72	8.75	8.79	8.83

(*continued*)

REDUCTION OF THE MERCURY COLUMN TO STANDARD TEMPERATURE

Metric units

Millimeter or millibar barometers and manometers

For temperatures above/below 0°C., the correction is to be subtracted/added (see p. 137).

(Correction in same units as height of mercury column.)

Attached thermometer °C.	Height of the mercury column 1200 mm. or mb. 0.0	0.2	0.4	0.6	0.8
0	0.00	0.04	0.08	0.12	0.16
1	.20	.24	.27	.31	.35
2	.39	.43	.47	.51	.55
3	.59	.63	.67	.71	.74
4	.78	.82	.86	.90	.94
5	0.98	1.02	1.06	1.10	1.14
6	1.17	1.21	1.25	1.29	1.33
7	1.37	1.41	1.45	1.49	1.53
8	1.57	1.61	1.65	1.68	1.72
9	1.76	1.80	1.84	1.88	1.92
10	1.96	2.00	2.04	2.07	2.11
11	2.15	2.19	2.23	2.27	2.31
12	2.35	2.39	2.43	2.46	2.50
13	2.54	2.58	2.62	2.66	2.70
14	2.74	2.78	2.82	2.85	2.89
15	2.93	2.97	3.01	3.05	3.09
16	3.13	3.17	3.21	3.24	3.28
17	3.32	3.36	3.40	3.44	3.48
18	3.52	3.56	3.60	3.63	3.67
19	3.71	3.75	3.79	3.83	3.87
20	3.91	3.95	3.99	4.02	4.06
21	4.10	4.14	4.18	4.22	4.26
22	4.30	4.34	4.37	4.41	4.45
23	4.49	4.53	4.57	4.61	4.65
24	4.68	4.72	4.76	4.80	4.84
25	4.88	4.92	4.96	5.00	5.04
26	5.07	5.11	5.15	5.19	5.23
27	5.27	5.31	5.35	5.38	5.42
28	5.46	5.50	5.54	5.58	5.62
29	5.66	5.70	5.73	5.77	5.81
30	5.85	5.89	5.93	5.97	6.01
31	6.04	6.08	6.12	6.16	6.20
32	6.24	6.28	6.32	6.36	6.39
33	6.43	6.47	6.51	6.55	6.59
34	6.63	6.66	6.70	6.74	6.78
35	6.82	6.86	6.90	6.93	6.97
36	7.01	7.05	7.09	7.13	7.17
37	7.21	7.24	7.28	7.32	7.36
38	7.40	7.44	7.48	7.52	7.55
39	7.59	7.63	7.67	7.71	7.75
40	7.79	7.83	7.86	7.90	7.94
41	7.98	8.02	8.06	8.10	8.13
42	8.17	8.21	8.25	8.29	8.33
43	8.37	8.40	8.44	8.48	8.52
44	8.56	8.60	8.64	8.67	8.71
45	8.75	8.79	8.83	8.87	8.91

CORRECTIONS TO REDUCE BAROMETRIC READINGS TO STANDARD GRAVITY

The observed height of a mercurial barometer, corrected for instrumental errors, is a function of the temperature of the barometer and of the local acceleration of gravity, as well as of the pressure. Therefore, to obtain a true relative measure of the atmospheric pressure, the observed height of the mercurial column must not only be reduced to what its height would be if at a standard temperature (Tables 45 and 46), but also to what it would be at a standard value of gravity.

This correction may be written in the form

$$c = \frac{g_l - g_0}{g_0} B, \qquad (1)$$

where

c = correction to be applied to the barometric height B,
g_0 = standard value of gravity adopted,
g_l = value of local gravity,
B = height of the mercury column, corrected for temperature and instrumental errors.

The correction c will be in the same units as the height of the barometer B.

Instruction for obtaining g_l are given in Table 167. For most meteorological applications the standard value of gravity is 980.665 cm. sec.$^{-2}$ (see Introduction, p. 3). For $g_l < g_0$, the correction is to be subtracted from B, for $g_l > g_0$, it is to be added.

Since c is a linear function of B and $(g_l - g_0)$ linear interpolation and linear combinations of the values given in Table 47 A are valid.

Example:

Barometer reading B, corrected for temperature and instrumental error = 29.647 in. Hg.
Local gravity $g_l = 978.12$ cm. sec.$^{-2}$
$g_l - g_0 = 978.12 - 980.665 = -2.54$ cm. sec.$^{-2}$

From the table:

Correction for $B = 20$	0.0518
" " $B = 9$	.0233
" " $B = 0.6$	.0016
" " $B = 0.05$	.0001
Total correction	0.0768 = 0.077

Barometer reading corrected for gravity = 29.647 − 0.077 = 29.570 in. Hg.

For routine use at a land station, data for the appropriate $g_l - g_0$ can be extracted from the table and conveniently expanded for the range required by the barometer in use. Table 47 A can also be used with no appreciable error for reducing barometric readings to other values of standard gravity g_0 in the neighborhood of 980.665 cm. sec.$^{-2}$

Ships at sea.—For reducing barometric observations made aboard ships, where it is impractical to determine local gravity g_l in accordance with the procedure given in Table 167, it is necessary to assume that no gravity anomalies exist and that the local acceleration of gravity is a function of latitude only. The correction c may then be written

$$c = \frac{g_\phi - g_0}{g_0} B \qquad (2)$$

where g_ϕ is the acceleration of gravity at latitude ϕ and sea level.

Table 47 B gives values of c computed from equation (2).

(*continued*)

CORRECTIONS TO REDUCE BAROMETRIC READINGS TO STANDARD GRAVITY

TABLE 47 A.—Values of $\frac{g_l - g_0}{g_0} B$

g_0 = standard acceleration of gravity, 980.665 cm. sec.$^{-2}$
g_l = local acceleration of gravity, cm. sec.$^{-2}$
B = height of the mercury column, corrected for temperature and instrumental errors.

(Corrections are in the same units as the height of the barometer, B.)
If $g_l < g_0$, the correction is to be subtracted; if $g_l > g_0$, it is to be added.

$g_l - g_0$ cm. sec.$^{-2}$	Height of the mercury column, B									
	100	200	300	400	500	600	700	800	900	1000
0.1	0.010	0.020	0.031	0.041	0.051	0.061	0.071	0.082	0.092	0.102
0.2	.020	.041	.061	.082	.102	.122	.143	.163	.184	.204
0.3	.031	.061	.092	.122	.153	.184	.214	.245	.275	.306
0.4	.041	.082	.122	.163	.204	.245	.286	.326	.367	.408
0.5	.051	.102	.153	.204	.255	.306	.357	.408	.459	.510
0.6	0.061	0.122	0.184	0.245	0.306	0.367	0.428	0.489	0.551	0.612
0.7	.071	.143	.214	.286	.357	.428	.500	.571	.642	.714
0.8	.082	.163	.245	.326	.408	.489	.571	.653	.734	.816
0.9	.092	.184	.275	.367	.459	.551	.642	.734	.826	.918
1.0	.102	.204	.306	.408	.510	.612	.714	.816	.918	1.020
1.1	0.112	0.224	0.337	0.449	0.561	0.673	0.785	0.897	1.010	1.122
1.2	.122	.245	.367	.489	.612	.734	.857	.979	1.101	1.224
1.3	.133	.265	.398	.530	.663	.795	.928	1.061	1.193	1.326
1.4	.143	.286	.428	.571	.714	.857	.999	1.142	1.285	1.428
1.5	.153	.306	.459	.612	.765	.918	1.071	1.224	1.377	1.530
1.6	0.163	0.326	0.489	0.653	0.816	0.979	1.142	1.305	1.468	1.632
1.7	.173	.347	.520	.693	.867	1.040	1.214	1.387	1.560	1.734
1.8	.184	.367	.551	.734	.918	1.101	1.285	1.468	1.652	1.836
1.9	.194	.388	.581	.775	.969	1.163	1.356	1.550	1.744	1.938
2.0	.204	.408	.612	.816	1.020	1.224	1.428	1.632	1.836	2.040
2.1	0.214	0.428	0.642	0.857	1.071	1.285	1.499	1.713	1.927	2.142
2.2	.224	.449	.673	.897	1.122	1.346	1.570	1.795	2.019	2.244
2.3	.235	.469	.704	.938	1.173	1.407	1.642	1.876	2.111	2.346
2.4	.245	.489	.734	.979	1.224	1.468	1.713	1.958	2.203	2.447
2.5	.255	.510	.765	1.020	1.275	1.530	1.785	2.040	2.294	2.549
2.6	0.265	0.530	0.795	1.061	1.326	1.591	1.856	2.121	2.386	2.651
2.7	.275	.551	.826	1.101	1.377	1.652	1.927	2.203	2.478	2.753
2.8	.286	.571	.857	1.142	1.428	1.713	1.999	2.284	2.570	2.855
2.9	.296	.591	.887	1.183	1.479	1.774	2.070	2.366	2.662	2.957
3.0	.306	.612	.918	1.224	1.530	1.836	2.142	2.447	2.753	3.059
3.1	0.316	0.632	0.948	1.265	1.581	1.897	2.213	2.529	2.845	3.161
3.2	.326	.653	.979	1.305	1.632	1.958	2.284	2.611	2.937	3.263
3.3	.337	.673	1.010	1.346	1.683	2.019	2.356	2.692	3.029	3.365
3.4	.347	.693	1.040	1.387	1.734	2.080	2.427	2.774	3.120	3.467
3.5	.357	.714	1.071	1.428	1.785	2.142	2.498	2.855	3.212	3.569
3.6	0.367	0.734	1.101	1.468	1.836	2.203	2.570	2.937	3.304	3.671
3.7	.377	.755	1.132	1.509	1.887	2.264	2.641	3.018	3.396	3.773
3.8	.388	.775	1.163	1.550	1.938	2.325	2.713	3.100	3.488	3.875
3.9	.398	.795	1.193	1.591	1.989	2.386	2.784	3.182	3.579	3.977
4.0	.408	.816	1.224	1.632	2.040	2.447	2.855	3.263	3.671	4.079

(*continued*)

CORRECTIONS TO REDUCE BAROMETRIC READINGS TO STANDARD GRAVITY

TABLE 47 B.—Values of $\frac{g_\phi - g_0}{g_0} B$, for use by ships at sea.

g_0 = standard acceleration of gravity at sea level, 980.665 cm. sec.$^{-2}$
g_ϕ = acceleration of gravity at latitude ϕ and sea level.
B = height of mercury column, corrected for temperature and instrumental errors.

Corrections are to be applied according to indicated sign.

(Correction is zero at latitude 45° 32′ 40″; positive poleward and negative equatorward of this latitude.)

	Height of the mercury column														
	Inches					Millimeters						Millibars			
Latitude	26	27	28	29	30	680	700	720	740	760	780	900	950	1000	1050
ϕ	in.	in.	in.	in.	in.	mm.	mm.	mm.	mm.	mm.	mm.	mb.	mb.	mb.	mb.
90°	+.067	+.070	+.073	+.075	+.078	+1.76	+1.82	+1.87	+1.92	+1.97	+2.02	+2.33	+2.46	+2.59	+2.72
88	.067	.070	.072	.075	.078	1.76	1.81	1.86	1.91	1.97	2.02	2.33	2.46	2.59	2.72
86	.067	.069	.072	.074	.077	1.75	1.80	1.85	1.90	1.95	2.00	2.31	2.44	2.57	2.70
84	.066	.068	.071	.074	.076	1.72	1.77	1.83	1.88	1.93	1.98	2.28	2.41	2.54	2.66
82	.065	.067	.070	.072	.075	1.69	1.74	1.79	1.84	1.89	1.94	2.24	2.37	2.49	2.61
80	+.063	+.066	+.068	+.071	+.073	+1.65	+1.70	+1.75	+1.80	+1.85	+1.90	+2.19	+2.31	+2.43	+2.55
78	.061	.064	.066	.069	.071	1.61	1.65	1.70	1.75	1.80	1.84	2.13	2.25	2.36	2.48
76	.059	.062	.064	.066	.068	1.55	1.60	1.64	1.69	1.74	1.78	2.05	2.17	2.28	2.40
74	.057	.059	.061	.064	.066	1.49	1.53	1.58	1.62	1.66	1.71	1.97	2.08	2.19	2.30
72	.054	.056	.058	.061	.063	1.42	1.46	1.50	1.54	1.59	1.63	1.88	1.98	2.09	2.19
70	+.051	+.053	+.055	+.057	+.059	+1.34	+1.38	+1.42	+1.46	+1.50	+1.54	+1.78	+1.88	+1.97	+2.07
68	.048	.050	.052	.054	.055	1.26	1.29	1.33	1.37	1.41	1.44	1.66	1.76	1.85	1.94
66	.045	.046	.048	.050	.052	1.17	1.20	1.24	1.27	1.31	1.34	1.55	1.63	1.72	1.80
64	.041	.043	.044	.046	.047	1.07	1.10	1.13	1.17	1.20	1.23	1.42	1.50	1.58	1.65
62	.037	.039	.040	.041	.043	0.97	1.00	1.03	1.06	1.08	1.11	1.28	1.36	1.43	1.50
60	+.033	+.034	+.036	+.037	+.038	+0.86	+0.89	+0.91	+0.94	+0.97	+0.99	+1.14	+1.21	+1.27	+1.33
58	.029	.030	.031	.032	.033	0.75	0.78	0.80	0.82	0.84	0.86	1.00	1.05	1.11	1.16
56	.024	.025	.026	.027	.028	0.64	0.66	0.68	0.69	0.71	0.73	0.85	0.89	0.94	0.99
54	.020	.021	.021	.022	.023	0.52	0.54	0.55	0.57	0.58	0.60	0.69	0.73	0.77	0.80
52	.015	.016	.016	.017	.018	0.40	0.41	0.42	0.44	0.45	0.46	0.53	0.56	0.59	0.62
50	+.011	+.011	+.011	+.012	+.012	+0.28	+0.29	+0.29	+0.30	+0.31	+0.32	+0.37	+0.39	+0.41	+0.43
48	.006	.006	.006	.007	.007	0.15	0.16	0.16	0.17	0.17	0.18	0.20	0.21	0.23	0.24
46	+.001	+.001	+.001	+.001	+.001	+0.03	+0.03	+0.03	+0.03	+0.03	+0.03	+0.04	+0.04	+0.04	+0.04
45	—.001	—.001	—.001	—.001	—.001	—0.03	—0.03	—0.04	—0.04	—0.04	—0.04	—0.04	—0.05	—0.05	—0.05
44	.004	.004	.004	.004	.004	0.10	0.10	0.10	0.10	0.11	0.11	0.13	0.13	0.14	0.15
42	.008	.009	.009	.009	.010	0.22	0.23	0.23	0.24	0.25	0.25	0.29	0.31	0.33	0.34
40	—.013	—.014	—.014	—.015	—.015	—0.35	—0.36	—0.37	—0.38	—0.39	—0.40	—0.46	—0.48	—0.51	—0.53
38	.018	.019	.019	.020	.021	0.47	0.48	0.49	0.51	0.52	0.54	0.62	0.65	0.69	0.72
36	.022	.023	.024	.025	.026	0.59	0.61	0.62	0.64	0.66	0.67	0.78	0.82	0.86	0.91
34	.027	.028	.029	.030	.031	0.71	0.73	0.75	0.77	0.79	0.81	0.93	0.99	1.04	1.09
32	.031	.033	.034	.035	.036	0.82	0.84	0.87	0.89	0.92	0.94	1.08	1.15	1.21	1.27
30	—.036	—.037	—.038	—.040	—.041	—0.93	—0.96	—0.98	—1.01	—1.04	—1.07	—1.23	—1.30	—1.37	—1.44
28	.040	.041	.043	.044	.046	1.04	1.07	1.10	1.13	1.16	1.19	1.37	1.45	1.52	1.60
26	.043	.045	.047	.048	.050	1.14	1.17	1.20	1.24	1.27	1.30	1.50	1.59	1.67	1.75
24	.047	.049	.051	.053	.054	1.23	1.27	1.30	1.34	1.38	1.41	1.63	1.72	1.81	1.90
22	.051	.052	.054	.056	.058	1.32	1.36	1.40	1.44	1.48	1.52	1.75	1.85	1.94	2.04
20	—.054	—.056	—.058	—.060	—.062	—1.41	—1.45	—1.49	—1.53	—1.57	—1.61	—1.86	—1.96	—2.07	—2.17
18	.057	.059	.061	.063	.065	1.48	1.53	1.57	1.61	1.66	1.70	1.96	2.07	2.18	2.29
16	.059	.062	.064	.066	.068	1.55	1.60	1.64	1.69	1.73	1.78	2.05	2.17	2.28	2.40
14	.062	.064	.066	.069	.071	1.61	1.66	1.71	1.76	1.80	1.85	2.14	2.26	2.37	2.49
12	.064	.066	.069	.071	.074	1.67	1.72	1.77	1.82	1.87	1.91	2.21	2.33	2.45	2.58
10	—.066	—.068	—.071	—.073	—.076	—1.72	—1.77	—1.82	—1.87	—1.92	—1.97	—2.27	—2.40	—2.52	—2.65
8	.067	.070	.072	.075	.077	1.75	1.81	1.86	1.91	1.96	2.01	2.32	2.45	2.58	2.71
6	.068	.071	.073	.076	.079	1.78	1.84	1.89	1.94	1.99	2.05	2.36	2.49	2.62	2.75
4	.069	.072	.074	.077	.080	1.81	1.86	1.91	1.96	2.02	2.07	2.39	2.52	2.66	2.79
2	.070	.072	.075	.078	.080	1.82	1.87	1.93	1.98	2.03	2.09	2.41	2.54	2.67	2.81
0	—.070	—.072	—.075	—.078	—.080	—1.82	—1.88	—1.93	—1.98	—2.04	—2.09	—2.41	—2.55	—2.68	—2.81

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS[1]

DETERMINATION OF HEIGHT

The geopotential Φ_2 at a level of pressure p_2 is given by

$$\Phi_2 = \Phi_1 + \Delta\Phi \tag{1}$$

where Φ_1 is the geopotential at a level of pressure p_1 and $\Delta\Phi$ is the difference in geopotential between the levels of p_2 and p_1. If p_1 is station pressure, Φ_1 can be found from Table 50 provided the latitude and station elevation are known. To ascertain Φ_2 by means of equation (1) it is necessary to make a calculation of $\Delta\Phi$, a method for which is given below.

According to equation (4a), page 224, $\Delta\Phi$ in geopotential meters is given by

$$\begin{aligned}\Delta\Phi &= 67.442\ T'_{mv} \log \frac{p_1}{p_2} \\ &= \frac{T'_{mv}}{T_0}\left(67.442\ T_0 \log \frac{p_s}{p_2} - 67.442\ T_0 \log \frac{p_s}{p_1}\right)\end{aligned} \tag{2}$$

where T'_{mv} is the mean adjusted virtual temperature[2] of the stratum (°K.), T_0 is the temperature of the ice point, 273.16 °K., and p_s is an arbitrary reference pressure.

We choose $p_s = 1100$ millibars, a value not likely to be exceeded in the atmosphere, in order to avoid negative values in (3) and (4). Defining $\Delta\Phi_{s1}$ as the geopotential difference between the level of p_1 and the 1100-millibar level when $T'_{mv} = T_0$, then

$$\Delta\Phi_{s1} = 67.442\ T_0 \log (1100/p_1), \tag{3}$$

and similarly,

$$\Delta\Phi_{s2} = 67.442\ T_0 \log (1100/p_2). \tag{4}$$

Equation (2) may be written

$$\begin{aligned}\Delta\Phi &= \frac{T'_{mv}}{T_0}(\Delta\Phi_{s2} - \Delta\Phi_{s1}) \\ &= (\Delta\Phi_{s2} - \Delta\Phi_{s1}) + \frac{T'_{mv} - T_0}{T_0}(\Delta\Phi_{s2} - \Delta\Phi_{s1}) \\ &= (\Delta\Phi_{s2} - \Delta\Phi_{s1}) + \frac{t'_{mv}}{T_0}(\Delta\Phi_{s2} - \Delta\Phi_{s1})\end{aligned} \tag{5}$$

where $t'_{mv} = T'_{mv} - T_0 =$ mean adjusted virtual temperature in °C.

Table 48 B gives values of $67.442\ T_0 \log (1100/p)$ as a function of p, and Table 48 C gives values of $(t'_{mv}/T_0)(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ as a function of $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ and of t'_{mv}.

To calculate $\Delta\Phi$ given p_1, p_2, and t_{mv}.—

1. Determine $\Delta\Phi_{s1}$ and $\Delta\Phi_{s2}$ corresponding to pressure p_1 and p_2 from Table 48 B.
2. Take the difference $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$.
3. Compute or estimate the mean adjusted virtual temperature between p_1 and p_2. (See Table 72.)
4. Determine $(t'_{mv}/T_0)(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ from Table 48 C corresponding to the value of t'_{mv} between p_1 and p_2 and the value of $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ found in step 2. (NOTE.—$(t'_{mv}/T_0)(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ is linear in $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ for a given t'_{mv} and the result for any value of $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ can be found by a linear combination of the values in Table 48 C. For example if $(\Delta\Phi_{s2} - \Delta\Phi_{s1}) = 1793$ gpm. and $t'_{mv} = 19$ °C., Table 48 B gives for 19 °C. the following values: for 1000 gpm., 69.6; for 700 gpm., 48.7; for one-tenth of the value for 900 gpm., 6.3; and for one-hundredth of the value for 300 gpm., 0.2. The sum $69.6 + 48.7 + 6.3 + 0.2 = 124.8$ gpm. is the desired value of $t_{mv}/T_0\ (\Delta\Phi_{s2} - \Delta\Phi_{s1})$. *If $t'_{mv} <$ 0 °C. a minus sign must be prefixed to the result.*)
5. Add algebraically the value of $(t'_{mv}/T_0)(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ found in step 4 to the value of $(\Delta\Phi_{s2} - \Delta\Phi_{s1})$ found in step 2. The sum is the required $\Delta\Phi$, in accord with equation (5).

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[1] This table involves relationships between pressure, geopotential and virtual temperature in the atmosphere. The unit of geopotential used herein is the "geopotential meter." The relationship of geometric height to geopotential is explained in Table 49. *In this section, all logarithms are to the base 10.*

[2] See Table 72.

(*Continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

REDUCTION OF PRESSURE

If the pressure p_2 and geopotential Φ_2 at a given level are known and it is desired to obtain the pressure p_1 at some other given level Φ_1, use is made of the following expression derived from equation (5),

$$\Delta\Phi_{s1} = \Delta\Phi_{s2} - \Delta\Phi \frac{T_0}{T'_{mv}} = \Delta\Phi_{s2} - \Delta\Phi \; \frac{T_0}{T_0 + t_{mv}} \qquad (6)$$

Considering the independent variables in the right-hand member of equation (6), the values of $\Delta\Phi_{s2}$ corresponding to the station pressure p_2 can be found from Table 48 B; $\Delta\Phi$ is equal to $(\Phi_2 - \Phi_1)$; and methods for determining t_{mv} are outlined in the following paragraphs. After computing $\Delta\Phi_{s1}$ by means of this equation the corresponding pressure p_1 can be obtained from Table 48 B. In the case of reduction of pressure to sea level, $\Phi_1 = 0$ and $\Delta\Phi = \Phi_2$ (see Table 50). If $\Phi_2 < \Phi_1$, $\Delta\Phi < 0$.

Mean adjusted virtual temperature.—To solve (6) it is necessary to estimate t'_{mv} for the stratum between Φ_1 and Φ_2. If this stratum is in the free air and temperature soundings are available the customary procedures may be used.[3] If no soundings are available or reduction must be made through a fictitious air column (the usual case in reducing pressure to sea level) a reasonable estimate of the temperature lapse rate and moisture conditions between Φ_1 and Φ_2 must be made.[4]

The mean adjusted virtual temperature of an air column t'_{mv} can be considered to be the algebraic sum of three terms:

(a) a representative station temperature t_s,
(b) a correction for lapse rate, L,
(c) a correction for humidity, C,

$$t'_{mv} = t_s + L + C. \qquad (7)$$

We now consider t_s, L, and C in order:

(a) t_s: In the United States t_s is usually taken to be the mean of the current and the 12-hour previous air temperature, although this practice is not world-wide.

(b) L: If we assume that the lapse rate is one-half of the dry adiabatic, i.e., 1 °C./200 gpm., and that the mean temperature of the air column occurs at a point $\Delta\Phi/2$ geopotential meters below the station elevation Φ_2, then $L = \Delta\Phi/400$, in °C. Some meteorological services make different assumptions in determining L. (The sign of L depends on the lapse rate assumed and on the sign of $\Delta\Phi$.)

(c) C: In the case of reducing pressure to sea level, a satisfactory estimate of C can be made from Table 48 A, using current dew-point temperature and station elevation as arguments. Table 48 A is based on two assumptions: (1) that pressure varies with altitude in accordance with the U. S. Standard Atmosphere, and (2) that the vapor pressure varies with height in accordance with Hann's empirical formula[5]

$$e/e_0 = 10^{-h/6300} \qquad (8)$$

where e is the vapor pressure at a height of h meters above sea level, and e_0 is the vapor pressure at sea level. An alternative method of obtaining C where no other information is available is to use Table 72 after making reasonable estimates of the temperature, relative humidity, and pressure at the midpoint of the column. The temperature at this point is approximately given by $(t_s + L)$. (C is always positive.)

The method for determining t'_{mv} in reducing pressure to sea level outlined above will in general give a value slightly different from that used by the U. S. Weather Bureau, which employs a system developed by Bigelow[6] based on representative lapse rates and humidity conditions differing for each station. Other countries generally use still different procedures.[7]

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[3] See U. S. Weather Bureau Circular P, Instruction for modulated audio frequency radiosonde observations, January 1945, p. 63. See also Table 72.

[4] See U. S. Weather Bureau forms 1154 A and B.

[5] Hann, J., Lehrbuch der Meteorol. 3d ed., p. 230, 1915.

[6] Bigelow, F. H., Report on the barometry of the U. S., Canada, and the West Indies, Report of the Chief of the Weather Bureau, 1900-1901, vol. 2, Washington, 1902.

[7] Report of the International Meteorological Conference at Innsbruck, September 1905, app. III, p. 60. Meteorol. Off. Publ. No. 195, London, 1908.

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

Plateau correction.—In the United States, Canada, and Alaska, a so-called "plateau correction"[8] P_c is applied to the reduced sea-level pressure obtained with the aid of equation (6). The plateau correction in millibars is given by

$$P_c = 0.000210(t_m - \bar{t}_m)\Phi_2 \qquad (9)$$

where t_m is the mean dry-bulb temperature (°C.) of the air column between Φ_2 and sea level, and $\bar{t}_m$ is the normal annual value of t_m. For practical purposes $(t_m - \bar{t}_m)$ may be replaced by $(t'_{mv} - \bar{t'}_{mv})$. The purpose of the plateau correction is to cause the deviations from the annual mean of the pressure reduced to sea level to have about the same value for high-altitude stations as for surrounding stations near sea level.

It is of *greatest importance*, for consistency of results, that all meteorological stations in continental United States, Alaska, and any other contiguous regions where the plateau correction is generally used, should conform to this practice. That is, harmony with official sea-level pressures will not be secured in this area *unless* the plateau correction is applied.

Investigation has shown that in the case of a station of markedly greater (or lower) elevation than the surrounding stations, the value of Φ_2 to be used in computing the plateau correction is the average of the elevations of the surrounding stations. This applies to a station located on an isolated mountain rising considerably above the general level of the stations within several hundred miles radius.

To compute reduced pressure given Φ_1, Φ_2, p_2, and t_{mv}.—

1. Determine $\Delta\Phi$ the geopotential difference between the level Φ_2 for which the pressure is given and the fixed level Φ_1 to which pressures are to be reduced. (NOTE.—If the fixed level is sea level, $\Delta\Phi$ is the geopotential of the station Φ_2 and can be determined from Table 50. For other fixed levels geometric height can be converted to geopotential by Table 50 and the difference $\Delta\Phi$ computed.)
2. Determine the mean adjusted virtual temperature t_{mv} in °C. as outlined above.
3. Determine $\Delta\Phi T_0/T_{mv}$ from Table 48 D as a function of $\Delta\Phi$ and of t_{mv}. (NOTE.—Since this function is linear in $\Delta\Phi$ the value of $\Delta\Phi T_0/T_{mv}$ for any $\Delta\Phi$ can be found by a linear combination of values in Table 48 D for the given value of t_{mv}.)
4. Determine $\Delta\Phi_{s2}$ corresponding to the pressure p_2 from Table 48 B.
5. Find the algebraic difference $(\Delta\Phi_{s2} - \Delta\Phi T_0/T_{mv})$. According to equation (6) this difference is $\Delta\Phi_{s1}$.
6. Enter Table 48 B with the value of $\Delta\Phi_{s1}$ found in step 5 as the tabular value. The corresponding argument is the reduced pressure p_1.
7. Apply the plateau correction if pertinent.

English units.—For computing heights or reducing pressure when data are given in English or other systems of units, first convert to millibars, meters, and centigrade temperatures by means of conversion tables in Section I.

[8] Ferrel, Wm., Annual Report of the Chief Signal Officer of the Army, 1886, app. 23, Washington. See also reference 6.

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 A.—Correction for humidity C, used in determining t_{mv} when reducing pressure to sea level

Station elevation m.	Station dew-point temperature—°C.									
	−28	−26	−24	−22	−20	−18	−16	−14	−12	−10
0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3
500	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3
1000	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4
1500	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4
2000	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5
2500	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5

Station elevation m.	Station dew-point temperature—°C.									
	−8	−6	−4	−2	0	2	4	6	8	10
0	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.3
500	0.4	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.3	1.5
1000	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.3	1.5	1.7
1500	0.5	0.6	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.9
2000	0.5	0.6	0.8	0.9	1.1	1.2	1.4	1.6	1.8	2.1
2500	0.6	0.7	0.9	1.0	1.2	1.4	1.6	1.8	2.1	2.4

Station elevation m.	Station dew-point temperature—°C.									
	12	14	16	18	20	22	24	26	28	30
0	1.5	1.7	1.9	2.2	2.5	2.8	3.2	3.6	4.1	4.6
500	1.7	1.9	2.2	2.5	2.8	3.2	3.6	4.0	4.6	5.1
1000	1.9	2.2	2.5	2.8	3.2	3.6	4.0	4.6	5.1	5.8
1500	2.1	2.4	2.8	3.1	3.6	4.0	4.6	5.1	5.8	6.5
2000	2.4	2.7	3.1	3.5	4.0	4.5	5.1	5.8	6.5	7.3
2500	2.7	3.1	3.5	4.0	4.5	5.1	5.8	6.5	7.3	8.2

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 B.—Values of 67.442 $T_0 \log \frac{1100}{p}$

Pressure mb.	0	1	2	3	4	5	6	7	8	9
0		56030.1	50484.3	47240.3	44938.6	43153.3	41694.6	40461.2	39392.9	38450.5
10	37607.6	36845.0	36148.8	35508.4	34915.5	34363.5	33847.2	33362.1	32904.8	32472.2
20	32061.8	31671.5	31299.3	30943.6	30603.1	30276.5	29962.7	29660.8	29369.8	29089.0
30	28817.8	28555.4	28301.4	28055.2	27816.4	27584.5	27359.1	27139.9	26926.5	26718.7
40	26516.1	26318.5	26125.7	25937.5	25753.5	25573.7	25397.9	25225.8	25057.4	24892.4
50	24730.8	24572.3	24417.0	24264.6	24115.0	23968.2	23824.1	23682.5	23543.3	23406.5
60	23272.1	23139.8	23009.7	22881.7	22755.7	22631.7	22509.5	22389.2	22270.7	22153.9
70	22038.7	21925.3	21813.3	21703.0	21594.1	21486.7	21380.8	21276.2	21172.9	21071.0
80	20970.4	20871.0	20772.8	20675.8	20580.0	20485.3	20391.8	20299.3	20207.8	20117.4
90	20028.0	19939.6	19852.2	19765.7	19680.1	19595.4	19511.7	19428.8	19346.7	19265.5
100	19185.1	19105.4	19026.6	18948.6	18871.3	18794.7	18718.9	18643.7	18569.3	18495.6
110	18422.5	18350.1	18278.3	18207.2	18136.7	18066.9	17997.6	17928.9	17860.8	17793.3
120	17726.3	17659.9	17594.1	17528.8	17464.0	17399.7	17336.0	17272.7	17210.0	17147.7
130	17085.9	17024.6	16963.8	16903.4	16843.5	16784.0	16724.9	16666.3	16608.1	16550.4
140	16493.0	16436.1	16379.5	16323.4	16267.6	16212.3	16157.3	16102.7	16048.4	15994.5
150	15941.0	15887.9	15835.0	15782.6	15730.5	15678.7	15627.2	15576.1	15525.3	15474.8
160	15424.7	15374.8	15325.3	15276.0	15227.1	15178.5	15130.1	15082.1	15034.3	14986.8
170	14939.6	14892.7	14846.0	14799.7	14753.5	14707.7	14662.1	14616.8	14571.7	14526.9
180	14482.3	14438.0	14393.9	14350.1	14306.5	14263.1	14220.0	14177.1	14134.4	14091.9
190	14049.7	14007.7	13965.9	13924.4	13883.0	13841.9	13801.0	13760.3	13719.7	13679.4
200	13639.3	13599.4	13559.7	13520.2	13480.9	13441.8	13402.8	13364.1	13325.5	13287.2
210	13249.0	13211.0	13173.1	13135.5	13098.0	13060.7	13023.6	12986.6	12949.8	12913.2
220	12876.8	12840.5	12804.4	12768.4	12732.6	12697.0	12661.5	12626.2	12591.0	12556.0
230	12521.1	12486.4	12451.9	12417.4	12383.2	12349.1	12315.1	12281.3	12247.6	12214.0
240	12180.6	12147.3	12114.2	12081.2	12048.4	12015.6	11983.1	11950.6	11918.3	11886.1
250	11854.0	11822.1	11790.3	11758.6	11727.0	11695.6	11664.3	11633.1	11602.0	11571.0
260	11540.2	11509.5	11478.9	11448.4	11418.1	11387.8	11357.7	11327.7	11297.7	11267.9
270	11238.3	11208.7	11179.2	11149.9	11120.6	11091.5	11062.4	11033.5	11004.6	10975.9
280	10947.3	10918.8	10890.3	10862.0	10833.8	10805.7	10777.7	10749.7	10721.9	10694.2
290	10666.5	10639.0	10611.5	10584.2	10556.9	10529.8	10502.7	10475.7	10448.8	10422.0
300	10395.3	10368.7	10342.1	10315.7	10289.3	10263.0	10236.9	10210.7	10184.7	10158.8
310	10132.9	10107.2	10081.5	10055.9	10030.4	10004.9	9979.6	9954.3	9929.1	9904.0
320	9878.9	9854.0	9829.1	9804.3	9779.5	9754.9	9730.3	9705.8	9681.4	9657.0
330	9632.7	9608.5	9584.4	9560.3	9536.3	9512.4	9488.6	9464.8	9441.1	9417.5
340	9393.9	9370.4	9347.0	9323.6	9300.3	9277.1	9253.9	9230.8	9207.8	9184.9
350	9162.0	9139.1	9116.4	9093.7	9071.0	9048.5	9026.0	9003.5	8981.1	8958.8
360	8936.6	8914.4	8892.2	8870.2	8848.2	8826.2	8804.3	8782.5	8760.7	8739.0
370	8717.4	8695.8	8674.2	8652.8	8631.3	8610.0	8588.7	8567.4	8546.2	8525.1
380	8504.0	8483.0	8462.0	8441.1	8420.2	8399.4	8378.7	8358.0	8337.3	8316.7
390	8296.2	8275.7	8255.2	8234.9	8214.5	8194.2	8174.0	8153.8	8133.7	8113.6
400	8093.6	8073.6	8053.7	8033.8	8014.0	7994.2	7974.5	7954.8	7935.2	7915.6
410	7896.0	7876.6	7857.1	7837.7	7818.4	7799.1	7779.8	7760.6	7741.4	7722.3
420	7703.2	7684.2	7665.2	7646.3	7627.4	7608.6	7589.8	7571.0	7552.3	7533.6
430	7515.0	7496.4	7477.9	7459.4	7440.9	7422.5	7404.1	7385.8	7367.5	7349.3
440	7331.0	7312.9	7294.8	7276.7	7258.6	7240.6	7222.7	7204.8	7186.9	7169.0
450	7151.2	7133.5	7115.8	7098.1	7080.4	7062.8	7045.3	7027.8	7010.3	6992.8
460	6975.4	6958.0	6940.7	6923.4	6906.1	6888.9	6871.7	6854.6	6837.5	6820.4
470	6803.3	6786.3	6769.4	6752.4	6735.5	6718.7	6701.8	6685.1	6668.3	6651.6
480	6634.9	6618.2	6601.6	6585.0	6568.5	6552.0	6535.5	6519.1	6502.6	6486.3
490	6469.9	6453.6	6437.3	6421.1	6404.9	6388.7	6372.5	6356.4	6340.4	6324.3
500	6308.3	6292.3	6276.3	6260.4	6244.5	6228.7	6212.8	6197.0	6181.3	6165.5
510	6149.8	6134.2	6118.5	6102.9	6087.3	6071.8	6056.3	6040.8	6025.3	6009.9
520	5994.5	5979.1	5963.8	5948.5	5933.2	5917.9	5902.7	5887.5	5872.3	5857.2
530	5842.1	5827.0	5812.0	5796.9	5781.9	5767.0	5752.0	5737.1	5722.2	5707.4
540	5692.5	5677.7	5663.0	5648.2	5633.5	5618.8	5604.1	5589.5	5574.9	5560.3

(continued)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 B.—Values of 67.442 $T_0 \log \frac{1100}{p}$

Pressure mb.	0	1	2	3	4	5	6	7	8	9
550	5545.7	5531.2	5516.7	5502.2	5487.7	5473.3	5458.9	5444.5	5430.2	5415.9
560	5401.6	5387.3	5373.0	5358.8	5344.6	5330.4	5316.3	5302.2	5288.1	5274.0
570	5260.0	5245.9	5231.9	5218.0	5204.0	5190.1	5176.2	5162.3	5148.4	5134.6
580	5120.8	5107.0	5093.3	5079.5	5065.8	5052.1	5038.5	5024.8	5011.2	4997.6
590	4984.0	4970.5	4957.0	4943.5	4930.0	4916.5	4903.1	4889.7	4876.3	4862.9
600	4849.6	4836.2	4822.9	4809.7	4796.4	4783.2	4770.0	4756.8	4743.6	4730.4
610	4717.3	4704.2	4691.1	4678.1	4665.0	4652.0	4639.0	4626.0	4613.1	4600.1
620	4587.2	4574.3	4561.5	4586.6	4535.8	4523.0	4510.2	4497.4	4484.6	4471.9
630	4459.2	4446.5	4433.8	4421.2	4408.6	4396.0	4383.4	4370.8	4358.2	4345.7
640	4333.2	4320.7	4308.2	4295.8	4283.4	4270.9	4258.5	4246.2	4233.8	4221.5
650	4209.2	4196.9	4184.6	4172.3	4160.1	4147.9	4135.6	4123.5	4111.3	4099.1
660	4087.0	4074.9	4062.8	4050.7	4038.7	4026.6	4014.6	4002.6	3990.6	3978.6
670	3966.7	3954.8	3942.8	3930.9	3919.1	3907.2	3895.4	3883.5	3871.7	3859.9
680	3848.2	3836.4	3824.7	3812.9	3801.2	3789.5	3777.9	3766.2	3754.6	3743.0
690	3731.4	3719.8	3708.2	3696.6	3685.1	3673.6	3662.1	3650.6	3639.1	3627.7
700	3616.2	3604.8	3593.4	3582.0	3570.6	3559.3	3548.0	3536.6	3525.3	3514.0
710	3502.8	3491.5	3480.2	3469.0	3457.8	3446.6	3435.4	3424.3	3413.1	3402.0
720	3390.8	3379.7	3368.7	3357.6	3346.5	3335.5	3324.5	3313.4	3302.4	3291.5
730	3280.5	3269.5	3258.6	3247.7	3236.8	3225.9	3215.0	3204.1	3193.3	3182.5
740	3171.6	3160.8	3150.0	3139.3	3128.5	3117.8	3107.0	3096.3	3085.6	3074.9
750	3064.2	3053.6	3042.9	3032.3	3021.7	3011.1	3000.5	2989.9	2979.4	2968.8
760	2958.3	2947.7	2937.2	2926.7	2916.3	2905.8	2895.4	2884.9	2874.5	2864.1
770	2853.7	2843.3	2832.9	2822.6	2812.2	2801.9	2791.6	2781.3	2771.0	2760.7
780	2750.4	2740.2	2730.0	2719.7	2709.5	2699.3	2689.1	2679.0	2668.8	2658.7
790	2648.5	2638.4	2628.3	2618.2	2608.1	2598.0	2588.0	2577.9	2567.9	2557.9
800	2547.9	2537.9	2527.9	2517.9	2508.0	2498.0	2488.1	2478.2	2468.3	2458.4
810	2448.5	2438.6	2428.8	2418.9	2409.1	2399.3	2389.4	2379.6	2369.9	2360.1
820	2350.3	2340.6	2330.8	2321.1	2311.4	2301.7	2292.0	2282.3	2272.6	2263.0
830	2253.3	2243.7	2234.1	2224.5	2214.9	2205.3	2195.7	2186.1	2176.6	2167.1
840	2157.5	2148.0	2138.5	2129.0	2119.5	2110.0	2100.6	2091.1	2081.7	2072.3
850	2062.8	2053.4	2044.0	2034.6	2025.3	2015.9	2006.6	1997.2	1987.9	1978.6
860	1969.3	1960.0	1950.7	1941.4	1932.1	1922.9	1913.6	1904.4	1895.2	1886.0
870	1876.8	1867.6	1858.4	1849.2	1840.1	1830.9	1821.8	1812.6	1803.5	1794.4
880	1785.3	1776.2	1767.2	1758.1	1749.0	1740.0	1731.0	1721.9	1712.9	1703.9
890	1694.9	1685.9	1677.0	1668.0	1659.0	1650.1	1641.2	1632.2	1623.3	1614.4
900	1605.5	1596.6	1587.8	1578.9	1570.0	1561.2	1552.4	1543.5	1534.7	1525.9
910	1517.1	1508.3	1499.6	1490.8	1482.0	1473.3	1464.5	1455.8	1447.1	1438.4
920	1429.7	1421.0	1412.3	1403.6	1395.0	1386.3	1377.7	1369.0	1360.4	1351.8
930	1343.2	1334.6	1326.0	1317.4	1308.8	1300.3	1291.7	1283.2	1274.7	1266.1
940	1257.6	1249.1	1240.6	1232.1	1223.6	1215.2	1206.7	1198.2	1189.8	1181.4
950	1172.9	1164.5	1156.1	1147.7	1139.3	1130.9	1122.6	1114.2	1105.9	1097.5
960	1089.2	1080.8	1072.5	1064.2	1055.9	1047.6	1039.3	1031.0	1022.8	1014.5
970	1006.3	998.0	989.8	981.5	973.3	965.1	956.9	948.7	940.5	932.4
980	924.2	916.0	907.9	899.7	891.6	883.5	875.4	867.2	859.1	851.1
990	843.0	834.9	826.8	818.8	810.7	802.7	794.6	786.6	778.6	770.6
1000	762.6	754.6	746.6	738.6	730.6	722.7	714.7	706.7	698.8	690.9
1010	682.9	675.0	667.1	659.2	651.3	643.4	635.6	627.7	619.8	612.0
1020	604.1	596.3	588.4	580.6	572.8	565.0	557.2	549.4	541.6	533.8
1030	526.1	518.3	510.5	502.8	495.1	487.3	479.6	471.9	464.2	456.5
1040	448.8	441.1	433.4	425.7	418.0	410.4	402.7	395.1	387.5	379.8
1050	372.2	364.6	357.0	349.4	341.8	334.2	326.6	319.0	311.5	303.9
1060	296.4	288.8	281.3	273.7	266.2	258.7	251.2	243.7	236.2	228.7
1070	221.2	213.8	206.3	198.8	191.4	183.9	176.5	169.1	161.6	154.2

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 C.—Values of $\frac{t'_{mv}}{T_0}(\Delta\Phi_{s2} - \Delta\Phi_{s1})$

t'_{mv}	$(\Delta\Phi_{s2} - \Delta\Phi_{s1})$—geopotential meters											
°C.	100	200	300	400	500	600	700	800	900	1000	2000	3000
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.4	0.7	1.1	1.5	1.8	2.2	2.6	2.9	3.3	3.7	7.3	11.0
2	0.7	1.5	2.2	2.9	3.7	4.4	5.1	5.9	6.6	7.3	14.6	22.0
3	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	22.0	32.9
4	1.5	2.9	4.4	5.9	7.3	8.8	10.3	11.7	13.2	14.6	29.3	43.9
5	1.8	3.7	5.5	7.3	9.2	11.0	12.8	14.6	16.5	18.3	36.6	54.9
6	2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6	19.8	22.0	43.9	65.9
7	2.6	5.1	7.7	10.3	12.8	15.4	17.9	20.5	23.1	25.6	51.3	76.9
8	2.9	5.9	8.8	11.7	14.6	17.6	20.5	23.4	26.4	29.3	58.6	87.9
9	3.3	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	32.9	65.9	98.8
10	3.7	7.3	11.0	14.6	18.3	22.0	25.6	29.3	32.9	36.6	73.2	109.8
11	4.0	8.1	12.1	16.1	20.1	24.2	28.2	32.2	36.2	40.3	80.5	120.8
12	4.4	8.8	13.2	17.6	22.0	26.4	30.8	35.1	39.5	43.9	87.9	131.8
13	4.8	9.5	14.3	19.0	23.8	28.6	33.3	38.1	42.8	47.6	95.2	142.8
14	5.1	10.3	15.4	20.5	25.6	30.8	35.9	41.0	46.1	51.3	102.5	153.8
15	5.5	11.0	16.5	22.0	27.5	32.9	38.4	43.9	49.4	54.9	109.8	164.7
16	5.9	11.7	17.6	23.4	29.3	35.1	41.0	46.9	52.7	58.6	117.1	175.7
17	6.2	12.4	18.7	24.9	31.1	37.3	43.6	49.8	56.0	62.2	124.5	186.7
18	6.6	13.2	19.8	26.4	32.9	39.5	46.1	52.7	59.3	65.9	131.8	197.7
19	7.0	13.9	20.9	27.8	34.8	41.7	48.7	55.6	62.6	69.6	139.1	208.7
20	7.3	14.6	22.0	29.3	36.6	43.9	51.3	58.6	65.9	73.2	146.4	219.7
21	7.7	15.4	23.1	30.8	38.4	46.1	53.8	61.5	69.2	76.9	153.8	230.6
22	8.1	16.1	24.2	32.2	40.3	48.3	56.4	64.4	72.5	80.5	161.1	241.6
23	8.4	16.8	25.3	33.7	42.1	50.5	58.9	67.4	75.8	84.2	168.4	252.6
24	8.8	17.6	26.4	35.1	43.9	52.7	61.5	70.3	79.1	87.9	175.7	263.6
25	9.2	18.3	27.5	36.6	45.8	54.9	64.1	73.2	82.4	91.5	183.0	274.6
26	9.5	19.0	28.6	38.1	47.6	57.1	66.6	76.1	85.7	95.2	190.4	285.5
27	9.9	19.8	29.7	39.5	49.4	59.3	69.2	79.1	89.0	98.8	197.7	296.5
28	10.3	20.5	30.8	41.0	51.3	61.5	71.8	82.0	92.3	102.5	205.0	307.5
29	10.6	21.2	31.8	42.5	53.1	63.7	74.3	84.9	95.5	106.2	212.3	318.5
30	11.0	22.0	32.9	43.9	54.9	65.9	76.9	87.9	98.8	109.8	219.7	329.5
31	11.3	22.7	34.0	45.4	56.7	68.1	79.4	90.8	102.1	113.5	227.0	340.5
32	11.7	23.4	35.1	46.9	58.6	70.3	82.0	93.7	105.4	117.1	234.3	351.4
33	12.1	24.2	36.2	48.3	60.4	72.5	84.6	96.6	108.7	120.8	241.6	362.4
34	12.4	24.9	37.3	49.8	62.2	74.7	87.1	99.6	112.0	124.5	248.9	373.4
35	12.8	25.6	38.4	51.3	64.1	76.9	89.7	102.5	115.3	128.1	256.3	384.4
36	13.2	26.4	39.5	52.7	65.9	79.1	92.3	105.4	118.6	131.8	263.6	395.4
37	13.5	27.1	40.6	54.2	67.7	81.3	94.8	108.4	121.9	135.5	270.9	406.4
38	13.9	27.8	41.7	55.6	69.6	83.5	97.4	111.3	125.2	139.1	278.2	417.3
39	14.3	28.6	42.8	57.1	71.4	85.7	99.9	114.2	128.5	142.8	285.5	428.3
40	14.6	29.3	43.9	58.6	73.2	87.9	102.5	117.1	131.8	146.4	292.9	439.3
41	15.0	30.0	45.0	60.0	75.0	90.1	105.1	120.1	135.1	150.1	300.2	450.3
42	15.4	30.8	46.1	61.5	76.9	92.3	107.6	123.0	138.4	153.8	307.5	461.3
43	15.7	31.5	47.2	63.0	78.7	94.5	110.2	125.9	141.7	157.4	314.8	472.3
44	16.1	32.2	48.3	64.4	80.5	96.6	112.8	128.9	145.0	161.1	322.2	483.2
45	16.5	32.9	49.4	65.9	82.4	98.8	115.3	131.8	148.3	164.7	329.5	494.2
46	16.8	33.7	50.5	67.4	84.2	101.0	117.9	134.7	151.6	168.4	336.8	505.2
47	17.2	34.4	51.6	68.8	86.0	103.2	120.4	137.6	154.9	172.1	344.1	516.2
48	17.6	35.1	52.7	70.3	87.9	105.4	123.0	140.6	158.1	175.7	351.4	527.2
49	17.9	35.9	53.8	71.8	89.7	107.6	125.6	143.5	161.4	179.4	358.8	538.1
50	18.3	36.6	54.9	73.2	91.5	109.8	128.1	146.4	164.7	183.0	366.1	549.1

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 C.—Values of $\frac{t'_{mv}}{T_0}(\Delta\Phi_{s2}-\Delta\Phi_{s1})$

t'_{mv}	$(\Delta\Phi_{s2}-\Delta\Phi_{s1})$—geopotential meters											
°C.	100	200	300	400	500	600	700	800	900	1000	2000	3000
50	18.3	36.6	54.9	73.2	91.5	109.8	128.1	146.4	164.7	183.0	366.1	549.1
51	18.7	37.3	56.0	74.7	93.4	112.0	130.7	149.4	168.0	186.7	373.4	560.1
52	19.0	38.1	57.1	76.1	95.2	114.2	133.3	152.3	171.3	190.4	380.7	571.1
53	19.4	38.8	58.2	77.6	97.0	116.4	135.8	155.2	174.6	194.0	388.0	582.1
54	19.8	39.5	59.3	79.1	98.8	118.6	138.4	158.1	177.9	197.7	395.4	593.1
55	20.1	40.3	60.4	80.5	100.7	120.8	140.9	161.1	181.2	201.3	402.7	604.0
56	20.5	41.0	61.5	82.0	102.5	123.0	143.5	164.0	184.5	205.0	410.0	615.0
57	20.9	41.7	62.6	83.5	104.3	125.2	146.1	166.9	187.8	208.7	417.3	626.0
58	21.2	42.5	63.7	84.9	106.2	127.4	148.6	169.9	191.1	212.3	424.7	637.0
59	21.6	43.2	64.8	86.4	108.0	129.6	151.2	172.8	194.4	216.0	432.0	648.0
60	22.0	43.9	65.9	87.9	109.8	131.8	153.8	175.7	197.7	219.7	439.3	659.0
61	22.3	44.7	67.0	89.3	111.7	134.0	156.3	178.6	201.0	223.3	446.6	669.9
62	22.7	45.4	68.1	90.8	113.5	136.2	158.9	181.6	204.3	227.0	453.9	680.9
63	23.1	46.1	69.2	92.3	115.3	138.4	161.4	184.5	207.6	230.6	461.3	691.9
64	23.4	46.9	70.3	93.7	117.1	140.6	164.0	187.4	210.9	234.3	468.6	702.9
65	23.8	47.6	71.4	95.2	119.0	142.8	166.6	190.4	214.2	238.0	475.9	713.9
66	24.2	48.3	72.5	96.6	120.8	145.0	169.1	193.3	217.5	241.6	483.2	724.9
67	24.5	49.1	73.6	98.1	122.6	147.2	171.7	196.2	220.7	245.3	490.6	735.8
68	24.9	49.8	74.7	99.6	124.5	149.4	174.3	199.2	224.0	248.9	497.9	746.8
69	25.3	50.5	75.8	101.0	126.3	151.6	176.8	202.1	227.3	252.6	505.2	757.8
70	25.6	51.3	76.9	102.5	128.1	153.8	179.4	205.0	230.6	256.3	512.5	768.8
71	26.0	52.0	78.0	104.0	130.0	156.0	181.9	207.9	233.9	259.9	519.8	779.8
72	26.4	52.7	79.1	105.4	131.8	158.1	184.5	210.9	237.2	263.6	527.2	790.7
73	26.7	53.4	80.2	106.9	133.6	160.3	187.1	213.8	240.5	267.2	534.5	801.7
74	27.1	54.2	81.3	108.4	135.5	162.5	189.6	216.7	243.8	270.9	541.8	812.7
75	27.5	54.9	82.4	109.8	137.3	164.7	192.2	219.7	247.1	274.6	549.1	823.7
76	27.8	55.6	83.5	111.3	139.1	166.9	194.8	222.6	250.4	278.2	556.4	834.7
77	28.2	56.4	84.6	112.8	140.9	169.1	197.3	225.5	253.7	281.9	563.8	845.7
78	28.6	57.1	85.7	114.2	142.8	171.3	199.9	228.4	257.0	285.5	571.1	856.6
79	28.9	57.8	86.8	115.7	144.6	173.5	202.4	231.4	260.3	289.2	578.4	867.6
80	29.3	58.6	87.9	117.1	146.4	175.7	205.0	234.3	263.6	292.9	585.7	878.6
81	29.7	59.3	89.0	118.6	148.3	177.9	207.6	237.2	266.9	296.5	593.1	889.6
82	30.0	60.0	90.1	120.1	150.1	180.1	210.1	240.2	270.2	300.2	600.4	900.6
83	30.4	60.8	91.2	121.5	151.9	182.3	212.7	243.1	273.5	303.9	607.7	911.6
84	30.8	61.5	92.3	123.0	153.8	184.5	215.3	246.0	276.8	307.5	615.0	922.5
85	31.1	62.2	93.4	124.5	155.6	186.7	217.8	248.9	280.1	311.2	622.3	933.5
86	31.5	63.0	94.5	125.9	157.4	188.9	220.4	251.9	283.4	314.8	629.7	944.5
87	31.8	63.7	95.5	127.4	159.2	191.1	222.9	254.8	286.6	318.5	637.0	955.5
88	32.2	64.4	96.6	128.9	161.1	193.3	225.5	257.7	289.9	322.2	644.3	966.5
89	32.6	65.2	97.7	130.3	162.9	195.5	228.1	260.7	293.2	325.8	651.6	977.4
90	32.9	65.9	98.8	131.8	164.7	197.7	230.6	263.6	296.5	329.5	659.0	988.4
91	33.3	66.6	99.9	133.3	166.6	199.9	233.2	266.5	299.8	333.1	666.3	999.4
92	33.7	67.4	101.0	134.7	168.4	202.1	235.8	269.4	303.1	336.8	673.6	1010.4
93	34.0	68.1	102.1	136.2	170.2	204.3	238.3	272.4	306.4	340.5	680.9	1021.4
94	34.4	68.8	103.2	137.6	172.1	206.5	240.9	275.3	309.7	344.1	688.2	1032.4
95	34.8	69.6	104.3	139.1	173.9	208.7	243.4	278.2	313.0	347.8	695.6	1043.3
96	35.1	70.3	105.4	140.6	175.7	210.9	246.0	281.2	316.3	351.4	702.9	1054.3
97	35.5	71.0	106.5	142.0	177.6	213.1	248.6	284.1	319.6	355.1	710.2	1065.3
98	35.9	71.8	107.6	143.5	179.4	215.3	251.1	287.0	322.9	358.8	717.5	1076.3
99	36.2	72.5	108.7	145.0	181.2	217.5	253.7	289.9	326.2	362.4	724.8	1087.3
100	36.6	73.2	109.8	146.4	183.0	219.7	256.3	292.9	329.5	366.1	732.2	1098.3

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 D.—Values of $\Delta\Phi T_0/T'_{mv}$

t'_{mv}	$\Delta\Phi$—geopotential meters											
°C.	100	200	300	400	500	600	700	800	900	1000	2000	3000
−100	157.8	315.5	473.2	631.0	788.8	946.5	1104.2	1262.0	1419.8	1577.5	3155.0	4732.5
− 99	156.8	313.7	470.5	627.4	784.2	941.1	1097.9	1254.8	1411.6	1568.4	3136.9	4705.3
− 98	155.9	311.9	467.8	623.8	779.7	935.7	1091.6	1247.6	1403.5	1559.5	3119.0	4678.5
− 97	155.1	310.1	465.2	620.3	775.3	930.4	1085.4	1240.5	1395.6	1550.6	3101.3	4651.9
− 96	154.2	308.4	462.6	616.8	770.9	925.1	1079.3	1233.5	1387.7	1541.9	3083.8	4625.6
− 95	153.3	306.6	460.0	613.3	766.6	919.9	1073.3	1226.6	1379.9	1533.2	3066.5	4599.7
− 94	152.5	304.9	457.4	609.9	762.3	914.8	1067.3	1219.7	1372.2	1524.7	3049.3	4574.0
− 93	151.6	303.2	454.9	606.5	758.1	909.7	1061.3	1213.0	1364.6	1516.2	3032.4	4548.6
− 92	150.8	301.6	452.4	603.1	753.9	904.7	1055.5	1206.3	1357.1	1507.8	3015.7	4523.5
− 91	150.0	299.9	449.9	599.8	749.8	899.7	1049.7	1199.6	1349.6	1499.6	2999.1	4498.7
− 90	149.1	298.3	447.4	596.5	745.7	894.8	1044.0	1193.1	1342.2	1491.4	2982.7	4474.1
− 89	148.3	296.7	445.0	593.3	741.6	890.0	1038.3	1186.6	1335.0	1483.3	2966.6	4449.8
− 88	147.5	295.1	442.6	590.1	737.6	885.2	1032.7	1180.2	1327.7	1475.3	2950.5	4425.8
− 87	146.7	293.5	440.2	586.9	733.7	880.4	1027.1	1173.9	1320.6	1467.3	2934.7	4402.0
− 86	146.0	291.9	437.8	583.8	729.8	875.7	1021.6	1167.6	1313.6	1459.5	2919.0	4378.5
− 85	145.2	290.3	435.5	580.7	725.9	871.0	1016.2	1161.4	1306.6	1451.7	2903.5	4355.2
− 84	144.4	288.8	433.2	577.6	722.0	866.4	1010.8	1155.3	1299.7	1444.1	2888.1	4332.2
− 83	143.6	287.3	430.9	574.6	718.2	861.9	1005.5	1149.2	1292.8	1436.5	2872.9	4309.4
− 82	142.9	285.8	428.7	571.6	714.5	857.4	1000.3	1143.2	1286.1	1429.0	2857.9	4286.9
− 81	142.2	284.3	426.5	568.6	710.8	852.9	995.1	1137.2	1279.4	1421.5	2843.0	4264.6
− 80	141.4	282.8	424.2	565.7	707.1	848.5	989.9	1131.3	1272.7	1414.2	2828.3	4242.5
− 79	140.7	281.4	422.1	562.8	703.4	844.1	984.8	1125.5	1266.2	1406.9	2813.8	4220.6
− 78	140.0	279.9	419.9	559.9	699.8	839.8	979.8	1119.7	1259.7	1399.7	2799.3	4199.0
− 77	139.3	278.5	417.8	557.0	696.3	835.5	974.8	1114.0	1253.3	1392.5	2785.1	4177.6
− 76	138.5	277.1	415.6	554.2	692.7	831.3	969.8	1108.4	1246.9	1385.5	2770.9	4156.4
− 75	137.8	275.7	413.5	551.4	689.2	827.1	964.9	1102.8	1240.6	1378.5	2757.0	4135.4
− 74	137.2	274.3	411.5	548.6	685.8	822.9	960.1	1097.2	1234.4	1371.6	2743.1	4114.7
− 73	136.5	272.9	409.4	545.9	682.4	818.8	955.3	1091.8	1228.2	1364.7	2729.4	4094.1
− 72	135.8	271.6	407.4	543.2	679.0	814.8	950.5	1086.3	1222.1	1357.9	2715.8	4073.8
− 71	135.1	270.2	405.4	540.5	675.6	810.7	945.8	1081.0	1216.1	1351.2	2702.4	4053.6
− 70	134.5	268.9	403.4	537.8	672.3	806.7	941.2	1075.6	1210.1	1344.6	2689.1	4033.7
− 69	133.8	267.6	401.4	535.2	669.0	802.8	936.6	1070.4	1204.2	1338.0	2675.9	4013.9
− 68	133.1	266.3	399.4	532.6	665.7	798.9	932.0	1065.2	1198.3	1331.4	2662.9	3994.4
− 67	132.5	265.0	397.5	530.0	662.5	795.0	927.5	1060.0	1192.5	1325.0	2650.0	3975.0
− 66	131.9	263.7	395.6	527.4	659.3	791.2	923.0	1054.9	1186.7	1318.6	2637.2	3955.8
− 65	131.2	262.5	393.7	524.9	656.1	787.4	918.6	1049.8	1181.0	1312.3	2624.5	3936.8
− 64	130.6	261.2	391.8	522.4	653.0	783.6	914.2	1044.8	1175.4	1306.0	2612.0	3918.0
− 63	130.0	260.0	389.9	519.9	649.9	779.9	909.8	1039.8	1169.8	1299.8	2599.5	3899.3
− 62	129.4	258.7	388.1	517.4	646.8	776.2	905.5	1034.9	1164.3	1293.6	2587.2	3880.9
− 61	128.8	257.5	386.3	515.0	643.8	772.5	901.3	1030.0	1158.8	1287.5	2575.0	3862.6
− 60	128.1	256.3	384.4	512.6	640.7	768.9	897.0	1025.2	1153.3	1281.5	2563.0	3844.4
− 59	127.5	255.1	382.6	510.2	637.7	765.3	892.8	1020.4	1147.9	1275.5	2551.0	3826.5
− 58	127.0	253.9	380.9	507.8	634.8	761.7	888.7	1015.7	1142.6	1269.6	2539.1	3808.7
− 57	126.4	252.7	379.1	505.5	631.8	758.2	884.6	1011.0	1137.3	1263.7	2527.4	3791.1
− 56	125.8	251.6	377.4	503.1	628.9	754.7	880.5	1006.3	1132.1	1257.9	2515.7	3773.6
− 55	125.2	250.4	375.6	500.8	626.1	751.3	876.5	1001.7	1126.9	1252.1	2504.2	3756.3
− 54	124.6	249.3	373.9	498.6	623.2	747.8	872.5	997.1	1121.8	1246.4	2492.8	3739.2
− 53	124.1	248.1	372.2	496.3	620.4	744.4	868.5	992.6	1116.7	1240.7	2481.5	3722.2
− 52	123.5	247.0	370.5	494.0	617.6	741.1	864.6	988.1	1111.6	1235.1	2470.2	3705.4
− 51	123.0	245.9	368.9	491.8	614.8	737.7	860.7	983.6	1106.6	1229.6	2459.1	3688.7
− 50	122.4	244.8	367.2	489.6	612.0	734.4	856.8	979.2	1101.6	1224.0	2448.1	3672.2

(*continued*)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 D.—Values of $\Delta\Phi T_0/T'_{mv}$

t'_{mv}	ΔΦ—geopotential meters											
°C.	100	200	300	400	500	600	700	800	900	1000	2000	3000
−50	122.4	244.8	367.2	489.6	612.0	734.4	856.8	979.2	1101.6	1224.0	2448.1	3672.2
−49	121.9	243.7	365.6	487.4	609.3	731.2	853.0	974.9	1096.7	1218.6	2437.2	3655.8
−48	121.3	242.6	364.0	485.3	606.6	727.9	849.2	970.5	1091.9	1213.2	2426.4	3639.5
−47	120.8	241.6	362.3	483.1	603.9	724.7	845.5	966.3	1087.0	1207.8	2415.6	3623.5
−46	120.2	240.5	360.8	481.0	601.2	721.5	841.8	962.0	1082.2	1202.5	2405.0	3607.5
−45	119.7	239.4	359.2	478.9	598.6	718.3	838.1	957.8	1077.5	1197.2	2394.5	3591.7
−44	119.2	238.4	357.6	476.8	596.0	715.2	834.4	953.6	1072.8	1192.0	2384.0	3576.0
−43	118.7	237.4	356.0	474.7	593.4	712.1	830.8	949.5	1068.1	1186.8	2373.7	3560.5
−42	118.2	236.3	354.5	472.7	590.8	709.0	827.2	945.4	1063.5	1181.7	2363.4	3545.1
−41	117.7	235.3	353.0	470.6	588.3	706.0	823.6	941.3	1058.9	1176.6	2353.2	3529.8
−40	117.2	234.3	351.5	468.6	585.8	702.9	820.1	937.2	1054.4	1171.6	2343.1	3514.7
−39	116.7	233.3	350.0	466.6	583.3	699.9	816.6	933.2	1049.9	1166.6	2333.1	3499.6
−38	116.2	232.3	348.5	464.6	580.8	697.0	813.1	929.3	1045.4	1161.6	2323.2	3484.8
−37	115.7	231.3	347.0	462.7	578.3	694.0	809.7	925.3	1041.0	1156.7	2313.3	3470.0
−36	115.2	230.4	345.5	460.7	575.9	691.1	806.3	921.4	1036.6	1151.8	2303.6	3455.4
−35	114.7	229.4	344.1	458.8	573.5	688.2	802.9	917.6	1032.3	1147.0	2293.9	3440.9
−34	114.2	228.4	342.6	456.9	571.1	685.3	799.5	913.7	1027.9	1142.2	2284.3	3426.5
−33	113.7	227.5	341.2	455.0	568.7	682.4	796.2	909.9	1023.7	1137.4	2274.8	3412.2
−32	113.3	226.5	339.8	453.1	566.3	679.6	792.9	906.2	1019.4	1132.7	2265.4	3398.1
−31	112.8	225.6	338.4	451.2	564.0	676.8	789.6	902.4	1015.2	1128.0	2256.0	3384.0
−30	112.3	224.7	337.0	449.4	561.7	674.0	786.4	898.7	1011.0	1123.4	2246.8	3370.1
−29	111.9	223.8	335.6	447.5	559.4	671.3	783.1	895.0	1006.9	1118.8	2237.5	3356.3
−28	111.4	222.8	334.3	445.7	557.1	668.5	779.9	891.4	1002.8	1114.2	2228.4	3342.6
−27	111.0	221.9	332.9	443.9	554.8	665.8	776.8	887.7	998.7	1109.7	2219.4	3329.0
−26	110.5	221.0	331.6	442.1	552.6	663.1	773.6	884.2	994.7	1105.2	2210.4	3315.6
−25	110.1	220.1	330.2	440.3	550.4	660.4	770.5	880.6	990.7	1100.7	2201.5	3302.2
−24	109.6	219.3	328.9	438.5	548.2	657.8	767.4	877.1	986.7	1096.3	2192.6	3289.0
−23	109.2	218.4	327.6	436.8	546.0	655.2	764.4	873.6	982.7	1091.9	2183.9	3275.8
−22	108.8	217.5	326.3	435.0	543.8	652.6	761.3	870.1	978.8	1087.6	2175.2	3262.8
−21	108.3	216.7	325.0	433.3	541.6	650.0	758.3	866.6	975.0	1083.3	2166.6	3249.8
−20	107.9	215.8	323.7	431.6	539.5	647.4	755.3	863.2	971.1	1079.0	2158.0	3237.0
−19	107.5	215.0	322.4	429.9	537.4	644.9	752.3	859.8	967.3	1074.8	2149.5	3224.3
−18	107.1	214.1	321.2	428.2	535.3	642.3	749.4	856.4	963.5	1070.5	2141.1	3211.6
−17	106.6	213.3	319.9	426.5	533.2	639.8	746.5	853.1	959.7	1066.4	2132.7	3199.1
−16	106.2	212.4	318.7	424.9	531.1	637.3	743.6	849.8	956.0	1062.2	2124.4	3186.7
−15	105.8	211.6	317.4	423.2	529.0	634.9	740.7	846.5	952.3	1058.1	2116.2	3174.3
−14	105.4	210.8	316.2	421.6	527.0	632.4	737.8	843.2	948.6	1054.0	2108.0	3162.1
−13	105.0	210.0	315.0	420.0	525.0	630.0	735.0	840.0	945.0	1050.0	2099.9	3149.9
−12	104.6	209.2	313.8	418.4	523.0	627.6	732.2	836.8	941.4	1046.0	2091.9	3137.8
−11	104.2	208.4	312.6	416.8	521.0	625.2	729.4	833.6	937.8	1042.0	2083.9	3125.9
−10	103.8	207.6	311.4	415.2	519.0	622.8	726.6	830.4	934.2	1038.0	2076.0	3114.0
− 9	103.4	206.8	310.2	413.6	517.0	620.4	723.8	827.3	930.7	1034.1	2068.1	3102.2
− 8	103.0	206.0	309.1	412.1	515.1	618.1	721.1	824.1	927.2	1030.2	2060.3	3090.5
− 7	102.6	205.3	307.9	410.5	513.2	615.8	718.4	821.0	923.7	1026.3	2052.6	3078.9
− 6	102.2	204.5	306.7	409.0	511.2	613.5	715.7	818.0	920.2	1022.5	2044.9	3067.4
− 5	101.9	203.7	305.6	407.5	509.3	611.2	713.1	814.9	916.8	1018.6	2037.3	3056.0
− 4	101.5	203.0	304.5	405.9	507.4	608.9	710.4	811.9	913.4	1014.9	2029.7	3044.6
− 3	101.1	202.2	303.3	404.4	505.6	606.7	707.8	808.9	910.0	1011.1	2022.2	3033.3
− 2	100.7	201.5	302.2	403.0	503.7	604.4	705.2	805.9	906.6	1007.4	2014.8	3022.1
− 1	100.4	200.7	301.1	401.5	501.8	602.2	702.6	802.9	903.3	1003.7	2007.3	3011.0
0	100.0	200.0	300.0	400.0	500.0	600.0	700.0	800.0	900.0	1000.0	2000.0	3000.0

(continued)

DETERMINATION OF HEIGHT BY THE BAROMETER AND REDUCTION OF PRESSURE TO FIXED LEVELS

TABLE 48 D.—Values of $\Delta\Phi T_0/T'_{mv}$

t'_{mv}	$\Delta\Phi$—geopotential meters											
°C.	100	200	300	400	500	600	700	800	900	1000	2000	3000
0	100.0	200.0	300.0	400.0	500.0	600.0	700.0	800.0	900.0	1000.0	2000.0	3000.0
1	99.6	199.3	298.9	398.5	498.2	597.8	697.4	797.1	896.7	996.4	1992.7	2989.0
2	99.3	198.5	297.8	397.1	496.4	595.6	694.9	794.2	893.5	992.7	1985.5	2978.2
3	98.9	197.8	296.7	395.7	494.6	593.5	692.4	791.3	890.2	989.1	1978.3	2967.4
4	98.6	197.1	295.7	394.2	492.8	591.3	689.9	788.5	887.0	985.6	1971.1	2956.7
5	98.2	196.4	294.6	392.8	491.0	589.2	687.4	785.6	883.8	982.0	1964.0	2946.1
6	97.9	195.7	293.6	391.4	489.3	587.1	685.0	782.8	880.7	978.5	1957.0	2935.5
7	97.5	195.0	292.5	390.0	487.5	585.0	682.5	780.0	877.5	975.0	1950.0	2925.0
8	97.2	194.3	291.5	388.6	485.8	582.9	680.1	777.2	874.4	971.6	1943.1	2914.6
9	96.8	193.6	290.4	387.2	484.0	580.9	677.7	774.5	871.3	968.1	1936.2	2904.3
10	96.5	192.9	289.4	385.9	482.3	578.8	675.3	771.7	868.2	964.7	1929.4	2894.0
11	96.1	192.3	288.4	384.5	480.6	576.8	672.9	769.0	865.2	961.3	1922.6	2883.9
12	95.8	191.6	287.4	383.2	479.0	574.8	670.5	766.3	862.1	957.9	1915.8	2873.8
13	95.5	190.9	286.4	381.8	477.3	572.7	668.2	763.7	859.1	954.6	1909.1	2863.7
14	95.1	190.2	285.4	380.5	475.6	570.8	665.9	761.0	856.1	951.2	1902.5	2853.8
15	94.8	189.6	284.4	379.2	474.0	568.8	663.6	758.4	853.2	948.0	1895.9	2843.8
16	94.5	188.9	283.4	377.9	472.3	566.8	661.3	755.7	850.2	944.7	1889.3	2834.0
17	94.1	188.3	282.4	376.6	470.7	564.8	659.0	753.1	847.3	941.4	1882.8	2824.2
18	93.8	187.6	281.5	375.3	469.1	562.9	656.7	750.5	844.4	938.2	1876.4	2814.5
19	93.5	187.0	280.5	374.0	467.5	561.0	654.5	748.0	841.5	935.0	1869.9	2804.9
20	93.2	186.4	279.5	372.7	465.9	559.1	652.2	745.4	838.6	931.8	1863.6	2795.3
21	92.9	185.7	278.6	371.4	464.3	557.2	650.0	742.9	835.7	928.6	1857.2	2785.8
22	92.5	185.1	277.6	370.2	462.7	555.3	647.8	740.4	832.9	925.5	1850.9	2776.4
23	92.2	184.5	276.7	368.9	461.2	553.4	645.6	737.9	830.1	922.3	1844.7	2767.0
24	91.9	183.8	275.8	367.7	459.6	551.5	643.5	735.4	827.3	919.2	1838.5	2757.7
25	91.6	183.2	274.8	366.5	458.1	549.7	641.3	732.9	824.5	916.2	1832.3	2748.4
26	91.3	182.6	273.9	365.2	456.5	547.9	639.2	730.5	821.8	913.1	1826.2	2739.3
27	91.0	182.0	273.0	364.0	455.0	546.0	637.0	728.0	819.0	910.0	1820.1	2730.2
28	90.7	181.4	272.1	362.8	453.5	544.2	634.9	725.6	816.3	907.0	1814.1	2721.1
29	90.4	180.8	271.2	361.6	452.0	542.4	632.8	723.2	813.6	904.0	1808.0	2712.1
30	90.1	180.2	270.3	360.4	450.5	540.6	630.7	720.8	810.9	901.0	1802.1	2703.1
31	89.8	179.6	269.4	359.2	449.0	538.8	628.7	718.5	808.3	898.1	1796.2	2694.2
32	89.5	179.0	268.5	358.1	447.6	537.1	626.6	716.1	805.6	895.1	1790.3	2685.4
33	89.2	178.4	267.7	356.9	446.1	535.3	624.5	713.8	803.0	892.2	1784.4	2676.6
34	88.9	177.9	266.8	355.7	444.7	533.6	622.5	711.4	800.4	889.3	1778.6	2667.9
35	88.6	177.3	265.9	354.6	443.2	531.9	620.5	709.1	797.8	886.4	1772.8	2659.3
36	88.4	176.7	265.1	353.4	441.8	530.1	618.5	706.8	795.2	883.6	1767.1	2650.7
37	88.1	176.1	264.2	352.3	440.4	528.4	616.5	704.6	792.6	880.7	1761.4	2642.1
38	87.8	175.6	263.4	351.2	438.9	526.7	614.5	702.3	790.1	877.9	1755.8	2633.6
39	87.5	175.0	262.5	350.0	437.5	525.0	612.5	700.0	787.6	875.1	1750.1	2625.2
40	87.2	174.5	261.7	348.9	436.1	523.4	610.6	697.8	785.0	872.3	1744.5	2616.8
41	86.9	173.9	260.8	347.8	434.7	521.7	608.6	695.6	782.5	869.5	1739.0	2608.5
42	86.7	173.3	260.0	346.7	433.4	520.0	606.7	693.4	780.1	866.7	1733.5	2600.2
43	86.4	172.8	259.2	345.6	432.0	518.4	604.8	691.2	777.6	864.0	1728.0	2592.0
44	86.1	172.3	258.4	344.5	430.6	516.8	602.9	689.0	775.1	861.3	1722.5	2583.8
45	85.9	171.7	257.6	343.4	429.3	515.1	601.0	686.8	772.7	858.6	1717.1	2575.7
46	85.6	171.2	256.8	342.3	427.9	513.5	599.1	684.7	770.3	855.9	1711.7	2567.6
47	85.3	170.6	256.0	341.3	426.6	511.9	597.2	682.6	767.9	853.2	1706.4	2559.6
48	85.1	170.1	255.2	340.2	425.3	510.3	595.4	680.4	765.5	850.5	1701.1	2551.6
49	84.8	169.6	254.4	339.2	424.0	508.7	593.5	678.3	763.1	847.9	1695.8	2543.7
50	84.5	169.1	253.6	338.1	422.6	507.2	591.7	676.2	760.8	845.3	1690.6	2535.8

Section IV

GEOPOTENTIAL AND AEROLOGICAL TABLES

RELATION BETWEEN GEOPOTENTIAL AND GEOMETRIC HEIGHT[1]

Definition of geopotential.—The *geopotential* or *gravity potential* at any point is the potential energy, due to gravity, of unit mass at the point. Conventionally, geopotential is taken to be zero at mean sea level, in large part because mean sea level is a horizontal or level surface, and therefore has no component of gravity tangent to it.

If

g = acceleration of gravity, cm. sec.$^{-2}$,
Z = geometric height above mean sea level, cm.,
Φ = geopotential, cm.^{2} sec.$^{-2}$

then

$$\Phi = \int_0^Z g\, dZ \tag{1}$$

which is numerically equivalent to the work done against gravity in lifting unit mass from mean sea level to a point at elevation Z. The cgs unit of geopotential is the cm.^{2} sec.$^{-2}$, equivalent to the erg gram.$^{-1}$

Prof. V. Bjerknes[2] made use of the term "dynamic height" in referring to the geopotential of a point, because the latter is preferable to geometric height in meteorology as a representation of the vertical coordinate of the point. Professor Bjerknes proposed as the unit of geopotential the so-called *geodynamic meter* (gdm.) or *dynamic meter*, for short. By definition 1 geodynamic meter = 10 m.^{2} sec.$^{-2}$ = 10^5 cm.^{2} sec.$^{-2}$

At the meeting of the International Commission for the Exploration of the Upper Air[3] held in London, 1925, a resolution was adopted to the effect that heights in all forms and publications of the International Commission are to be represented as geopotentials in terms of the geodynamic meter as the unit. This unit was officially sanctioned until 1947 when the Aerological Commission of the International Meteorological Organization met in Toronto. At the Toronto meeting of the Aerological Commission[4] a new unit of geopotential was adopted for official use in aerological work. This was given the name *geopotential meter* (gpm.), and defined by the relation 1 geopotential meter = 0.98 dynamic meter. It follows that 1 gpm. = 0.98 gdm. = 9.8 m.^{2} sec.$^{-2}$ = 98,000 cm.^{2} sec.$^{-2}$

Accordingly, if

g = acceleration of gravity, m. sec.$^{-2}$,
Z = geometric height, m.,
Φ = geopotential, gpm.

$$\Phi = \frac{1}{9.8}\int_0^Z g\, dZ \tag{2}$$

The unit of geopotential in English measures was given the name *geopotential foot* (gpft.); its relation to the geopotential meter is 1 gpft. = 0.3048 gpm.

The geopotential meter was chosen as the unit of geopotential because the geometric height in meters and the geopotential in geopotential meters are approximately equal in the lower atmosphere, where g is approximately 980 cm. sec.$^{-2}$

Pressure altitudes in the standard atmosphere are actually in terms of a special unit of geopotential. For the NACA Standard Atmosphere the unit called the *meter* is actually 0.980665 gdm., and for the ICAN Standard Atmosphere it is actually 0.98062 gdm. (See Tables 63 and 64.)

Computation.—To integrate equation (2), using Newton's inverse-square law of gravitation, let

g_ϕ = actual acceleration of gravity at mean sea level at the given latitude ϕ, m. sec.$^{-2}$,
g = acceleration of gravity, in m. sec.$^{-2}$, at elevation Z *meters* and latitude ϕ,
R = appropriate value of radius of earth at given latitude, in *meters*,

then

$$g = g_\phi R^2/(R+Z)^2 \tag{3}$$

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[1] Harrison, L. P., unpublished manuscript, 1949.
[2] Bjerknes, V., et al., Dynamical meteorology and hydrography, vol. 1, Washington, 1910.
[3] International Commission for the Exploration of the Upper Air. Report of the meeting in London, April 16-22, 1925. Meteorol. Off. Publ. No. 281, London, 1925.
[4] I. M. O. Aerological Commission, abridged final report, Publ. 62, Lausanne, 1949.

(*continued*)

RELATION BETWEEN GEOPOTENTIAL AND GEOMETRIC HEIGHT

Integration of equation (2) after (3) is substituted therein yields

$$\Phi = \left(\frac{g_\phi R}{9.8}\right)\left(\frac{Z}{R+Z}\right), \text{ in gpm.} \tag{4}$$

or

$$Z = \frac{R\Phi}{\left(\frac{g_\phi R}{9.8}\right) - \Phi} \text{ in meters} \tag{5}$$

Equations (4) and (5) are strictly valid for a nonrotating sphere composed of spherical shells of equal density. Since these conditions are not fulfilled for the earth, and since centrifugal acceleration does not diminish according to the inverse-square law but rather increases with the distance from the center, it is, strictly speaking, necessary to make some allowance for the deviations from the simple conditions assumed.

This is done by following a suggestion of W. D. Lambert[5] of the U. S. Coast and Geodetic Survey. Taking the partial derivative of g with respect to Z in equation (3), and evaluating it for $Z = 0$, i.e., obtaining $\left(\frac{\partial g}{\partial Z}\right)_{Z=0}$, we find for the corresponding value of R, without giving it a special symbol,

$$R = \frac{2g_\phi}{-\left(\frac{\partial g}{\partial Z}\right)_{Z=0}} \tag{6}$$

The quantity in the denominator is a function of latitude, given by

$$-\left(\frac{\partial g}{\partial Z}\right)_{Z=0} = 3.085462 \times 10^{-6} + 2.27 \times 10^{-9} \cos 2\phi - 2 \times 10^{-12} \cos 4\phi \tag{7}$$

An equation expressing g_ϕ as a function of latitude is given in Table 167.

When equation (7) is substituted in equation (6) and the resulting value of R used in equations (4) and (5), these expressions for Φ and Z are made to satisfy two boundary conditions, that is, (a) they are in harmony with the value of g_ϕ for the given latitude (neglecting local anomalies), and (b) they are in harmony with the vertical gradient of g at the given latitude at sea level (neglecting local anomalies), assuming the International Ellipsoid represents the figure of the earth.

The value of R obtained by means of equations (6) and (7) is a fictitious quantity satisfying these two conditions and does not represent the radius vector of either the geoid or the International Ellipsoid of Reference. Effects of the nonspherical figure of the earth, its mean density distribution, and centrifugal acceleration are thus taken into account at mean sea level. Use of the inverse-square law in conjunction with this value of R then yields a satisfactory approximation for the relation of geopotential and geometric height even up to heights of several hundred kilometers.[6] The validity of the foregoing technique for relating geopotential and geometric height is uncertain for heights above 600 kilometers. To obtain relationships of greater reliability for great heights it is necessary to have recourse to the more advanced theory given by Helmert.[7]

NOTE.—The notion of geopotential is derived from purely statical considerations. Therefore the concept of geopotential breaks down absolutely at distances from the earth where the gravitational attraction and the force of centrifugal acceleration are equal and oppositely directed. This occurs at a distance from the earth's center of 6.6 terrestrial radii in the plane of the Equator, about 4.4 terrestrial radii on the earth's axis extended. Within the spheroidal surface at which this absolute break-down occurs, in the statical case, there are high levels where the gravitational attraction and the force of centrifugal acceleration are of the same order of magnitude. Here the vertical component of the force on a moving body due to the Coriolis acceleration which does not have a potential may be significant in relation to the other forces. Where moving bodies are involved at these levels some caution in the use of the concept of geopotential is necessary. Also, the definitions of *geographic latitude* and *elevation* become ambiguous at these heights.

Description of tables.—Table 49 provides values of the quantities R and $\left(\frac{g_\phi R}{9.8}\right)$ as functions of latitude, for every whole degree. The last figure in the tabular values of R and $\left(\frac{g_\phi R}{9.8}\right)$ is not significant but is given to permit obtainment of smooth interpolated

[5] Lambert, W. D., Some notes on the calculation of geopotential, unpublished manuscript, 1949.

[6] In the fifth edition of these tables, use was made of the assumption of a constant vertical gradient of g, as in Helmert's equation, $g = g_\phi - 0.000003086\ Z$. This yields results which become appreciably erroneous at heights of the order of 10 km., and neglects the latitudinal variation.

[7] Helmert, F. R., Die mathematischen und physikalischen Theorieen der höheren Geodasie, vol. 2, 1886.

(*continued*)

RELATION BETWEEN GEOPOTENTIAL AND GEOMETRIC HEIGHT

results especially for high altitudes. These data are applicable in equation (4) for computing Φ as a function of Z, and in equation (5) for computing Z as a function of Φ, for given latitudes.

Examples:

1. Given: Station at latitude $\phi = 51° 10'$, elevation $Z = 1384.4$ meters. To find the geopotential Φ. Refer to Table 49, and by interpolation obtain $R = 6{,}360{,}942$ meters, and $\left(\frac{g_\phi R}{9.8}\right) = 6{,}368{,}529$ gpm. Using these data in equation (4) we find $\Phi = 1385.7$ gpm.
2. Given: A point at latitude $\phi = 20° 30'$ has a geopotential $\Phi = 6400.0$ gpm. To find Z, its geometric height. Refer to Table 49, and by interpolation we obtain $R = 6{,}340{,}216$ meters, and $\left(\frac{g_\phi R}{9.8}\right) = 6{,}331{,}593$ gpm. Using these data in equation (5), we find $Z = 6415.2$ meters.

Table 50 gives values of geopotential Φ directly as a function of latitude ϕ and geometric height Z.

Table 51 gives values of geometric height Z directly as a function of latitude ϕ and geopotential Φ.

Tables 50 and 51 were computed from equations (4)-(7), using values of g_ϕ from Table 167. Tabular values for arguments exceeding 200,000 gpm. or 200,000 m. are uncertain by approximately one unit in the last figure.

TABLE 49

FACTORS FOR COMPUTING THE RELATION BETWEEN GEOPOTENTIAL AND GEOMETRIC HEIGHT

Latitude	R m.	$\frac{g_\phi R}{9.8}$ gpm.	Latitude	R m.	$\frac{g_\phi R}{9.8}$ gpm.	Latitude	R m.	$\frac{g_\phi R}{9.8}$ gpm.
0°	6334984	6322289	30°	6345653	6341274	60°	6367103	6379519
1	6334995	6322306	31	6346305	6342440	61	6367738	6380658
2	6335035	6322378	32	6346967	6343616	62	6368371	6381783
3	6335099	6322492	33	6347647	6344829	63	6368983	6382880
4	6335191	6322654	34	6348337	6346058	64	6369582	6383945
5	6335306	6322863	35	6349033	6347300	65	6370171	6385001
6	6335449	6323114	36	6349736	6348549	66	6370732	6386003
7	6335616	6323407	37	6350456	6349834	67	6371280	6386979
8	6335806	6323745	38	6351177	6351120	68	6371810	6387931
9	6336030	6324144	39	6351907	6352422	69	6372324	6388847
10	6336267	6324570	40	6352638	6353718	70	6372821	6389734
11	6336536	6325048	41	6353376	6355034	71	6373294	6390578
12	6336824	6325557	42	6354120	6356363	72	6373743	6391379
13	6337140	6326120	43	6354868	6357696	73	6374175	6392150
14	6337480	6326725	44	6355612	6359025	74	6374584	6392879
15	6337838	6327368	45	6356360	6360358	75	6374972	6393574
16	6338219	6328046	46	6357108	6361685	76	6375340	6394230
17	6338626	6328769	47	6357852	6363015	77	6375680	6394839
18	6339058	6329537	48	6358601	6364349	78	6375997	6395406
19	6339506	6330333	49	6359345	6365679	79	6376293	6395938
20	6339971	6331158	50	6360083	6366996	80	6376562	6396412
21	6340461	6332028	51	6360820	6368313	81	6376806	6396855
22	6340973	6332945	52	6361552	6369612	82	6377025	6397240
23	6341496	6333874	53	6362273	6370900	83	6377222	6397597
24	6342043	6334845	54	6362993	6372188	84	6377389	6397892
25	6342603	6335848	55	6363697	6373446	85	6377532	6398151
26	6343184	6336879	56	6364401	6374699	86	6377654	6398369
27	6343782	6337946	57	6365092	6375932	87	6377746	6398531
28	6344393	6339032	58	6365772	6377148	88	6377811	6398647
29	6345018	6340145	59	6366435	6378328	89	6377845	6398707
						90	6377862	6398737

TABLE 50

GEOMETRIC METERS TO GEOPOTENTIAL METERS

(Explanation on p. 217.)

Geo-metric meters	Latitude										
	0°	10°	20°	30°	40°	45°	50°	60°	70°	80°	90°
m.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
1000	998	998	998	999	1000	1000	1001	1002	1002	1003	1003
2000	1995	1996	1997	1998	2000	2001	2002	2003	2005	2006	2006
3000	2993	2993	2994	2997	2999	3000	3002	3004	3007	3008	3008
4000	3989	3990	3992	3995	3998	4000	4002	4005	4008	4010	4011
5000	4986	4987	4989	4993	4997	4999	5002	5006	5009	5012	5012
6000	5982	5983	5986	5990	5995	5998	6001	6006	6010	6013	6014
7000	6978	6979	6983	6987	6993	6997	7000	7006	7011	7014	7015
8000	7974	7975	7979	7984	7991	7995	7999	8006	8011	8015	8016
9000	8969	8971	8975	8981	8989	8993	8997	9005	9011	9015	9017
10000	9964	9966	9970	9977	9986	9991	9995	10004	10011	10015	10017
11000	10959	10961	10966	10973	10983	10988	10993	11002	11010	11015	11017
12000	11953	11955	11961	11969	11979	11985	11990	12001	12009	12015	12017
13000	12947	12949	12955	12964	12976	12982	12988	12999	13008	13014	13016
14000	13941	13943	13950	13960	13972	13978	13984	13997	14006	14013	14015
15000	14935	14937	14944	14954	14967	14974	14981	14994	15004	15011	15014
16000	15928	15930	15938	15949	15963	15970	15977	15991	16002	16010	16012
17000	16921	16923	16931	16943	16958	16965	16973	16988	17000	17008	17010
18000	17913	17916	17924	17937	17952	17960	17969	17984	17997	18005	18008
19000	18905	18908	18917	18930	18947	18955	18964	18980	18994	19003	19006
20000	19897	19900	19909	19923	19941	19950	19959	19976	19990	20000	20003
21000	20889	20892	20902	20916	20934	20944	20954	20972	20987	20996	21000
22000	21880	21883	21893	21909	21928	21938	21948	21967	21982	21993	21996
23000	22871	22875	22885	22901	22921	22931	22942	22962	22978	22989	22992
24000	23862	23865	23876	23893	23914	23925	23936	23956	23973	23984	23988
25000	24852	24856	24867	24885	24906	24918	24929	24951	24968	24980	24984
26000	25842	25846	25858	25876	25898	25910	25922	25945	25963	25975	25979
27000	26832	26836	26848	26867	26890	26903	26915	26938	26957	26970	26974
28000	27821	27825	27838	27858	27882	27895	27908	27932	27952	27964	27969
29000	28810	28815	28828	28848	28873	28886	28900	28925	28945	28959	28963
30000	29799	29804	29817	29838	29864	29878	29892	29918	29939	29952	29957
35000	34738	34743	34759	34784	34814	34830	34846	34877	34901	34917	34923
40000	39669	39676	39694	39722	39756	39775	39793	39828	39856	39874	39881
45000	44593	44600	44621	44652	44691	44712	44732	44771	44803	44824	44831
50000	49509	49517	49540	49575	49618	49641	49664	49707	49742	49765	49773
55000	54417	54426	54451	54490	54537	54562	54588	54635	54674	54699	54708
60000	59318	59327	59355	59397	59449	59476	59504	59556	59598	59626	59635
65000	64211	64221	64251	64297	64353	64383	64412	64469	64514	64544	64555
70000	69096	69107	69139	69188	69249	69281	69313	69374	69423	69455	69467
75000	73974	73986	74020	74073	74137	74172	74206	74271	74324	74359	74371
80000	78844	78857	78893	78949	79018	79055	79092	79161	79218	79255	79268
85000	83707	83720	83759	83819	83892	83931	83970	84044	84104	84143	84157
90000	88561	88576	88617	88680	88758	88799	88841	88919	88982	89024	89038
95000	93409	93424	93467	93534	93616	93660	93704	93786	93853	93897	93912
100000	98249	98265	98310	98381	98467	98513	98559	98646	98716	98762	98779
105000	103081	103098	103146	103220	103310	103359	103407	103498	103572	103621	103637
110000	107906	107923	107974	108051	108146	108197	108247	108343	108421	108471	108489
115000	112723	112741	112794	112875	112974	113027	113080	113180	113261	113314	113333
120000	117533	117552	117607	117692	117795	117851	117906	118010	118095	118150	118169
125000	122336	122355	122413	122501	122609	122666	122724	122832	122921	122978	122998
130000	127131	127151	127211	127302	127415	127475	127534	127647	127739	127799	127820

(*continued*)

GEOMETRIC METERS TO GEOPOTENTIAL METERS

Geo-metric meters	Latitude										
	0°	10°	20°	30°	40°	45°	50°	60°	70°	80°	90°
m.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
130000	127131	127151	127211	127302	127415	127475	127534	127647	127739	127799	127820
140000	136698	136721	136785	136883	137004	137069	137134	137255	137354	137419	137441
150000	146237	146261	146329	146435	146565	146634	146703	146833	146940	147009	147033
160000	155746	155771	155845	155957	156096	156170	156243	156382	156496	156569	156595
170000	165225	165252	165330	165450	165597	165676	165754	165902	166022	166101	166128
180000	174676	174705	174787	174914	175070	175153	175236	175393	175520	175603	175632
190000	184098	184128	184215	184349	184514	184601	184689	184854	184989	185077	185107
200000	193490	193522	193614	193755	193928	194021	194113	194287	194429	194521	194554
210000	202855	202888	202985	203133	203315	203412	203509	203691	203840	203937	203971
220000	212190	212225	212326	212482	212672	212774	212876	213067	213223	213325	213360
230000	221497	221534	221640	221802	222001	222108	222214	222414	222577	222684	222721
240000	230776	230814	230925	231094	231302	231413	231524	231733	231903	232015	232053
250000	240027	240066	240181	240358	240575	240691	240806	241024	241201	241317	241358
260000	249249	249291	249410	249594	249820	249940	250060	250287	250471	250592	250634
270000	258444	258487	258611	258802	259036	259161	259286	259521	259713	259838	259882
280000	267611	267655	267784	267982	268225	268355	268484	268728	268927	269057	269102
290000	276750	276796	276930	277135	277386	277521	277655	277908	278114	278248	278295
300000	285861	285909	286047	286260	286520	286659	286798	287060	287273	287412	287460
310000	294946	294995	295138	295357	295627	295770	295914	296184	296404	296548	296598
320000	304003	304054	304201	304427	304706	304854	305002	305281	305509	305657	305709
330000	313032	313085	313237	313471	313757	313910	314063	314351	314586	314739	314792
340000	322035	322089	322246	322487	322782	322940	323097	323394	323636	323794	323849
350000	331011	331067	331228	331476	331780	331942	332104	332410	332659	332821	332878
360000	339960	340017	340183	340438	340751	340918	341085	341399	341655	341822	341881
370000	348882	348941	349112	349374	349695	349867	350039	350362	350625	350797	350857
380000	357777	357838	358013	358283	358613	358790	358966	359297	359568	359745	359806
390000	366647	366709	366889	367165	367505	367686	367866	368207	368485	368666	368729
400000	375489	375553	375738	376021	376370	376555	376741	377090	377375	377561	377626
410000	384306	384372	384561	384851	385208	385399	385589	385947	386239	386430	386496
420000	393097	393164	393358	393655	394021	394216	394411	394778	395077	395272	395340
430000	401861	401930	402128	402433	402808	403007	403207	403583	403889	404089	404159
440000	410600	410670	410873	411185	411569	411773	411977	412362	412675	412880	412951
450000	419313	419385	419593	419912	420304	420513	420721	421115	421436	421645	421718
460000	428000	428074	428286	428612	429013	429227	429440	429842	430170	430384	430459
470000	436662	436737	436954	437287	437697	437915	438133	438545	438880	439098	439175
480000	445298	445375	445597	445937	446355	446579	446801	447221	447563	447787	447865
490000	453909	453987	454214	454561	454989	455216	455444	455872	456222	456450	456529
500000	462495	462575	462806	463161	463597	463829	464061	464499	464855	465088	465169
510000	471056	471137	471373	471735	472179	472417	472653	473100	473463	473701	473784
520000	479591	479674	479915	480284	480737	480979	481221	481676	482047	482289	482373
530000	488102	488187	488432	488808	489270	489517	489763	490227	490605	490852	490938
540000	496588	496675	496924	497308	497779	498030	498281	498753	499139	499390	499478
550000	505050	505138	505392	505783	506262	506518	506774	507255	507648	507904	507993
560000	513487	513576	513835	514233	514721	514982	515242	515732	516132	516393	516484
570000	521899	521990	522254	522659	523156	523421	523686	524185	524592	524857	524950
580000	530287	530380	530648	531060	531566	531836	532106	532614	533028	533298	533392
590000	538651	538746	539019	539438	539952	540227	540501	541018	541439	541714	541810
600000	546991	547087	547365	547791	548314	548594	548872	549398	549826	550106	550203
610000	555307	555404	555687	556120	556652	556936	557220	557754	558190	558474	558573
620000	563599	563698	563985	564425	564966	565255	565543	566086	566529	566818	566918
630000	571867	571968	572259	572707	573256	573550	573843	574394	574844	575138	575240

TABLE 51

GEOPOTENTIAL METERS TO GEOMETRIC METERS

(Explanation on p. 217.)

Geo-potential meters	Latitude										
	0°	10°	20°	30°	40°	45°	50°	60°	70°	80°	90°
gpm.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
1000	1002	1002	1002	1001	1000	1000	999	998	998	997	997
2000	2005	2004	2003	2002	2000	1999	1998	1997	1995	1994	1994
3000	3007	3007	3006	3003	3001	3000	2998	2996	2993	2992	2992
4000	4011	4010	4008	4005	4002	4000	3998	3995	3992	3990	3989
5000	5014	5013	5011	5007	5003	5001	4998	4994	4991	4988	4988
6000	6018	6017	6014	6010	6005	6002	5999	5994	5990	5987	5986
7000	7022	7021	7018	7013	7007	7003	7000	6994	6989	6986	6985
8000	8026	8025	8021	8016	8009	8005	8001	7994	7989	7985	7984
9000	9031	9029	9025	9019	9011	9007	9003	8995	8989	8985	8983
10000	10036	10034	10030	10023	10014	10009	10005	9996	9989	9985	9983
11000	11041	11040	11034	11027	11017	11012	11007	10998	10990	10985	10983
12000	12047	12045	12040	12031	12021	12015	12010	11999	11991	11985	11983
13000	13053	13051	13045	13036	13024	13018	13012	13001	12992	12986	12984
14000	14059	14057	14051	14041	14029	14022	14016	14003	13994	13987	13985
15000	15066	15063	15057	15046	15033	15026	15019	15006	14995	14989	14986
16000	16073	16070	16063	16052	16038	16030	16023	16009	15998	15990	15988
17000	17080	17077	17069	17057	17043	17035	17027	17012	17000	16992	16990
18000	18088	18085	18076	18064	18048	18040	18031	18016	18003	17995	17992
19000	19096	19092	19084	19070	19054	19045	19036	19020	19006	18997	18994
20000	20104	20101	20091	20077	20060	20050	20041	20024	20010	20000	19997
21000	21112	21109	21099	21084	21066	21056	21047	21028	21013	21004	21000
22000	22121	22118	22107	22092	22073	22062	22052	22033	22018	22007	22004
23000	23130	23127	23116	23100	23080	23069	23058	23038	23022	23011	23008
24000	24140	24136	24125	24108	24087	24076	24065	24044	24027	24016	24012
25000	25150	25146	25134	25116	25094	25083	25071	25050	25032	25020	25016
26000	26160	26156	26144	26125	26102	26090	26078	26056	26037	26025	26021
27000	27170	27166	27153	27134	27111	27098	27086	27062	27043	27030	27026
28000	28181	28177	28164	28144	28119	28106	28093	28069	28049	28036	28031
29000	29192	29187	29174	29153	29128	29115	29101	29076	29055	29042	29037
30000	30204	30199	30185	30163	30137	30123	30109	30083	30062	30048	30043
35000	35266	35260	35244	35219	35188	35172	35155	35125	35100	35083	35078
40000	40336	40329	40310	40282	40247	40228	40209	40174	40145	40127	40120
45000	45414	45406	45385	45353	45313	45292	45271	45231	45199	45178	45171
50000	50500	50492	50468	50432	50388	50365	50341	50297	50261	50238	50229
55000	55594	55585	55559	55520	55471	55445	55419	55370	55331	55305	55296
60000	60697	60687	60658	60615	60562	60533	60505	60452	60408	60380	60370
65000	65807	65796	65766	65719	65661	65630	65599	65541	65494	65464	65453
70000	70926	70914	70881	70830	70768	70734	70701	70639	70588	70555	70543
75000	76053	76040	76005	75950	75883	75847	75812	75745	75690	75654	75642
80000	81188	81175	81137	81078	81006	80968	80930	80858	80800	80762	80749
85000	86331	86317	86277	86214	86138	86097	86057	85980	85918	85877	85863
90000	91483	91468	91425	91359	91278	91234	91191	91110	91044	91001	90986
95000	96643	96627	96581	96511	96426	96380	96334	96248	96178	96133	96117
100000	101811	101794	101746	101672	101582	101534	101485	101395	101321	101273	101256
105000	106988	106970	106919	106842	106746	106695	106645	106549	106472	106421	106403
110000	112173	112154	112101	112019	111919	111866	111812	111712	111631	111577	111559
115000	117366	117346	117291	117205	117100	117044	116988	116883	116798	116742	116723
120000	122567	122547	122489	122399	122289	122231	122172	122062	121973	121915	121894
125000	127777	127756	127695	127602	127487	127426	127365	127250	127157	127096	127075
130000	132996	132974	132910	132813	132693	132629	132566	132446	132349	132285	132263

(*continued*)

GEOPOTENTIAL METERS TO GEOMETRIC METERS

Geo-potential meters	Latitude										
	0°	10°	20°	30°	40°	45°	50°	60°	70°	80°	90°
gpm.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
130000	132996	132974	132910	132813	132693	132629	132566	132446	132349	132285	132263
140000	143458	143434	143365	143260	143130	143061	142992	142863	142757	142689	142665
150000	153954	153928	153854	153740	153601	153526	153452	153313	153199	153125	153100
160000	164484	164456	164377	164255	164105	164026	163946	163797	163675	163596	163568
170000	175048	175019	174934	174804	174644	174559	174474	174314	174184	174100	174070
180000	185647	185616	185525	185387	185217	185126	185036	184866	184727	184637	184606
190000	196280	196247	196151	196004	195824	195728	195632	195451	195305	195209	195176
200000	206948	206913	206812	206656	206465	206363	206262	206071	205916	205815	205779
210000	217651	217614	217507	217343	217141	217034	216927	216725	216561	216455	216418
220000	228389	228350	228237	228064	227852	227739	227626	227414	227242	227129	227090
230000	239163	239121	239003	238821	238598	238479	238361	238138	237957	237838	237797
240000	249971	249928	249804	249613	249379	249255	249130	248896	248706	248582	248539
250000	260815	260770	260640	260440	260196	260065	259935	259690	259491	259361	259316
260000	271696	271648	271512	271303	271047	270911	270775	270519	270311	270175	270128
270000	282612	282562	282420	282202	281935	281793	281651	281383	281166	281024	280975
280000	293564	293512	293364	293137	292858	292710	292562	292284	292057	291909	291858
290000	304552	304499	304344	304108	303818	303663	303509	303219	302983	302830	302776
300000	315577	315522	315361	315115	314814	314653	314493	314191	313946	313786	313730
310000	326638	326581	326414	326159	325845	325679	325512	325199	324944	324778	324720
320000	337737	337677	337504	337239	336914	336741	336568	336243	335979	335807	335747
330000	348872	348810	348631	348356	348019	347840	347661	347324	347050	346872	346809
340000	360045	359981	359795	359511	359162	358976	358790	358442	358158	357973	357908
350000	371255	371189	370997	370702	370341	370149	369957	369596	369302	369111	369044
360000	382503	382434	382236	381931	381558	381359	381161	380787	380484	380286	380217
370000	393789	393718	393512	393198	392812	392606	392402	392016	391702	391498	391427
380000	405112	405039	404827	404502	404104	403892	403680	403282	402958	402747	402674
390000	416474	416398	416180	415845	415434	415215	414996	414586	414252	414034	413958
400000	427874	427796	427571	427225	426801	426576	426351	425927	425583	425358	425280
410000	439313	439232	439000	438644	438207	437975	437743	437307	436952	436721	436640
420000	450790	450707	450468	450101	449652	449413	449174	448725	448359	448121	448038
430000	462306	462221	461975	461598	461135	460889	460643	460181	459805	459560	459474
440000	473862	473774	473521	473133	472657	472404	472151	471675	471289	471036	470949
450000	485457	485367	485106	484707	484218	483957	483698	483209	482811	482552	482462
460000	497091	496999	496731	496321	495818	495551	495284	494781	494373	494106	494014
470000	508765	508670	508396	507974	507458	507183	506909	506393	505973	505700	505604
480000	520480	520382	520100	519667	519137	518855	518573	518044	517613	517332	517234
490000	532234	532134	531844	531401	530856	530567	530278	529734	529292	529004	528904
500000	544029	543926	543629	543174	542616	542318	542022	541465	541011	540715	540613
510000	555864	555758	555454	554987	554415	554110	553806	553235	552770	552467	552361
520000	567740	567632	567320	566841	566255	565943	565631	565045	564569	564258	564150
530000	579657	579546	579227	578736	578136	577815	577496	576896	576408	576089	575979
540000	591615	591502	591174	590672	590057	589729	589402	588787	588287	587961	587848
550000	603615	603499	603164	602650	602019	601684	601349	600720	600207	599874	599758
560000	615657	615538	615194	614668	614023	613680	613337	612693	612169	611827	611708
570000	627740	627618	627267	626729	626069	625717	625367	624707	624171	623821	623700
580000	639865	639741	639381	638831	638156	637796	637437	636763	636214	635857	635732
590000	652033	651905	651538	650975	650284	649917	649550	648861	648299	647934	647807
600000	664243	664113	663737	663161	662456	662080	661705	661000	660426	660053	659923
610000	676496	676363	675979	675391	674669	674285	673902	673181	672595	672213	672080
620000	688792	688656	688264	687662	686925	686533	686141	685405	684806	684416	684280
630000	701131	700992	700591	699977	699224	698823	698423	697671	697059	696661	696522

TABLE 52

GEOPOTENTIAL COMPUTATIONS

Resolution 78, I. M. O. Twelfth Conference of Directors (Washington, 1947) states:
The Conference decides:

(1) *that the geopotential used in upper air reports and analyses shall be expressed in terms of geopotential meters (gpm.), or geopotential feet (gpft.);*

(2) *that the geopotential meter shall be defined as being equal to 0.98 of the dynamic meter so that the value of the geopotential shall, for practical purposes, be numerically equal to the height expressed in meters.*

The geopotential Φ of a point at height Z above mean sea level is the work which must be done against gravity in raising a unit mass from sea level to height Z

$$\Phi = \int_0^Z g\,d\,z \qquad (1)$$

where g is the local acceleration of gravity at the height z. Similarly, the difference in geopotential $\Delta\Phi$ between levels z_1 and z_2 is

$$\Delta\Phi = \int_{z_1}^{z_2} g\,d\,z \qquad (2)$$

If p_0 is the pressure at mean sea level and p the pressure at height Z, from the hydrostatic equation

$$\Phi = R\,T'_{mv} \log_e \frac{p_0}{p}, \text{ in cgs units,} \qquad (3)$$

where R is the gas constant for dry air and T'_{mv} is the mean adjusted virtual temperature[1] (°K.) between p_0 and p. Similarly if p_1 and p_2 are the pressures at z_1 and z_2 respectively

$$\Delta\Phi = R\,T'_{mv} \log_e \frac{p_1}{p_2}, \text{ in cgs units.} \qquad (4)$$

If $\Delta\Phi_0$ is the geopotential difference between levels having pressures p_2 and p_1 for a mean temperature of the layer of 0°C. (273.16 °K.) and t'_{mv} is the actual mean adjusted virtual temperature of the layer in °C.

$$\Delta\Phi = \Delta\Phi_0 + \Delta\Phi_0 \frac{t'_{mv}}{T_0} \qquad (5)$$

where $T_0 = 273.16$ °K. and

$$\Delta\Phi_0 = R\,T_0\,log_e \frac{p_1}{p_2}, \text{ in cgs units.} \qquad (6)$$

Expressing geopotential differences in terms of the geopotential meter, gpm. (1 gpm. = 98000 ergs g.$^{-1}$ = 98000 cm.^{2} sec.$^{-2}$ = 0.98 dynamic meter), equations (4) and (6) become

$$\Delta\Phi = 67.442\ T'_{mv} \log_{10} \frac{p_1}{p_2} = 67.442\ (273.16 + t'_{mv})\ \log_{10} \frac{p_1}{p_2} \qquad (4a)$$

$$\Delta\Phi_0 = 18422.5 \log_{10} \frac{p_1}{p_2} \qquad (6a)$$

Table 52 A gives $\Delta\Phi_0$ in geopotential meters between a given pressure and the nearest standard pressure surface above it. Table 52 B gives $\Delta\Phi$ in geopotential meters between successive standard pressure surfaces as a function of t'_{mv}. Table 52 C gives $\Delta\Phi_0$ in geopotential meters between a given pressure and the nearest standard pressure surface below it. Table 52 D gives values of $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ to be used in connection with the values obtained from Tables 52A and 52C to determine $\Delta\Phi$ in accordance with equation (5).

To evaluate geopotential in terms of geopotential meters:

1. Determine the geopotential of the surface level. (This quantity is approximately numerically equal to the elevation in meters of the surface level above mean sea level; for exact value see Table 50.)

[1] See Table 72 for definition of mean adjusted virtual temperature.

(*continued*)

GEOPOTENTIAL COMPUTATIONS

2. Determine the mean adjusted virtual temperature t'_{mv} (°C.):
   (a) between the surface level and the first standard pressure surface above it,
   (b) between each successive pair of standard pressure surfaces, and
   (c) between the highest point reached and the nearest standard pressure surface below it.
3. Determine $\Delta\Phi_0$ between the surface and the first standard pressure surface above it from Table 52 A. Determine $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ from Table 52 D as a function of t'_{mv} and $\Delta\Phi_0$. If $t'_{mv} > 0$°C. add the value of $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ to $\Delta\Phi_0$ to determine $\Delta\Phi$ for the layer, if $t'_{mv} < 0$°C. the value is to be subtracted. (Note that Table 52 D is given in an abbreviated form. Since the function $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ is linear in both $\Delta\Phi_0$ and t'_{mv} it can be readily obtained from the table for intermediate values of $\Delta\Phi_0$; e.g., if $\Delta\Phi_0 = 1260$ gpm. add together the values of $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ for $\Delta\Phi_0 = 1000$ gpm., 200 gpm., and 60 gpm. as determined from the table for the appropriate t'_{mv}.)
4. Determine $\Delta\Phi$ for the layers between each successive pair of standard pressure surfaces for the appropriate t'_{mv} from Table 52 B.
5. Determine $\Delta\Phi_0$ between the highest point reached and the nearest standard pressure surface below it from Table 52 C. Determine $\Delta\Phi_0 \frac{t'_{mv}}{T_0}$ from Table 52 D and obtain $\Delta\Phi$ for the layer as indicated by equation (5) (see step 3).
6. The geopotential at any level is the sum of the geopotential differences determined for all the layers between sea level and the level in question.

Table 51 gives the relationship between geopotential and heights measured in geometric units.

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 A.—Geopotential difference between a given pressure and the nearest standard pressure surface *above* it, for a mean adjusted virtual temperature of 0°C.

Geopotential differences from the	Pressure mb.	0 gpm.	1 gpm.	2 gpm.	3 gpm.	4 gpm.	5 gpm.	6 gpm.	7 gpm.	8 gpm.	9 gpm.
700 mb. surface	700		11	23	34	46	57	68	80	91	102
	710	113	125	136	147	158	170	181	192	203	214
	720	225	236	248	259	270	281	292	303	314	325
	730	336	347	358	369	379	390	401	412	423	434
	740	445	455	466	477	488	498	509	520	531	541
750 mb. surface	750		11	21	32	43	53	64	74	85	95
	760	106	116	127	137	148	158	169	179	190	200
	770	211	221	231	242	252	262	273	283	293	304
	780	314	324	334	345	355	365	375	385	395	406
	790	416	426	436	446	456	466	476	486	496	506
800 mb. surface	800		10	20	30	40	50	60	70	80	90
	810	99	109	119	129	139	149	158	168	178	188
	820	198	207	217	227	236	246	256	266	275	285
	830	295	304	314	323	333	343	352	362	371	381
	840	390	400	409	419	428	438	447	457	466	476
850 mb. surface	850		9	19	28	38	47	56	66	75	84
	860	94	103	112	121	131	140	149	158	168	177
	870	186	195	204	214	223	232	241	250	259	268
	880	278	287	296	305	314	323	332	341	350	359
	890	368	377	386	395	404	413	422	431	440	448
900 mb. surface	900		9	18	27	35	44	53	62	71	80
	910	88	97	106	115	123	132	141	150	158	167
	920	176	185	193	202	211	219	228	236	245	254
	930	262	271	280	288	297	305	314	322	331	339
	940	348	356	365	373	382	390	399	407	416	424
950 mb. surface	950		8	17	25	34	42	50	59	67	75
	960	84	92	100	109	117	125	134	142	150	158
	970	167	175	183	191	200	208	216	224	232	241
	980	249	257	265	273	281	289	298	306	314	322
	990	330	338	346	354	362	370	378	386	394	402
1000 mb. surface	1000		8	16	24	32	40	48	56	64	72
	1010	80	88	95	103	111	119	127	135	143	151
	1020	158	166	174	182	190	198	205	213	221	229
	1030	236	244	252	260	268	275	283	291	298	306
	1040	314	321	329	337	345	352	360	367	375	383
1050 mb. surface	1050		8	15	23	30	38	46	53	61	68
	1060	76	83	91	98	106	113	121	128	136	143
	1070	151	158	166	173	181	188	196	203	211	218
	1080	225	233	240	248	255	262	270	277	284	292
	1090	299	306	314	321	328	336	343	350	358	365

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 A.—Geopotential difference between a given pressure and the nearest standard pressure surface *above* it, for a mean adjusted virtual temperature of 0°C.

Geopotential differences from the	Pressure mb.	0	1	2	3	4	5	6	7	8	9
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
400 mb. surface	400		20	40	60	80	99	119	139	158	178
	410	198	217	236	256	275	295	314	333	352	371
	420	390	409	428	447	466	485	504	523	541	560
	430	579	597	616	634	653	671	689	708	726	744
	440	763	781	799	817	835	853	871	889	907	925
	450	942	960	978	996	1013	1031	1048	1066	1083	1101
	460	1118	1136	1153	1170	1187	1205	1222	1239	1256	1273
	470	1290	1307	1324	1341	1358	1375	1392	1409	1425	1442
	480	1459	1475	1492	1509	1525	1542	1558	1575	1591	1607
	490	1624	1640	1656	1673	1689	1705	1721	1737	1753	1769
500 mb. surface	500		16	32	48	64	80	95	111	127	143
	510	158	174	190	205	221	236	252	268	283	298
	520	314	329	345	360	375	390	406	421	436	451
	530	466	481	496	511	526	541	556	571	586	601
	540	616	631	645	660	675	689	704	719	733	748
	550	763	777	792	806	821	835	849	864	878	892
	560	907	921	935	949	964	978	992	1006	1020	1034
	570	1048	1062	1076	1090	1104	1118	1132	1146	1160	1174
	580	1187	1201	1215	1229	1242	1256	1270	1283	1297	1311
	590	1324	1338	1351	1365	1378	1392	1405	1419	1432	1445
600 mb. surface	600		13	27	40	53	66	80	93	106	119
	610	132	145	158	171	185	198	211	224	236	249
	620	262	275	288	301	314	327	339	352	365	378
	630	390	403	416	428	441	454	466	479	491	504
	640	516	529	541	554	566	579	591	603	616	628
	650	640	653	665	677	689	702	714	726	738	750
	660	763	775	787	799	811	823	835	847	859	871
	670	883	895	907	919	930	942	954	966	978	990
	680	1001	1013	1025	1037	1048	1060	1072	1083	1095	1107
	690	1118	1130	1141	1153	1164	1176	1187	1199	1210	1222

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
850											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−70	340	338	337	335	333	332	330	328	327	325
	−60	357	355	354	352	350	348	347	345	343	342
	−50	374	372	370	369	367	365	364	362	360	359
	−40	390	389	387	385	384	382	380	379	377	375
	−30	407	405	404	402	400	399	397	395	394	392
	−20	424	422	420	419	417	415	414	412	410	409
	−10	441	439	437	436	434	432	431	429	427	426
	− 0	457	456	454	452	451	449	447	446	444	442
	+ 0	457	459	461	462	464	466	467	469	471	472
	10	474	476	477	479	481	482	484	486	487	489
	20	491	492	494	496	497	499	501	503	504	506
	30	508	509	511	513	514	516	518	519	521	523
	40	524	526	528	529	531	533	534	536	538	539
	50	541	543	544	546	548	549	551	553	554	556
900											
	−70	322	320	319	317	315	314	312	311	309	307
	−60	338	336	334	333	331	330	328	326	325	323
	−50	353	352	350	349	347	345	344	342	341	339
	−40	369	368	366	364	363	361	360	358	357	355
	−30	385	383	382	380	379	377	376	374	372	371
	−20	401	399	398	396	395	393	391	390	388	387
	−10	417	415	414	412	410	409	407	406	404	402
	− 0	433	431	429	428	426	425	423	421	420	418
	+ 0	433	434	436	437	439	440	442	444	445	447
	10	448	450	452	453	455	456	458	460	461	463
	20	464	466	467	469	471	472	474	475	477	479
	30	480	482	483	485	486	488	490	491	493	494
	40	496	498	499	501	502	504	505	507	509	510
	50	512	513	515	517	518	520	521	523	524	526
950											
	−70	305	304	302	301	299	298	296	295	293	292
	−60	320	319	317	316	314	313	311	310	308	307
	−50	335	334	332	331	329	328	326	325	323	322
	−40	350	349	347	346	344	343	341	340	338	337
	−30	365	364	362	361	359	358	356	355	353	352
	−20	380	379	377	376	374	373	371	370	368	367
	−10	395	394	392	391	389	388	386	385	383	382
	− 0	410	409	407	406	404	403	401	400	398	397
	+ 0	410	412	413	415	416	418	419	421	422	424
	10	425	427	428	430	431	433	434	436	437	439
	20	440	442	443	445	446	448	449	451	452	454
	30	455	457	458	460	461	463	464	466	467	469
	40	470	472	473	475	476	478	479	481	482	484
	50	486	487	489	490	492	493	495	496	498	499
1000											
	−70	290	289	287	286	285	283	282	280	279	277
	−60	305	303	302	300	299	297	296	295	293	292
	−50	319	317	316	315	313	312	310	309	307	306
	−40	333	332	330	329	327	326	325	323	322	320
	−30	347	346	345	343	342	340	339	337	336	335
	−20	362	360	359	357	356	355	353	352	350	349
	−10	376	375	373	372	370	369	367	366	365	363
	− 0	390	389	388	386	385	383	382	380	379	377
	+ 0	390	392	393	395	396	398	399	400	402	403
	10	405	406	408	409	410	412	413	415	416	418
	20	419	420	422	423	425	426	428	429	430	432
	30	433	435	436	438	439	440	442	443	445	446
	40	448	449	450	452	453	455	456	458	459	460
	50	462	463	465	466	468	469	470	472	473	475
1050											

(continued)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
600											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−70	917	913	908	904	899	895	890	886	881	877
	−60	962	958	953	949	944	940	935	931	926	922
	−50	1008	1003	999	994	990	985	980	976	971	967
	−40	1053	1048	1044	1039	1035	1030	1026	1021	1017	1012
	−30	1098	1093	1089	1084	1080	1075	1071	1066	1062	1057
	−20	1143	1139	1134	1129	1125	1120	1116	1111	1107	1102
	−10	1188	1184	1179	1175	1170	1166	1161	1157	1152	1148
	− 0	1233	1229	1224	1220	1215	1211	1206	1202	1197	1193
	+ 0	1233	1238	1242	1247	1251	1256	1260	1265	1269	1274
	10	1278	1283	1288	1292	1297	1301	1306	1310	1315	1319
	20	1324	1328	1333	1337	1342	1346	1351	1355	1360	1364
	30	1369	1373	1378	1382	1387	1391	1396	1400	1405	1409
	40	1414	1418	1423	1427	1432	1436	1441	1446	1450	1455
700											
	−70	411	409	407	404	402	400	398	396	394	392
	−60	431	429	427	425	423	421	419	417	415	413
	−50	451	449	447	445	443	441	439	437	435	433
	−40	471	469	467	465	463	461	459	457	455	453
	−30	491	489	487	485	483	481	479	477	475	473
	−20	512	510	508	506	503	501	499	497	495	493
	−10	532	530	528	526	524	522	520	518	516	514
	− 0	552	550	548	546	544	542	540	538	536	534
	+ 0	552	554	556	558	560	562	564	566	568	570
	10	572	574	576	578	580	582	584	586	588	590
	20	592	594	596	598	600	603	605	607	609	611
	30	613	615	617	619	621	623	625	627	629	631
	40	633	635	637	639	641	643	645	647	649	651
750											
	−70	384	382	380	378	376	375	373	371	369	367
	−60	403	401	399	397	395	393	392	390	388	386
	−50	422	420	418	416	414	412	411	409	407	405
	−40	441	439	437	435	433	431	429	428	426	424
	−30	460	458	456	454	452	450	448	446	445	443
	−20	479	477	475	473	471	469	467	465	463	462
	−10	497	496	494	492	490	488	486	484	482	480
	− 0	516	514	513	511	509	507	505	503	501	499
	+ 0	516	518	520	522	524	526	528	530	531	533
	10	535	537	539	541	543	545	547	548	550	552
	20	554	556	558	560	562	564	566	567	569	571
	30	573	575	577	579	581	583	584	586	588	590
	40	592	594	596	598	600	601	603	605	607	609
800											
	−70	361	359	357	355	354	352	350	348	347	345
	−60	379	377	375	373	371	370	368	366	364	363
	−50	396	394	393	391	389	387	386	384	382	380
	−40	414	412	410	409	407	405	403	402	400	398
	−30	432	430	428	426	425	423	421	419	418	416
	−20	450	448	446	444	442	441	439	437	435	434
	−10	467	466	464	462	460	458	457	455	453	451
	− 0	485	483	481	480	478	476	474	473	471	469
	+ 0	485	487	489	490	492	494	496	497	499	501
	10	503	505	506	508	510	512	513	515	517	519
	20	521	522	524	526	528	529	531	533	535	537
	30	538	540	542	544	545	547	549	551	553	554
	40	556	558	560	561	563	565	567	568	570	572
850											

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
300											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−70	917	913	908	904	899	895	890	886	881	877
	−60	962	958	953	949	944	940	935	931	926	922
	−50	1008	1003	999	994	990	985	980	976	971	967
	−40	1053	1048	1044	1039	1035	1030	1026	1021	1017	1012
	−30	1098	1093	1089	1084	1080	1075	1071	1066	1062	1057
	−20	1143	1139	1134	1129	1125	1120	1116	1111	1107	1102
	−10	1188	1184	1179	1175	1170	1166	1161	1157	1152	1148
	− 0	1233	1229	1224	1220	1215	1211	1206	1202	1197	1193
	+ 0	1233	1238	1242	1247	1251	1256	1260	1265	1269	1274
	10	1278	1283	1288	1292	1297	1301	1306	1310	1315	1319
	20	1324	1328	1333	1337	1342	1346	1351	1355	1360	1364
350											
	−70	795	791	787	783	779	775	771	767	763	759
	−60	834	830	826	822	818	814	810	806	802	798
	−50	873	869	865	861	857	853	849	845	842	838
	−40	912	908	904	900	896	892	888	885	881	877
	−30	951	947	943	939	935	931	928	924	920	916
	−20	990	986	982	978	974	971	967	963	959	955
	−10	1029	1025	1021	1018	1014	1010	1006	1002	998	994
	− 0	1068	1064	1061	1057	1053	1049	1045	1041	1037	1033
	+ 0	1068	1072	1076	1080	1084	1088	1092	1096	1100	1104
	10	1107	1111	1115	1119	1123	1127	1131	1135	1139	1143
	20	1147	1150	1154	1158	1162	1166	1170	1174	1178	1182
400											
	−70	1328	1321	1315	1308	1302	1295	1289	1282	1276	1269
	−60	1393	1387	1380	1374	1367	1360	1354	1347	1341	1334
	−50	1459	1452	1445	1439	1432	1426	1419	1413	1406	1400
	−40	1524	1517	1511	1504	1498	1491	1485	1478	1472	1465
	−30	1589	1583	1576	1570	1563	1557	1550	1543	1537	1530
	−20	1655	1648	1642	1635	1628	1622	1615	1609	1602	1596
	−10	1720	1713	1707	1700	1694	1687	1681	1674	1668	1661
	− 0	1785	1779	1772	1766	1759	1753	1746	1740	1733	1726
	+ 0	1785	1792	1798	1805	1811	1818	1825	1831	1838	1844
	10	1851	1857	1864	1870	1877	1883	1890	1896	1903	1910
	20	1916	1923	1929	1936	1942	1949	1955	1962	1968	1975
	30	1981	1988	1994	2001	2008	2014	2021	2027	2034	2040
500											
	−70	1085	1080	1074	1069	1064	1058	1053	1048	1042	1037
	−60	1138	1133	1128	1122	1117	1112	1106	1101	1096	1090
	−50	1192	1186	1181	1176	1170	1165	1160	1154	1149	1144
	−40	1245	1240	1234	1229	1224	1218	1213	1208	1202	1197
	−30	1299	1293	1288	1282	1277	1272	1266	1261	1256	1250
	−20	1352	1347	1341	1336	1331	1325	1320	1315	1309	1304
	−10	1405	1400	1395	1389	1384	1379	1373	1368	1363	1357
	− 0	1459	1453	1448	1443	1437	1432	1427	1421	1416	1411
	+ 0	1459	1464	1469	1475	1480	1485	1491	1496	1501	1507
	10	1512	1517	1523	1528	1533	1539	1544	1549	1555	1560
	20	1566	1571	1576	1582	1587	1592	1598	1603	1608	1614
	30	1619	1624	1630	1635	1640	1646	1651	1656	1662	1667
600											

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
150											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−90	827	822	818	813	809	804	800	795	791	786
	−80	872	868	863	859	854	850	845	841	836	831
	−70	917	913	908	904	899	895	890	886	881	877
	−60	962	958	953	949	944	940	935	931	926	922
	−50	1008	1003	999	994	990	985	980	976	971	967
	−40	1053	1048	1044	1039	1035	1030	1026	1021	1017	1012
	−30	1098	1093	1089	1084	1080	1075	1071	1066	1062	1057
	−20	1143	1139	1134	1129	1125	1120	1116	1111	1107	1102
	−10	1188	1184	1179	1175	1170	1166	1161	1157	1152	1148
	− 0	1233	1229	1224	1220	1215	1211	1206	1202	1197	1193
	+ 0	1233	1238	1242	1247	1251	1256	1260	1265	1269	1274
175											
	−90	716	712	709	705	701	697	693	689	685	681
	−80	755	752	748	744	740	736	732	728	724	720
	−70	795	791	787	783	779	775	771	767	763	759
	−60	834	830	826	822	818	814	810	806	802	798
	−50	873	869	865	861	857	853	849	845	842	838
	−40	912	908	904	900	896	892	888	885	881	877
	−30	951	947	943	939	935	931	928	924	920	916
	−20	990	986	982	978	974	971	967	963	959	955
	−10	1029	1025	1021	1018	1014	1010	1006	1002	998	994
	− 0	1068	1064	1061	1057	1053	1049	1045	1041	1037	1033
	+ 0	1068	1072	1076	1080	1084	1088	1092	1096	1100	1104
	10	1107	1111	1115	1119	1123	1127	1131	1135	1139	1143
200											
	−80	1262	1256	1249	1243	1236	1230	1223	1217	1210	1204
	−70	1328	1321	1315	1308	1302	1295	1289	1282	1276	1269
	−60	1393	1387	1380	1374	1367	1360	1354	1347	1341	1334
	−50	1459	1452	1445	1439	1432	1426	1419	1413	1406	1400
	−40	1524	1517	1511	1504	1498	1491	1485	1478	1472	1465
	−30	1589	1583	1576	1570	1563	1557	1550	1543	1537	1530
	−20	1655	1648	1642	1635	1628	1622	1615	1609	1602	1596
	−10	1720	1713	1707	1700	1694	1687	1681	1674	1668	1661
	− 0	1785	1779	1772	1766	1759	1753	1746	1740	1733	1726
	+ 0	1785	1792	1798	1805	1811	1818	1825	1831	1838	1844
	10	1851	1857	1864	1870	1877	1883	1890	1896	1903	1910
250											
	−80	1032	1026	1021	1015	1010	1005	999	994	989	983
	−70	1085	1080	1074	1069	1064	1058	1053	1048	1042	1037
	−60	1138	1133	1128	1122	1117	1112	1106	1101	1096	1090
	−50	1192	1186	1181	1176	1170	1165	1160	1154	1149	1144
	−40	1245	1240	1234	1229	1224	1218	1213	1208	1202	1197
	−30	1299	1293	1288	1282	1277	1272	1266	1261	1256	1250
	−20	1352	1347	1341	1336	1331	1325	1320	1315	1309	1304
	−10	1405	1400	1395	1389	1384	1379	1373	1368	1363	1357
	− 0	1459	1453	1448	1443	1437	1432	1427	1421	1416	1411
	+ 0	1459	1464	1469	1475	1480	1485	1491	1496	1501	1507
	10	1512	1517	1523	1528	1533	1539	1544	1549	1555	1560
300											

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
60											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−100	1459	1451	1442	1434	1425	1417	1409	1400	1392	1383
	− 90	1543	1535	1526	1518	1510	1501	1493	1484	1476	1467
	− 80	1628	1619	1611	1602	1594	1585	1577	1569	1560	1552
	− 70	1712	1703	1695	1687	1678	1670	1661	1653	1644	1636
	− 60	1796	1788	1779	1771	1762	1754	1746	1737	1729	1720
	− 50	1880	1872	1864	1855	1847	1838	1830	1821	1813	1805
	− 40	1965	1956	1948	1939	1931	1923	1914	1906	1897	1889
	− 30	2049	2040	2032	2024	2015	2007	1998	1990	1981	1973
	− 20	2133	2125	2116	2108	2099	2091	2083	2074	2066	2057
	− 10	2217	2209	2201	2192	2184	2175	2167	2158	2150	2142
	− 0	2302	2293	2285	2276	2268	2260	2251	2243	2234	2226
80											
	−100	1132	1125	1119	1112	1106	1099	1093	1086	1079	1073
	− 90	1197	1191	1184	1177	1171	1164	1158	1151	1145	1138
	− 80	1262	1256	1249	1243	1236	1230	1223	1217	1210	1204
	− 70	1328	1321	1315	1308	1302	1295	1289	1282	1276	1269
	− 60	1393	1387	1380	1374	1367	1360	1354	1347	1341	1334
	− 50	1459	1452	1445	1439	1432	1426	1419	1413	1406	1400
	− 40	1524	1517	1511	1504	1498	1491	1485	1478	1472	1465
	− 30	1589	1583	1576	1570	1563	1557	1550	1543	1537	1530
	− 20	1655	1648	1642	1635	1628	1622	1615	1609	1602	1596
	− 10	1720	1713	1707	1700	1694	1687	1681	1674	1668	1661
	− 0	1785	1779	1772	1766	1759	1753	1746	1740	1733	1726
100											
	− 90	1197	1191	1184	1177	1171	1164	1158	1151	1145	1138
	− 80	1262	1256	1249	1243	1236	1230	1223	1217	1210	1204
	− 70	1328	1321	1315	1308	1302	1295	1289	1282	1276	1269
	− 60	1393	1387	1380	1374	1367	1360	1354	1347	1341	1334
	− 50	1459	1452	1445	1439	1432	1426	1419	1413	1406	1400
	− 40	1524	1517	1511	1504	1498	1491	1485	1478	1472	1465
	− 30	1589	1583	1576	1570	1563	1557	1550	1543	1537	1530
	− 20	1655	1648	1642	1635	1628	1622	1615	1609	1602	1596
	− 10	1720	1713	1707	1700	1694	1687	1681	1674	1668	1661
	− 0	1785	1779	1772	1766	1759	1753	1746	1740	1733	1726
125											
	− 90	978	973	967	962	957	951	946	941	935	930
	− 80	1032	1026	1021	1015	1010	1005	999	994	989	983
	− 70	1085	1080	1074	1069	1064	1058	1053	1048	1042	1037
	− 60	1138	1133	1128	1122	1117	1112	1106	1101	1096	1090
	− 50	1192	1186	1181	1176	1170	1165	1160	1154	1149	1144
	− 40	1245	1240	1234	1229	1224	1218	1213	1208	1202	1197
	− 30	1299	1293	1288	1282	1277	1272	1266	1261	1256	1250
	− 20	1352	1347	1341	1336	1331	1325	1320	1315	1309	1304
	− 10	1405	1400	1395	1389	1384	1379	1373	1368	1363	1357
	− 0	1459	1453	1448	1443	1437	1432	1427	1421	1416	1411
	+ 0	1459	1464	1469	1475	1480	1485	1491	1496	1501	1507
150											

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
20											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−100	2056	2045	2033	2021	2009	1997	1985	1973	1961	1950
	− 90	2175	2163	2151	2140	2128	2116	2104	2092	2080	2068
	− 80	2294	2282	2270	2258	2246	2235	2223	2211	2199	2187
	− 70	2413	2401	2389	2377	2365	2353	2341	2330	2318	2306
	− 60	2531	2520	2508	2496	2484	2472	2460	2448	2436	2425
	− 50	2650	2638	2626	2615	2603	2591	2579	2567	2555	2543
	− 40	2769	2757	2745	2733	2721	2710	2698	2686	2674	2662
	− 30	2888	2876	2864	2852	2840	2828	2817	2805	2793	2781
	− 20	3007	2995	2983	2971	2959	2947	2935	2923	2912	2900
	− 10	3125	3113	3102	3090	3078	3066	3054	3042	3030	3018
	− 0	3244	3232	3220	3208	3197	3185	3173	3161	3149	3137
30											
	−100	1459	1451	1442	1434	1425	1417	1409	1400	1392	1383
	− 90	1543	1535	1526	1518	1510	1501	1493	1484	1476	1467
	− 80	1628	1619	1611	1602	1594	1585	1577	1569	1560	1552
	− 70	1712	1703	1695	1687	1678	1670	1661	1653	1644	1636
	− 60	1796	1788	1779	1771	1762	1754	1746	1737	1729	1720
	− 50	1880	1872	1864	1855	1847	1838	1830	1821	1813	1805
	− 40	1965	1956	1948	1939	1931	1923	1914	1906	1897	1889
	− 30	2049	2040	2032	2024	2015	2007	1998	1990	1981	1973
	− 20	2133	2125	2116	2108	2099	2091	2083	2074	2066	2057
	− 10	2217	2209	2201	2192	2184	2175	2167	2158	2150	2142
	− 0	2302	2293	2285	2276	2268	2260	2251	2243	2234	2226
40											
	−100	1132	1125	1119	1112	1106	1099	1093	1086	1079	1073
	− 90	1197	1191	1184	1177	1171	1164	1158	1151	1145	1138
	− 80	1262	1256	1249	1243	1236	1230	1223	1217	1210	1204
	− 70	1328	1321	1315	1308	1302	1295	1289	1282	1276	1269
	− 60	1393	1387	1380	1374	1367	1360	1354	1347	1341	1334
	− 50	1459	1452	1445	1439	1432	1426	1419	1413	1406	1400
	− 40	1524	1517	1511	1504	1498	1491	1485	1478	1472	1465
	− 30	1589	1583	1576	1570	1563	1557	1550	1543	1537	1530
	− 20	1655	1648	1642	1635	1628	1622	1615	1609	1602	1596
	− 10	1720	1713	1707	1700	1694	1687	1681	1674	1668	1661
	− 0	1785	1779	1772	1766	1759	1753	1746	1740	1733	1726
50											
	−100	925	919	914	909	903	898	893	887	882	877
	− 90	978	973	967	962	957	951	946	941	935	930
	− 80	1032	1026	1021	1015	1010	1005	999	994	989	983
	− 70	1085	1080	1074	1069	1064	1058	1053	1048	1042	1037
	− 60	1138	1133	1128	1122	1117	1112	1106	1101	1096	1090
	− 50	1192	1186	1181	1176	1170	1165	1160	1154	1149	1144
	− 40	1245	1240	1234	1229	1224	1218	1213	1208	1202	1197
	− 30	1299	1293	1288	1282	1277	1272	1266	1261	1256	1250
	− 20	1352	1347	1341	1336	1331	1325	1320	1315	1309	1304
	− 10	1405	1400	1395	1389	1384	1379	1373	1368	1363	1357
	− 0	1459	1453	1448	1443	1437	1432	1427	1421	1416	1411
60											

(continued)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 B.—Geopotential differences between consecutive standard isobaric surfaces for various mean adjusted virtual temperatures (t'_{mv})

Standard isobaric surface mb.	t'_{mv} °C.	0	1	2	3	4	5	6	7	8	9
5											
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
	−100	3516	3495	3475	3455	3434	3414	3394	3373	3353	3333
	− 90	3719	3698	3678	3658	3637	3617	3597	3576	3556	3536
	− 80	3922	3901	3881	3861	3840	3820	3800	3779	3759	3739
	− 70	4125	4104	4084	4064	4043	4023	4003	3982	3962	3942
	− 60	4328	4307	4287	4267	4246	4226	4206	4185	4165	4145
	− 50	4531	4510	4490	4470	4449	4429	4409	4388	4368	4348
	− 40	4734	4713	4693	4673	4652	4632	4612	4592	4571	4551
	− 30	4937	4916	4896	4876	4855	4835	4815	4795	4774	4754
	− 20	5140	5119	5099	5079	5058	5038	5018	4998	4977	4957
	− 10	5343	5322	5302	5282	5261	5241	5221	5201	5180	5160
	− 0	5546	5525	5505	5485	5465	5444	5424	5404	5383	5363
10											
	−100	2056	2045	2033	2021	2009	1997	1985	1973	1961	1950
	− 90	2175	2163	2151	2140	2128	2116	2104	2092	2080	2068
	− 80	2294	2282	2270	2258	2246	2235	2223	2211	2199	2187
	− 70	2413	2401	2389	2377	2365	2353	2341	2330	2318	2306
	− 60	2531	2520	2508	2496	2484	2472	2460	2448	2436	2425
	− 50	2650	2638	2626	2615	2603	2591	2579	2567	2555	2543
	− 40	2769	2757	2745	2733	2721	2710	2698	2686	2674	2662
	− 30	2888	2876	2864	2852	2840	2828	2817	2805	2793	2781
	− 20	3007	2995	2983	2971	2959	2947	2935	2923	2912	2900
	− 10	3125	3113	3102	3090	3078	3066	3054	3042	3030	3018
	− 0	3244	3232	3220	3208	3197	3185	3173	3161	3149	3137
15											
	−100	1459	1451	1442	1434	1425	1417	1409	1400	1392	1383
	− 90	1543	1535	1526	1518	1510	1501	1493	1484	1476	1467
	− 80	1628	1619	1611	1602	1594	1585	1577	1569	1560	1552
	− 70	1712	1703	1695	1687	1678	1670	1661	1653	1644	1636
	− 60	1796	1788	1779	1771	1762	1754	1746	1737	1729	1720
	− 50	1880	1872	1864	1855	1847	1838	1830	1821	1813	1805
	− 40	1965	1956	1948	1939	1931	1923	1914	1906	1897	1889
	− 30	2049	2040	2032	2024	2015	2007	1998	1990	1981	1973
	− 20	2133	2125	2116	2108	2099	2091	2083	2074	2066	2057
	− 10	2217	2209	2201	2192	2184	2175	2167	2158	2150	2142
	− 0	2302	2293	2285	2276	2268	2260	2251	2243	2234	2226
20											

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 C.—Geopotential difference between a given pressure and the nearest standard pressure surface *below* it, for a mean adjusted virtual temperature of 0°C.

Geopotential differences from the	Pressure mb.	0	1	2	3	4	5	6	7	8	9
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
700 mb. surface	600	1233	1220	1207	1193	1180	1167	1154	1141	1127	1114
	610	1101	1088	1075	1062	1049	1036	1023	1010	997	984
	620	971	958	945	932	920	907	894	881	868	856
	630	843	830	818	805	792	780	767	755	742	729
	640	717	704	692	680	667	655	642	630	618	605
	650	593	581	568	556	544	532	519	507	495	483
	660	471	459	447	434	422	410	398	386	374	362
	670	350	339	327	315	303	291	279	267	255	244
	680	232	220	208	197	185	173	162	150	138	127
	690	115	104	92	80	69	57	46	34	23	11
750 mb. surface	700	552	541	529	518	506	495	484	472	461	450
	710	439	427	416	405	394	382	371	360	349	338
	720	327	316	304	293	282	271	260	249	238	227
	730	216	205	194	183	173	162	151	140	129	118
	740	107	97	86	75	64	54	43	32	21	11
800 mb. surface	750	516	506	495	484	474	463	453	442	431	421
	760	410	400	389	379	368	358	347	337	327	316
	770	306	295	285	275	264	254	244	233	223	213
	780	203	192	182	172	162	151	141	131	121	111
	790	101	91	80	70	60	50	40	30	20	10
850 mb. surface	800	485	475	465	455	445	435	425	415	405	396
	810	386	376	366	356	346	336	327	317	307	297
	820	287	278	268	258	249	239	229	219	210	200
	830	191	181	171	162	152	142	133	123	114	104
	840	95	85	76	66	57	47	38	28	19	9
900 mb. surface	850	457	448	439	429	420	410	401	392	382	373
	860	364	354	345	336	327	317	308	299	290	280
	870	271	262	253	244	235	225	216	207	198	189
	880	180	171	162	153	144	134	125	116	107	98
	890	89	80	71	62	54	45	36	27	18	9
950 mb. surface	900	433	424	415	406	397	388	379	371	362	353
	910	344	335	327	318	309	300	292	283	274	265
	920	257	248	239	231	222	213	205	196	187	179
	930	170	162	153	144	136	127	119	110	102	93
	940	85	76	68	59	51	42	34	25	17	8
1000 mb. surface	950	410	402	394	385	377	368	360	352	343	335
	960	327	318	310	302	293	285	277	268	260	252
	970	244	235	227	219	211	203	194	186	178	170
	980	162	153	145	137	129	121	113	105	97	88
	990	80	72	64	56	48	40	32	24	16	8
1050 mb. surface	1000	390	382	374	366	358	350	342	335	327	319
	1010	311	303	295	287	279	271	263	255	248	240
	1020	232	224	216	208	201	193	185	177	169	162
	1030	154	146	138	131	123	115	107	100	92	84
	1040	77	69	61	54	46	38	31	23	15	8

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 C.—Geopotential difference between a given pressure and the nearest standard pressure surface *below* it, for a mean adjusted virtual temperature of 0°C.

Geopotential differences from the	Pressure mb.	0	1	2	3	4	5	6	7	8	9
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
300 mb. surface	250	1459	1427	1395	1363	1332	1300	1269	1238	1207	1176
	260	1145	1114	1084	1053	1023	993	962	932	902	873
	270	843	813	784	755	725	696	667	638	609	581
	280	552	523	495	467	439	410	382	354	327	299
	290	271	244	216	189	162	134	107	80	54	27
350 mb. surface	300	1233	1207	1180	1154	1127	1101	1075	1049	1023	997
	310	971	945	920	894	868	843	818	792	767	742
	320	717	692	667	642	618	593	568	544	519	495
	330	471	447	422	398	374	350	327	303	279	255
	340	232	208	185	162	138	115	92	69	46	23
400 mb. surface	350	1068	1046	1023	1000	977	955	932	910	888	865
	360	843	821	799	777	755	733	711	689	667	645
	370	624	602	581	559	538	516	495	474	453	431
	380	410	389	368	347	327	306	285	264	244	223
	390	203	182	162	141	121	101	80	60	40	20
500 mb. surface	400	1785	1765	1745	1726	1706	1686	1666	1647	1627	1607
	410	1588	1568	1549	1529	1510	1491	1472	1452	1433	1414
	420	1395	1376	1357	1338	1319	1300	1281	1263	1244	1225
	430	1207	1188	1170	1151	1133	1114	1096	1078	1059	1041
	440	1023	1005	986	968	950	932	914	896	879	861
	450	843	825	807	790	772	755	737	719	702	685
	460	667	650	632	615	598	581	563	546	529	512
	470	495	478	461	444	427	410	394	377	360	343
	480	327	310	293	277	260	244	227	211	194	178
	490	162	145	129	113	97	80	64	48	32	16
600 mb. surface	500	1459	1443	1427	1411	1395	1379	1363	1347	1332	1316
	510	1300	1285	1269	1253	1238	1222	1207	1191	1176	1160
	520	1145	1130	1114	1099	1084	1068	1053	1038	1023	1008
	530	993	977	962	947	932	917	902	888	873	858
	540	843	828	813	799	784	769	755	740	725	711
	550	696	682	667	653	638	624	609	595	581	566
	560	552	538	523	509	495	481	467	453	439	424
	570	410	396	382	368	354	341	327	313	299	285
	580	271	257	244	230	216	203	189	175	162	148
	590	134	121	107	94	80	67	54	40	27	13

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 C.—Geopotential difference between a given pressure and the nearest standard pressure surface *below* it, for a mean adjusted virtual temperature of 0°C.

Geopotential differences from the	Pressure mb.	0	1	2	3	4	5	6	7	8	9
		gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
10 mb. surface	5	....	....	....	....	....	5546	4087	2854	1785	843
15 mb. surface	10	3244	2481	1785	1145	552	....	....	....	....	....
20 mb. surface	15	....	....	....	....	....	2302	1785	1300	843	410
30 mb. surface	20	3244	2854	2481	2126	1785	1459	1145	843	552	271
40 mb. surface	30	2302	2039	1785	1539	1300	1068	843	624	410	203
50 mb. surface	40	1785	1588	1395	1207	1023	843	667	495	327	162
60 mb. surface	50	1459	1300	1145	993	843	696	552	410	271	134
80 mb. surface	60	2302	2169	2039	1911	1785	1661	1539	1419	1300	1183
	70	1068	955	843	733	624	516	410	306	203	101
100 mb. surface	80	1785	1686	1588	1491	1395	1300	1207	1114	1023	932
	90	843	755	667	581	495	410	327	244	162	80
125 mb. surface	100	1785	1706	1627	1549	1472	1395	1319	1244	1170	1096
	110	1023	950	879	807	737	667	598	529	461	394
	120	327	260	194	129	64	....	....	....	....	....
150 mb. surface	125	....	....	....	....	....	1459	1395	1332	1269	1207
	130	1145	1084	1023	962	902	843	784	725	667	609
	140	552	495	439	382	327	271	216	162	107	54
175 mb. surface	150	1233	1180	1127	1075	1023	971	920	868	818	767
	160	717	667	618	568	519	471	422	374	327	279
	170	232	185	138	92	46	....	....	....	....	....
200 mb. surface	175	....	....	....	....	....	1068	1023	977	932	888
	180	843	799	755	711	667	624	581	538	495	453
	190	410	368	327	285	244	203	162	121	80	40
250 mb. surface	200	1785	1745	1706	1666	1627	1588	1549	1510	1472	1433
	210	1395	1357	1319	1281	1244	1207	1170	1133	1096	1059
	220	1023	986	950	914	879	843	807	772	737	702
	230	667	632	598	563	529	495	461	427	394	360
	240	327	293	260	227	194	162	129	97	64	32

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 D.—Correction to geopotential differences given in Tables 52 A and 52 C as a function of departure of mean adjusted virtual temperature from 0°C.

For temperatures above/below 0°C. the values are to be added/subtracted.

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
10	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
20	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
30	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2
40	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3
50	0	0	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3
60	0	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4
70	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5
80	0	1	1	1	1	2	2	2	3	3	3	4	4	4	4	5	5	5
90	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6
100	0	1	1	1	2	2	3	3	3	4	4	4	5	5	5	6	6	7
200	1	1	2	3	4	4	5	6	7	7	8	9	10	10	11	12	12	13
300	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	18	19	20
400	1	3	4	6	7	9	10	12	13	15	16	18	19	21	22	23	25	26
500	2	4	5	7	9	11	13	15	16	18	20	22	24	26	27	29	31	33
600	2	4	7	9	11	13	15	18	20	22	24	26	29	31	33	35	37	40
700	3	5	8	10	13	15	18	21	23	26	28	31	33	36	38	41	44	46
800	3	6	9	12	15	18	21	23	26	29	32	35	38	41	44	47	50	53
900	3	7	10	13	16	20	23	26	30	33	36	40	43	46	49	53	56	59
1000	4	7	11	15	18	22	26	29	33	37	40	44	48	51	55	59	62	66
2000	7	15	22	29	37	44	51	59	66	73	81	88	95	103	110	117	124	132
3000	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198
4000	15	29	44	59	73	88	103	117	132	146	161	176	190	205	220	234	249	264
5000	18	37	55	73	92	110	128	146	165	183	201	220	238	256	275	293	311	329

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
30	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4
40	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5
50	3	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	7
60	4	4	5	5	5	5	5	6	6	6	6	7	7	7	7	7	8	8
70	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	9	9	9
80	6	6	6	6	7	7	7	8	8	8	8	9	9	9	10	10	10	11
90	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12
100	7	7	8	8	8	9	9	10	10	10	11	11	11	12	12	12	13	13
200	14	15	15	16	17	18	18	19	20	21	21	22	23	23	24	25	26	26
300	21	22	23	24	25	26	27	29	30	31	32	33	34	35	36	37	38	40
400	28	29	31	32	34	35	37	38	40	41	42	44	45	47	48	50	51	53
500	35	37	38	40	42	44	46	48	49	51	53	55	57	59	60	62	64	66
600	42	44	46	48	51	53	55	57	59	62	64	66	68	70	72	75	77	79
700	49	51	54	56	59	62	64	67	69	72	74	77	79	82	85	87	90	92
800	56	59	62	64	67	70	73	76	79	82	85	88	91	94	97	100	103	105
900	63	66	69	72	76	79	82	86	89	92	96	99	102	105	109	112	115	119
1000	70	73	77	81	84	88	92	95	99	103	106	110	113	117	121	124	128	132
2000	139	146	154	161	168	176	183	190	198	205	212	220	227	234	242	249	256	264
3000	209	220	231	242	253	264	275	286	297	308	318	329	340	351	362	373	384	395
4000	278	293	308	322	337	351	366	381	395	410	425	439	454	469	483	498	513	527
5000	348	366	384	403	421	439	458	476	494	513	531	549	567	586	604	622	641	659

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 D.—Correction to geopotential differences given in Tables 52 A and 52 C as a function of departure of mean adjusted virtual temperature from 0°C.

For temperatures above/below 0°C. the values are to be added/subtracted.

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
10	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4
30	4	4	4	4	5	5	5	5	5	5	5	5	5	5	6	6	6	6
40	5	6	6	6	6	6	6	6	7	7	7	7	7	7	7	8	8	8
50	7	7	7	7	8	8	8	8	8	8	9	9	9	9	9	10	10	10
60	8	8	9	9	9	9	9	10	10	10	10	11	11	11	11	11	12	12
70	9	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14
80	11	11	11	12	12	12	13	13	13	13	14	14	14	15	15	15	16	16
90	12	13	13	13	14	14	14	14	15	15	15	16	16	16	17	17	17	18
100	14	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	19	20
200	27	28	29	29	30	31	31	32	33	34	34	35	36	37	37	38	39	40
300	41	42	43	44	45	46	47	48	49	51	52	53	54	55	56	57	58	59
400	54	56	57	59	60	62	63	64	66	67	69	70	72	73	75	76	78	79
500	68	70	71	73	75	77	79	81	82	84	86	88	90	92	93	95	97	99
600	81	83	86	88	90	92	94	97	99	101	103	105	108	110	112	114	116	119
700	95	97	100	103	105	108	110	113	115	118	120	123	126	128	131	133	136	138
800	108	111	114	117	120	123	126	129	132	135	138	141	144	146	149	152	155	158
900	122	125	128	132	135	138	142	145	148	152	155	158	161	165	168	171	175	178
1000	135	139	143	146	150	154	157	161	165	168	172	176	179	183	187	190	194	198
2000	271	278	286	293	300	308	315	322	329	337	344	351	359	366	373	381	388	395
3000	406	417	428	439	450	461	472	483	494	505	516	527	538	549	560	571	582	593
4000	542	556	571	586	600	615	630	644	659	674	688	703	718	732	747	761	776	791
5000	677	696	714	732	750	769	787	805	824	842	860	879	897	915	934	952	970	988

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
20	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5
30	6	6	6	6	6	7	7	7	7	7	7	7	7	7	8	8
40	8	8	8	8	9	9	9	9	9	9	10	10	10	10	10	10
50	10	10	10	11	11	11	11	11	12	12	12	12	12	12	13	13
60	12	12	13	13	13	13	13	14	14	14	14	14	15	15	15	15
70	14	14	15	15	15	15	16	16	16	16	17	17	17	17	18	18
80	16	16	17	17	17	18	18	18	18	19	19	19	20	20	20	21
90	18	18	19	19	19	20	20	20	21	21	21	22	22	22	23	23
100	20	21	21	21	22	22	22	23	23	23	24	24	25	25	25	26
200	40	41	42	42	43	44	45	45	46	47	48	48	49	50	51	51
300	60	62	63	64	65	66	67	68	69	70	71	72	74	75	76	77
400	81	82	83	85	86	88	89	91	92	94	95	97	98	100	101	103
500	101	103	104	106	108	110	112	113	115	117	119	121	123	124	126	128
600	121	123	125	127	130	132	134	136	138	141	143	145	147	149	152	154
700	141	144	146	149	151	154	156	159	161	164	167	169	172	174	177	179
800	161	164	167	170	173	176	179	182	185	187	190	193	196	199	202	205
900	181	185	188	191	194	198	201	204	208	211	214	217	221	224	227	231
1000	201	205	209	212	216	220	223	227	231	234	238	242	245	249	253	256
2000	403	410	417	425	432	439	447	454	461	469	476	483	491	498	505	513
3000	604	615	626	637	648	659	670	681	692	703	714	725	736	747	758	769
4000	805	820	835	849	864	879	893	908	923	937	952	966	981	996	1010	1025
5000	1007	1025	1043	1062	1080	1098	1117	1135	1153	1171	1190	1208	1226	1245	1263	1281

(*continued*)

GEOPOTENTIAL COMPUTATIONS

TABLE 52 D.—Correction to geopotential differences given in Tables 52 A and 52 C as a function of departure of mean adjusted virtual temperatures from 0°C.

For temperatures above / below 0°C. the values are to be added. / subtracted.

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6
30	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9
40	10	11	11	11	11	11	11	11	12	12	12	12	12	12	12
50	13	13	13	14	14	14	14	14	14	15	15	15	15	15	16
60	16	16	16	16	16	17	17	17	17	18	18	18	18	18	19
70	18	18	19	19	19	19	20	20	20	21	21	21	21	22	22
80	21	21	21	22	22	22	23	23	23	23	24	24	24	25	25
90	23	24	24	24	25	25	25	26	26	26	27	27	27	28	28
100	26	26	27	27	27	28	28	29	29	29	30	30	30	31	31
200	52	53	53	54	55	56	56	57	58	59	59	60	61	62	62
300	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93
400	104	105	107	108	110	111	113	114	116	117	119	120	122	123	124
500	130	132	134	135	137	139	141	143	145	146	148	150	152	154	156
600	156	158	160	163	165	167	169	171	174	176	178	180	182	185	187
700	182	185	187	190	192	195	197	200	202	205	208	210	213	215	218
800	208	211	214	217	220	223	226	228	231	234	237	240	243	246	249
900	234	237	241	244	247	250	254	257	260	264	267	270	273	277	280
1000	260	264	267	271	275	278	282	286	289	293	297	300	304	308	311
2000	520	527	534	542	549	556	564	571	578	586	593	600	608	615	622
3000	780	791	802	813	824	835	846	857	868	879	890	901	912	923	934
4000	1040	1054	1069	1084	1098	1113	1128	1142	1157	1171	1186	1201	1215	1230	1245
5000	1300	1318	1336	1355	1373	1391	1409	1428	1446	1464	1483	1501	1519	1538	1556

Geo-potential difference gpm.	Mean adjusted virtual temperature—°C. 86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
10	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
20	6	6	6	7	7	7	7	7	7	7	7	7	7	7	7
30	9	10	10	10	10	10	10	10	10	10	11	11	11	11	11
40	13	13	13	13	13	13	13	14	14	14	14	14	14	14	15
50	16	16	16	16	16	17	17	17	17	17	18	18	18	18	18
60	19	19	19	20	20	20	20	20	21	21	21	21	22	22	22
70	22	22	23	23	23	23	24	24	24	24	25	25	25	25	26
80	25	25	26	26	26	27	27	27	28	28	28	28	29	29	29
90	28	29	29	29	30	30	30	31	31	31	32	32	32	33	33
100	31	32	32	33	33	33	34	34	34	35	35	36	36	36	37
200	63	64	64	65	66	67	67	68	69	70	70	71	72	72	73
300	94	96	97	98	99	100	101	102	103	104	105	107	108	109	110
400	126	127	129	130	132	133	135	136	138	139	141	142	144	145	146
500	157	159	161	163	165	167	168	170	172	174	176	178	179	181	183
600	189	191	193	195	198	200	202	204	206	209	211	213	215	217	220
700	220	223	226	228	231	233	236	238	241	243	246	249	251	254	256
800	252	255	258	261	264	267	269	272	275	278	281	284	287	290	293
900	283	287	290	293	297	300	303	306	310	313	316	320	323	326	329
1000	315	318	322	326	329	333	337	340	344	348	351	355	359	362	366
2000	630	637	644	652	659	666	674	681	688	696	703	710	718	825	732
3000	945	955	966	977	988	999	1010	1021	1032	1043	1054	1065	1076	1087	1098
4000	1259	1274	1289	1303	1318	1333	1347	1362	1376	1391	1406	1420	1435	1450	1464
5000	1574	1592	1611	1629	1647	1666	1684	1702	1721	1739	1757	1776	1794	1812	1830

THICKNESS AND MEAN ADJUSTED VIRTUAL TEMPERATURE OF STRATA BETWEEN STANDARD ISOBARIC SURFACES

Aerological charts are usually prepared for the 1000-, 850-, 700-, 500-, 300-, 200-, and 100-millibar standard isobaric surfaces. Tables 53 and 54 give the thickness of the stratum between each of the above standard isobaric surfaces and every other such surface as a function of the mean adjusted virtual temperature (°C.). Table 53 gives the results in geopotential meters and Table 54 in geopotential feet.

Tables 55 and 56 give the mean adjusted virtual temperature (°C.) of the stratum between each successive pair of standard isobaric surfaces listed above and for the 1000-700-millibar stratum as a function of the thickness in geopotential meters (Table 55) and geopotential feet (Table 56).

Computations were based on the following equations for data in geopotential meters and geopotential feet, respectively (see p. 224):

$$\Delta\Phi_{gpm} = 67.442 \ (273.16 + t'_{mv}) \log_{10} \frac{p_1}{p_2} \qquad (1)$$

and

$$\Delta\Phi_{gpft} = 221.266 \ (273.16 + t'_{mv}) \log_{10} \frac{p_1}{p_2} \qquad (2)$$

where

$\Delta\Phi_{gpm}$ = thickness of the stratum in geopotential meters,
$\Delta\Phi_{gpft}$ = thickness of the stratum in geopotential feet,
t'_{mv} = mean adjusted virtual temperature of the stratum (°C.) (see Table 72),
p_1 = pressure of the base of the stratum,
p_2 = pressure at the top of the stratum.

TABLE 53

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

(Explanation on p. 241.)

t'_{mv}	Thickness between 1000 mb. and 850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	Thickness between 850 mb. and 700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
60	1586	3480									
59	1581	3470									
58	1576	3460									
57	1572	3449									
56	1567	3439									
55	1562	3428									
54	1557	3418									
53	1553	3407									
52	1548	3397									
51	1543	3386									
50	1538	3376	6561				1838	5023			
49	1534	3366	6541				1832	5007			
48	1529	3355	6520				1826	4991			
47	1524	3345	6500				1821	4976			
46	1519	3334	6480				1815	4960			
45	1514	3324	6459				1809	4945			
44	1510	3313	6439				1804	4929			
43	1505	3303	6419				1798	4914			
42	1500	3292	6398				1792	4898			
41	1495	3282	6378				1787	4883			
40	1491	3272	6358	11043	14762		1781	4867	9553	13272	
39	1486	3261	6337	11008	14715		1775	4852	9522	13229	
38	1481	3251	6317	10973	14668		1769	4836	9492	13187	
37	1476	3240	6297	10937	14621		1764	4820	9461	13145	
36	1472	3230	6277	10902	14574		1758	4805	9431	13102	
35	1467	3219	6256	10867	14527		1752	4789	9400	13060	
34	1462	3209	6236	10832	14480		1747	4774	9370	13017	
33	1457	3198	6216	10796	14432		1741	4758	9339	12975	
32	1453	3188	6195	10761	14385		1735	4743	9309	12933	
31	1448	3178	6175	10726	14338		1730	4727	9278	12890	
30	1443	3167	6155	10691	14291	20446	1724	4712	9248	12848	19003
29	1438	3157	6134	10655	14244	20378	1718	4696	9217	12805	18940
28	1434	3146	6114	10620	14197	20311	1713	4681	9187	12763	18877
27	1429	3136	6094	10585	14150	20243	1707	4665	9156	12721	18815
26	1424	3125	6074	10550	14102	20176	1701	4650	9126	12678	18752
25	1419	3115	6053	10514	14055	20109	1696	4634	9095	12636	18689
24	1415	3104	6033	10479	14008	20041	1690	4618	9065	12594	18627
23	1410	3094	6013	10444	13961	19974	1684	4603	9034	12551	18564
22	1405	3084	5992	10409	13914	19906	1679	4587	9004	12509	18501
21	1400	3073	5972	10373	13867	19839	1673	4572	8973	12466	18438
20	1395	3063	5952	10338	13820	19771	1667	4556	8943	12424	18376
19	1391	3052	5931	10303	13772	19704	1661	4541	8912	12382	18313
18	1386	3042	5911	10267	13725	19636	1656	4525	8882	12339	18250
17	1381	3031	5891	10232	13678	19569	1650	4510	8851	12297	18188
16	1376	3021	5871	10197	13631	19502	1644	4494	8820	12255	18125
15	1372	3010	5850	10162	13584	19434	1639	4479	8790	12212	18062
14	1367	3000	5830	10126	13537	19367	1633	4463	8759	12170	18000
13	1362	2989	5810	10091	13490	19299	1627	4447	8729	12127	17937
12	1357	2979	5789	10056	13442	19232	1622	4432	8698	12085	17874
11	1353	2969	5769	10021	13395	19164	1616	4416	8668	12043	17812

(*continued*)

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

	Thickness between 1000 mb. and						Thickness between 850 mb. and				
t'_{mv}	850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
10	1348	2958	5749	9985	13348	19097	1610	4401	8637	12000	17749
9	1343	2948	5728	9950	13301	19029	1605	4385	8607	11958	17686
8	1338	2937	5708	9915	13254	18962	1599	4370	8576	11916	17624
7	1334	2927	5688	9880	13207	18895	1593	4354	8546	11873	17561
6	1329	2916	5668	9844	13160	18827	1588	4339	8515	11831	17498
5	1324	2906	5647	9809	13112	18760	1582	4323	8485	11788	17436
4	1319	2895	5627	9774	13065	18692	1576	4308	8454	11746	17373
3	1315	2885	5607	9739	13018	18625	1570	4292	8424	11704	17310
2	1310	2875	5586	9703	12971	18557	1565	4277	8393	11661	17248
1	1305	2864	5566	9668	12924	18490	1559	4261	8363	11619	17185
0	1300	2854	5546	9633	12877	18422	1553	4245	8332	11576	17122
− 1	1296	2843	5525	9597	12830	18355	1548	4230	8302	11534	17059
− 2	1291	2833	5505	9562	12782	18288	1542	4214	8271	11492	16997
− 3	1286	2822	5485	9527	12735	18220	1536	4199	8241	11449	16934
− 4	1281	2812	5465	9492	12688	18153	1531	4183	8210	11407	16871
− 5	1276	2801	5444	9456	12641	18085	1525	4168	8180	11365	16809
− 6	1272	2971	5424	9421	12594	18018	1519	4152	8149	11322	16746
− 7	1267	2781	5404	9386	12547	17950	1514	4137	8119	11280	16683
− 8	1262	2770	5383	9351	12500	17883	1508	4121	8088	11237	16621
− 9	1257	2760	5363	9315	12452	17815	1502	4106	8058	11195	16558
−10	1253	2749	5343	9280	12405	17748	1497	4090	8027	11153	16495
−11	1248	2739	5322	9245	12358	17681	1491	4074	7997	11110	16433
−12	1243	2728	5302	9210	12311	17613	1485	4059	7966	11068	16370
−13	1238	2718	5282	9174	12264	17546	1479	4043	7936	11026	16307
−14	1234	2707	5261	9139	12217	17478	1474	4028	7905	10983	16245
−15	1229	2697	5241	9104	12170	17411	1468	4012	7875	10941	16182
−16	1224	2687	5221	9068	12123	17343	1462	3997	7844	10898	16119
−17	1219	2676	5201	9033	12075	17276	1457	3981	7814	10856	16057
−18	1215	2666	5180	8998	12028	17209	1451	3966	7783	10814	15994
−19	1210	2655	5160	8963	11981	17141	1445	3950	7753	10771	15931
−20	1205	2645	5140	8927	11934	17074	1440	3935	7722	10729	15869
−21	1200	2634	5119	8892	11887	17006	1434	3919	7692	10686	15806
−22	1196	2624	5099	8857	11840	16939	1428	3904	7661	10644	15743
−23	1191	2613	5079	8822	11793	16871	1423	3888	7631	10602	15680
−24	1186	2603	5058	8786	11745	16804	1417	3872	7600	10559	15618
−25	1181	2593	5038	8751	11698	16736	1411	3857	7570	10517	15555
−26	1177	2582	5018	8716	11651	16669	1406	3841	7539	10475	15492
−27	1172	2572	4998	8681	11604	16602	1400	3826	7509	10432	15430
−28	1167	2561	4977	8645	11557	16534	1394	3810	7478	10390	15367
−29	1162	2551	4957	8610	11510	16467	1388	3795	7448	10347	15304
−30	1157	2540	4937	8575	11463	16399	1383	3779	7417	10305	15242
−31	1153	2530	4916	8540	11415	16332	1377	3764	7387	10263	15179
−32	1148	2519	4896	8504	11368	16264	1371	3748	7356	10220	15116
−33	1143	2509	4876	8469	11321	16197	1366	3733	7326	10178	15054
−34	1138	2498	4855	8434	11274	16129	1360	3717	7295	10136	14991
−35	1134	2488	4835	8398	11227	16062	1354	3701	7265	10093	14928
−36	1129	2478	4815	8363	11180	15995	1349	3686	7234	10051	14866
−37	1124	2467	4795	8328	11133	15927	1343	3670	7204	10008	14803
−38	1119	2457	4774	8293	11085	15860	1337	3655	7173	9966	14740
−39	1115	2446	4754	8257	11038	15792	1332	3639	7143	9924	14678

(*continued*)

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 1000 mb. and 850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	Thickness between 850 mb. and 700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
−40	1110	2436	4734	8222	10991	15725	1326	3624	7112	9881	14615
−41	1105	2425	4713	8187	10944	15657	1320	3608	7082	9839	14552
−42	1100	2415	4693	8152	10897	15590	1315	3593	7051	9797	14490
−43	1096	2404	4673	8116	10850	15522	1309	3577	7021	9754	14427
−44	1091	2394	4652	8081	10803	15455	1303	3562	6990	9712	14364
−45	1086	2384	4632	8046	10755	15388	1297	3546	6960	9669	14301
−46	1081	2373	4612	8011	10708	15320	1292	3531	6929	9627	14239
−47	1077	2363	4592	7975	10661	15253	1286	3515	6899	9585	14176
−48	1072	2352	4571	7940	10614	15185	1280	3499	6868	9542	14113
−49	1067	2342	4551	7905	10567	15118	1275	3484	6838	9500	14051
−50	1062	2331	4531	7870	10520	15050	1269	3468	6807	9457	13988
−51	1058	2321	4510	7834	10473	14983	1263	3453	6777	9415	13925
−52	1053	2310	4490	7799	10425	14915	1258	3437	6746	9373	13863
−53	1048	2300	4470	7764	10378	14848	1252	3422	6716	9330	13800
−54	1043	2290	4449	7728	10331	14781	1246	3406	6685	9288	13737
−55	1038	2279	4429	7693	10284	14713	1241	3391	6655	9246	13675
−56	1034	2269	4409	7658	10237	14646	1235	3375	6624	9203	13612
−57	1029	2258	4388	7623	10190	14578	1229	3360	6594	9161	13549
−58	1024	2248	4368	7587	10143	14511	1224	3344	6563	9118	13487
−59	1019	2237	4348	7552	10095	14443	1218	3328	6533	9076	13424
−60	1015	2227	4328	7517	10048	14376	1212	3313	6502	9034	13361
−61	1010	2216	4307	7482	10001	14308	1207	3297	6472	8991	13299
−62	1005	2206	4287	7446	9954	14241	1201	3282	6441	8949	13236
−63	1000	2196	4267	7411	9907	14174	1195	3266	6411	8907	13173
−64	996	2185	4246	7376	9860	14106	1189	3251	6380	8864	13111
−65	991	2175	4226	7341	9813	14039	1184	3235	6350	8822	13048
−66	986	2164	4206	7305	9766	13971	1178	3220	6319	8779	12985
−67	981	2154	4185	7270	9718	13904	1172	3204	6289	8737	12922
−68	977	2143	4165	7235	9671	13836	1167	3189	6258	8695	12860
−69	972	2133	4145	7199	9624	13769	1161	3173	6228	8652	12797
−70	967	2122	4125	7164	9577	13702	1155	3157	6197	8610	12734
−71	962	2112	4104	7129	9530	13634	1150	3142	6167	8568	12672
−72	958	2101	4084	7094	9483	13567	1144	3126	6136	8525	12609
−73	953	2091	4064	7058	9436	13499	1138	3111	6106	8483	12546
−74	948	2081	4043	7023	9388	13432	1133	3095	6075	8440	12484
−75	943	2070	4023	6988	9341	13364	1127	3080	6045	8398	12421
−76	939	2060	4003	6953	9294	13297	1121	3064	6014	8356	12358
−77	934	2049	3982	6917	9247	13229	1116	3049	5984	8313	12296
−78	929	2039	3962	6882	9200	13162	1110	3033	5953	8271	12233
−79	924	2028	3942	6847	9153	13095	1104	3018	5923	8228	12170
−80											12108
−81											12045
−82											11982
−83											11920
−84											11857
−85											11794
−86											11732
−87											11669
−88											11606
−89											11543

(*continued*)

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 700 mb. and 500 mb.	300 mb.	200 mb.	100 mb.	Thickness between 500 mb. and 300 mb.	200 mb.	100 mb.	Thickness between 300 mb. and 200 mb.	100 mb.	200 mb. and 100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
40	3086	7772	11491							
39	3076	7747	11454							
38	3067	7722	11417							
37	3057	7697	11381							
36	3047	7672	11344							
35	3037	7648	11307							
34	3027	7623	11271							
33	3017	7598	11234							
32	3007	7573	11197							
31	2998	7548	11161							
30	2988	7524	11124	17279	4536	8136	14291			
29	2978	7499	11087	17222	4521	8109	14244			
28	2968	7474	11050	17165	4506	8082	14197			
27	2958	7449	11014	17108	4491	8056	14150			
26	2948	7424	10977	17051	4476	8029	14102			
25	2938	7399	10940	16994	4461	8002	14055			
24	2929	7375	10904	16937	4446	7975	14008			
23	2919	7350	10867	16880	4431	7948	13961			
22	2909	7325	10830	16823	4416	7921	13914			
21	2899	7300	10794	16766	4401	7895	13867			
20	2889	7275	10757	16709	4386	7868	13820	3482		
19	2879	7251	10720	16652	4371	7841	13772	3470		
18	2869	7226	10684	16595	4356	7814	13725	3458		
17	2860	7201	10647	16538	4341	7787	13678	3446		
16	2850	7176	10610	16481	4326	7760	13631	3434		
15	2840	7151	10573	16424	4311	7734	13584	3422		
14	2830	7126	10537	16367	4296	7707	13537	3410		
13	2820	7102	10500	16310	4282	7680	13490	3398		
12	2810	7077	10463	16253	4267	7653	13442	3387		
11	2800	7052	10427	16196	4252	7626	13395	3375		
10	2791	7027	10390	16139	4237	7599	13348	3363	9112	5749
9	2781	7002	10353	16082	4222	7573	13301	3351	9079	5728
8	2771	6978	10317	16025	4207	7546	13254	3339	9047	5708
7	2761	6953	10280	15968	4192	7519	13207	3327	9015	5688
6	2751	6928	10243	15911	4177	7492	13160	3315	8983	5668
5	2741	6903	10207	15854	4162	7465	13112	3303	8951	5647
4	2731	6878	10170	15797	4147	7438	13065	3292	8918	5627
3	2722	6853	10133	15740	4132	7412	13018	3280	8886	5607
2	2712	6829	10096	15683	4117	7385	12971	3268	8854	5586
1	2702	6804	10060	15626	4102	7358	12924	3256	8822	5566
0	2692	6779	10023	15569	4087	7331	12877	3244	8790	5546
−1	2682	6754	9986	15512	4072	7304	12830	3232	8758	5525
−2	2672	6729	9950	15455	4057	7277	12782	3220	8725	5505
−3	2662	6705	9913	15398	4042	7251	12735	3208	8693	5485
−4	2653	6680	9876	15341	4027	7224	12688	3197	8661	5465
−5	2643	6655	9840	15284	4012	7197	12641	3185	8629	5444
−6	2633	6630	9803	15227	3997	7170	12594	3173	8597	5424
−7	2623	6605	9766	15170	3982	7143	12547	3161	8565	5404
−8	2613	6580	9730	15113	3967	7116	12500	3149	8532	5383
−9	2603	6556	9693	15056	3952	7089	12452	3137	8500	5363

(continued)

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

	Thickness between 700 mb. and				Thickness between 500 mb. and			Thickness between 300 mb. and		200 mb. and
t'_{mv}	500 mb.	300 mb.	200 mb.	100 mb.	300 mb.	200 mb.	100 mb.	200 mb.	100 mb.	100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
−10	2593	6531	9656	14999	3937	7063	12405	3125	8468	5343
−11	2584	6506	9619	14942	3922	7036	12359	3113	8436	5322
−12	2574	6481	9583	14885	3907	7009	12311	3102	8404	5302
−13	2564	6456	9546	14828	3892	6982	12264	3090	8371	5282
−14	2554	6432	9509	14771	3878	6955	12217	3078	8339	5261
−15	2544	6407	9473	14714	3863	6928	12170	3066	8307	5241
−16	2534	6382	9436	14657	3848	6902	12123	3054	8275	5221
−17	2524	6357	9399	14600	3833	6875	12075	3042	8243	5201
−18	2515	6332	9363	14543	3818	6848	12028	3030	8211	5180
−19	2505	6308	9326	14486	3803	6821	11981	3018	8178	5160
−20	2495	6283	9289	14429	3788	6794	11934	3007	8146	5140
−21	2485	6258	9253	14372	3773	6767	11887	2995	8114	5119
−22	2475	6233	9216	14315	3758	6741	11840	2983	8082	5099
−23	2465	6208	9179	14258	3743	6714	11793	2971	8050	5079
−24	2456	6183	9142	14201	3728	6687	11745	2959	8017	5058
−25	2446	6159	9106	14144	3713	6660	11698	2947	7985	5038
−26	2436	6134	9069	14087	3698	6633	11651	2935	7953	5018
−27	2426	6109	9032	14030	3683	6606	11604	2923	7921	4998
−28	2416	6084	8996	13973	3668	6580	11557	2912	7889	4977
−29	2406	6059	8959	13916	3653	6553	11510	2900	7857	4957
−30	2396	6035	8922	13859	3638	6526	11463	2888	7824	4937
−31	2387	6010	8886	13802	3623	6499	11415	2876	7792	4916
−32	2377	5985	8849	13745	3608	6472	11368	2864	7760	4896
−33	2367	5960	8812	13688	3593	6445	11321	2852	7728	4876
−34	2357	5935	8776	13631	3578	6419	11274	2840	7696	4855
−35	2347	5910	8739	13574	3563	6392	11227	2828	7664	4835
−36	2337	5886	8702	13517	3548	6365	11180	2817	7631	4815
−37	2327	5861	8665	13460	3533	6338	11133	2805	7599	4795
−38	2318	5836	8629	13403	3518	6311	11085	2793	7567	4774
−39	2308	5811	8592	13346	3503	6284	11038	2781	7535	4754
−40	2298	5786	8555	13289	3489	6258	10991	2769	7503	4734
−41	2288	5762	8519	13232	3474	6231	10944	2757	7470	4713
−42	2278	5737	8482	13175	3459	6204	10897	2745	7438	4693
−43	2268	5712	8445	13118	3444	6177	10850	2733	7406	4673
−44	2258	5687	8409	13061	3429	6150	10803	2721	7374	4652
−45	2249	5662	8372	13004	3414	6123	10755	2710	7342	4632
−46	2239	5637	8335	12947	3399	6096	10708	2698	7310	4612
−47	2229	5613	8298	12890	3384	6070	10661	2686	7277	4592
−48	2219	5588	8262	12833	3369	6043	10614	2674	7245	4571
−49	2209	5563	8225	12776	3354	6016	10567	2662	7213	4551
−50	2199	5538	8188	12719	3339	5989	10520	2650	7181	4531
−51	2189	5513	8152	12662	3324	5962	10473	2638	7149	4510
−52	2180	5489	8115	12605	3309	5935	10425	2626	7116	4490
−53	2170	5464	8078	12548	3294	5909	10378	2615	7084	4470
−54	2160	5439	8042	12491	3279	5882	10331	2603	7052	4449
−55	2150	5414	8005	12434	3264	5855	10284	2591	7020	4429
−56	2140	5389	7968	12377	3249	5828	10237	2579	6988	4409
−57	2130	5364	7932	12320	3234	5801	10190	2567	6956	4388
−58	2120	5340	7895	12263	3219	5774	10143	2555	6923	4368
−59	2111	5315	7858	12206	3204	5748	10095	2543	6891	4348

(*continued*)

THICKNESS IN GEOPOTENTIAL METERS OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 700 mb. and 500 mb.	300 mb.	200 mb.	100 mb.	Thickness between 500 mb. and 300 mb.	200 mb.	100 mb.	Thickness between 300 mb. and 200 mb.	100 mb.	Thickness between 200 mb. and 100 mb.
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
− 60	2101	5290	7821	12149	3189	5721	10048	2531	6859	4328
− 61	2091	5265	7785	12092	3174	5694	10001	2520	6827	4307
− 62	2081	5240	7748	12035	3159	5667	9954	2508	6795	4287
− 63	2071	5216	7711	11978	3144	5640	9907	2496	6763	4267
− 64	2061	5191	7675	11921	3129	5613	9860	2484	6730	4246
− 65	2051	5166	7638	11864	3114	5587	9813	2472	6698	4226
− 66	2042	5141	7601	11807	3100	5560	9766	2460	6666	4206
− 67	2032	5116	7565	11750	3085	5533	9718	2448	6634	4185
− 68	2022	5091	7528	11693	3070	5506	9671	2436	6602	4165
− 69	2012	5067	7491	11636	3055	5479	9624	2425	6569	4145
− 70	2002	5042	7455	11579	3040	5452	9577	2413	6537	4125
− 71	1992	5017	7418	11522	3025	5426	9530	2401	6505	4104
− 72	1982	4992	7381	11465	3010	5399	9483	2389	6473	4084
− 73	1973	4967	7344	11408	2995	5372	9436	2377	6441	4064
− 74	1963	4943	7308	11351	2980	5345	9388	2365	6409	4043
− 75	1953	4918	7271	11294	2965	5318	9341	2353	6376	4023
− 76	1943	4893	7234	11237	2950	5291	9294	2341	6344	4003
− 77	1933	4868	7198	11180	2935	5265	9247	2330	6312	3982
− 78	1923	4843	7161	11123	2920	5238	9200	2318	6280	3962
− 79	1913	4818	7124	11066	2905	5211	9153	2306	6248	3942
− 80			7088	11009		5184	9106	2294	6216	3922
− 81			7051	10952		5157	9058	2282	6183	3901
− 82			7014	10895		5130	9011	2270	6151	3881
− 83			6978	10838		5103	8964	2258	6119	3861
− 84			6941	10781		5077	8917	2246	6087	3840
− 85			6904	10724		5050	8870	2235	6055	3820
− 86			6867	10667		5023	8823	2223	6022	3800
− 87			6831	10610		4996	8776	2211	5990	3779
− 88			6794	10553		4969	8728	2199	5958	3759
− 89			6757	10496		4942	8681	2187	5926	3739
− 90									5894	3719
− 91									5862	3698
− 92									5829	3678
− 93									5797	3658
− 94									5765	3637
− 95									5733	3617
− 96									5701	3597
− 97									5668	3576
− 98									5636	3556
− 99									5604	3536
−100									5572	3516

TABLE 54

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

(Explanation on p. 241.)

	Thickness between 1000 mb. and						Thickness between 850 mb. and				
t'_{mv}	850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
60	5203	11419									
59	5187	11385									
58	5172	11350									
57	5156	11316									
56	5141	11282									
55	5125	11248									
54	5109	11213									
53	5094	11179									
52	5078	11145									
51	5062	11110									
50	5047	11076	21525				6029				
49	5031	11042	21458				6011				
48	5016	11008	21392				5992				
47	5000	10973	21325				5973				
46	4984	10939	21259				5955				
45	4969	10905	21192				5936				
44	4953	10871	21125				5917				
43	4938	10836	21059				5899				
42	4922	10802	20992				5880				
41	4906	10768	20925				5861				
40	4891	10733	20859	36231			5843	15968			
39	4875	10699	20792	36115			5824	15917			
38	4859	10665	20726	36000			5805	15866			
37	4844	10631	20659	35884			5787	15815			
36	4828	10596	20592	35768			5768	15764			
35	4813	10562	20526	35653			5749	15713			
34	4797	10528	20459	35537			5731	15662			
33	4781	10493	20393	35421			5712	15611			
32	4766	10459	20326	35306			5693	15560			
31	4750	10425	20259	35190			5675	15509			
30	4735	10391	20193	35074	46886	67079	5656	15458	30340	42152	
29	4719	10356	20126	34958	46732	66858	5638	15407	30240	42013	
28	4703	10322	20060	34843	46577	66636	5619	15356	30140	41874	
27	4688	10288	19993	34727	46422	66415	5600	15305	30039	41735	
26	4672	10254	19926	34611	46268	66194	5582	15254	29939	41596	
25	4656	10219	19860	34496	46113	65973	5563	15203	29839	41456	
24	4641	10185	19793	34380	45958	65751	5544	15152	29739	41317	
23	4625	10151	19727	34264	45804	65530	5526	15101	29639	41178	
22	4610	10116	19660	34149	45649	65309	5507	15050	29539	41039	
21	4594	10082	19593	34033	45494	65088	5488	14999	29439	40900	
20	4578	10048	19527	33917	45340	64866	5470	14948	29339	40761	60288
19	4563	10014	19460	33802	45185	64645	5451	14897	29239	40622	60082
18	4547	9979	19393	33686	45030	64424	5432	14846	29139	40483	59877
17	4531	9945	19327	33570	44876	64203	5414	14795	29039	40344	59671
16	4516	9911	19260	33454	44721	63981	5395	14744	28939	40205	59465
15	4500	9877	19194	33339	44566	63760	5376	14693	28838	40066	59260
14	4485	9842	19127	33223	44412	63539	5358	14642	28738	39927	59054
13	4469	9808	19060	33107	44257	63317	5339	14591	28638	39788	58848
12	4453	9774	18994	32992	44102	63096	5320	14540	28538	39649	58643
11	4438	9739	18927	32876	43948	62875	5302	14489	28438	39510	58437

(*continued*)

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

	Thickness between 1000 mb. and						Thickness between 850 mb. and				
t'_{mv}	850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
10	4422	9705	18861	32760	43793	62654	5283	14438	28338	39371	58232
9	4407	9671	18794	32645	43638	62432	5264	14387	28238	39232	58026
8	4391	9637	18727	32529	43484	62211	5246	14336	28138	39093	57820
7	4375	9602	18661	32413	43329	61990	5227	14286	28038	38954	57615
6	4360	9568	18594	32297	43174	61769	5208	14235	27938	38815	57409
5	4344	9534	18528	32182	43020	61547	5190	14184	27838	38676	57203
4	4328	9500	18461	32066	42865	61326	5171	14133	27738	38537	56998
3	4313	9465	18394	31950	42710	61105	5152	14082	27638	38398	56792
2	4297	9431	18328	31835	42556	60884	5134	14031	27537	38259	56586
1	4282	9397	18261	31719	42401	60662	5115	13980	27437	38120	56381
0	4266	9362	18195	31603	42246	60441	5096	13929	27337	37980	56175
−1	4250	9328	18128	31488	42092	60220	5078	13878	27237	37841	55969
−2	4235	9294	18061	31372	41937	59998	5059	13827	27137	37702	55764
−3	4219	9260	17995	31256	41782	59777	5040	13776	27037	37563	55558
−4	4204	9225	17928	31141	41628	59556	5022	13725	26937	37424	55352
−5	4188	9191	17862	31025	41473	59335	5003	13674	26837	37285	55147
−6	4172	9157	17795	30909	41319	59113	4984	13623	26737	37146	54941
−7	4157	9123	17728	30793	41164	58892	4966	13572	26637	37007	54735
−8	4141	9088	17662	30678	41009	58671	4947	13521	26537	36868	54530
−9	4125	9054	17595	30562	40855	58450	4929	13470	26437	36729	54324
−10	4110	9020	17528	30446	40700	58228	4910	13419	26337	36590	54119
−11	4094	8985	17462	30331	40545	58007	4891	13368	26236	36451	53913
−12	4079	8951	17395	30215	40391	57786	4873	13317	26136	36312	53707
−13	4063	8917	17329	30099	40236	57565	4854	13266	26036	36173	53502
−14	4047	8883	17262	29984	40081	57343	4835	13215	25936	36034	53296
−15	4032	8848	17195	29868	39927	57122	4817	13164	25836	35895	53090
−16	4016	8814	17129	29752	39772	56901	4798	13113	25736	35756	52885
−17	4001	8780	17062	29637	39617	56679	4779	13062	25636	35617	52679
−18	3985	8745	16996	29521	39463	56458	4761	13011	25536	35478	52473
−19	3969	8711	16929	29405	39308	56237	4742	12960	25436	35339	52268
−20	3954	8677	16862	29289	39153	56016	4723	12909	25336	35200	52062
−21	3938	8643	16796	29174	38999	55794	4705	12858	25236	35061	51856
−22	3922	8608	16729	29058	38844	55573	4686	12807	25136	34922	51651
−23	3907	8574	16663	28942	38689	55352	4667	12756	25036	34783	51445
−24	3891	8540	16596	28827	38535	55131	4649	12705	24935	34643	51239
−25	3876	8506	16529	28711	38380	54909	4630	12654	24835	34504	51034
−26	3860	8471	16463	28595	38225	54688	4611	12603	24735	34365	50828
−27	3844	8437	16396	28480	38071	54467	4593	12552	24635	34226	50623
−28	3829	8403	16330	28364	37916	54246	4574	12501	24535	34087	50417
−29	3813	8368	16263	28248	37761	54024	4555	12450	24435	33948	50211
−30	3797	8334	16196	28132	37607	53803	4537	12399	24335	33809	50006
−31	3782	8300	16130	28017	37452	53582	4518	12348	24235	33670	49800
−32	3766	8266	16063	27901	37297	53361	4499	12297	24135	33531	49594
−33	3751	8231	15997	27785	37143	53139	4481	12246	24035	33392	49389
−34	3735	8197	15930	27670	36988	52918	4462	12195	23935	33253	49183
−35	3719	8163	15863	27554	36833	52697	4443	12144	23835	33114	48977
−36	3704	8129	15797	27438	36679	52475	4425	12093	23735	32975	48772
−37	3688	8094	15730	27323	36524	52254	4406	12042	23634	32836	48566
−38	3673	8060	15663	27207	36369	52033	4387	11991	23534	32697	48360
−39	3657	8026	15597	27091	36215	51812	4369	11940	23434	32558	48155

(*continued*)

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 1000 mb. and						Thickness between 850 mb. and				
	850 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.	700 mb.	500 mb.	300 mb.	200 mb.	100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
−40	3641	7991	15530	26976	36060	51590	4350	11889	23334	32419	47949
−41	3626	7957	15464	26860	35905	51369	4331	11838	23234	32280	47743
−42	3610	7923	15397	26744	35751	51148	4313	11787	23134	32141	47538
−43	3594	7889	15330	26628	35596	50927	4294	11736	23034	32002	47332
−44	3579	7854	15264	26513	35441	50705	4276	11685	22934	31863	47126
−45	3563	7820	15197	26397	35287	50484	4257	11634	22834	31724	46921
−46	3548	7786	15131	26281	35132	50263	4238	11583	22734	31585	46715
−47	3532	7752	15064	26166	34978	50042	4220	11532	22634	31446	46510
−48	3516	7717	14997	26050	34823	49820	4201	11481	22534	31306	46304
−49	3501	7683	14931	25934	34668	49599	4182	11430	22434	31167	46098
−50	3485	7649	14864	25819	34514	49378	4164	11379	22333	31028	45893
−51	3470	7614	14798	25703	34359	49156	4145	11328	22233	30889	45687
−52	3454	7580	14731	25587	34204	48935	4126	11277	22133	30750	45481
−53	3438	7546	14664	25471	34050	48714	4108	11226	22033	30611	45276
−54	3423	7512	14598	25356	33895	48493	4089	11175	21933	30472	45070
−55	3407	7477	14531	25240	33740	48271	4070	11124	21833	30333	44864
−56	3391	7443	14465	25124	33586	48050	4052	11073	21733	30194	44659
−57	3376	7409	14398	25009	33431	47829	4033	11022	21633	30055	44453
−58	3360	7375	14331	24893	33276	47608	4014	10971	21533	29916	44247
−59	3345	7340	14265	24777	33122	47386	3996	10920	21433	29777	44042
−60	3329	7306	14198	24662	32967	47165	3977	10869	21333	29638	43836
−61	3313	7272	14131	24546	32812	46944	3958	10818	21233	29499	43630
−62	3298	7237	14065	24430	32658	46723	3940	10767	21132	29360	43425
−63	3282	7203	13998	24315	32503	46501	3921	10716	21032	29221	43219
−64	3266	7169	13932	24199	32348	46280	3902	10665	20932	29082	43014
−65	3251	7135	13865	24083	32194	46059	3884	10614	20832	28943	42808
−66	3235	7100	13798	23967	32039	45837	3865	10563	20732	28804	42602
−67	3220	7066	13732	23852	31884	45616	3846	10512	20632	28665	42397
−68	3204	7032	13665	23736	31730	45395	3828	10461	20532	28526	42191
−69	3188	6997	13599	23620	31575	45174	3809	10410	20432	28387	41985
−70	3173	6963	13532	23505	31420	44952	3790	10359	20332	28248	41780
−71	3157	6929	13465	23389	31266	44731	3772	10308	20232	28109	41574
−72	3142	6895	13399	23273	31111	44510	3753	10257	20132	27970	41368
−73	3126	6860	13332	23158	30956	44289	3734	10206	20032	27830	41163
−74	3110	6826	13266	23042	30802	44067	3716	10155	19932	27691	40957
−75	3095	6792	13199	22926	30647	43846	3697	10104	19831	27552	40751
−76	3079	6758	13132	22810	30492	43625	3678	10053	19731	27413	40546
−77	3063	6723	13066	22695	30338	43404	3660	10002	19631	27274	40340
−78	3048	6689	12999	22579	30183	43182	3641	9951	19531	27135	40134
−79	3032	6655	12933	22463	30028	42961	3623	9900	19431	26996	39929
−80											39723
−81											39517
−82											39312
−83											39106
−84											38901
−85											38695
−86											38489
−87											38284
−88											38078
−89											37872

(*continued*)

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

	Thickness between 700 mb. and				Thickness between 500 mb. and			Thickness between 300 mb. and		Thickness between 200 mb. and
t'_{mv}	500 mb.	300 mb.	200 mb.	100 mb.	300 mb.	200 mb.	100 mb.	200 mb.	100 mb.	100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
40	10125				15372					
39	10093				15323					
38	10061				15274					
37	10028				15225					
36	9996				15176					
35	9964				15127					
34	9931				15078					
33	9899				15029					
32	9867				14980					
31	9834				14930					
30	9802				14881	26693				
29	9770				14832	26605				
28	9737				14783	26517				
27	9705				14734	26429				
26	9673				14685	26341				
25	9640				14636	26253				
24	9608				14587	26165				
23	9576				14538	26077				
22	9543				14489	25989				
21	9511				14440	25901				
20	9479	23869			14391	25813		11422		
19	9446	23788			14341	25725		11383		
18	9414	23706			14292	25637		11344		
17	9382	23625			14243	25549		11306		
16	9349	23544			14194	25461		11267		
15	9317	23462			14145	25373		11228		
14	9285	23381			14096	25285		11189		
13	9252	23299			14047	25197		11150		
12	9220	23218			13998	25109		11111		
11	9188	23137			13949	25020		11072		
10	9155	23055	34088	52949	13900	24932	43793	11033		
9	9123	22974	33967	52762	13851	24844	43638	10994		
8	9091	22892	33847	52575	13801	24756	43484	10955		
7	9058	22811	33727	52388	13752	24668	43329	10916		
6	9026	22729	33606	52201	13703	24580	43174	10877		
5	8994	22648	33486	52014	13654	24492	43020	10838		
4	8961	22567	33366	51827	13605	24404	42865	10799		
3	8929	22485	33245	55640	13556	24316	42710	10760		
2	8897	22404	33125	51453	13507	24228	42556	10721		
1	8864	22322	33004	51266	13458	24140	42401	10682		
0	8832	22241	32884	51079	13409	24052	42246	10643	28838	18195
−1	8800	22159	32764	50892	13360	23964	42092	10604	28732	18128
−2	8767	22078	32643	50705	13311	23876	41937	10565	28627	18061
−3	8735	21997	32523	50518	13261	23788	41782	10526	28521	17995
−4	8703	21915	32402	50331	13212	23700	41628	10487	28415	17928
−5	8670	21834	32282	50144	13163	23612	41473	10448	28310	17862
−6	8638	21752	32162	49957	13114	23524	41319	10409	28204	17795
−7	8606	21671	32041	49770	13065	23436	41164	10370	28099	17728
−8	8573	21590	31921	49583	13016	23347	41009	10331	27993	17662
−9	8541	21508	31801	49396	12967	23259	40855	10292	27888	17595

(*continued*)

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 700 mb. and 500 mb.	300 mb.	200 mb.	100 mb.	Thickness between 500 mb. and 300 mb.	200 mb.	100 mb.	Thickness between 300 mb. and 200 mb.	100 mb.	Thickness between 200 mb. and 100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
−10	8509	21427	31680	49209	12918	23171	40700	10254	27782	17528
−11	8476	21345	31560	49022	12869	23083	40545	10215	27676	17462
−12	8444	21264	31439	48835	12820	22995	40391	10176	27571	17395
−13	8412	21182	31319	48648	12771	22907	40236	10137	27465	17329
−14	8379	21101	31199	48461	12722	22819	40081	10098	27360	17262
−15	8347	21020	31078	48274	12672	22731	39927	10059	27254	17195
−16	8315	20938	30958	48087	12623	22643	39772	10020	27149	17129
−17	8282	20857	30838	47900	12574	22555	39617	9981	27043	17062
−18	8250	20775	30717	47713	12525	22467	39463	9942	26937	16996
−19	8218	20694	30597	47526	12476	22379	39308	9903	26832	16929
−20	8185	20612	30476	47339	12427	22291	39153	9864	26726	16862
−21	8153	20531	30356	47152	12378	22203	38999	9825	26621	16796
−22	8121	20450	30236	46965	12329	22115	38844	9786	26515	16729
−23	8088	20368	30115	46778	12280	22027	38689	9747	26410	16663
−24	8056	20287	29995	46591	12231	21939	38535	9708	26304	16596
−25	8024	20205	29874	46404	12182	21851	38380	9669	26198	16529
−26	7991	20124	29754	46217	12132	21763	38225	9630	26093	16463
−27	7959	20043	29634	46030	12083	21675	38071	9591	25987	16396
−28	7927	19961	29513	45843	12034	21586	37916	9552	25882	16330
−29	7894	19880	29393	45656	11985	21498	37761	9513	25776	16263
−30	7862	19798	29273	45469	11936	21410	37607	9474	25671	16196
−31	7830	19717	29152	45282	11887	21322	37452	9435	25565	16130
−32	7797	19635	29032	45095	11838	21234	37297	9396	25459	16063
−33	7765	19554	28911	44908	11789	21146	37143	9357	25354	15997
−34	7733	19473	28791	44721	11740	21058	36988	9318	25248	15930
−35	7700	19391	28671	44534	11691	20970	36833	9279	25143	15863
−36	7668	19310	28550	44347	11642	20882	36679	9240	25037	15797
−37	7636	19228	28430	44160	11593	20794	36524	9202	24932	15730
−38	7603	19147	28309	43973	11543	20706	36369	9163	24826	15663
−39	7571	19065	28189	43786	11494	20618	36215	9124	24720	15597
−40	7539	18984	28069	43599	11445	20530	36060	9085	24615	15530
−41	7506	18903	27948	43412	11396	20442	35905	9046	24509	15464
−42	7474	18821	27828	43225	11347	20354	35751	9007	24404	15397
−43	7442	18740	27708	43038	11298	20266	35596	8968	24298	15330
−44	7409	18658	27587	42851	11249	20178	35441	8929	24193	15264
−45	7377	18577	27467	42664	11200	20090	35287	8890	24087	15197
−46	7345	18496	27346	42477	11151	20002	35132	8851	23981	15131
−47	7312	18414	27226	42290	11102	19914	34978	8812	23876	15064
−48	7280	18333	27106	42103	11053	19825	34823	8773	23770	14997
−49	7248	18251	26985	41916	11003	19737	34668	8734	23665	14931
−50	7215	18170	26865	41729	10954	19649	34514	8695	23559	14864
−51	7183	18088	26744	41542	10905	19561	34359	8656	23454	14798
−52	7151	18007	26624	41355	10856	19473	34204	8617	23348	14731
−53	7118	17926	26504	41168	10807	19385	34050	8578	23242	14664
−54	7086	17844	26383	40981	10758	19297	33895	8539	23137	14598
−55	7054	17763	26263	40794	10709	19209	33740	8500	23031	14531
−56	7021	17681	26143	40607	10660	19121	33586	8461	22926	14465
−57	6989	17600	26022	40420	10611	19033	33431	8422	22820	14398
−58	6957	17518	25902	40233	10562	18945	33276	8383	22715	14331
−59	6924	17437	25781	40046	10513	18857	33122	8344	22609	14265

(*continued*)

THICKNESS IN GEOPOTENTIAL FEET OF STRATA BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF MEAN ADJUSTED VIRTUAL TEMPERATURE

t'_{mv}	Thickness between 700 mb. and				Thickness between 500 mb. and			Thickness between 300 mb. and		Thickness between 200 mb. and
	500 mb.	300 mb.	200 mb.	100 mb.	300 mb.	200 mb.	100 mb.	200 mb.	100 mb.	100 mb.
°C.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
− 60	6892	17356	25661	39859	10464	18769	32967	8305	22503	14198
− 61	6860	17274	25541	39672	10414	18681	32812	8266	22398	14131
− 62	6827	17193	25420	39485	10365	18593	32658	8227	22292	14065
− 63	6795	17111	25300	39298	10316	18505	32504	8188	22187	13998
− 64	6763	17030	25179	39111	10267	18417	32348	8150	22081	13932
− 65	6730	16949	25059	38924	10218	18329	32194	8111	21976	13865
− 66	6698	16867	24939	38737	10169	18241	32039	8072	21870	13798
− 67	6666	16786	24818	38550	10120	18153	31884	8033	21764	13732
− 68	6633	16704	24698	38363	10071	18064	31730	7994	21659	13665
− 69	6601	16623	24578	38176	10022	17976	31575	7955	21553	13599
− 70	6569	16541	24457	37989	9973	17888	31420	7916	21448	13532
− 71	6536	16460	24337	37802	9924	17800	31266	7877	21342	13465
− 72	6504	16379	24216	37615	9874	17712	31111	7838	21237	13399
− 73	6472	16297	24096	37428	9825	17624	30956	7799	21131	13332
− 74	6439	16216	23976	37241	9776	17536	30802	7760	21025	13266
− 75	6407	16134	23855	37054	9727	17448	30647	7721	20929	13199
− 76	6375	16053	23735	36867	9678	17360	30492	7682	20814	13132
− 77	6342	15971	23614	36680	9629	17272	30338	7643	20709	13066
− 78	6310	15890	23494	36493	9580	17184	30183	7604	20603	12999
− 79	6278	15809	23374	36306	9531	17096	30028	7565	20498	12933
− 80			23253	36119		17008	29874	7526	20392	12866
− 81			23133	35932		16920	29719	7487	20286	12799
− 82			23013	35745		16832	29564	7448	20181	12733
− 83			22892	35558		16744	29410	7409	20075	12666
− 84			22772	35371		16656	29255	7370	19970	12600
− 85			22651	35184		16568	29101	7331	19864	12533
− 86			22531	34997		16480	28946	7292	19758	12466
− 87			22411	34810		16391	28791	7253	19653	12400
− 88			22290	34623		16303	28637	7214	19547	12333
− 89			22170	34436		16215	28482	7175	19442	12266
− 90									19336	12200
− 91									19231	12133
− 92									19125	12067
− 93									19020	12000
− 94									18914	11933
− 95									18808	11867
− 96									18703	11800
− 97									18597	11734
− 98									18492	11667
− 99									18386	11600
−100									18281	11534

Table 55

MEAN ADJUSTED VIRTUAL TEMPERATURE BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF THICKNESS IN GEOPOTENTIAL METERS

(Explanation on p. 241.)

Isobaric surfaces

1000-850 mb.		1000-700 mb.		700-500 mb.		500-300 mb.		300-200 mb.		200-100 mb.	
Thickness	t'_{mv}	Thickness	t'_{mv}	Thickness	t'_{mv}	Thickness	t'_{mv}	Thickness	t'_{mv}	Thickness	t'_{mv}
gpm.	°C.	gpm.	°C.	gpm.	°C.	gpm.	°C.	gpm.	°C.	gpm.	°C.
1600	63.0	3350	47.5	3150	46.5	4600	34.3	3500	21.6	5900	17.5
1550	52.5	3300	42.7	3100	41.4	4550	30.9	3450	17.3	5850	15.0
1500	42.0	3250	37.9	3050	36.3	4500	27.6	3400	13.1	5800	12.5
1450	31.5	3200	33.2	3000	31.2	4450	24.3	3350	8.9	5750	10.1
1400	20.9	3150	28.4	2950	26.2	4400	20.9	3300	4.7	5700	7.6
1350	10.4	3100	23.6	2900	21.1	4350	17.6	3250	0.5	5650	5.1
1300	−0.1	3050	18.8	2850	16.0	4300	14.2	3200	−3.7	5600	2.7
1250	−10.6	3000	14.0	2800	11.0	4250	10.9	3150	−7.9	5550	0.2
1200	−21.1	2950	9.2	2750	5.9	4200	7.6	3100	−12.1	5500	−2.3
1150	−31.6	2900	4.4	2700	0.8	4150	4.2	3050	−16.3	5450	−4.7
1100	−42.1	2850	−0.4	2650	−4.3	4100	0.9	3000	−20.5	5400	−7.2
1050	−52.6	2800	−5.1	2600	−9.3	4050	−2.5	2950	−24.8	5350	−9.6
1000	−63.1	2750	−9.9	2550	−14.4	4000	−5.8	2900	−29.0	5300	−12.1
950	−73.6	2700	−14.7	2500	−19.5	3950	−9.2	2850	−33.2	5250	−14.6
		2650	−19.5	2450	−24.6	3900	−12.5	2800	−37.4	5200	−17.0
		2600	−24.3	2400	−29.6	3850	−15.8	2750	−41.6	5150	−19.5
		2550	−29.1	2350	−34.7	3800	−19.2	2700	−45.8	5100	−22.0
		2500	−33.9	2300	−39.8	3750	−22.5	2650	−50.0	5050	−24.4
		2450	−38.6	2250	−44.9	3700	−25.9	2600	−54.2	5000	−26.9
		2400	−43.4	2200	−49.9	3650	−29.2	2550	−58.4	4950	−29.3
		2350	−48.2	2150	−55.0	3600	−32.5	2500	−62.7	4900	−31.8
		2300	−53.0	2100	−60.1	3550	−35.9	2450	−66.9	4850	−34.3
		2250	−57.8	2050	−65.1	3500	−39.2	2400	−71.1	4800	−36.7
		2200	−62.6	2000	−70.2	3450	−42.6	2350	−75.3	4750	−39.2
		2150	−67.4	1950	−75.3	3400	−45.9	2300	−79.5	4700	−41.7
		2100	−72.1	1900	−80.4	3350	−49.3	2250	−83.7	4650	−44.1
		2050	−76.9			3300	−52.6	2200	−87.9	4600	−46.6
						3250	−55.9	2150	−92.1	4550	−49.0
						3200	−59.3	2100	−96.3	4500	−51.5
						3150	−62.6			4450	−54.0
						3100	−66.0			4400	−56.4
						3050	−69.3			4350	−58.9
						3000	−72.7			4300	−61.4
						2950	−76.0			4250	−63.8
						2900	−79.3			4200	−66.3
						2850	−82.7			4159	−68.7
						2800	−86.0			4100	−71.2
						2750	−89.4			4050	−73.7
										4000	−76.1
										3950	−78.6
										3900	−81.1
										3850	−83.5
										3800	−86.0
										3750	−88.4
										3700	−90.9
										3650	−93.4
										3600	−95.8
										3550	−98.3
										3550	−100.8

850-700 mb.	
Thickness	t'_{mv}
gpm.	°C.
1850	52.2
1800	43.4
1750	34.6
1700	25.8
1650	17.0
1600	8.2
1550	−0.6
1500	−9.4
1450	−18.2
1400	−27.0
1350	−35.8
1300	−44.6
1250	−53.4
1200	−62.1
1150	−70.9
1100	−79.7

MEAN ADJUSTED VIRTUAL TEMPERATURE BETWEEN STANDARD ISOBARIC SURFACES AS A FUNCTION OF THICKNESS IN GEOPOTENTIAL FEET

(Explanation on p. 241.)

Isobaric surfaces

1000-850 mb.

Thickness gpft.	t'_{mv} °C.
5200	59.8
5100	53.4
5000	47.0
4900	40.6
4800	34.2
4700	27.8
4600	21.4
4500	15.0
4400	8.6
4300	2.2
4200	−4.2
4100	−10.6
4000	−17.0
3900	−23.4
3800	−29.8
3700	−36.2
3600	−42.6
3500	−49.0
3400	−55.5
3300	−61.9
3200	−68.3
3100	−74.7

850-700 mb.

Thickness gpft.	t'_{mv} °C.
6000	48.4
5900	43.1
5800	37.7
5700	32.3
5600	27.0
5500	21.6
5400	16.3
5300	10.9
5200	5.6
5100	0.2
5000	−5.2
4900	−10.5
4800	−15.9
4700	−21.2
4600	−26.6
4500	−32.0
4400	−37.3
4300	−42.7
4200	−48.0
4100	−53.4
4000	−58.8
3900	−64.1
3800	−69.5
3700	−74.8
3600	−80.2

1000-700 mb.

Thickness gpft.	t'_{mv} °C.
11000	47.8
10900	44.9
10800	41.9
10700	39.0
10600	36.1
10500	33.2
10400	30.3
10300	27.4
10200	24.4
10100	21.5
10000	18.6
9900	15.7
9800	12.8
9700	9.8
9600	6.9
9500	4.0
9400	1.1
9300	−1.8
9200	−4.7
9100	−7.7
9000	−10.6
8900	−13.5
8800	−16.4
8700	−19.3
8600	−22.2
8500	−25.2
8400	−28.1
8300	−31.0
8200	−33.9
8100	−36.8
8000	−39.8
7900	−42.7
7800	−45.6
7700	−48.5
7600	−51.4
7500	−54.3
7400	−57.3
7300	−60.2
7200	−63.1
7100	−66.0
7000	−68.9
6900	−71.8
6800	−74.8
6700	−77.7

700-500 mb.

Thickness gpft.	t'_{mv} °C.
10400	48.5
10300	45.4
10200	42.3
10100	39.2
10000	36.1
9900	33.0
9800	29.9
9700	26.8
9600	23.7
9500	20.7
9400	17.6
9300	14.5
9200	11.4
9100	8.3
9000	5.2
8900	2.1
8800	−1.0
8700	−4.1
8600	−7.2
8500	−10.3
8400	−13.4
8300	−16.5
8200	−19.6
8100	−22.6
8000	−25.7
7900	−28.8
7800	−31.9
7700	−35.0
7600	−38.1
7500	−41.2
7400	−44.3
7300	−47.4
7200	−50.5
7100	−53.6
7000	−56.7
6900	−59.8
6800	−62.8
6700	−65.9
6600	−69.0
6500	−72.1
6400	−75.2
6300	−78.3
6200	−81.4

500-300 mb.

Thickness gpft.	t'_{mv} °C.
14900	30.4
14800	28.3
14700	26.3
14600	24.3
14500	22.2
14400	20.2
14300	18.2
14200	16.1
14100	14.1
14000	12.0
13900	10.0
13800	8.0
13700	5.9
13600	3.9
13500	1.9
13400	−0.2
13300	−2.2
13200	−4.3
13100	−6.3
13000	−8.3
12900	−10.4
12800	−12.4
12700	−14.4
12600	−16.5
12500	−18.5
12400	−20.5
12300	−22.6
12200	−24.6
12100	−26.7
12000	−28.7
11900	−30.7
11800	−32.8
11700	−34.8
11600	−36.8
11500	−38.9
11400	−40.9
11300	−43.0
11200	−45.0
11100	−47.0
11000	−49.1
10900	−51.1
10800	−53.1
10700	−55.2
10600	−57.2
10500	−59.3
10400	−61.3
10300	−63.3
10200	−65.4
10100	−67.4
10000	−69.4
9900	−71.5
9800	−73.5
9700	−75.6
9600	−77.6
9500	−79.6

300-200 mb.

Thickness gpft.	t'_{mv} °C.
11400	19.4
11300	16.9
11200	14.3
11100	11.7
11000	9.2
10900	6.6
10800	4.0
10700	1.5
10600	−1.1
10500	−3.7
10400	−6.2
10300	−8.8
10200	−11.4
10100	−13.9
10000	−16.5
9900	−19.1
9800	−21.6
9700	−24.2
9600	−26.8
9500	−29.3
9400	−31.9
9300	−34.5
9200	−37.0
9100	−39.6
9000	−42.2
8900	−44.7
8800	−47.3
8700	−49.9
8600	−52.4
8500	−55.0
8400	−57.6
8300	−60.1
8200	−62.7
8100	−65.3
8000	−67.8
7900	−70.4
7800	−73.0
7700	−75.5
7600	−78.1
7500	−80.7
7400	−83.2
7300	−85.8
7200	−88.4
7100	−90.9
7000	−93.5
6900	−96.1
6800	−98.6

200-100 mb.

Thickness gpft.	t'_{mv} °C.
19000	12.1
18800	9.1
18600	6.1
18400	3.1
18200	0.1
18000	−2.9
17800	−5.9
17600	−8.9
17400	−11.9
17200	−14.9
17000	−17.9
16800	−20.9
16600	−23.9
16400	−26.9
16200	−29.9
16000	−32.9
15800	−35.9
15600	−39.0
15400	−42.0
15200	−45.0
15000	−48.0
14800	−51.0
14600	−54.0
14400	−57.0
14200	−60.0
14000	−63.0
13800	−66.0
13600	−69.0
13400	−72.0
13200	−75.0
13000	−78.0
12800	−81.0
12600	−84.0
12400	−87.0
12200	−90.0
12000	−93.0
11800	−96.0
11600	−99.0

RELATION BETWEEN PRESSURE CHANGE AND GEOPOTENTIAL CHANGE

From the hydrostatic equation and the definition of geopontential[1]

$$d\Phi = -RT'_v \frac{dp}{p} \qquad (1)$$

where

Φ = geopotential,
R = gas constant for dry air,
T'_v = adjusted virtual temperature of the air, °K. (see Table 72),
p = pressure,

$$\text{or } dp = \frac{-p d\Phi}{RT'_v} \qquad (2)$$

Tables 57–62 give solutions to equations (1) and (2) for various combinations of units as indicated below:

A. Change in geopotential corresponding to a given change in pressure

	Unit of geopotential[2]	Unit of pressure	Temperature scale
Table 57	gpm.	mb.	°C.
Table 58	gpft.	mb.	°C.
Table 59	gpft.	0.1 in. Hg.	°F.

B. Change in pressure corresponding to a given change in geopotential

Table 60	10 gpm.	mb.	°C.
Table 61	10 gpft.	mb.	°C.
Table 62	10 gpft.	in. Hg.	°F.

Equations (1) and (2) take the following forms for the various tables:

Table 57, $d\Phi = -29.2898\ T'_v/p$ gpm.
Table 58, $d\Phi = -96.0951\ T'_v/p$ gpft.
Table 59, $d\Phi = -9.60951\ T'_v/p$ gpft.
Table 60, $dp = -0.341416\ p/T'_v$ mb.
Table 61, $dp = -0.1040635\ p/T'_v$ mb.
Table 62, $dp = -0.1040635\ p/T'_v$ in. Hg.

NOTE.—T'_v must be expressed in °K. in the above formulas.

[1] See Table 49 for definition of geopotential.
[2] 1 geopotential foot (gpft.) = 0.3048 geopotential meter (gpm.).

CHANGE IN HEIGHT (GEOPOTENTIAL METERS) CORRESPONDING TO 1 MILLIBAR CHANGE IN PRESSURE

(Explanation on p. 256.)

Temperature	Pressure—millibars								
	1050	1000	950	900	850	800	750	700	600
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
− 80	5.3882	5.6576	5.9554	6.2862	6.6560	7.0720	7.5435	8.0823	9.4294
− 70	5.6671	5.9505	6.2637	6.6117	7.0006	7.4381	7.9340	8.5007	9.9175
− 60	5.9461	6.2434	6.5720	6.9371	7.3452	7.8043	8.3246	8.9192	10.406
− 50	6.2250	6.5363	6.8803	7.2626	7.6898	8.1704	8.7151	9.3376	10.894
− 40	6.5040	6.8292	7.1886	7.5880	8.0344	8.5365	9.1056	9.7560	11.382
− 30	6.7829	7.1221	7.4970	7.9134	8.3790	8.9026	9.4962	10.174	11.870
− 20	7.0619	7.4150	7.8053	8.2389	8.7235	9.2687	9.8867	10.593	12.358
− 10	7.3408	7.7079	8.1136	8.5643	9.0681	9.6349	10.277	11.011	12.846
0	7.6198	8.0008	8.4219	8.8898	9.4127	10.001	10.668	11.430	13.335
10	7.8987	8.2937	8.7302	9.2152	9.7573	10.367	11.058	11.848	13.823
20	8.1777	8.5866	9.0385	9.5407	10.102	10.733	11.449	12.267	14.311
30	8.4566	8.8795	9.3468	9.8661	10.446	11.099	11.839	12.685	14.799
40	8.7356	9.1724	9.6552	10.192	10.791	11.465	12.230	13.103	15.287
50	9.0145	9.4653	9.9635	10.517	11.136	11.832	12.620	13.522	
60	9.2935	9.7582	10.272	10.842					

Temperature	Pressure—millibars								
	500	400	350	300	250	200	175	150	125
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
−100						25.359	28.982	33.812	40.575
− 90				17.882	21.459	26.824	30.655	35.765	42.918
− 80	11.315	14.144	16.165	18.859	22.630	28.288	32.329	37.717	45.261
− 70	11.901	14.876	17.001	19.835	23.802	29.753	34.003	39.670	47.604
− 60	12.487	15.609	17.838	20.811	24.974	31.217	35.677	41.623	49.947
− 50	13.073	16.341	18.675	21.788	26.145	32.682	37.350	43.575	52.290
− 40	13.658	17.073	19.512	22.764	27.317	34.146	39.024	45.528	54.634
− 30	14.244	17.805	20.349	23.740	28.488	35.611	40.698	47.481	56.977
− 20	14.830	18.538	21.186	24.717	29.660	37.075	42.371	49.433	59.320
− 10	15.416	19.270	22.023	25.693	30.832	38.540	44.045	51.386	61.663
0	16.002	20.002	22.859	26.669	32.003	40.004	45.719	53.339	64.006
10	16.587	20.734	23.696	27.646	33.175	41.468	47.392	55.291	
20	17.173	21.466	24.533	28.622	34.346	42.933			
30	17.759	22.199	25.370						
40	18.345								

Temperature	Pressure—millibars									
	100	80	60	50	40	30	20	15	10	5
°C.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.	gpm.
−110	47.789	59.736	79.649	95.578	119.47	159.30	238.95	318.59	477.89	955.78
−100	50.718	63.398	84.530	101.44	126.80	169.06	253.59	338.12	507.18	1014.4
− 90	53.647	67.059	89.412	107.29	134.12	178.82	268.24	357.65	536.47	1072.9
− 80	56.576	70.720	94.294	113.15	141.44	188.59	282.88	377.17	565.76	1131.5
− 70	59.505	74.381	99.175	119.01	148.76	198.35	297.53	396.70	595.05	1190.1
− 60	62.434	78.043	104.06	124.87	156.09	208.11	312.17	416.23	624.34	1248.7
− 50	65.363	81.704	108.94	130.73	163.41	217.88	326.82	435.75	653.63	1307.3
− 40	68.292	85.365	113.82	136.58	170.73	227.64	341.46	455.28	682.92	1365.8
− 30	71.221	89.026	118.70	142.44	178.05	237.40	356.11	474.81	712.21	1424.4
− 20	74.150	92.687	123.58	148.30	185.38	247.17	370.75	494.33	741.50	1483.0
− 10	77.079	96.349	128.46	154.16	192.70	256.93	385.40	513.86	770.79	1541.6
0	80.008	100.01	133.35	160.02	200.02	266.69	400.04	533.39	800.08	1600.2

Table 58

CHANGE IN HEIGHT (GEOPOTENTIAL FEET) CORRESPONDING TO 1 MILLIBAR CHANGE IN PRESSURE

(Explanation on p. 256.)

Temperature °C.	Pressure—millibars 1050 gpft.	1000 gpft.	950 gpft.	900 gpft.	850 gpft.	800 gpft.	750 gpft.	700 gpft.	600 gpft.
− 80	17.678	18.562	19.539	20.624	21.837	23.202	24.749	26.517	30.936
− 70	18.593	19.523	20.550	21.692	22.968	24.403	26.030	27.890	32.538
− 60	19.508	20.484	21.562	22.760	24.098	25.605	27.312	29.262	34.139
− 50	20.423	21.445	22.573	23.827	25.229	26.806	28.593	30.635	35.741
− 40	21.339	22.406	23.585	24.895	26.359	28.007	29.874	32.008	37.342
− 30	22.254	23.366	24.596	25.963	27.490	29.208	31.155	33.381	38.944
− 20	23.169	24.327	25.608	27.030	28.620	30.409	32.437	34.754	40.546
− 10	24.084	25.288	26.619	28.098	29.751	31.611	33.718	36.126	42.147
0	24.999	26.249	27.631	29.166	30.882	32.812	34.999	37.499	43.749
10	25.915	27.210	28.642	30.234	32.012	34.013	36.280	38.872	45.350
20	26.830	28.171	29.654	31.301	33.143	35.214	37.562	40.245	46.952
30	27.745	29.132	30.666	32.369	34.273	36.415	38.843	41.618	48.553
40	28.660	30.093	31.677	33.437	35.404	37.616	40.124	42.990	50.155
50	29.575	31.054	32.689	34.504	36.534	38.818	41.406	44.363	
60	30.491	32.015	33.700	35.572					

Temperature °C.	Pressure—millibars 500 gpft.	400 gpft.	350 gpft.	300 gpft.	250 gpft.	200 gpft.	175 gpft.	150 gpft.	125 gpft.
−100						83.199	95.085	110.93	133.12
− 90				58.669	70.403	88.004	100.58	117.34	140.81
− 80	37.123	46.404	53.033	61.872	74.247	92.809	106.07	123.74	148.49
− 70	39.045	48.807	55.779	65.076	78.091	97.614	111.56	130.15	156.18
− 60	40.967	51.209	58.525	68.279	81.934	102.42	117.05	136.56	163.87
− 50	42.889	53.612	61.270	71.482	85.778	107.22	122.54	142.96	171.56
− 40	44.811	56.014	64.016	74.685	89.622	112.03	128.03	149.37	179.24
− 30	46.733	58.416	66.761	77.888	93.466	116.83	133.52	155.78	186.93
− 20	48.655	60.819	69.507	81.091	97.310	121.64	139.01	162.18	194.62
− 10	50.577	63.221	72.252	84.295	101.15	126.44	144.51	168.59	202.31
0	52.499	65.623	74.998	87.498	105.00	131.25	150.00	175.00	209.99
10	54.421	68.026	77.744	90.701	108.84	136.05	155.49	191.40	
20	56.342	70.428	80.489	93.904	112.68	140.86			
30	58.264	72.831	83.235						
40	60.186								

Temperature °C.	Pressure—millibars 100 gpft.	80 gpft.	60 gpft.	50 gpft.	40 gpft.	30 gpft.	20 gpft.	15 gpft.	10 gpft.	5 gpft.
−110	156.79	195.99	261.31	313.58	391.97	522.63	783.94	1045.3	1567.9	3135.8
−100	166.40	208.00	277.33	332.80	416.00	554.66	831.99	1109.3	1664.0	3328.0
− 90	176.01	220.01	293.35	352.02	440.02	586.69	880.04	1173.4	1760.1	3520.2
− 80	185.62	232.02	309.36	371.23	464.04	618.72	928.09	1237.4	1856.2	3712.3
− 70	195.23	244.03	325.38	390.45	488.07	650.76	976.14	1301.5	1952.3	3904.5
− 60	204.84	256.05	341.39	409.67	512.09	682.79	1024.2	1365.6	2048.4	4096.7
− 50	214.45	268.06	357.41	428.89	536.12	714.82	1072.2	1429.6	2144.5	4288.9
− 40	224.06	280.07	373.42	448.11	560.14	746.85	1120.3	1493.7	2240.6	4481.1
− 30	233.66	292.08	389.44	467.33	584.16	778.88	1168.3	1557.8	2336.6	4673.3
− 20	243.27	304.09	405.46	486.55	608.19	810.91	1216.4	1621.8	2432.7	4865.5
− 10	252.88	316.11	421.47	505.77	632.21	842.95	1264.4	1685.9	2528.8	5057.7
0	262.49	328.12	437.49	524.99	656.23	874.98	1312.5	1750.0	2624.9	5249.9

CHANGE IN HEIGHT (GEOPOTENTIAL FEET) CORRESPONDING TO A CHANGE IN PRESSURE OF ONE-TENTH OF AN INCH OF MERCURY

(Explanation on p. 256.)

Temperature °F.	Pressure—inches of mercury									
	31.00	30.00	29.00	28.00	27.00	26.00	25.00	24.00	23.00	22.00
	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
−110	60.221	62.228	64.374	66.673	69.142	71.802	74.674	77.785	81.167	84.856
−100	61.944	64.009	66.216	68.581	71.121	73.857	76.811	80.011	83.490	87.285
− 90	63.665	65.787	68.055	70.486	73.096	75.908	78.944	82.233	85.809	89.709
− 80	65.388	67.568	69.898	72.394	75.075	77.963	81.081	84.460	88.132	92.138
− 70	67.108	69.345	71.737	74.299	77.051	80.014	83.214	86.682	90.451	94.562
− 60	68.832	71.126	73.579	76.207	79.029	82.069	85.352	88.908	92.774	96.991
− 50	70.552	72.904	75.418	78.112	81.005	84.120	87.485	91.130	95.092	99.415
− 40	72.276	74.685	77.260	80.020	82.984	86.175	89.622	93.356	97.415	101.84
− 30	73.999	76.466	79.103	81.928	84.962	88.230	91.759	95.583	99.738	104.27
− 20	75.720	78.244	80.942	83.833	86.938	90.281	93.893	97.805	102.06	106.70
− 10	77.443	80.025	82.784	85.741	88.916	92.336	96.030	100.03	104.38	109.12
0	79.164	81.803	84.623	87.646	90.892	94.388	98.163	102.25	106.70	111.55
10	80.887	83.584	86.466	89.554	92.871	96.443	100.30	104.48	109.02	113.98
20	82.608	85.361	88.305	91.459	94.846	98.494	102.43	106.70	111.34	116.40
30	84.331	87.142	90.147	93.367	96.825	100.55	104.57	108.93	113.66	118.83
40	86.052	88.920	91.986	95.271	98.800	102.60	106.70	111.15	115.98	121.25
50	87.775	90.701	93.828	97.180	100.78	104.66	108.84	113.38	118.31	123.68
60	89.499	92.482	95.671	99.088	102.76	106.71	110.98	115.60	120.63	126.11
70	91.219	94.260	97.510	100.99	104.73	108.76	113.11	117.82	122.95	128.54
80	92.943	96.041	99.352	102.90	106.71	110.82	115.25	120.05	125.27	130.96
90	94.663	97.818	101.19	104.81	108.69	112.87	117.38	122.27	127.59	133.39
100	96.386	99.599	103.03	106.71	110.67	114.92	119.52	124.50	129.91	135.82
110	98.107	101.38	104.87	108.62	112.64	116.97	121.65	126.72	132.23	138.24
120	99.830	103.16	106.72	110.53	114.62	119.03	123.79	128.95	134.55	140.67
130	101.55	104.94	108.55	112.43	116.60	121.08				
140	103.27	106.72	110.40	114.34	118.57	123.13				

Temperature °F.	Pressure—inches of mercury									
	21.00	20.00	18.00	16.00	14.00	12.00	10.00	8.00	6.00	4.00
	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.	gpft.
−110	88.897	93.342	103.71	116.68	133.35	155.57	186.68	233.36	311.14	466.71
−100	91.441	96.014	106.68	120.02	137.16	160.02	192.03	240.03	320.04	480.07
− 90	93.981	98.680	109.64	123.35	140.97	164.47	197.36	246.70	328.93	493.40
− 80	96.525	101.35	112.61	126.69	144.79	168.92	202.70	253.38	337.84	506.76
− 70	99.065	104.02	115.58	130.02	148.60	173.36	208.04	260.05	346.73	520.09
− 60	101.61	106.69	118.54	133.36	152.41	177.82	213.38	266.72	355.63	533.45
− 50	104.15	109.36	121.51	136.70	156.22	182.26	218.71	273.39	364.52	546.78
− 40	106.69	112.03	124.48	140.03	160.04	186.71	224.06	280.07	373.42	560.14
− 30	109.24	114.70	127.44	143.37	163.86	191.17	229.40	286.75	382.33	573.50
− 20	111.78	117.37	130.41	146.71	167.67	195.61	234.73	293.41	391.22	586.83
− 10	114.32	120.04	133.37	150.05	171.48	200.06	240.07	300.09	400.12	600.19
0	116.86	122.70	136.34	153.38	175.29	204.51	245.41	306.76	409.01	613.52
10	119.41	125.38	139.31	156.72	179.11	208.96	250.75	313.44	417.92	626.88
20	121.94	128.04	142.27	160.05	182.92	213.40	256.08	320.11	426.81	640.21
30	124.49	130.71	145.24	163.39	186.73	217.86	261.43	326.78	435.71	653.57
40	127.03	133.38	148.20	166.72	190.54	222.30	266.76	333.45	444.60	
50	129.57	136.05	151.17	170.06	194.36	226.75	272.10	340.13	453.50	
60	132.12	138.72	154.14	173.40	198.18	231.20	277.45	346.81	462.41	
70	134.66	141.39	157.10	176.74	201.99	235.65	282.78	353.47	471.30	
80	137.20	144.06	160.07	180.08	205.80	240.10	288.12			
90	139.74	146.73	163.03	183.41	209.61					
100	142.28	149.40	166.00	186.75	213.43					
110	144.82	152.07								
120	147.37	154.74								

Table 60

CHANGE IN PRESSURE (MILLIBARS) CORRESPONDING TO A CHANGE IN HEIGHT OF 10 GEOPOTENTIAL METERS

(Explanation on p. 256.)

Temperature °C.	Pressure—millibars 1050 mb.	1000 mb.	950 mb.	900 mb.	850 mb.	800 mb.	750 mb.	700 mb.	600 mb.
− 80	1.8559	1.7675	1.6792	1.5908	1.5024	1.4140	1.3256	1.2373	1.0605
− 70	1.7646	1.6805	1.5965	1.5125	1.4284	1.3444	1.2604	1.1764	1.0083
− 60	1.6818	1.6017	1.5216	1.4415	1.3614	1.2814	1.2013	1.1212	.96101
− 50	1.6064	1.5299	1.4534	1.3769	1.3004	1.2239	1.1474	1.0709	.91795
− 40	1.5375	1.4643	1.3911	1.3179	1.2447	1.1714	1.0982	1.0250	.87858
− 30	1.4743	1.4041	1.3339	1.2637	1.1935	1.1233	1.0531	.98285	.84245
− 20	1.4160	1.3486	1.2812	1.2138	1.1463	1.0789	1.0115	.94403	.80917
− 10	1.3622	1.2974	1.2325	1.1676	1.1028	1.0379	.97303	.90816	.77842
0	1.3124	1.2499	1.1874	1.1249	1.0624	.99990	.93741	.87491	.74992
10	1.2660	1.2057	1.1454	1.0852	1.0249	.96459	.90430	.84401	.72344
20	1.2228	1.1646	1.1064	1.0481	.98991	.93169	.87345	.81522	.69876
30	1.1825	1.1262	1.0699	1.0136	.95726	.90095	.84464	.78833	.67571
40	1.1447	1.0902	1.0357	.98120	.92669	.87218	.81767	.76316	.65414
50	1.1093	1.0565	1.0037	.95084	.89802	.84519	.79237	.73954	
60	1.0760	1.0248	.97354	.92230					

Temperature °C.	Pressure—millibars 500 mb.	400 mb.	350 mb.	300 mb.	250 mb.	200 mb.	175 mb.	150 mb.	125 mb.
−100						.39434	.34504	.29575	.24646
− 90				.55921	.46601	.37281	.32621	.27960	.23300
− 80	.88376	.70701	.61864	.53026	.44188	.35351	.30932	.26513	.22094
− 70	.84026	.67221	.58819	.50416	.42013	.33611	.29409	.25208	.21007
− 60	.80084	.64067	.56059	.48051	.40042	.32034	.28030	.24025	.20021
− 50	.76496	.61196	.53547	.45898	.38248	.30598	.26774	.22949	.19124
− 40	.73215	.58572	.51251	.43929	.36607	.29286	.25625	.21964	.18304
− 30	.70204	.56163	.49143	.42122	.35102	.28082	.24571	.21061	.17551
− 20	.67431	.53945	.47202	.40459	.33715	.26972	.23601	.20229	.16858
− 10	.64869	.51895	.45408	.38921	.32434	.25947	.22704	.19461	.16217
0	.62494	.49995	.43746	.37496	.31247	.24998	.21873	.18748	.15623
10	.60287	.48229	.42201	.36172	.30143	.24115	.21100	.18086	
20	.58230	.46584	.40761	.34938	.29115	.23292			
30	.56310	.45047	.39417						
40	.54511								

Temperature °C.	Pressure—millibars 100 mb.	80 mb.	60 mb.	50 mb.	40 mb.	30 mb.	20 mb.	15 mb.	10 mb.	5 mb.
−110	.20925	.16740	.12555	.10463	.08370	.06278	.04185	.03139	.02093	.01046
−100	.19717	.15773	.11830	.09858	.07887	.05915	.03943	.02958	.01972	.00986
− 90	.18640	.14912	.11184	.09320	.07456	.05592	.03728	.02796	.01864	.00932
− 80	.17675	.14140	.10605	.08838	.07070	.05303	.03535	.02651	.01768	.00884
− 70	.16805	.13444	.10083	.08403	.06722	.05042	.03361	.02521	.01681	.00840
− 60	.16017	.12814	.09610	.08008	.06407	.04805	.03203	.02403	.01602	.00801
− 50	.15299	.12239	.09179	.07650	.06120	.04590	.03060	.02295	.01530	.00765
− 40	.14643	.11714	.08786	.07321	.05857	.04393	.02929	.02196	.01464	.00732
− 30	.14041	.11233	.08424	.07020	.05616	.04212	.02808	.02106	.01404	.00702
− 20	.13486	.10789	.08092	.06743	.05394	.04046	.02697	.02023	.01349	.00674
− 10	.12974	.10379	.07784	.06487	.05189	.03892	.02595	.01946	.01297	.00649
0	.12499	.09999	.07499	.06249	.04999	.03750	.02500	.01875	.01250	.00625

CHANGE IN PRESSURE (MILLIBARS) CORRESPONDING TO A CHANGE IN HEIGHT OF 10 GEOPOTENTIAL FEET

(Explanation on p. 256.)

Temperature °C.	Pressure—millibars 1050 mb.	1000 mb.	950 mb.	900 mb.	850 mb.	800 mb.	750 mb.	700 mb.	600 mb.
− 80	.56568	.53874	.51181	.48487	.45793	.43099	.40406	.37712	.32325
− 70	.53784	.51223	.48661	.46100	.43539	.40978	.38417	.35856	.30733
− 60	.51261	.48820	.46378	.43938	.41497	.39056	.36615	.34174	.29292
− 50	.48964	.46632	.44300	.41969	.39637	.37305	.34974	.32642	.27979
− 40	.46864	.44632	.42400	.40169	.37937	.35705	.33474	.31242	.26779
− 30	.44936	.42797	.40656	.38517	.36377	.34237	.32097	.29957	.25678
− 20	.43161	.41106	.39051	.36995	.34940	.32885	.30829	.28774	.24663
− 10	.41521	.39544	.37567	.35589	.33612	.31635	.29658	.27681	.23726
0	.40001	.38096	.36191	.34287	.32382	.30477	.28572	.26667	.22858
10	.38588	.36751	.34913	.33076	.31238	.29401	.27563	.25726	.22050
20	.37272	.35497	.33722	.31947	.30173	.28398	.26623	.24848	.21298
30	.36043	.34326	.32610	.30894	.29177	.27461	.25745	.24028	.20596
40	.34892	.33230	.31569	.29907	.28246	.26584	.24923	.23261	.19938
50	.33812	.32202	.30592	.28982	.27372	.25761	.24151	.22541	
60	.32797	.31235	.29674	.28112					

Temperature °C.	Pressure—millibars 500 mb.	400 mb.	350 mb.	300 mb.	250 mb.	200 mb.	175 mb.	150 mb.	125 mb.
−100						.12019	.10517	.09014	.07512
− 90				.17045	.14204	.11363	.09943	.08522	.07102
− 80	.26937	.21550	.18856	.16162	.13469	.10775	.09428	.08081	.06734
− 70	.25611	.20489	.17928	.15367	.12806	.10244	.08964	.07683	.06403
− 60	.24410	.19528	.17087	.14646	.12205	.09764	.08543	.07323	.06102
− 50	.23316	.18653	.16321	.13990	.11658	.09326	.08161	.06995	.05829
− 40	.22316	.17853	.15621	.13390	.11158	.08926	.07811	.06695	.05579
− 30	.21398	.17119	.14979	.12839	.10699	.08559	.07489	.06419	.05350
− 20	.20553	.16442	.14387	.12332	.10276	.08221	.07194	.06166	.05138
− 10	.19772	.15818	.13840	.11863	.09886	.07909	.06920	.05932	.04943
0	.19048	.15238	.13334	.11429	.09524	.07619	.06667	.05714	.04762
10	.18375	.14700	.12863	.11025	.09188	.07350	.06431	.05513	
20	.17749	.14199	.12424	.10649	.08874	.07099			
30	.17163	.13730	.12014						
40	.16615								

Temperature °C.	Pressure—millibars 100 mb.	80 mb.	60 mb.	50 mb.	40 mb.	30 mb.	20 mb.	15 mb.	10 mb.	5 mb.
−110	.06378	.05102	.03827	.03189	.02551	.01913	.01276	.00957	.00638	.00319
−100	.06010	.04808	.03606	.03005	.02404	.01803	.01202	.00901	.00601	.00300
− 90	.05682	.04545	.03409	.02841	.02273	.01704	.01136	.00852	.00568	.00284
− 80	.05387	.04310	.03232	.02694	.02155	.01616	.01077	.00808	.00539	.00269
− 70	.05122	.04098	.03073	.02561	.02049	.01537	.01024	.00768	.00512	.00256
− 60	.04882	.03906	.02929	.02441	.01953	.01465	.00976	.00732	.00488	.00244
− 50	.04663	.03731	.02798	.02332	.01865	.01399	.00933	.00699	.00466	.00233
− 40	.04463	.03571	.02678	.02232	.01785	.01339	.00893	.00669	.00446	.00223
− 30	.04280	.03424	.02568	.02140	.01712	.01284	.00856	.00642	.00428	.00214
− 20	.04111	.03288	.02466	.02055	.01644	.01233	.00822	.00617	.00411	.00206
− 10	.03954	.03164	.02373	.01977	.01582	.01186	.00791	.00593	.00395	.00198
0	.03810	.03048	.02286	.01905	.01524	.01143	.00762	.00571	.00381	.00190

TABLE 62

CHANGE IN PRESSURE (INCHES OF MERCURY) CORRESPONDING TO A CHANGE IN HEIGHT OF 10 GEOPOTENTIAL FEET

(Explanation on p. 256.)

Temperature °F.	Pressure—inches of mercury 31.00 gpft.	30.00 gpft.	29.00 gpft.	28.00 gpft.	27.00 gpft.	26.00 gpft.	25.00 gpft.	24.00 gpft.	23.00 gpft.	22.00 gpft.
−110	0.016606	0.016070	0.015534	0.014999	0.014463	0.013927	0.013392	0.012856	0.012320	0.011785
−100	.016144	.015623	.015102	.014581	.014061	.013540	.013019	.012498	.011977	.011457
− 90	.015707	.015201	.014694	.014187	.013680	.013174	.012667	.012160	.011654	.011147
− 80	.015293	.014800	.014307	.013813	.013320	.012827	.012333	.011840	.011347	.010853
− 70	.014901	.014421	.013940	.013459	.012978	.012498	.012017	.011536	.011056	.010575
− 60	0.014528	0.014059	0.013591	0.013122	0.012654	0.012185	0.011716	0.011248	0.010779	0.010310
− 50	.014174	.013717	.013259	.012802	.012345	.011888	.011431	.010973	.010516	.010059
− 40	.013836	.013390	.012943	.012497	.012051	.011604	.011158	.010712	.010265	.009819
− 30	.013514	.013078	.012642	.012206	.011770	.011334	.010898	.010462	.010026	.009590
− 20	.013207	.012781	.012355	.011929	.011502	.011076	.010650	.010224	.009798	.009372
− 10	0.012913	0.012496	0.012080	0.011663	0.011246	0.010830	0.010413	0.009997	0.009580	0.009164
0	.012632	.012225	.011817	.011410	.011002	.010595	.010187	.009780	.009372	.008965
10	.012363	.011964	.011565	.011166	.010768	.010369	.009970	.009571	.009172	.008774
20	.012105	.011715	.011324	.010934	.010543	.010153	.009762	.009372	.008981	.008591
30	.011858	.011475	.011093	.010710	.010328	.009945	.009563	.009180	.008798	.008415
40	0.011621	0.011246	0.010871	0.010496	0.010121	0.009747	0.009372	0.008997	0.008622	0.008247
50	.011393	.011025	.010658	.010290	.009923	.009555	.009188	.008820	.008453	.008085
60	.011173	.010813	.010452	.010092	.009732	.009371	.009011	.008650	.008290	.007929
70	.010963	.010609	.010255	.009902	.009548	.009194	.008841	.008487	.008134	.007780
80	.010759	.010412	.010065	.009718	.009371	.009024	.008677	.008330	.007983	.007636
90	0.010564	0.010223	0.009882	0.009541	0.009201	0.008860	0.008519	0.008178	0.007838	0.007497
100	.010375	.010040	.009706	.009371	.009036	.008702	.008367	.008032	.007697	.007363
110	.010193	.009864	.009535	.009207	.008878	.008549	.008220	.007891	.007563	.007234
120	.010017	.009694	.009371	.009048	.008724	.008401	.008078	.007755	.007432	.007109
130	.009847	.009530	.009212	.008894	.008577	.008259				
140	0.009683	0.009371	0.009058	0.008746	0.008434	0.008121				

Temperature °F.	Pressure—inches of mercury 21.00 gpft.	20.00 gpft.	18.00 gpft.	16.00 gpft.	14.00 gpft.	12.00 gpft.	10.00 gpft.	8.00 gpft.	6.00 gpft.	4.00 gpft.
−110	0.011249	0.010713	0.009642	0.008571	0.007499	0.006428	0.005357	0.004285	0.003214	0.002143
−100	.010936	.010415	.009374	.008332	.007291	.006249	.005208	.004166	.003125	.002083
− 90	.010640	.010134	.009120	.008107	.007094	.006080	.005067	.004054	.003040	.002027
− 80	.010360	.009867	.008880	.007893	.006907	.005920	.004933	.003947	.002960	.001973
− 70	.010094	.009614	.008652	.007691	.006730	.005768	.004807	.003845	.002884	.001923
− 60	0.009842	0.009373	0.008436	0.007498	0.006561	0.005624	0.004687	0.003749	0.002812	0.001875
− 50	.009602	.009144	.008230	.007316	.006401	.005487	.004572	.003658	.002743	.001829
− 40	.009373	.008926	.008034	.007141	.006248	.005356	.004463	.003571	.002678	.001785
− 30	.009154	.008718	.007847	.006975	.006103	.005231	.004359	.003487	.002616	.001744
− 20	.008946	.008520	.007668	.006816	.005964	.005112	.004260	.003408	.002556	.001704
− 10	0.008747	0.008331	0.007498	0.006665	0.005832	0.004998	0.004165	0.003332	0.002499	0.001666
0	.008557	.008150	.007335	.006520	.005705	.004890	.004075	.003260	.002445	.001630
10	.008375	.007976	.007178	.006381	.005583	.004786	.003988	.003190	.002393	.001595
20	.008200	.007810	.007029	.006248	.005467	.004686	.003905	.003124	.002343	.001562
30	.008033	.007650	.006885	.006120	.005355	.004590	.003825	.003060	.002295	.001530
40	0.007872	0.007497	0.006748	0.005998	0.005248	0.004498	0.003749	0.002999	0.002249	
50	.007718	.007350	.006615	.005880	.005145	.004410	.003675	.002940	.002205	
60	.007569	.007209	.006488	.005767	.005046	.004325	.003604	.002883	.002163	
70	.007426	.007073	.006365	.005658	.004951	.004244	.003536	.002829	.002122	
80	.007289	.006942	.006247	.005553	.004859	.004165	.003471			
90	0.007156	0.006815	0.006135	0.005452	0.004771					
100	.007028	.006693	.006024	.005355	.004685					
110	.006905	.006576								
120	.006786	.006463								

Section V

STANDARD ATMOSPHERE AND ALTIMETRY TABLES

NACA STANDARD ATMOSPHERE, LOWER ATMOSPHERE[1]*

In 1922 the Weather Bureau at the request of the National Advisory Committee for Aeronautics prepared a "standard atmosphere"[2] for scientific and engineering use based primarily on the average conditions over the United States at latitude 40°. Later Diehl extended the computations to 20,000 meters using constants adopted by the NACA effective January 1, 1925. This atmosphere was based on the assumption of a linear decrease of temperature with height up to the tropopause and an isothermal layer above. In 1935 Brombacher[3] prepared additional tables giving alttude as a function of pressure. A tentative extension of the standard atmosphere to 120,000 meters was prepared in 1947 (see Table 68).

Standard values.—The standard atmosphere is based on approximate absolute temperatures, $T = 273 + t$ °C., or for the equivalent absolute Fahrenheit scale $T = 459.4 + t$ °F. since $459.4 + 32$ °F. corresponds to 273 °A. Engineering (gravitational) systems of units have been used, the kilogrameter-second, and the pound-foot-second system. The following standard values have been adopted for use in the definition of the standard atmosphere:

		Metric	English
Standard pressure at sea level	p_0	= 760 mm. Hg.	= 29.921 in. Hg.
Standard temperature at sea level	t_0	= 15 °C.	= 59 °F.
Standard absolute temperature at sea level	T_0	= 288 °A.	= 518.4 °Rankine
Standard isothermal layer temperature	T_i	= − 55 °C.	= − 67 °F.
Standard specific weight[4] at sea level	$g\rho_0$	= 1.2255 kg. m.$^{-3}$	= 0.07651 lb. ft.$^{-3}$
Standard gravity	g	= 9.80665 m. sec.$^{-2}$	= 32.1740 ft. sec.$^{-2}$
Standard temperature lapse rate	a	= 0.0065 °C. m.$^{-1}$	= 0.003566 °F. ft.$^{-1}$
	aR	= 0.190284	
Standard gas constant for dry air[5]	R	= 29.2745	= 53.3551

The standard conversion factors used are:

1 meter = 3.280833 feet
1 kilogram = 2.204622 pounds

Other symbols employed are:

Z = altitude (see assumption (c) below),
T = absolute temperature,
T_m = mean temperature (absolute) of the air column,
p = pressure,
M = modulus for the common logarithms = $\log_{10}e$ = 0.4342945,
Z_i = altitude of the base of the isothermal layer,
T_{mi} = mean temperature of the air column up to base of isothermal level = 251.378 °A = 452.680 °Rankine,
ρ = specific mass.

Basic assumptions.—The primary basic assumption is a linear decrease in temperature with altitude

$$T = T_0 - aZ \tag{1}$$

In addition certain other basic assumptions are necessary to define the standard atmosphere. These assumptions are as follows:

That (a) the air is dry,
(b) air is a perfect gas, obeying the laws of Charles and Boyle, i.e.,

$$p = Rg\rho T \tag{2}$$

or

$$\left(\frac{p}{p_0}\right) = \left(\frac{\rho}{\rho_0}\right)\left(\frac{T}{T_0}\right) \tag{2a}$$

[1] Condensed from Diehl, Walter S., Standard atmosphere—Tables and data, NACA Rep. No. 218, 1925. (Often referred to as the U. S. Standard Atmosphere.)
[2] Gregg, W. R., Standard atmosphere, NACA Techn. Rep. No. 147, 1922.
[3] Brombacher, W. G., Altitude-pressure tables based on the United States standard atmosphere, NACA Rep. No. 538, 1935.
[4] "Density" in absolute system of units.
[5] In Diehl's report the values of aR and R are given as 0.19026 and 29.2708 respectively, but these are not in agreement with the numerical values of the other physical constants given, where $R = p_0/g\rho_0T_0$; p_0 here is in kg. m.$^{-2}$.
* The NACA standard atmosphere has been superseded by the ICAO standard atmosphere. NACA Rep. No. 1235, 1955.

(continued)

NACA STANDARD ATMOSPHERE, LOWER ATMOSPHERE

(c) gravity is constant at all altitudes with the standard value,[6]
(d) the temperature of the isothermal atmosphere is − 55 °C. or − 67 °F.,
(e) equation (1) holds true for altitudes up to the isothermal atmosphere; the gradient vanishing at the lower limit of the isothermal atmosphere.

The last assumption not only simplifies the standard atmosphere but it also appears to be a very close approximation to actual conditions at any given time.[7] The altitude of the lower limit of the isothermal atmosphere is found from equation (1) by substituting the isothermal temperature:

$$Z_\iota = \frac{288 - 218}{.0065} = 10769 \text{ meters}$$

$$Z_\iota = \frac{518.4 - 392.4}{.00356617} = 35332 \text{ feet}$$

Since the air is assumed to be a perfect gas, the difference in pressure between two levels is due to the weight of a column of air of unit cross section between the two levels or

$$dp = - g\rho dZ \qquad (3)$$

Calculation of pressures and densities.—At any altitude in the standard atmosphere the air temperature is known. The corresponding pressure is calculated from

$$Z = \frac{p_0}{\rho_0 gM}\left(\frac{T_m}{T_0}\right)\log_{10}\left(\frac{p_0}{p}\right) = K'T_m \log_{10}\left(\frac{p_0}{p}\right) \qquad (4)$$

where:

$$K' = \frac{p_0}{\rho_0 gMT_0}$$

For metric measures $K' = 67.4072$ and for English measures $K' = 122.862$.

Calculation of mean temperature.—The mean temperature T_m which appears in equation (4) is a harmonic mean given by

$$T_m = \frac{\int_0^z dZ}{\int_0^z \frac{dZ}{T}} \qquad (5)$$

whence below the isothermal region

$$T_m = \frac{aZ}{\log_e \frac{T_0}{T_0 - aZ}} \qquad (6)$$

and in the isothermal region

$$T_m = \frac{Z}{\frac{Z_\iota}{T_{m\iota}} + \frac{(Z - Z_\iota)}{T}} \qquad (6a)$$

Useful relationships.—In the levels *below the isothermal layer* the following relationships will prove useful:

$$\frac{T}{T_0} = \left(\frac{p}{p_0}\right)^{aR}$$

$$\frac{p}{p_0} = \left(\frac{T}{T_0}\right)^{\frac{1}{aR}} = \left(\frac{\rho}{\rho_0}\right)^{\frac{1}{1-aR}} = \left(1 - \frac{a}{T_0}Z\right)^{\frac{1}{aR}}$$

$$\frac{\rho}{\rho_0} = \left(\frac{T}{T_0}\right)^{\frac{1}{aR}-1} = \left(1 - \frac{a}{T_0}Z\right)^{\frac{1}{aR}-1}$$

where $aR = .190284$.

[6] This is tantamount to using as the unit of "height," the unit of geopotential equal to 0.980665 dynamic meters, or $\frac{9.80665}{9.80}$ geopotential meters (gpm.), where 1 dynamic meter $= 10^5$ cm.^{2} sec.$^{-2}$.

[7] See Table 68 for altitudes above 20,000 m.

(continued)

NACA STANDARD ATMOSPHERE, LOWER ATMOSPHERE

Metric units

Altitude Z	Temperature t	Mean temperature T_m	Pressure p		Specific weight* ρg
m.	°C.	°A.	mm. hg.	mb.	kg. m.$^{-3}$
−1000	21.500	291.235	854.58	1139.34	1.3476
− 500	18.250	289.621	806.16	1074.79	1.2854
0	15.000	288.000	760.00	1013.25	1.2255
500	11.750	286.371	715.99	954.57	1.1677
1000	8.500	284.736	674.09	898.71	1.1120
1500	5.250	283.096	634.18	845.50	1.0584
2000	2.000	281.450	596.23	794.90	1.0068
2500	− 1.250	279.798	560.11	746.75	.9572
3000	− 4.500	278.138	525.79	700.99	.9094
3500	− 7.750	276.470	493.19	657.53	.8634
4000	−11.000	274.796	462.26	616.29	.8193
4500	−14.250	273.115	432.90	577.15	.7770
5000	−17.500	271.425	405.09	540.07	.7363
5500	−20.750	269.730	378.71	504.90	.6972
6000	−24.000	268.027	353.77	471.65	.6598
6500	−27.250	266.315	330.18	440.20	.6240
7000	−30.500	264.598	307.87	410.46	.5896
7500	−33.750	262.872	286.79	382.35	.5567
8000	−37.000	261.140	266.89	355.82	.5252
8500	−40.250	259.395	248.13	330.81	.4952
9000	−43.500	257.644	230.45	307.24	.4664
9500	−46.750	255.884	213.82	285.07	.4388
10000	−50.000	254.116	198.16	264.19	.4127
10500	−53.250	252.342	183.45	244.58	.3876
10769	−55.000	251.378	175.91	234.53	.3747
11000	−55.000	250.572	169.66	226.19	.3614
12000	−55.000	247.491	145.05	193.38	.3090
13000	−55.000	244.942	124.01	165.33	.2642
14000	−55.000	242.798	106.02	141.35	.2259
15000	−55.000	240.971	90.65	120.86	.1931
16000	−55.000	239.394	77.48	103.30	.1651
17000	−55.000	238.020	66.26	88.34	.1412
18000	−55.000	236.812	56.65	75.53	.1207
19000	−55.000	235.741	48.43	64.57	.1032
20000	−55.000	234.786	41.41	55.21	.0883

English units

Altitude Z	Temperature t	Mean temperature T_m	Pressure p	Specific weight* ρg
feet	°F.	°Rankine	in. Hg.	lb. ft.$^{-3}$
−4000	73.265	525.500	34.51	0.08588
−3000	69.699	523.731	33.31	.08346
−2000	66.132	521.962	32.15	.08109
−1000	62.566	520.181	31.02	.07878
0	59.000	518.400	29.92	0.07651
1000	55.434	516.615	28.86	.07430
2000	51.868	514.830	27.82	.07213
3000	48.301	513.033	26.81	.07001
4000	44.735	511.237	25.84	.06794
5000	41.169	509.434	24.89	0.06592
6000	37.603	507.629	23.98	.06395
7000	34.037	505.816	23.09	.06202
8000	30.471	504.002	22.22	.06013
9000	26.904	502.180	21.38	.05829
10000	23.338	500.359	20.58	0.05649
11000	19.772	498.535	19.79	.05474
12000	16.206	496.710	19.03	.05303
13000	12.640	494.865	18.29	.05136
14000	9.074	493.017	17.57	.04973
15000	5.507	491.168	16.88	0.04814
16000	1.941	489.317	16.21	.04658
17000	− 1.625	487.459	15.56	.04507
18000	− 5.191	485.598	14.94	.04359
19000	− 8.757	483.729	14.33	.04216
20000	−12.323	481.859	13.75	0.04075
21000	−15.890	479.980	13.18	.03938
22000	−19.456	478.100	12.63	.03806
23000	−23.022	476.210	12.10	.03676
24000	−26.588	474.320	11.59	.03550
25000	−30.154	472.420	11.10	0.03427
26000	−33.720	470.518	10.62	.03308
27000	−37.287	468.607	10.16	.03192
28000	−40.853	466.695	9.720	.03078
29000	−44.419	464.773	9.293	.02968
30000	−47.985	462.849	8.880	0.02861
31000	−51.551	460.914	8.483	.02757
32000	−55.117	458.980	8.101	.02656
33000	−58.684	457.034	7.732	.02558
34000	−62.250	455.087	7.377	.02463
35000	−65.816	453.132	7.036	0.02369
35332	−67.000	452.680	6.925	.02339
40000	−67.000	444.537	5.541	.01872
45000	−67.000	438.071	4.364	.01474
50000	−67.000	433.030	3.436	.01161
55000	−67.000	428.991	2.707	0.009143
60000	−67.000	425.685	2.132	.007201
65000	−67.000	422.922	1.680	.005671

* In the absolute (length-mass-time) system of units this quantity is termed "density" and is usually designated by the symbol ρ.

Table 64

ICAN STANDARD ATMOSPHERE

The standard atmosphere adopted by the International Commission for Air Navigation (ICAN) in 1924 is used, with minor modifications, by many countries as a standard for calibrating altimeters and in other applications.

DEFINITION OF INTERNATIONAL STANDARD ATMOSPHERE[1]

1. It will be assumed that the air is dry and that its chemical composition is the same at all altitudes (it is recalled, by way of information, that this composition is in volume approximately as follows: 78.03% nitrogen, 20.99% oxygen, 0.94% argon, 0.04% carbon dioxide); g will be given a uniform value of 980.62 in cgs units. Nevertheless, when the accuracy of the measurements under consideration permits, it will be sufficient to use for g the approximate and simpler value of 980.
2. It will be assumed that at mean sea level the temperature is 15 °C. and the barometric height, reduced to 0 °C., 760 mm. of mercury.
3. Under these conditions, the atmospheric pressure is 10,332 kilograms-weight per square meter (1013.2 millibars) and the weight of a cubic meter of air is 1.226 kilogram-weight.
4. It will be assumed that, for any altitude z, measured above mean sea level and between 0 and 11,000 m., the law of variation of the temperature θ_z of the air is as follows:

$$\theta_z = 15 - 0.0065z.$$

5. It will be assumed that, for all altitudes above 11,000 m., the temperature of the air is constant and equal to − 56.5 °C.
6. It follows that, for any altitude z measured above mean sea level and between 0 and 11,000 m., the barometric pressure p_z, the specific weight a_z, and the specific mass ρ_z of the air will vary according to the following equations:

$$\frac{p_z}{p_0} = \left(\frac{288 - 0.0065z}{288}\right)^{5.256}$$

$$\text{and } \frac{\rho_z}{\rho_0} = \frac{a_z}{a_0} = \left(\frac{288 - 0.0065z}{288}\right)^{4.256}$$

7. Similarly for all altitudes above 11,000 m. the foregoing equations will be replaced by the following:

$$\log_{10}\frac{p11{,}000}{p_z} = \log_{10}\frac{11{,}000}{\rho_z} = \log_{10}\frac{a11{,}000}{a_z} = \frac{z - 11{,}000}{14{,}600}$$

The principal differences between the NACA Standard Atmosphere (Table 63) widely used in the United States and the ICAN Standard Atmosphere are in the value of standard gravity adopted and in the definitions of the height and temperature of the tropopause and the isothermal region above. Since the value of standard gravity adopted for use in the definition of the standard atmosphere is also used for the definition of the inch or millimeter of mercury, an altimeter calibrated by the NACA Standard Atmosphere will read about 1.3 ft. (0.4 m.) higher at a given pressure than an altimeter calibrated by the ICAN atmosphere at altitudes below the tropopause. Above the tropopause, other slight differences will be introduced.

Brombacher[2] has published a discussion of the modifications in the ICAN atmosphere made by various countries as well as a summary of other standard atmospheres that have been used for calibrating altimeters.

[1] International Commission for Air Navigation, Official Bulletin No. 26, Resolution No. 1053, December 1938; also Official Bulletin No. 7, Resolution No. 192, December 1924.

[2] Brombacher, W. G., Journ. Washington Acad. Sci., vol. 34, p. 277, 1944.

ALTIMETER SETTING COMPUTATION FACTORS[1]

The *altimeter setting* is a pressure used for setting a pressure-scale type of sensitive altimeter in an aircraft so that upon landing of the aircraft at an airport the instrument will indicate an altitude reading equal to or very close to the field elevation above sea level, provided that the instrument is functioning properly. The altimeter setting furnished to a pilot for setting the sensitive altimeter just prior to landing should be determined near the time and place of landing at a station equipped with suitable instruments for computing the altimeter setting.

The altimeter setting in millibars, $A_{mb.}$, is given by:

$$A_{mb.} = (p_{mb.} - 0.3)F \qquad (1)$$

and in inches of mercury, $A_{in.}$, by:

$$A_{in.} = (p_{in.} - 0.01)F \qquad (2)$$

where:

$p_{mb.}$ = station pressure in millibars,
$p_{in.}$ = station pressure in inches of mercury,
F = altimeter setting computation factor.

F is a dimensionless factor given by equation (3), valid only below the height of the standard atmosphere tropopause. It is derivable from the relations given in Table 63 and depends only on the station pressure p and the station elevation H_b.

$$F = \left[1 + \left(\frac{p_0^n a}{T_0}\right)\frac{H_b}{p_1^n}\right]^{\frac{1}{n}} \qquad (3)$$

where:

p_0 = standard sea level pressure (1013.25 mb. or 29.921 in. Hg.),
$p_1 = (p_{mb.} - 0.3)$ when $p_0 = 1013.25$ mb.
$= (p_{in.} - 0.01)$ when $p_0 = 29.921$ in. Hg.,
a = lapse rate in NACA standard atmosphere below the isothermal layer (0.0065 °C. m.$^{-1}$),
T_0 = standard sea-level temperature (288 °A.),
H_b = station elevation in *meters* (elevation for which station pressures are given),
$n = aR = 0.190284$, where R is the gas constant for dry air.

The correction to p of -0.3 mb. (or -0.01 in. Hg.) arises from the fact that the altimeter of an airplane is usually about 10 feet above the landing gear and it desirable to indicate the height of the landing gear rather than of the cockpit.

Example.—Given, station elevation $H_b = 1236$ m.

when $p = 910.0$ mb., $F = 1.15901$, $A = 1054.4$ mb.
$p = 909.9$ mb., $F = 1.15902$, $A = 1054.2$ mb.
$p = 909.8$ mb., $F = 1.15902$, $A = 1054.1$ mb., etc.

For data in English units the appropriate values of F may be found by converting to metric units, then apply equation (2) to obtain A.

Given $H_b = 4964$ ft. (= 1513 m.)
when $p = 26.00$ in. Hg. (= 880.5 mb.), $F = 1.19862$, $A = 31.15$ in. Hg.
$p = 25.99$ in. Hg. (= 880.1 mb.), $F = 1.19865$, $A = 31.14$ in. Hg., etc.

[1] An alternative method for computing altimeter settings is given in Table 66.

(*continued*)

TABLE 65 (CONTINUED)

ALTIMETER SETTING COMPUTATION FACTORS

Pressure mb.	Station elevation H_b—meters 100	200	300	400	500	600	700	800	900	1000
1060	1.01182	1.02375	1.03579	1.04795	1.06022					
1050	1.01184	1.02379	1.03585	1.04803	1.06033					
1040	1.01186	1.02383	1.03592	1.04812	1.06044					
1030	1.01188	1.02388	1.03599	1.04821	1.06056	1.07301				
1020	1.01190	1.02392	1.03606	1.04831	1.06067	1.07316				
1010	1.01193	1.02397	1.03613	1.04840	1.06079	1.07330	1.08593			
1000	1.01195	1.02401	1.03619	1.04849	1.06090	1.07344	1.08609	1.09887		
990	1.01197	1.02406	1.03627	1.04859	1.06103	1.07359	1.08627	1.09907	1.11199	
980	1.01200	1.02411	1.03634	1.04869	1.06115	1.07374	1.08644	1.09927	1.11222	1.12529
970	1.01202	1.02416	1.03641	1.04878	1.06127	1.07388	1.08661	1.09947	1.11244	1.12554
960	1.01204	1.02420	1.03648	1.04888	1.06139	1.07403	1.08679	1.09967	1.11267	1.12580
950	1.01207	1.02425	1.03655	1.04897	1.06152	1.07418	1.08696	1.09987	1.11291	1.12606
940	1.01209	1.02430	1.03663	1.04908	1.06164	1.07433	1.08715	1.10008	1.11314	1.12633
930	1.01212	1.02435	1.03671	1.04918	1.06178	1.07449	1.08733	1.10030	1.11339	1.12660
920	1.01214	1.02440	1.03678	1.04928	1.06190	1.07465	1.08752	1.10051	1.11363	1.12687
910	1.01217	1.02445	1.03686	1.04939	1.06204	1.07481	1.08771	1.10073	1.11388	1.12715
900	1.01219	1.02451	1.03694	1.04950	1.06217	1.07498	1.08790	1.10095	1.11413	1.12744
890	1.01222	1.02456	1.03702	1.04960	1.06231	1.07514	1.08809	1.10117	1.11438	1.12772
880	1.01225	1.02461	1.03710	1.04971	1.06245	1.07531	1.08829	1.10140	1.11464	1.12801
870	1.01227	1.02467	1.03718	1.04982	1.06258	1.07547	1.08849	1.10163	1.11490	1.12830
860	1.01230	1.02472	1.03726	1.04993	1.06272	1.07564	1.08869	1.10186	1.11516	1.12859
850	1.01233	1.02478	1.03735	1.05005	1.06287	1.07582	1.08889	1.10210	1.11543	1.12890
840	1.01236	1.02483	1.03744	1.05016	1.06301	1.07599	1.08910	1.10234	1.11570	1.12920
830	1.01238	1.02489	1.03752	1.05028	1.06316	1.07617	1.08931	1.10258	1.11598	1.12951
820	1.01241	1.02495	1.03761	1.05039	1.06331	1.07635	1.08952	1.10282	1.11626	1.12982
810	1.01244	1.02501	1.03770	1.05051	1.06346	1.07653	1.08974	1.10307	1.11654	1.13014
800	1.01247	1.02507	1.03779	1.05064	1.06362	7.07672	1.08996	1.10333	1.11683	1.13047
790	1.01250	1.02513	1.03788	1.05077	1.06378	1.07692	1.09019	1.10359	1.11713	1.13080
780	1.01253	1.02519	1.03798	1.05089	1.06393	1.07711	1.09041	1.10385	1.11742	1.13113
770	1.01256	1.02525	1.03807	1.05102	1.06410	1.07730	1.09065	1.10412	1.11773	1.13147
760	1.01259	1.02532	1.03817	1.05115	1.06426	1.07750	1.09088	1.10439	1.11803	1.13181
750	1.01263	1.02538	1.03826	1.05128	1.06442	1.07770	1.09111	1.10466	1.11834	1.13216
740	1.01266	1.02545	1.03836	1.05141	1.06459	1.07791	1.09135	1.10494	1.11866	1.13252
730	1.01269	1.02551	1.03846	1.05155	1.06476	1.07811	1.09160	1.10522	1.11898	1.13288
720	1.01272	1.02558	1.03857	1.05168	1.06494	1.07832	1.09185	1.10551	1.11931	1.13324
710	1.01276	1.02565	1.03867	1.05183	1.06512	1.07854	1.09211	1.10580	1.11964	1.13362
700		1.02572	1.03878	1.05197	1.06530	1.07876	1.09236	1.10610	1.11998	1.13400
690				1.05211	1.06548	1.07898	1.09262	1.10640	1.12032	1.13438
680					1.06567	1.07921	1.09289	1.10671	1.12068	1.13478
670						1.07944	1.09317	1.10703	1.12103	1.13518
660							1.09344	1.10735	1.12140	1.13559
650								1.10767	1.12177	1.13600
640										1.13643

(*continued*)

ALTIMETER SETTING COMPUTATION FACTORS

Pressure mb.	Station elevation H_b—meters 1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
1060										
1050										
1040										
1030										
1020										
1010										
1000										
990										
980										
970	1.13877									
960	1.13906									
950	1.13935	1.15276								
940	1.13964	1.15308	1.16665							
930	1.13994	1.15341	1.16701	1.18074						
920	1.14025	1.15375	1.16738	1.18114	1.19503					
910	1.14055	1.15409	1.16775	1.18154	1.19546	1.20952				
900	1.14087	1.15443	1.16813	1.18195	1.19591	1.21000	1.22422			
890	1.14118	1.15478	1.16851	1.18237	1.19636	1.21048	1.22474	1.23913		
880	1.14150	1.15513	1.16889	1.18278	1.19681	1.21097	1.22526	1.23969	1.25426	
870	1.14183	1.15549	1.16928	1.18321	1.19727	1.21146	1.22579	1.24026	1.25487	1.26961
860	1.14216	1.15585	1.16968	1.18364	1.19774	1.21197	1.22634	1.24084	1.25548	1.27027
850	1.14249	1.15622	1.17008	1.18408	1.19821	1.21247	1.22688	1.24142	1.25610	1.27092
840	1.14283	1.15660	1.17049	1.18452	1.19869	1.21299	1.22744	1.24202	1.25674	1.27160
830	1.14317	1.15697	1.17090	1.18497	1.19917	1.21352	1.22800	1.24261	1.25738	1.27228
820	1.14352	1.15736	1.17133	1.18543	1.19967	1.21405	1.22857	1.24323	1.25803	1.27297
810	1.14388	1.15775	1.17175	1.18590	1.20018	1.21459	1.22915	1.24385	1.25869	1.27368
800	1.14424	1.15814	1.17219	1.18637	1.20068	1.21514	1.22974	1.24448	1.25936	1.27439
790	1.14460	1.15855	1.17263	1.18684	1.20120	1.21570	1.23034	1.25412	1.26004	1.27511
780	1.14497	1.15895	1.17307	1.18733	1.20172	1.21626	1.23094	1.24576	1.26073	1.27584
770	1.14535	1.15937	1.17353	1.18782	1.20226	1.21684	1.23156	1.24643	1.26144	1.27659
760	1.14573	1.15979	1.17399	1.18833	1.20281	1.21743	1.23219	1.24710	1.26215	1.27736
750	1.14612	1.16022	1.17446	1.18883	1.20335	1.21802	1.23283	1.24778	1.26288	1.27812
740	1.14651	1.16065	1.17493	1.18935	1.20391	1.21862	1.23347	1.24847	1.26361	1.27891
730	1.14692	1.16110	1.17542	1.18988	1.20449	1.21924	1.23413	1.24918	1.26437	1.27971
720	1.14732	1.16155	1.17591	1.19041	1.20506	1.21986	1.23480	1.24989	1.26513	1.28052
710	1.14774	1.16200	1.17641	1.19096	1.20565	1.22049	1.23548	1.25062	1.26590	1.28134
700	1.14816	1.16247	1.17692	1.19151	1.20625	1.22114	1.23617	1.25136	1.26669	1.28218
690	1.14859	1.16294	1.17744	1.19208	1.20686	1.22180	1.23688	1.25211	1.26750	1.28304
680	1.14903	1.16342	1.17796	1.19265	1.20748	1.22246	1.23760	1.25288	1.26832	1.28390
670	1.14948	1.16391	1.17850	1.19323	1.20811	1.22314	1.23832	1.25366	1.26915	1.28479
660	1.14993	1.16441	1.17905	1.19383	1.20876	1.22384	1.23907	1.25445	1.26999	1.28569
650	1.15039	1.16492	1.17960	1.19443	1.20941	1.22454	1.23983	1.25527	1.27086	1.28661
640	1.15086	1.16544	1.18017	1.19505	1.21008	1.22526	1.24060	1.25609	1.27174	1.28754
630	1.15134	1.16597	1.18075	1.19568	1.21076	1.22600	1.24139	1.25693	1.27264	1.28850
620		1.16651	1.18134	1.19632	1.21145	1.22674	1.24219	1.25779	1.27355	1.28947
610			1.18194	1.19698	1.21217	1.22751	1.24301	1.25867	1.27449	1.29047
600					1.21288	1.22828	1.24384	1.25956	1.27544	1.29148
590						1.22908	1.24469	1.26047	1.27641	1.29251
580							1.24556	1.26140	1.27740	1.29357
570									1.27842	1.29465
560										1.29575

(*continued*)

ALTIMETER SETTING COMPUTATION FACTORS

Station elevation H_b—meters

Pressure mb.	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
840	1.28660	1.30175								
830	1.28732	1.30251	1.31785							
820	1.28806	1.30329	1.31867	1.33419						
810	1.28881	1.30408	1.31950	1.33507	1.35078					
800	1.28956	1.30488	1.32034	1.33595	1.35171	1.36763				
790	1.29033	1.30569	1.32120	1.33686	1.35266	1.36862	1.38473			
780	1.29111	1.30651	1.32207	1.33778	1.35363	1.36964	1.38580	1.40211		
770	1.29190	1.30735	1.32296	1.33871	1.35461	1.27067	1.38688	1.40324	1.41976	
760	1.29271	1.30820	1.32385	1.33965	1.35560	1.37171	1.38797	1.40439	1.42096	1.43769
750	1.29352	1.30907	1.32477	1.34062	1.35662	1.37277	1.38909	1.40555	1.42218	1.43896
740	1.29435	1.30995	1.32569	1.34159	1.35765	1.37385	1.39022	1.40674	1.42342	1.44026
730	1.29520	1.31085	1.32664	1.34259	1.35870	1.37496	1.39137	1.40795	1.42468	1.44158
720	1.29606	1.31175	1.32760	1.34360	1.35975	1.37607	1.39254	1.40917	1.42596	1.44291
710	1.29693	1.31268	1.32857	1.34463	1.36084	1.37721	1.39373	1.41042	1.42727	1.44428
700	1.29782	1.31362	1.32957	1.34568	1.36194	1.37837	1.39495	1.41169	1.42860	1.44567
690	1.29873	1.31458	1.33058	1.34674	1.36306	1.37954	1.39618	1.41298	1.42995	1.44708
680	1.29965	1.31555	1.33161	1.34783	1.36420	1.38074	1.39744	1.41430	1.43133	1.44852
670	1.30059	1.31654	1.33266	1.34893	1.36536	1.38196	1.39872	1.41564	1.43272	1.44998
660	1.30154	1.31755	1.33373	1.35006	1.36655	1.38320	1.40002	1.41700	1.43415	1.45147
650	1.30252	1.31859	1.33482	1.35121	1.36776	1.38447	1.40135	1.41840	1.43561	1.45299
640	1.30351	1.31964	1.33593	1.35237	1.36899	1.38576	1.40271	1.41982	1.43709	1.45454
630	1.30452	1.32071	1.33706	1.35357	1.37024	1.38708	1.40409	1.42126	1.43861	1.45612
620	1.30556	1.32180	1.33821	1.35478	1.37152	1.38842	1.40549	1.42274	1.44015	1.45773
610	1.30661	1.32292	1.33938	1.35602	1.37282	1.38979	1.40693	1.42424	1.44172	1.45937
600	1.30768	1.32405	1.34058	1.35728	1.37415	1.39119	1.40840	1.42577	1.44333	1.46106
590	1.30878	1.32521	1.34181	1.35858	1.37551	1.39262	1.40989	1.42734	1.44497	1.46277
580	1.30990	1.32639	1.34306	1.35989	1.37690	1.39407	1.41142	1.42895	1.44664	1.46452
570	1.31105	1.32761	1.34434	1.36125	1.37832	1.39557	1.41299	1.43059	1.44836	1.46631
560	1.31221	1.32885	1.34565	1.36262	1.37977	1.39709	1.41459	1.43226	1.45011	1.46814
550	1.31340	1.33011	1.34698	1.36403	1.38125	1.39864	1.41621	1.43396	1.45189	1.47000
540			1.34834	1.36546	1.38276	1.40023	1.41788	1.43571	1.45372	1.47192
530				1.36694	1.38431	1.40186	1.41959	1.43750	1.45559	1.47387
520					1.38590	1.40353	1.42134	1.43934	1.45752	1.47588

mb.	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
740	1.45726	1.47442	1.49175							
730	1.45864	1.47586	1.49324	1.51080						
720	1.46003	1.47731	1.49476	1.51237	1.53015					
710	1.46146	1.47880	1.49630	1.61398	1.53182	1.54983				
700	1.46290	1.48031	1.49787	1.51561	1.53352	1.55159	1.56984			
690	1.46437	1.38184	1.49947	1.51727	1.53524	1.55338	1.57170	1.59019		
680	1.46588	1.48340	1.50110	1.51897	1.53701	1.55522	1.57360	1.59216	1.61090	
670	1.46740	1.48499	1.50276	1.52069	1.53880	1.55708	1.57553	1.59416	1.61297	1.63196
660	1.46896	1.48662	1.50445	1.52245	1.54062	1.55897	1.57750	1.59620	1.61509	1.63415
650	1.47055	1.48827	1.50617	1.52424	1.54248	1.56091	1.57950	1.59828	1.61724	1.63638
640	1.47216	1.48996	1.50792	1.52606	1.54438	1.56288	1.58155	1.60040	1.61944	1.63865
630	1.47381	1.49168	1.50971	1.52793	1.54632	1.56489	1.58364	1.60257	1.62168	1.64098
620	1.47549	1.49343	1.51154	1.52983	1.54829	1.56694	1.58576	1.60477	1.62397	1.64335
610	1.47721	1.49521	1.51340	1.53176	1.55030	1.56902	1.58793	1.60702	1.62630	1.64576
600	1.47896	1.49704	1.51530	1.53374	1.55236	1.57117	1.59015	1.60932	1.62868	1.64823
590	1.48075	1.49891	1.51724	1.53576	1.55446	1.57334	1.59241	1.61167	1.63111	1.65075
580	1.48258	1.50081	1.51923	1.53783	1.55661	1.57558	1.59473	1.61407	1.63360	1.65333
570	1.48445	1.50276	1.52126	1.53994	1.55880	1.57785	1.59709	1.61652	1.63614	1.65595
560	1.48635	1.50475	1.52333	1.54209	1.56104	1.58018	1.59951	1.61902	1.63873	1.65864
550	1.48830	1.50678	1.52545	1.54430	1.56333	1.58256	1.60198	1.62159	1.64140	1.66140
540	1.49029	1.50886	1.52761	1.54655	1.56568	1.58499	1.60451	1.62421	1.64411	1.66421
530	1.49234	1.51099	1.52983	1.54886	1.56808	1.58749	1.60710	1.62690	1.64690	1.66710
520	1.49443	1.51317	1.53210	1.55123	1.57054	1.59005	1.60975	1.62965	1.64975	1.67005

TABLE 66

NACA STANDARD ATMOSPHERE ALTITUDE-PRESSURE TABLE

Table 66 gives the NACA standard atmosphere altitude in feet corresponding to the pressure for each tenth of an inch of mercury, and provides an alternate method for computing the "altimeter setting" defined in Table 65.

To compute the altimeter setting:

1. Determine the station elevation H_b in feet and the corresponding station pressure p in inches of mercury.
2. Subtract 0.01 in. Hg. from the station pressure obtaining $(p - 0.01'')$. The purpose of this is to correct for the fact that an aircraft altimeter is usually about 10 feet above the landing gear.
3. From Table 66, determine the altitude corresponding to $(p - 0.01'')$, found in step 2. Interpolate if necessary.
4. Subtract the station elevation H_b from the altitude found in step 3.
5. Re-enter Table 66 with the difference found in step 4 as the tabular value. The corresponding pressure, to the nearest 0.01 inch of mercury, is the altimeter setting.

Inches of mercury	.00	.10	.20	.30	.40	.50	.60	.70	.80	.90
	feet	feet	feet	feet	feet	feet	feet	feet	feet	feet
0									80 522	78 056
1	75 850	73 854	72 032	70 357	68 805	67 361	66 009	64 740	63 543	62 411
2	61 337	60 315	59 341	58 411	57 519	56 665	55 844	55 053	54 292	53 557
3	52 847	52 161	51 496	50 852	50 228	49 620	49 030	48 456	47 898	47 354
4	46 824	46 307	45 803	45 310	44 829	44 358	43 898	43 448	43 007	42 575
5	42 151	41 737	41 330	40 931	40 540	40 156	39 779	39 408	39 044	38 686
6	38 334	37 989	37 648	37 313	36 983	36 659	36 339	36 024	35 714	35 408
7	35 106	34 809	34 514	34 222	33 934	33 649	33 367	33 088	32 812	32 539
8	32 269	32 001	31 736	31 474	31 214	30 957	30 702	30 449	30 199	29 951
9	29 706	29 462	29 221	28 982	28 745	28 510	28 276	28 046	27 816	27 589
10	27 363	27 140	26 917	26 697	26 479	26 262	26 048	25 834	25 622	25 412
11	25 204	24 996	24 791	24 587	24 384	24 183	23 983	23 785	23 588	23 392
12	23 198	23 005	22 813	22 622	22 433	22 245	22 058	21 872	21 688	21 505
13	21 323	21 142	20 962	20 783	20 605	20 429	20 253	20 079	19 905	19 733
14	19 561	19 391	19 221	19 052	18 885	18 718	18 553	18 388	18 224	18 061
15	17 899	17 737	17 577	17 417	17 259	17 101	16 944	16 787	16 632	16 477
16	16 324	16 171	16 018	15 867	15 716	15 566	15 416	15 268	15 120	14 973
17	14 826	14 681	14 536	14 391	14 247	14 104	13 962	13 820	13 679	13 539
18	13 399	13 260	13 121	12 983	12 846	12 709	12 573	12 437	12 302	12 168
19	12 034	11 901	11 768	11 636	11 505	11 374	11 243	11 113	10 984	10 855
20	10 726	10 599	10 471	10 344	10 218	10 092	9 967	9 842	9 718	9 594
21	9 471	9 348	9 225	9 103	8 982	8 861	8 740	8 620	8 500	8 381
22	8 262	8 144	8 026	7 909	7 791	7 675	7 559	7 443	7 327	7 212
23	7 098	6 984	6 870	6 756	6 643	6 531	6 418	6 307	6 195	6 084
24	5 974	5 863	5 753	5 644	5 534	5 425	5 317	5 209	5 101	4 994
25	4 886	4 780	4 673	4 567	4 462	4 356	4 251	4 146	4 042	3 938
26	3 834	3 731	3 628	3 525	3 422	3 320	3 218	3 117	3 016	2 915
27	2 814	2 714	2 614	2 514	2 415	2 315	2 217	2 118	2 020	1 922
28	1 824	1 727	1 630	1 533	1 436	1 340	1 244	1 148	1 053	957
29	863	768	673	579	485	392	298	205	112	20
30	− 73	−165	−257	−348	−440	−531	−622	−712	−803	−893
31	−983									

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

Introduction.—The sensitive pressure altimeter is essentially a refined aneroid barometer calibrated so that when the *altimeter setting* is 29.921 in Hg. (1013.25 mb.) the instrument indicates the altitude in the standard atmosphere corresponding to the ambient barometric pressure. The instrument is so constructed that the *altimeter setting scale* may be adjusted to make the instrument indicate the true elevation of the ground above sea level when the aircraft is on the ground. The appropriate reading on the altimeter setting scale for this to be true is termed the *altimeter setting* (see Table 65). For aircraft in flight, the altimeter indicates elevation above sea level assuming the pressure to vary between the ground and flight level in accordance with a *standard atmosphere* (see Table 63). According to current practice, aircraft flying over land areas or making landings set their altimeters to the current, local altimeter setting. Aircraft on transoceanic flights use a constant altimeter setting of 29.92 in Hg. (1013.2 mb.).

Sources of error.—In addition to instrumental and installation errors, which will not be discussed here, the altitude indications of the altimeter may differ from the actual altitude of the aircraft because of:

1. Deviation of the mean virtual temperature of the actual air column from the value assumed in the standard atmosphere.
2. Use of an altimeter setting inappropriate to the pressure and elevation at the ground beneath the aircraft.

Correction for mean temperature, aircraft using constant standard altimeter setting.—Considering first the case of an aircraft flying at a constant altimeter setting of 29.92 in. Hg. (1013.2 mb.), from the hypsometric equation

$$A = E + T_{mv}\left(\frac{I_p}{T_{mp}} - \frac{H_p}{T_{ms}}\right), \qquad (1)$$

where

A = actual elevation[1] of the aircraft above sea level,
E = elevation of the surface above sea level,
T_{mv} = actual mean virtual temperature (approx. absolute),[2] of the air column between E and A (the corresponding value in °C. is denoted by t_{mv}.),
I_p = "pressure altitude" at flight level, the altitude in the standard atmosphere corresponding to the pressure at flight level (= indicated altitude in this case),
H_p = "pressure altitude" at the surface, the altitude in the standard atmosphere corresponding to the pressure at the surface, E,
T_{mp} = mean temperature (approx. absolute) of the standard atmosphere air column between sea level and I_p,
T_{ms} = mean temperature (approx. absolute) of the standard atmosphere air column between sea level and H_p.

To evaluate equation (1), we define a temperature T_{mx} by the equation

$$\left(\frac{I_p - H_p}{T_{mx}}\right) = \left(\frac{I_p}{T_{mp}} - \frac{H_p}{T_{ms}}\right), \qquad (2)$$

where T_{mx} may be regarded, to a close degree of approximation, to be the mean temperature (approx. absolute) of the standard atmosphere air column between sea level and the level $(I_p + H_p)$, provided $(I_p + H_p)$ is less than the height of the base of the standard atmosphere stratosphere (35,332 ft. or 10,769 m. in the NACA standard atmosphere).

Equation (1) can therefore be written

$$A = E + T_{mv}\left(\frac{I_p - H_p}{T_{mx}}\right) \qquad (3)$$

[1] Strictly speaking, A, E, I_p, and H_p should be expressed in the same units. Actually A and E are customarily given in geometric units, while I_p and H_p are measured in terms of geopotential (see footnote 6, Table 63). The difference may be neglected here.
[2] Approximate absolute temperature = $273 + t$ °C.

(*continued*)

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

Table 67 A gives values of $\left(\frac{I_p - H_p}{T_{mx}}\right)$, as a function of I_p and H_p and Table 67 B give values of $T_{mv}\left(\frac{I_p - H_p}{T_{mx}}\right)$, the actual height above the ground, as a function of T_{mv} and $\left(\frac{I_p - H_p}{T_{mx}}\right)$. The actual altitude above sea level, A, is then obtained by adding E, the elevation of the surface, to the value obtained from Table 67 B. It is obvious from equation (3), that if H_p is in error, A will be in error by approximately the same amount.

The value of H_p may be related to the altimeter setting, P_1, at elevation E by means of the approximate[3] equations

$$H_p = E + 925\ (29.92 - P_1)\ \text{ft.,} \tag{4}$$

where P_1 is in inches of mercury, or

$$H_p = E + 27.3\ (1013.2\ \text{mb.} - P_1)\ \text{ft.,} \tag{4a}$$

where P_1 is in millibars.

Correction for mean temperature, aircraft using current, local altimeter setting.—In the case of an aircraft flying at an indicated altitude I with the altimeter set to the current, local altimeter setting,

$$I_p - H_p = I - E \tag{5}$$

and to a close degree of approximation

$$I_p + H_p = I + E \tag{6}$$

Equation (3) can now be rewritten

$$A = E + T_{mv}\left(\frac{I - E}{T_{mx}}\right) \tag{7}$$

Table 67 A also gives values of $\left(\frac{I - E}{T_{mx}}\right)$ as a function of I and E and Table 67 B gives values of $T_{mv}\left(\frac{I - E}{T_{mx}}\right)$, the actual height above the ground as a function of T_{mv} and $\left(\frac{I - E}{T_{mx}}\right)$. The actual altitude above sea level, A, is then obtained by adding E, the elevation of the surface, to the value obtained from Table 67 B.

Correction for erroneous altimeter setting.—If the altimeter is set to an erroneous altimeter setting P_2 when the true current, local altimeter setting is P_1, the observed indicated altitude, I_0, will be in error, and the appropriate value of I to be used in equation (7) and Table 67 A is given by

$$I = I_0 + 925\ (P_1 - P_2)\ \text{ft.} \tag{8}$$

if P_1 and P_2 are in inches of mercury, and

$$I = I_0 + 27.3\ (P_1 - P_2)\ \text{ft.} \tag{8a}$$

if P_1 and P_2 are in millibars.

From equations (8) and (8a) it is evident that errors due to use of an inappropriate value for the current, local altimeter setting may be corrected (within 1.8 percent for the normal range of altimeter settings 31.00-29.00 in. Hg., 1045.0-980.0 mb.) by use of the following relationships:

0.01 in. Hg.	change in altimeter setting	= 9.25	ft.	change in indicated altitude.
" " "	" " " "	= 2.82	m.	" " " "
0.1 mb.	" " " "	= 2.73	ft.	" " " "
" "	" " " "	= 0.833	m.	" " " "

If the altimeter setting used is lower than the true altimeter setting, the observed indicated altitude should be increased in accordance with the above relationships before

[3] The last term of equations (4) and (4a) is accurate within 1.8 percent when P_1 lies in the range 31.00-29.00 in. Hg. (1045.0-980.0 mb.).

(*continued*)

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

using Table 67 A. If the altimeter setting used is higher than the true altimeter setting the indicated altitude should be decreased.

Examples.—*Case I* (altimeter setting 29.92 in. Hg. or 1013.2 mb.).

What is the actual altitude A of flight relative to sea level when the elevation of the surface E is 5,000 feet above sea level, the pressure altitude at the surface H_p is 5,500 feet, the pressure altitude at flight level I_p is 12,000 feet, and the value of t_{mv} is -10 °C?

Referring to Table 67 A with $I_p = 12{,}000$ ft. and $H_p = 5{,}500$ ft. as arguments, $\left(\frac{I_p - H_p}{T_{mx}}\right) = 24.0$. Then referring to Table 67 B with $\left(\frac{I_p - H_p}{T_{mx}}\right) = 24.0$ and $t_{mv} = -10$ °C. as arguments we find $T_{mv}\left(\frac{I_p - H_p}{T_{mx}}\right) = 6310$ ft. (to the nearest 10 ft.).

It follows from equation (3) that $A = 5{,}000 + 6{,}310 = 11{,}310$ ft.

Case II (current, local altimeter setting being used).

What is the actual altitude A of flight relative to sea level when the elevation of the surface E is 5,000 feet above sea level, the indicated altitude I at flight level is 12,000 feet, the altimeter setting at the surface is 29.38 in. Hg., and the value of t_{mv} is -10 °C.?

Referring to Table 67 A with $I = 12{,}000$ ft. and $E = 5{,}000$ ft. as arguments, $\left(\frac{I - E}{T_{mx}}\right) = 25.8$.

Then referring to Table 67 B with $\left(\frac{I - E}{T_{mx}}\right) = 25.8$ and $t_{mv} = -10$ °C. as arguments we find $T_{mv}\left(\frac{I - E}{T_{mx}}\right) = 6790$ ft. (to the nearest 10 ft.). It follows from equation (7) that $A = 5{,}000 + 6{,}790 = 11{,}790$ ft.

Allowance for perturbations of the pressure field caused by mountains.—Great caution must be used in applying the above procedures to aircraft operation in regions of marked perturbations of the pressure field. An aircraft flying in the vicinity of a mountain during periods of strong winds and using an altimeter setting appropriate to a nearby valley station may have an indicated altitude several hundred feet too high. This error is caused by the lowering of the constant pressure surfaces in the vicinity of mountains by the action of strong winds. The error is numerically equal to the depression of the constant pressure surface in which the aircraft is flying from its location over the valley station furnishing the altimeter setting to its location over the mountain. In planning operations in such circumstance, equation (3) and (7) can be rewritten

$$A_m + C \leq E + T_{mv}\left(\frac{I_p - H_p}{T_{mx}}\right) - D \qquad (9)$$

$$\text{or } A_m + C \leq E + T_{mv}\left(\frac{I - E}{T_{mx}}\right) - D \qquad (9a)$$

where

A_m = maximum height of the terrain to be cleared,
C = minimum vertical clearance relative to the terrain,
D = estimated maximum depression of the constant-pressure surface being flown between the valley and the mountain.

Example.—Suppose $A_m = 9{,}200$ ft., $C = 2{,}000$ ft., $D = 500$ ft., $E = 5{,}000$ ft., and $H_p = 5{,}500$ ft. for valley station, and $t_{mv} = -10$ °C. What are the minimum values of I_p or I which satisfy equations (9) and (9a), respectively? Use of Tables 67 A and 67 B yields $I_p = 12{,}390$ ft. or $I = 11{,}920$ ft.

(*continued*)

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

TABLE 67 A.—Values of $\left(\frac{I-E}{T_{ms}}\right)$ or $\left(\frac{I_p-H_p}{T_{ms}}\right)$

Indicated altitude I or I_p	Elevation E or pressure-altitude H_p of surface—feet										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
ft.											
0	0.0										
1000	3.5	0.0									
2000	7.0	3.5	0.0								
3000	10.5	7.0	3.5	0.0							
4000	14.1	10.6	7.1	3.6	0.0						
5000	17.7	14.2	10.7	7.1	3.6	0.0					
6000	21.3	17.8	14.3	10.8	7.2	3.6	0.0				
7000	24.9	21.4	17.9	14.4	10.8	7.2	3.6	0.0			
8000	28.6	25.1	21.6	18.0	14.5	10.9	7.3	3.7	0.0		
9000	32.3	28.8	25.3	21.7	18.2	14.6	11.0	7.4	3.7	0.0	
10000	36.0	32.5	29.0	25.5	21.9	18.3	14.7	11.1	7.4	3.7	0.0
11000	39.7	36.2	32.7	29.2	25.6	22.1	18.5	14.8	11.2	7.5	3.8
12000	43.5	40.0	36.5	33.0	29.4	25.8	22.2	18.6	14.9	11.2	7.5
13000	47.3	43.8	40.3	36.8	33.2	29.6	26.0	22.4	18.8	15.1	11.3
14000	51.1	47.6	44.1	40.6	37.1	33.5	29.9	26.2	22.6	18.9	15.2
15000	55.0	51.5	48.0	44.5	40.9	37.4	33.8	30.1	26.5	22.8	19.0
16000	58.9	55.4	51.9	48.4	44.8	41.2	37.6	34.0	30.4	26.7	23.0
17000	62.8	59.3	55.8	52.3	48.8	45.2	41.6	38.0	34.3	30.6	26.9
18000	66.7	63.3	59.8	56.2	52.7	49.1	45.5	41.9	38.3	34.6	30.9
19000	70.7	67.2	63.8	60.2	56.7	53.1	49.5	45.9	42.2	38.6	34.9
20000	74.7	71.2	67.8	64.3	60.7	57.2	53.6	49.9	46.3	42.6	38.9
21000	78.8	75.3	71.8	68.3	64.8	61.2	57.6	54.0	50.4	46.7	43.0
22000	82.8	79.4	75.9	72.4	68.9	65.3	61.7	58.1	54.4	50.8	47.1
23000	86.9	83.5	80.0	76.5	73.0	69.4	65.8	62.2	58.6	54.9	51.2
24000	91.1	87.6	84.2	80.7	77.1	73.6	70.0	66.4	62.8	59.1	55.4
25000	95.2	91.8	88.4	84.8	81.3	77.8	74.2	70.6	67.0	63.3	59.6
26000	99.5	96.0	92.6	89.1	85.6	82.0	78.4	74.8	71.2	67.5	
27000	103.7	100.3	96.8	93.3	89.8	86.3	82.7	79.1	75.5		
28000	108.0	104.6	101.1	97.6	94.1	90.6	87.0	83.4			
29000	112.3	108.9	105.4	102.0	98.5	94.9	91.4				
30000	116.7	113.2	109.8	106.3	102.8	99.3					
31000	121.1	117.6	114.2	110.8	107.2						
32000	125.5	122.1	118.7	115.2							
33000	130.0	126.6	123.1								
34000	134.5	131.1									
35000	139.0										

I or I_p	E or H_p—feet				
	11000	12000	13000	14000	15000
11000	0.0				
12000	3.8	0.0			
13000	7.6	3.8	0.0		
14000	11.4	7.6	3.8	0.0	
15000	15.3	11.5	7.7	3.9	0.0
16000	19.2	15.4	11.6	7.8	3.9
17000	23.1	19.4	15.6	11.7	7.8
18000	27.1	23.3	19.5	15.7	11.8
19000	31.1	27.3	23.5	19.7	15.8
20000	35.2	31.4	27.6	23.7	19.9
21000	39.2	35.4	31.6	27.8	
22000	43.3	39.6	35.8		
23000	47.5	43.7			
24000	51.6				

(*continued*)

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

TABLE 67 B.—Actual height above the surface

$\left(\frac{I-E}{T_{mx}}\right)$ or $\left(\frac{I_p-H_p}{T_{mx}}\right)$	Actual mean virtual temperature of the air column—°C.											
	−70	−60	−50	−40	−30	−20	−10	0	+10	20	30	40
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
0	0	0	0	0	0	0	0	0	0	0	0	0
1	203	213	223	233	243	253	263	273	283	293	303	313
2	406	426	446	466	486	506	526	546	566	586	606	626
3	609	639	669	699	729	759	789	819	849	879	909	939
4	812	852	892	932	972	1012	1052	1092	1132	1172	1212	1252
5	1015	1065	1115	1165	1215	1265	1315	1365	1415	1465	1515	1565
6	1218	1278	1338	1398	1458	1518	1578	1638	1698	1758	1818	1878
7	1421	1491	1561	1631	1701	1771	1841	1911	1981	2051	2121	2191
8	1624	1704	1784	1864	1944	2024	2104	2184	2264	2344	2424	2504
9	1827	1917	2007	2097	2187	2277	2367	2457	2547	2637	2727	2817
10	2030	2130	2230	2330	2430	2530	2630	2730	2830	2930	3030	3130
11	2233	2343	2453	2563	2673	2783	2893	3003	3113	3223	3333	3443
12	2436	2556	2676	2796	2916	3036	3156	3276	3396	3516	3636	3756
13	2639	2769	2899	3029	3159	3289	3419	3549	3679	3809	3939	4069
14	2842	2982	3122	3262	3402	3542	3682	3822	3962	4102	4242	4382
15	3045	3195	3345	3495	3645	3795	3945	4095	4245	4395	4545	4695
16	3248	3408	3568	3728	3888	4048	4208	4368	4528	4688	4848	5008
17	3451	3621	3791	3961	4131	4301	4471	4641	4811	4981	5151	5321
18	3654	3834	4014	4194	4374	4554	4734	4914	5094	5274	5454	5634
19	3857	4047	4237	4427	4617	4807	4997	5187	5377	5567	5757	5947
20	4060	4260	4460	4660	4860	5060	5260	5460	5660	5860	6060	6260
21	4263	4473	4683	4893	5103	5313	5523	5733	5943	6153	6363	6573
22	4466	4686	4906	5126	5346	5566	5786	6006	6226	6446	6666	6886
23	4669	4899	5129	5359	5589	5819	6049	6279	6509	6739	6969	7199
24	4872	5112	5352	5592	5832	6072	6312	6552	6792	7032	7272	7512
25	5075	5325	5575	5825	6075	6325	6575	6825	7075	7325	7575	7825
26	5278	5538	5798	6058	6318	6578	6838	7098	7358	7618	7878	8138
27	5481	5751	6021	6291	6561	6831	7101	7371	7641	7911	8181	8451
28	5684	5964	6244	6524	6804	7084	7364	7644	7924	8204	8484	8764
29	5887	6177	6467	6757	7047	7337	7627	7917	8207	8497	8787	9077
30	6090	6390	6690	6990	7290	7590	7890	8190	8490	8790	9090	9390
31	6293	6603	6913	7223	7533	7843	8153	8463	8773	9083	9393	9703
32	6496	6816	7136	7456	7776	8096	8416	8736	9056	9376	9696	10016
33	6699	7029	7359	7689	8019	8349	8679	9009	9339	9669	9999	10329
34	6902	7242	7582	7922	8262	8602	8942	9282	9622	9962	10302	10642
35	7105	7455	7805	8155	8505	8855	9205	9555	9905	10255	10605	10955
36	7308	7668	8028	8388	8748	9108	9468	9828	10188	10548	10908	11268
37	7511	7881	8251	8621	8991	9361	9731	10101	10471	10841	11211	11581
38	7714	8094	8474	8854	9234	9614	9994	10374	10754	11134	11514	11894
39	7917	8307	8697	9087	9477	9867	10257	10647	11037	11427	11817	12207
40	8120	8520	8920	9320	9720	10120	10520	10920	11320	11720	12120	12520
41	8323	8733	9143	9553	9963	10373	10783	11193	11603	12013	12423	12833
42	8526	8946	9366	9786	10206	10626	11046	11466	11886	12306	12726	13146
43	8729	9159	9589	10019	10449	10879	11309	11739	12169	12599	13029	13459
44	8932	9372	9812	10252	10692	11132	11572	12012	12452	12892	13332	13772
45	9135	9585	10035	10485	10935	11385	11835	12285	12735	13185	13635	14085
46	9338	9798	10258	10718	11178	11638	12098	12558	13018	13478	13938	14398
47	9541	10011	10481	10951	11421	11891	12361	12831	13301	13771	14241	14711
48	9744	10224	10704	11184	11664	12144	12624	13104	13584	14064	14544	15024
49	9947	10437	10927	11417	11907	12397	12887	13377	13867	14357	14847	15337
50	10150	10650	11150	11650	12150	12650	13150	13650	14150	14650	15150	15650

(*continued*)

CORRECTION OF ALTIMETER READINGS FOR MEAN TEMPERATURE OF THE AIR COLUMN

TABLE 67 B.—Actual height above the surface

$\left(\frac{I-E}{T_{mx}}\right)$ or $\left(\frac{I_p-H_p}{T_{mx}}\right)$	Actual mean virtual temperature of the air column—°C.											
	−70	−60	−50	−40	−30	−20	−10	0	+10	20	30	40
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
50	10150	10650	11150	11650	12150	12650	13150	13650	14150	14650	15150	15650
51	10353	10863	11373	11883	12393	12903	13413	13923	14433	14943	15453	15963
52	10556	11076	11596	12116	12636	13156	13676	14196	14716	15236	15756	16276
53	10759	11289	11819	12349	12879	13409	13939	14469	14999	15529	16059	16589
54	10962	11502	12042	12582	13122	13662	14202	14742	15282	15822	16362	16902
55	11165	11715	12265	12815	13365	13915	14465	15015	15565	16115	16665	17215
56	11368	11928	12488	13048	13608	14168	14728	15288	15848	16408	16968	17528
57	11571	12141	12711	13281	13851	14421	14991	15561	16131	16701	17271	17841
58	11774	12354	12934	13514	14094	14674	15254	15834	16414	16994	17574	18154
59	11977	12567	13157	13747	14337	14927	15517	16107	16697	17287	17877	18467
60	12180	12780	13380	13980	14580	15180	15780	16380	16980	17580	18180	18780
61	12383	12993	13603	14213	14823	15433	16043	16653	17263	17873	18483	19093
62	12586	13206	13826	14446	15066	15686	16306	16926	17546	18166	18786	19406
63	12789	13419	14049	14679	15309	15939	16569	17199	17829	18459	19089	19719
64	12992	13632	15272	14912	15552	16192	16832	17472	18112	18752	19392	20032
65	13195	13845	14495	15145	15795	16445	17095	17745	18395	19045	19695	20345
66	13398	14058	14718	15378	16038	16698	17358	18018	18678	19338	19998	20658
67	13061	14271	14941	15611	16281	16951	17621	18291	18961	19631	20301	20971
68	13804	14484	15164	15844	16524	17204	17884	18564	19244	19924	20604	21284
69	14007	14697	15387	16077	16767	17457	18147	18837	19527	20217	20907	21597
70	14210	14910	15610	16310	17010	17710	18410	19110	19810	20510	21210	21910
71	14413	15123	15833	16543	17253	17963	18673	19383	20093	20803	21513	22223
72	14616	15336	16056	16776	17496	18216	18936	19656	20376	21096	21816	22536
73	14819	15549	16279	17009	17739	18469	19199	19929	20659	21389	22119	22849
74	15022	15762	16502	17242	17982	18722	19462	20202	20942	21682	22422	23162
75	15225	15975	16725	17475	18225	18975	19725	20475	21225	21975	22725	23475
76	15428	16188	16948	17708	18468	19228	19988	20748	21508	22268	23028	23788
77	15631	16401	17171	17941	18711	19481	20251	21021	21791	22561	23331	24101
78	15834	16614	17394	18174	18954	19734	20514	21294	22074	22854	23634	24414
79	16037	16827	17617	18407	19197	19987	20777	21567	22357	23147	23937	24727
80	16240	17040	17840	18640	19440	20240	21040	21840	22640	23440	24240	25040
81	16443	17253	18063	18873	19683	20493	21303	22113	22923	23733	24543	25353
82	16646	17466	18286	19106	19926	20746	21566	22386	23206	24026	24846	25666
83	16849	17679	18509	19339	20169	20999	21829	22659	23489	24319	25149	25979
84	17052	17892	18732	19572	20412	21252	22092	22932	23772	24612	25452	26292
85	17255	18105	18955	19805	20655	21505	22355	23205	24055	24905	25755	26605
86	17458	18318	19178	20038	20898	21758	22618	23478	24338	25198	26058	26918
87	17661	18531	19401	20271	21141	22011	22881	23751	24621	25491	26361	27231
88	17864	18744	19624	20504	21384	22264	23144	24024	24904	25784	26664	27544
89	18067	18957	19847	20737	21627	22517	23407	24297	25187	26077	26967	27857
90	18270	19170	20070	20970	21870	22770	23670	24570	25470	26370	27270	28170
91	18473	19383	20293	21203	22113	23023	23933	24843	25753	26663	27573	28483
92	18676	19596	20516	21436	22356	23276	24196	25116	26036	26956	27876	28796
93	18879	19809	20739	21669	22599	23529	24459	25389	26319	27249	28179	29109
94	19082	20022	20962	21902	22842	23782	24722	25662	26602	27542	28482	29422
95	19285	20235	21185	22135	23085	24035	24985	25935	26885	27835	28785	29735
96	19488	20448	21408	22368	23328	24288	25248	26208	27168	28128	29088	30048
97	19691	20661	21631	22601	23571	24541	25511	26481	27451	28421	29391	30361
98	19894	20874	21854	22834	23814	24794	25774	26754	27734	28714	29694	30674
99	20097	21087	22077	23067	24057	25047	26037	27027	28017	29007	29997	30987
100	20300	21300	22300	23300	24300	25300	26300	27300	28300	29300	30300	31300

Table 68

NACA STANDARD ATMOSPHERE, TENTATIVE PROPERTIES OF THE UPPER ATMOSPHERE [1] *

Recent developments in aeronautics and ordnance have demonstrated the need for information concerning the characteristics of the upper atmosphere. As a result of this need the National Advisory Committee for Aeronautics has prepared tentative tables of pertinent properties of the atmosphere for altitudes extending to 120 kilometers. The tables are intended to serve as a tentative standard for evaluating the performance characteristics of aircraft, missiles, and prime movers, and for design purposes, and constitute an extension of Table 63, "Standard Atmosphere, Lower Atmosphere."

Tentative temperatures.—Three sets of tentative temperature-height relationships have been adopted. One set gives tentative standard temperatures which are used as the basis of the tables and the other two list values of the probable minimum and the probable maximum temperatures for the entire world. These three sets of temperature distributions which were originally recommended by the NACA Subcommittee on the Upper Atmosphere are given by linear variations with altitude between the points specified in the following tabulation of temperatures:

TEMPERATURES

Altitude	Probable minimum [2]	Tentative standard	Probable maximum [2]
km.	°K.	°K.	°K.
0	225	288	320
10.76923	...	218	...
11	...	...	250
17	180	...	...
20	...	218	...
25	...	...	255
32	...	218	...
45	200	...	380
50	...	350	...
55	300	...	...
60	...	350	...
70	...	...	380
78	...	240	...
80	170	...	300
83	...	240	...
120	300	375	600

Tentative composition.—The tentative composition used in computing the table was arrived at by taking into consideration the fact that, at altitudes below 80 kilometers in the daytime and below 105 kilometers at night, the generally accepted variations in chemical composition are too small to affect appreciably the computed pressures and densities. However, it is believed that at levels above those just specified significant changes in composition result from the dissociation of oxygen molecules by solar radiation. It is furthermore known that the presence of water vapor in the atmosphere does not appreciably affect pressures and densities in the upper atmosphere. As a result of such considerations, and in the interest of simplicity, the following tentative specifications for

[1] Condensed from Warfield, C. N., Tentative tables for the properties of the upper atmosphere, NACA Techn. Note No. 1200, 1947.

[2] The values of ambient air temperature listed in these two columns are not intended to represent extreme values for the entire world, and for all time, but rather values that bracket the temperatures over nearly all the earth most of the time. It is, of course, unlikely that at any given time the atmosphere will assume the "probable minimum" (or "maximum") temperature distribution throughout its depth or through any major segment thereof.

* Superseded by U. S. Extension to ICAO Standard Atmosphere, 1956. Geophysics Research Directorate, Air Force Cambridge Research Center, and U. S. Weather Bureau.

(*continued*)

NACA STANDARD ATMOSPHERE, TENTATIVE PROPERTIES OF THE UPPER ATMOSPHERE

composition of the upper atmosphere were recommended by the Subcommittee and have been adopted for the purposes of computing the values in these tables:

(1) For daytime, the dissociation of oxygen is such as to produce a constant volume gradient[3] from all-molecular oxygen at 80 kilometers to all-atomic oxygen at 100 kilometers. Except for oxygen dissociation the composition is the same as that at sea level.

(2) For night time, the dissociation of oxygen such as to produce a constant volume gradient[3] from all-molecular oxygen at 105 kilometers to all-atomic oxygen at 120 kilometers. Except for oxygen dissociation the composition is the same as that at sea level.

(3) At altitudes below the regions of oxygen dissociation the composition is the same as that at sea level.

(4) At altitudes above the regions in which both molecular and atomic oxygen exist, as stipulated in (1) and (2), and up to at least 120 kilometers, the composition is the same as that at sea level, except for oxygen which is in the atomic rather than molecular form.

List of Symbols.—

ρ = mass per unit volume,
p = pressure,
T = temperature °A. (= 273 + °C.),
M = molecular weight,
h = height,
g = acceleration of gravity,
v = volume fraction of molecular oxygen in normal dry air.

The following subscripts are used to refer to the indicated conditions:

$_0$ = sea level,
$_1$ = lower level,
$_m$ = base of the region of oxygen dissociation,
$_a$ = top of the region of oxygen dissociation where oxygen is all atomic,
$_A$ = base of region with constant temperature and constant composition,
$_B$ = base of region with constant temperature gradient and constant composition,
$_C$ = base of region with constant temperature and constant volume gradient of dissociation,
$_D$ = base of region with constant temperature gradient and constant volume gradient of dissociation.

Basic constants.—In addition to the constants for the lower atmosphere given in Table 63, the following sea-level values of the various quantities have been adopted:

Coefficient of viscosity........................	$\mu_0 = 17835 \times 10^{-8}$ poise
Kinematic viscosity	$\nu_0 = \frac{\mu_0}{\rho_0} = 14.553 \times 10^{-6}$ m.^{2} sec.$^{-1}$
Speed of sound................................	$a_0 = 340.22$ m. sec.$^{-1}$
Mean free path of nitrogen molecules...........	$\lambda_n = 7.38 \times 10^{-8}$ m.
Mean free path of oxygen molecules............	$\lambda_o = 7.36 \times 10^{-8}$ m.
Mean free parth of air molecules...............	$\lambda_{air} = 7.37 \times 10^{-8}$ m
Average molecular weight......................	$M_0 = 28.966$
Ratio of specific heats.........................	$\gamma_0 = 1.4$
Volume fraction of oxygen in normal dry air.....	$v_0 = 0.2095$

Basic equations.—In addition to the specifications for temperature and composition already listed, certain other assumptions are made and serve as the basis for deriving

[3] "Constant volume gradient" signifies linear variation with height of the existing volume of molecular oxygen per unit initial volume of normal dry air.

(*continued*)

NACA STANDARD ATMOSPHERE, TENTATIVE PROPERTIES OF THE UPPER ATMOSPHERE

the various equations used in computing the properties of the upper atmosphere. These additional assumptions are:

(a) the air is dry,

(b) the air behaves as a perfect gas and hence obeys the general gas law which may be written

$$\frac{\rho}{\rho_0}=\frac{p}{p_0}\frac{T_0}{T}\frac{M}{M_0} \qquad (1)$$

(c) the air is at rest with respect to the earth and hence obeys the basic law for fluid statics

$$dp=-g\rho dh \qquad (2)$$

(d) the acceleration of gravity is constant with height. (Reference 1 also contains tables based on the assumption of a variation in the acceleration of gravity inversely with the square of the distance from the center of the earth.) A method for correcting to true height is given below (see p. 283).

By means of equations (1) and (2) and equations representing the adopted specifications for temperature and composition, relationships may be deduced between pressure and height. The equations representing the adopted specifications are

$$T=T_1+L(h-h_1) \qquad (3)$$

where L is the vertical temperature gradient $\Delta T/\Delta h$, and

$$\frac{M}{M_0}=\frac{1}{1-K\ (h-h_m)} \qquad (4)$$

where

$$K=-\frac{v_0}{h_a-h_m} \qquad (5)$$

which represents the vertical gradient of the existing volume of molecular oxygen per unit initial volume of normal dry air.

Pressure-height relationships.—The equations that are based on a constant value of g are as follows:[4]

For combination A (constant temperature and constant composition):

$$\log_e\frac{p}{p_A}=C_A\ (h-h_A) \qquad (6)$$

where

$$C_A=-\frac{g_0\rho_0}{p_0}\frac{T_0}{T}\frac{M}{M_0} \qquad (7)$$

For combination B (constant temperature gradient and constant composition):

$$\log\frac{p}{p_B}=C_B\ \log\frac{T}{T_B} \qquad (8)$$

where

$$C_B=-\frac{g_0\rho_0T_0}{p_0\ L}\frac{M}{M_0} \qquad (9)$$

For combination C (constant temperature and constant volume gradient of dissociation):

$$\log\frac{p}{P_C}=C_C\ \log\frac{M}{M_C} \qquad (10)$$

where

$$C_C=-\frac{g_0\rho_0T_0}{p_0\ KT} \qquad (11)$$

[4] See footnote 6, p. 266.

(continued)

NACA STANDARD ATMOSPHERE, TENTATIVE PROPERTIES OF THE UPPER ATMOSPHERE

For combination D (constant temperature gradient and constant volume gradient of dissociation):

$$\log \frac{p}{p_D} = C_D \log \frac{T}{T_D} \frac{M}{M_D} \tag{12}$$

where

$$C_D = \frac{-g_0 \rho_0 T_0 M_D}{p_0 \ (LM_0 + M_D T_D K)} \tag{13}$$

Values of p_A, p_B, p_C, p_D, T_B, and T_D can be found in the table corresponding to the appropriate height. T and M may be computed from equations (3) and (4) respectively. The value of M in the region where oxygen is all-atomic is equal to the value of M at the top of the underlying region where dissociation is occurring.

Speed of sound.—The speed of sound a at any altitude relative to that at sea level a_0 is computed by the equation

$$\frac{a}{a_0} = \left(\frac{\gamma T M_0}{\gamma_0 T_0 M}\right)^{1/2} \tag{14}$$

where

$$a_0 = \left(\frac{\gamma_0 p_0}{\rho_0}\right)^{1/2} \tag{15}$$

and the ratio of the specific heats γ ($= c_p/c_v$, see Table 70) is given by

$$\frac{\gamma}{\gamma_0} = 1 - \frac{128 \ K \ (h - h_m)}{21 \ M_0} \tag{16}$$

Coefficient of viscosity.—Sutherland's equation for the variation of the coefficient of viscosity μ with temperature is used,

$$\frac{\mu}{\mu_0} = \left(\frac{T}{T_0}\right)^{3/2} \left(\frac{T_0 + S}{T + S}\right) \tag{17}$$

and the value adopted for S is 120. The Sutherland formula is strictly applicable only to a gas of constant composition and to pressures which are not too small, and consequently the tabulated values for the kinematic viscosity are obviously not entirely reliable at the higher altitudes.

Molecular mean free path.—The ratio of the molecular mean free path λ at any altitude to the corresponding value at sea level λ_0 is computed by

$$\frac{\lambda}{\lambda_0} = \frac{p_0 T g}{p T_0 g_0} \tag{18}$$

Conversion to true height.—To convert a height h computed on the assumption of a constant value of the acceleration of gravity $g_0 = 9.80665$ m. sec.$^{-2}$ to a "true height" H based on the assumption that gravity varies inversely as the square of the distance from the center of the earth the following formula may be used:

$$H = \frac{9.80665 \ R \ h}{g'_0 \ R - 9.80665 \ h} \tag{19}$$

where g'_0 is the acceleration of gravity (m. sec.$^{-2}$) at sea level at the latitude in question and R is the radius of the earth in meters. Conversely

$$h = \frac{g'_0 \ R \ H}{9.80665 \ (R + H)} \tag{20}$$

Certain second-order terms which are customarily neglected in determining the variation of gravity with height have been neglected in the derivation of equations (19) and (20); at very great heights these terms will give rise to small corrections.

(continued)

NACA STANDARD ATMOSPHERE, TENTATIVE PROPERTIES OF THE UPPER ATMOSPHERE

Altitude h m.	Temperature T °A.	Pressure p mb.	Pressure ratio p/p_0	Specific weight * ρg kg. m.$^{-3}$	Kinematic viscosity μ m.^{2} sec.$^{-1}$	Speed of sound a m. sec.$^{-1}$	Mean free path of molecules λ m.
			(a) For both day and night				
20000	218.0	55.21	5.449×10^{-2}	8.821×10^{-2}	0.0001607	296.0	0.00102×10^{-3}
25000	218.0	25.22	2.489	4.030	.0003518	296.0	.00224
30000	218.0	11.52	1.137	1.841	.0007700	296.0	.00490
32000	218.0	8.421	8.311×10^{-3}	1.346	.001054	296.0	.00671
35000	240.0	5.381	5.311	7.810×10^{-3}	.001969	310.6	.0116
40000	276.7	2.775	2.739	3.494	0.004944	333.5	0.0259
45000	313.3	1.554	1.534	1.728	.01103	354.9	.0523
50000	350.0	0.9282	9.160×10^{-4}	9.237×10^{-4}	.02245	375.1	.0978
55000	350.0	.5698	5.623	5.670	.03658	375.1	.159
60000	350.0	.3498	3.452	3.481	.05959	375.1	.259
65000	319.4	0.2099	2.072	2.289	0.08452	358.3	0.395
70000	288.9	.1196	1.181	1.443	.1239	340.7	.626
75000	258.3	.06406	6.322×10^{-5}	8.637×10^{-5}	.1892	322.2	1.05
78000	240.0	.04244	4.189	6.161	.2496	310.6	1.47
			(b) For day only				
80000	240.0	0.03193	3.151×10^{-5}	4.635×10^{-5}	0.3318	310.6	1.95×10^{-3}
83000	240.0	.02098	2.070	2.951	.5211	316.5	2.97
85000	247.3	.01602	1.582	2.145	.7348	325.2	4.00
90000	265.5	.008640	8.527×10^{-6}	1.026	1.629	347.1	7.97
95000	283.8	.004981	4.916	5.284×10^{-6}	3.336	369.2	14.8
100000	302.0	0.003042	3.002	2.901	6.383	391.5	25.7
105000	320.3	.001932	1.907	1.737	11.16	403.2	43.0
110000	338.5	.001258	1.242	1.071	18.89	414.5	69.8
115000	356.8	.0008383	8.273×10^{-7}	6.766×10^{-7}	31.10	425.5	110
120000	375.0	.0005698	5.624	4.376	49.92	436.3	171
			(c) For night only				
80000	240.0	0.03193	3.151×10^{-5}	4.635×10^{-5}	0.3318	310.6	1.95×10^{-3}
83000	240.0	.02084	2.056	3.024	.5085	310.6	2.99
85000	247.3	.01574	1.553	2.217	.7110	315.3	4.07
90000	265.5	.008084	7.978×10^{-6}	1.060	1.576	326.7	8.52
95000	283.8	.004339	4.283	5.327×10^{-6}	3.309	337.7	17.0
100000	302.0	0.002421	2.390	2.793	6.630	348.4	32.3
105000	320.3	.001398	1.380	1.521	12.74	358.8	59.4
110000	338.5	.0008469	8.358×10^{-7}	8.146×10^{-7}	24.83	384.3	104
115000	356.8	.0005427	5.356	4.649	45.26	410.1	170
120000	375.0	.0003646	3.598	2.800	78.01	436.3	267

* In the absolute (length-mass-time) system of units this quantity is termed "density" and is usually designated by the symbol ρ.

DENSITY-ALTITUDE DIAGRAM

This diagram expresses density-altitude (ft.) in the U. S. Standard Atmosphere as a function of barometric pressure (in. Hg.) and virtual temperature (°F.). (Heavy dashed curve shows interrelations of temperature, pressure, and pressure-altitude in the U. S. Standard Atmosphere, where $t°F. = 59° - 0.003566Z$ (Z = pressure-altitude in feet).)

The diagram is based on the following equation which is only valid up to 35,332 ft. (10.769 Km.):

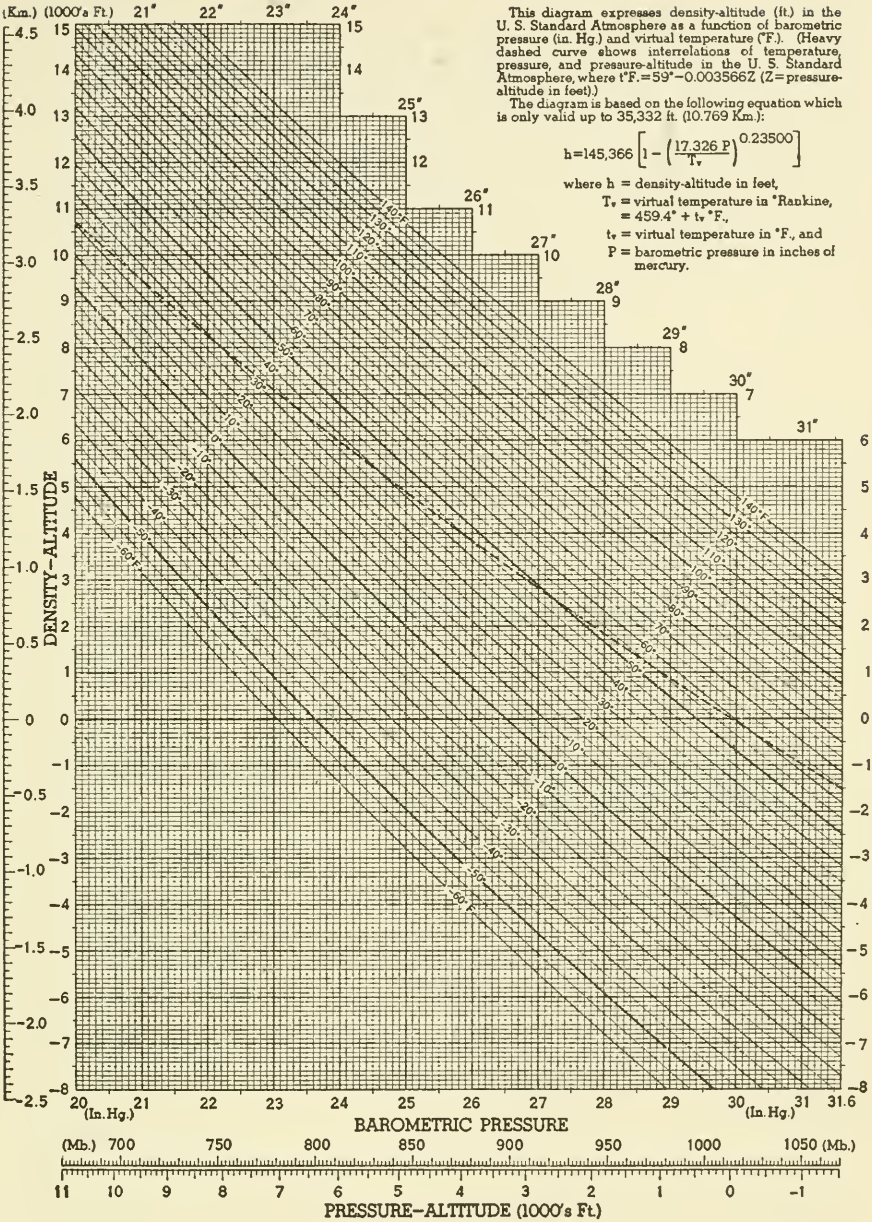
$$h = 145{,}366\left[1 - \left(\frac{17.326\,P}{T_v}\right)^{0.23500}\right]$$

where h = density-altitude in feet,

T_v = virtual temperature in °Rankine, = 459.4° + t_v °F.,

t_v = virtual temperature in °F., and

P = barometric pressure in inches of mercury.



SECTION VI

THERMODYNAMIC TABLES

TABLE 70

THERMODYNAMIC CONSTANTS

Basic constants:[1]

Apparent molecular weight of dry air, M.

$$M = 28.966$$

Absolute temperature of the ice point, T_0.

$$T_0 = 273.16\ °K.$$

Energy equivalent of the International Steam Table calorie (ITcal.) and the 15 °C. water calorie ($cal._{15}$). (Also see Table 1).

$$1\ ITcal. = 4.18684 \times 10^7\ ergs$$

$$= \frac{1}{860 \times 10^3}\ \text{mean International kilowatt-hours}$$

$$1\ ITcal. = 1.00032\ cal._{15}$$

Gas constant, R^*, for 1 gram mol of ideal gas.

$$R^* = 8.31436 \times 10^7\ erg.\ mol^{-1}\ °K.^{-1}$$
$$= 1.98583\ ITcal.\ mol^{-1}\ °K.^{-1}$$

Gas constant, R, for 1 gram of dry air.

$$R = 2.8704 \times 10^6\ erg\ g.^{-1}\ °K.^{-1}$$
$$= 6.8557 \times 10^{-2}\ ITcal.\ g.^{-1}\ °K.^{-1}$$

Molecular weight, M_w, of water vapor.

$$M_w = 18.0160$$

Gas constant, R_v, for 1 gram of water vapor.

$$R_v = 4.6150 \times 10^6\ erg\ g.^{-1}\ °K.^{-1}$$
$$= 1.10226 \times 10^{-1}\ ITcal.\ g.^{-1}\ °K.^{-1}$$

Specific heats:[2]

	Recommended value	Range of actual values
Dry air,		
constant pressure, c_p	$7R/2 = 0.240$ ITcal. $g.^{-1}$ $°K.^{-1}$	0.2394-0.2414 (see Table 88)
constant volume, c_v	$5R/2 = 0.171$ ITcal. $g.^{-1}$ $°K.^{-1}$	0.171-0.172
ratio, c_p/c_v	$7/5 = 1.400$	1.40-1.41
difference, $c_p - c_v$	$R = 0.0686$ ITcal. $g.^{-1}$ $°K.^{-1}$	
Water,		
liquid, c_w	1.000 ITcal. $g.^{-1}$ $°K.^{-1}$	0.999-1.3 (see Table 92)
ice, c_i	0.5 ITcal. $g.^{-1}$ $°K.^{-1}$	0.5-0.3 (see Table 92)
Water vapor,		
constant pressure, c_{pv}	$4R_v = 0.441$ ITcal. $g.^{-1}$ $°K.^{-1}$	0.44-0.46 (see Table 91)
constant volume, c_{vv}	$3R_v = 0.331$ ITcal. $g.^{-1}$ $°K.^{-1}$	0.33-0.34
ratio, c_{pv}/c_{vv}	$4/3 = 1.333$	1.32-1.33
difference, $c_{pv} - c_{vv}$	$R_v = 0.110$ ITcal. $g.^{-1}$ $°K.^{-1}$	

[1] I. M. O. Twelfth Conference of Directors, Resolution 164, Washington, 1948.
[2] I. M. O. Aerological Commission, Doc. 71, app. IV, Toronto, 1948.

TABLE 71

DENSITY OF AIR

The density ρ of air, in cgs units, is given by

$$\rho = \frac{p}{RT'_v}, \qquad (1)$$

where

p = total barometric pressure, dynes. cm.$^{-2}$,
R = gas constant for dry air, 2.8704×10^6 erg g.$^{-1}$ °K.$^{-1}$,
T'_v = adjusted virtual temperature of the air, °K. (see Table 72).

For pressure p measured in millibars, the density ρ in kg. m.$^{-3}$ (1 kg. m.$^{-3}$ = 10^{-3} g. cm.$^{-3}$) is

$$\rho = 0.34838 \frac{p}{T'_v}. \qquad (2)$$

For $p = 1013.25$ and $T'_v = 273.16$ °K. (0 °C.), $\rho = 1.2923 \times 10^{-3}$ g. cm.$^{-3}$

(*continued*)

DENSITY OF AIR

Adjusted virtual temperature t'_v	Pressure—millibars										
	1100	1000	900	800	700	600	500	400	300	200	100
°C.	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³
−110	2.3488	2.1352	1.9217	1.7082	1.4947	1.2811	1.0676	0.8541	0.6406	0.4270	0.2135
−109	2.3344	2.1222	1.9100	1.6978	1.4856	1.2733	1.0611	0.8489	0.6367	0.4244	0.2122
−108	2.3203	2.1094	1.8984	1.6875	1.4766	1.2656	1.0547	0.8437	0.6328	0.4219	0.2109
−107	2.3063	2.0967	1.8870	1.6773	1.4677	1.2580	1.0483	0.8387	0.6290	0.4193	0.2097
−106	2.2925	2.0841	1.8757	1.6673	1.4589	1.2505	1.0421	0.8337	0.6252	0.4168	0.2084
−105	2.2789	2.0717	1.8646	1.6574	1.4502	1.2430	1.0359	0.8287	0.6215	0.4143	0.2072
−104	2.2654	2.0595	1.8535	1.6476	1.4416	1.2357	1.0297	0.8238	0.6178	0.4119	0.2059
−103	2.2521	2.0474	1.8427	1.6379	1.4332	1.2284	1.0237	0.8190	0.6142	0.4095	0.2047
−102	2.2390	2.0354	1.8319	1.6283	1.4248	1.2213	1.0177	0.8142	0.6106	0.4071	0.2035
−101	2.2260	2.0236	1.8212	1.6189	1.4165	1.2142	1.0118	0.8094	0.6071	0.4047	0.2024
−100	2.2131	2.0119	1.8107	1.6095	1.4083	1.2072	1.0060	0.8048	0.6036	0.4024	0.2012
− 99	2.2004	2.0004	1.8003	1.6003	1.4003	1.2002	1.0002	0.8001	0.6001	0.4001	0.2000
− 98	2.1878	1.9890	1.7901	1.5912	1.3923	1.1934	0.9945	0.7956	0.5967	0.3978	1.1989
− 97	2.1754	1.9776	1.7799	1.5821	1.3844	1.1866	0.9888	0.7911	0.5933	0.3955	0.1978
− 96	2.1631	1.9665	1.7698	1.5732	1.3765	1.1799	0.9832	0.7866	0.5899	0.3933	0.1966
− 95	2.1510	1.9554	1.7599	1.5644	1.3688	1.1733	0.9777	0.7822	0.5866	0.3911	0.1955
− 94	2.1390	1.9445	1.7501	1.5556	1.3612	1.1667	0.9723	0.7778	0.5834	0.3889	0.1945
− 93	2.1271	1.9338	1.7404	1.5470	1.3536	1.1602	0.9669	0.7735	0.5801	0.3868	0.1934
− 92	2.1154	1.9231	1.7308	1.5385	1.3461	1.1538	0.9615	0.7692	0.5769	0.3846	0.1923
− 91	2.1038	1.9125	1.7213	1.5300	1.3388	1.1475	0.9563	0.7650	0.5738	0.3825	0.1913
− 90	2.0923	1.9021	1.7119	1.5217	1.3314	1.1412	0.9510	0.7608	0.5706	0.3804	0.1902
− 89	2.0809	1.8917	1.7026	1.5134	1.3242	1.1350	0.9459	0.7567	0.5675	0.3783	0.1892
− 88	2.0697	1.8815	1.6934	1.5052	1.3171	1.1289	0.9408	0.7526	0.5645	0.3763	0.1882
− 87	2.0586	1.8714	1.6843	1.4971	1.3100	1.1229	0.9357	0.7486	0.5614	0.3743	0.1871
− 86	2.0476	1.8614	1.6753	1.4891	1.3030	1.1169	0.9307	0.7446	0.5584	0.3723	0.1861
− 85	2.0367	1.8515	1.6664	1.4812	1.2961	1.1109	0.9258	0.7406	0.5555	0.3703	0.1852
− 84	2.0259	1.8417	1.6576	1.4734	1.2892	1.1050	0.9209	0.7367	0.5525	0.3683	0.1842
− 83	2.0153	1.8321	1.6489	1.4656	1.2824	1.0992	0.9160	0.7328	0.5496	0.3664	0.1832
− 82	2.0047	1.8225	1.6402	1.4580	1.2757	1.0935	0.9112	0.7290	0.5467	0.3645	0.1822
− 81	1.9943	1.8130	1.6317	1.4504	1.2691	1.0878	0.9065	0.7252	0.5439	0.3626	0.1813
− 80	1.9840	1.8036	1.6232	1.4429	1.2625	1.0822	0.9018	0.7214	0.5411	0.3607	0.1804
− 79	1.9737	1.7943	1.6149	1.4354	1.2560	1.0766	0.8972	0.7177	0.5383	0.3589	0.1794
− 78	1.9636	1.7851	1.6066	1.4281	1.2496	1.0711	0.8926	0.7140	0.5355	0.3570	0.1785
− 77	1.9536	1.7760	1.5984	1.4208	1.2432	1.0656	0.8880	0.7104	0.5328	0.3552	0.1776
− 76	1.9437	1.7670	1.5903	1.4136	1.2369	1.0602	0.8835	0.7068	0.5301	0.3534	0.1767
− 75	1.9339	1.7581	1.5823	1.4065	1.2307	1.0549	0.8790	0.7032	0.5274	0.3516	0.1758
− 74	1.9242	1.7493	1.5743	1.3994	1.2245	1.0496	0.8746	0.6997	0.5248	0.3499	0.1749
− 73	1.9146	1.7405	1.5665	1.3924	1.2184	1.0443	0.8703	0.6962	0.5222	0.3481	0.1741
− 72	1.9051	1.7319	1.5587	1.3855	1.2123	1.0391	0.8659	0.6927	0.5196	0.3464	0.1732
− 71	1.8956	1.7233	1.5510	1.3786	1.2063	1.0340	0.8617	0.6893	0.5170	0.3447	0.1723
− 70	1.8863	1.7148	1.5433	1.3719	1.2004	1.0289	0.8574	0.6859	0.5144	0.3430	0.1715
− 69	1.8771	1.7064	1.5358	1.3651	1.1945	1.0239	0.8532	0.6826	0.5119	0.3413	0.1706
− 68	1.8679	1.6981	1.5283	1.3585	1.1887	1.0189	0.8491	0.6792	0.5094	0.3396	0.1698
− 67	1.8589	1.6899	1.5209	1.3519	1.1829	1.0139	0.8449	0.6759	0.5070	0.3380	0.1690
− 66	1.8499	1.6817	1.5135	1.3454	1.1772	1.0090	0.8409	0.6727	0.5045	0.3363	0.1682
− 65	1.8410	1.6736	1.5063	1.3389	1.1715	1.0042	0.8368	0.6695	0.5021	0.3347	0.1674
− 64	1.8322	1.6656	1.4991	1.3325	1.1659	0.9994	0.8328	0.6663	0.4997	0.3331	0.1666
− 63	1.8235	1.6577	1.4919	1.3262	1.1604	0.9946	0.8289	0.6631	0.4973	0.3315	0.1658
− 62	1.8148	1.6498	1.4849	1.3199	1.1549	0.9899	0.8249	0.6599	0.4950	0.3300	0.1650
− 61	1.8063	1.6421	1.4779	1.3137	1.1495	0.9852	0.8210	0.6568	0.4926	0.3284	0.1642
− 60	1.7978	1.6344	1.4709	1.3075	1.1441	0.9806	0.8172	0.6538	0.4903	0.3269	0.1634
− 59	1.7894	1.6267	1.4641	1.3014	1.1387	0.9760	0.8134	0.6507	0.4880	0.3253	0.1627
− 58	1.7811	1.6192	1.4573	1.2953	1.1334	0.9715	0.8096	0.6477	0.4858	0.3238	0.1619
− 57	1.7729	1.6117	1.4505	1.2894	1.1282	0.9670	0.8058	0.6447	0.4835	0.3223	0.1612
− 56	1.7647	1.6043	1.4438	1.2834	1.1230	0.9626	0.8021	0.6417	0.4813	0.3209	0.1604
− 55	1.7566	1.5969	1.4372	1.2775	1.1178	0.9582	0.7985	0.6388	0.4791	0.3194	0.1597

(continued)

DENSITY OF AIR

Adjusted virtual temperature t'_v	Pressure—millibars										
	1100	1000	900	800	700	600	500	400	300	200	100
°C.	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$
−55	1.7566	1.5969	1.4372	1.2775	1.1178	0.9582	0.7985	0.6388	0.4791	0.3194	0.1597
−54	1.7486	1.5896	1.4307	1.2717	1.1127	0.9538	0.7948	0.6359	0.4769	0.3179	0.1590
−53	1.7407	1.5824	1.4242	1.2659	1.1077	0.9494	0.7912	0.6330	0.4747	0.3165	0.1582
−52	1.7328	1.5752	1.4177	1.2602	1.1027	0.9452	0.7876	0.6301	0.4726	0.3150	0.1575
−51	1.7250	1.5682	1.4113	1.2545	1.0977	0.9409	0.7841	0.6273	0.4704	0.3136	0.1568
−50	1.7173	1.5611	1.4050	1.2489	1.0928	0.9367	0.7806	0.6245	0.4683	0.3122	0.1561
−49	1.7096	1.5542	1.3988	1.2433	1.0879	0.9325	0.7771	0.6217	0.4663	0.3108	0.1554
−48	1.7020	1.5473	1.3925	1.2378	1.0831	0.9284	0.7736	0.6189	0.4642	0.3095	0.1547
−47	1.6945	1.5404	1.3864	1.2323	1.0783	0.9243	0.7702	0.6162	0.4621	0.3081	0.1540
−46	1.6870	1.5336	1.3803	1.2269	1.0736	0.9202	0.7668	0.6135	0.4601	0.3067	0.1534
−45	1.6796	1.5269	1.3742	1.2215	1.0689	0.9162	0.7635	0.6108	0.4581	0.3054	0.1527
−44	1.6723	1.5203	1.3682	1.2162	1.0642	0.9122	0.7601	0.6081	0.4561	0.3041	0.1520
−43	1.6650	1.5137	1.3623	1.2109	1.0596	0.9082	0.7568	0.6055	0.4541	0.3027	0.1514
−42	1.6578	1.5071	1.3564	1.2057	1.0550	0.9043	0.7536	0.6028	0.4521	0.3014	0.1507
−41	1.6507	1.5006	1.3506	1.2005	1.0504	0.9004	0.7503	0.6002	0.4502	0.3001	0.1501
−40	1.6436	1.4942	1.3448	1.1953	1.0459	0.8965	0.7471	0.5977	0.4483	0.2988	0.1494
−39	1.6366	1.4878	1.3390	1.1902	1.0415	0.8927	0.7439	0.5951	0.4463	0.2976	0.1488
−38	1.6296	1.4815	1.3333	1.1852	1.0370	0.8889	0.7407	0.5926	0.4444	0.2963	0.1481
−37	1.6227	1.4752	1.3277	1.1802	1.0326	0.8851	0.7376	0.5901	0.4426	0.2950	0.1475
−36	1.6159	1.4690	1.3221	1.1752	1.0283	0.8814	0.7345	0.5876	0.4407	0.2938	0.1469
−35	1.6091	1.4628	1.3165	1.1702	1.0240	0.8777	0.7314	0.5851	0.4388	0.2926	0.1463
−34	1.6024	1.4567	1.3110	1.1654	1.0197	0.8740	0.7284	0.5827	0.4370	0.2913	0.1457
−33	1.5957	1.4506	1.3056	1.1605	1.0154	0.8704	0.7253	0.5803	0.4352	0.2901	0.1451
−32	1.5891	1.4446	1.3001	1.1557	1.0112	0.8668	0.7223	0.5778	0.4334	0.2889	0.1445
−31	1.5825	1.4386	1.2948	1.1509	1.0071	0.8632	0.7193	0.5755	0.4316	0.2877	0.1439
−30	1.5760	1.4327	1.2895	1.1462	1.0029	0.8596	0.7164	0.5731	0.4298	0.2865	0.1433
−29	1.5696	1.4269	1.2842	1.1415	0.9988	0.8561	0.7134	0.5707	0.4281	0.2854	0.1427
−28	1.5632	1.4210	1.2789	1.1368	0.9947	0.8526	0.7105	0.5684	0.4263	0.2842	0.1421
−27	1.5568	1.4153	1.2737	1.1322	0.9907	0.8492	0.7076	0.5661	0.4246	0.2831	0.1415
−26	1.5505	1.4096	1.2686	1.1276	0.9867	0.8457	0.7048	0.5638	0.4229	0.2819	0.1410
−25	1.5443	1.4039	1.2635	1.1231	0.9827	0.8423	0.7019	0.5615	0.4212	0.2808	0.1404
−24	1.5381	1.3982	1.2584	1.1186	0.9788	0.8389	0.6991	0.5593	0.4195	0.2796	0.1398
−23	1.5319	1.3926	1.2534	1.1141	0.9748	0.8356	0.6963	0.5571	0.4178	0.2785	0.1393
−22	1.5258	1.3871	1.2484	1.1097	0.9710	0.8323	0.6936	0.5548	0.4161	0.2774	0.1387
−21	1.5198	1.3816	1.2434	1.1053	0.9671	0.8290	0.6908	0.5526	0.4145	0.2763	0.1382
−20	1.5138	1.3761	1.2385	1.1009	0.9633	0.8257	0.6881	0.5505	0.4128	0.2752	0.1376
−19	1.5078	1.3707	1.2336	1.0966	0.9595	0.8224	0.6854	0.5483	0.4112	0.2741	0.1371
−18	1.5019	1.3654	1.2288	1.0923	0.9557	0.8192	0.6827	0.5461	0.4096	0.2731	0.1365
−17	1.4960	1.3600	1.2240	1.0880	0.9520	0.8160	0.6800	0.5440	0.4080	0.2720	0.1360
−16	1.4902	1.3547	1.2193	1.0838	0.9483	0.8128	0.6774	0.5419	0.4064	0.2709	0.1355
−15	1.4844	1.3495	1.2145	1.0796	0.9446	0.8097	0.6747	0.5398	0.4048	0.2699	0.1349
−14	1.4787	1.3443	1.2099	1.0754	0.9410	0.8066	0.6721	0.5377	0.4033	0.2689	0.1344
−13	1.4730	1.3391	1.2052	1.0713	0.9374	0.8035	0.6696	0.5356	0.4017	0.2678	0.1339
−12	1.4674	1.3340	1.2006	1.0672	0.9338	0.8004	0.6670	0.5336	0.4002	0.2668	0.1334
−11	1.4618	1.3289	1.1960	1.0631	0.9302	0.7973	0.6644	0.5316	0.3987	0.2658	0.1329
−10	1.4562	1.3238	1.1915	1.0591	0.9267	0.7943	0.6619	0.5295	0.3972	0.2648	0.1324
− 9	1.4507	1.3188	1.1869	1.0551	0.9232	0.7913	0.6594	0.5275	0.3956	0.2638	0.1319
− 8	1.4452	1.3139	1.1825	1.0511	0.9197	0.7883	0.6569	0.5255	0.3942	0.2628	0.1314
− 7	1.4398	1.3089	1.1780	1.0471	0.9162	0.7854	0.6545	0.5236	0.3927	0.2618	0.1309
− 6	1.4344	1.3040	1.1736	1.0432	0.9128	0.7824	0.6520	0.5216	0.3912	0.2608	0.1304
− 5	1.4291	1.2992	1.1692	1.0393	0.9094	0.7795	0.6496	0.5197	0.3897	0.2598	0.1299
− 4	1.4238	1.2943	1.1649	1.0355	0.9060	0.7766	0.6472	0.5177	0.3883	0.2589	0.1294
− 3	1.4185	1.2896	1.1606	1.0316	0.9027	0.7737	0.6448	0.5158	0.3869	0.2579	0.1290
− 2	1.4133	1.2848	1.1563	1.0278	0.8994	0.7709	0.6424	0.5139	0.3854	0.2570	0.1285
− 1	1.4081	1.2801	1.1521	1.0241	0.8960	0.7680	0.6400	0.5120	0.3840	0.2560	0.1280
0	1.4029	1.2754	1.1478	1.0203	0.8928	0.7652	0.6377	0.5102	0.3826	0.2551	0.1275

(continued)

DENSITY OF AIR

Adjusted virtual temperature t'_v	Pressure—millibars										
	1100	1000	900	800	700	600	500	400	300	200	100
°C.	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³	kg. m.⁻³
0	1.4029	1.2754	1.1478	1.0203	0.8928	0.7652	0.6377	0.5102	0.3826	0.2551	0.1275
1	1.3978	1.2707	1.1437	1.0166	0.8895	0.7624	0.6354	0.5083	0.3812	0.2541	0.1271
2	1.3927	1.2661	1.1395	1.0129	0.8863	0.7597	0.6331	0.5064	0.3798	0.2532	0.1266
3	1.3877	1.2615	1.1354	1.0092	0.8831	0.7569	0.6308	0.5046	0.3785	0.2523	0.1262
4	1.3827	1.2570	1.1313	1.0056	0.8799	0.7542	0.6285	0.5028	0.3771	0.2514	0.1257
5	1.3777	1.2525	1.1272	1.0020	0.8767	0.7515	0.6262	0.5010	0.3757	0.2505	0.1252
6	1.3728	1.2480	1.1232	0.9984	0.8736	0.7488	0.6240	0.4992	0.3744	0.2496	0.1248
7	1.3679	1.2435	1.1192	0.9948	0.8705	0.7461	0.6218	0.4974	0.3731	0.2487	0.1244
8	1.3630	1.2391	1.1152	0.9913	0.8674	0.7435	0.6195	0.4956	0.3717	0.2478	0.1239
9	1.3582	1.2347	1.1112	0.9878	0.8643	0.7408	0.6174	0.4939	0.3704	0.2469	0.1235
10	1.3534	1.2303	1.1073	0.9843	0.8612	0.7382	0.6152	0.4921	0.3691	0.2461	0.1230
11	1.3486	1.2260	1.1034	0.9808	0.8582	0.7356	0.6130	0.4904	0.3678	0.2452	0.1226
12	1.3439	1.2217	1.0995	0.9774	0.8552	0.7330	0.6109	0.4887	0.3665	0.2443	0.1222
13	1.3392	1.2174	1.0957	0.9740	0.8522	0.7305	0.6087	0.4870	0.3652	0.2435	0.1217
14	1.3345	1.2132	1.0919	0.9706	0.8492	0.7279	0.6066	0.4853	0.3640	0.2426	0.1213
15	1.3299	1.2090	1.0881	0.9672	0.8463	0.7254	0.6045	0.4836	0.3627	0.2418	0.1209
16	1.3253	1.2048	1.0843	0.9638	0.8434	0.7229	0.6024	0.4819	0.3614	0.2410	0.1205
17	1.3207	1.2007	1.0806	0.9605	0.8405	0.7204	0.6003	0.4803	0.3602	0.2401	0.1201
18	1.3162	1.1965	1.0769	0.9572	0.8376	0.7179	0.5983	0.4786	0.3590	0.2393	0.1197
19	1.3117	1.1924	1.0732	0.9540	0.8347	0.7155	0.5962	0.4770	0.3577	0.2385	0.1192
20	1.3072	1.1884	1.0695	0.9507	0.8319	0.7130	0.5942	0.4753	0.3565	0.2377	0.1188
21	1.3028	1.1843	1.0659	0.9475	0.8290	0.7106	0.5922	0.4737	0.3553	0.2369	0.1184
22	1.2984	1.1803	1.0623	0.9443	0.8262	0.7082	0.5902	0.4721	0.3541	0.2361	0.1180
23	1.2940	1.1763	1.0587	0.9411	0.8234	0.7058	0.5882	0.4705	0.3529	0.2353	0.1176
24	1.2896	1.1724	1.0551	0.9379	0.8207	0.7034	0.5862	0.4690	0.3517	0.2345	0.1172
25	1.2853	1.1684	1.0516	0.9348	0.8179	0.7011	0.5842	0.4674	0.3505	0.2337	0.1168
26	1.2810	1.1645	1.0481	0.9316	0.8152	0.6987	0.5823	0.4658	0.3494	0.2329	0.1165
27	1.2767	1.1607	1.0446	0.9285	0.8125	0.6964	0.5803	0.4643	0.3482	0.2321	0.1161
28	1.2725	1.1568	1.0411	0.9254	0.8098	0.6941	0.5784	0.4627	0.3470	0.2314	0.1157
29	1.2683	1.1530	1.0377	0.9224	0.8071	0.6918	0.5765	0.4612	0.3459	0.2306	0.1153
30	1.2641	1.1492	1.0343	0.9193	0.8044	0.6895	0.5746	0.4597	0.3448	0.2298	0.1149
31	1.2599	1.1454	1.0309	0.9163	0.8018	0.6872	0.5727	0.4582	0.3436	0.2291	0.1145
32	1.2558	1.1416	1.0275	0.9133	0.7991	0.6850	0.5708	0.4567	0.3425	0.2283	0.1142
33	1.2517	1.1379	1.0241	0.9103	0.7965	0.6827	0.5690	0.4552	0.3414	0.2276	0.1138
34	1.2476	1.1342	1.0208	0.9074	0.7939	0.6805	0.5671	0.4537	0.3403	0.2268	0.1134
35	1.2436	1.1305	1.0175	0.9044	0.7914	0.6783	0.5653	0.4522	0.3392	0.2261	0.1131
36	1.2396	1.1269	1.0142	0.9015	0.7888	0.6761	0.5634	0.4507	0.3381	0.2254	0.1127
37	1.2356	1.1232	1.0109	0.8986	0.7863	0.6739	0.5616	0.4493	0.3370	0.2246	0.1123
38	1.2316	1.1196	1.0077	0.8957	0.7837	0.6718	0.5598	0.4479	0.3359	0.2239	0.1120
39	1.2276	1.1160	1.0044	0.8928	0.7812	0.6696	0.5580	0.4464	0.3348	0.2232	0.1116
40	1.2237	1.1125	1.0012	0.8900	0.7787	0.6675	0.5562	0.4450	0.3337	0.2225	0.1112
41	1.2198	1.1089	0.9980	0.8872	0.7763	0.6654	0.5545	0.4436	0.3327	0.2218	0.1109
42	1.2160	1.1054	0.9949	0.8843	0.7738	0.6633	0.5527	0.4422	0.3316	0.2211	0.1105
43	1.2121	1.1019	0.9917	0.8815	0.7713	0.6612	0.5510	0.4408	0.3306	0.2204	0.1102
44	1.2083	1.0984	0.9886	0.8788	0.7689	0.6591	0.5492	0.4394	0.3295	0.2197	0.1098
45	1.2045	1.0950	0.9855	0.8760	0.7665	0.6570	0.5475	0.4380	0.3285	0.2190	0.1095
46	1.2007	1.0916	0.9824	0.8732	0.7641	0.6549	0.5458	0.4366	0.3275	0.2183	0.1092
47	1.1970	1.0882	0.9793	0.8705	0.7617	0.6529	0.5441	0.4353	0.3264	0.2176	0.1088
48	1.1932	1.0848	0.9763	0.8678	0.7593	0.6509	0.5424	0.4339	0.3254	0.2170	0.1085
49	1.1895	1.0814	0.9733	0.8651	0.7570	0.6488	0.5407	0.4326	0.3244	0.2163	0.1081
50	1.1859	1.0780	0.9702	0.8624	0.7546	0.6468	0.5390	0.4312	0.3234	0.2156	0.1078

(*continued*)

Table 71 (concluded)

DENSITY OF AIR

Adjusted virtual temperature t'_v	Pressure—millibars										
	1100	1000	900	800	700	600	500	400	300	200	100
°C.	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$	kg. m.$^{-3}$
50	1.1859	1.0780	0.9702	0.8624	0.7546	0.6468	0.5390	0.4312	0.3234	0.2156	0.1078
51	1.1822	0.0747	0.9673	0.8598	0.7523	0.6448	0.5374	0.4299	0.3224	0.2149	0.1075
52	1.1786	1.0714	0.9643	0.8571	0.7500	0.6429	0.5357	0.4286	0.3214	0.2143	0.1071
53	1.1750	1.0681	0.9613	0.8545	0.7477	0.6409	0.5341	0.4273	0.3204	0.2136	0.1068
54	1.1714	1.0649	0.9584	0.8519	0.7454	0.6389	0.5324	0.4259	0.3195	0.2130	0.1065
55	1.1678	1.0616	0.9555	0.8493	0.7431	0.6370	0.5308	0.4247	0.3185	0.2123	0.1062
56	1.1642	1.0584	0.9526	0.8467	0.7409	0.6350	0.5292	0.4234	0.3175	0.2117	0.1058
57	1.1607	1.0552	0.9497	0.8442	0.7386	0.6331	0.5276	0.4221	0.3166	0.2110	0.1055
58	1.1572	1.0520	0.9468	0.8416	0.7364	0.6312	0.5260	0.4208	0.3156	0.2104	0.1052
59	1.1537	1.0488	0.9440	0.8391	0.7342	0.6293	0.5244	0.4195	0.3147	0.2098	0.1049
60	1.1503	1.0457	0.9411	0.8366	0.7320	0.6274	0.5228	0.4183	0.3137	0.2091	0.1046
61	1.1468	1.0426	0.9383	0.8340	0.7298	0.6255	0.5213	0.4170	0.3128	0.2085	0.1043
62	1.1434	1.0394	0.9355	0.8316	0.7276	0.6237	0.5197	0.4158	0.3118	0.2079	0.1039
63	1.1400	1.0364	0.9327	0.8291	0.7255	0.6218	0.5182	0.4145	0.3109	0.2073	0.1036
64	1.1366	1.0333	0.9300	0.8266	0.7233	0.6200	0.5166	0.4133	0.3100	0.2067	0.1033
65	1.1333	1.0302	0.9272	0.8242	0.7212	0.6181	0.5151	0.4121	0.3091	0.2060	0.1030
66	1.1299	1.0272	0.9245	0.8218	0.7190	0.6163	0.5136	0.4109	0.3082	0.2054	0.1027
67	1.1266	1.0242	0.9218	0.8193	0.7169	0.6145	0.5121	0.4097	0.3073	0.2048	0.1024
68	1.1233	1.0212	0.9191	0.8169	0.7148	0.6127	0.5106	0.4085	0.3064	0.2042	0.1021
69	1.1200	1.0182	0.9164	0.8146	0.7127	0.6109	0.5091	0.4073	0.3055	0.2036	0.1018
70	1.1167	1.0152	0.9137	0.8122	0.7107	0.6091	0.5076	0.4061	0.3046	0.2030	0.1015
71	1.1135	1.0123	0.9110	0.8098	0.7086	0.6074	0.5061	0.4049	0.3037	0.2025	0.1012
72	1.1103	1.0093	0.9084	0.8075	0.7065	0.6056	0.5047	0.4037	0.3028	0.2019	0.1009
73	1.1071	1.0064	0.9058	0.8051	0.7045	0.6039	0.5032	0.4026	0.3019	0.2013	0.1006
74	1.1039	1.0035	0.9032	0.8028	0.7025	0.6021	0.5018	0.4014	0.3011	0.2007	0.1004
75	1.1007	1.0006	0.9006	0.8005	0.7004	0.6004	0.5003	0.4003	0.3002	0.2001	0.1001
76	1.0976	0.9978	0.8980	0.7982	0.6984	0.5987	0.4989	0.3991	0.2993	0.1996	0.0998
77	1.0944	0.9949	0.8954	0.7959	0.6965	0.5970	0.4975	0.3980	0.2985	0.1990	0.0995
78	1.0913	0.9921	0.8929	0.7937	0.6945	0.5953	0.4960	0.3968	0.2976	0.1984	0.0992
79	1.0882	0.9893	0.8904	0.7914	0.6925	0.5936	0.4946	0.3957	0.2968	0.1979	0.0989
80	1.0851	0.9865	0.8878	0.7892	0.6905	0.5919	0.4932	0.3946	0.2959	0.1973	0.0986
81	1.0821	0.9837	0.8853	0.7870	0.6886	0.5902	0.4918	0.3935	0.2951	0.1967	0.0984
82	1.0790	0.9809	0.8828	0.7847	0.6866	0.5886	0.4905	0.3924	0.2943	0.1962	0.0981
83	1.0760	0.9782	0.8804	0.7825	0.6847	0.5869	0.4891	0.3913	0.2935	0.1956	0.0978
84	1.0730	0.9754	0.8779	0.7803	0.6828	0.5853	0.4877	0.3902	0.2926	0.1951	0.0975
85	1.0700	0.9727	0.8754	0.7782	0.6809	0.5836	0.4864	0.3891	0.2918	0.1945	0.0973
86	1.0670	0.9700	0.8730	0.7760	0.6790	0.5820	0.4850	0.3880	0.2910	0.1940	0.0970
87	1.0640	0.9673	0.8706	0.7738	0.6771	0.5804	0.4836	0.3869	0.2902	0.1935	0.0967
88	1.0611	0.9646	0.8682	0.7717	0.6752	0.5788	0.4823	0.3858	0.2894	0.1929	0.0965
89	1.0582	0.9620	0.8658	0.7696	0.6734	0.5772	0.4810	0.3848	0.2886	0.1924	0.0962
90	1.0552	0.9593	0.8634	0.7674	0.6715	0.5756	0.4797	0.3837	0.2878	0.1919	0.0959
91	1.0523	0.9567	0.8610	0.7653	0.6697	0.5740	0.4783	0.3827	0.2870	0.1913	0.0957
92	1.0495	0.9541	0.8587	0.7632	0.6678	0.5724	0.4770	0.3816	0.2862	0.1908	0.0954
93	1.0466	0.9514	0.8563	0.7612	0.6660	0.5709	0.4757	0.3806	0.2854	0.1903	0.0951
94	1.0437	0.9489	0.8540	0.7591	0.6642	0.5693	0.4744	0.3795	0.2847	0.1898	0.0949
95	1.0409	0.9463	0.8517	0.7570	0.6624	0.5678	0.4731	0.3785	0.2839	0.1893	0.0946
96	1.0381	0.9437	0.8493	0.7550	0.6606	0.5662	0.4719	0.3775	0.2831	0.1887	0.0944
97	1.0353	0.9412	0.8471	0.7529	0.6588	0.5647	0.4706	0.3765	0.2824	0.1882	0.0941
98	1.0325	0.9386	0.8448	0.7509	0.6570	0.5632	0.4693	0.3755	0.2816	0.1877	0.0939
99	1.0297	0.9361	0.8425	0.7489	0.6553	0.5617	0.4681	0.3744	0.2808	0.1872	0.0936
100	1.0270	0.9336	0.8402	0.7469	0.6535	0.5602	0.4668	0.3734	0.2801	0.1867	0.0934

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Introduction.—If both dry and moist air obeyed Dalton's law of partial pressures and behaved as a perfect gas, the partial pressures of dry air and water vapor in the moist air could be considered to be $(p-e)$ and e, respectively, where p is the total barometric pressure, and e is the vapor pressure. Then, according to the perfect gas law, the equations of state for the two constituents could be written

$$(p-e)v = RT \tag{1}$$

$$ev = rR_vT = \frac{r}{\epsilon}RT \tag{2}$$

where

$v =$ volume of $(1+r)$ gram of moist air, or the volume of the moist air per gram of dry air,
$R =$ gas constant for dry air,
$R_v =$ gas constant for water vapor,
$T =$ absolute temperature,
$\epsilon = \frac{M_v}{M_a} = \frac{R}{R_v} =$ ratio of molecular weight of water vapor to that of dry air,
$r =$ mixing ratio (grams of water vapor per gram of dry air).

Adding equations (1) and (2), and considering that the density ρ of the moist air is given by $\rho = \frac{(1+r)}{v}$, then *on the assumption of perfect gas behavior*

$$\rho = \frac{(1+r)}{\left(1+\frac{r}{\epsilon}\right)} \cdot \frac{p}{RT} \tag{3}$$

Virtual temperature.—The virtual temperature (T_v) as defined by the I. M. O. Aerological Commission, Subcommission I, on Physical Functions and Constants (Toronto, 1947)[1] is given by the expression

$$T_v = T\,\frac{1+\frac{r}{\epsilon}}{1+r} \tag{4}$$

Then T_v is the temperature which dry air must have at the given barometric pressure p in order to have the same density as moist air at the same pressure p, and given temperature T, and mixing ratio r, *provided the dry and moist air behave in accordance with the perfect gas equation of state.*

Deviations from perfect gas laws.—To take account of deviations of moist air from perfect gas behavior the I. M. O.[2] introduced the compressibility factor C, a function of pressure, temperature, and relative humidity (see Table 84), which makes the expression for the *actual density of moist air*

$$\rho = \frac{p}{CRT_v} \tag{5}$$

where T_v is the virtual temperature defined by equation (4).

Similarly the density of *dry air* (ρ_a) is given by

$$\rho_a = \frac{p}{C_aRT} \tag{5a}$$

where C_a, a function of pressure and temperature, is the compressibility factor for dry air. C_a is equal to the value of C when the relative humidity is zero. It should be noted that in general $C_a \neq 1$.

Adjusted virtual temperature.—In this volume there is introduced the quantity T'_v °K., (or t'_v °C.), termed *adjusted virtual temperature,* and defined by the expression

$$T'_v = CT_v. \tag{6}$$

[1] See also Sheppard, P. A., The physical properties of air with reference to meteorological practice and air conditioning engineer. A paper presented before the American Society of Mechanical Engineers in December 1948, Amer. Soc. Mech. Eng. Trans., vol. 71, 1949.
[2] I. M. O. Aerological Commission, Doc. 25, Toronto, 1947.

(*continued*)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Substitution of this expression in equation (5) yields

$$\rho = \frac{p}{RT'_v} \quad (7)$$

Accordingly, the *adjusted virtual temperature* (T'_v) may be defined as the temperature which dry air would have when, behaving as a perfect gas, it would possess the same density as the actual air at pressure p, temperature T, and mixing ratio r, the pressure being the same in both cases.

For precise calculations of air density, equation (5) or equations (6) and (7) are necessary; but for rough calculations, equation (3), which omits the compressibility factor C, will be satisfactory.

In view of equations (5), (6), and (7), the differential form of the hydrostatic equation for precise calculations is, in cgs units,

$$dp = -\rho g dZ = -\frac{1}{R}\frac{p}{CT_v} gdZ, \quad (8)$$

or

$$\frac{dp}{p} = -\frac{1}{RT'_v} gdZ, \quad (9)$$

and

$$d \log_e p = -\frac{1}{RT'_v} d\Phi; \quad (10)$$

since

$$d\Phi = gdZ \quad (11)$$

where

Z = geometric height,
g = acceleration of gravity,
Φ = geopotential.

Mean adjusted virtual temperature.—From equation (10), it follows that the hydrostatic equation, in cgs units for precise calculations is

$$\Phi_2 - \Phi_1 = RT'_{mv} \log_e \frac{p_1}{p_2} \quad (12)$$

where Φ_1 is the geopotential at pressure p_1, and Φ_2 the geopotential at pressure p_2, and the *mean adjusted virtual temperature* T'_{mv} is defined by

$$T'_{mv} = \frac{\int_{p_1}^{p_2} T'_v d \log_e p}{\int_{p_1}^{p_2} d \log_e p} = \frac{\int_{p_1}^{p_2} CT_v d \log_e p}{\int_{p_1}^{p_2} d \log_e p} \quad (13)$$

For most meteorological calculations, the hydrostatic equation may be closely approximated by

$$\Phi_2 - \Phi_1 = RT_{mv} \log_e \frac{p_1}{p_2} \quad (14)$$

where the mean virtual temperature T_{mv} is defined by

$$T_{mv} = \frac{\int_{p_1}^{p_2} T_v d \log_e p}{\int_{p_1}^{p_2} d \log_e p} \quad (15)$$

Virtual temperature increment.—Since the definition of the relative humidity U adopted by the I. M. O. in 1947 is (see Table 93):

$$U = \frac{r}{r_w}, \text{ expressed decimally} \quad (16)$$

(continued)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

where r = actual mixing ratio of the air and r_w = saturation mixing ratio at the same pressure p and temperature T (see Table 73). Equation (4) may be rewritten in terms of the virtual temperature increment ΔT_v

$$\Delta T_v \equiv (T_v - T) = TUr_w \left(\frac{1}{\epsilon} - 1\right)\left(\frac{1}{1+Ur_w}\right) \tag{17}$$

The *saturation virtual temperature increment* $(T_v - T)_w$, corresponding to the virtual temperature increment under saturated conditions, i.e., with $U = 1$ (100 percent relative humidity), is therefore given by

$$(T_v - T)_w = Tr_w \left(\frac{1}{\epsilon} - 1\right)\left(\frac{1}{1+r_w}\right) \tag{18}$$

Making use of equation (18), equation (17) may be rewritten

$$(T_v - T) = U(T_v - T)_w + U(1-U)\left(\frac{r_w}{1+Ur_w}\right)(T_v - T)_w \tag{19}$$

where U is expressed decimally.

Table 72 contains values of $(T_v - T)_w$ as a function of pressure and temperature.

Comparing the two terms of the right-hand member of equation (19) it will be seen that the first term is the dominant one and that the second term does not contribute more than 0.1 °C. to $(T_v - T)$ so long as $(T_v - T)_w$ does not exceed 8 °C. The second term may therefore be ignored in rough calculations, so that

$$(T_v - T) = U(T_v - T)_w, \text{ approximately} \tag{20}$$

where U is expressed decimally, or

$$(T_v - T) = (T_v - T)_w \frac{U\%}{100}, \text{ approximately} \tag{21}$$

where U is expressed in percent.

(*continued*)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Temperature	Pressure—millibars									
	1100	1050	1000	950	900	850	800	750	700	650
°C.	°C.	°C.	°C	°C.	°C.	°C.	°C.	°C.	°C.	°C.
−40	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
−39	.02	.02	.02	.02	.02	.02	.02	.02	.03	.03
−38	.02	.02	.02	.02	.02	.03	.03	.03	.03	.03
−37	.02	.02	.02	.03	.03	.03	.03	.03	.03	.04
−36	.02	.03	.03	.03	.03	.03	.03	.04	.04	.04
−35	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05
−34	.03	.03	.03	.03	.04	.04	.04	.04	.05	.05
−33	.03	.03	.04	.04	.04	.04	.05	.05	.05	.06
−32	.04	.04	.04	.04	.04	.05	.05	.05	.06	.06
−31	.04	.04	.04	.05	.05	.05	.05	.06	.06	.07
−30	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.07	0.07
−29	.05	.05	.05	.05	.06	.06	.07	.07	.07	.08
−28	.05	.06	.06	.06	.06	.07	.07	.08	.08	.09
−27	.06	.06	.06	.07	.07	.08	.08	.09	.09	.10
−26	.07	.07	.07	.07	.08	.08	.09	.09	.10	.11
−25	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.12
−24	.08	.08	.09	.09	.10	.10	.11	.11	.12	.13
−23	.09	.09	.09	.10	.10	.11	.12	.13	.13	.14
−22	.09	.10	.10	.11	.11	.12	.13	.14	.15	.16
−21	.10	.11	.11	.12	.12	.13	.14	.15	.16	.17
−20	0.11	0.12	0.12	0.13	0.13	0.14	0.15	0.16	0.17	0.18
−19	.12	.13	.13	.14	.15	.16	.17	.18	.19	.20
−18	.13	.14	.15	.15	.16	.17	.18	.20	.21	.22
−17	.15	.15	.16	.17	.18	.19	.20	.21	.23	.24
−16	.16	.17	.18	.19	.20	.21	.22	.23	.25	.26
−15	0.17	0.18	0.19	0.20	0.21	0.23	0.24	0.26	0.27	0.29
−14	.19	.20	.21	.22	.23	.25	.26	.28	.30	.31
−13	.21	.22	.23	.24	.25	.27	.28	.30	.32	.34
−12	.22	.23	.25	.26	.27	.29	.31	.33	.35	.37
−11	.24	.25	.27	.28	.30	.31	.33	.35	.38	.41
−10	0.26	0.27	0.29	0.30	0.32	0.34	0.36	0.38	0.41	0.44
− 9	.28	.30	.31	.33	.34	.37	.39	.41	.44	.48
− 8	.31	.32	.34	.35	.37	.40	.42	.45	.48	.52
− 7	.33	.35	.37	.38	.40	.43	.46	.49	.52	.56
− 6	.36	.38	.40	.42	.44	.46	.49	.53	.56	.61
− 5	0.39	0.41	0.43	0.45	0.48	0.50	0.53	0.57	0.61	0.66
− 4	.42	.44	.46	.49	.51	.55	.58	.62	.66	.71
− 3	.46	.48	.50	.53	.56	.59	.63	.67	.72	.77
− 2	.49	.52	.54	.57	.60	.64	.68	.72	.78	.84
− 1	.53	.56	.59	.62	.65	.69	.73	.78	.84	.90
0	0.58	0.60	0.64	0.67	0.70	0.75	0.79	0.85	0.91	0.98
1	.62	.65	.68	.72	.76	.80	.86	.91	.98	1.05
2	.67	.70	.74	.78	.82	.87	.92	.98	1.05	1.13
3	.72	.76	.79	.84	.88	.93	.99	1.06	1.13	1.22
4	.78	.81	.85	.90	.95	1.01	1.07	1.14	1.22	1.32
5	0.84	0.88	0.92	0.97	1.02	1.08	1.15	1.23	1.32	1.42
6	.90	.94	.99	1.04	1.10	1.17	1.24	1.32	1.42	1.53
7	.97	1.02	1.07	1.12	1.18	1.25	1.33	1.42	1.52	1.64
8	1.04	1.09	1.15	1.21	1.27	1.35	1.43	1.53	1.64	1.77
9	1.12	1.17	1.23	1.30	1.37	1.45	1.54	1.65	1.76	1.90
10	1.20	1.26	1.32	1.40	1.47	1.56	1.66	1.77	1.90	2.04

(continued)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Temperature	Pressure—millibars									
	1100	1050	1000	950	900	850	800	750	700	650
°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
10	1.20	1.26	1.32	1.40	1.47	1.56	1.66	1.77	1.90	2.04
11	1.29	1.35	1.42	1.50	1.58	1.67	1.78	1.90	2.03	2.19
12	1.38	1.45	1.52	1.60	1.69	1.79	1.90	2.03	2.18	2.35
13	1.48	1.55	1.63	1.72	1.81	1.92	2.04	2.18	2.33	2.51
14	1.59	1.66	1.75	1.84	1.94	2.06	2.19	2.33	2.50	2.69
15	1.70	1.78	1.87	1.97	2.08	2.20	2.34	2.50	2.68	2.89
16	1.82	1.91	2.00	2.11	2.23	2.36	2.51	2.68	2.87	3.09
17	1.95	2.04	2.15	2.26	2.39	2.53	2.68	2.87	3.07	3.31
18	2.09	2.19	2.30	2.42	2.55	2.70	2.87	3.07	3.29	3.54
19	2.23	2.34	2.46	2.59	2.73	2.89	3.07	3.28	3.52	3.79
20	2.38	2.50	2.62	2.76	2.92	3.09	3.29	3.51	3.76	4.05
21	2.54	2.67	2.80	2.95	3.11	3.30	3.51	3.74	4.02	4.33
22	2.71	2.84	2.99	3.15	3.32	3.52	3.74	3.99	4.29	4.62
23	2.90	3.03	3.19	3.36	3.54	3.75	3.99	4.26	4.58	4.93
24	3.09	3.23	3.40	3.58	3.78	4.00	4.26	4.54	4.88	5.26
25	3.29	3.45	3.62	3.82	4.03	4.27	4.54	4.85	5.21	5.61
26	3.51	3.67	3.86	4.07	4.29	4.55	4.84	5.17	5.55	5.98
27	3.74	3.92	4.11	4.33	4.58	4.85	5.16	5.50	5.91	6.37
28	3.98	4.17	4.38	4.62	4.87	5.17	5.49	5.87	6.30	6.79
29	4.24	4.44	4.67	4.91	5.19	5.50	5.85	6.25	6.71	7.23
30	4.51	4.73	4.97	5.23	5.53	5.86	6.23	6.65	7.14	7.70
31	4.79	5.02	5.28	5.56	5.88	6.23	6.62	7.08	7.59	8.19
32	5.09	5.34	5.61	5.91	6.25	6.62	7.04	7.52	8.07	8.71
33	5.41	5.67	5.96	6.28	6.64	7.04	7.48	8.00	8.58	9.26
34	5.74	6.02	6.33	6.67	7.05	7.47	7.95	8.50	9.12	9.84
35	6.10	6.39	6.73	7.09	7.49	7.94	8.45	9.02	9.69	10.45
36	6.47	6.78	7.14	7.52	7.95	8.43	8.97	9.58	10.29	11.10
37	6.87	7.20	7.57	7.98	8.44	8.94	9.52	10.17	10.92	11.79
38	7.28	7.64	8.03	8.47	8.95	9.49	10.10	10.80	11.59	12.52
39	7.73	8.10	8.52	8.98	9.49	10.07	10.72	11.45	12.30	13.29
40	8.19	8.59	9.03	9.52	10.06	10.68	11.36	12.15	13.05	14.10
41	8.68	9.10	9.57	10.09	10.66	11.31	12.04	12.88	13.84	14.95
42	9.19	9.64	10.14	10.69	11.30	11.99	12.76	13.66	14.67	15.86
43	9.73	10.21	10.73	11.32	11.97	12.70	13.52	14.47	15.54	16.81
44	10.30	10.80	11.36	11.98	12.67	13.44	14.32	15.33	16.46	17.82
45	10.90	11.43	12.02	12.68	13.41	14.23	15.16	16.24	17.44	18.89
46	11.53	12.10	12.72	13.42	14.19	15.07	16.05	17.19	18.47	20.00
47	12.19	12.79	13.46	14.19	15.02	15.94	16.99	18.20	19.55	21.18
48	12.89	13.53	14.23	15.01	15.88	16.87	17.98	19.26	20.70	22.42
49	13.63	14.30	15.05	15.87	16.80	17.84	19.02	20.37	21.91	23.73
50	14.40	15.11	15.90	16.78	17.76	18.86	20.11	21.54	23.18	25.10
51	15.21	15.97	16.81	17.74	18.77	19.95				
52	16.07	16.87	17.76	18.74	19.83	21.08				
53	16.97	17.82	18.76	19.80	20.95	22.28				
54	17.91	18.81	19.81	20.91	22.13	23.54				
55	18.90	19.86	20.91	22.08	23.37	24.87				
56	19.95	20.95	22.07	23.31	24.67	26.26				
57	21.04	22.11	23.29	24.60	26.04	27.73				
58	22.19	23.32	24.57	25.96	27.49	29.27				
59	23.40	24.59	25.91	27.38	29.01	30.89				
60	24.66	25.92	27.32	28.87	30.62	32.59				

(continued)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Temperature	Pressure—millibars									
	650	600	550	500	450	400	350	300	250	200
°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
−40	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.08
−39	.03	.03	.03	.04	.04	.05	.05	.06	.07	.09
−38	.03	.04	.04	.04	.05	.05	.06	.07	.08	.10
−37	.04	.04	.04	.05	.05	.06	.06	.08	.09	.11
−36	.04	.04	.05	.05	.06	.07	.07	.08	.10	.13
−35	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.11	0.14
−34	.05	.05	.06	.06	.07	.08	.09	.10	.12	.15
−33	.06	.06	.06	.07	.08	.09	.10	.11	.14	.17
−32	.06	.07	.07	.08	.09	.10	.11	.13	.15	.19
−31	.07	.07	.08	.09	.10	.11	.12	.14	.17	.21
−30	0.07	0.08	0.08	0.09	0.10	0.12	0.13	0.16	0.19	0.23
−29	.08	.09	.09	.10	.12	.13	.15	.17	.21	.26
−28	.09	.10	.11	.12	.13	.15	.16	.19	.23	.28
−27	.10	.11	.12	.13	.14	.16	.18	.21	.25	.31
−26	.11	.12	.13	.14	.16	.18	.20	.23	.27	.34
−25	0.12	0.13	0.14	0.16	0.17	0.20	0.21	0.25	0.30	0.38
−24	.13	.14	.16	.17	.19	.21	.24	.28	.33	.41
−23	.14	.16	.17	.19	.21	.23	.26	.30	.36	.45
−22	.16	.17	.19	.20	.23	.26	.29	.33	.40	.50
−21	.17	.19	.20	.22	.25	.28	.31	.37	.44	.55
−20	0.18	0.20	0.22	0.24	0.27	0.30	0.34	0.40	0.48	0.60
−19	.20	.22	.24	.27	.29	.33	.38	.44	.53	.66
−18	.22	.24	.26	.29	.32	.36	.41	.48	.57	.72
−17	.24	.26	.28	.32	.35	.39	.45	.52	.63	.78
−16	.26	.28	.31	.35	.38	.43	.49	.57	.68	.85
−15	0.29	0.31	0.34	0.38	0.41	0.47	0.53	0.62	0.74	0.93
−14	.31	.34	.37	.42	.45	.51	.58	.68	.81	1.02
−13	.34	.37	.40	.45	.49	.55	.63	.74	.89	1.11
−12	.37	.40	.44	.49	.54	.60	.69	.80	.97	1.21
−11	.41	.44	.48	.53	.59	.66	.75	.88	1.05	1.32
−10	0.44	0.48	0.52	0.57	0.64	0.72	0.82	0.95	1.15	1.43
− 9	.48	.52	.56	.62	.69	.78	.89	1.04	1.24	1.56
− 8	.52	.56	.61	.67	.75	.84	.96	1.12	1.35	1.69
− 7	.56	.61	.66	.73	.81	.91	1.04	1.22	1.46	1.83
− 6	.61	.66	.72	.79	.88	.99	1.13	1.32	1.59	1.99
− 5	0.66	0.71	0.78	0.85	0.95	1.07	1.22	1.43	1.72	2.15
− 4	.71	.77	.84	.93	1.03	1.16	1.33	1.55	1.86	2.33
− 3	.77	.84	.91	1.00	1.12	1.26	1.44	1.68	2.02	2.52
− 2	.84	.90	.99	1.09	1.21	1.36	1.55	1.82	2.18	2.73
− 1	.90	.98	1.07	1.17	1.31	1.47	1.68	1.96	2.36	2.95
0	.98	1.06	1.15	1.27	1.41	1.59	1.82	2.12	2.55	3.19
1	1.05	1.14	1.24	1.37	1.52	1.72	1.96	2.29	2.75	3.45
2	1.13	1.23	1.34	1.47	1.64	1.85	2.12	2.47	2.97	3.72
3	1.22	1.32	1.44	1.59	1.77	2.00	2.28	2.67	3.20	4.01
4	1.32	1.43	1.56	1.71	1.90	2.15	2.46	2.88	3.45	4.33
5	1.42	1.53	1.67	1.84	2.05	2.32	2.65	3.10	3.72	4.66
6	1.53	1.65	1.80	1.99	2.21	2.49	2.85	3.34	4.00	5.02
7	1.64	1.78	1.94	2.14	2.38	2.68	3.07	3.59	4.31	5.41
8	1.77	1.91	2.09	2.30	2.56	2.88	3.30	3.86	4.64	5.82
9	1.90	2.06	2.25	2.47	2.75	3.10	3.55	4.15	4.99	6.26
10	2.04	2.21	2.42	2.66	2.96	3.33	3.81	4.46	5.36	6.73

(continued)

VIRTUAL TEMPERATURE INCREMENT OF SATURATED AIR

Temperature	Pressure—millibars									
	650	600	550	500	450	400	350	300	250	200
°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.
10	2.04	2.21	2.42	2.66	2.96	3.33	3.81	4.46	5.36	6.73
11	2.19	2.37	2.59	2.85	3.18	3.58	4.10	4.78	5.76	7.24
12	2.35	2.54	2.78	3.06	3.41	3.84	4.40	5.14	6.19	7.77
13	2.51	2.72	2.98	3.28	3.66	4.11	4.71	5.51	6.64	8.34
14	2.69	2.92	3.19	3.52	3.92	4.41	5.05	5.91	7.12	8.95
15	2.89	3.13	3.42	3.77	4.20	4.73	5.42	6.34	7.64	9.61
16	3.09	3.35	3.66	4.04	4.50	5.06	5.80	6.79	8.18	10.30
17	3.31	3.59	3.92	4.32	4.82	5.42	6.21	7.27	8.77	11.04
18	3.54	3.84	4.19	4.62	5.15	5.80	6.65	7.79	9.39	11.83
19	3.79	4.11	4.48	4.95	5.51	6.21	7.11	8.33	10.05	12.67
20	4.05	4.40	4.80	5.29	5.89	6.64	7.61	8.92	10.76	13.57
21	4.33	4.69	5.13	5.65	6.29	7.09	8.13			
22	4.62	5.01	5.48	6.03	6.72	7.58	8.69			
23	4.93	5.35	5.85	6.44	7.17	8.09	9.29			
24	5.26	5.71	6.24	6.87	7.66	8.64	9.92			
25	5.61	6.09	6.65	7.33	8.17	9.22	10.59			
26	5.98	6.49	7.09	7.82	8.72	9.84	11.29			
27	6.37	6.92	7.56	8.34	9.29	10.49	12.05			
28	6.79	7.37	8.06	8.88	9.90	11.18	12.85			
29	7.23	7.85	8.58	9.46	10.55	11.92	13.70			
30	7.70	8.36	9.14	10.08	11.24	12.70	14.60			
31	8.19	8.89	9.72	10.73	11.96					
32	8.71	9.46	10.34	11.41	12.73					
33	9.26	10.05	11.00	12.14	13.55					
34	9.84	10.68	11.69	12.91	14.41					
35	10.45	11.35	12.43	13.73	15.33					
36	11.10	12.06	13.20	14.59	16.29					
37	11.79	12.81	14.03	15.50	17.32					
38	12.52	13.61	14.90	16.47	18.40					
39	13.29	14.44	15.82	17.49	19.55					
40	14.10	15.33	16.79	18.57	20.76					
41	14.95									
42	15.86									
43	16.81									
44	17.82									
45	18.89									
46	20.00									
47	21.18									
48	22.42									
49	23.73									
50	25.10									

Table 73

SATURATION MIXING RATIO OVER WATER

$$r_w = \frac{0.62197 f_w e_w}{p - f_w e_w} \times 10^3 \text{ g./kg.}$$

r_w = saturation mixing ratio over water,
e_w = saturation vapor pressure over water in the pure phase, mb.,
f_w = correction factor for the departure of the mixture of air and water vapor from ideal gas laws (see Table 89),
p = total pressure, mb.

(Note.—1 g./kg. = 10^{-3} g./g.)

Temperature	Pressure—millibars									
	1050	1000	950	900	850	800	750	700	600	500
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
−50	0.03789	0.03977	0.04185	0.04416	0.04674	0.04966	0.05295	0.05672	0.06613	0.07931
−49	.04246	.04457	.04691	.04950	.05239	.05566	.05935	.06357	.07412	.08890
−48	.04753	.04989	.05250	.05540	.05865	.06230	.06643	.07116	.08297	.09951
−47	.05315	.05579	.05871	.06196	.06558	.06967	.07429	.07957	.09278	.1113
−46	.05936	.06231	.06557	.06920	.07325	.07781	.08297	.08887	.1036	.1243
−45	0.06621	0.06950	0.07314	0.07718	0.08169	0.08678	0.09255	0.09912	0.1156	0.1386
−44	.07383	.07750	.08157	.08607	.09111	.09679	.1032	.1106	.1289	.1546
−43	.08217	.08625	.09078	.09579	.1014	.1077	.1149	.1230	.1435	.1721
−42	.09141	.09595	.1010	.1066	.1128	.1198	.1278	.1369	.1596	.1914
−41	.1015	.1066	.1122	.1184	.1253	.1331	.1419	.1520	.1773	.2126
−40	0.1127	0.1183	0.1245	.01314	0.1390	0.1477	0.1575	0.1687	0.1967	0.2360
−39	.1250	.1312	.1380	.1457	.1542	.1638	.1747	.1871	.2181	.2617
−38	.1384	.1453	.1529	.1614	.1708	.1814	.1935	.2073	.2417	.2899
−37	.1532	.1608	.1692	.1786	.1890	.2008	.2141	.2294	.2675	.3208
−36	.1693	.1777	.1871	.1974	.2090	.2220	.2367	.2536	.2957	.3547
−35	0.1870	0.1963	0.2066	0.2180	0.2308	0.2452	0.2614	0.2801	0.3266	0.3918
−34	.2063	.2166	.2279	.2405	.2546	.2705	.2884	.3090	.3603	.4322
−33	.2275	.2388	.2513	.2652	.2808	.2982	.3180	.3407	.3973	.4765
−32	.2505	.2630	.2768	.2921	.3092	.3285	.3503	.3752	.4376	.5249
−31	.2757	.2894	.3046	.3215	.3403	.3615	.3855	.4130	.4816	.5777
−30	0.3031	0.3182	0.3349	0.3534	0.3742	0.3975	0.4238	0.4540	0.5295	0.6352
−29	.3330	.3495	.3679	.3883	.4110	.4366	.4656	.4988	.5817	.6978
−28	.3655	.3837	.4037	.4261	.4511	.4792	.5110	.5475	.6385	.7659
−27	.4008	.4207	.4428	.4673	.4947	.5255	.5604	.6004	.7002	.8400
−26	.4392	.4610	.4852	.5121	.5421	.5759	.6141	.6579	.7673	.9206
−25	0.4808	0.5048	0.5312	0.5607	0.5936	0.6305	0.6724	0.7204	0.8402	1.008
−24	.5260	.5522	.5811	.6133	.6493	.6897	.7356	.7881	.9191	1.103
−23	.5750	.6037	.6353	.6705	.7098	.7540	.8042	.8615	1.005	1.206
−22	.6280	.6593	.6939	.7323	.7753	.8236	.8783	.9409	1.097	1.317
−21	.6854	.7195	.7572	.7992	.8461	.8988	.9586	1.027	1.198	1.437
−20	0.7474	0.7847	0.8258	0.8716	0.9227	0.9802	1.045	1.120	1.306	1.568
−19	.8145	.8551	.8999	.9498	1.006	1.068	1.139	1.221	1.424	1.708
−18	.8868	.9310	.9799	1.034	1.095	1.163	1.241	1.329	1.550	1.861
−17	.9650	1.013	1.066	1.125	1.191	1.266	1.350	1.446	1.687	2.025
−16	1.049	1.102	1.159	1.224	1.295	1.376	1.468	1.573	1.835	2.202
−15	1.140	1.197	1.260	1.330	1.408	1.495	1.595	1.709	1.994	2.393
−14	1.238	1.300	1.368	1.444	1.529	1.624	1.732	1.856	2.165	2.599
−13	1.343	1.410	1.484	1.566	1.658	1.762	1.879	2.014	2.349	2.820
−12	1.456	1.529	1.609	1.698	1.798	1.910	2.038	2.183	2.548	3.059
−11	1.578	1.656	1.744	1.840	1.949	2.070	2.208	2.366	2.761	3.315

(*continued*)

SATURATION MIXING RATIO OVER WATER

Temperature	Pressure—millibars									
	1050	1000	950	900	850	800	750	700	600	500
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
−10	1.708	1.794	1.888	1.993	2.110	2.242	2.391	2.562	2.990	3.590
− 9	1.849	1.941	2.043	2.157	2.283	2.426	2.588	2.773	3.236	3.886
− 8	1.999	2.099	2.209	2.332	2.469	2.624	2.799	2.999	3.500	4.203
− 7	2.160	2.268	2.388	2.521	2.669	2.836	3.025	3.242	3.784	4.544
− 6	2.333	2.450	2.579	2.722	2.883	3.063	3.267	3.501	4.087	4.909
− 5	2.518	2.644	2.784	2.939	3.112	3.306	3.527	3.780	4.412	5.300
− 4	2.717	2.852	3.003	3.170	3.356	3.567	3.805	4.078	4.761	5.720
− 3	2.928	3.075	3.237	3.417	3.619	3.845	4.103	4.397	5.134	6.168
− 2	3.155	3.313	3.488	3.682	3.899	4.144	4.421	4.738	5.533	6.648
− 1	3.397	3.567	3.756	3.965	4.199	4.462	4.761	5.103	5.959	7.162
0	3.656	3.839	4.042	4.267	4.519	4.802	5.124	5.492	6.415	7.710
1	3.932	4.129	4.347	4.590	4.861	5.166	5.512	5.909	6.901	8.297
2	4.226	4.439	4.673	4.934	5.225	5.554	5.926	6.353	7.421	8.923
3	4.540	4.769	5.021	5.301	5.614	5.967	6.368	6.827	7.976	9.591
4	4.875	5.120	5.391	5.692	6.029	6.408	6.839	7.332	8.567	10.30
5	5.232	5.495	5.786	6.109	6.471	6.878	7.341	7.870	9.198	11.07
6	5.612	5.894	6.206	6.553	6.942	7.379	7.876	8.444	9.870	11.88
7	6.016	6.319	6.654	7.026	7.443	7.912	8.445	9.055	10.59	12.74
8	6.446	6.771	7.130	7.529	7.976	8.480	9.052	9.706	11.35	13.66
9	6.903	7.251	7.636	8.064	8.544	9.084	9.696	10.40	12.16	14.65
10	7.389	7.762	8.174	8.633	9.146	9.725	10.38	11.13	13.02	15.69
11	7.905	8.305	8.746	9.238	9.788	10.41	11.11	11.92	13.94	16.80
12	8.454	8.882	9.354	9.880	10.47	11.13	11.89	12.75	14.92	17.99
13	9.036	9.494	10.00	10.56	11.19	11.90	12.71	13.64	15.96	19.25
14	9.654	10.14	10.68	11.29	11.96	12.72	13.59	14.58	17.07	20.59
15	10.31	10.83	11.41	12.06	12.78	13.59	14.51	15.57	18.24	22.01
16	11.01	11.56	12.18	12.87	13.64	14.51	15.50	16.63	19.49	23.52
17	11.74	12.34	13.00	13.74	14.56	15.49	16.55	17.76	20.81	25.13
18	12.52	13.16	13.87	14.65	15.53	16.53	17.66	18.95	22.22	26.84
19	13.35	14.03	14.79	15.62	16.56	17.63	18.83	20.22	23.71	28.66
20	14.23	14.95	15.76	16.65	17.66	18.79	20.08	21.56	25.29	30.59
21	15.15	15.93	16.79	17.74	18.82	20.03	21.40	22.98	26.97	32.64
22	16.14	16.96	17.88	18.90	20.04	21.33	22.81	24.49	28.75	34.81
23	17.18	18.06	19.03	20.12	21.34	22.72	24.29	26.09	30.64	37.13
24	18.28	19.21	20.26	21.42	22.72	24.19	25.86	27.79	32.65	39.58
25	19.44	20.44	21.55	22.79	24.17	25.74	27.53	29.59	34.78	42.19
26	20.67	21.73	22.92	24.23	25.71	27.39	29.29	31.49	37.03	44.96
27	21.97	23.10	24.36	25.77	27.34	29.13	31.16	33.50	39.43	47.90
28	23.34	24.55	25.89	27.39	29.07	30.97	33.14	35.63	41.96	51.02
29	24.79	26.08	27.51	29.10	30.89	32.92	35.24	37.90	44.65	54.34
30	26.32	27.69	29.22	30.92	32.82	34.98	37.45	40.29	47.50	57.86
31	27.94	29.40	31.02	32.83	34.86	37.16	39.80	42.83	50.53	61.61
32	29.65	31.21	32.93	34.86	37.02	39.48	42.28	45.51	53.74	65.59
33	31.46	33.11	34.95	37.00	39.31	41.92	44.91	48.36	57.14	69.82
34	33.37	35.13	37.08	39.27	41.72	44.51	47.70	51.37	60.75	74.32
35	35.38	37.25	39.33	41.66	44.27	47.24	50.64	54.56	64.58	79.10
36	37.51	39.50	41.71	44.19	46.97	50.13	53.76	57.94	68.64	84.19
37	39.76	41.87	44.23	46.86	49.83	53.20	57.06	61.53	72.96	89.62
38	42.12	44.38	46.88	49.68	52.84	56.43	60.56	65.32	77.54	95.38
39	44.63	47.02	49.69	52.67	56.04	59.87	64.26	69.35	82.41	101.5

(*continued*)

SATURATION MIXING RATIO OVER WATER

Temperature	Pressure—millibars 1050	1000	950	900	850	800	750	700
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
40	47.27	49.81	52.65	55.83	59.41	63.49	68.18	73.61
41	50.05	52.76	55.78	59.16	62.98	67.33	72.33	78.13
42	53.00	55.88	59.10	62.70	66.77	71.40	76.74	82.94
43	56.11	59.18	62.59	66.43	70.76	75.71	81.41	88.03
44	59.39	62.65	66.30	70.38	75.00	80.28	86.36	93.44
45	62.86	66.33	70.20	74.55	79.48	85.11	91.61	99.18
46	66.52	70.21	74.33	78.97	84.22	90.23	97.17	105.3
47	70.39	74.33	78.71	83.66	89.26	95.68	103.1	111.8
48	74.48	78.66	83.34	88.61	94.59	101.4	109.4	118.7
49	78.79	83.25	88.24	93.86	100.3	107.6	116.1	126.0
50	83.37	88.12	93.43	99.43				
51	88.19	93.25	98.91	105.3				
52	93.30	98.69	104.7	111.6				
53	98.72	104.5	110.9	118.2				
54	104.4	110.6	117.5	125.3				
55	110.5	117.0	124.4	132.8				
56	116.9	123.9	131.8	140.7				
57	123.7	131.2	139.6	149.2				
58	131.0	138.9	148.0	158.2				
59	138.6	147.2	156.8	167.9				

Temperature	Pressure—millibars 400	350	300	250	200	175	150	125	100	80	60
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
—50	0.09909	0.1132	0.1320	0.1584	0.1980	0.2262	0.2639	0.3167	0.3958	0.4948	0.6598
—49	.1111	.1269	.1480	.1776	.2219	.2535	.2958	.3550	.4437	.5546	.7397
—48	.1243	.1420	.1657	.1988	.2484	.2839	.3312	.3974	.4967	.6210	.8281
—47	.1390	.1589	.1853	.2223	.2778	.3174	.3703	.4444	.5555	.6945	.9262
—46	.1553	.1774	.2070	.2483	.3103	.3546	.4137	.4964	.6205	.7758	1.035
—45	0.1732	0.1979	0.2308	0.2770	0.3461	0.3955	0.4614	0.5537	0.6922	0.8654	1.154
—44	.1931	.2207	.2574	.3088	.3860	.4411	.5146	.6176	.7720	.9652	1.288
—43	.2150	.2457	.2865	.3437	.4296	.4910	.5728	.6874	.8594	1.075	1.433
—42	.2391	.2733	.3187	.3824	.4779	.5462	.6372	.7648	.9561	1.196	1.595
—41	.2656	.3036	.3541	.4248	.5310	.6068	.7079	.8496	1.062	1.328	1.772
—40	0.2948	0.3369	0.3930	0.4715	0.5893	0.6735	0.7857	0.9430	1.179	1.474	1.967
—39	.3270	.3736	.4358	.5229	.6535	.7469	.8714	1.046	1.308	1.635	2.182
—38	.3622	.4139	.4828	.5793	.7241	.8275	.9655	1.159	1.449	1.812	2.418
—37	.4009	.4581	.5344	.6412	.8014	.9160	1.069	1.283	1.604	2.006	2.678
—36	.4432	.5064	.5908	.7089	.8860	1.013	1.182	1.418	1.774	2.219	2.961
—35	0.4896	0.5594	0.6526	0.7830	0.9788	1.119	1.305	1.567	1.960	2.451	3.272
—34	.5401	.6172	.7199	.8639	1.080	1.234	1.440	1.729	2.163	2.705	3.612
—33	.5955	.6805	.7938	.9526	1.191	1.361	1.588	1.907	2.385	2.984	3.985
—32	.6559	.7495	.8744	1.049	1.312	1.500	1.750	2.101	2.628	3.288	4.392
—31	.7220	.8250	.9625	1.155	1.444	1.651	1.926	2.313	2.894	3.621	4.837
—30	0.7938	0.9071	1.058	1.270	1.588	1.815	2.119	2.544	3.183	3.983	5.322
—29	.8721	.9966	1.163	1.396	1.745	1.995	2.328	2.795	3.498	4.378	5.850
—28	.9573	1.094	1.276	1.532	1.916	2.190	2.556	3.069	3.841	4.808	6.427
—27	1.050	1.200	1.400	1.680	2.101	2.402	2.804	3.368	4.215	5.277	7.055
—26	1.151	1.315	1.534	1.842	2.303	2.633	3.074	3.692	4.621	5.787	7.739
—25	1.260	1.440	1.680	2.017	2.523	2.884	3.367	4.044	5.063	6.341	8.483
—24	1.378	1.575	1.838	2.207	2.760	3.156	3.685	4.426	5.542	6.943	9.291
—23	1.507	1.722	2.010	2.413	3.019	3.452	4.030	4.842	6.064	7.597	10.17
—22	1.646	1.882	2.196	2.636	3.298	3.772	4.404	5.292	6.628	8.306	11.12
—21	1.797	2.054	2.397	2.878	3.601	4.118	4.809	5.779	7.240	9.076	12.16

(continued)

SATURATION MIXING RATIO OVER WATER

Temperature	Pressure—millibars										
	400	350	300	250	200	175	150	125	100	80	60
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
−20	1.960	2.240	2.615	3.140	3.929	4.494	5.248	6.307	7.903	9.910	13.28
−19	2.136	2.442	2.850	3.423	4.283	4.900	5.722	6.879	8.622	10.81	14.50
−18	2.327	2.660	3.104	3.728	4.666	5.338	6.236	7.497	9.399	11.79	15.82
−17	2.532	2.895	3.379	4.058	5.080	5.812	6.790	8.165	10.24	12.85	17.25
−16	2.754	3.148	3.675	4.415	5.527	6.324	7.389	8.887	11.15	14.00	18.80
−15	2.993	3.422	3.995	4.799	6.009	6.877	8.036	9.667	12.13	15.24	20.48
−14	3.251	3.717	4.340	5.214	6.529	7.473	8.735	10.51	13.19	16.58	22.30
−13	3.528	4.034	4.710	5.660	7.089	8.115	9.487	11.42	14.34	18.02	24.26
−12	3.826	4.376	5.110	6.141	7.693	8.807	10.30	12.40	15.57	19.59	26.39
−11	4.147	4.743	5.539	6.658	8.343	9.552	11.17	13.45	16.91	21.27	28.69
−10	4.492	5.138	6.001	7.214	9.042	10.35	12.11	14.59	18.34	23.10	31.18
− 9	4.863	5.562	6.498	7.812	9.794	11.22	13.12	15.81	19.89	25.06	33.87
− 8	5.261	6.018	7.031	8.455	10.60	12.15	14.21	17.13	21.56	27.19	36.78
− 7	5.688	6.507	7.603	9.145	11.47	13.14	15.39	18.55	23.36	29.48	39.93
− 6	6.146	7.032	8.218	9.885	12.40	14.21	16.64	20.08	25.30	31.95	43.33
− 5	6.637	7.594	8.876	10.68	13.40	15.37	18.00	21.72	27.39	34.61	47.02
− 4	7.163	8.198	9.584	11.53	14.48	16.60	19.46	23.49	29.64	37.49	51.01
− 3	7.726	8.844	10.34	12.45	15.63	17.93	21.02	25.39	32.06	40.60	55.32
− 2	8.329	9.535	11.15	13.43	16.87	19.35	22.69	27.43	34.67	43.94	60.00
− 1	8.974	10.28	12.02	14.48	18.20	20.88	24.50	29.62	37.47	47.55	65.05
0	9.664	11.07	12.95	15.60	19.62	22.52	26.43	31.98	40.49	51.45	70.54
1	10.40	11.91	13.94	16.80	21.14	24.27	28.50				
2	11.19	12.82	15.00	18.09	22.77	26.16	30.73				
3	12.03	13.79	16.14	19.47	24.52	28.18	33.12				
4	12.93	14.82	17.35	20.94	26.39	30.34	35.68				
5	13.89	15.92	18.65	22.51	28.39	32.66	38.43				
6	14.91	17.10	20.04	24.19	30.53	35.14	41.38				
7	16.00	18.35	21.51	25.99	32.82	37.80	44.54				
8	17.17	19.70	23.10	27.92	35.28	40.65	47.94				
9	18.41	21.12	24.78	29.97	37.91	43.70	51.58				
10	19.73	22.65	26.58	32.16	40.72						
11	21.14	24.27	28.50	34.50	43.73						
12	22.64	26.00	30.54	37.01	46.95						
13	24.24	27.85	32.73	39.68	50.40						
14	25.94	29.82	35.06	42.54	54.09						
15	27.75	31.91	37.54	45.59	58.04						
16	29.67	34.14	40.19	48.85	62.27						
17	31.72	36.51	43.01	52.33	66.80						
18	33.91	39.05	46.03	56.05	71.66						
19	36.23	41.74	49.24	60.03	76.87						
20	38.70	44.61									
21	41.32	47.67									
22	44.12	50.93									
23	47.10	54.40									
24	50.26	58.10									
25	53.63	62.04									
26	57.21	66.24									
27	61.02	70.72									
28	65.09	75.50									
29	69.41	80.61									

Table 74

SATURATION MIXING RATIO OVER ICE

$$r_i = \frac{0.62197 f_i e_i}{p - f_i e_i} \times 10^3 \text{ g./kg.}$$

r_i = saturation mixing ratio over ice,
e_i = saturation vapor pressure over ice in the pure phase, mb.,
f_i = correction factor for the departure of the mixture of air and water vapor from ideal gas laws (see Table 90),
p = total pressure, mb.

(NOTE.—1 g./kg. = 10^{-3} g./g.)

Temperature	Pressure—millibars				
	1000	850	700	500	300
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
−89					0.0002411
−88					.0002886
−87					.0003446
−86					.0004110
−85					0.0004891
−84					.0005811
−83					.0006892
−82					.0008157
−81					.0009639
−80					0.001137
−79	0.0004040	0.0004747	0.0005758	0.0008048	.001339
−78	.0004750	.0005582	.0006770	.0009462	.001575
−77	.0005576	.0006552	.0007946	.001110	.001848
−76	.0006532	.0007675	.0009309	.001301	.002165
−75	0.0007646	0.0008986	0.001090	0.001524	0.002535
−74	.0008930	.001050	.001273	.001780	.002961
−73	.001042	.001224	.001485	.002075	.003454
−72	.001213	.001426	.001729	.002417	.004023
−71	.001411	.001658	.002011	.002811	.004679
−70	0.001639	0.001926	0.002336	0.003265	0.005434
−69	.001900	.002233	.002707	.003786	.006300
−68	.002200	.002585	.003136	.004382	.007295
−67	.002543	.002989	.003625	.005068	.008435
−66	.002936	.003451	.004185	.005852	.009739
−65	0.003386	0.003979	0.004826	0.006749	0.01123
−64	.003899	.004581	.005558	.007770	.01294
−63	.004483	.005269	.006392	.008936	.01487
−62	.005149	.006051	.007341	.01026	.01708
−61	.005905	.006941	.008420	.01177	.01960
−60	0.006761	0.007947	0.009640	0.01347	0.02243
−59	.007738	.009094	.01103	.01543	.02568
−58	.008845	.01040	.01262	.01764	.02936
−57	.01009	.01186	.01438	.02011	.03348
−56	.01150	.01352	.01640	.02293	.03818
−55	0.01309	0.01539	0.01867	0.02611	0.04346
−54	.01489	.01751	.02124	.02970	.04944
−53	.01691	.01988	.02412	.03373	.05616
−52	.01920	.02256	.02737	.03827	.06370
−51	.02175	.02557	.03102	.04337	.07220

(*continued*)

Table 74 (concluded)
SATURATION MIXING RATIO OVER ICE

Temperature	Pressure—millibars				
	1000	850	700	500	300
°C.	g./kg.	g./kg.	g./kg.	g./kg.	g./kg.
−50	0.02463	0.02895	0.03512	0.04910	0.08174
−49	.02784	.03273	.03970	.05552	.09242
−48	.03144	.03696	.04484	.06272	.1044
−47	.03548	.04171	.05060	.07075	.1178
−46	.04000	.04701	.05704	.07977	.1328
−45	.04503	0.05293	0.06422	0.08981	0.1496
−44	.05066	.05954	.07224	.1010	.1682
−43	.05691	.06690	.08117	.1135	.1890
−42	.06387	.07508	.09109	.1274	.2121
−41	.07162	.08418	.1022	.1429	.2379
−40	0.08026	0.09434	0.1144	0.1600	0.2666
−39	.08982	.1056	.1281	.1792	.2984
−38	.1004	.1180	.1432	.2004	.3337
−37	.1122	.1319	.1600	.2238	.3728
−36	.1252	.1472	.1786	.2498	.4160
−35	0.1396	0.1642	0.1993	0.2787	0.4640
−34	.1556	.1829	.2220	.3105	.5171
−33	.1732	.2036	.2470	.3455	.5755
−32	.1926	.2264	.2747	.3842	.6400
−31	.2140	.2515	.3052	.4269	.7112
−30	0.2375	0.2792	0.3388	0.4740	0.7897
−29	.2635	.3098	.3759	.5259	.8761
−28	.2920	.3433	.4166	.5828	.9711
−27	.3233	.3801	.4613	.6454	1.076
−26	.3578	.4206	.5105	.7142	1.190
−25	0.3955	0.4650	0.5643	0.7895	1.316
−24	.4369	.5136	.6235	.8723	1.454
−23	.4822	.5670	.6881	.9628	1.604
−22	.5318	.6253	.7589	1.062	1.771
−21	5861	.6892	.8365	1.171	1.952
−20	0.6456	0.7592	0.9214	1.289	2.150
−19	.7101	.8350	1.013	1.418	2.366
−18	.7809	.9182	1.115	1.560	2.602
−17	.8579	1.009	1.225	1.714	2.859
−16	.9425	1.108	1.346	1.884	3.143
−15	1.034	1.216	1.476	2.067	3.449
−14	1.133	1.333	1.618	2.266	3.783
−13	1.242	1.461	1.774	2.484	4.147
−12	1.360	1.599	1.942	2.721	4.543
−11	1.488	1.750	2.125	2.977	4.972
−10	1.627	1.913	2.324	3.255	5.439
− 9	1.778	2.091	2.539	3.558	5.947
− 8	1.941	2.283	2.773	3.885	6.498
− 7	2.118	2.492	3.027	4.242	7.096
− 6	2.310	2.719	3.303	4.629	7.747
− 5	2.518	2.963	3.599	5.047	8.450
− 4	2.743	3.228	3.922	5.500	9.213
− 3	2.986	3.513	4.270	5.988	10.04
− 2	3.248	3.822	4.646	6.518	10.93
− 1	3.532	4.158	5.053	7.091	11.90
0	3.839	4.518	5.492	7.709	12.94

POTENTIAL TEMPERATURE

The potential temperature of dry air is the temperature acquired by the air when brought adiabatically to a standard pressure of 1000 mb.

$$\theta = T\left(\frac{1000}{p}\right)^{R/c_p}$$

where:

θ = potential temperature (°K.),
T = temperature of the air (°K.),
p = pressure (mb.),
R = gas constant for dry air,
c_p = specific heat of dry air at constant pressure.

θ has been computed using the values of $\left(\frac{1000}{p}\right)^{R/c_p}$ given in Table 77, where $R/c_p = 2/7$. .

Temperature	Pressure—millibars											
	1050	950	900	850	800	750	700	600	500	400	350	300
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−89												259.8
−88												261.2
−87												262.6
−86												264.0
−85												265.4
−84												266.8
−83												268.2
−82												269.7
−81												271.1
−80												272.5
−79	191.5	197.0	200.1	203.4	206.9	210.8	215.0	224.7	236.7	252.3	262.1	273.9
−78	192.5	198.0	201.1	204.4	208.0	211.9	216.1	225.8	237.9	253.6	263.4	275.3
−77	193.4	199.1	202.2	205.5	209.1	213.0	217.2	227.0	239.1	254.9	264.8	276.7
−76	194.4	200.1	203.2	206.5	210.1	214.1	218.3	228.1	240.3	256.2	266.1	278.1
−75	195.4	201.1	204.2	207.6	211.2	215.1	219.4	229.3	241.6	257.5	267.5	279.5
−74	196.4	202.1	205.3	208.6	212.3	216.2	220.5	230.4	242.8	258.8	268.8	280.9
−73	197.4	203.1	206.3	209.7	213.3	217.3	221.6	231.6	244.0	260.1	270.2	282.3
−72	198.4	204.1	207.3	210.7	214.4	218.4	222.7	232.8	245.2	261.4	271.5	283.8
−71	199.4	205.2	208.3	211.8	215.5	219.5	223.9	233.9	246.4	262.7	272.9	285.2
−70	200.3	206.2	209.4	212.8	216.5	220.6	225.0	235.1	247.7	264.0	274.2	286.6
−69	201.3	207.2	210.4	213.9	217.6	221.7	226.1	236.2	248.9	265.3	275.6	288.0
−68	202.3	208.2	211.4	214.9	218.7	222.7	227.2	237.4	250.1	266.6	276.9	289.4
−67	203.3	209.2	212.5	216.0	219.7	223.8	228.3	238.5	251.3	267.9	278.3	290.8
−66	204.3	210.2	213.5	217.0	220.8	224.9	229.4	239.7	252.5	269.2	279.6	292.2
−65	205.3	211.2	214.5	218.0	221.9	226.0	230.5	240.9	253.7	270.5	281.0	293.6
−64	206.3	212.3	215.6	219.1	222.9	227.1	231.6	242.0	255.0	271.8	282.3	295.0
−63	207.3	213.3	216.6	220.1	224.0	228.2	232.7	243.2	256.2	273.1	283.7	296.5
−62	208.2	214.3	217.6	221.2	225.1	229.3	233.8	244.3	257.4	274.4	285.0	297.9
−61	209.2	215.3	218.7	222.2	226.1	230.3	234.9	245.5	258.6	275.7	286.4	299.3

(continued)

POTENTIAL TEMPERATURE

Temperature	Pressure—millibars 250	200	175	150	125	100	80	60	50	40	30	20
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−109						316.9	337.8	366.8	386.4	411.8	447.1	502.0
−108						318.9	339.9	369.0	388.7	414.3	449.8	505.0
−107						320.8	341.9	371.2	391.1	416.8	452.5	508.1
−106						322.7	344.0	373.5	393.4	419.3	455.2	511.2
−105						324.7	346.0	375.7	395.8	421.8	458.0	514.2
−104						326.6	348.1	377.9	398.1	424.3	460.7	517.3
−103						328.5	350.2	380.2	400.5	426.8	463.4	520.3
−102						330.5	352.2	382.4	402.8	429.4	466.1	523.4
−101						332.4	354.3	384.6	405.2	431.9	468.9	526.4
−100						334.3	356.3	386.9	407.5	434.4	471.6	529.5
− 99		275.8	286.6	299.5	315.5	336.3	358.4	389.1	409.9	436.9	474.3	532.6
− 98		277.4	288.2	301.2	317.3	338.2	360.4	391.3	412.2	439.4	477.0	535.6
− 97		279.0	289.9	302.9	319.1	340.1	362.5	293.6	414.6	441.9	479.8	538.7
− 96		280.6	291.5	304.6	320.9	342.0	364.6	395.8	416.9	444.4	482.5	541.7
− 95		282.2	293.1	306.3	322.7	344.0	366.6	398.0	419.3	446.9	485.2	544.8
− 94		283.8	294.8	308.1	324.5	345.9	368.7	400.3	421.7	449.4	487.9	547.9
− 93		285.3	296.4	309.8	326.3	347.8	370.7	402.5	424.0	451.9	490.6	550.9
− 92		286.9	298.1	311.5	328.2	349.8	372.8	404.7	426.4	454.4	493.4	554.0
− 91		288.5	299.7	313.2	330.0	351.7	374.8	407.0	428.7	456.9	496.1	557.0
− 90		290.1	301.4	314.9	331.8	353.6	376.9	409.2	431.1	459.5	498.8	560.1
− 89	273.7	291.7	303.0	316.7	333.6	255.6	379.0	411.4	433.4	462.0	501.5	563.1
− 88	275.1	293.3	304.7	318.4	335.4	357.5	381.0	413.7	435.8	464.5	504.3	566.2
− 87	276.6	294.8	306.3	320.1	337.2	359.4	383.1	415.9	438.1	467.0	507.0	569.3
− 86	278.1	296.4	308.0	321.8	339.0	361.4	385.1	418.1	440.5	469.5	509.7	572.3
− 85	279.6	298.0	309.6	323.5	340.8	363.3	387.2	420.4	442.8	472.0	512.4	575.4
− 84	281.1	299.6	311.2	325.3	342.6	365.2	389.3	422.6	445.2	474.5	515.2	578.4
− 83	282.6	301.2	312.9	327.0	344.5	367.1	391.3	424.8	447.5	477.0	517.9	581.5
− 82	284.1	302.8	314.5	328.7	346.3	369.1	393.4	427.1	449.9	479.5	520.6	584.5
− 81	285.6	304.3	316.2	330.4	348.1	371.0	395.4	429.3	452.2	482.0	523.3	587.6
− 80	287.0	305.9	317.8	332.1	349.9	372.9	397.5	431.5	454.6	484.5	526.1	590.7
− 79	288.5	307.5	319.5	333.9	351.7	374.9	399.5	433.8	457.0	487.1	528.8	593.7
− 78	290.0	309.1	321.1	335.6	353.5	376.8	401.6	436.0	459.3	489.6	531.5	596.8
− 77	291.5	310.7	322.8	337.3	355.3	378.7	403.7	438.2	461.7	492.1	534.2	599.8
− 76	293.0	312.3	324.4	339.0	357.1	380.7	405.7	440.5	464.0	494.6	536.9	602.9
− 75	294.5	313.8	326.1	340.7	358.9	382.6	407.8	442.7	466.4	497.1	539.7	606.0
− 74	296.0	315.4	327.7	342.5	360.8	384.5	409.8	444.9	468.7	499.6	542.4	609.0
− 73	297.4	317.0	329.3	344.2	362.6	386.4	411.9	447.2	471.1	502.1	545.1	612.1
− 72	298.9	318.6	331.0	345.9	364.4	388.4	413.9	449.4	473.4	504.6	547.8	615.1
− 71	300.4	320.2	332.6	347.6	366.2	390.3	416.0	451.6	475.8	507.1	550.6	618.2
− 70	301.9	321.8	334.3	349.3	368.0	392.2	418.1	453.9	478.1	509.6	553.3	621.2
− 69	303.4	323.3	335.9	351.1	369.8	394.2	420.1	456.1	480.5	512.1	556.0	624.3
− 68	304.9	324.9	337.6	352.8	371.6	396.1	422.2	458.3	482.8	514.6	558.7	627.4
− 67	306.4	326.5	339.2	354.5	373.4	398.0	424.2	460.6	485.2	517.2	561.5	630.4
− 66	307.8	328.1	340.9	356.2	375.2	400.0	426.3	462.8	487.6	519.7	564.2	633.5
− 65	309.3	329.7	342.5	357.9	377.1	401.9	428.4	465.1	489.9	522.2	566.9	636.5
− 64	310.8	331.3	344.2	359.7	378.9	403.8	430.4	467.3	492.3	524.7	569.6	639.6
− 63	312.3	332.9	345.8	361.4	380.7	405.8	432.5	469.5	494.6	527.2	572.3	642.6
− 62	313.8	334.4	347.4	363.1	382.5	407.7	434.5	471.8	497.0	529.7	575.1	645.7
− 61	315.3	336.0	349.1	364.8	384.3	409.6	436.6	474.0	499.3	532.2	577.8	648.8

(*continued*)

TABLE 75 (CONTINUED)

POTENTIAL TEMPERATURE

Temperature	Pressure—millibars											
	1050	950	900	850	800	750	700	600	500	400	350	300
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−60	210.2	216.3	219.7	223.3	227.2	231.4	236.0	246.6	259.8	277.0	287.7	300.7
−59	211.2	217.3	220.7	224.3	228.3	232.5	237.1	247.8	261.1	278.3	289.1	302.1
−58	212.2	218.3	221.7	225.4	229.3	233.6	238.2	249.0	262.3	279.6	290.4	303.5
−57	213.2	219.4	222.8	226.4	230.4	234.7	239.4	250.1	263.5	280.9	291.8	304.9
−56	214.2	220.4	223.8	227.5	231.4	235.8	240.5	251.3	264.7	282.2	293.1	306.3
−55	251.1	221.4	224.8	228.5	232.5	236.9	241.6	252.4	265.9	283.5	294.5	307.7
−54	216.1	222.4	225.9	229.6	233.6	237.9	242.7	253.6	267.2	284.8	295.8	309.1
−53	217.1	223.4	226.9	230.6	234.6	239.0	243.8	254.7	268.4	286.1	297.2	310.6
−52	218.1	224.4	227.9	231.7	235.7	240.1	244.9	255.9	269.6	287.4	298.5	312.0
−51	219.1	225.4	229.0	232.7	236.8	241.2	246.0	257.1	270.8	288.7	299.9	313.4
−50	220.1	226.5	230.0	233.8	237.8	242.3	247.1	258.2	272.0	290.0	301.2	314.8
−49	221.1	227.5	231.0	234.8	238.9	243.4	248.2	259.4	273.3	291.3	302.6	316.2
−48	222.0	228.5	232.0	235.9	240.0	244.5	249.3	260.5	274.5	292.6	303.9	317.6
−47	223.0	229.5	233.1	236.9	241.0	245.5	250.4	261.7	275.7	293.8	305.3	319.0
−46	224.0	230.5	234.1	238.0	242.1	246.6	251.5	262.8	276.9	295.1	306.6	320.4
−45	225.0	231.5	235.1	239.0	243.2	247.7	252.6	264.0	278.1	296.4	308.0	321.8
−44	226.0	232.6	236.2	240.0	244.2	248.8	253.7	265.2	279.3	297.7	309.3	323.3
−43	227.0	233.6	237.2	241.1	245.3	249.9	254.9	266.3	280.6	299.0	310.7	324.7
−42	228.0	234.6	238.2	242.1	246.4	251.0	256.0	267.5	281.8	300.3	312.0	326.1
−41	228.9	235.6	239.3	243.2	247.4	252.1	257.1	268.6	283.0	301.6	313.4	327.5
−40	229.9	236.6	240.3	244.2	248.5	253.1	258.2	269.8	284.2	302.9	314.7	328.9
−39	230.9	237.6	241.3	245.3	249.6	254.2	259.3	270.9	285.4	304.2	316.1	330.3
−38	231.9	238.6	242.4	246.3	250.6	255.3	260.4	272.1	286.7	305.5	317.4	331.7
−37	232.9	239.7	243.4	247.4	251.7	256.4	261.5	273.3	287.9	306.8	318.8	333.1
−36	233.9	240.7	244.4	248.4	252.8	257.5	262.6	274.4	289.1	308.1	320.1	334.5
−35	234.9	241.7	245.4	249.5	253.8	258.6	263.7	275.6	290.3	309.4	321.5	335.9
−34	235.9	242.7	246.5	250.5	254.9	259.7	264.8	276.7	291.5	310.7	322.8	337.4
−33	236.8	243.7	247.5	251.6	256.0	260.7	265.9	277.9	292.8	312.0	324.2	338.8
−32	237.8	244.7	248.5	252.6	257.0	261.8	267.0	279.0	294.0	313.3	325.5	340.2
−31	238.8	245.7	249.6	253.7	258.1	262.9	268.1	280.2	295.2	314.6	326.9	341.6
−30	239.8	246.8	250.6	254.7	259.2	264.0	269.3	281.4	296.4	315.9	328.2	343.0
−29	240.8	247.8	251.6	255.8	260.2	265.1	270.4	282.5	297.6	317.2	329.6	344.4
−28	241.8	248.8	252.7	256.8	261.3	266.2	271.5	283.7	298.9	318.5	330.9	345.8
−27	242.8	249.8	253.7	257.9	262.4	267.3	272.6	284.8	300.1	319.8	332.3	347.2
−26	243.7	250.8	254.7	258.9	263.4	268.3	273.7	286.0	301.3	321.1	333.6	348.6
−25	244.7	251.8	255.8	259.9	264.5	269.4	274.8	287.1	302.5	322.4	335.0	350.1
−24	245.7	252.8	256.8	261.0	265.6	270.5	275.9	288.3	303.7	323.7	336.3	351.5
−23	246.7	253.9	257.8	262.0	266.6	271.6	277.0	289.5	304.9	325.0	337.7	352.9
−22	247.7	254.9	258.8	263.1	267.7	272.7	278.1	290.6	306.2	326.3	339.0	354.3
−21	248.7	255.9	259.9	264.1	268.8	273.8	279.2	291.8	307.4	327.6	340.4	355.7
−20	249.7	256.9	260.9	265.2	269.8	274.9	280.3	292.9	308.6	328.9	341.7	357.1
−19	250.6	257.9	261.9	266.2	270.9	275.9	281.4	294.1	309.8	330.2	343.1	358.5
−18	251.6	258.9	263.0	267.3	271.9	277.0	282.5	295.2	311.0	331.5	344.4	359.9
−17	252.6	260.0	264.0	268.3	273.0	278.1	283.6	296.4	312.3	332.8	345.8	361.3
−16	253.6	261.0	265.0	269.4	274.1	279.2	284.8	297.6	313.5	334.1	347.1	362.7
−15	254.6	262.0	266.1	270.4	275.1	280.3	285.9	298.7	314.7	335.4	348.5	364.2
−14	255.6	263.0	267.1	271.5	276.2	281.4	287.0	299.9	315.9	336.7	349.8	365.6
−13	256.6	264.0	268.1	272.5	277.3	282.5	288.1	301.0	317.1	338.0	351.2	367.0
−12	257.5	265.0	269.2	273.6	278.3	283.5	289.2	302.2	318.4	339.3	352.5	368.4
−11	258.5	266.0	270.2	274.6	279.4	284.6	290.3	303.3	319.6	340.6	353.9	369.8

(continued)

POTENTIAL TEMPERATURE

Temperature	Pressure—millibars											
	250	200	175	150	125	100	80	60	50	40	30	20
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−60	316.8	337.6	350.7	366.5	386.1	411.5	438.6	476.2	501.7	534.7	580.5	651.8
−59	318.2	339.2	352.4	368.2	387.9	413.5	440.7	478.5	504.0	537.2	583.2	654.9
−58	319.7	340.8	354.0	370.0	389.7	415.4	442.8	480.7	506.4	539.7	586.0	657.9
−57	321.2	342.4	355.7	371.7	391.6	417.3	444.8	482.9	508.7	542.2	588.7	661.0
−56	322.7	343.9	357.3	373.4	393.4	419.3	446.9	485.2	511.1	544.7	591.4	664.1
−55	324.2	345.5	359.0	375.1	395.2	421.2	448.9	487.4	513.4	547.3	594.1	667.1
−54	325.7	347.1	360.6	376.8	397.0	423.1	451.0	489.6	515.8	549.8	596.9	670.2
−53	327.2	348.7	362.3	378.6	398.8	425.1	453.0	491.9	518.1	552.3	599.6	673.2
−52	328.6	350.3	363.9	380.3	400.6	427.0	455.1	494.1	520.5	554.8	602.3	676.3
−51	330.1	351.9	365.5	382.0	402.4	428.9	457.2	496.3	522.9	557.3	605.0	679.3
−50	331.6	353.4	367.2	383.7	404.2	430.9	459.2	498.6	525.2	559.8	607.8	682.4
−49	333.1	355.0	368.8	385.4	406.0	432.8	461.3	500.8	527.6	562.3	610.5	685.5
−48	334.6	356.6	370.5	387.2	407.9	434.7	463.3	503.0	529.9	564.8	613.2	688.5
−47	336.1	358.2	372.1	388.9	409.7	436.6	465.4	505.3	532.3	567.3	615.9	691.6
−46	337.6	359.8	373.8	390.6	411.5	438.6	467.4	507.5	534.6	569.8	618.6	694.6
−45	339.0	361.4	375.4	392.3	413.3	440.5	469.5	509.7	537.0	572.3	621.4	697.7
−44	340.5	362.9	377.1	394.0	415.1	442.4	471.6	512.0	539.3	574.8	624.1	700.7
−43	342.0	364.5	378.7	395.8	416.9	444.4	473.6	514.2	541.7	577.4	626.8	703.8
−42	343.5	366.1	380.4	397.5	418.7	446.3	475.7	516.4	544.0	579.9	629.5	706.9
−41	345.0	367.7	382.0	399.2	420.2	448.2	477.7	518.7	546.4	582.4	632.3	709.9
−40	346.5	369.3	383.6	400.9	422.3	450.2	479.8	520.9	548.7	584.9	635.0	713.0
−39	348.0	370.9	384.3	402.6	424.2	452.1	481.9	523.1	551.1	587.4	637.7	716.0
−38	349.4	372.4	386.9	404.4	426.0	454.0	483.9	525.4	553.4	589.9	640.4	719.1
−37	350.9	374.0	388.6	406.1	427.8	456.0	486.0	527.6	555.8	592.4	643.2	722.2
−36	352.4	375.6	390.2	407.8	429.6	457.9	488.0	529.8	558.2	594.9	645.9	725.2
−35	353.9	377.2	391.9	409.5	431.4	459.8	490.1	532.1	560.5	597.4	648.6	728.3
−34	355.4	378.8	393.5	411.2	433.2	461.7	492.1	534.3	562.9	599.9	651.3	731.3
−33	356.9	380.4	395.2	413.0	435.0	463.7	494.2	536.5	565.2	602.4	654.1	734.4
−32	358.4	381.9	396.8	414.7	436.8	465.6	496.3	538.8	567.6	604.9	656.8	737.4
−31	359.9	383.5	398.5	416.4	438.6	467.5	498.3	541.0	569.9	607.5	659.5	740.5
−30	361.3	385.1	400.1	418.1	440.5	469.5	500.4	543.2	572.3	610.0	662.2	743.6
−29	362.8	386.7	401.7	419.8	442.3	471.4	502.4	545.5	574.6	612.5	664.9	746.6
−28	364.3	388.3	403.4	421.6	444.1	473.3	504.5	547.7	577.0	615.0	667.7	749.7
−27	365.8	389.9	405.0	423.3	445.9	475.3	506.5	549.9	579.3	617.5	670.4	752.7
−26	367.3	391.5	406.7	425.0	447.7	477.2	508.6	552.2	581.7	620.0	673.1	755.8
−25	368.8	393.0	408.3	426.7	449.5	479.1	510.7	554.4	584.0	622.5	675.8	758.8
−24	370.3	394.6	410.0	428.4	451.3	481.1	512.7	556.6	586.4	625.0	678.6	761.9
−23	371.7	396.2	411.6	430.2	453.1	483.0	514.8	558.9	588.8	627.5	681.3	765.0
−22	373.2	397.8	413.3	431.9	455.0	484.9	516.8	561.1	591.1	630.0	684.0	768.0
−21	374.7	399.4	414.9	433.6	456.8	486.8	518.9	563.4	593.5	632.5	686.7	771.1
−20	376.2	401.0	416.5	435.3	458.6	488.8	521.0	565.6	595.8	635.1	689.5	774.1
−19	377.7	402.5	418.2	437.0	460.4	490.7	523.0	567.8	598.2	637.6	692.2	777.2
−18	379.2	404.1	419.8	438.7	462.2	492.6	525.1	570.1	600.5	640.1	694.9	780.3
−17	380.7	405.7	421.5	440.5	464.0	494.6	527.1	572.3	602.9	642.6	697.6	783.3
−16	382.1	407.3	423.1	442.2	465.8	496.5	529.2	574.5	605.2	645.1	700.3	786.4
−15	383.6	408.9	424.8	443.9	467.6	498.4	531.2	576.8	607.6	647.6	703.1	789.4
−14	385.1	410.5	426.4	445.6	469.4	500.4	533.3	579.0	609.9	650.1	705.8	792.5
−13	386.6	412.0	428.1	447.3	471.3	502.3	535.4	581.2	612.3	652.6	708.5	795.5
−12	388.1	413.6	429.7	449.1	473.1	504.2	537.4	583.5	614.6	655.1	711.2	798.6
−11	389.6	415.2	431.4	450.8	474.9	506.2	539.5	585.7	617.0	657.6	714.0	801.7

(continued)

POTENTIAL TEMPERATURE

Temperature	Pressure—millibars											
	1050	950	900	850	800	750	700	600	500	400	350	300
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−10	259.5	267.1	271.2	275.7	280.5	285.7	291.4	304.5	320.8	341.9	355.2	371.2
− 9	260.5	268.1	272.2	276.7	281.5	286.8	292.5	305.7	322.0	343.2	356.6	372.6
− 8	261.5	269.1	273.3	277.8	282.6	287.9	293.6	306.8	323.2	344.5	357.9	374.0
− 7	262.5	270.1	274.3	278.8	283.7	289.0	294.7	308.0	324.4	345.8	359.3	375.4
− 6	263.5	271.1	275.3	279.9	284.7	290.1	295.8	309.1	325.7	347.1	360.6	376.9
− 5	264.4	272.1	276.4	280.9	285.8	291.1	296.9	310.3	326.9	348.4	362.0	378.3
− 4	265.4	273.1	277.4	281.9	286.9	292.2	298.0	311.4	328.1	349.7	363.3	379.7
− 3	266.4	274.2	278.4	283.0	287.9	293.3	299.1	312.6	329.3	351.0	364.7	381.1
− 2	267.4	275.2	279.5	284.0	289.0	294.4	300.3	313.8	330.5	352.3	366.0	382.5
− 1	268.4	276.2	280.5	285.1	290.1	295.5	301.4	314.9	331.8	353.6	367.4	383.9
0	269.4	277.2	281.5	286.1	291.1	296.6	302.5	316.1	333.0	354.9	368.7	385.3
1	270.4	278.2	282.5	287.2	292.2	297.7	303.6	317.2	334.2	356.2	370.1	386.7
2	271.4	279.2	283.6	288.2	293.3	298.7	304.7	318.4	335.4	357.5	371.4	388.1
3	272.3	280.2	284.6	289.3	294.3	299.8	305.8	319.5	336.6	358.8	372.8	389.6
4	273.3	281.3	285.6	290.3	295.4	300.9	306.9	320.7	337.9	360.1	374.1	391.0
5	274.3	282.3	286.7	291.4	296.5	302.0	308.0	321.9	339.1	361.4	375.5	392.4
6	275.3	283.3	287.7	292.4	297.5	303.1	309.1	323.0	340.3	362.7	376.8	393.8
7	276.3	284.3	288.7	293.5	298.6	304.2	310.2	324.2	341.5	364.0	378.2	395.2
8	277.3	285.3	289.8	294.5	299.7	305.3	311.3	325.3	342.7	365.3	379.5	396.6
9	278.3	286.3	290.8	295.6	300.7	306.3	312.4	326.5	344.0	366.6	380.9	398.0
10	279.2	287.4	291.8	296.6	301.8	307.4	313.5	327.6	345.2	367.9	382.2	399.4
11	280.2	288.4	292.9	297.7	302.9	308.5	314.7	328.8	346.4	369.2	383.6	400.8
12	281.2	289.4	293.9	298.7	303.9	309.6	315.8	330.0	347.6	370.5	384.9	402.2
13	282.2	290.4	294.9	299.8	305.0	310.7	316.9	331.1	348.8	371.8	386.3	403.7
14	283.2	291.4	295.9	300.8	306.1	311.8	318.0	332.3	350.0	373.1	387.6	405.1
15	284.2	292.4	297.0	301.8	307.1	312.9	319.1	333.4	351.3	374.4	389.0	406.5
16	285.2	293.4	298.0	302.9	308.2	313.9	320.2	334.6	352.5	375.7	390.3	407.9
17	286.1	294.5	299.0	303.9	309.3	315.0	321.3	335.7	353.7	377.0	391.7	409.3
18	287.1	295.5	300.1	305.0	310.3	316.1	322.4	336.9	354.9	378.3	393.0	410.7
19	288.1	296.5	301.1	306.0	311.4	317.2	323.5	338.1	356.1	379.6	394.4	412.1
20	289.1	297.5	302.1	307.1	312.5	318.3	324.6	339.2	357.4	380.9	395.7	
21	290.1	298.5	303.2	308.1	313.5	319.4	325.7	340.4	358.6	382.2	397.1	
22	291.1	299.5	304.2	309.2	314.6	320.5	326.8	341.5	359.8	383.5	398.4	
23	292.1	300.5	305.2	310.2	315.6	321.5	327.9	342.7	361.0	384.8	399.8	
24	293.0	301.6	306.3	311.3	316.7	322.6	329.0	343.8	362.2	386.1	401.1	
25	294.0	302.6	307.3	312.3	317.8	323.7	330.2	345.0	363.5	387.4	402.5	
26	295.0	303.6	308.3	313.4	318.8	324.8	331.3	346.2	364.7	388.7	403.8	
27	296.0	304.6	309.3	314.4	319.9	325.9	332.4	347.3	365.9	390.0	405.2	
28	297.0	305.6	310.4	315.5	321.0	327.0	333.5	348.5	367.1	391.3	406.5	
29	298.0	306.6	311.4	316.5	322.0	328.1	334.6	349.6	368.3			
30	299.0	307.6	312.4	317.6	323.1	329.1	335.7	350.8	369.6			
31	300.0	308.7	313.5	318.6	324.2	330.2	336.8	351.9	370.8			
32	300.9	309.7	314.5	319.7	325.2	331.3	337.9	353.1	372.0			
33	301.9	310.7	315.5	320.7	326.3	332.4	339.0	354.3	373.2			
34	302.9	311.7	316.6	321.8	327.4	333.5	340.1	355.4	374.4			
35	303.9	312.7	317.6	322.8	328.4	334.6	341.2	356.6	375.6			
36	304.9	313.7	318.6	323.8	329.5	335.7	342.3	357.7	376.9			
37	305.9	314.8	319.7	324.9	330.6	336.7	343.4	358.9	378.1			
38	306.9	315.8	320.7	325.9	331.6	337.8	344.5	360.0	379.3			
39	307.8	316.8	321.7	327.0	332.7	338.9	345.7	361.2	380.5			

(*continued*)

POTENTIAL TEMPERATURE

Temperature	Pressure—millibars 250	200	175	150	125	100	80	60	50	40	30	20
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
−10	391.1	416.8	433.0	452.5	476.7	508.1	541.5	587.9	619.3	660.1	716.7	804.7
− 9	392.5	418.4	434.6	454.2	478.5	510.0	543.6	590.2	621.7	662.6	719.4	807.8
− 8	394.0	420.0	436.3	455.9	480.3	511.9	545.6	592.4	624.1	665.2	722.1	810.8
− 7	395.5	421.5	437.9	457.7	482.1	513.9	547.7	594.6	626.4	667.7	724.9	813.9
− 6	397.0	423.1	439.6	459.4	483.9	515.8	549.8	596.9	628.8	670.2	727.6	816.9
− 5	398.5	424.7	441.2	461.1	485.7	517.7	551.8	599.1	631.1	672.7	730.3	820.0
− 4	400.0	426.3	442.9	462.8	487.6	519.7	553.9	601.3	633.5	675.2	733.0	823.1
− 3	401.5	427.9	444.5	464.5	389.4	521.6	555.9	603.6	635.8	677.7	735.8	826.1
− 2	402.9	429.5	446.2	466.3	491.2	523.5	558.0	605.8	638.2	680.2	738.5	829.2
− 1	404.4	431.0	447.8	468.0	493.0	525.5	560.1	608.0	640.5	682.7	741.2	832.2
0	405.9	432.6	449.5	469.7	494.8	527.4	562.1	610.3	642.9	685.2	743.9	835.3
1	407.4	434.2	451.1	471.4								
2	408.9	435.8	452.7	473.1								
3	410.4	437.4	454.4	474.9								
4	411.9	439.0	456.0	476.6								
5	413.3	440.6	457.7	478.3								
6	414.8	442.1	459.3	480.0								
7	416.3	443.7	461.0	481.7								
8	417.8	445.3	462.6	483.5								
9	419.3	446.9	464.3	485.2								
10	420.8	448.5										
11	422.3	450.1										
12	423.7	451.6										
13	425.2	453.2										
14	426.7	454.8										
15	428.2	456.4										
16	429.7	458.0										
17	431.2	459.6										
18	432.7	461.1										
19	434.2	462.7										

Temperature	Pressure—millibars 1050	950	900	850	800	750	700
°C.	°K.	°K.	°K.	°K.	°K.	°K.	°K.
40	308.8	317.8	322.7	328.0	333.8	340.0	346.8
41	309.8	318.8	323.8	329.1	334.8	341.1	347.9
42	310.8	319.8	324.8	330.1	335.9	342.2	349.0
43	311.8	320.8	325.8	331.2	337.0	343.3	350.1
44	312.8	321.9	326.9	332.2	338.0	344.3	351.2
45	313.8	322.9	327.9	333.3	339.1	345.4	352.3
46	314.7	323.9	328.9	334.3	340.2	346.5	353.4
47	315.7	324.9	330.0	335.4	341.2	347.6	354.5
48	316.7	325.9	331.0	336.4	342.3	348.7	355.6
49	317.7	326.9	332.0	337.5	343.4	349.8	356.7
50	318.7	327.9					
51	319.7	329.0					
52	320.7	330.0					
53	321.6	331.0					
54	322.6	332.0					
55	323.6	333.0					
56	324.6	334.0					
57	325.6	335.0					
58	326.6	336.1					
59	327.6	337.1					

TABLE 76

TWO-SEVENTHS POWER OF PRESSURE

(Explanation on p. 308.)

p	0	1	2	3	4	5	6	7	8	9
0		1.0000	1.2190	1.3687	1.4860	1.5838	1.6685	1.7436	1.8114	1.8734
10	1.9307	1.9840	2.0339	2.0810	2.1255	2.1678	2.2082	2.2468	2.2838	2.3193
20	2.3535	2.3866	2.4185	2.4494	2.4794	2.5085	2.5368	2.5643	2.5910	2.6171
30	2.6426	2.6675	2.6918	2.7156	2.7388	2.7616	2.7839	2.8058	2.8273	2.8483
40	2.8690	2.8893	2.9093	2.9289	2.9482	2.9672	2.9859	3.0043	3.0224	3.0403
50	3.0579	3.0752	3.0923	3.1092	3.1259	3.1423	3.1585	3.1745	3.1903	3.2060
60	3.2214	3.2366	3.2517	3.2666	3.2813	3.2959	3.3103	3.3246	3.3387	3.3526
70	3.3664	3.3801	3.3936	3.4070	3.4203	3.4335	3.4465	3.4594	3.4722	3.4848
80	3.4974	3.5098	3.5221	3.5343	3.5465	3.5585	3.5704	3.5822	3.5939	3.6055
90	3.6171	3.6285	3.6398	3.6511	3.6623	3.6734	3.6844	3.6953	3.7061	3.7169
100	3.7276	3.7382	3.7487	3.7592	3.7696	3.7799	3.7902	3.8004	3.8105	3.8205
110	3.8305	3.8404	3.8503	3.8601	3.8698	3.8795	3.8891	3.8986	3.9081	3.9175
120	3.9269	3.9362	3.9455	3.9547	3.9639	3.9730	3.9820	3.9910	4.0000	4.0089
130	4.0178	4.0266	4.0353	4.0440	4.0527	4.0613	4.0699	4.0784	4.0869	0.0953
140	4.1037	4.1121	4.1204	4.1287	4.1369	4.1451	4.1532	4.1613	4.1694	4.1774
150	4.1854	4.1934	4.2013	4.2092	4.2170	4.2248	4.2326	4.2403	4.2480	4.2557
160	4.2633	4.2709	4.2785	4.2860	4.2935	4.3010	4.3084	4.3158	4.3232	4.3305
170	4.3378	4.3451	4.3523	4.3596	4.3667	4.3739	4.3810	4.3881	4.3952	4.4022
180	4.4092	4.4162	4.4232	4.4301	4.4370	4.4439	4.4507	4.4576	4.4644	4.4711
190	4.4779	4.4846	4.4913	4.4980	4.5046	4.5112	4.5178	4.5244	4.5310	4.5375
200	4.5440	4.5505	4.5569	4.5634	4.5698	4.5762	4.5825	4.5889	4.5952	4.6015
210	4.6078	4.6140	4.6203	4.6265	4.6327	4.6389	4.6450	4.6511	4.6573	4.6634
220	4.6694	4.6755	4.6815	4.6875	4.6935	4.6995	4.7055	4.7114	4.7173	4.7232
230	4.7291	4.7350	4.7408	4.7467	4.7525	4.7583	4.7640	4.7698	4.7755	4.7813
240	4.7870	4.7927	4.7983	4.8040	4.8096	4.8153	4.8209	4.8264	4.8320	4.8376
250	4.8431	4.8487	4.8542	4.8597	4.8651	4.8706	4.8761	4.8815	4.8869	4.8923
260	4.8977	4.9031	4.9084	4.9138	4.9191	4.9244	4.9297	4.9350	4.9403	4.9456
270	4.9508	4.9560	4.9613	4.9665	4.9716	4.9768	4.9820	4.9871	4.9923	4.9974
280	5.0025	5.0076	5.0127	5.0178	5.0228	5.0279	5.0329	5.0379	5.0429	5.0479
290	5.0529	5.0579	5.0629	5.0678	5.0727	5.0777	5.0826	5.0875	5.0924	5.0972
300	5.1021	5.1070	5.1118	5.1166	5.1214	5.1263	5.1310	5.1358	5.1406	5.1454
310	5.1501	5.1549	5.1596	5.1643	5.1690	5.1737	5.1784	5.1831	5.1878	5.1924
320	5.1971	5.2017	5.2063	5.2109	5.2155	5.2201	5.2247	5.2293	5.2338	5.2384
330	5.2429	5.2475	5.2520	5.2565	5.2610	5.2655	5.2700	5.2745	5.2790	5.2834
340	5.2879	5.2923	5.2967	5.3011	5.3056	5.3100	5.3144	5.3187	5.3231	5.3275
350	5.3318	5.3362	5.3405	5.3449	5.3492	5.3535	5.3578	5.3621	5.3664	5.3707
360	5.3749	5.3792	5.3834	5.3877	5.3919	5.3961	5.4004	5.4046	5.4088	5.4130
370	5.4172	5.4213	5.4255	5.4297	5.4338	5.4380	5.4421	5.4462	5.4504	5.4545
380	5.4586	5.4627	5.4668	5.4709	5.4750	5.4790	5.4831	5.4871	5.4912	5.4952
390	5.4993	5.5033	5.5073	5.5113	5.5153	5.5193	5.5233	5.5273	5.5313	5.5352
400	5.5392	5.5431	5.5471	5.5510	5.5550	5.5589	5.5628	5.5667	5.5706	5.5745
410	5.5784	5.5823	5.5862	5.5900	5.5939	5.5978	5.6016	5.6054	5.6093	5.6131
420	5.6169	5.6208	5.6246	5.6284	5.6322	5.6360	5.6398	5.6435	5.6473	5.6511
430	5.6548	5.6586	5.6623	5.6661	5.6698	5.6735	5.6773	5.6810	5.6847	5.6884
440	5.6921	5.6958	5.6995	5.7032	5.7068	5.7105	5.7142	5.7178	5.7215	5.7251
450	5.7288	5.7324	5.7360	5.7396	5.7433	5.7469	5.7505	5.7541	5.7577	5.7613
460	5.7648	5.7684	5.7720	5.7756	5.7791	5.7827	5.7862	5.7898	5.7933	5.7969
470	5.8004	5.8039	5.8074	5.8109	5.8144	5.8179	5.8214	5.8249	5.8284	5.8319
480	5.8354	5.8388	5.8423	5.8458	5.8492	5.8527	5.8561	5.8596	5.8630	5.8664
490	5.8699	5.8733	5.8767	5.8801	5.8835	5.8869	5.8903	5.8937	5.8971	5.9005
500	5.9038	5.9072	5.9106	5.9139	5.9173	5.9206	5.9240	5.9273	5.9307	5.9340
510	5.9373	5.9407	5.9440	5.9473	5.9506	5.9539	5.9572	5.9605	5.9638	5.9671
520	5.9704	5.9736	5.9769	5.9802	5.9835	5.9867	5.9900	5.9932	5.9965	5.9997
530	6.0029	6.0062	6.0094	6.0126	6.0159	6.0191	6.0223	6.0255	6.0287	6.0319
540	6.0351	6.0383	6.0415	6.0447	6.0478	6.0510	6.0542	6.0573	6.0605	6.0637

(continued)

TWO-SEVENTHS POWER OF PRESSURE

(Explanation on p. 308.)

p	0	1	2	3	4	5	6	7	8	9
550	6.0668	6.0700	6.0731	6.0763	6.0794	6.0825	6.0857	6.0888	6.0919	6.0950
560	6.0981	6.1012	6.1043	6.1074	6.1105	6.1136	6.1167	6.1198	6.1229	6.1260
570	6.1290	6.1321	6.1352	6.1382	6.1413	6.1444	6.1474	6.1505	6.1535	6.1565
580	6.1596	6.1626	6.1656	6.1687	6.1717	6.1747	6.1777	6.1807	6.1837	6.1867
590	6.1897	6.1927	6.1957	6.1987	6.2017	6.2047	6.2077	6.2106	6.2136	6.2166
600	6.2195	6.2225	6.2254	6.2284	6.2313	6.2343	6.2372	6.2402	6.2431	6.2460
610	6.2490	6.2519	6.2548	6.2577	6.2607	6.2636	6.2665	6.2694	6.2723	6.2752
620	6.2781	6.2810	6.2838	6.2867	6.2896	6.2925	6.2954	6.2982	6.3011	6.3040
630	6.3068	6.3097	6.3126	6.3154	6.3183	6.3211	6.3239	6.3268	6.3296	6.3324
640	6.3353	6.3381	6.3409	6.3437	6.3466	6.3494	6.3522	6.3550	6.3578	6.3606
650	6.3634	6.3662	6.3690	6.3718	6.3746	6.3774	6.3801	6.3829	6.3857	6.3885
660	6.3912	6.3940	6.3968	6.3995	6.4023	6.4050	6.4078	6.4105	6.4133	6.4160
670	6.4187	6.4215	6.4242	6.4269	6.4297	6.4324	6.4351	6.4378	6.4405	6.4433
680	6.4460	6.4487	6.4514	6.4541	6.4568	6.4595	6.4622	6.4649	6.4675	6.4702
690	6.4729	6.4756	6.4783	6.4809	6.4836	6.4863	6.4889	6.4916	6.4943	6.4969
700	6.4996	6.5022	6.5049	6.5075	6.5102	6.5128	6.5154	6.5181	6.5207	6.5233
710	6.5260	6.5286	6.5312	6.5338	6.5365	6.5391	6.5417	6.5443	6.5469	6.5495
720	6.5521	6.5547	6.5573	6.5599	6.5625	6.5651	6.5677	6.5702	6.5728	6.5754
730	6.5780	6.5805	6.5831	6.5857	6.5883	6.5908	6.5934	6.5959	6.5985	6.6010
740	6.6036	6.6061	6.6087	6.6112	6.6138	6.6163	6.6188	6.6214	6.6239	6.6264
750	6.6290	6.6315	6.6340	6.6365	6.6391	6.6416	6.6441	6.6466	6.6491	6.6516
760	6.6541	6.6566	6.6591	6.6616	6.6641	6.6666	6.6691	6.6716	6.6740	6.6765
770	6.6790	6.6815	6.6840	6.6864	6.6889	6.6914	6.6938	6.6963	6.6988	6.7012
780	6.7037	6.7061	6.7086	6.7110	6.7135	6.7159	6.7184	6.7208	6.7232	6.7257
790	6.7281	6.7305	6.7330	6.7354	6.7378	6.7403	6.7427	6.7451	6.7475	6.7499
800	6.7523	6.7548	6.7572	6.7596	6.7620	6.7644	6.7668	6.7692	6.7716	6.7740
810	6.7763	6.7787	6.7811	6.7835	6.7859	6.7883	6.7907	6.7930	6.7954	6.7978
820	6.8001	6.8025	6.8049	6.8072	6.8096	6.8120	6.8143	6.8167	6.8190	6.8214
830	6.8237	6.8261	6.8284	6.8308	6.8331	6.8355	6.8378	6.8401	6.8425	6.8448
840	6.8471	6.8495	6.8518	6.8541	6.8564	6.8587	6.8611	6.8634	6.8657	6.8680
850	6.8703	6.8726	6.8749	6.8772	6.8795	6.8818	6.8841	6.8864	6.8887	6.8910
860	6.8933	6.8956	6.8979	6.9002	6.9025	6.9047	6.9070	6.9093	6.9116	6.9139
870	6.9161	6.9184	6.9207	6.9229	6.9252	6.9275	6.9297	6.9320	6.9342	6.9365
880	6.9387	6.9410	6.9432	6.9455	6.9477	6.9500	6.9522	6.9545	6.9567	6.9589
890	6.9612	6.9634	6.9656	6.9679	6.9701	6.9723	6.9746	6.9768	6.9790	6.9812
900	6.9834	6.9857	6.9879	6.9901	6.9923	6.9945	6.9967	6.9989	7.0011	7.0033
910	7.0055	7.0077	7.0099	7.0121	7.0143	7.0165	7.0187	7.0209	7.0231	7.0252
920	7.0274	7.0296	7.0318	7.0340	7.0361	7.0383	7.0405	7.0427	7.0448	7.0470
930	7.0492	7.0513	7.0535	7.0557	7.0578	7.0600	7.0621	7.0643	7.0664	7.0686
940	7.0707	7.0729	7.0750	7.0772	7.0793	7.0815	7.0836	7.0857	7.0879	7.0900
950	7.0922	7.0943	7.0964	7.0985	7.1007	7.1028	7.1049	7.1070	7.1092	7.1113
960	7.1134	7.1155	7.1176	7.1197	7.1219	7.1240	7.1261	7.1282	7.1303	7.1324
970	7.1345	7.1366	7.1387	7.1408	7.1429	7.1450	7.1471	7.1492	7.1513	7.1533
980	7.1554	7.1575	7.1596	7.1617	7.1638	7.1658	7.1679	7.1700	7.1721	7.1741
990	7.1762	7.1783	7.1804	7.1824	7.1845	7.1866	7.1886	7.1907	7.1927	7.1948
1000	7.1969	7.1989	7.2010	7.2030	7.2051	7.2071	7.2092	7.2112	7.2133	7.2153
1010	7.2173	7.2194	7.2214	7.2235	7.2255	7.2275	7.2296	7.2316	7.2336	7.2357
1020	7.2377	7.2397	7.2417	7.2438	7.2458	7.2478	7.2498	7.2518	7.2539	7.2559
1030	7.2579	7.2599	7.2619	7.2639	7.2659	7.2679	7.2700	7.2720	7.2740	7.2760
1040	7.2780	7.2800	7.2820	7.2840	7.2859	7.2879	7.2899	7.2919	7.2939	7.2959
1050	7.2979	7.2999	7.3019	7.3038	7.3058	7.3078	7.3098	7.3118	7.3137	7.3157
1060	7.3177	7.3196	7.3216	7.3236	7.3256	7.3275	7.3295	7.3314	7.3334	7.3354
1070	7.3373	7.3393	7.3412	7.3432	7.3452	7.3471	7.3491	7.3510	7.3530	7.3549
1080	7.3569	7.3588	7.3608	7.3627	7.3646	7.3666	7.3685	7.3705	7.3724	7.3743
1090	7.3763	7.3782	7.3801	7.3821	7.3840	7.3859	7.3878	7.3898	7.3917	7.3936
1100	7.3955									

Table 77

TWO-SEVENTHS POWER OF (1000/p)

(Explanation on p. 308.)

p	0	1	2	3	4	5	6	7	8	9
0		7.1969	5.9038	5.2580	4.8431	4.5440	4.3133	4.1275	3.9730	3.8415
10	3.7276	3.6275	3.5384	3.4584	3.3859	3.3198	3.2592	3.2032	3.1513	3.1030
20	3.0579	3.0155	2.9757	2.9382	2.9027	2.8690	2.8370	2.8066	2.7776	2.7499
30	2.7234	2.6980	2.6736	2.6502	2.6277	2.6060	2.5851	2.5650	2.5455	2.5267
40	2.5085	2.4908	2.4738	2.4572	2.4411	2.4255	2.4103	2.3955	2.3812	2.3672
50	2.3535	2.3403	2.3273	2.3147	2.3024	2.2903	2.2786	2.2671	2.2558	2.2448
60	2.2341	2.2236	2.2133	2.2032	2.1933	2.1836	2.1741	2.1647	2.1556	2.1466
70	2.1378	2.1292	2.1207	2.1123	2.1042	2.0961	2.0882	2.0804	2.0727	2.0652
80	2.0578	2.0505	2.0433	2.0363	2.0293	2.0225	2.0157	2.0091	2.0025	1.9961
90	1.9897	1.9834	1.9772	1.9711	1.9651	1.9592	1.9533	1.9476	1.9419	1.9362
100	1.9307	1.9252	1.9198	1.9145	1.9092	1.9040	1.8988	1.8937	1.8887	1.8837
110	1.8788	1.8740	1.8692	1.8644	1.8598	1.8551	1.8505	1.8460	1.8415	1.8371
120	1.8327	1.8284	1.8241	1.8198	1.8156	1.8114	1.8073	1.8033	1.7992	1.7952
130	1.7913	1.7873	1.7835	1.7796	1.7758	1.7721	1.7683	1.7646	1.7610	1.7573
140	1.7537	1.7502	1.7466	1.7431	1.7397	1.7362	1.7328	1.7295	1.7261	1.7228
150	1.7195	1.7162	1.7130	1.7098	1.7066	1.7035	1.7003	1.6972	1.6942	1.6911
160	1.6881	1.6851	1.6821	1.6791	1.6762	1.6733	1.6704	1.6676	1.6647	1.6619
170	1.6591	1.6563	1.6536	1.6508	1.6481	1.6454	1.6427	1.6401	1.6374	1.6348
180	1.6322	1.6296	1.6271	1.6245	1.6220	1.6195	1.6170	1.6145	1.6121	1.6096
190	1.6072	1.6048	1.6024	1.6000	1.5977	1.5953	1.5930	1.5907	1.5884	1.5861
200	1.5838	1.5816	1.5793	1.5771	1.5749	1.5727	1.5705	1.5683	1.5662	1.5640
210	1.5619	1.5598	1.5577	1.5556	1.5535	1.5514	1.5494	1.5473	1.5453	1.5433
220	1.5413	1.5393	1.5373	1.5353	1.5334	1.5314	1.5295	1.5275	1.5256	1.5237
230	1.5218	1.5199	1.5181	1.5162	1.5143	1.5125	1.5107	1.5088	1.5070	1.5052
240	1.5034	1.5016	1.4999	1.4981	1.4963	1.4946	1.4929	1.4911	1.4894	1.4877
250	1.4860	1.4843	1.4826	1.4809	1.4793	1.4776	1.4760	1.4743	1.4727	1.4711
260	1.4694	1.4678	1.4662	1.4646	1.4630	1.4615	1.4599	1.4583	1.4568	1.4552
270	1.4537	1.4521	1.4506	1.4491	1.4476	1.4461	1.4446	1.4431	1.4416	1.4401
280	1.4386	1.4372	1.4357	1.4343	1.4328	1.4314	1.4300	1.4285	1.4271	1.4257
290	1.4243	1.4229	1.4215	1.4201	1.4187	1.4174	1.4160	1.4146	1.4133	1.4119
300	1.4106	1.4092	1.4079	1.4066	1.4052	1.4039	1.4026	1.4013	1.4000	1.3987
310	1.3974	1.3961	1.3948	1.3936	1.3923	1.3910	1.3898	1.3885	1.3873	1.3860
320	1.3848	1.3836	1.3823	1.3811	1.3799	1.3787	1.3775	1.3763	1.3751	1.3739
330	1.3727	1.3715	1.3703	1.3691	1.3680	1.3668	1.3656	1.3645	1.3633	1.3622
340	1.3610	1.3599	1.3587	1.3576	1.3565	1.3554	1.3542	1.3531	1.3520	1.3509
350	1.3498	1.3487	1.3476	1.3465	1.3454	1.3443	1.3433	1.3422	1.3411	1.3400
360	1.3390	1.3379	1.3369	1.3358	1.3347	1.3337	1.3327	1.3316	1.3306	1.3296
370	1.3285	1.3275	1.3265	1.3255	1.3245	1.3234	1.3224	1.3214	1.3204	1.3194
380	1.3184	1.3175	1.3165	1.3155	1.3145	1.3135	1.3126	1.3116	1.3106	1.3097
390	1.3087	1.3077	1.3068	1.3058	1.3049	1.3039	1.3030	1.3021	1.3011	1.3002
400	1.2993	1.2983	1.2974	1.2965	1.2956	1.2947	1.2937	1.2928	1.2919	1.2910
410	1.2901	1.2892	1.2883	1.2874	1.2866	1.2857	1.2848	1.2839	1.2830	1.2822
420	1.2813	1.2804	1.2795	1.2787	1.2778	1.2770	1.2761	1.2752	1.2744	1.2735
430	1.2727	1.2718	1.2710	1.2702	1.2693	1.2685	1.2677	1.2668	1.2660	1.2652
440	1.2644	1.2635	1.2627	1.2619	1.2611	1.2603	1.2595	1.2587	1.2579	1.2571
450	1.2563	1.2555	1.2547	1.2539	1.2531	1.2523	1.2515	1.2507	1.2500	1.2492
460	1.2484	1.2476	1.2469	1.2461	1.2453	1.2446	1.2438	1.2430	1.2423	1.2415
470	1.2408	1.2400	1.2393	1.2385	1.2378	1.2370	1.2363	1.2355	1.2348	1.2340
480	1.2333	1.2326	1.2319	1.2311	1.2304	1.2297	1.2289	1.2282	1.2275	1.2268
490	1.2261	1.2254	1.2246	1.2239	1.2232	1.2225	1.2218	1.2211	1.2204	1.2197
500	1.2190	1.2183	1.2176	1.2169	1.2162	1.2156	1.2149	1.2142	1.2135	1.2128
510	1.2121	1.2115	1.2108	1.2101	1.2094	1.2088	1.2081	1.2074	1.2068	1.2061
520	1.2054	1.2048	1.2041	1.2035	1.2028	1.2021	1.2015	1.2008	1.2002	1.1995
530	1.1989	1.1982	1.1976	1.1970	1.1963	1.1957	1.1950	1.1944	1.1938	1.1931
540	1.1925	1.1919	1.1912	1.1906	1.1900	1.1894	1.1887	1.1881	1.1875	1.1869

(continued)

TWO-SEVENTHS POWER OF (1000/p)

(Explanation on p. 308.)

p	0	1	2	3	4	5	6	7	8	9
550	1.1863	1.1857	1.1850	1.1844	1.1838	1.1832	1.1826	1.1820	1.1814	1.1808
560	1.1802	1.1796	1.1790	1.1784	1.1778	1.1772	1.1766	1.1760	1.1754	1.1748
570	1.1742	1.1736	1.1730	1.1725	1.1719	1.1713	1.1707	1.1701	1.1696	1.1690
580	1.1684	1.1678	1.1673	1.1667	1.1661	1.1655	1.1650	1.1644	1.1638	1.1633
590	1.1627	1.1621	1.1616	1.1610	1.1605	1.1599	1.1594	1.1588	1.1582	1.1577
600	1.1571	1.1566	1.1560	1.1555	1.1549	1.1544	1.1539	1.1533	1.1528	1.1522
610	1.1517	1.1511	1.1506	1.1501	1.1495	1.1490	1.1485	1.1479	1.1474	1.1469
620	1.1463	1.1458	1.1453	1.1448	1.1442	1.1437	1.1432	1.1427	1.1422	1.1416
630	1.1411	1.1406	1.1401	1.1396	1.1391	1.1385	1.1380	1.1375	1.1370	1.1365
640	1.1360	1.1355	1.1350	1.1345	1.1340	1.1335	1.1330	1.1325	1.1320	1.1315
650	1.1310	1.1305	1.1300	1.1295	1.1290	1.1285	1.1280	1.1275	1.1270	1.1265
660	1.1261	1.1256	1.1251	1.1246	1.1241	1.1236	1.1231	1.1227	1.1222	1.1217
670	1.1212	1.1207	1.1203	1.1198	1.1193	1.1188	1.1184	1.1179	1.1174	1.1170
680	1.1165	1.1160	1.1156	1.1151	1.1146	1.1142	1.1137	1.1132	1.1128	1.1123
690	1.1118	1.1114	1.1109	1.1105	1.1100	1.1096	1.1091	1.1086	1.1082	1.1077
700	1.1073	1.1068	1.1064	1.1059	1.1055	1.1050	1.1046	1.1041	1.1037	1.1032
710	1.1028	1.1024	1.1019	1.1015	1.1010	1.1006	1.1002	1.0997	1.0993	1.0988
720	1.0984	1.0980	1.0975	1.0971	1.0967	1.0962	1.0958	1.0954	1.0949	1.0945
730	1.0941	1.0937	1.0932	1.0928	1.0924	1.0920	1.0915	1.0911	1.0907	1.0903
740	1.0898	1.0894	1.0890	1.0886	1.0882	1.0877	1.0873	1.0869	1.0865	1.0861
750	1.0857	1.0853	1.0848	1.0844	1.0840	1.0836	1.0832	1.0828	1.0824	1.0820
760	1.0816	1.0812	1.0808	1.0803	1.0799	1.0795	1.0791	1.0787	1.0783	1.0779
770	1.0775	1.0771	1.0767	1.0763	1.0759	1.0755	1.0751	1.0748	1.0744	1.0740
780	1.0736	1.0732	1.0728	1.0724	1.0720	1.0716	1.0712	1.0708	1.0704	1.0701
790	1.0697	1.0693	1.0689	1.0685	1.0681	1.0677	1.0674	1.0670	1.0666	1.0662
800	1.0658	1.0655	1.0651	1.0647	1.0643	1.0639	1.0636	1.0632	1.0628	1.0624
810	1.0621	1.0617	1.0613	1.0609	1.0606	1.0602	1.0598	1.0594	1.0591	1.0587
820	1.0583	1.0580	1.0576	1.0572	1.0569	1.0565	1.0561	1.0558	1.0554	1.0550
830	1.0547	1.0543	1.0540	1.0536	1.0532	1.0529	1.0525	1.0522	1.0518	1.0514
840	1.0511	1.0507	1.0504	1.0500	1.0497	1.0493	1.0489	1.0486	1.0482	1.0479
850	1.0475	1.0472	1.0468	1.0465	1.0461	1.0458	1.0454	1.0451	1.0447	1.0444
860	1.0440	1.0437	1.0433	1.0430	1.0427	1.0423	1.0420	1.0416	1.0413	1.0409
870	1.0406	1.0402	1.0399	1.0396	1.0392	1.0389	1.0386	1.0382	1.0379	1.0375
880	1.0372	1.0369	1.0365	1.0362	1.0359	1.0355	1.0352	1.0349	1.0345	1.0342
890	1.0339	1.0335	1.0332	1.0329	1.0325	1.0322	1.0319	1.0315	1.0312	1.0309
900	1.0306	1.0302	1.0299	1.0296	1.0293	1.0289	1.0286	1.0283	1.0280	1.0276
910	1.0273	1.0270	1.0267	1.0263	1.0260	1.0257	1.0254	1.0251	1.0247	1.0244
920	1.0241	1.0238	1.0235	1.0232	1.0228	1.0225	1.0222	1.0219	1.0216	1.0213
930	1.0210	1.0206	1.0203	1.0200	1.0197	1.0194	1.0191	1.0188	1.0185	1.0181
940	1.0178	1.0175	1.0172	1.0169	1.0166	1.0163	1.0160	1.0157	1.0154	1.0151
950	1.0148	1.0145	1.0142	1.0138	1.0135	1.0132	1.0129	1.0126	1.0123	1.0120
960	1.0117	1.0114	1.0111	1.0108	1.0105	1.0102	1.0099	1.0096	1.0093	1.0090
970	1.0087	1.0084	1.0081	1.0079	1.0076	1.0073	1.0070	1.0067	1.0064	1.0061
980	1.0058	1.0055	1.0052	1.0049	1.0046	1.0043	1.0040	1.0037	1.0035	1.0032
990	1.0029	1.0026	1.0023	1.0020	1.0017	1.0014	1.0011	1.0009	1.0006	1.0003
1000	1.0000	0.99971	0.99943	0.99914	0.99886	0.99858	0.99829	0.99801	0.99773	0.99744
1010	0.99716	.99688	.99660	.99632	.99604	.99576	.99548	.99520	.99492	.99464
1020	.99436	.99408	.99380	.99352	.99325	.99297	.99269	.99242	.99214	.99187
1030	.99159	.99132	.99104	.99077	.99049	.99022	.98995	.98967	.98940	.98913
1040	.98886	.98859	.98831	.98804	.98777	.98750	.98723	.98696	.98669	.98642
1050	0.98616	0.98589	0.98562	0.98535	0.98509	0.98482	0.98455	0.98429	0.98402	0.98375
1060	.98349	.98322	.98296	.98270	.98243	.98217	.98190	.98164	.98138	.98112
1070	.98085	.98059	.98033	.98007	.97981	.97955	.97929	.97903	.97877	.97851
1080	.97825	.97799	.97773	.97748	.97722	.97696	.97670	.97645	.97619	.97593
1090	.97568	.97542	.97517	.97491	.97466	.97440	.97415	.97390	.97364	.97339
1100	0.97314									

TEMPERATURE AND PRESSURE ALONG SATURATION PSEUDOADIABATS

The differential equation of the pseudoadiabatic condensation stage involving saturation with respect to water (rain stage) as given by von Bezold[1] is

$$(c_p + c_w r_w)dT - RT\left(\frac{dp_a}{p_a}\right) + Td\left(\frac{L_v r_w}{T}\right) = 0. \tag{1}$$

Where

c_p = specific heat of dry air at constant pressure,
c_w = specific heat of water,
T = temperature, °K.,
R = gas constant for dry air,
p_a = partial pressure of the dry air,
L_v = latent heat of condensation of water,
r_w = saturation mixing ratio over water.

All quantities are to be expressed in cgs work units.

Integrating equation (1) between nearby values of (p_a, T) denoted by subscripts 1 and 2, and regarding c_p and c_w as constants within this interval we get

$$c_p \log_e \frac{T_2}{T_1} + c_w \int_{T_1}^{T_2} r_w \frac{dT}{T} - R \log_e \frac{p_{a2}}{p_{a1}} \left(\frac{L_{v2} r_{w2}}{T_2} - \frac{L_{v1} r_{w1}}{T_1}\right) = 0. \tag{2}$$

The integral in equation (2) may be replaced by its equivalent

$$c_w \int_{T_1}^{T_2} r_w \frac{dT}{T} = c_w \overline{r_w} \log_e \frac{T_2}{T_1} \tag{3}$$

where $\overline{r_w}$ is the mean value of r_w on a logarithmic basis in the interval.

p_{a1} is related to the total, barometric pressure p_1 by

$$p_{a1} = p_1 - e_{w1} \tag{4}$$

where e_{w1} is the saturation vapor pressure over water at temperatures T_1.
Similarly,

$$p_{a2} = p_2 - e_{w2}. \tag{5}$$

Making use of equations (3) and (4), equation (2) can be solved to a close degree of approximation for p_{a2} when values of T_1, p_1, T_2, are given, provided T_2 is sufficiently near T_1. Ususally 2°C. intervals are used, and equation (2) is solved stepwise for a succession of values of p_{a2} on the pseudoadiabat and p_2 is determined from equation (5).

The U. S. Weather Bureau has computed the values of p at various values of T along a number of pseudoadiabats. In making the computations it was assumed that $\overline{r_w}$ could be adequately represented by the relation $\overline{r_w} = \epsilon \overline{e_w}/\overline{p_a}$ where $\overline{e_w} = (e_{w1} + e_{w2})/2$, $\overline{p_a} = (p_{a1} + p_{a2})/2$, and ϵ = ratio of molecular weight of water vapor to molecular weight of dry air. The following constants were used in the computations:

$c_p = 0.238$ cal. g.$^{-1}$ °K.$^{-1}$ $= 0.995 \times 10^7$ ergs g.$^{-1}$ °K.$^{-1}$
$c_w = 1$ cal. g.$^{-1}$ °K.$^{-1}$ $= 4.18 \times 10^7$ ergs g.$^{-1}$ °K.$^{-1}$
$R = 28.71 \times 10^6$ cm.^{2} deg.$^{-1}$ sec.$^{-2}$ = cm.^{2} deg.$^{-1}$ sec.$^{-1}$
$L_v = [596.73 - 0.601$ t (°C.)] cal. g.$^{-1}$ = [2494.3 − 2.512 t (°C.)] ergs g.$^{-1}$
$\epsilon = 0.622$

The values of e_w used also differ slightly from those given in this volume.

Table 78 gives the corresponding pressure for each even whole degree centigrade along the pseudoadiabats having temperatures at 1000 mb. (pseudo-wet-bulb potential temperature) from −20°C. to 40°C. at 2° intervals. The corresponding equivalent potential temperature for each pseudoadiabat is also indicated.

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[1] Von Bezold, Zur Thermodynamik der Atmosphere, Sitzungsber. Berlin Akad., 1888.

(continued)

TEMPERATURE AND PRESSURE ALONG SATURATION PSEUDOADIABATS

Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)

Temperature	40 °C. 478.4°A.	38 °C. 454.8°A.	36 °C. 434.2°A.	34 °C. 416.5°A.	32 °C. 400.5°A.	30 °C. 386.2°A.	28 °C. 373.8°A.	26 °C. 362.6°A.	24 °C. 352.8°A.	22 °C. 343.5°A.	20 °C. 335.5°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
42	1072.6										
40	1000	1071.4									
38	932.0	1000	1069.8								
36	868.4	933.3	1000	1068.2							
34	808.9	870.9	934.7	1000	1066.7						
32	753.3	812.5	873.5	937	1000	1064.8					
30	701.5	758.0	816.4	876	937	1000	1063.2				
28	653.1	707.1	762.9	821	879	940	1000	1061.5			
26	607.9	659.5	712.9	769	825	883	941	1000	1059.2		
24	566.1	615.4	666.6	720	774	830	885	942	1000	1057.7	
22	527.1	574.2	623.2	674	725	779	833	888	944	1000	1055.6
20	490.7	535.8	582.9	631	681	733	785	837	892	946	1000
18	456.9	500.0	545.1	592	640	690	740	792	844	896	947
16	425.6	466.9	510.2	555	601	650	698	747	798	849	899
14	396.6	436.1	477.7	521	566	612	659	707	755	805	853
12	369.6	407.5	447.5	489	532	577	622	668	715	763	811
10	344.7	381.1	419.6	459	501	544	588	632	678	724	770
8	321.6	356.5	393.6	433	472	514	556	600	644	689	733
6	300.3	333.8	369.6	406	445	486	526	568	611	655	698
4	280.5	312.7	347.1	382.3	420	459	499	540	581	623	665
2	262.2	293.2	326.4	360.3	396.8	435	473	513	553	594	635
0	245.4	275.3	307.3	340.1	375.3	412.4	449	488	527	567	606
−2	230.0	258.8	289.7	321.4	355.5	391.4	427	464	502	541	579
−4	215.8	243.6	273.4	304.1	337.2	371.9	407	443	480	518	555
−6	202.2	229.5	258.4	288.1	320.1	353.8	387.8	423	459	495	531
−8	190.6	216.5	244.4	273.2	304.3	337.0	370.0	404.2	438	474	509
−10	179.6	204.6	231.6	259.5	289.6	321.4	353.4	386.6	420	455	489
−12	169.1	193.3	219.5	246.5	275.7	306.6	337.7	369.9	402	436	469
−14	159.8	183.3	208.6	234.8	263.2	293.1	323.4	354.8	385.9	419	451
−16	151.1	173.8	198.4	223.8	251.3	280.4	309.8	340.3	370.6	403	435
−18	143.1	165.1	189.0	213.6	240.4	268.6	297.2	326.8	356.3	387.8	418
−20	135.9	157.2	180.4	204.3	230.3	257.7	285.5	314.3	342.9	373.6	403
−22	129.1	149.8	172.3	195.5	220.8	247.4	274.4	302.4	330.2	360.0	388.6
−24	122.8	142.9	164.7	187.3	211.8	237.6	263.9	291.1	318.2	347.1	375.0
−26	117.0	136.4	157.6	179.5	203.3	228.5	254.0	280.4	306.7	334.9	362.0
−28	111.7	130.6	151.1	172.4	195.5	220.0	244.7	270.4	296.0	323.4	349.7
−30	106.8	125.1	145.1	165.7	188.2	212.0	236.0	261.0	285.8	312.4	338.0
−32	101.7	120.0	139.4	159.4	181.3	204.3	227.7	252.0	276.1	301.9	326.8
−34	97.9	115.2	134.0	153.5	174.7	197.1	219.8	243.4	266.8	291.9	316.0
−36	94.0	110.8	129.0	148.0	168.6	190.3	212.4	235.2	258.0	282.4	305.8
−38	90.3	106.5	124.2	142.6	162.6	183.7	205.1	227.3	249.5	273.1	295.9
−40	86.8	102.6	119.8	137.7	157.1	177.6	198.3	219.9	241.4	264.3	286.4
−42	83.6	98.9	115.6	132.9	151.7	171.7	191.8	212.7	233.6	255.8	277.3
−44	80.5	95.3	111.5	128.3	146.6	165.9	185.5	205.8	226.0	247.6	268.4
−46	77.6	92.0	107.7	124.0	141.7	160.4	179.4	199.1	218.7	239.6	259.8
−48	74.8	88.8	104.0	119.8	137.0	155.1	173.5	192.6	211.6	231.9	251.5
−50	72.2	85.8	100.5	115.8	132.5	150.1	167.9	186.4	204.8	224.5	243.5
−52	69.7	82.9	97.2	112.0	128.1	145.2	162.5	180.4	198.3	217.4	235.8
−54	67.2	80.0	93.8	108.2	123.8	140.4	157.1	174.5	191.8	210.3	228.1
−56	65.0	77.3	90.7	104.6	119.8	135.8	152.0	168.8	185.6	203.5	220.8
−58	62.8	74.7	87.7	101.2	115.8	131.4	147.1	163.4	179.6	197.0	213.7
−60	60.6	72.2	84.8	97.8	112.0	127.0	142.3	158.0	173.8	190.6	206.8
−62	58.6	69.8	82.0	94.6	108.3	122.9	137.6	152.9	168.1	184.3	200.0
−64	56.6	67.4	79.2	91.4	104.7	118.8	133.0	147.8	162.5	178.3	193.4
−66	54.7	65.2	76.6	88.4	101.2	114.8	128.6	142.9	157.1	172.4	187.0
−68	52.8	63.0	74.0	85.4	97.8	111.0	124.3	138.1	151.9	166.6	180.8

(continued)

TEMPERATURE AND PRESSURE ALONG SATURATION PSEUDOADIABATS

Temperature	Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)										
	40 °C. 478.4°A.	38 °C. 454.8°A.	36 °C. 434.2°A.	34 °C. 416.5°A.	32 °C. 400.5°A.	30 °C. 386.2°A.	28 °C. 373.8°A.	26 °C. 362.6°A.	24 °C. 352.8°A.	22 °C. 343.5°A.	20 °C. 335.5°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
− 70	51.0	60.8	71.5	82.5	94.5	107.3	120.1	133.5	146.8	161.0	174.7
− 72	49.3	58.7	69.0	79.7	91.3	103.6	116.0	128.9	141.8	155.5	168.8
− 74	47.6	56.7	66.7	77.0	88.2	100.1	112.1	124.5	137.0	150.2	163.0
− 76	45.9	54.7	64.3	74.3	85.1	96.6	108.2	120.2	132.2	145.0	157.4
− 78	44.3	52.8	62.1	71.7	82.2	93.2	104.4	116.0	127.6	140.0	151.9
− 80	42.8	51.0	59.9	69.2	79.3	89.9	100.7	112.0	123.1	135.1	146.6
− 82	41.2	49.2	57.8	66.7	76.4	86.7	97.2	108.0	118.8	130.3	141.4
− 84	39.8	47.4	55.7	64.3	73.7	83.6	93.7	104.1	114.5	125.6	136.3
− 86	38.3	45.7	53.7	62.0	71.0	80.6	90.3	100.3	110.4	121.1	131.4
− 88	36.9	44.0	51.7	59.7	68.4	77.7	87.0	96.7	106.3	116.6	126.6
− 90	35.5	42.4	49.8	57.5	65.9	74.8	83.8	93.1	102.4	112.3	121.9
− 92	34.2	40.8	47.9	55.4	63.4	72.0	80.6	89.6	98.6	108.1	117.3
− 94	32.9	39.2	46.1	53.3	61.0	69.3	77.6	86.2	94.8	104.0	112.9
− 96	31.7	37.7	44.4	51.2	58.7	66.6	74.6	82.9	91.2	100.1	108.6
− 98	30.4	36.3	42.6	49.3	56.4	64.0	71.7	79.7	87.7	96.2	
−100	29.2	34.9	41.0	47.3	54.2	61.5	68.9	76.6	84.3	92.4	
−102	28.1	33.5	39.4	45.5	52.1	59.1	66.2				
−104	27.0	32.2	37.8	43.6	50.0	56.8					

Temperature	Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)									
	18 °C. 328.0°A.	16 °C. 321.3°A.	14 °C. 315.3°A.	12 °C. 309.6°A.	10 °C. 304.4°A.	8 °C. 299.6°A.	6 °C. 295.0°A.	4 °C. 290.8°A.	2 °C. 286.9°A.	0 °C. 283.4°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
20	1054.1									
18	1000	1052.0								
16	949	1000	1050.2	1100.3						
14	902	951	1000	1048.6	1096.7					
12	858	906	953	1000	1046.7	1093.3				
10	816	863	908	954	1000.0	1045.2	1090.2			
8	778	823	868	912	957	1000.0	1043.7	1087.2		
6	741	785	828	871	915	957	1000.0	1042.3	1084.3	
4	707	750	792	834	876	917	959	1000.0	1040.9	1081.5
2	675	717	758	799	840	880	920	960	1000.0	1039.5
0	646	686	726	766	805	844	884	923	961	1000.0
− 2	618	657	696	734	773	811	850	887	925	963
− 4	593	631	668	706	744	781	818	855	892	928
− 6	568	605	642	678	715	751	787	823	859	894
− 8	544	581	616	652	688	723	758	793	828	862
−10	523	559	593	628	663	697	732	765	799	833
−12	503	537	570	604	638	671	705	738	771	804
−14	484	517	550	583	616	648	681	713	745	777
−16	466	499	530	563	595	626	658	689	720	751
−18	449	480	511	542	573	604	635	665	696	726
−20	433	463	494	524	554	584	614	644	673	703
−22	418	448	477	507	536	565	594	623	652	680
−24	404	432	461	490	518	546	575	603	631	659
−26	390.2	418	446	474	502	529	557	584	611	638
−28	377.1	404	431	458	485	512	539	566	592	618
−30	364.6	390.8	417	444	470	496	522	548	574	599
−32	352.7	378.1	403	429	454	479	505	530	555	580
−34	341.2	365.9	390.1	415	440	464	489	513	538	562
−36	330.3	354.2	377.7	402	426	450	474	497	521	544
−38	319.6	342.9	365.7	389.3	413	436	459	482	505	528

(continued)

TEMPERATURE AND PRESSURE ALONG SATURATION PSEUDOADIABATS

Temperature	Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)									
	18 °C. 328.0°A.	16 °C. 321.3°A.	14 °C. 315.3°A.	12 °C. 309.6°A.	10 °C. 304.4°A.	8 °C. 299.6°A.	6 °C. 295.0°A.	4 °C. 290.8°A.	2 °C. 286.9°A.	0 °C. 283.4°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−40	309.5	332.0	354.2	377.1	400	422	445	467	489	511
−42	299.6	321.6	343.1	365.3	387.5	409	431	453	474	496
−44	290.1	311.4	332.2	353.8	375.3	396.2	418	439	460	480
−46	280.5	301.5	321.7	342.6	363.5	383.7	404.9	425.3	445.6	465.0
−48	271.9	291.9	311.5	331.8	352.1	371.7	392.2	411.9	431.7	450.5
−50	263.3	282.7	301.7	321.3	341.0	360.0	379.9	399.0	418.1	436.4
−52	254.9	273.7	292.1	311.2	330.2	348.7	367.9	386.5	405.0	422.7
−54	246.7	264.9	282.8	301.2	319.7	337.5	356.2	374.2	392.2	409.3
−56	238.8	256.4	273.7	291.6	309.5	326.8	344.9	362.3	379.7	396.3
−58	231.1	248.2	265.0	282.3	299.6	316.3	333.8	350.7	367.6	383.7
−60	223.6	240.2	256.4	273.1	289.9	306.1	323.1	339.4	355.8	371.3
−62	216.3	232.3	248.0	264.3	280.5	296.2	312.6	328.4	344.2	359.3
−64	209.2	224.7	239.9	255.6	271.3	286.5	302.4	317.6	332.9	347.5
−66	202.3	217.3	232.0	247.1	262.3	277.0	292.4	307.2	322.0	336.1
−68	195.5	210.0	224.2	238.9	253.6	267.8	282.7	297.0	311.3	324.9
−70	189.0	203.0	216.7	230.9	245.1	258.8	273.2	287.0	300.8	314.0
−72	182.6	196.1	209.4	223.1	236.8	250.1	263.9	277.3	290.6	303.4
−74	176.3	189.4	202.2	215.5	228.7	241.5	254.9	267.8	280.7	293.0
−76	170.3	182.9	195.3	208.0	220.8	233.2	246.1	258.6	271.1	282.9
−78	164.3	176.5	188.5	200.8	213.2	225.1	237.6	249.6	261.6	273.1
−80	158.5	170.3	181.8	193.7	205.7	217.2	229.2	240.8	252.4	263.5
−82	152.9	164.3	175.4	186.9	198.4	209.5	221.1	232.3	243.5	254.1
−84	147.4	158.4	169.1	180.2	191.3	202.0	213.2	224.0	234.8	245.0
−86	142.1	152.6	163.0	173.6	184.3	194.7	205.5	215.9	226.3	236.2
−88	136.9	147.1	157.0	167.3	177.6	187.5	197.9	208.0	218.0	227.5
−90	131.8	141.6	151.2	161.1	171.0	180.6	190.6	200.3	209.9	219.1
−92	126.9	136.3	145.6	155.1	164.6	173.9	183.5	192.8	202.1	210.9
−94	122.1	131.2	140.1	149.2	158.4	167.3	176.6	185.5	194.4	203.0
−96	117.4	126.2	134.7	143.5	152.4	160.9	169.8	178.4	187.0	195.2

Temperature	Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)									
	−2 °C. 279.9°A.	−4 °C. 276.7°A.	−6 °C. 273.6°A.	−8 °C. 270.6°A.	−10 °C. 267.7°A.	−12 °C. 265.0°A.	−14 °C. 262.4°A.	−16 °C. 259.9°A.	−18 °C. 257.4°A.	−20 °C. 255.0°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
2	1078.8									
0	1038.2	1076.4								
− 2	1000.0	1037.1	1074.4							
− 4	965	1000.0	1036.3	1072.6						
− 6	930	964	1000.0	1035.3	1070.8					
− 8	897	930	965	1000.0	1034.5	1069.6				
−10	866	899	933	967	1000.0	1034.2	1068.1			
−12	836	868	901	934	966	1000.0	1033.0	1066.8		
−14	809	840	872	904	935	968	1000.0	1032.8		
−16	782	812	844	875	905	937	968	1000.0		
−18	756	785	816	846	876	907	937	968	1000.0	
−20	732	760	790	820	849	879	908	938	969	1000.0
−22	709	836	765	794	822	852	880	909	940	969.3
−24	687	713	741	769	797	825	853	882	911	939.7
−26	665	691	718	746	772	800	827	855	883	911.0
−28	644	670	696	723	749	776	802	829	857	883.5

(*continued*)

TEMPERATURE AND PRESSURE ALONG SATURATION PSEUDOADIABATS

Temperature	Pseudo-wet-bulb potential temperature (°C.) and equivalent potential temperature (°A.)									
	−2 °C. 279.9°A.	−4 °C. 276.7°A.	−6 °C. 273.6°A.	−8 °C. 270.6°A.	−10 °C. 267.7°A.	−12 °C. 265.0°A.	−14 °C. 262.4°A.	−16 °C. 259.9°A.	−18 °C. 257.4°A.	−20 °C. 255.0°A.
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−30	624	649	675	701	726	752	778	804	831	856.8
−32	604	628	653	678	703	728	753	779	805	830.9
−34	585	609	633	658	681	706	730	755	781	805.8
−36	568	590	614	638	661	685	708	732	757	781.5
−38	550	572	595	618	641	664	687	710	734	757.8
−40	533	555	577	599	621	644	666	688	712	734.8
−42	517	538	559	581	602	624	645	667	690	712.5
−44	501	521	542	563	584	605	626	647	669	690.7
−46	485.4	504.8	525.1	545.5	565.9	586.2	606.6	627.0	648.3	669.5
−48	470.2	489.0	508.8	528.5	548.3	568.0	587.8	607.5	628.2	648.7
−50	455.5	473.8	492.9	512.1	531.2	550.3	569.5	588.6	608.7	628.6
−52	441.3	458.9	477.5	496.1	514.6	533.2	551.7	570.3	589.7	609.0
−54	427.3	444.4	462.4	480.3	498.3	516.3	534.3	552.3	571.1	589.8
−56	413.7	430.3	447.7	465.1	482.6	500.0	517.4	534.8	553.1	571.1
−58	400.5	416.6	433.5	450.3	467.2	484.1	500.9	517.8	535.5	553.0
−60	387.6	403.2	419.5	435.8	452.2	468.5	484.8	501.2	518.3	535.3
−62	375.1	390.1	405.9	421.7	437.5	453.3	469.1	484.9	501.5	517.9
−64	362.8	377.3	392.6	407 9	423.2	438.5	453.8	469.1	485.1	501.0
−66	350.8	364.9	379.7	394.5	409.3	424.1	438.9	453.7	469.2	484.5
−68	339.2	352.8	367.1	381.4	395.7	410.0	424.3	438.6	453.6	468.5
−70	327.8	341.0	354.8	368.6	382.4	396.3	410.1	423.9	438.4	452.8
−72	316.7	329.4	342.8	356.2	369.5	382.9	396.2	409.6	423.6	437.5
−74	305.9	318.2	331.1	344.0	356.9	369.8	382.7	395.6	409.1	422.6
−76	295.4	307.2	319.7	332.2	344.6	357.1	369.5	382.0	395.0	408.0
−78	285.1	296.5	308.6	320.6	332.6	344.7	356.7	368.7	381.3	393.8
−80	275.1	286.1	297.7	309.3	320.9	332.5	344.1	355.8	367.9	380.0
−82	265.3	276.0	287.2	298.4	309.6	320.8	331.9	343.2	354.9	366.5
−84	255.8	266.1	276.9	287.7	298.5	309.3	320.1	330.8	342.2	353.4
−86	246.6	256.5	266.9	277.3	287.7	298.1	308.5	318.9	329.8	340.6
−88	237.5	247.1	257.1	267.1	277.1	287.2	297.2	307.2	317.7	328.1
−90	228.8	237.9	247.6	257.3	266.9	276.6	286.2	295.9	306.0	316.0
−92	220.2	229.1	238.4	247.6	256.9	266.2	275.5	284.8	294.5	304.2
−94	211.9	220.4	229.3	238.3	247.2	256.2				

PSEUDOADIABATIC LAPSE RATE

Water stage

The pseudoadiabatic equation for the water stage recommended by the Aerological Commission of the International Meteorological Organization (Toronto, 1947) is

$$(c_p + r_w c_w)dT/T - R dp'/p' + d(r_w L_v/T) = 0$$

where:

c_p = specific heat of dry air at constant pressure (work units),
c_w = specific heat of liquid water (work units),
R = gas constant for dry air (work units),
L_v = latent heat of vaporization of water (work units),
r_w = mixing ratio at saturation with respect to water,
p' = partial pressure of dry air,
T = absolute temperature.

Upon introducing the hydrostatic equation and the definition of geopotential,

$$dT/d\Phi = -Y/X \text{ °C./100 gpm.*}$$

where:

Φ = geopotential,

$$Y = 9.8 \times 10^6 \frac{(1 + r_w)(RT + r_w L_v)}{RT},$$

$$X = c_p + r_w \left[c_w + dL_v/dT - L_v/T + 1/k \frac{d \log_e e_w}{dT} (RT + r_w L_v + kL_v) \right],$$

k = ratio of the molecular weight of water vapor to that of dry air = 0.62197,
e_w = saturation vapor pressure over water.

In performing the computations a constant value of $c_p = 1.005 \times 10^7$ erg. g.$^{-1}$ °K.$^{-1}$ was assumed.

Temperature °C.	Pressure—millibars												
	1050 °C./100 gpm.	1000 °C./100 gpm.	950 °C./100 gpm.	900 °C./100 gpm.	850 °C./100 gpm.	800 °C./100 gpm.	700 °C./100 gpm.	600 °C./100 gpm.	500 °C./100 gpm.	400 °C./100 gpm.	300 °C./100 gpm.	200 °C./100 gpm.	100 °C./100 gpm.
−50	0.967	0.966	0.965	0.965	0.964	0.963	0.961	0.959	0.955	0.951	0.943	0.928	0.886
−45	.960	.959	.958	.957	.956	.954	.953	.949	.943	.936	.923	.900	.838
−40	.951	.950	.948	.947	.945	.944	.939	.934	.925	.913	.896	.863	.775
−35	.937	.936	.934	.931	.930	.926	.920	.911	.900	.882	.857	.810	.698
−30	.918	.917	.913	.910	.907	.903	.893	.882	.866	.842	.807	.746	.615
−25	0.893	0.890	0.887	0.882	0.877	0.872	0.858	0.842	0.820	0.790	0.746	0.673	0.531
−20	.860	.855	.850	.844	.838	.830	.814	.794	.767	.730	.677	.596	.454
−15	.819	.813	.806	.798	.790	.782	.762	.736	.703	.661	.603	.520	.388
−10	.771	.763	.755	.745	.735	.725	.701	.672	.637	.592	.532	.452	.335
− 5	.714	.705	.695	.686	.675	.664	.637	.606	.569	.524	.467	.393	.293
0	0.655	0.645	0.634	0.624	0.613	0.601	0.573	0.542	0.505	0.462	0.409	0.345	0.262
5	.594	.584	.574	.563	.552	.539	.513	.482	.447	.408	.361	.306	
10	.536	.527	.516	.506	.495	.483	.457	.429	.398	.362	.323	.276	
15	.482	.473	.463	.453	.443	.432	.409	.384	.356	.325	.291	.253	
20	.434	.426	.417	.408	.398	.389	.368	.346	.322	.296			
25	0.393	0.385	0.377	0.370	0.361	0.353	0.334	0.315	0.295	0.273			
30	.358	.352	.345	.338	.330	.323	.307	.291	.273				
35	.329	.324	.318	.311	.305	.299	.285	.271	.256				
40	.306	.301	.295	.290	.285	.279	.267						
45	.287	.282	.278	.273	.268	.263	.253						
50	0.271	0.267	0.263	0.259									

* Harrison, L. P., unpublished manuscript, 1948.

Table 80

PSEUDOADIABATIC LAPSE RATE

Ice stage

The pseudoadiabatic equation for the ice stage recommended by the Aerological Commission of the International Meteorological Organization (Toronto, 1947) is

$$(c_p + r_i c_i)dT/T - Rdp'/p' + d(r_i L_s/T) = 0$$

where:

c_p = specific heat of dry air at constant pressure (work units),
c_i = specific heat of ice (work units),
R = gas constant for dry air (work units),
L_s = latent heat of sublimation (work units),
r_i = mixing ratio at saturation with respect to ice,
p' = partial pressure of dry air,
T = absolute temperature.

Upon introducing the hydrostatic equation and the definition of geopotential,

$$dT/d\Phi = -Y/X \text{ °C./100 gpm.*}$$

where:

Φ = geopotential,
$Y = 9.8 \times 10^6 \frac{(1 + r_i)(RT + r_i L_s)}{RT}$,
$X = c_p + r_i \left[c_i + dL_s/dT - L_s/T + 1/k \frac{d \log_e e_i}{dT} (RT + r_i L_s + kL_s) \right]$,
k = ratio of the molecular weight of water vapor to that of dry air = 0.62197,
e_i = saturation vapor pressure over ice.

In performing the computations a constant value of $c_p = 1.005 \times 10^7$ erg. g.$^{-1}$ °K.$^{-1}$ was assumed.

Temperature °C.	Pressure—millibars						
	1000 °C./100 gpm.	850 °C./100 gpm.	700 °C./100 gpm.	500 °C./100 gpm.	300 °C./100 gpm.	200 °C./100 gpm.	100 °C./100 gpm.
−85					0.975	0.975	0.974
−80					.974	.974	.973
−75	0.975	0.975	0.975	0.974	.974	.973	.972
−70	.974	.974	.974	.974	.973	.972	.969
−65	.974	.973	.973	.972	.971	.969	.964
−60	0.972	0.972	0.971	0.971	0.967	0.965	0.953
−55	.971	.970	.969	.967	.962	.955	.936
−50	.967	.967	.966	.961	.952	.940	.908
−45	.963	.960	.957	.951	.935	.917	.864
−40	.953	.951	.945	.934	.908	.879	.803
−35	0.941	0.935	0.927	0.909	0.869	0.827	0.723
−30	.921	.911	.900	.872	.817	.758	.629
−25	.892	.878	.861	.822	.747	.675	.532
−20	.851	.833	.808	.758	.667	.584	.441
−15	.799	.775	.743	.683	.580	.495	.364
−10	0.735	0.706	0.669	0.601	0.495	0.416	0.304
− 5	.663	.630	.590	.520	.419	.349	.258
0	.586	.553	.512	.445	.354	.296	.225

* Harrison, L. P., unpublished manuscript.

RATE OF CONDENSATION IN ASCENDING MOIST AIR[1]

The rate of condensation per unit cross-section area in an adiabatically ascending shallow layer of saturated air may be expressed by

$$R_w = \rho_d \Delta z \frac{dr_w}{dt} \qquad (1)$$

where

ρ_d = partial density of dry air,
Δz = vertical thickness of the layer under consideration,
r_w = saturation mixing ratio over water (g./g.),
t = time,
R_w = rate of condensation (rain stage).

A similar equation can be obtained for the snow stage by replacing r_w by r_i, the saturation mixing ratio over ice.

Fulks has shown that for a layer of air 100 meters thick (through which the density may be considered uniform) and ascending at a vertical velocity w, the rate of condensation R_w expressed in millimeters depth of water per hour can be written

$$R_w = (1 + r_w) \left[\frac{780}{T} \frac{de_w}{dT} \gamma_w - 2665 \frac{e_w}{T^2} \right] w + r_w \frac{474}{T} \frac{de_w}{dT} \gamma_w w \qquad (2)$$

where

e_w = saturation vapor pressure over water (mb.),
T = temperature, (°K.),
γ_w = saturated pseudoadiabatic lapse rate, rain stage, (°C./100 gpm.),
w = vertical velocity (m. sec.$^{-1}$).

Since r_w is ordinarily small in comparison with unity, equation (2) for a vertical velocity of 1 meter per second is approximately

$$R_w = \frac{780}{T} \frac{de_w}{dT} \gamma_w - 2665 \frac{e_w}{T^2} \qquad (3)$$

Corresponding equations for R_i, the rate of condensation in millimeters depth of water for the snow stage, are obtained by replacing e_w by e_i, the saturated vapor pressure over ice; γ_w by γ_i, the pseudoadiabatic lapse rate for the snow stage; r_w by r_i.

Table 81 contains values of R_w computed from equation (2) for a layer 100 meters thick having an upward motion of 1 meter per second. Values of R_i are shown in parentheses. When the rate of condensation in layers of other thickness or having different vertical speeds is desired, select a mean value of R_w (or R_i) for each 100-meter layer, multiply by the appropriate vertical velocity in meters per second, and sum the results for the various layers. Or an approximate result may be obtained by selecting a mean R_w (or R_i) for the whole layer and multiplying by the thickness in hundreds of meters and the upward speed in meters per second.

It should be noted that modifications introduced by turbulent mixing, radiation and other nonadiabatic processes, and the effect of the air in sustaining the condensate, have been neglected. These effects must be considered in determining the rate of precipitation as actually observed at the ground.

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[1] Fulks, J. R., Month. Weath. Rev., vol. 63, p. 291, 1935.

(*continued*)

RATE OF CONDENSATION IN ASCENDING MOIST AIR

Rain stage *

Temperature	Pressure—millibars 1050	1000	950	900	850	800	700	600	500	400	300
°C.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
−50	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		(.01)			(.01)		(.01)		(.01)		(.01)
−45	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
		(.02)			(.02)		(.02)		(.02)		(.02)
−40	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
		(.04)			(.04)		(.04)		(.04)		(.04)
−35	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.07
		(.06)			(.06)		(.06)		(.06)		(.06)
−30	.12	.12	.12	.12	.12	.12	.11	.11	.11	.11	.10
		(.10)			(.10)		(.10)		(.09)		(.09)
−25	.17	.17	.17	.17	.16	.16	.16	.16	.15	.15	.14
		(.15)			(.15)		(.14)		(.14)		(.12)
−20	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.21	0.20	0.19	0.17
		(.22)			(.21)		(.20)		(.19)		(.16)
−15	.31	.31	.31	.30	.30	.30	.29	.28	.26	.24	.21
		(.30)			(.29)		(.28)		(.25)		(.20)
−10	.41	.40	.40	.39	.38	.38	.36	.34	.32	.29	.25
		(.40)			(.38)		(.36)		(.31)		(.24)
− 5	.51	.50	.49	.48	.47	.46	.44	.41	.38	.34	.28
		(.52)			(.48)		(.44)		(.37)		(.27)
0	.62	.60	.59	.58	.56	.55	.51	.48	.43	.38	.31
		(.63)			(.58)		(.52)		(.43)		(.30)
5	0.72	0.70	0.69	0.67	0.65	0.63	0.58	0.53	0.47	0.41	0.33
10	.82	.80	.77	.75	.72	.70	.64	.58	.51	.43	.34
15	.90	.88	.85	.82	.79	.76	.69	.62	.54	.45	.35
20	.97	.94	.91	.88	.84	.80	.73	.64	.55	.46	
25	1.03	1.00	.96	.92	.88	.84	.75	.66	.57	.46	
30	1.08	1.04	1.00	0.96	0.91	0.86	0.77	0.67	0.57		
35	1.10	1.06	1.02	.97	.92	.88	.78	.67	.57		
40	1.13	1.08	1.02	.98	.93	.88	.77				
45	1.13	1.08	1.03	.98	.93	.87	.77				
50	1.13	1.08	1.03	.98							

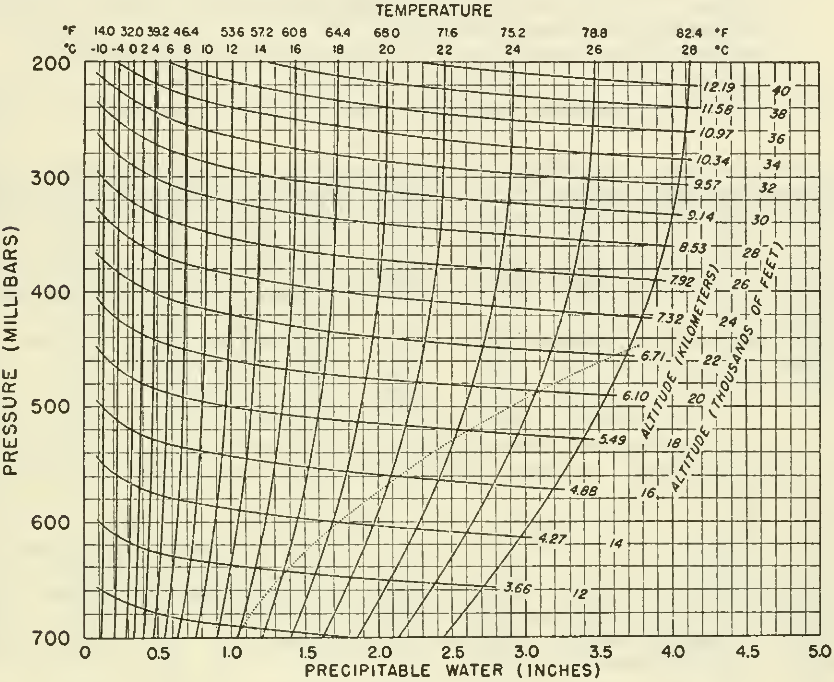
* Values in parentheses refer to the snow stage.

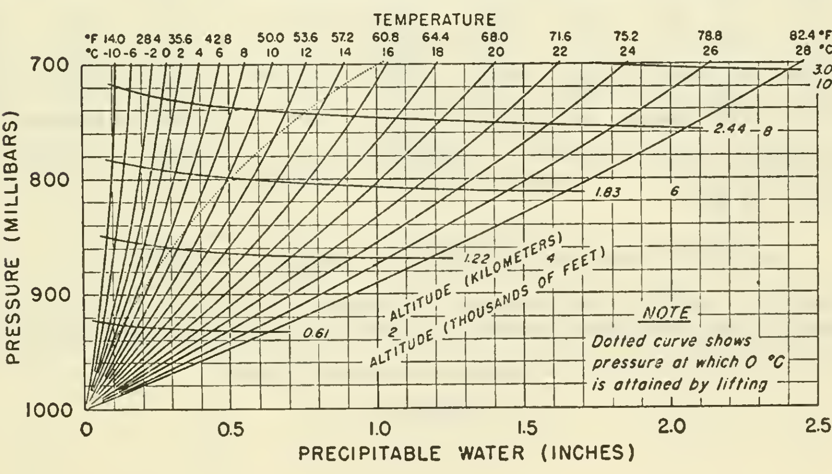
TABLE 82

PRECIPITABLE WATER IN A SATURATED PSEUDOADIABATIC ATMOSPHERE

If all the water vapor in a column of air were precipitated, the depth of water which would accumulate is defined as the depth of "precipitable water" of the column. The chart[1] below gives the precipitable water (inches) of a column between the 1000-mb. surface and any pressure surface aloft in a saturated pseudoadiabatic atmosphere (Table 78) as a function of the 1000-mb. temperature of the pseudoadiabat (pseudo-wet-bulb potential temperature, °C. or °F.). Altitude lines represent heights above the 1000-mb. surface in a pseudoadiabatic atmosphere.

[1] Prepared by the Hydrometerological Section, U. S. Weather Bureau.





LIFTING CONDENSATION LEVEL DATA

Lifting condensation temperature.—If a parcel of air is lifted adiabatically to its condensation level with the potential temperature and the mixing ratio remaining constant,

$$\frac{e}{T^{\frac{1}{k}}} = \frac{e_{sc}}{T_c^{\frac{1}{k}}} \tag{1}$$

$$\text{or} \quad \log T^{\frac{1}{k}} - \log e = -\log\left(e_{sc}/T_c^{\frac{1}{k}}\right) \tag{2}$$

where

T = initial temperature, °K.,
e = vapor pressure of the space at the initial temperature,
T_c = temperature at the condensation level, °K.,
e_{sc} = saturation vapor pressure at the temperature of the condensation level,
$k = R/c_p = 0.286$.

To find the lifting condensation temperature if the *temperature* and *dew point* at the initial level are given, determine $\log T^{\frac{1}{k}}$ corresponding to the temperature (°C.) at the initial level from part A of Table 83. In accordance with equation (2) subtract from this the value of $\log e$ corresponding to the initial dew-point temperature (°C.) as determined from part B thus obtaining the difference, $-\log\left(e_{sc}/T_c^{\frac{1}{k}}\right)$. Enter part C with this difference as the tabular value. The corresponding argument is the condensation temperature (°C.).

If the *temperature* and *relative humidity* at the initial level are given, (2) may be rewritten

$$\log (U/100) + \log\left(e_s/T^{\frac{1}{k}}\right) = \log\left(e_{sc}/T_c^{\frac{1}{k}}\right) \tag{3}$$

where U is the "approximate" relative humidity[1] and e_s is the saturation vapor pressure at the initial temperature. To obtain the lifting condensation temperature determine the value of $-\log\left(e_s/T^{\frac{1}{k}}\right)$ corresponding to the initial temperature (°C.) from part C, add to this the value of $-\log (U/100)$ from part D. As shown by equation (3) the sum is $-\log\left(e_{sc}/T_c^{\frac{1}{k}}\right)$. Enter part C of the table with this sum as the tabular value. The corresponding argument is the condensation temperature (°C.).

Lifting condensation pressure.—The corresponding condensation pressure p_c may be obtained by means of Poisson's equation

$$\frac{\theta}{T_c} = \left(\frac{1000}{p_c}\right)^k \tag{4}$$

where θ is the potential temperature, °K. Values of p_c may be computed with the aid of Table 77 which tabulates the function $\left(\frac{1000}{p}\right)^k$. A more rapid means of determining the lifting condensation pressure for processes occuring at potential temperatures of 302.16, 314.16, or 330.16 °K. is provided by part E. Introducing Poisson's equation into equation (3) gives

$$\log (U/100) + \log\left\{e_s/\left[\theta/\left(\frac{1000}{p}\right)^k\right]^{\frac{1}{k}}\right\} = \log\left\{e_{sc}/\left[\theta/\left(\frac{1000}{p_c}\right)^k\right]^{\frac{1}{k}}\right\} \tag{5}$$

where p is the pressure at the initial level. Note that e_s and e_{sc} are the saturation vapor pressures at the temperatures as given by the associated expressions inside the square

[1] $U = e/e_s \times 100$. See Table 93 for definition of true relative humidity.

(*continued*)

LIFTING CONDENSATION LEVEL DATA

brackets. Part E of Table 83 contains values of $-\log\left\{e_s/\left[\theta/\left(\frac{1000}{p}\right)^k\right]^{\frac{1}{k}}\right\}$ for $\theta =$ 302.16, 314.16, 330.16 °K. as a function of p. To obtain the lifting condensation pressure, determine the value of $-\log\left\{e_s/\left[\theta/\left(\frac{1000}{p}\right)^k\right]^{\frac{1}{k}}\right\}$ at the initial pressure p and the potential temperature θ from part E, add to this the value of $-\log\ (U/100)$ from part D. As shown by equation (5) this sum is $-\log\left\{e_{sc}/\left[\theta/\left(\frac{1000}{p_c}\right)^k\right]^{\frac{1}{k}}\right\}$. Enter part E with this sum as the tabular value in the given potential temperature column. The corresponding argument is the condensation pressure p_c.

TABLE 83 A. $\log T^{\frac{1}{k}}$

Temperature °C.	0	1	2	3	4	5	6	7	8	9
−50	8.212									
−40	8.279	8.272	8.265	8.259	8.252	8.246	8.239	8.232	8.225	8.219
−30	8.342	8.336	8.330	8.323	8.317	8.311	8.304	8.298	8.291	8.285
−20	8.403	8.397	8.391	8.385	8.379	8.373	8.367	8.361	8.355	8.349
−10	8.462	8.457	8.451	8.445	8.439	8.433	8.427	8.421	8.415	8.409
− 0	8.519	8.513	8.508	8.502	8.497	8.491	8.485	8.480	8.474	8.468
0	8.519	8.524	8.530	8.536	8.541	8.546	8.552	8.557	8.563	8.568
10	8.574	8.579	8.584	8.590	8.595	8.600	8.605	8.611	8.616	8.621
20	8.626	8.631	8.637	8.642	8.647	8.652	8.657	8.662	8.667	8.672
30	8.677	8.682	8.687	8.692	8.697	8.702	8.707	8.712	8.717	8.722
40	8.726	8.731	8.736	8.741	8.746	8.751	8.755	8.760	8.765	8.769
50	8.774									

TABLE 83 B. $\log e$

Temperature °C.	0	1	2	3	4	5	6	7	8	9
−50	−1.197									
−40	−0.723	−0.769	−0.814	−0.860	−0.907	−0.954	−1.002	−1.050	−1.098	−1.147
−30	−0.293	−0.335	−0.376	−0.418	−0.461	−0.503	−0.546	−0.590	−0.634	−0.678
−20	0.098	0.061	0.023	−0.016	−0.054	−0.093	−0.132	−0.172	−0.212	−0.253
−10	0.457	0.422	0.388	0.352	0.317	0.281	0.245	0.209	0.173	0.136
− 0	0.786	0.754	0.722	0.690	0.658	0.625	0.592	0.558	0.525	0.491
0	0.786	0.817	0.848	0.879	0.910	0.940	0.971	1.001	1.030	1.060
10	1.089	1.118	1.147	1.175	1.203	1.232	1.259	1.287	1.314	1.342
20	1.369	1.396	1.422	1.448	1.475	1.501	1.526	1.552	1.577	1.603
30	1.628	1.653	1.677	1.702	1.726	1.750	1.774	1.798	1.821	1.845
40	1.868	1.891	1.914	1.937	1.959	1.982	2.004	2.026	2.048	2.070
50	2.091									

(*continued*)

LIFTING CONDENSATION LEVEL DATA

TABLE 83 C. $-\log\left(e_s/T^{\frac{1}{k}}\right)$

Temperature °C.	0	1	2	3	4	5	6	7	8	9
−50	9.409									
−40	9.002	9.041	9.080	9.119	9.159	9.200	9.241	9.282	9.324	9.366
−30	8.636	8.671	8.706	8.742	8.778	8.814	8.851	8.888	8.925	8.963
−20	8.305	8.337	8.369	8.401	8.433	8.466	8.500	8.533	8.567	8.601
−10	8.006	8.034	8.063	8.092	8.122	8.152	8.182	8.212	8.243	8.274
− 0	7.733	7.759	7.786	7.812	7.839	7.866	7.893	7.921	7.949	7.977
0	7.733	7.707	7.682	7.656	7.631	7.606	7.581	7.557	7.532	7.508
10	7.485	7.461	7.438	7.414	7.391	7.369	7.346	7.324	7.301	7.279
20	7.258	7.236	7.214	7.193	7.172	7.151	7.131	7.110	7.090	7.070
30	7.050	7.030	7.010	6.990	6.971	6.952	6.933	6.914	6.895	6.877
40	6.859	6.840	6.822	6.804	6.787	6.769	6.751	6.734	6.717	6.700
50	6.683									

TABLE 83 D. $-\log\ (U/100)$

Relative humidity %	0	1	2	3	4	5	6	7	8	9
90	0.046	0.041	0.036	0.032	0.027	0.022	0.018	0.013	0.009	0.004
80	.097	.092	.086	.081	.076	.071	.066	.060	.056	.051
70	.155	.149	.143	.137	.131	.125	.119	.114	.108	.102
60	.222	.215	.208	.201	.194	.187	.180	.174	.167	.161
50	.301	.292	.284	.276	.268	.260	.252	.244	.237	.229
40	0.398	0.387	0.377	0.367	0.357	0.347	0.337	0.328	0.319	0.310
30	.523	.509	.495	.481	.469	.456	.444	.432	.420	.409
20	.699	.678	.658	.638	.620	.602	.585	.569	.553	.538
10	1.000	.959	.921	.886	.854	.824	.796	.770	.745	.721
0	—	2.000	1.699	1.523	1.398	1.301	1.222	1.155	1.097	1.046

TABLE 83 E. $-\log\left\{e_s/\left[\theta/\left(\frac{1000}{p}\right)^k\right]^{\frac{1}{k}}\right\}$

Pressure mb.	Potential temperature—°K. 302.16	314.16	330.16	Pressure mb.	Potential temperature—°K. 302.16	314.16	330.16	Pressure mb.	Potential temperature—°K. 302.16	314.16	330.16
1040	7.002			770	7.551	7.293		500	8.477	8.167	7.795
1030	7.019			760	7.577	7.317	7.008	490	8.525	8.212	7.837
1020	7.035			750	7.603	7.342	7.031	480	8.574	8.258	7.880
1010	7.052			740	7.629	7.367	7.054	470	8.625	8.306	7.924
1000	7.069			730	7.656	7.392	7.078	460	8.677	8.355	7.970
990	7.087			720	7.684	7.418	7.102	450	8.731	8.406	8.017
980	7.105			710	7.712	7.445	7.127	440	8.786	8.458	8.066
970	7.123			700	7.741	7.472	7.152	430	8.843	8.512	8.116
960	7.141			690	7.770	7.500	7.177	420	8.902	8.568	8.168
950	7.160			680	7.800	7.528	7.203	410	8.964	8.626	8.222
940	7.178			670	7.831	7.557	7.230	400	9.027	8.686	8.277
930	7.198			660	7.862	7.586	7.257	390	9.093	8.748	8.335
920	7.217			650	7.894	7.616	7.285	380	9.161	8.812	8.395
910	7.237			640	7.927	7.647	7.314	370	9.232	8.879	8.457
900	7.257	7.016		630	7.960	7.679	7.343	360	9.305	8.948	8.521
890	7.277	7.036		620	7.994	7.711	7.373	350	9.382	9.020	8.589
880	7.298	7.055		610	8.029	7.744	7.403	340		9.095	8.658
870	7.319	7.075		600	8.065	7.778	7.435	330		9.174	8.731
860	7.340	7.095		590	8.102	7.812	7.467	320		9.256	8.807
850	7.362	7.116		580	8.140	7.848	7.500	310		9.341	8.887
840	7.384	7.136		570	8.178	7.884	7.533	300		9.431	8.970
830	7.407	7.158		560	8.218	7.921	7.568	290			9.058
820	7.430	7.179		550	8.258	7.959	7.603	280			9.149
810	7.453	7.201		540	8.300	7.999	7.640	270			9.246
800	7.477	7.224		530	8.342	8.039	7.677	260			9.347
790	7.501	7.246		520	8.386	8.080	7.715	250			9.454
780	7.526	7.269		510	8.431	8.123	7.755				

THERMODYNAMIC PROPERTIES OF MOIST AIR

All material contained in Tables 84-92 has been specially prepared for this volume by John A. Goff [1] and Serge Gratch.[2] The data are calculated on the basis of the *Goff-Gratch formulation* of the thermodynamic properties of air and water vapor. The basic references for this formulation are:

1. "Final Report of the Working Subcommittee of the International Joint Committee on Psychrometric Data," by J. A. Goff. Paper presented before the American Society of Mechanical Engineers, December 1948. Amer. Soc. Mech. Eng. Trans., vol. 71, 1949.
2. "Thermodynamic Properties of Moist Air," by J. A. Goff and S. Gratch, Trans. Amer. Soc. Heat. and Vent. Eng., vol. 51, pp. 125-128, 1945. Also: Heating, Piping & Air Conditioning, ASHVE Journal Section, vol. 17, pp. 334-348, 1945.
3. "Low Pressure Properties of Water from − 160 to 212 F," by J. A. Goff and S. Gratch. Trans. Amer. Soc. Heat. and Vent. Eng., vol. 52, pp. 95-129, 1946.

At the Toronto (1947) meetings of the International Meteorological Organization, the Aerological Commission, Subcommission on Physical Functions and Tables recommended [3] the adoption of "the most acceptable values of aerological constants and functions consistent with (a) present-day observational knowledge, (b) thermodynamic logic, and (c) theoretical and practical requirements of aerology." It also recommended agreement with those values adopted by the Working Subcommittee of the International Joint Committee on Psychrometric Data (see reference 1, above). With this in view, the Aerological Commission recommended the adoption of the *Goff-Gratch formulation* of the thermodynamic properties of air and water vapor. These recommendations were later approved by the I. M. O. Twelfth Conference of Directors (Washington, 1947).

The formulation provides for a consistent and logical system for the values of the various thermodynamic parameters. In order to take into account the deviations of the density of air and water vapor from ideal gas laws, the compressibility factors C and C_v were introduced into the respective equations of state (see Tables 84 and 91). The modifications in the saturation vapor pressure over water and ice due to the presence of air has been taken into account by the introduction of the factors f_w and f_i respectively (see Tables 89 and 90).[4]

The unit of energy used throughout the discussion and tables to follow is the International Steam Tables calorie, ITcal. (see Introduction, p. 4). Equations and footnotes have been numbered consecutively in Tables 84-92 because of the frequent use of cross references.

All computations were carried out in the University of Pennsylvania Thermodynamic Research Laboratory operated under contract with the Navy Department, Office of Naval Research.

Relative humidity.—For the purpose of thermodynamic analysis, moist air is to be regarded as a mixture of only two constituents, namely, dry air and water vapor. The mass of water vapor per unit mass of dry air is a convenient parameter in terms of which to express the relative composition of the mixture. This parameter is called the mixing ratio of the moist air and is denoted by the symbol r. At any pressure p and temperature T within certain limits,[5] moist air can coexist in neutral or metastable equilibrium, over a

[1] Dean, Towne Scientific School, University of Pennsylvania; Director, University of Pennsylvania Thermodynamic Research Laboratory.

[2] Assistant Professor of Mechanical Engineering, Towne Scientific School, University of Pennsylvania; Project Leader, University of Pennsylvania Thermodynamic Research Laboratory.

[3] I. M. O. Aerological Commission, Doc. 25, Toronto, 1947.

[4] See also Sheppard, P. A., The physical properties of air with reference to meteorological practice and air conditioning engineer. A paper presented before the American Society of Mechanical Engineers in December 1948, Amer. Soc. Mech. Eng. Trans., vol. 71, 1949.

[5] At any given temperature T there is a lowest pressure $p = e_w(T)$ for saturation with respect to liquid, where $e_w(T)$ denotes the saturation pressure of pure water vapor with respect to liquid water. At and below this pressure, $r_w(p, T)$ ceases to exist and relative humidity, therefore, is not defined.

At any given pressure p there is a highest temperature, namely, the solution of $e_w(T) = p$, for saturation with respect to liquid water. At and above this temperature, $r_w(p, T)$ ceases to exist and relative humidity, therefore, is not defined.

(*continued*)

THERMODYNAMIC PROPERTIES OF MOIST AIR

relatively flat surface of separation, with an associated *liquid* phase. When capable of such coexistence, the moist air is said to be *saturated with respect to liquid* and its mixing ratio r assumes a definite value $r_w(p, T)$ depending on the pressure p and temperature T. According to the redefinition, moist air at pressure p, temperature T, and mixing ratio r is said to have relative humidity U, expressed decimally,

$$U = r/r_w \tag{1}$$

Thermodynamic temperature.—The Second Law of Thermodynamics asserts the existence of a universal temperature function T which, according to experimental and other evidence, is strictly proportional to the zero-pressure value of the pressure-volume product in the case of a gas or gas mixture. The relation

$$(pv)^\circ = R^*T \tag{2}$$

where v denotes volume per mol and the superscript ° refers specifically to zero pressure, has come to be regarded as exact. For practical purposes, the so-called Kelvin scale may be defined by arbitrary assignment of the value 273.17 °K. to the triple point of pure ordinary water, the corresponding ice-point temperature being

$$T_0 = 273.16 \text{ °K.} \tag{3}$$

In terms of the Kelvin degree (°K.) thus defined, the present best value of the universal gas constant R^* is that recommended in 1941 by Birge,[6] namely,

$$R^* = 8.31436 \times 10^7 \text{ erg °K.}^{-1} \text{ gmol.}^{-1} \tag{4}$$

From the Kelvin scale T(°K.) is derived the so-called *thermodynamic* Celsius (centigrade) scale t(°C.) through the relation,

$$t = T - T_0 \tag{5}$$

It departs from the scale of the platinum resistance thermometer, that is, from the *international* Celsius scale, by at most 0.008 °C. in the range 0 to 100 °C.; and the departure itself is known in this range with an accuracy probably better than 0.002 °C. It is temperature on this *thermodynamic* Celsius scale that is used as independent argument in the tables to follow.

TABLE 84

COMPRESSIBILITY FACTOR OF MOIST AIR

(Further explanation on p. 331. See also p. 295.)

The compressibility factor C of moist air is defined by[7]

$$pv = C(1 + r/\epsilon)RT, \tag{6}$$

where v is the volume of moist air per unit mass of dry air according to the *Goff-Gratch formulation*, ϵ is the ratio of the molecular weight of water ($M_v = 18.016$ g. gmol^{-1}) to the apparent molecular weight of dry air ($M = 28.966$ g. gmol^{-1}), namely,

$$\epsilon = 0.62197; \tag{7}$$

and R is the gas constant for dry air, namely,

$$R = 0.28704 \times 10^7 \text{ erg g.}^{-1} \text{ °K.}^{-1}$$
$$= 6.8557 \times 10^{-2} \text{ ITcal. g.}^{-1} \text{ °K.}^{-1} \tag{8}$$

In Table 84 are listed values of compressibility factor C as a function of pressure p, thermodynamic Celsius temperature t, and relative humidity U. Linear interpolation is valid throughout the table. To aid interpolation, zero-pressure values for dry air ($r = 0$) are listed in the column $U = 0$ even though relative humidity is not defined at this pressure (see footnote 5, p. 331). In the region covered by Table 84, the compressibility factor C lies between 1.0000 and 0.9956, which means that its departure from unity can safely be disregarded in rough calculations.

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[6] Birge, R. T., Rev. Mod. Phys., vol. 13, pp. 233-239, 1941.

[7] Equaion (6) can also be written as $\rho = p/CRT_v$ where ρ is the density of the moist air and T_v is its virtual temperature (see Table 72).

(*continued*)

COMPRESSIBILITY FACTOR OF MOIST AIR

Pressure mb.	Temperature °C.	Relative humidity 0%
0	−100	1.0000
300		0.9988
700		0.9972
1100		0.9956
0	− 90	1.0000
300		0.9990
700		0.9977
1100		0.9964
0	− 80	1.0000
300		0.9992
700		0.9981
1100		0.9970
0	− 70	1.0000
300		0.9993
700		0.9984
1100		0.9975
0	− 60	1.0000
300		0.9994
700		0.9987
1100		0.9979
0	− 50	1.0000
300		0.9995
700		0.9989
1100		0.9983
0	− 40	1.0000
300		0.9996
700		0.9991
1100		0.9986
0	− 30	1.0000
300		0.9997
700		0.9993
1100		0.9988
0	− 20	1.0000
300		0.9997
700		0.9994
1100		0.9990
0	− 10	1.0000
300		0.9998
700		0.9995
1100		0.9992

Pressure	Temperature	Relative humidity, %				
mb.	°C.	0	25	50	75	100
0	0	1.0000				
300		0.9998	0.9998	0.9998	0.9998	0.9998
700		0.9996	0.9996	0.9996	0.9996	0.9996
1100		0.9994	0.9994	0.9994	0.9993	0.9993
0	10	1.0000				
300		0.9999	0.9999	0.9998	0.9998	0.9998
700		0.9997	0.9997	0.9997	0.9997	0.9996
1100		0.9995	0.9995	0.9995	0.9995	0.9994
0	20	1.0000				
300		0.9999	0.9999	0.9998	0.9998	0.9997
700		0.9997	0.9997	0.9997	0.9997	0.9996
1100		0.9996	0.9996	0.9996	0.9995	0.9995
0	30	1.0000				
300		0.9999	0.9999	0.9998	0.9997	0.9996
700		0.9998	0.9998	0.9997	0.9997	0.9996
1100		0.9997	0.9997	0.9996	0.9996	0.9995
0	40	1.0000				
300		0.9999	0.9998	0.9996	0.9994	0.9992
700		0.9999	0.9998	0.9997	0.9996	0.9994
1100		0.9998	0.9997	0.9997	0.9996	0.9995
0	50	1.0000				
300		0.9999				
700		0.9999	0.9998	0.9996	0.9993	0.9990
1100		0.9999	0.9998	0.9996	0.9994	0.9992
0	60	1.0000				
300		1.0000				
700		0.9999	0.9997	0.9996	0.9988	0.9982
1100		0.9999	0.9997	0.9996	0.9991	0.9987

ENTHALPY RESIDUAL OF MOIST AIR

(Further explanation on p. 331.)

The enthalpy residual Δh of moist air is defined by

$$h = \frac{7}{2} R \left[t + \frac{8}{7} (r/\epsilon)(t + 1354.74) \right] + \Delta h, \tag{9}$$

where h is the enthalpy of moist air per unit mass of dry air according to the *Goff-Gratch formulation.* The constant 1354.74 °C. is the numerical value of the quantity, $\epsilon L_v(0)/4R$, where $L_v(0)$ is the latent heat of vaporization of water at 0 °C. (Table 92).

In Table 85 are listed values of enthalpy residual Δh as a function of pressure p, temperature t, and relative humidity U. The unit of energy is the International Steam Tables calorie (ITcal.) defined in terms of the absolute watthour (whr) by the conversion factor, 860/1.00019 ITcal. whr^{-1}, which is equivalent to

$$1 \text{ ITcal.} = 4.18684 \times 10^7 \text{ erg} \tag{10}$$

making

$$R = 0.068557 \text{ ITcal. °K.}^{-1} \text{ (gram dry air)}^{-1} \tag{11}$$

The enthalpy of moist air is a relative quantity subject to augmentation by amount $A + rB$, where A and B are constants that can be disposed of quite arbitrarily. For the present purpose, the residual Δh has arbitrarily been assigned the value *zero* at $r = 0$, $t = 0$ °C., $p = 0$; the quantity $\Delta h/r$ has arbitrarily been assigned the value *zero* at $r = \infty$, $t = 0$ °C., $p = e_w(0) = 6.1078$ millibars in conformity with the usual steam tables practice.

Linear interpolation is valid throughout Table 85. Below 0 °C. the dependence of enthalpy residual on relative humidity is entirely negligible. To aid interpolation, zero-pressure values for dry air ($r = 0$) are listed in the column $U = 0$ even though relative humidity is not defined at this pressure (see footnote 5, p. 331). In the region covered by Table 85, the enthalpy residual lies between -0.20 and $+0.05$ ITcal. (gram dry air)$^{-1}$, which means that it can safely be disregarded in rough calculations.

(*continued*)

ENTHALPY RESIDUAL OF MOIST AIR

Unit of Δh: ITcal. (gram dry air)$^{-1}$

Pressure mb.	Temperature °C.	Relative humidity 0%
0	−100	0.05
300		0.00
700		−0.07
1100		−0.14
0	− 90	0.04
300		0.00
700		−0.06
1100		−0.12
0	− 80	0.03
300		−0.01
700		−0.06
1100		−0.11
0	− 70	0.03
300		−0.01
700		−0.05
1100		−0.10
0	− 60	0.02
300		−0.01
700		−0.05
1100		−0.10
0	− 50	0.02
300		−0.01
700		−0.05
1100		−0.09
0	− 40	0.01
300		−0.01
700		−0.05
1100		−0.09
0	− 30	0.01
300		−0.01
700		−0.05
1100		−0.08
0	− 20	0.01
300		−0.02
700		−0.05
1100		−0.08
0	− 10	0.00
300		−0.02
700		−0.05
1100		−0.08

Pressure	Temperature	Relative humidity, %				
mb.	°C.	0	25	50	75	100
0	0	0.00				
300		−0.02	−0.02	−0.02	−0.02	−0.02
700		−0.05	−0.05	−0.05	−0.05	−0.05
1100		−0.07	−0.07	−0.07	−0.07	−0.07
0	10	0.00				
300		−0.02	−0.02	−0.02	−0.02	−0.02
700		−0.04	−0.04	−0.05	−0.05	−0.05
1100		−0.07	−0.07	−0.07	−0.07	−0.07
0	20	0.00				
300		−0.02	−0.02	−0.02	−0.02	−0.03
700		−0.04	−0.04	−0.04	−0.04	−0.05
1100		−0.06	−0.06	−0.07	−0.07	−0.07
0	30	0.00				
300		−0.02	−0.02	−0.02	−0.03	−0.04
700		−0.04	−0.04	−0.04	−0.04	−0.05
1100		−0.06	−0.06	−0.06	−0.06	−0.07
0	40	0.00				
300		−0.02	−0.01	−0.02	−0.04	−0.07
700		−0.03	−0.03	−0.04	−0.05	−0.06
1100		−0.05	−0.06	−0.06	−0.06	−0.07
0	50	0.00				
300		−0.01				
700		−0.03	−0.03	−0.04	−0.07	−0.10
1100		−0.05	−0.05	−0.06	−0.07	−0.09
0	60	0.01				
300		−0.01				
700		−0.02	−0.03	−0.06	−0.12	−0.20
1100		−0.04	−0.04	−0.06	−0.10	−0.15

ENTROPY RESIDUAL OF MOIST AIR

(Further explanation on p. 331.)

The entropy residual Δs of moist air is defined by

$$s = \frac{7}{2} R[\log_e (T/p^{2/7}) - 5.61010]$$
$$+ 4R(r/\epsilon)[\log_e (T/p^{1/4}) + 1.15901]$$
$$+ R[(r/\epsilon) \log_e (r/\epsilon) - (1 + r/\epsilon) \log_e (1 + r/\epsilon)]$$
$$+ \Delta s, \qquad (12)$$

where s is the entropy of moist air per unit mass of dry air according to the *Goff-Gratch formulation.* The constant 5.61010 is the numerical value of $\log_e T$; the constant 1.15901 is that of the quantity, $\epsilon L_v(0)/4RT_0 - \log_e T_0 + \frac{1}{4} \log_e e_w(0)$, where $e_w(0)$ is the saturation pressure of water vapor with respect to liquid at 0 °C. In using (12) it is to be understood that absolute temperature is to be expressed in Kelvin degrees and pressure in millibars.

In Table 86 are listed values of entropy residual Δs as a function of pressure p, temperature t, and relative humidity U. The entropy of moist air, like its enthalpy, is a relative quantity subject to augmentation by amount $A + rB$, where A and B are constants that can be disposed of quite arbitrarily. For the present purpose, the residual Δs has arbitrarily been assigned the value *zero* at $r = 0$, $t = 0$ °C., $p = 0$; the quantity $\Delta s/r$ has arbitrarily been assigned the value *zero* at $r = \infty$, $t = 0$ °C., $p = 6.1078$ millibars in conformity with the usual steam tables practice.

Linear interpolation is valid throughout Table 86. Below 0 °C. the dependence of entropy residual on relative humidity is entirely negligible. To aid interpolation, zero-pressure values for dry air ($r = 0$) are listed in the column $U = 0$ even though relative humidity is not defined at this pressure (see footnote 5, p. 331). In the region covered by Table 86, the entropy residual lies between −0.00054 and +0.00023 ITcal. °K.$^{-1}$ (gram dry air)$^{-1}$, which means that it can be safely disregarded in rough calculations.

The third line of (12) is the so-called *mixing entropy* s_m of moist air per unit mass of dry air. It is a function of mixing ratio only and is represented as such in Table 87 since space limitations preclude the tabulation of it as a function of pressure, temperature, and relative humidity at close enough intervals for linear interpolation.

ENTROPY RESIDUAL OF MOIST AIR

Unit of Δs: ITcal. °K.$^{-1}$ (gram dry air)$^{-1}$

Pressure mb.	Temperature °C.	Relative humidity 0%
0	−100	.00022
300		.00001
700		−.00027
1100		−.00054
0	−90	.00018
300		.00001
700		−.00023
1100		−.00046
0	−80	.00015
300		.00000
700		−.00020
1100		−.00040
0	−70	.00012
300		−.00001
700		−.00018
1100		−.00036
0	−60	.00010
300		−.00001
700		−.00017
1100		−.00032
0	−50	.00008
300		−.00002
700		−.00016
1100		−.00029
0	−40	.00006
300		−.00003
700		−.00015
1100		−.00027
0	−30	.00004
300		−.00004
700		−.00015
1100		−.00026
0	−20	.00002
300		−.00005
700		−.00015
1100		−.00024
0	−10	.00001
300		−.00006
700		−.00014
1100		−.00023

Pressure	Temperature	Relative humidity, %				
mb.	°C.	0	25	50	75	100
0	0	.00000				
300		−.00006	−.00006	−.00006	−.00006	−.00006
700		−.00014	−.00014	−.00014	−.00014	−.00014
1100		−.00022	−.00022	−.00022	−.00022	−.00022
0	10	−.00001				
300		−.00006	−.00006	−.00006	−.00006	−.00006
700		−.00013	−.00013	−.00013	−.00014	−.00014
1100		−.00021	−.00021	−.00021	−.00021	−.00021
0	20	−.00001				
300		−.00006	−.00006	−.00006	−.00006	−.00007
700		−.00013	−.00012	−.00013	−.00013	−.00013
1100		−.00019	−.00019	−.00019	−.00020	−.00020
0	30	−.00001				
300		−.00006	−.00005	−.00005	−.00007	−.00009
700		−.00012	−.00012	−.00012	−.00012	−.00014
1100		−.00018	−.00018	−.00018	−.00019	−.00019
0	40	−.00001				
300		−.00005	−.00003	−.00004	−.00009	−.00016
700		−.00010	−.00010	−.00011	−.00012	−.00016
1100		−.00016	−.00016	−.00016	−.00018	−.00020
0	50	.00000				
300		−.00004				
700		−.00009	−.00008	−.00010	−.00015	−.00022
1100		−.00014	−.00014	−.00015	−.00018	−.00023
0	60	.00002				
300		−.00002				
700		−.00007	−.00005	−.00011	−.00023	−.00041
1100		−.00012	−.00011	−.00014	−.00022	−.00032

TABLE 87

MIXING ENTROPY OF MOIST AIR

(Explanation on p. 336.)

Unit of s_m: ITcal. °K.$^{-1}$ (gram dry air)$^{-1}$

r g./g.	s_m	r g./g.	s_m	r g./g.	s_m	r g./g.	s_m
0	0	0.005	0.00321	0.040	0.01665	0.20	0.05027
0.0005	0.00045	.006	.00373	.045	.01816	.22	.0533
.0010	.00082	.007	.00424	.050	.01962	.24	.0562
.0015	.00116	.008	.00473	.055	.02103	.26	.0590
.0020	.00149	.009	.00520	.060	.02239	.28	.0616
0.0025	0.00180	0.010	0.00566	0.065	0.02371	0.30	0.0641
.0030	.00210	.011	.00612	.070	.02499	.32	.0665
.0035	.00238	.012	.00656	.075	.02623	.34	.0689
.0040	.00267	.013	.00699	.080	.02745	.36	.0711
.0045	.00294	.014	.00741	.085	.02863	.38	.0733
0.0050	0.00321	0.015	0.00783	0.090	0.02978	0.40	0.0754
		.016	.00824	.095	.03091	.42	.0774
		.017	.00864	.100	.03201	.44	.0794
		.018	.00904	.105	.03309	.46	.0813
		.019	.00943	.110	.03414	.48	.0832
		0.020	0.00982	0.115	0.03518	0.50	0.0850
		.021	.01020	.120	.03619	.52	.0867
		.022	.01057	.125	.03719	.54	.0885
		.023	.01094	.130	.03816	.56	.0901
		.024	.01131	.135	.03912	.58	.0918
		0.025	0.01167	0.140	0.04006	0.60	0.0933
		.026	.01202	.145	.04099	.62	.0949
		.027	.01238	.150	.04190	.64	.0964
		.028	.01272	.155	.04280	.66	.0979
		.029	.01307	.160	.04368	.68	.0993
		0.030	0.01341	0.165	0.04454	0.70	0.1007
		.031	.01375	.170	.04540	.72	.1021
		.032	.01408	.175	.04624	.74	.1035
		.033	.01441	.180	.04707	.76	.1048
		.034	.01474	.185	.04789	.78	.1061
		0.035	0.01507	0.190	0.04869	0.80	0.1074
		.036	.01539	.195	.04949		
		.037	.01571	.200	.05027		
		.038	.01602				
		.039	.01634				
		0.040	0.01665				

ISOBARIC SPECIFIC HEAT RESIDUAL OF MOIST AIR

(Further explanation on p. 331.)

The isobaric specific heat residual Δc_p of moist air is defined by

$$c_p = \frac{7}{2} R \left[1 + \frac{8}{7} (r/\epsilon) \right] + \Delta c_p,$$

$$= 0.2399 + 0.4409r + \Delta c_p \qquad (13)$$

where c_p is derivable from the *Goff-Gratch formulation* by means of the identical relation, $c_p = (\partial h / \partial T)_{p,\, r}$. Values are listed in Table 88 as a function of pressure p, temperature t, and relative humidity U. In the range covered by this table the isobaric specific heat residual lies between —0.0009 and +0.0068 ITcal. °K.$^{-1}$ (gram dry air)$^{-1}$.

ISOBARIC SPECIFIC HEAT RESIDUAL OF MOIST AIR

Unit of Δc_p: ITcal. °K.$^{-1}$ (gram dry air)$^{-1}$

Pressure mb.	Temperature °C.	Relative humidity 0%
0	—100	—.0006
300		.0000
700		.0009
1100		.0017
0	— 90	—.0006
300		—.0001
700		.0006
1100		.0013
0	— 80	—.0006
300		—.0001
700		.0004
1100		.0010
0	— 70	—.0005
300		—.0002
700		.0003
1100		.0008
0	— 60	—.0005
300		—.0002
700		.0002
1100		.0007
0	— 50	—.0005
300		—.0002
700		.0002
1100		.0005
0	— 40	—.0005
300		—.0002
700		.0001
1100		.0004
0	— 30	—.0004
300		—.0002
700		.0001
1100		.0004
0	— 20	—.0004
300		—.0002
700		.0001
1100		.0003
0	— 10	—.0003
300		—.0001
700		.0001
1100		.0003

Pressure mb.	Temperature °C.	Relative humidity, % 0	25	50	75	100
0	0	—.0002				
300		—.0001	—.0001	.0000	.0000	.0000
700		.0001	.0001	.0001	.0001	.0002
1100		.0003	.0003	.0003	.0003	.0003
0	10	—.0001				
300		.0000	.0000	.0001	.0001	.0002
700		.0002	.0002	.0002	.0002	.0003
1100		.0004	.0004	.0004	.0004	.0004
0	20	.0000				
300		.0001	.0002	.0003	.0004	.0006
700		.0003	.0003	.0003	.0004	.0005
1100		.0004	.0004	.0005	.0005	.0006
0	30	.0001				
300		.0002	.0004	.0006	.0010	.0014
700		.0003	.0004	.0005	.0007	.0008
1100		.0005	.0005	.0006	.0007	.0008
0	40	.0002				
300		.0003	.0007	.0014	.0023	.0035
700		.0004	.0006	.0008	.0012	.0016
1100		.0006	.0007	.0008	.0010	.0013
0	50	.0004				
300		.0004				
700		.0006	.0009	.0015	.0023	.0032
1100		.0007	.0009	.0012	.0017	.0023
0	60	.0005				
300		.0006				
700		.0007	.0015	.0028	.0046	.0068
1100		.0008	.0013	.0020	.0030	.0043

THE COEFFICIENTS f_w AND f_i

(Further explanation on p. 331.)

Given values of pressure p, temperature t, and relative humidity U, it is necessary first to calculate the corresponding value of mixing ratio r from (1) before attempting to calculate those of volume v, enthalpy h, entropy s, and isobaric specific heat c_p—all per unit mass of dry air—from (6), (9), (12), and (13), respectively. This obviously requires information regarding the saturation mixing ratio $r_w(p, T)$.

The function $f_w(p, T)$ is defined by

$$r_w = \epsilon f_w e_w / (p - f_w e_w), \tag{14}$$

where $e_w(T)$ is the saturation pressure of pure water vapor with respect to liquid. It may be well to mention that as pressure p approaches $e_w(T)$ from above at any temperature the coefficient f_w approaches unity.

It is frequently necessary in other connections to have information regarding the mixing ratio of moist air at saturation with respect to ice, that is, regarding the function $r_i(p, T)$. Similarly, the auxiliary function $f_i(p, T)$ is defined by

$$r_i = \epsilon f_i e_i / (p - f_i e_i), \tag{15}$$

where $e_i(T)$ is the saturation pressure of pure water vapor with respect to ice. The coefficient f_i approaches unity as pressure p approaches $e_i(T)$ from above at any temperature.

The *Goff-Gratch formulation* includes explicit expressions for the functions $e_w(T)$ and $e_i(T)$ (see Tables 94-97).

Values of the coefficients f_w and f_i calculated from the *Goff-Gratch formulation* are listed in Table 89 and Table 90, respectively. Within the ranges covered by these tables, f_w lies between 1.0000 and 1.0065 while f_i lies between 1.0000 and 1.0089. These departures from unity may be ascribed to three separate though not unrelated effects: (a) the effect of dissolved gases on the properties of the condensed phase, (b) the effect of pressure on the properties of the condensed phase, (c) the effect of intermolecular force (gas imperfections) on the properties of the moist air itself. While it is true that these departures are small enough to be disregarded in rough calculations, it should be kept in mind that the error thus committed may well exceed the probable error of the saturation pressure data themselves.

TABLE 89

THE COEFFICIENT f_w

Temperature °C.	Pressure—millibars										
	5	10	30	50	100	200	300	500	700	900	1100
−50	1.0000	1.0001	1.0002	1.0003	1.0006	1.0012	1.0018	1.0030	1.0042	1.0053	1.0065
−40	1.0001	1.0001	1.0002	1.0003	1.0006	1.0011	1.0017	1.0027	1.0038	1.0049	1.0060
−30	1.0001	1.0001	1.0002	1.0003	1.0006	1.0011	1.0016	1.0026	1.0036	1.0046	1.0055
−20	1.0001	1.0002	1.0003	1.0004	1.0006	1.0011	1.0015	1.0024	1.0034	1.0043	1.0052
−10	1.0001	1.0002	1.0004	1.0005	1.0007	1.0011	1.0015	1.0024	1.0032	1.0041	1.0049
0		1.0002	1.0005	1.0006	1.0008	1.0012	1.0016	1.0024	1.0032	1.0040	1.0047
10					1.0010	1.0014	1.0018	1.0025	1.0032	1.0040	1.0047
20					1.0012	1.0016	1.0020	1.0027	1.0034	1.0041	1.0048
30							1.0023	1.0030	1.0037	1.0044	1.0050
40							1.0026	1.0034	1.0041	1.0048	1.0054
50								1.0037	1.0045	1.0052	1.0059
60									1.0048	1.0056	1.0064

TABLE 90

THE COEFFICIENT f_i

Temperature °C.	Pressure—millibars 5	10	30	50	100	200	300	500	700	900	1100
−100	1.0001	1.0001	1.0003	1.0005	1.0010	1.0020	1.0030				
− 90	1.0000	1.0001	1.0003	1.0004	1.0009	1.0018	1.0027	1.0045			
− 80	1.0000	1.0001	1.0002	1.0004	1.0008	1.0016	1.0024	1.0040	1.0057	1.0073	1.0089
− 70	1.0000	1.0001	1.0002	1.0004	1.0007	1.0015	1.0022	1.0036	1.0051	1.0066	1.0080
− 60	1.0000	1.0001	1.0002	1.0003	1.0007	1.0013	1.0020	1.0033	1.0046	1.0059	1.0073
− 50	1.0000	1.0001	1.0002	1.0003	1.0006	1.0012	1.0018	1.0030	1.0042	1.0054	1.0066
− 40	1.0001	1.0001	1.0002	1.0003	1.0006	1.0011	1.0017	1.0028	1.0039	1.0050	1.0061
− 30	1.0001	1.0001	1.0002	1.0003	1.0006	1.0011	1.0016	1.0026	1.0036	1.0046	1.0056
− 20	1.0001	1.0002	1.0003	1.0004	1.0006	1.0011	1.0015	1.0024	1.0034	1.0043	1.0052
− 10	1.0001	1.0002	1.0004	1.0005	1.0007	1.0011	1.0015	1.0024	1.0033	1.0041	1.0050
0		1.0002	1.0005	1.0006	1.0008	1.0012	1.0016	1.0024	1.0032	1.0040	1.0048

TABLE 91

PROPERTIES OF WATER VAPOR

(Further explanation on p. 331.)

The *compressibility factor* C_v of water vapor is defined by

$$\rho_v = e/C_v R_v T, \qquad (19)$$

where ρ_v is its density according to the *Goff-Gratch formulation*, e is its pressure, and R_v is the gas constant for water vapor, namely,

$$\begin{aligned} R_v &= 0.46150 \times 10^7 \text{ erg g.}^{-1} \text{ °K.}^{-1} \\ &= 0.110226 \text{ ITcal. g.}^{-1} \text{ °K.}^{-1} \end{aligned} \qquad (20)$$

Values of compressibility factor C_v are listed in Table 91.

The enthalpy, entropy, and isobaric specific heat residuals of water vapor are defined by the equations

$$\begin{aligned} h_v &= 4R_v(t + 1354.74) + \Delta h_v \\ s_v &= 4R_v[\log_e (T/e^{1/4}) + 1.15901] + \Delta s_v \\ c_{pv} &= 4R_v + \Delta c_{pv} = 0.4409 + \Delta c_{pv} \end{aligned} \qquad (21)$$

Each of these expressions is obtained from the corresponding one for moist air on dividing the latter through by mixing ratio r and then putting $r = \infty$. Clearly, therefore, h_v denotes the enthalpy of water vapor per unit mass of water vapor, that is, *specific* enthalpy—and similarly for s_v and c_{pv}.

Values of the above residuals are listed in Table 91 along with values of the compressibility factor C_v. Linear interpolation is valid throughout. In the whole range covered by the table, namely, − 100 to 60 °C. by 0 to 199.26 millibars, the compressibility factor lies between 1.0000 and 0.9948, the enthalpy residual lies between − 0.6 and + 0.4 ITcal. gm.$^{-1}$ the entropy residual lies between − 0.0012 and + 0.0013 ITcal. g.$^{-1}$ °K.$^{-1}$ and the isobaric specific heat residual lies between + 0.0009 and + 0.0241 ITcal. g.$^{-1}$ °K.$^{-1}$

As mentioned previously, values of the saturation pressure of water vapor with respect to liquid $e_w(T)$ and with respect to ice $e_i(T)$ as calculated from the *Goff-Gratch formulation* appear in Tables 94-97. From the evidence currently available, extrapolation of the formula for $e_w(T)$ to obtain values of the saturation pressure with respect to undercooled liquid down to − 50 °C. appears to be justified pending further research.

(*continued*)

PROPERTIES OF WATER VAPOR

C_v = compressibility factor of water vapor, dimensionless,
Δh_v = enthalpy residual of water vapor, ITcal. g.$^{-1}$,
Δs_v = entropy residual of water vapor, ITcal. g.$^{-1}$ °K.$^{-1}$,
Δc_{pv} = isobaric specific heat residual of water vapor, ITcal. g.$^{-1}$ °K.$^{-1}$

Temperature °C.		Vapor pressure—mb. 0	e_i	e_w
−100	C_v	1.0000	1.0000	
	Δh_v	—.1	—.1	
	Δs_v	—.0004	—.0004	
	Δc_{pv}	.0009	.0009	
− 90	C_v	1.0000	1.0000	
	Δh_v	—.1	—.1	
	Δs_v	—.0004	—.0004	
	Δc_{pv}	.0010	.0010	
− 80	C_v	1.0000	1.0000	
	Δh_v	.0	—.1	
	Δs_v	—.0003	—.0003	
	Δc_{pv}	.0011	.0011	
− 70	C_v	1.0000	1.0000	
	Δh_v	.0	.0	
	Δs_v	—.0003	—.0003	
	Δc_{pv}	.0012	.0012	
− 60	C_v	1.0000	1.0000	
	Δh_v	.0	.0	
	Δs_v	—.0002	—.0002	
	Δc_{pv}	.0014	.0014	
− 50	C_v	1.0000	1.0000	1.0000
	Δh_v	.0	.0	.0
	Δs_v	—.0001	—.0002	—.0002
	Δc_{pv}	.0015	.0017	.0017
− 40	C_v	1.0000	1.0000	1.0000
	Δh_v	.0	.0	.0
	Δs_v	—.0001	—.0001	—.0001
	Δc_{pv}	.0017	.0020	.0021

Temperature °C.		Vapor pressure—mb. 0	e_i	e_w
−30	C_v	1.0000	.9999	.9999
	Δh_v	.0	.0	.0
	Δs_v	.0000	.0000	—.0001
	Δc_{pv}	.0020	.0025	.0027
−20	C_v	1.0000	.9999	.9998
	Δh_v	.0	.0	.0
	Δs_v	.0001	.0000	.0000
	Δc_{pv}	.0023	.0032	.0034
−10	C_v	1.0000	.9997	.9997
	Δh_v	.1	.0	.0
	Δs_v	.0002	.0000	.0000
	Δc_{pv}	.0027	.0042	.0043
0	C_v	1.0000	.9995	.9995
	Δh_v	.1	.0	.0
	Δs_v	.0003	.0000	.0000
	Δc_{pv}	.0031	.0056	.0056
10	C_v	1.0000		.9992
	Δh_v	.1		.0
	Δs_v	.0004		.0000
	Δc_{pv}	.0036		.0073
20	C_v	1.0000		.9988
	Δh_v	.2		—.1
	Δs_v	.0005		—.0001
	Δc_{pv}	.0041		.0094
30	C_v	1.0000		.9982
	Δh_v	.2		—.1
	Δs_v	.0007		—.0003
	Δc_{pv}	.0047		.0121

Temperature °C.		Vapor pressure—mb. 0	50	100	150	e_w
40	C_v	1.0000	.9982			.9973
	Δh_v	.3	—.1			—.2
	Δs_v	.0009	.0000			—.0005
	Δc_{pv}	.0054	.0119			.0153
50	C_v	1.0000	.9985	.9969		.9962
	Δh_v	.3	.0	—.3		—.4
	Δs_v	.0011	.0003	—.0004		—.0008
	Δc_{pv}	.0061	.0111	.0166		.0193
60	C_v	1.0000	.9987	.9974	.9961	.9948
	Δh_v	.4	.1	—.1	—.4	—.6
	Δs_v	.0013	.0007	—.0001	—.0006	—.0012
	Δc_{pv}	.0069	.0108	.0150	.0195	.0241

PROPERTIES OF CONDENSED WATER, LATENT AND SPECIFIC HEATS

(Further explanation on p. 331.)

In Table 92 are listed values of the isobaric specific heats c_i and c_w of solid (ice) and liquid water, respectively. In order to obtain those of c_w below 0 °C. it was necessary to extrapolate the *Goff-Gratch formula* for $e_w(T)$ and the Smith-Keyes liquid volume data.[8] Only the former extrapolation contributes appreciable uncertainty to the results, but the justification for relying upon it pending further research has been discussed elsewhere.[9]

In Table 92 are also listed values of the pressure derivative of c_w, namely, $(\partial c_w/\partial p)_T$ above 0 °C. No attempt has been made to calculate values for temperatures below 0 °C. because of the uncertainty of present knowledge regarding c_w itself at these temperatures.

In Table 92 are also listed values of the latent heats of vaporization, fusion, and sublimation as calculated from the *Goff-Gratch formulation*. Values for undercooled liquid are consistent with and, therefore, subject to the same extrapolation uncertainties as are the values of c_w.

PROPERTIES OF CONDENSED WATER, LATENT AND SPECIFIC HEATS

c_i = specific heat of ice, ITcal. g.$^{-1}$ °K.$^{-1}$,
c_w = specific heat of water, ITcal. g.$^{-1}$ °K.$^{-1}$,
$(\partial c_w/\partial p)_T$ = pressure derivative of c_w at constant temperature, 10^{-8} ITcal. g.$^{-1}$ °K.$^{-1}$ mb.$^{-1}$,
L_v = latent heat of vaporization of water, ITcal. g.$^{-1}$,
L_f = latent heat of fusion of water, ITcal. g.$^{-1}$,
L_s = latent heat of sublimation of water, ITcal. g.$^{-1}$

Temperature °C.	c_i	c_w	$(\partial c_w/\partial p)_T$	L_v	L_f	L_s
−100	0.330					674.4
− 90	.346					675.4
− 80	.363					676.3
− 70	.380					677.0
− 60	.397					677.5
− 50	.415	1.3		629.3	48.6	677.9
− 40	.433	1.14		621.7	56.3	678.0
− 30	.450	1.08		615.0	63.0	678.0
− 20	.468	1.04		608.9	69.0	677.9
− 10	.485	1.02		603.0	74.5	677.5
0	.503	1.0074		597.3	79.7	677.0
0		1.0074	0.9	597.31		
5		1.0037	.8	594.5		
10		1.0013	.8	591.7		
15		0.9998	.7	588.9		
20		.9988	.7	586.0		
25		.9983	.7	583.2		
30		.9980	.7	580.4		
35		.9979	.6	577.6		
40		.9980	.6	574.7		
45		.9982	.6	571.9		
50		.9985	.6	569.0		
55		.9989	.6	566.1		
60		.9994	.6	563.2		

[8] Smith, L. B., and Keyes, F. G., Proc. Amer. Acad. Arts and Sci., vol. 69, pp. 285-314, 1934.

[9] Goff, J. A., Final report of the Working Subcommittee of the International Joint Committee on Psychrometric Data. A paper presented before the American Society of Mechanical Engineers in December 1948, Amer. Soc. Mech. Eng. Trans., vol. 71, 1949.

Section VII

HYGROMETRIC AND PSYCHROMETRIC TABLES

DEFINITIONS AND SPECIFICATIONS OF WATER VAPOR IN THE ATMOSPHERE[1]

The Conference of Directors, International Meteorological Organization, Washington, 1947, decided to adopt the following definitions and specifications of the parameters of water vapor in the atmosphere:

(1) **The mixing ratio** r of moist air is the ratio of the mass m_v of water vapor to the mass m_a of dry air with which the water vapor is associated.

$$r = m_v/m_a$$

(2) **The specific humidity,** mass concentration or moisture content q of moist air is the ratio of the mass m_v of water vapor to the mass $(m_v + m_a)$ of moist air in which the mass of water vapor m_v is contained.

$$q = \frac{m_v}{m_v + m_a}$$

(3) **Vapor concentration** (density of water vapor in a mixture) **or absolute humidity.**—For a mixture of water vapor and dry air the vapor-concentration d_v is defined as the ratio of the mass of vapor m_v to the volume V occupied by the mixture.

$$d_v = \frac{m_v}{V}$$

(4) **The vapor pressure** e' **of water vapor in moist air** at total pressure p and with mixing ratio r is defined by:

$$e' = \frac{r}{0.62197 + r}\, p$$

(5) **Saturation.**—Moist air at temperature T and at total pressure p is said to be saturated if its composition is such that it can coexist in neutral equilibrium with a plane surface of pure condensed phase (water or ice) at the same temperature and pressure.

(6) **Saturation mixing ratio.**—The symbol r_w denotes saturation mixing ratio of moist air with respect to a plane surface of pure water. The symbol r_i denotes saturation mixing ratio of moist air with respect to a plane surface of pure ice.

(7) **Saturation vapor pressure in the pure phase.**—The saturation vapor pressure e_w of pure aqueous vapor with respect to water is the pressure of the vapor when in a state of neutral equilibrium with a plane surface of pure water at the same temperature and pressure; similarly for e_i in respect to ice. e_w and e_i are temperature-dependent functions only; i.e.

$$e_w = e_w(T)$$
$$e_i = e_i(T)$$

(8) **Saturation vapor pressure of moist air.**—The saturation vapor pressure with respect to water e'_w of moist air at pressure p and temperature T is defined by:

$$e'_w = \frac{r_w}{0.62197 + r_w}\, p$$

Similarly, the saturation vapor pressure with respect to ice e'_i of moist air at pressure p and temperature T is defined by:

$$e'_i = \frac{r_i}{0.62197 + r_i}\, p$$

(9) **Relations between saturation vapor pressures of pure phase and of moist air.**—In the meteorological range of pressure and temperature the following relations hold with an error of 0.5 percent or less:[2]

$$e'_w = e_w$$
$$e'_i = e_i$$

(10) **The thermodynamic dew-point temperature** T_d of moist air at temperature T, pressure p and mixing ratio r is the temperature to which the air must be cooled in order that it shall be saturated with respect to water at the initial pressure p and mixing ratio r.

[1] Resolution 166, International Meteorological Organization, Conference of Directors, Washington, 1947.
[2] See Tables 89 and 90 for the exact relationship.

(*continued*)

DEFINITIONS AND SPECIFICATIONS OF WATER VAPOR IN THE ATMOSPHERE

(11) **The thermodynamic frost-point temperature** T_f of moist air at temperature T, pressure p and mixing ratio r is the temperature to which the air must be cooled in order that it shall be saturated with respect to ice at the initial pressure p and mixing ratio r.

(12) **The dew- and frost-point temperatures,** so defined, are related with the mixing ratio and total pressure p by the respective equations:

$$e'_w(T_d) = \frac{r}{0.62197 + r}\,p$$

$$e'_i(T_f) = \frac{r}{0.62197 + r}\,p$$

(13)* **The relative humidity** U (in percent) of moist air is defined by:

$$U = 100\,\frac{r}{r_w}$$

where r is the mixing ratio of moist air at pressure p and temperature T and r_w the saturation mixing ratio at the same pressure and temperature.

NOTE.—At the Philadelphia meeting (May 6, 1950) of the International Joint Committee on Psychrometric Data, resolutions were adopted giving definitions of relative humidity different from the above. These may be paraphrased as follows:

(a) In regard to a mixture of air and water vapor under given conditions of barometric pressure and temperature at which saturation of air is *possible,* relative humidity is the ratio of the mol fraction of water vapor in the mixture to the mol fraction of water vapor in a mass of air saturated with water vapor at the given barometric pressure and temperature.

(b) In regard to a mixture of air and water vapor or a sample of pure water vapor unadmixed with any other substance under given conditions of barometric pressure and temperature at which saturation is *impossible,* relative humidity is the ratio of the partial pressure of water vapor in the mixture or sample to the saturation pressure of pure water at the given temperature.

The Committee adopted (b) subject to verification. The mol fraction of water vapor in any mixture is the number of mols, or molecules, of water vapor in the mixture divided by the total number of mols, or molecules, of all constituents in the mixture.

$$\text{Mol fraction of water vapor} = \frac{r}{r + (m_w/m)}$$

(14) **Relative humidity at temperatures less than 0°C.** is to be evaluated with respect to water. The advantages of this procedure are as follows:

(a) Most hygrometers which are essentially responsive to the relative humidity indicate relative humidity with respect to water at all temperatures.
(b) The majority of clouds at temperatures below 0 °C. consist of water, or mainly of water.
(c) Relative humidities greater than 100 percent would in general not be observed. This is of particular importance in synoptic weather messages, since the atmosphere is often supersaturated with respect to ice at temperatures below 0 °C.
(d) The majority of existing records of relative humidity at temperatures below 0 °C. are expressed on a basis of saturation with respect to water.

(15)* **The thermodynamic wet-bulb temperature** T_w of moist air at pressure p, temperature T and mixing ratio r is the temperature which this air assumes when water is introduced gradually by infinitesimal amounts at the current temperatures and evaporated into the air by an adiabatic process at constant pressure until saturation is reached.

T_w is determined by the equation

$$\log\frac{L_v(T_w)}{L_v(T)} = \frac{c_{pv} - c_w}{c_{pv}}\log\frac{c_p + c_{pv}r}{c_p + c_{pv}r_w(T_w)}$$

where:

$L_v(T)$ = heat of vaporization of water at temperature T,
$L_v(T_w)$ = heat of vaporization of water at temperature T_w,
c_w = specific heat of liquid water,
$r_w(T_w)$ = saturation mixing ratio with respect to water at pressure p and temperature T_w,
c_p = specific heat of dry air at constant pressure, and
c_{pv} = specific heat of water vapor at constant pressure.

Here c_p and c_{pv} are assumed to be independent of temperature in the interval T_w to T . . .

(continued)

DEFINITIONS AND SPECIFICATIONS OF WATER VAPOR IN THE ATMOSPHERE

The relationship between T_w as defined and the wet-bulb temperature as indicated by a particular psychrometer is a matter to be determined by carefully controlled experiment, taking account of the various parameters concerned; e.g., ventilation, size of thermometer bulb, radiation, etc.[3]

(16)* **The thermodynamic equivalent temperature** T_e of moist air at pressure p, temperature T and mixing ratio r, is the temperature which the air assumes by means of adiabatic condensation at constant pressure of all the water vapor which it contains, the condensed water falling out of the system immediately.

T_e is determined by the equation

$$\log \frac{L_v(T_e)}{L_v(T)} = \frac{c_{pv} - c_w}{c_{pv}} \log\left(1 + \frac{c_{pv}}{c_p} r\right)$$

where:

$L_v(T)$ = heat of vaporization of water at temperature T,
$L_v(T_e)$ = heat of vaporization of water at temperature T_e,
c_w = specific heat of liquid water,
c_p = specific heat of dry air at constant pressure,
c_{pv} = specific heat of water vapor at constant pressure.

Here c_p and c_{pv} are assumed to be independent of temperature in the interval T_w to T_e.

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[3] The Working Subcommittee of the International Joint Committee on Psychrometric Data (Goff, J. A., Amer. Soc. Mech. Eng. Trans., vol. 71, 1949) recommends as preferable that thermodynamic wet-bulb temperature be defined as the solution $T_w(p, T, r)$ of the equation:

$$h(p, T, r) - r \cdot h'_w(p, T_w) = h_s(p, T_w) - r_w(p, T_w) \cdot h'_w(p, T_w)$$

where $h(p, T, r)$ = specific enthalpy of moist air, $h'_w(p, T_w)$ = specific enthalpy of pure compressed liquid (or solid) water, and $h_s(p, T_w)$ = specific enthalpy of saturated air at pressure p and temperature T_w. This definition combines the correct energy and weight accountings for the steady-flow process of injecting pure compressed liquid (or solid) water at pressure p and temperature T_w into a stream of moist air at pressure p, temperature T, and mixing ratio r to bring the air adiabatically to saturation at pressure p and temperature T_w. This is to be regarded as the appropriate idealization of the actual process by which the thin film of water on a wet-bulb thermometer immersed in a stream of moist air maintains, at any rate for a time, a steady value below that of the air itself.

* Definitions (13), (15), and (16) were rescinded and the definitions in note (a) under (13) and in footnote 3 were adopted for relative humidity and for thermodynamic wet-bulb temperature by the WMO Commission for Aerology, First Session, Toronto, 1953, and approved by the Executive Committee, WMO, 1953.

SATURATION VAPOR PRESSURE TABLES

Resolution 164 of the Twelfth Conference of Directors of the International Meteorological Organization (Washington, 1947) adopted the *Goff-Gratch*[1] *formulation* for the saturation vapor pressure in the pure phase over plane surfaces of pure water and pure ice:

$$\log_{10} e_w = -7.90298(T_s/T - 1) + 5.02808 \log_{10}(T_s/T) \qquad (1)$$
$$- 1.3816 \times 10^{-7}(10^{11.344(1-T/T_s)} - 1)$$
$$+ 8.1328 \times 10^{-3}(10^{-3.19149(T_s/T-1)} - 1) + \log_{10} e_{ws},$$

and

$$\log_{10} e_i = -9.09718(T_0/T - 1) - 3.56654 \log_{10}(T_0/T) \qquad (2)$$
$$+ 0.876793(1 - T/T_0) + \log_{10} e_{i0},$$

where:

e_w = saturation vapor pressure over a plane surface of pure ordinary liquid water (mb.),
e_i = saturation vapor pressure of a plane surface of pure ordinary water ice (mb.),
T = absolute (thermodynamic) temperature (°K.),
T_s = steam-point temperature (373.16 °K.),
T_0 = ice-point temperature (273.16 °K.),
e_{ws} = saturation pressure of pure ordinary liquid water at steam-point temperature (1 standard atmosphere = 1013.246 mb.),
e_{i0} = saturation pressure of pure ordinary water ice at ice-point temperature (0.0060273 standard atmosphere = 6.1071 mb.).

The Goff-Gratch formulas are based on integration of the Clausius-Clapeyron equation considering the deviations from a perfect gas, and on modern experimental data. The stated range of validity of (1) is 0° to 100 °C. Since there is a dearth of experimental data on vapor pressure over supercooled water and the necessary thermodynamic data for an exact integration of the Clausius-Clapeyron equation do not exist, no completely satisfactory formula exists for the vapor pressure over liquid water at temperatures below 0 °C. However, direct extrapolation of (1) gives values of e_w in the middle of the range suggested by other investigators and has been adopted for the range 0° to − 50 °C. pending further research.

Values for each half degree centigrade and whole degree Fahrenheit were computed from (1) and (2), and values for each 0.1° were obtained by interpolation (Newton's method), with the exception of the few values in Table 94 for $T > 100$ °C., which were computed from Keyes[2] formula:

$$\log_{10} e_w \text{ (mm. of mercury)} = -2892.3693/T$$
$$- 2.892736 \log_{10} T - 4.9369728 \times 10^{-3} T + 5.606905 \times 10^{-6} T^2$$
$$- 4.645869 \times 10^{-9} T^3 + 3.7874 \times 10^{-12} T^4 + 19.3011421.$$

The small difference between e_w and e_i at 0 °C. (32 °F.) arises from the fact that the triple point for water is 0.01 °C.

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[1] Goff, J. A., and Gratch, S., Trans. Amer. Soc. Heat. and Vent. Eng., vol. 52, p. 95, 1946. Also see Tables 84-92.

[2] Keyes, F. G., Journ. Chem. Phys., vol. 15, No. 8, pp. 602-12, 1947.

TABLE 94

SATURATION VAPOR PRESSURE OVER WATER

(Explanation on p. 350.)

Metric units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−50	0.06356									
−49	0.07124	0.07044	0.06964	0.06885	0.06807	0.06730	0.06654	0.06578	0.06503	0.06429
−48	0.07975	0.07886	0.07797	0.07710	0.07624	0.07538	0.07453	0.07370	0.07287	0.07205
−47	0.08918	0.08819	0.08722	0.08625	0.08530	0.08435	0.08341	0.08248	0.08156	0.08065
−46	0.09961	0.09852	0.09744	0.09637	0.09531	0.09426	0.09322	0.09220	0.09118	0.09017
−45	0.1111	0.1099	0.1087	0.1075	0.1063	0.1052	0.1041	0.1030	0.1018	0.1007
−44	0.1239	0.1226	0.1213	0.1200	0.1187	0.1174	0.1161	0.1149	0.1136	0.1123
−43	0.1379	0.1364	0.1350	0.1335	0.1321	0.1307	0.1293	0.1279	0.1266	0.1252
−42	0.1534	0.1518	0.1502	0.1486	0.1470	0.1455	0.1440	0.1424	0.1409	0.1394
−41	0.1704	0.1686	0.1669	0.1651	0.1634	0.1617	0.1600	0.1583	0.1567	0.1550
−40	0.1891	0.1872	0.1852	0.1833	0.1815	0.1796	0.1777	0.1759	0.1740	0.1722
−39	0.2097	0.2076	0.2054	0.2033	0.2013	0.1992	0.1971	0.1951	0.1931	0.1911
−38	0.2323	0.2299	0.2276	0.2253	0.2230	0.2207	0.2185	0.2162	0.2140	0.2119
−37	0.2571	0.2545	0.2520	0.2494	0.2469	0.2444	0.2419	0.2395	0.2371	0.2347
−36	0.2842	0.2814	0.2786	0.2758	0.2730	0.2703	0.2676	0.2649	0.2623	0.2597
−35	0.3139	0.3108	0.3077	0.3047	0.3017	0.2987	0.2957	0.2928	0.2899	0.2870
−34	0.3463	0.3429	0.3396	0.3362	0.3330	0.3297	0.3265	0.3233	0.3201	0.3170
−33	0.3818	0.3781	0.3745	0.3708	0.3673	0.3637	0.3602	0.3567	0.3532	0.3497
−32	0.4205	0.4165	0.4125	0.4085	0.4046	0.4007	0.3968	0.3930	0.3893	0.3855
−31	0.4628	0.4584	0.4541	0.4497	0.4454	0.4412	0.4370	0.4328	0.4287	0.4246
−30	0.5088	0.5040	0.4993	0.4946	0.4899	0.4853	0.4807	0.4762	0.4717	0.4672
−29	0.5589	0.5537	0.5485	0.5434	0.5383	0.5333	0.5283	0.5234	0.5185	0.5136
−28	0.6134	0.6077	0.6021	0.5966	0.5911	0.5856	0.5802	0.5748	0.5694	0.5642
−27	0.6727	0.6666	0.6605	0.6544	0.6484	0.6425	0.6366	0.6307	0.6249	0.6191
−26	0.7371	0.7304	0.7238	0.7172	0.7107	0.7042	0.6978	0.6914	0.6851	0.6789
−25	0.8070	0.7997	0.7926	0.7854	0.7783	0.7713	0.7643	0.7574	0.7506	0.7438
−24	0.8827	0.8748	0.8671	0.8593	0.8517	0.8441	0.8366	0.8291	0.8217	0.8143
−23	0.9649	0.9564	0.9479	0.9396	0.9313	0.9230	0.9148	0.9067	0.8986	0.8906
−22	1.0538	1.0446	1.0354	1.0264	1.0173	1.0084	0.9995	0.9908	0.9821	0.9734
−21	1.1500	1.1400	1.1301	1.1203	1.1106	1.1009	1.0913	1.0818	1.0724	1.0631
−20	1.2540	1.2432	1.2325	1.2219	1.2114	1.2010	1.1906	1.1804	1.1702	1.1600
−19	1.3664	1.3548	1.3432	1.3318	1.3204	1.3091	1.2979	1.2868	1.2758	1.2648
−18	1.4877	1.4751	1.4627	1.4503	1.4381	1.4259	1.4138	1.4018	1.3899	1.3781
−17	1.6186	1.6051	1.5916	1.5783	1.5650	1.5519	1.5389	1.5259	1.5131	1.5003
−16	1.7597	1.7451	1.7306	1.7163	1.7020	1.6879	1.6738	1.6599	1.6460	1.6323
−15	1.9118	1.8961	1.8805	1.8650	1.8496	1.8343	1.8191	1.8041	1.7892	1.7744
−14	2.0755	2.0586	2.0418	2.0251	2.0085	1.9921	1.9758	1.9596	1.9435	1.9276
−13	2.2515	2.2333	2.2153	2.1973	2.1795	2.1619	2.1444	2.1270	2.1097	2.0925
−12	2.4409	2.4213	2.4019	2.3826	2.3635	2.3445	2.3256	2.3069	2.2883	2.2698
−11	2.6443	2.6233	2.6024	2.5817	2.5612	2.5408	2.5205	2.5004	2.4804	2.4606
−10	2.8627	2.8402	2.8178	2.7956	2.7735	2.7516	2.7298	2.7082	2.6868	2.6655
− 9	3.0971	3.0729	3.0489	3.0250	3.0013	2.9778	2.9544	2.9313	2.9082	2.8854
− 8	3.3484	3.3225	3.2967	3.2711	3.2457	3.2205	3.1955	3.1706	3.1459	3.1214
− 7	3.6177	3.5899	3.5623	3.5349	3.5077	3.4807	3.4539	3.4272	3.4008	3.3745
− 6	3.9061	3.8764	3.8468	3.8175	3.7883	3.7594	3.7307	3.7021	3.6738	3.6456
− 5	4.2148	4.1830	4.1514	4.1200	4.0888	4.0579	4.0271	3.9966	3.9662	3.9361
− 4	4.5451	4.5111	4.4773	4.4437	4.4103	4.3772	4.3443	4.3116	4.2791	4.2468
− 3	4.8981	4.8617	4.8256	4.7897	4.7541	4.7187	4.6835	4.6486	4.6138	4.5794
− 2	5.2753	5.2364	5.1979	5.1595	5.1214	5.0836	5.0460	5.0087	4.9716	4.9347
− 1	5.6780	5.6365	5.5953	5.5544	5.5138	5.4734	5.4333	5.3934	5.3538	5.3144
− 0	6.1078	6.0636	6.019[illegible]	5.9759	5.9325	5.8894	5.8466	5.8040	5.7617	5.7197

(continued)

SATURATION VAPOR PRESSURE OVER WATER

Metric units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
0	6.1078	6.1523	6.1971	6.2422	6.2876	6.3333	6.3793	6.4256	6.4721	6.5190
1	6.5662	6.6137	6.6614	6.7095	6.7579	6.8066	6.8556	6.9049	6.9545	7.0044
2	7.0547	7.1053	7.1562	7.2074	7.2590	7.3109	7.3631	7.4157	7.4685	7.5218
3	7.5753	7.6291	7.6833	7.7379	7.7928	7.8480	7.9036	7.9595	8.0158	8.0724
4	8.1294	8.1868	8.2445	8.3026	8.3610	8.4198	8.4789	8.5384	8.5983	8.6586
5	8.7192	8.7802	8.8416	8.9033	8.9655	9.0280	9.0909	9.1542	9.2179	9.2820
6	9.3465	9.4114	9.4766	9.5423	9.6083	9.6748	9.7416	9.8089	9.8765	9.9446
7	10.013	10.082	10.151	10.221	10.291	10.362	10.433	10.505	10.577	10.649
8	10.722	10.795	10.869	10.943	11.017	11.092	11.168	11.243	11.320	11.397
9	11.474	11.552	11.630	11.708	11.787	11.867	11.947	12.027	12.108	12.190
10	12.272	12.355	12.438	12.521	12.606	12.690	12.775	12.860	12.946	13.032
11	13.119	13.207	13.295	13.383	13.472	13.562	13.652	13.742	13.833	13.925
12	14.017	14.110	14.203	14.297	14.391	14.486	14.581	14.678	14.774	14.871
13	14.969	15.067	15.166	15.266	15.365	15.466	15.567	15.669	15.771	15.874
14	15.977	16.081	16.186	16.291	16.397	16.503	16.610	16.718	16.826	16.935
15	17.044	17.154	17.264	17.376	17.487	17.600	17.713	17.827	17.942	18.057
16	18.173	18.290	18.407	18.524	18.643	18.762	18.882	19.002	19.123	19.245
17	19.367	19.490	19.614	19.739	19.864	19.990	20.117	20.244	20.372	20.501
18	20.630	20.760	20.891	21.023	21.155	21.288	21.422	21.556	21.691	21.827
19	21.964	22.101	22.240	22.379	22.518	22.659	22.800	22.942	23.085	23.229
20	23.373	23.518	23.664	23.811	23.959	24.107	24.256	24.406	24.557	24.709
21	24.861	25.014	25.168	25.323	25.479	25.635	25.792	25.950	26.109	26.269
22	26.430	26.592	26.754	26.918	27.082	27.247	27.413	27.580	27.748	27.916
23	28.086	28.256	28.428	28.600	28.773	28.947	29.122	29.298	29.475	29.652
24	29.831	30.011	30.191	30.373	30.555	30.739	30.923	31.109	31.295	31.483
25	31.671	31.860	32.050	32.242	32.434	32.627	32.821	33.016	33.212	33.410
26	33.608	33.807	34.008	34.209	34.411	34.615	34.820	35.025	35.232	35.440
27	35.649	35.859	36.070	36.282	36.495	36.709	36.924	37.140	37.358	37.576
28	37.796	38.017	38.239	38.462	38.686	38.911	39.137	39.365	39.594	39.824
29	40.055	40.287	40.521	40.755	40.991	41.228	41.466	41.705	41.945	42.187
30	42.430	42.674	42.919	43.166	43.414	43.663	43.913	44.165	44.418	44.672
31	44.927	45.184	45.442	45.701	45.961	46.223	46.486	46.750	47.016	47.283
32	47.551	47.820	48.091	48.364	48.637	48.912	49.188	49.466	49.745	50.025
33	50.307	50.590	50.874	51.160	51.447	51.736	52.026	52.317	52.610	52.904
34	53.200	53.497	53.796	54.096	54.397	54.700	55.004	55.310	55.617	55.926
35	56.236	56.548	56.861	57.176	57.492	57.810	58.129	58.450	58.773	59.097
36	59.422	59.749	60.077	60.407	60.739	61.072	61.407	61.743	62.081	62.421
37	62.762	63.105	63.450	63.796	64.144	64.493	64.844	65.196	65.550	65.906
38	66.264	66.623	66.985	67.347	67.712	68.078	68.446	68.815	69.186	69.559
39	69.934	70.310	70.688	71.068	71.450	71.833	72.218	72.605	72.994	73.385
40	73.777	74.171	74.568	74.966	75.365	75.767	76.170	76.575	76.982	77.391
41	77.802	78.215	78.630	79.046	79.465	79.885	80.307	80.731	81.157	81.585
42	82.015	82.447	82.881	83.316	83.754	84.194	84.636	85.079	85.525	85.973
43	86.423	86.875	87.329	87.785	88.243	88.703	89.165	89.629	90.095	90.564
44	91.034	91.507	91.981	92.458	92.937	93.418	93.901	94.386	94.874	95.363
45	95.855	96.349	96.845	97.343	97.844	98.347	98.852	99.359	99.869	100.38
46	100.89	101.41	101.93	102.45	102.97	103.50	104.03	104.56	105.09	105.62
47	106.16	106.70	107.24	107.78	108.33	108.88	109.43	109.98	110.54	111.10
48	111.66	112.22	112.79	113.36	113.93	114.50	115.07	115.65	116.23	116.81
49	117.40	117.99	118.58	119.17	119.77	120.37	120.97	121.57	122.18	122.79
50	123.40	124.01	124.63	125.25	125.87	126.49	127.12	127.75	128.38	129.01

(*continued*)

SATURATION VAPOR PRESSURE OVER WATER

Metric units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
50	123.40	124.01	124.63	125.25	125.87	126.49	127.12	127.75	128.38	129.01
51	129.65	130.29	130.93	131.58	132.23	132.88	133.53	134.19	134.84	135.51
52	136.17	136.84	137.51	138.18	138.86	139.54	140.22	140.91	141.60	142.29
53	142.98	143.68	144.38	145.08	145.78	146.49	147.20	147.91	148.63	149.35
54	150.07	150.80	151.53	152.26	152.99	153.73	154.47	155.21	155.96	156.71
55	157.46	158.22	158.97	159.74	160.50	161.27	162.04	162.82	163.59	164.38
56	165.16	165.95	166.74	167.53	168.33	169.13	169.93	170.74	171.55	172.36
57	173.18	174.00	174.82	175.65	176.48	177.31	178.15	178.99	179.83	180.68
58	181.53	182.38	183.24	184.10	184.96	185.83	186.70	187.58	188.45	189.34
59	190.22	191.11	192.00	192.89	193.79	194.69	195.60	196.51	197.42	198.34
60	199.26	200.18	201.11	202.05	202.98	203.92	204.86	205.81	206.76	207.71
61	208.67	209.63	210.59	211.56	212.53	213.51	214.49	215.48	216.46	217.45
62	218.45	219.45	220.45	221.46	222.47	223.48	224.50	225.52	226.54	227.58
63	228.61	229.65	230.70	231.74	232.79	233.85	234.91	235.97	237.03	238.11
64	239.18	240.26	241.34	242.43	243.52	244.62	245.72	246.82	247.93	249.04
65	250.16	251.28	252.41	253.54	254.67	255.81	256.95	258.10	259.25	260.40
66	261.56	262.73	263.90	265.07	266.25	267.43	268.61	269.80	271.00	272.20
67	273.40	274.61	275.82	277.04	278.26	279.49	280.72	281.96	283.20	284.45
68	285.70	286.96	288.21	289.48	290.75	292.02	293.30	294.58	295.86	297.15
69	298.45	299.75	301.06	302.37	303.69	305.01	306.34	307.67	309.00	310.34
70	311.69	313.04	314.39	315.75	317.12	318.49	319.87	321.25	322.63	324.02
71	325.42	326.82	328.22	329.63	331.05	332.47	333.89	335.33	336.76	338.20
72	339.65	341.10	342.56	344.03	345.50	346.97	348.45	349.93	351.42	352.91
73	354.41	355.91	357.43	358.94	360.46	361.99	363.52	365.06	366.61	368.15
74	369.71	371.27	372.84	374.41	375.99	377.57	379.16	380.75	382.35	383.95
75	385.56	387.18	388.80	390.43	392.06	393.70	395.34	396.99	398.65	400.31
76	401.98	403.65	405.34	407.02	408.71	410.41	412.11	413.82	415.53	417.25
77	418.98	420.71	422.45	424.20	425.95	427.71	429.47	431.24	433.02	434.80
78	436.59	438.38	440.18	441.99	443.80	445.62	447.45	449.28	451.11	452.96
79	454.81	456.67	458.53	460.40	462.28	464.16	466.05	467.94	469.85	471.76
80	473.67	475.59	477.52	479.45	481.39	483.34	485.29	487.25	489.22	491.19
81	493.17	495.16	497.15	499.16	501.17	503.18	505.20	507.23	509.26	511.30
82	513.35	515.41	517.47	519.54	521.62	523.70	525.79	527.89	529.99	532.10
83	534.22	536.35	538.48	540.62	542.77	544.92	547.08	549.25	551.43	553.61
84	555.80	557.99	560.20	562.41	564.62	566.85	569.08	571.32	573.57	575.83
85	578.09	580.36	582.64	584.93	587.22	589.52	591.83	594.14	596.46	598.79
86	601.13	603.48	605.83	608.19	610.56	612.94	615.32	617.72	620.12	622.52
87	624.94	627.36	629.79	632.23	634.68	637.13	639.59	642.07	644.55	647.03
88	649.53	652.03	654.54	657.06	659.59	662.12	664.66	667.22	669.78	672.34
89	674.92	677.50	680.09	682.69	685.30	687.92	690.55	693.18	695.82	698.47
90	701.13	703.80	706.47	709.16	711.85	714.55	717.26	719.98	722.71	725.45
91	728.19	730.94	733.70	736.47	739.25	742.04	744.84	747.64	750.46	753.28
92	756.11	758.95	761.80	764.66	767.52	770.40	773.29	776.18	779.09	782.00
93	784.92	787.85	790.79	793.74	796.69	799.66	802.63	805.62	808.61	811.62
94	814.63	817.65	820.69	823.73	826.78	829.84	832.91	835.99	839.08	842.17
95	845.28	848.40	851.52	854.66	857.80	860.96	864.12	867.30	870.48	873.68
96	876.88	880.09	883.31	886.55	889.79	893.04	896.30	899.57	902.86	906.15
97	909.45	912.76	916.08	919.42	922.76	926.11	929.47	932.84	936.23	939.62
98	943.02	946.43	949.85	953.28	956.73	960.18	963.65	967.12	970.61	974.10
99	977.61	981.13	984.65	988.19	991.74	995.30	998.87	1002.45	1006.04	1009.64
100	1013.25	1016.87	1020.50	1024.14	1027.80	1031.46	1035.13	1038.82	1042.51	1046.22
101	1049.94	1053.67	1057.41	1061.16	1064.93	1068.70	1072.49	1076.28	1080.09	1083.91
102	1087.74									

TABLE 95

SATURATION VAPOR PRESSURE OVER WATER

(Explanation on p. 351.)

English units

Temperature °F.	Vapor pressure	Temperature °F.	Vapor pressure	Temperature °F.	Vapor pressure	Temperature °F.	Vapor pressure	Temperature °F.	Vapor pressure
Unit:	10^{-3} in. Hg.		10^{-3} in. Hg.		10^{-3} in. Hg.		10^{-3} in. Hg.		10^{-3} in. Hg
−60.0	1.651	−56.0	2.130	−52.0	2.733	−48.0	3.488	−44.0	4.424
−59.5	1.705	−55.5	2.198	−51.5	2.818	−47.5	3.594	−43.5	4.556
−59.0	1.761	−55.0	2.268	−51.0	2.906	−47.0	3.703	−43.0	4.692
−58.5	1.818	−54.5	2.340	−50.5	2.997	−46.5	3.815	−42.5	4.831
−58.0	1.877	−54.0	2.414	−50.0	3.089	−46.0	3.930	−42.0	4.973
−57.5	1.938	−53.5	2.491	−49.5	3.183	−45.5	4.049	−41.5	5.121
−57.0	2.000	−53.0	2.569	−49.0	3.281	−45.0	4.170	−41.0	5.271
−56.5	2.064	−52.5	2.650	−48.5	3.384	−44.5	4.294	−40.5	5.425

Temperature °F.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Unit:	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.
−40	5.584									
−39	5.915	5.881	5.847	5.814	5.780	5.747	5.714	5.681	5.649	5.616
−38	6.263	6.227	6.192	6.156	6.121	6.086	6.051	6.017	5.983	5.949
−37	6.630	6.592	6.555	6.517	6.480	6.443	6.406	6.370	6.334	6.298
−36	7.016	6.977	6.937	6.898	6.860	6.821	6.782	6.744	6.706	6.668
−35	7.424	7.382	7.341	7.299	7.258	7.217	7.176	7.136	7.096	7.056
−34	7.849	7.805	7.762	7.719	7.676	7.634	7.592	7.549	7.507	7.466
−33	8.298	8.252	8.206	8.161	8.116	8.071	8.026	7.982	7.937	7.893
−32	8.770	8.721	8.673	8.626	8.578	8.531	8.484	8.437	8.390	8.344
−31	9.270	9.219	9.169	9.118	9.068	9.018	8.968	8.918	8.869	8.819
−30	9.789	9.736	9.683	9.630	9.578	9.526	9.474	9.423	9.372	9.321
−29	10.34	10.28	10.23	10.17	10.12	10.06	10.00	9.951	9.896	9.842
−28	10.91	10.85	10.79	10.73	10.68	10.62	10.56	10.51	10.45	10.40
−27	11.52	11.46	11.40	11.33	11.27	11.21	11.15	11.09	11.03	10.97
−26	12.15	12.08	12.02	11.96	11.90	11.83	11.77	11.70	11.64	11.58
−25	12.82	12.75	12.69	12.62	12.55	12.49	12.42	12.35	12.29	12.22
−24	13.52	13.45	13.38	13.31	13.24	13.17	13.10	13.03	12.96	12.89
−23	14.25	14.17	14.10	14.03	13.95	13.88	13.81	13.73	13.66	13.59
−22	15.02	14.94	14.87	14.79	14.71	14.64	14.56	14.48	14.41	14.33
−21	15.83	15.75	15.66	15.58	15.50	15.42	15.34	15.26	15.18	15.10
−20	16.68	16.59	16.51	16.42	16.34	16.25	16.17	16.08	16.00	15.91
−19	17.56	17.47	17.38	17.29	17.21	17.12	17.03	16.94	16.86	16.77
−18	18.49	18.40	18.30	18.21	18.11	18.02	17.93	17.83	17.74	17.65
−17	19.46	19.36	19.26	19.16	19.07	18.97	18.87	18.78	18.68	18.59
−16	20.48	20.38	20.27	20.17	20.07	19.97	19.87	19.77	19.66	19.56
−15	21.55	21.44	21.33	21.22	21.12	21.01	20.90	20.80	20.69	20.59
−14	22.66	22.55	22.43	22.32	22.21	22.10	21.99	21.88	21.77	21.66
−13	23.83	23.71	23.59	23.47	23.36	23.24	23.12	23.01	22.89	22.78
−12	25.05	24.93	24.80	24.68	24.55	24.43	24.31	24.19	24.07	23.95
−11	26.33	26.20	26.07	25.94	25.81	25.68	25.55	25.43	25.30	25.17
−10	27.66	27.52	27.39	27.26	27.12	26.99	26.86	26.72	26.59	26.46
− 9	29.06	28.92	28.77	28.63	28.49	28.35	28.21	28.07	27.93	27.80
− 8	30.52	30.37	30.22	30.07	29.93	29.78	29.63	29.49	29.35	29.20
− 7	32.04	31.88	31.73	31.58	31.42	31.27	31.12	30.97	30.82	30.67
− 6	33.63	33.47	33.31	33.15	32.99	32.83	32.67	32.51	32.35	32.20
− 5	35.29	35.12	34.95	34.79	34.62	34.46	34.29	34.13	33.96	33.80
− 4	37.03	36.85	36.68	36.50	36.32	36.15	35.98	35.80	35.63	35.46
− 3	38.84	38.66	38.47	38.29	38.11	37.93	37.75	37.57	37.39	37.21
− 2	40.73	40.54	40.35	40.16	39.97	39.78	39.59	39.40	39.21	39.03
− 1	42.71	42.51	42.31	42.11	41.91	41.71	41.51	41.32	41.12	40.92
− 0	44.77	44.56	44.35	44.14	43.94	43.73	43.52	43.32	43.12	42.91

(continued)

SATURATION VAPOR PRESSURE OVER WATER

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
0	0.04477	0.04498	0.04519	0.04540	0.04562	0.04583	0.04604	0.04626	0.04647	0.04669
1	0.04691	0.04713	0.04735	0.04757	0.04780	0.04802	0.04824	0.04847	0.04869	0.04892
2	0.04915	0.04938	0.04961	0.04984	0.05008	0.05031	0.05054	0.05078	0.05102	0.05125
3	0.05149	0.05173	0.05197	0.05221	0.05245	0.05269	0.05293	0.05318	0.05343	0.05367
4	0.05392	0.05417	0.05442	0.05467	0.05492	0.05517	0.05543	0.05568	0.05594	0.05620
5	0.05646	0.05672	0.05698	0.05724	0.05750	0.05776	0.05803	0.05829	0.05856	0.05883
6	0.05910	0.05937	0.05964	0.05991	0.06019	0.06046	0.06074	0.06101	0.06129	0.06157
7	0.06185	0.06213	0.06242	0.06270	0.06298	0.06327	0.06355	0.06384	0.06413	0.06442
8	0.06471	0.06500	0.06530	0.06560	0.06589	0.06619	0.06649	0.06679	0.06709	0.06739
9	0.06769	0.06800	0.06830	0.06861	0.06892	0.06923	0.06954	0.06985	0.07017	0.07048
10	0.07080	0.07112	0.07144	0.07176	0.07208	0.07240	0.07272	0.07305	0.07337	0.07370
11	0.07403	0.07436	0.07469	0.07503	0.07536	0.07570	0.07604	0.07638	0.07672	0.07706
12	0.07740	0.07774	0.07809	0.07843	0.07878	0.07913	0.07948	0.07983	0.08018	0.08053
13	0.08089	0.08125	0.08161	0.08197	0.08234	0.08270	0.08307	0.08343	0.08380	0.08417
14	0.08454	0.08491	0.08528	0.08566	0.08603	0.08641	0.08679	0.08717	0.08755	0.08793
15	0.08832	0.08871	0.08910	0.08949	0.08988	0.09027	0.09067	0.09106	0.09146	0.09186
16	0.09226	0.09266	0.09306	0.09347	0.09387	0.09428	0.09469	0.09510	0.09551	0.09592
17	0.09634	0.09676	0.09718	0.09760	0.09802	0.09845	0.09888	0.09931	0.09974	0.10017
18	0.10060	0.10104	0.10147	0.10191	0.10235	0.10279	0.10323	0.10367	0.10411	0.10456
19	0.10501	0.10546	0.10592	0.10637	0.10683	0.10729	0.10775	0.10821	0.10867	0.10913
20	0.10960	0.11007	0.11054	0.11102	0.11149	0.11197	0.11245	0.11292	0.11340	0.11389
21	0.11437	0.11486	0.11535	0.11584	0.11633	0.11683	0.11733	0.11783	0.11833	0.11883
22	0.11933	0.11983	0.12034	0.12085	0.12136	0.12187	0.12238	0.12290	0.12342	0.12394
23	0.12446	0.12499	0.12552	0.12605	0.12658	0.12711	0.12764	0.12818	0.12872	0.12926
24	0.12980	0.13035	0.13090	0.13145	0.13200	0.13255	0.13310	0.13366	0.13422	0.13478
25	0.13534	0.13591	0.13647	0.13704	0.13762	0.13819	0.13877	0.13934	0.13992	0.14051
26	0.14109	0.14168	0.14226	0.14285	0.14345	0.14404	0.14464	0.14524	0.14584	0.14644
27	0.14705	0.14766	0.14827	0.14889	0.14950	0.15012	0.15074	0.15136	0.15198	0.15261
28	0.15324	0.15387	0.15450	0.15514	0.15578	0.15642	0.15706	0.15771	0.15836	0.15901
29	0.15966	0.16032	0.16097	0.16163	0.16230	0.16296	0.16362	0.16429	0.16496	0.16563
30	0.16631	0.16699	0.16767	0.16835	0.16904	0.16973	0.17042	0.17111	0.17181	0.17251
31	0.17321	0.17392	0.17462	0.17533	0.17605	0.17676	0.17747	0.17819	0.17891	0.17963
32	0.18036	0.18109	0.18182	0.18256	0.18330	0.18404	0.18478	0.18553	0.18628	0.18703
33	0.18778	0.18854	0.18929	0.19005	0.19082	0.19158	0.19235	0.19313	0.19390	0.19468
34	0.19546	0.19624	0.19703	0.19782	0.19861	0.19940	0.20020	0.20100	0.20181	0.20261
35	0.20342	0.20423	0.20504	0.20586	0.20668	0.20750	0.20833	0.20916	0.20999	0.21082
36	0.21166	0.21250	0.21334	0.21419	0.21504	0.21589	0.21675	0.21761	0.21847	0.21933
37	0.22020	0.22107	0.22194	0.22282	0.22370	0.22458	0.22547	0.22636	0.22725	0.22814
38	0.22904	0.22994	0.23084	0.23175	0.23266	0.23357	0.23449	0.23541	0.23633	0.23726
39	0.23819	0.23912	0.24006	0.24100	0.24194	0.24289	0.24384	0.24479	0.24575	0.24671
40	0.24767	0.24864	0.24960	0.25058	0.25155	0.25253	0.25352	0.25450	0.25549	0.25648
41	0.25748	0.25848	0.25948	0.26049	0.26150	0.26251	0.26353	0.26455	0.26557	0.26660
42	0.26763	0.26866	0.26970	0.27074	0.27179	0.27284	0.27389	0.27494	0.27600	0.27706
43	0.27813	0.27920	0.28027	0.28135	0.28243	0.28351	0.28460	0.28569	0.28679	0.28789
44	0.28899	0.29010	0.29121	0.29232	0.29344	0.29456	0.29569	0.29682	0.29795	0.29909
45	0.30023	0.30137	0.30252	0.30367	0.30483	0.30599	0.30715	0.30832	0.30949	0.31067
46	0.31185	0.31303	0.31422	0.31541	0.31661	0.31781	0.31901	0.32022	0.32143	0.32265
47	0.32387	0.32509	0.32632	0.32755	0.32879	0.33003	0.33127	0.33252	0.33377	0.33503
48	0.33629	0.33755	0.33882	0.34010	0.34137	0.34266	0.34394	0.34523	0.34653	0.34783
49	0.34913	0.35044	0.35175	0.35306	0.35439	0.35571	0.35704	0.35837	0.35971	0.36105
50	0.36240	0.36375	0.36511	0.36646	0.36783	0.36920	0.37057	0.37195	0.37333	0.37472

(*continued*)

SATURATION VAPOR PRESSURE OVER WATER

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
50	0.36240	0.36375	0.36511	0.36646	0.36783	0.36920	0.37057	0.37195	0.37333	0.37472
51	.37611	.37751	.37891	.38031	.38172	.38314	.38456	.38598	.38741	.38884
52	.39028	.39172	.39317	.39462	.39608	.39754	.39901	.40048	.40195	.40343
53	.40492	.40641	.40790	.40940	.41090	.41241	.41393	.41544	.41697	.41850
54	.42003	.42157	.42311	.42466	.42621	.42777	.42933	.43090	.43248	.43406
55	0.43564	0.43723	0.43882	0.44042	0.44203	0.44364	0.44525	0.44687	0.44849	0.45012
56	.45176	.45340	.45504	.45670	.45835	.46001	.46168	.46335	.46503	.46671
57	.46840	.47009	.47179	.47350	.47521	.47692	.47864	.48037	.48210	.48384
58	.48558	.48733	.48908	.49084	.49260	.49437	.49614	.49792	.49971	.50150
59	.50330	.50510	.50691	.50873	.51055	.51238	.51421	.51605	.51789	.51974
60	0.52160	0.52346	0.52533	0.52720	0.52908	0.53096	0.53285	0.53475	0.53665	0.53856
61	.54047	.54239	.54432	.54625	.54818	.55013	.55208	.55403	.55600	.55797
62	.55994	.56192	.56391	.56590	.56790	.56990	.57191	.57393	.57595	.57798
63	.58002	.58206	.58411	.58616	.58823	.59029	.59237	.59445	.59654	.59863
64	.60073	.60284	.60495	.60707	.60919	.61133	.61347	.61561	.61777	.61992
65	0.62209	0.62426	0.62644	0.62862	0.63082	0.63302	0.63522	0.63743	0.63965	0.64188
66	.64411	.64635	.64859	.65085	.65311	.65537	.65765	.65993	.66221	.66451
67	.66681	.66912	.67143	.67376	.67608	.67842	.68076	.68312	.68547	.68784
68	.69021	.69259	.69497	.69737	.69977	.70217	.70459	.70701	.70944	.71188
69	.71432	.71677	.71923	.72169	.72416	.72664	.72913	.73163	.73413	.73664
70	0.73916	0.74169	0.74422	0.74676	0.74931	0.75186	0.75443	0.75700	0.75958	0.76217
71	.76476	.76736	.76997	.77259	.77521	.77785	.78049	.78314	.78579	.78846
72	.79113	.79381	.79650	.79919	.80190	.80461	.80733	.81006	.81279	.81554
73	.81829	.82105	.82382	.82659	.82938	.83217	.83497	.83778	.84060	.84343
74	.84626	.84910	.85195	.85481	.85768	.86055	.86344	.86633	.86923	.87214
75	0.87506	0.87799	0.88092	0.88387	0.88682	0.88978	0.89275	0.89573	0.89872	0.90172
76	.90472	.90773	.91075	.91378	.91682	.91987	.92292	.92599	.92906	.93215
77	.93524	.93834	.94145	.94457	.94770	.95084	.95398	.95714	.96030	.96348
78	.96666	.96985	.97305	.97626	.97948	.98271	.98595	.98920	.99246	.99572
79	.99900	1.00228	1.00558	1.00888	1.01220	1.01552	1.01885	1.02220	1.02555	1.02891
80	1.0323	1.0357	1.0391	1.0425	1.0459	1.0493	1.0527	1.0561	1.0596	1.0630
81	1.0665	1.0700	1.0735	1.0769	1.0804	1.0840	1.0875	1.0910	1.0946	1.0981
82	1.1017	1.1053	1.1089	1.1125	1.1161	1.1197	1.1234	1.1270	1.1307	1.1343
83	1.1380	1.1417	1.1453	1.1490	1.1527	1.1564	1.1602	1.1639	1.1677	1.1714
84	1.1752	1.1790	1.1828	1.1866	1.1904	1.1943	1.1981	1.2020	1.2058	1.2097
85	1.2136	1.2175	1.2214	1.2253	1.2292	1.2332	1.2371	1.2411	1.2450	1.2490
86	1.2530	1.2570	1.2610	1.2650	1.2691	1.2731	1.2772	1.2812	1.2853	1.2894
87	1.2935	1.2976	1.3017	1.3059	1.3100	1.3142	1.3183	1.3225	1.3267	1.3309
88	1.3351	1.3393	1.3436	1.3478	1.3521	1.3564	1.3606	1.3649	1.3692	1.3736
89	1.3779	1.3822	1.3866	1.3910	1.3954	1.3998	1.4042	1.4086	1.4130	1.4174
90	1.4219	1.4264	1.4308	1.4353	1.4398	1.4443	1.4489	1.4534	1.4580	1.4625
91	1.4671	1.4717	1.4763	1.4809	1.4856	1.4902	1.4949	1.4995	1.5042	1.5089
92	1.5136	1.5183	1.5230	1.5278	1.5325	1.5373	1.5421	1.5469	1.5517	1.5565
93	1.5613	1.5661	1.5710	1.5759	1.5807	1.5856	1.5905	1.5955	1.6004	1.6053
94	1.6103	1.6153	1.6203	1.6253	1.6303	1.6353	1.6404	1.6454	1.6505	1.6556
95	1.6607	1.6658	1.6709	1.6761	1.6812	1.6864	1.6916	1.6967	1.7019	1.7072
96	1.7124	1.7176	1.7229	1.7282	1.7335	1.7388	1.7441	1.7494	1.7548	1.7601
97	1.7655	1.7709	1.7763	1.7817	1.7871	1.7926	1.7980	1.8035	1.8090	1.8145
98	1.8200	1.8255	1.8311	1.8366	1.8422	1.8478	1.8533	1.8590	1.8646	1.8702
99	1.8759	1.8816	1.8873	1.8930	1.8987	1.9045	1.9102	1.9160	1.9218	1.9276
100	1.9334	1.9392	1.9450	1.9509	1.9568	1.9626	1.9685	1.9745	1.9804	1.9863

(continued)

SATURATION VAPOR PRESSURE OVER WATER

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
100	1.9334	1.9392	1.9450	1.9509	1.9568	1.9626	1.9685	1.9745	1.9804	1.9863
101	1.9923	1.9983	2.0043	2,0103	2.0164	2.0224	2.0285	2.0346	2.0407	2.0486
102	2.0529	2.0590	2.0652	2.0713	2.0775	2.0837	2.0899	2.0961	2.1024	2.1086
103	2.1149	2.1212	2.1275	2.1338	2,1402	2.1465	2.1529	2.1593	2.1657	2.1722
104	2.1786	2.1851	2.1916	2.1981	2.2046	2.2111	2.2176	2.2242	2.2308	2.2374
105	2.2440	2.2506	2.2573	2.2639	2.2706	2.2773	2.2840	2.2907	2.2975	2.3042
106	2.3110	2.3178	2.3246	2.3315	2.3383	2.3452	2.3521	2.3590	2.3659	2.3728
107	2.3798	2.3868	2.3938	2.4008	2.4078	2.4148	2.4219	2.4290	2.4361	2.4432
108	2.4503	2.4574	2.4646	2.4718	2.4790	2.4862	2.4935	2.5007	2.5080	2.5153
109	2.5226	2.5299	2.5373	2.5447	2.5521	2.5595	2.5669	2.5744	2.5818	2.5893
110	2.5968	2.6043	2.6118	2.6194	2.6270	2.6346	2.6422	2.6498	2.6574	2.6651
111	2.6728	2.6805	2.6882	2.6960	2.7037	2.7115	2.7193	2.7271	2.7350	2.7428
112	2.7507	2.7586	2,7665	2.7745	2.7824	2.7904	2.7984	2.8064	2.8145	2.8225
113	2.8306	2.8387	2.8468	2.8550	2.8631	2.8713	2.8795	2.8877	2.8960	2.9042
114	2.9125	2.9208	2.9291	2.9374	2.9458	2.9541	2.9625	2.9709	2.9794	2.9878
115	2.9963	3.0048	3.0133	3.0219	3.0305	3.0390	3.0477	3.0563	3.0649	3.0736
116	3.0823	3.0910	3.0997	3.1085	3.1172	3.1260	3.1348	3.1437	3.1525	3.1614
117	3.1703	3.1792	3.1882	3.1972	3.2062	3.2152	3.2242	3.2333	3.2424	3.2515
118	3.2606	3.2697	3.2789	3.2881	3.2973	3.3065	3.3158	3.3250	3.3343	3.3437
119	3.3530	3.3624	3.3718	3.3812	3.3906	3.4001	3.4096	3.4191	3.4286	3.4381
120	3.4477	3.4573	3.4669	3.4765	3.4862	3.4958	3.5056	3.5153	3.5250	3.5348
121	3.5446	3.5544	3.5643	3.5741	3.5840	3.5940	3.6039	3.6139	3.6239	3.6339
122	3.6439	3.6539	3.6640	3.6741	3.6842	3.6944	3.7046	3.7148	3.7250	3.7352
123	3.7455	3.7558	3.7661	3.7765	3.7869	3.7972	3.8077	3.8181	3.8286	3.8391
124	3.8496	3.8601	3.8707	3.8813	3.8919	3.9025	3.9132	3.9239	3.9346	3.9453
125	3.9561	3.9669	3.9777	3.9885	3.9994	4.0103	4.0212	4.0321	4.0431	4.0541
126	4.0651	4.0762	4.0872	4.0983	4.1095	4.1206	4.1318	4.1430	4.1543	4.1655
127	4.1768	4.1881	4.1994	4.2108	4.2222	4.2336	4.2450	4.2565	4.2680	4.2795
128	4.2910	4.3026	4.3141	4.3257	4.3374	4.3490	4.3607	4.3725	4.3842	4.3960
129	4.4078	4.4196	4.4315	4.4434	4.4553	4.4672	4.4792	4.4912	4.5033	4.5153
130	4.5274	4.5395	4.5517	4.5638	4.5760	4.5882	4.6005	4.6128	4.6251	4.6374
131	4.6498	4.6622	4.6746	4.6871	4.6995	4.7120	4.7246	4.7371	4.7497	4.7624
132	4.7750	4.7877	4.8004	4.8131	4.8258	4.8386	4.8514	4.8643	4.8772	4.8901
133	4.9030	4.9160	4.9290	4.9420	4.9551	4.9681	4.9813	4.9944	5.0076	5.0208
134	5.0340	5.0473	5.0605	5.0738	5.0872	5.1006	5.1140	5.1274	5.1409	5.1544
135	5.1679	5.1815	5.1951	5.2087	5.2223	5.2360	5.2497	5.2635	5.2773	5.2911
136	5.3049	5.3188	5.3327	5.3466	5.3606	5.3746	5.3886	5.4027	5.4167	5.4309
137	5.4450	5.4592	5.4734	5.4876	5.5018	5.5161	5.5305	5.5448	5.5592	5.5736
138	5.5881	5.6026	5.6171	5.6317	5.6463	5.6609	5.6755	5.6902	5.7050	5.7197
139	5.7345	5.7493	5.7642	5.7791	5.7940	5.8090	5.8239	5.8390	5.8540	5.8691
140	5.8842	5.8993	5.9145	5.9297	5.9450	5.9602	5.9755	5.9909	6.0062	6.0217
141	6.0371	6.0526	6.0681	6.0836	6.0992	6.1148	6.1305	6.1461	6.1619	6.1776
142	6.1934	6.2092	6.2251	6.2410	6.2569	6.2729	6.2889	6.3049	6.3210	6.3371
143	6.3532	6.3694	6.3856	6.4018	6.4180	6.4344	6.4507	6.4671	6.4835	6.4999
144	6.5164	6.5329	6.5495	6.5661	6.5827	6.5994	6.6160	6.6328	6.6496	6.6664
145	6.6832	6.7001	6.7170	6.7339	6.7509	6.7679	6.7850	6.8021	6.8192	6.8364
146	6.8536	6.8708	6.8881	6.9054	6.9228	6.9402	6.9576	6.9751	6.9926	7.0101
147	7.0277	7.0453	7.0630	7.0807	7.0984	7.1162	7.1340	7.1518	7.1697	7.1876
148	7.2056	7.2236	7.2416	7.2597	7.2778	7.2959	7.3141	7.3323	7.3506	7.3689
149	7.3872	7.4056	7.4240	7.4424	7.4609	7.4794	7.4980	7.5166	7.5353	7.5540
150	7.5727	7.5915	7.6103	7.6291	7.6480	7.6670	7.6859	7.7049	7.7240	7.7431

(continued)

SATURATION VAPOR PRESSURE OVER WATER

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
150	7.5727	7.5915	7.6103	7.6291	7.6480	7.6670	7.6859	7.7049	7.7240	7.7431
151	7.7622	7.7814	7.8005	7.8198	7.8391	7.8584	7.8777	7.8971	7.9166	7.9361
152	7.9556	7.9752	7.9948	8.0145	8.0342	8.0539	8.0737	8.0935	8.1134	8.1333
153	8.1532	8.1732	8.1932	8.2132	8.2333	8.2535	8.2736	8.2939	8.3141	8.3344
154	8.3548	8.3752	8.3956	8.4161	8.4367	8.4572	8.4778	8.4985	8.5192	8.5399
155	8.5607	8.5815	8.6024	8.6233	8.6442	8.6652	8.6862	8.7073	8.7284	8.7496
156	8.7708	8.7921	8.8133	8.8347	8.8561	8.8775	8.8990	8.9205	8.9420	8.9637
157	8.9853	9.0070	9.0287	9.0505	9.0723	9.0942	9.1161	9.1381	9.1601	9.1821
158	9.2042	9.2263	9.2485	9.2707	9.2930	9.3153	9.3377	9.3601	9.3826	9.4051
159	9.4276	9.4502	9.4728	9.4955	9.5182	9.5410	9.5638	9.5867	9.6096	9.6326
160	9.6556	9.6786	9.7017	9.7249	9.7481	9.7713	9.7946	9.8179	9.8413	9.8647
161	9.8882	9.9117	9.9353	9.9589	9.9826	10.006	10.030	10.054	10.078	10.102
162	10.126	10.150	10.174	10.198	10.222	10.246	10.271	10.295	10.319	10.344
163	10.368	10.392	10.417	10.442	10.466	10.491	10.516	10.540	10.565	10.590
164	10.615	10.640	10.665	10.690	10.715	10.740	10.766	10.791	10.816	10.842
165	10.867	10.892	10.918	10.944	10.969	10.995	11.021	11.046	11.072	11.098
166	11.124	11.150	11.176	11.202	11.228	11.254	11.281	11.307	11.333	11.360
167	11.386	11.412	11.439	11.466	11.492	11.519	11.546	11.572	11.599	11.626
168	11.653	11.680	11.707	11.734	11.761	11.788	11.815	11.843	11.870	11.898
169	11.925	11.953	11.980	12.008	12.035	12.063	12.091	12.119	12.147	12.175
170	12.203	12.231	12.259	12.288	12.316	12.344	12.373	12.401	12.430	12.458
171	12.487	12.515	12.544	12.573	12.601	12.630	12.659	12.688	12.717	12.746
172	12.775	12.804	12.834	12.863	12.892	12.922	12.951	12.981	13.011	13.040
173	13.070	13.100	13.130	13.159	13.189	13.219	13.249	13.279	13.310	13.340
174	13.370	13.400	13.431	13.461	13.492	13.522	13.553	13.584	13.614	13.645
175	13.676	13.707	13.738	13.769	13.800	13.831	13.862	13.893	13.924	13.956
176	13.987	14.019	14.050	14.082	14.113	14.145	14.177	14.209	14.241	14.273
177	14.305	14.337	14.369	14.402	14.434	14.466	14.499	14.531	14.564	14.596
178	14.629	14.662	14.695	14.727	14.760	14.793	14.826	14.859	14.893	14.926
179	14.959	14.992	15.026	15.059	15.093	15.126	15.160	15.194	15.227	15.261
180	15.295	15.329	15.363	15.397	15.431	15.465	15.499	15.534	15.568	15.602
181	15.637	15.672	15.706	15.741	15.776	15.811	15.846	15.881	15.916	15.951
182	15.986	16.021	16.056	16.092	16.127	16.163	16.198	16.234	16.269	16.305
183	16.341	16.377	16.413	16.449	16.485	16.521	16.557	16.594	16.630	16.667
184	16.703	16.739	16.776	16.813	16.849	16.886	16.923	16.960	16.997	17.034
185	17.071	17.108	17.145	17.183	17.220	17.258	17.295	17.333	17.370	17.408
186	17.446	17.484	17.522	17.560	17.598	17.637	17.675	17.713	17.752	17.790
187	17.829	17.868	17.906	17.945	17.984	18.023	18.062	18.101	18.140	18.179
188	18.218	18.257	18.297	18.336	18.376	18.415	18.455	18.494	18.534	18.574
189	18.614	18.654	18.694	18.734	18.774	18.814	18.855	18.895	18.936	18.976
190	19.017	19.058	19.099	19.140	19.181	19.222	19.263	19.304	19.345	19.387
191	19.428	19.469	19.511	19.553	19.594	19.636	19.678	19.720	19.762	19.804
192	19.846	19.888	19.930	19.973	20.015	20.058	20.100	20.143	20.185	20.228
193	20.271	20.314	20.357	20.400	20.443	20.486	20.530	20.573	20.617	20.660
194	20.704	20.748	20.792	20.835	20.879	20.924	20.968	21.012	21.056	21.101
195	21.145	21.190	21.234	21.279	21.324	21.369	21.414	21.459	21.504	21.549
196	21.594	21.639	21.684	21.730	21.775	21.821	21.867	21.912	21.958	22.004
197	22.050	22.096	22.142	22.189	22.235	22.282	22.328	22.375	22.421	22.468
198	22.515	22.562	22.609	22.656	22.703	22.750	22.797	22.844	22.892	22.939
199	22.987	23.035	23.083	23.130	23.178	23.226	23.275	23.323	23.371	23.420
200	23.468	23.516	23.565	23.614	23.663	23.711	23.760	23.809	23.858	23.908

(continued)

SATURATION VAPOR PRESSURE OVER WATER

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
200	23.468	23.516	23.565	23.614	23.663	23.711	23.760	23.809	23.858	23.908
201	23.957	24.006	24.056	24.106	24.155	24.205	24.255	24.305	24.355	24.405
202	24.455	24.505	24.555	24.606	24.656	24.707	24.758	24.808	24.859	24.910
203	24.961	25.012	25.063	25.115	25.166	25.217	25.269	25.321	25.372	25.424
204	25.476	25.528	25.580	25.632	25.685	25.737	25.789	25.842	25.895	25.947
205	26.000	26.053	26.106	26.159	26.212	26.265	26.318	26.371	26.425	26.478
206	26.532	26.586	26.640	26.694	26.748	26.802	26.856	26.910	26.965	27.019
207	27.074	27.129	27.183	27.238	27.293	27.348	27.404	27.459	27.514	27.569
208	27.625	27.681	27.736	27.792	27.848	27.904	27.960	28.016	28.072	28.129
209	28.185	28.241	28.298	28.355	28.411	28.468	28.525	28.582	28.639	28.697
210	28.754	28.811	28.869	28.927	28.985	29.042	29.100	29.158	29.216	29.275
211	29.333	29.391	29.450	29.508	29.567	29.626	29.685	29.744	29.803	29.862
212	29.921									

TABLE 96

SATURATION VAPOR PRESSURE OVER ICE

(Explanation on p. 350.)

Metric units

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Unit:	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.	10^{-5} mb.
−100	1.403									
− 99	1.719	1.685	1.651	1.617	1.585	1.553	1.522	1.491	1.461	1.432
− 98	2.101	2.059	2.019	1.979	1.939	1.901	1.863	1.826	1.790	1.754
− 97	2.561	2.511	2.462	2.414	2.366	2.320	2.274	2.230	2.186	2.143
− 96	3.117	3.057	2.997	2.939	2.882	2.826	2.771	2.717	2.664	2.612
− 95	3.784	3.712	3.640	3.571	3.502	3.435	3.369	3.304	3.240	3.178
− 94	4.584	4.497	4.412	4.329	4.246	4.166	4.087	4.009	3.932	3.858
− 93	5.542	5.438	5.336	5.236	5.138	5.041	4.946	4.853	4.762	4.672
− 92	6.685	6.561	6.439	6.320	6.203	6.088	5.975	5.863	5.754	5.647
− 91	8.049	7.902	7.757	7.615	7.475	7.338	7.203	7.070	6.939	6.811
− 90	9.672	9.497	9.324	9.155	8.988	8.825	8.664	8.506	8.351	8.199
− 89	11.60	11.39	11.19	10.98	10.79	10.59	10.40	10.22	10.03	9.850
− 88	13.88	13.63	13.39	13.15	12.92	12.69	12.46	12.24	12.02	11.81
− 87	16.58	16.29	16.00	15.72	15.45	15.18	14.91	14.65	14.39	14.13
− 86	19.77	19.43	19.09	18.76	18.43	18.11	17.79	17.48	17.18	16.88
− 85	23.53	23.13	22.73	22.34	21.96	21.58	21.21	20.84	20.48	20.12
− 84	27.96	27.48	27.02	26.56	26.10	25.66	25.22	24.79	24.36	23.94
− 83	33.16	32.60	32.05	31.51	30.98	30.45	29.93	29.43	28.93	28.44
− 82	39.25	38.60	37.95	37.32	36.69	36.08	35.48	34.88	34.30	33.72
− 81	46.38	45.62	44.86	44.12	43.40	42.68	41.97	41.28	40.59	39.91
− 80	54.72	53.83	52.95	52.08	51.23	50.39	49.56	48.75	47.95	47.16
− 79	64.44	63.40	62.37	61.36	60.37	59.39	58.43	57.48	56.54	55.62
− 78	75.77	74.56	73.36	72.19	71.03	69.89	68.77	67.66	66.57	65.50
− 77	88.94	87.53	86.14	84.78	83.43	82.11	80.80	79.52	78.25	77.00
− 76	104.2	102.6	101.0	99.41	97.85	96.31	94.79	93.29	91.82	90.37
Unit:	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.	10^{-3} mb.
− 75	1.220	1.201	1.182	1.164	1.146	1.128	1.110	1.093	1.076	1.059
− 74	1.425	1.403	1.382	1.360	1.340	1.319	1.299	1.279	1.259	1.239
− 73	1.662	1.637	1.612	1.587	1.563	1.539	1.515	1.492	1.470	1.447
− 72	1.936	1.907	1.878	1.850	1.822	1.794	1.767	1.740	1.714	1.688
− 71	2.252	2.218	2.185	2.152	2.120	2.088	2.057	2.026	1.995	1.965
− 70	2.615	2.576	2.538	2.501	2.464	2.427	2.391	2.355	2.320	2.286
− 69	3.032	2.988	2.944	2.901	2.858	2.816	2.775	2.734	2.694	2.654
− 68	3.511	3.460	3.410	3.360	3.311	3.263	3.215	3.169	3.122	3.077
− 67	4.060	4.002	3.944	3.887	3.831	3.776	3.721	3.668	3.615	3.562
− 66	4.688	4.621	4.555	4.490	4.426	4.363	4.301	4.239	4.179	4.119
− 65	5.406	5.330	5.255	5.180	5.107	5.035	4.964	4.893	4.824	4.755
− 64	6.225	6.138	6.052	5.968	5.884	5.802	5.721	5.640	5.561	5.483
− 63	7.159	7.060	6.962	6.866	6.771	6.677	6.584	6.493	6.402	6.313
− 62	8.223	8.110	7.999	7.889	7.781	7.674	7.568	7.464	7.361	7.259
− 61	9.432	9.304	9.177	9.053	8.930	8.808	8.688	8.569	8.452	8.337
− 60	10.80	10.66	10.51	10.37	10.24	10.10	9.961	9.826	9.693	9.562
− 59	12.36	12.20	12.03	11.87	11.72	11.56	11.40	11.25	11.10	10.95
− 58	14.13	13.94	13.76	13.58	13.40	13.22	13.04	12.87	12.70	12.53
− 57	16.12	15.91	15.70	15.49	15.29	15.09	14.89	14.70	14.51	14.32
− 56	18.38	18.14	17.91	17.68	17.45	17.22	17.00	16.77	16.55	16.34
− 55	20.92	20.65	20.39	20.12	19.86	19.61	19.36	19.11	18.86	18.62
− 54	23.80	23.50	23.20	22.90	22.61	22.32	22.03	21.75	21.47	21.19
− 53	27.03	26.69	26.35	26.02	25.69	25.37	25.05	24.73	24.42	24.11
− 52	30.67	30.29	29.91	29.53	29.17	28.80	28.44	28.08	27.73	27.38
− 51	34.76	34.33	33.90	33.48	33.06	32.65	32.24	31.84	31.45	31.06
− 50	39.35	38.87	38.39	37.92	37.45	36.99	36.53	36.08	35.64	35.20

(*continued*)

SATURATION VAPOR PRESSURE OVER ICE

Metric units

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Unit:	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−50	0.03935	0.03887	0.03839	0.03792	0.03745	0.03699	0.03653	0.03608	0.03564	0.03520
−49	0.04449	0.04395	0.04341	0.04289	0.04236	0.04185	0.04134	0.04083	0.04033	0.03984
−48	0.05026	0.04965	0.04905	0.04846	0.04788	0.04730	0.04673	0.04616	0.04560	0.04504
−47	0.05671	0.05603	0.05536	0.05470	0.05405	0.05340	0.05276	0.05212	0.05150	0.05087
−46	0.06393	0.06317	0.06242	0.06168	0.06095	0.06022	0.05950	0.05879	0.05809	0.05740
−45	0.07198	0.07113	0.07030	0.06947	0.06865	0.06784	0.06704	0.06625	0.06547	0.06469
−44	0.08097	0.08003	0.07909	0.07817	0.07725	0.07635	0.07546	0.07457	0.07370	0.07283
−43	0.09098	0.08993	0.08889	0.08786	0.08684	0.08584	0.08484	0.08386	0.08289	0.08192
−42	0.1021	0.1010	0.09981	0.09866	0.09753	0.09641	0.09530	0.09420	0.09312	0.09204
−41	0.1145	0.1132	0.1119	0.1107	0.1094	0.1082	0.1070	0.1057	0.1045	0.1033
−40	0.1283	0.1268	0.1254	0.1240	0.1226	0.1212	0.1198	0.1185	0.1171	0.1158
−39	0.1436	0.1420	0.1404	0.1389	0.1373	0.1358	0.1343	0.1328	0.1313	0.1298
−38	0.1606	0.1588	0.1571	0.1553	0.1536	0.1519	0.1502	0.1485	0.1469	0.1452
−37	0.1794	0.1774	0.1755	0.1736	0.1717	0.1698	0.1679	0.1661	0.1642	0.1624
−36	0.2002	0.1980	0.1959	0.1938	0.1917	0.1896	0.1875	0.1855	0.1834	0.1814
−35	0.2233	0.2209	0.2185	0.2161	0.2138	0.2115	0.2092	0.2069	0.2047	0.2024
−34	0.2488	0.2461	0.2435	0.2409	0.2383	0.2357	0.2332	0.2307	0.2282	0.2257
−33	0.2769	0.2740	0.2711	0.2682	0.2653	0.2625	0.2597	0.2569	0.2542	0.2515
−32	0.3079	0.3047	0.3014	0.2983	0.2951	0.2920	0.2889	0.2859	0.2828	0.2799
−31	0.3421	0.3385	0.3350	0.3315	0.3280	0.3246	0.3212	0.3178	0.3145	0.3112
−30	0.3798	0.3759	0.3720	0.3681	0.3643	0.3605	0.3567	0.3530	0.3494	0.3457
−29	0.4213	0.4170	0.4127	0.4084	0.4042	0.4000	0.3959	0.3918	0.3877	0.3838
−28	0.4669	0.4621	0.4574	0.4527	0.4481	0.4435	0.4390	0.4345	0.4300	0.4256
−27	0.5170	0.5118	0.5066	0.5014	0.4964	0.4913	0.4863	0.4814	0.4765	0.4717
−26	0.5720	0.5663	0.5606	0.5549	0.5493	0.5438	0.5383	0.5329	0.5276	0.5222
−25	0.6323	0.6260	0.6198	0.6136	0.6075	0.6015	0.5955	0.5895	0.5836	0.5778
−24	0.6985	0.6916	0.6848	0.6780	0.6713	0.6646	0.6580	0.6515	0.6450	0.6386
−23	0.7709	0.7634	0.7559	0.7485	0.7412	0.7339	0.7267	0.7195	0.7125	0.7055
−22	0.8502	0.8419	0.8338	0.8257	0.8176	0.8097	0.8018	0.7940	0.7862	0.7785
−21	0.9370	0.9280	0.9190	0.9101	0.9013	0.8926	0.8840	0.8754	0.8669	0.8585
−20	1.032	1.022	1.012	1.002	0.9928	0.9833	0.9739	0.9645	0.9553	0.9461
−19	1.135	1.124	1.114	1.103	1.092	1.082	1.072	1.062	1.052	1.042
−18	1.248	1.236	1.225	1.213	1.201	1.190	1.179	1.168	1.157	1.146
−17	1.371	1.358	1.345	1.333	1.320	1.308	1.296	1.284	1.272	1.260
−16	1.506	1.492	1.478	1.464	1.451	1.437	1.424	1.410	1.397	1.384
−15	1.652	1.637	1.622	1.607	1.592	1.577	1.562	1.548	1.534	1.520
−14	1.811	1.795	1.778	1.762	1.746	1.730	1.714	1.698	1.683	1.667
−13	1.984	1.966	1.948	1.930	1.913	1.895	1.878	1.861	1.844	1.827
−12	2.172	2.153	2.133	2.114	2.095	2.076	2.057	2.039	2.020	2.002
−11	2.376	2.355	2.334	2.313	2.292	2.271	2.251	2.231	2.211	2.191
−10	2.597	2.574	2.551	2.529	2.506	2.484	2.462	2.440	2.419	2.397
− 9	2.837	2.812	2.787	2.763	2.739	2.715	2.691	2.667	2.644	2.620
− 8	3.097	3.070	3.043	3.017	2.991	2.965	2.939	2.913	2.888	2.862
− 7	3.379	3.350	3.321	3.292	3.264	3.236	3.208	3.180	3.152	3.124
− 6	3.685	3.653	3.622	3.591	3.560	3.529	3.499	3.468	3.438	3.409
− 5	4.015	3.981	3.947	3.913	3.879	3.846	3.813	3.781	3.748	3.717
− 4	4.372	4.335	4.298	4.262	4.226	4.190	4.154	4.119	4.084	4.049
− 3	4.757	4.717	4.678	4.638	4.600	4.561	4.523	4.485	4.447	4.409
− 2	5.173	5.130	5.087	5.045	5.003	4.961	4.920	4.878	4.838	4.797
− 1	5.623	5.577	5.530	5.485	5.439	5.394	5.349	5.305	5.260	5.217
− 0	6.107	6.057	6.007	5.958	5.909	5.860	5.812	5.764	5.717	5.670

TABLE 97

SATURATION VAPOR PRESSURE OVER ICE

(Explanation on p. 350.)

English units

Temperature °F.	Vapor pressure in. Hg.	Temperature °F.	Vapor pressure in. Hg.	Temperature °F.	Vapor pressure in. Hg.	Temperature °F.	Vapor pressure in. Hg.	Temperature °F.	Vapor pressure in. Hg.
−160.0	1.008×10^{-7}	−136.0	1.536×10^{-6}	−112.0	1.616×10^{-5}	−88.0	1.258×10^{-4}	−64.0	$7.652\times10^{-}$
−159.5	1.071	−135.5	1.619	−111.5	1.691	−87.5	1.310	−63.5	7.927
−159.0	1.138	−135.0	1.706	−111.0	1.770	−87.0	1.363	−63.0	8.211
−158.5	1.209	−134.5	1.798	−110.5	1.852	−86.5	1.418	−62.5	8.505
−158.0	1.285	−134.0	1.894	−110.0	1.938	−86.0	1.475	−62.0	8.808
−157.5	1.365×10^{-7}	−133.5	1.995×10^{-6}	−109.5	2.027×10^{-5}	−85.5	1.534×10^{-4}	−61.5	$9.121\times10^{-}$
−157.0	1.450	−133.0	2.101	−109.0	2.120	−85.0	1.596	−61.0	9.444
−156.5	1.539	−132.5	2.212	−108.5	2.217	−84.5	1.660	−60.5	9.778
−156.0	1.634	−132.0	2.328	−108.0	2.319	−84.0	1.727	−60.0	$1.012\times10^{-}$
−155.5	1.734	−131.5	2.450	−107.5	2.425	−83.5	1.796	−59.5	1.048
−155.0	1.840×10^{-7}	−131.0	2.579×10^{-6}	−107.0	2.535×10^{-5}	−83.0	1.867×10^{-4}	−59.0	$1.085\times10^{-}$
−154.5	1.953	−130.5	2.714	−106.5	2.650	−82.5	1.941	−58.5	1.123
−154.0	2.072	−130.0	2.856	−106.0	2.770	−82.0	2.018	−58.0	1.162
−153.5	2.196	−129.5	3.004	−105.5	2.895	−81.5	2.098	−57.5	1.202
−153.0	2.329	−129.0	3.160	−105.0	3.025	−81.0	2.181	−57.0	1.244
−152.5	2.470×10^{-7}	−128.5	3.323×10^{-6}	−104.5	3.160×10^{-5}	−80.5	2.266×10^{-4}	−56.5	$1.287\times10^{-}$
−152.0	2.618	−128.0	3.494	−104.0	3.301	−80.0	2.355	−56.0	1.332
−151.5	2.774	−127.5	3.674	−103.5	3.448	−79.5	2.447	−55.5	1.378
−151.0	2.939	−127.0	3.862	−103.0	3.602	−79.0	2.542	−55.0	1.426
−150.5	3.113	−126.5	4.058	−102.5	3.762	−78.5	2.641	−54.5	1.475
−150.0	3.298×10^{-7}	−126.0	4.265×10^{-6}	−102.0	3.928×10^{-5}	−78.0	2.743×10^{-4}	−54.0	$1.525\times10^{-}$
−149.5	3.492	−125.5	4.481	−101.5	4.101	−77.5	2.849	−53.5	1.577
−149.0	3.698	−125.0	4.708	−101.0	4.281	−77.0	2.959	−53.0	1.631
−148.5	3.914	−124.5	4.945	−100.5	4.468	−76.5	3.073	−52.5	1.686
−148.0	4.143	−124.0	5.194	−100.0	4.664	−76.0	3.191	−52.0	1.743
−147.5	4.384×10^{-7}	−123.5	5.454×10^{-6}	−99.5	4.867×10^{-5}	−75.5	3.313×10^{-4}	−51.5	$1.802\times10^{-}$
−147.0	4.639	−123.0	5.726	−99.0	5.079	−75.0	3.439	−51.0	1.863
−146.5	4.907	−122.5	6.011	−98.5	5.299	−74.5	3.570	−50.5	1.925
−146.0	5.190	−122.0	6.310	−98.0	5.528	−74.0	3.705	−50.0	1.990
−145.5	5.488	−121.5	6.622	−97.5	5.766	−73.5	3.846	−49.5	2.057
−145.0	5.803×10^{-7}	−121.0	6.949×10^{-6}	−97.0	6.014×10^{-5}	−73.0	3.991×10^{-4}	−49.0	2.126×10^{-3}
−144.5	6.133	−120.5	7.291	−96.5	6.271	−72.5	4.141	−48.5	2.197
−144.0	6.483	−120.0	7.649	−96.0	6.539	−72.0	4.296	−48.0	2.270
−143.5	6.852	−119.5	8.022	−95.5	6.818	−71.5	4.457	−47.5	2.345
−143.0	7.240	−119.0	8.414	−95.0	7.108	−71.0	4.624	−47.0	2.422
−142.5	7.646×10^{-7}	−118.5	8.823×10^{-6}	−94.5	7.409×10^{-5}	−70.5	4.796×10^{-4}	−46.5	2.502×10^{-3}
−142.0	8.076	−118.0	9.251	−94.0	7.722	−70.0	4.974	−46.0	2.585
−141.5	8.416	−117.5	9.698	−93.5	8.047	−69.5	5.158	−45.5	2.670
−141.0	9.005	−117.0	1.017×10^{-5}	−93.0	8.385	−69.0	5.349	−45.0	2.757
−140.5	9.518	−116.5	1.065	−92.5	8.736	−68.5	5.547	−44.5	2.847
−140.0	1.003×10^{-6}	−116.0	1.116×10^{-5}	−92.0	9.102×10^{-5}	−68.0	5.751×10^{-4}	−44.0	2.940×10^{-3}
−139.5	1.058	−115.5	1.170	−91.5	9.482	−67.5	5.962	−43.5	3.036
−139.0	1.117	−115.0	1.226	−91.0	9.876	−67.0	6.180	−43.0	3.134
−138.5	1.178	−114.5	1.284	−90.5	1.028×10^{-4}	−66.5	6.405	−42.5	3.235
−138.0	1.243	−114.0	1.344	−90.0	1.071	−66.0	6.638	−42.0	3.340
−137.5	1.311×10^{-6}	−113.5	1.408×10^{-5}	−89.5	1.115×10^{-4}	−65.5	6.879×10^{-4}	−41.5	3.448×10^{-3}
−137.0	1.382	−113.0	1.474	−89.0	1.161	−65.0	7.128	−41.0	3.559
−136.5	1.457	−112.5	1.544	−88.5	1.208	−64.5	7.386	−40.5	3.673
								−40.0	3.790×10^{-3}

(*continued*)

SATURATION VAPOR PRESSURE OVER ICE

English units

Temperature °F.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Unit:	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.	10^{-3} in. Hg.
−39	4.035	4.010	3.985	3.960	3.935	3.911	3.886	3.862	3.838	3.814
−38	4.295	4.268	4.242	4.215	4.189	4.163	4.137	4.111	4.086	4.060
−37	4.570	4.542	4.514	4.486	4.458	4.430	4.403	4.376	4.349	4.322
−36	4.862	4.832	4.802	4.773	4.743	4.714	4.685	4.656	4.627	4.598
−35	5.170	5.138	5.107	5.076	5.045	5.014	4.983	4.952	4.922	4.892
−34	5.497	5.463	5.430	5.397	5.364	5.331	5.299	5.266	5.234	5.202
−33	5.843	5.808	5.772	5.737	5.702	5.668	5.633	5.599	5.565	5.531
−32	6.208	6.171	6.133	6.096	6.059	6.023	5.986	5.950	5.914	5.879
−31	6.595	6.555	6.516	6.477	6.438	6.399	6.360	6.322	6.284	6.246
−30	7.003	6.961	6.919	6.878	6.837	6.796	6.755	6.715	6.675	6.635
−29	7.435	7.391	7.347	7.303	7.259	7.216	7.173	7.130	7.087	7.045
−28	7.891	7.844	7.798	7.751	7.705	7.660	7.614	7.569	7.524	7.479
−27	8.373	8.324	8.274	8.226	8.177	8.129	8.081	8.033	7.985	7.938
−26	8.882	8.830	8.778	8.726	8.675	8.624	8.573	8.523	8.472	8.423
−25	9.420	9.365	9.310	9.256	9.201	9.147	9.094	9.040	8.987	8.934
−24	9.987	9.929	9.871	9.814	9.756	9.700	9.643	9.587	9.531	9.475
−23	10.59	10.52	10.46	10.40	10.34	10.28	10.22	10.16	10.10	10.05
−22	11.22	11.16	11.09	11.03	10.96	10.90	10.84	10.78	10.71	10.65
−21	11.88	11.81	11.74	11.68	11.61	11.54	11.48	11.41	11.35	11.28
−20	12.59	12.52	12.45	12.37	12.30	12.23	12.16	12.09	12.02	11.95
Unit:	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
−19	0.01333	0.01325	0.01318	0.01310	0.01303	0.01296	0.01288	0.01281	0.01274	0.01266
−18	0.01410	0.01402	0.01394	0.01386	0.01378	0.01371	0.01363	0.01355	0.01348	0.01340
−17	0.01493	0.01485	0.01476	0.01468	0.01459	0.01451	0.01443	0.01435	0.01426	0.01418
−16	0.01579	0.01570	0.01561	0.01553	0.01544	0.01535	0.01527	0.01518	0.01510	0.01501
−15	0.01670	0.01661	0.01651	0.01642	0.01633	0.01624	0.01615	0.01606	0.01597	0.01588
−14	0.01766	0.01756	0.01746	0.01737	0.01727	0.01717	0.01708	0.01698	0.01689	0.01679
−13	0.01867	0.01857	0.01846	0.01836	0.01826	0.01816	0.01806	0.01796	0.01786	0.01776
−12	0.01974	0.01963	0.01952	0.01941	0.01931	0.01920	0.01909	0.01899	0.01888	0.01877
−11	0.02086	0.02075	0.02063	0.02052	0.02041	0.02029	0.02018	0.02007	0.01996	0.01985
−10	0.02203	0.02191	0.02179	0.02167	0.02155	0.02144	0.02132	0.02120	0.02109	0.02097
− 9	0.02327	0.02314	0.02302	0.02289	0.02277	0.02264	0.02252	0.02240	0.02227	0.02215
− 8	0.02457	0.02444	0.02430	0.02417	0.02404	0.02391	0.02378	0.02365	0.02352	0.02340
− 7	0.02594	0.02580	0.02566	0.02552	0.02538	0.02525	0.02511	0.02497	0.02484	0.02470
− 6	0.02737	0.02722	0.02708	0.02693	0.02679	0.02664	0.02650	0.02636	0.02622	0.02608
− 5	0.02888	0.02873	0.02857	0.02842	0.02827	0.02812	0.02796	0.02781	0.02767	0.02752
− 4	0.03047	0.03031	0.03015	0.02999	0.02983	0.02967	0.02951	0.02935	0.02919	0.02904
− 3	0.03213	0.03196	0.03179	0.03162	0.03146	0.03129	0.03112	0.03096	0.03079	0.03063
− 2	0.03388	0.03370	0.03352	0.03335	0.03317	0.03299	0.03282	0.03265	0.03247	0.03230
− 1	0.03572	0.03553	0.03535	0.03516	0.03497	0.03479	0.03461	0.03442	0.03424	0.03406
− 0	0.03764	0.03744	0.03725	0.03705	0.03686	0.03667	0.03648	0.03629	0.03610	0.03591
0	0.03764	0.03784	0.03804	0.03824	0.03844	0.03864	0.03884	0.03904	0.03925	0.03945
1	0.03966	0.03987	0.04008	0.04029	0.04050	0.04071	0.04092	0.04113	0.04135	0.04156
2	0.04178	0.04200	0.04222	0.04243	0.04265	0.04288	0.04310	0.04332	0.04355	0.04377
3	0.04400	0.04423	0.04446	0.04469	0.04492	0.04515	0.04538	0.04562	0.04585	0.04609
4	0.04633	0.04657	0.04681	0.04705	0.04730	0.04754	0.04779	0.04803	0.04828	0.04853
5	0.04878	0.04903	0.04928	0.04954	0.04979	0.05004	0.05030	0.05056	0.05082	0.05108
6	0.05134	0.05160	0.05187	0.05213	0.05240	0.05266	0.05293	0.05320	0.05347	0.05375
7	0.05402	0.05430	0.05457	0.05485	0.05513	0.05541	0.05569	0.05597	0.05626	0.05654
8	0.05683	0.05712	0.05741	0.05770	0.05799	0.05828	0.05858	0.05887	0.05917	0.05947
9	0.05977	0.06007	0.06038	0.06068	0.06099	0.06130	0.06161	0.06192	0.06223	0.06255
10	0.06286	0.06317	0.06349	0.06381	0.06413	0.06445	0.06477	0.06510	0.06542	0.06575

(*continued*)

SATURATION VAPOR PRESSURE OVER ICE

English units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°F.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.	in. Hg.
10	0.06286	0.06317	0.06349	0.06381	0.06413	0.06445	0.06477	0.06510	0.06542	0.06575
11	0.06608	0.06641	0.06674	0.06708	0.06741	0.06775	0.06809	0.06843	0.06877	0.06911
12	0.06946	0.06981	0.07016	0.07051	0.07086	0.07121	0.07157	0.07192	0.07228	0.07264
13	0.07300	0.07336	0.07372	0.07409	0.07445	0.07482	0.07519	0.07556	0.07594	0.07631
14	0.07669	0.07707	0.07745	0.07783	0.07822	0.07860	0.07899	0.07938	0.07977	0.08016
15	0.08056	0.08096	0.08136	0.08176	0.08216	0.08256	0.08297	0.08338	0.08379	0.08420
16	0.08461	0.08502	0.08544	0.08586	0.08628	0.08670	0.08713	0.08755	0.08798	0.08841
17	0.08884	0.08927	0.08971	0.09014	0.09058	0.09102	0.09147	0.09191	0.09236	0.09281
18	0.09326	0.09371	0.09417	0.09463	0.09509	0.09555	0.09601	0.09648	0.09695	0.09742
19	0.09789	0.09836	0.09884	0.09932	0.09980	0.1003	0.1008	0.1013	0.1018	0.1022
20	0.1027	0.1032	0.1037	0.1042	0.1047	0.1052	0.1057	0.1063	0.1068	0.1073
21	0.1078	0.1083	0.1088	0.1093	0.1098	0.1104	0.1109	0.1114	0.1119	0.1125
22	0.1130	0.1136	0.1141	0.1147	0.1152	0.1158	0.1163	0.1169	0.1175	0.1180
23	0.1186	0.1192	0.1197	0.1203	0.1208	0.1214	0.1220	0.1226	0.1231	0.1237
24	0.1243	0.1249	0.1255	0.1261	0.1267	0.1273	0.1279	0.1285	0.1291	0.1297
25	0.1303	0.1309	0.1315	0.1322	0.1328	0.1334	0.1341	0.1347	0.1353	0.1360
26	0.1366	0.1372	0.1379	0.1385	0.1392	0.1398	0.1405	0.1411	0.1418	0.1424
27	0.1431	0.1438	0.1445	0.1451	0.1458	0.1465	0.1472	0.1479	0.1486	0.1493
28	0.1500	0.1507	0.1514	0.1521	0.1528	0.1535	0.1542	0.1549	0.1557	0.1564
29	0.1571	0.1578	0.1585	0.1593	0.1600	0.1608	0.1615	0.1622	0.1630	0.1637
30	0.1645	0.1653	0.1660	0.1668	0.1676	0.1684	0.1692	0.1699	0.1707	0.1715
31	0.1723	0.1731	0.1739	0.1747	0.1755	0.1763	0.1771	0.1779	0.1787	0.1795
32	0.1803									

REDUCTION OF PSYCHROMETRIC DATA

Two distinct theories of the psychrometer have been advanced, the convection theory of August and the diffusion theory of Maxwell. Both predict the same (correct) *form* of the humidity-temperature relationship, but neither gives a correct value for the proportionality constants because of their physical incompleteness. Arnold[1] has presented an analysis which embodies the effects of convection, diffusion, and radiation.

In agreement with theory, many empirical workers have verified, for the system water-air, the validity in restricted range of air velocities of the expression

$$A = \frac{(e' - e)}{p(t - t')} \qquad (1)$$

where:

t = air temperature,
t' = wet-bulb temperature,
p = barometric pressure,
e = vapor pressure in the air,
e' = saturation vapor pressure at temperature t',
A = proportionality factor which for a given ventilation velocity and instrument varies slightly with t'.

From an examination of a large number of observations, Ferrel[2] obtained for centigrade temperatures

$$A = 0.000660(1 + 0.00115t') \qquad (2)$$

Subsequent investigations by Brooks and Allen[3] and others have resulted in slightly different constants, but this difference is so slight that there is no advantage in altering the conventional formula of Ferrel and thereby destroying consistency in psychrometric observations. Although Ferrel's observations included only a very limited number of cases with wet-bulb temperatures below freezing and these in the neighborhood of 0 °C., they indicated the constants that applied to liquid-covered wet bulbs also applied to ice-covered. Brooks and Allen have substantiated his results provided the wet-bulb is covered with a frozen *wick*.[4] In experiments using a thin layer of ice directly on the bulb, the constants of Ferrel were invalid and should be multiplied by the ratio of the latent heat of evaporation of water to that of ice which is 0.882.

Psychrometric observations.—In making psychrometric observations, Resolution 145, International Meteorological Organization, Twelfth Conference of Directors (Washington, 1947) recommends that air be drawn past the bulbs at a rate not less than 4 meters per second and not greater than 10 meters per second, if the thermometers are of the types ordinarily used at meteorological stations. Resolution 145 also emphasizes the necessity for using clean, washed wicks and pure water, and draws attention to the fact that supercooled water may exist on the bulb at temperatures well below 0 °C., and that if this is not noticed by the observer, very serious errors will occur. The freezing can be initiated by touching the bulb with clean snow or ice, a pencil, or other object. For a discussion on low-temperature psychometry see Wile.[5]

While concise, Tables 98 and 99 are not best suited for routine use in reducing psychrometric observations. Where many reductions are to be made, access should be obtained to one of the many tables,[6, 7] nomograms,[8] and slide rules[9] constructed for this purpose.

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[1] Arnold, J. Howard, The theory of the psychrometer, Physics, vol. 4, pp. 255-262, 334-340, 1933. See also Dropkin, David, The deviation of the actual wet-bulb temperature from the temperature of adiabatic saturation, Cornell Univ. Eng. Exp. Stat. Bull. 23, 1936; Effect of radiation on psychrometry readings, Cornell Univ. Eng. Exp. Stat. Bull. 26, 1939.

[2] Ferrel, Wm., Ann. Rep. Chief Signal Officer, 1886, app. 24, pp. 233-259.

[3] Brooks, Donald B., and Allen, H. H., Journ. Washington Acad. Sci., pp. 121-134, 1933.

[4] Note.—On the basis of certain other investigations, some European psychrometer tables use as the value of A for ice-covered bulbs 0.882 times the value of A for water, e.g., see Trabert, W., Jelineks Psychrometer-Tafeln, Leipzig, 1911.

[5] Wile, D. D., Psychrometry in the frost zone, Refrig. Eng., October 1944.

[6] Marvin, C. F., Psychrometric tables, U. S. Dep. Commerce, Weather Bur., No. 235, 1941.

[7] Goodman, William, Air conditioning analysis with psychrometric charts and tables, 455 pp., Macmillan, 1943.

[8] Brooks, D. B., Psychrometric charts for high and low pressures, Nat. Bur. Stand. Misc. Publ. M 146, 1935.

[9] U. S. Weather Bur. Psychrometric calculator, Nos. 1183 and 1184.

(*continued*)

REDUCTION OF PSYCHROMETRIC DATA

Table 98, Centigrade Temperatures.—Equation (1) can be rewritten

$$e = e' - [0.000660(1 + 0.00115t')]p(t - t') \quad (3)$$

or

$$e = e' - \Delta e$$

where $\Delta e = [0.000660(1 + 0.00115t')]p(t - t')$, temperatures are in °C., and p, e, and e' are in the same pressure units. Table 98 gives values of Δe in millibars for a pressure p of 1000 mb. for various values of the wet-bulb temperature t' and of the depression of the wet-bulb $(t - t')$. Since $[0.000660(1 + 0.00115t')]p(t - t')$ is linear in both p and $(t - t')$ values of Δe for another barometric pressure p may be found by multiplying the tabular value by $p/1000$. In practice it is sufficient to use the nearest round 100 mb. value so that this operation can be performed by subtraction (e.g., if $p = 900$ mb., subtract 0.1 Δe from Δe, etc.). The linearity in $(t - t')$ enables rapid computations for fractions of a degree depression of the wet-bulb (e.g., if $(t - t') = 2.4°$, Δe is one-tenth the value for 24°). For ordinary purposes the t' column for the temperature nearest the wet-bulb temperature may be used; for extreme precision Δe should be interpolated linearly for t'.

Instructions for use of Table 98.— To obtain e, the vapor pressure of the air:

1. Determine e' the saturation vapor pressure at the wet-bulb temperature
   (a) if the wet-bulb temperature is 0 °C. or above use Table 94 (e' for water);
   (b) if the wet-bulb temperature is below 0 °C. use Table 96 (e' for ice).
2. Determine Δe at a pressure of 1000 mb. (Δe_{1000}) from Table 98.
3. Reduce Δe_{1000} to the appropriate pressure p by:
   (a) multiplying Δe_{1000} by $p/1000$, or
   (b) substracting 0.1 Δe_{1000} from Δe_{1000} if pressure is 900 mb., 0.2 Δe_{1000} if 800 mb., etc.
4. Subtract Δe from e', the result is the desired vapor pressure e.

Example.—Given $t = 40.1$ °C., $t' = 36.9$ °C., $(t - t') = 3.2$ °C., $p = 923$ mb.

1. From Table 94, $e' = 62.421$ mb.
2. From Table 98, with $t' = 40$ °C., and $p = 1000$ mb. Δe_{1000} for $(t - t') = 32$ °C. is 22.092 mb., therefore for $(t - t') = 3.2$ °C., $\Delta e_{1000} = 2.209$ mb.
3. For 900 mb. $\Delta e = \Delta e_{1000} - 0.1\ \Delta e_{1000} = 2.209 - 0.221 = 1.988$ mb.,
4. $e = e' - \Delta e = 62.421 - 1.988 = 60.433$ mb.

Table 99, Fahrenheit temperatures.—For Fahrenheit temperature (3) can be rewritten

$$e = e' - \left[0.000367\left(1 + \frac{t' - 32}{1571}\right)\right]p(t - t') \quad (4)$$

or

$e = e' - \Delta e$

where $\Delta e = \left[0.000367\ \left(1 + \frac{t' - 32}{1571}\right)\right] p(t - t')$, temperatures are in °F., and p, e, and e' are in the same pressure units. Table 99 gives values of Δe in inches of mercury for a pressure p of 30 in. Hg. (with auxiliary columns for $p = 1$ in. Hg.) for various values of the wet-bulb temperature t' and of the depression of the wet-bulb $(t - t')$. Since Δe is linear in both p and $(t - t')$, values of Δe for another barometric pressure p (in. Hg.) may be found by multiplying the value for 1 in. Hg. by p, or by a linear combination of the 30 and 1 in. Hg. columns. (E.g., if $p = 29$ in. Hg., subtract the value of Δe for 1 in. Hg. from the value of Δe for 30 in. Hg.). The linearity in $(t - t')$ enables rapid computations for fractions of a degree depression of the wet-bulb (e.g., if $(t - t') = 2.4°$, Δe is one-tenth the value for 24°). For ordinary purposes the t' column for the temperature nearest the wet-bulb temperature may be used, or for extreme precision Δe should be interpolated linearly.

Instructions for the use of Table 99.—To obtain e, the vapor pressure of the air:

1. Determine e' the saturation vapor pressure at the wet-bulb temperature
   (a) if the wet-bulb temperature is 32 °F. or above use Table 95, (e' for water);
   (b) if the wet-bulb temperature is below 32 °F. use Table 97 (e' for ice).

(continued)

REDUCTION OF PSYCHROMETRIC DATA

2. Determine Δe for a pressure of 30 in. Hg. (Δe_{30}) and Δe for a pressure 1 in. Hg. (Δe_1).
3. Reduce to Δe for the appropriate pressure p by:
   (a) multiplying Δe_1 by p (in. Hg.), or
   (b) linearly combining Δe_{30} and Δe_1; e.g., if $p = 28$ in. Hg. $\Delta e = \Delta e_{30} - 2\Delta e_1$.
4. Subtract Δe from e', the result is the desired vapor pressure.

Example.—Given $t = 58.5$ °F., $t' = 54.8$ °F., $t - t' = 3.7$ °F. $p = 28.73$ in. Hg.

1. From Table 95, $e' = 0.43248$ in. Hg.
2. From Table 99, with $t' = 60$ °F. and $(t - t') = 3.7$ °F. Δe for 30 in. Hg. $(\Delta e_{30}) =$ 0.41463 in. Hg., Δe for 1 in. Hg. $(\Delta e_1) = 0.01382$ in. Hg. and for $(t - t') =$ 3.7 °F. $\Delta e_{30} = 0.04146$ in. Hg. $\Delta e_1 = 0.00138$ in. Hg.
3. For $p = 29$ in. Hg. $\Delta e = \Delta e_{30} - \Delta e_1 = 0.04146 - 0.00138 = 0.04008$ in. Hg.
4. $e = e' - \Delta e = 0.43248 - 0.04008 = 0.39240$ in. Hg.

Dew point.—Resolutions 180 and 184 of the Twelfth Conference of Directors (Washington, 1947) recommend the use of dew point (not frost point) in all synoptic surface and upper air reports including those in circumstances where the vapor pressure is lower than the saturated vapor pressure at 0 °C. (32 °F.). To obtain the dew point corresponding to the vapor pressure computed above, enter the body of the table "Saturation Vapor Pressure Over Water" (Table 94 for vapor pressure in millibars, Table 95 for vapor pressure in inches of mercury) and read off the corresponding dew-point temperature. (E.g., if $e = 60.433$ mb., the dew-point temperature $= 36.3$ °C., if $e = 0.39240$ in. Hg., the dew-point temperature $= 52.1$ °F.)

Frost point.—Frost-point temperatures may be determined in the same manner as the dew-point temperature; use the tables "Saturation Vapor Pressure Over Ice" (Table 96 for vapor pressure in millibars, Table 97 for vapor pressure in inches of mercury).

Relative humidity.—Resolution 166 of the Twelfth Conference of Directors (Washington, 1947) (see Table 93) redefines the relative humidity as 100 r/r_w percent, where r is the mixing ratio of the air at the given pressure and temperature and r_w is the saturation mixing ratio over water at the same temperature and pressure. This value may be closely approximated by the ratio 100 e/e_w where e is the vapor pressure as obtained above and e_w is the saturation vapor pressure over water at the dry-bulb temperature. The approximate relative humidity so determined will differ from the true relative humidity at most by $2\frac{1}{2}$ percent under the extreme conditions of about 50 percent relative humidity and a very high temperature of about 50 °C. At 0 percent relative humidity there is no difference and at 100 percent the difference is negligible. At a temperature of 10 °C. and 50 percent relative humidity the difference is about 0.5 percent.

(*continued*)

REDUCTION OF PSYCHROMETRIC OBSERVATIONS

Centigrade temperatures

Values of $\Delta e = 0.000660(1 + 0.00115t')p(t - t')$ for $p = 1000$ mb.

(See p. 365 for discussion and explanation of table.)

Depression of wet bulb $t - t'$ °C.	Wet-bulb temperature t' — °C. −50	−40	−30	−20	−10	0	10	20	30	40	50
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.6220	0.6296	0.6372	0.6448	0.6524	0.6600	0.6676	0.675	0.683	0.690	0.698
2	1.2441	1.2593	1.2745	1.2896	1.3048	1.3200	1.3352	1.350	1.366	1.381	1.396
3	1.8662	1.8889	1.9117	1.9345	1.9572	1.9800	2.0028	2.026	2.048	2.071	2.094
4	2.4882	2.5186	2.5489	2.5793	2.6096	2.6400	2.6704	2.701	2.731	2.761	2.792
5	3.1102	3.1482	3.1862	3.2241	3.2620	3.3000	3.3380	3.376	3.414	3.452	3.490
6	3.7323	3.7778	3.8234	3.8689	3.9145	3.9600	4.0055	4.051	4.097	4.142	4.188
7	4.3544	4.4075	4.4606	4.5137	4.5669	4.6200	4.6731	4.726	4.779	4.833	4.886
8	4.9764	5.0371	5.0978	5.1586	5.2193	5.2800	5.3407	5.401	5.462	5.523	5.584
9	5.5984	5.6668	5.7351	5.8034	5.8717	5.9400	6.0083	6.077	6.145	6.213	6.282
10						6.6000	6.6759	6.752	6.828	6.904	6.980
11							7.3435	7.427	7.510	7.594	7.677
12							8.0111	8.102	8.193	8.284	8.375
13							8.6787	8.777	8.876	8.975	9.073
14							9.3463	9.453	9.559	9.665	9.771
15							10.0138	10.128	10.242	10.355	10.469
16							10.6814	10.803	10.924	11.046	11.167
17							11.3490	11.478	11.607	11.736	11.865
18							12.0166	12.153	12.290	12.426	12.563
19							12.6842	12.828	12.973	13.117	13.261
20								13.504	13.655	13.807	13.959
21								14.179	14.338	14.498	14.657
22								14.854	15.021	15.188	15.355
23								15.529	15.704	15.878	16.053
24								16.204	16.386	16.569	16.751
25								16.880	17.069	17.259	17.449
26								17.555	17.752	17.949	18.147
27								18.230	18.435	18.640	18.845
28								18.905	19.118	19.330	19.543
29								19.580	19.800	20.020	20.241
30								20.255	20.483	20.711	20.938
31								20.931	21.166	21.401	21.636
32								21.606	21.849	22.092	22.334
33								22.281	22.531	22.782	23.032
34								22.956	23.214	23.472	23.730
35								23.631	23.897	24.163	24.428

REDUCTION OF PSYCHROMETRIC OBSERVATIONS

Fahrenheit temperatures

Values of $\Delta e = 0.000367p(t - t')\left(1 + \frac{t' - 32}{1571}\right)$ for $p = 30$ in. Hg. and 1 in. Hg.

(See p. 365 for discussion and explanation of table.)

Wet-bulb temperature t' — °F.

Depression of wet bulb $t - t'$ °F.	0		20		40		60		80		
	30 in. in. Hg.	1 in. in. Hg	30 in. in. Hg.	1 in. in. Hg.	30 in. in. Hg.	1 in. in. Hg.	30 in. in. Hg.	1 in. in. Hg.	30 in. in. Hg.	1 in. in. Hg.	°F.
1	0.01079	0.00036	0.01093	0.00037	0.01107	0.00037	0.01121	0.00038	0.01135	0.00038	1
2	.02157	.00072	.02185	.00072	.02213	.00073	.02241	.00074	.02269	.00075	2
3	.03236	.00108	.03278	.00109	.03320	.00111	.03362	.00112	.03404	.00113	3
4	.04314	.00144	.04370	.00146	.04426	.00148	.04482	.00150	.04539	.00151	4
5	0.05393	0.00180	0.05463	0.00183	0.05533	0.00185	0.05603	0.00187	0.05673	0.00190	5
6	.06471	.00216	.06556	.00218	.06640	.00221	.06724	.00224	.06808	.00227	6
7	.07550	.00252	.07648	.00255	.07746	.00258	.07844	.00262	.07942	.00265	7
8	.08629	.00288	.08741	.00292	.08853	.00295	.08965	.00299	.09077	.00303	8
9	.09707	.00323	.09833	.00327	.09959	.00332	.10086	.00336	.10212	.00340	9
10			0.10926	0.00364	0.11066	0.00369	0.11206	0.00374	0.11346	0.00378	10
11			.12018	.00401	.12173	.00406	.12327	.00411	.12481	.00416	11
12					.13279	.00442	.13447	.00448	.13616	.00453	12
13					.14386	.00479	.14568	.00486	.14750	.00492	13
14					.15492	.00517	.15689	.00523	.15885	.00530	14
15					0.16599	0.00553	0.16809	0.00560	0.17020	0.00567	15
16					.17706	.00590	.17930	.00597	.18154	.00605	16
17					.18812	.00627	.19051	.00635	.19289	.00643	17
18					.19919	.00664	.20171	.00673	.20423	.00681	18
19					.21025	.00701	.21292	.00709	.21558	.00718	19
20					0.22132	0.00738	0.22412	0.00747	0.22693	0.00756	20
21					.23239	.00775	.23533	.00785	.23827	.00795	21
22							.24654	.00821	.24962	.00832	22
23							.25774	.00859	.26097	.00870	23
24							.26895	.00897	.27231	.00908	24
25							0.28015	0.00934	0.28366	0.00946	25
26							.29136	.00971	.29501	.00983	26
27							.30257	.01009	.30635	.01021	27
28							.31377	.01046	.31770	.01059	28
29							.32498	.01083	.32904	.01097	29
30							0.33619	0.01121	0.34039	0.01135	30
							.34739	.01158	.35174	.01173	31
							.35860	.01195	.36308	.01210	32
							.36980	.01233	.37443	.01248	33
							.38101	.01270	.38578	.01286	34
							0.39222	0.01307	0.39712	0.01323	35
							.40342	.01345	.40847	.01361	36
							.41463	.01382	.41982	.01399	37
							.42584	.01420	.43116	.01438	38
							.43704	.01456	.44251	.01475	39
							0.44825	0.01494	0.45385	0.01513	40
							.45945	.01532	.46520	.01551	41
							.47066	.01568	.47655	.01588	42
							.48187	.01606	.48789	.01626	43
							.49307	.01644	.49924	.01664	44
							0.50428	0.01681	0.51059	0.01702	45
							.51549	.01718	.52193	.01740	46
							.52669	.01756	.53328	.01778	47
									.54463	.01816	48
									.55597	.01853	49
									0.56732	0.01891	50

Wet-bulb temperature t' — °F.

Depression of wet bulb $t - t'$ °F.	−40		−20	
	30 in. in. Hg.	1 in. in. Hg.	30 in. in. Hg.	1 in. in. Hg.
1	0.010505	0.000353	0.010646	0.000358
2	.021011	.000697	.021291	.000706
3	.031516	.001050	.031937	.001064
4	.042022	.001403	.042582	.001421
5	0.052527	0.001756	0.053228	0.001779
6	.063032	.002099	.063873	.002127
7	.073538	.002452	.074519	.002485
8	.084043	.002805	.085165	.002843
9	.094549	.003149	.095810	.003191

Table 100

RATIO OF THE SATURATION VAPOR PRESSURE OVER WATER TO THAT OVER ICE AT THE SAME TEMPERATURE

Values of $\frac{e_w}{e_i}$ for **centigrade temperatures** where e_w is the saturation vapor pressure over water and e_i the saturation vapor pressure over ice

°C.	0	1	2	3	4	5	6	7	8	9
− 0	1.000	1.010	1.020	1.030	1.040	1.050	1.060	1.071	1.081	1.092
−10	1.102	1.113	1.124	1.135	1.146	1.157	1.168	1.181	1.192	1.204
−20	1.215	1.227	1.239	1.252	1.264	1.276	1.289	1.301	1.314	1.327
−30	1.340	1.353	1.366	1.379	1.392	1.406	1.420	1.433	1.446	1.460
−40	1.474	1.488	1.502	1.516	1.530	1.543	1.558	1.573	1.587	1.601
−50	1.615									

Values of $\frac{e_w}{e_i}$ for **Fahrenheit temperatures**

°F.	0	1	2	3	4	5	6	7	8	9
30	1.011	1.006	1.000							
20	1.067	1.061	1.056	1.050	1.044	1.039	1.033	1.027	1.022	1.016
10	1.127	1.120	1.114	1.108	1.102	1.096	1.090	1.085	1.079	1.073
0	1.189	1.183	1.176	1.170	1.164	1.157	1.151	1.145	1.139	1.133
− 0	1.189	1.196	1.203	1.209	1.215	1.222	1.229	1.235	1.242	1.249
−10	1.256	1.262	1.269	1.276	1.283	1.290	1.297	1.304	1.311	1.318
−20	1.325	1.333	1.340	1.347	1.354	1.362	1.368	1.376	1.383	1.390
−30	1.398	1.406	1.413	1.421	1.428	1.436	1.443	1.450	1.459	1.466
−40	1.474	1.481	1.489	1.498	1.505	1.513	1.521	1.529	1.537	1.543
−50	1.552	1.560	1.568	1.576	1.584	1.591	1.600	1.608	1.615	1.623
−60	1.631									

Table 101

RATIO OF THE SATURATION VAPOR PRESSURE OVER ICE TO THAT OVER WATER AT THE SAME TEMPERATURE

Values of $\frac{e_i}{e_w}$ for **centigrade temperatures**

°C.	0	1	2	3	4	5	6	7	8	9
− 0	1.000	.990	.981	.971	.962	.953	.943	.934	.925	.916
−10	.907	.899	.890	.881	.873	.864	.856	.847	.839	.831
−20	.823	.815	.807	.799	.791	.784	.776	.769	.761	.754
−30	.746	.739	.732	.725	.718	.711	.704	.698	.691	.685
−40	.678	.672	.666	.660	.654	.648	.642	.636	.630	.625
−50	.619									

Values of $\frac{e_i}{e_w}$ for **Fahrenheit temperatures**

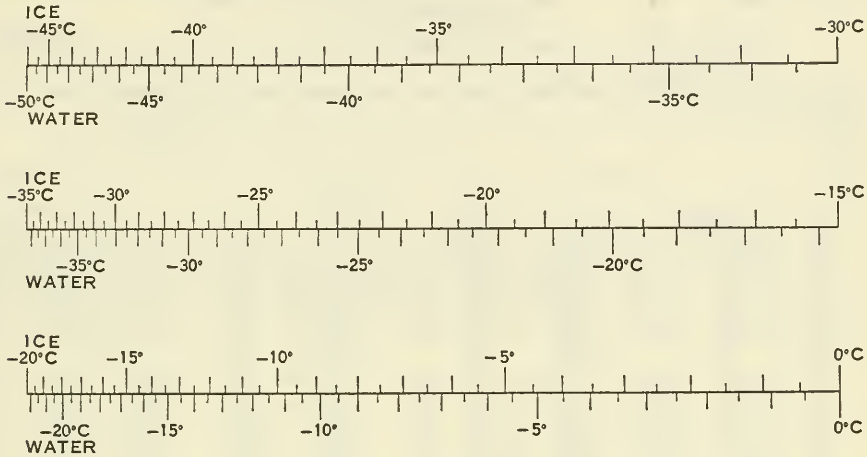
°F.	0	1	2	3	4	5	6	7	8	9
30	.989	.994	1.000							
20	.937	.942	.947	.953	.958	.963	.968	.973	.979	.984
10	.888	.893	.897	.902	.907	.912	.917	.922	.927	.932
0	.841	.845	.850	.855	.859	.864	.868	.873	.878	.883
− 0	.841	.836	.832	.827	.823	.818	.814	.809	.805	.801
−10	.796	.792	.788	.784	.779	.775	.771	.767	.763	.759
−20	.755	.750	.746	.742	.739	.734	.731	.727	.723	.719
−30	.715	.711	.708	.704	.700	.696	.693	.690	.686	.682
−40	.678	.675	.672	.668	.665	.661	.658	.654	.651	.648
−50	.644	.641	.638	.635	.631	.628	.625	.622	.619	.616
−60	.613									

TABLE 102

DEW-POINT CONVERSION CHART

Showing the relationship between dew point with respect to water and dew point with respect to ice, frost point.

Centigrade temperatures



Fahrenheit temperatures

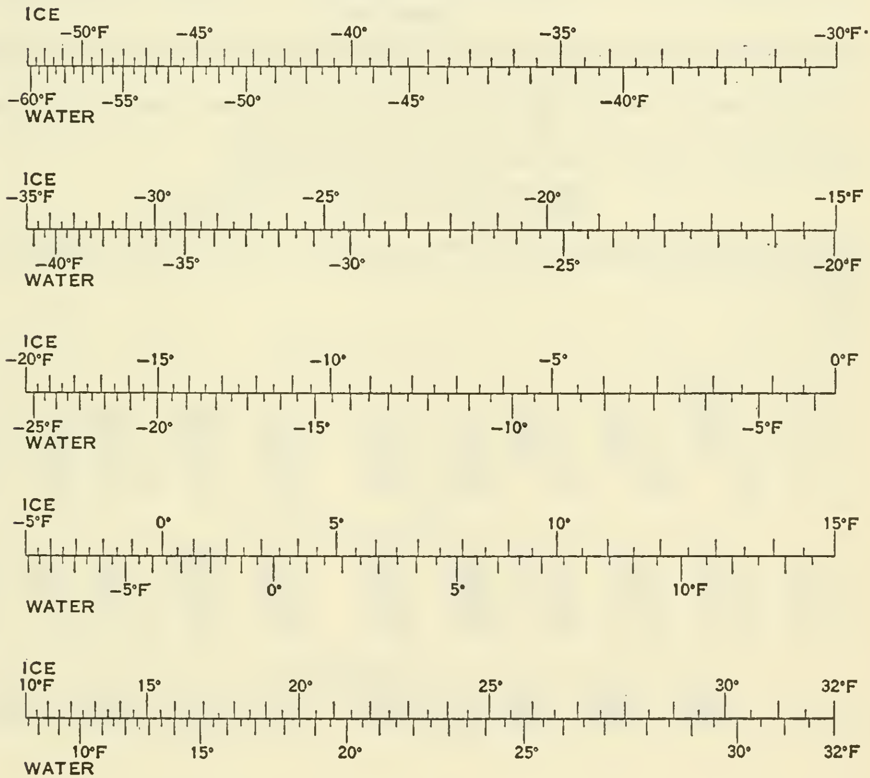


TABLE 103

VARIATION OF SATURATION VAPOR PRESSURE OVER WATER WITH TEMPERATURE

This table contains values of $\frac{de_w}{dT}$ where e_w is the saturation vapor pressure over water and T is the temperature (°K.). Values were computed from the formula

$$\frac{de_w}{dT} = \frac{e_w}{T^2}\left(6790.5 - 5.02808T + 4916.8 \times 10^{-.0304T}T^2 + 174209 \times 10^{-\frac{1302.88}{T}}\right)$$

obtained by differentiating the Goff-Gratch equation for the saturation vapor pressure over water (see p. 350).

Temperature °C.	0	1	2	3	4	5	6	7	8	9
	mb. °K.⁻¹									
−50	0.007286									
−40	0.01962	0.01785	0.01623	0.01473	0.01337	0.01211	0.01097	0.009916	0.008958	0.008084
−30	0.04802	0.04409	0.04043	0.03706	0.03393	0.03104	0.02837	0.02591	0.02364	0.02155
−20	0.1081	0.1000	0.09248	0.08544	0.07887	0.07276	0.06706	0.06176	0.05684	0.05226
−10	0.2262	0.2108	0.1962	0.1826	0.1698	0.1577	0.1465	0.1359	0.1260	0.1168
− 0	0.4438	0.4160	0.3897	0.3649	0.3414	0.3193	0.2984	0.2787	0.2601	0.2427
0	0.4438	0.4732	0.5043	0.5370	0.5717	0.6082	0.6467	0.6872	0.7299	0.7749
10	0.8222	0.8720	0.9244	0.9793	1.037	1.098	1.161	1.228	1.298	1.371
20	1.448	1.528	1.612	1.700	1.792	1.888	1.988	2.093	2.202	2.316
30	2.435	2.560	2.689	2.824	2.964	3.110	3.262	3.420	3.585	3.755
40	3.933	4.118	4.309	4.508	4.715	4.929	5.151	5.381	5.620	5.867
50	6.123	6.388	6.662	6.946	7.240	7.544	7.858	8.182	8.518	8.864
60	9.221									

TABLE 104

VARIATION OF SATURATION VAPOR PRESSURE OVER ICE WITH TEMPERATURE

This table contains values of $\frac{de_i}{dT}$ where e_i is the saturation vapor pressure over ice and T is the temperature (°K.). Values were computed from the formula

$$\frac{de_i}{dT} = \frac{e_i}{T^2}\left(5721.9 + 3.56654T - 0.0073908T^2\right)$$

obtained by differentiating the Goff-Gratch equation for the saturation vapor pressure over ice (see p. 350).

Temperature °C.	0	1	2	3	4	5	6	7	8	9
	Unit: 10⁻⁵ mb. °K.⁻¹									
−100	0.2863									
− 90	1.766	1.486	1.248	1.046	0.8745	0.7299	0.6080	0.5051	0.4191	0.3468
− 80	8.998	7.705	6.588	5.624	4.792	4.075	3.460	2.933	2.481	2.096
− 70	38.91	33.84	29.38	25.47	22.05	19.07	16.45	14.19	12.21	10.49
− 60	146.1	128.8	113.3	99.60	87.43	76.65	67.11	58.68	51.24	44.68
	Unit: 10⁻³ mb. °K.⁻¹									
− 50	4.859	4.331	3.856	3.429	3.047	2.702	2.396	2.121	1.876	1.656
− 40	14.52	13.07	11.75	10.56	9.484	8.505	7.620	6.819	6.097	5.445
− 30	39.52	35.89	32.57	29.54	26.76	24.22	21.90	19.79	17.87	16.11
− 20	99.05	90.65	82.91	75.78	69.21	63.16	57.60	52.49	47.79	43.48
	Unit: mb. °K.⁻¹									
− 10	0.2306	0.2126	0.1958	0.1803	0.1658	0.1524	0.1401	0.1285	0.1179	0.1081
− 0	0.5029	0.4665	0.4324	0.4006	0.3709	0.3432	0.3174	0.2932	0.2708	0.2500

SATURATION VAPOR PRESSURE OVER WATER OF SALINITY 35‰ [1]

The saturation vapor pressure over a plane surface of pure water depends only on the temperature of the water. The salinity decreases the saturation vapor pressure slightly, the empirical relation being

$$e_s = e_w(1 - 0.000537S)$$

where

e_s = saturation vapor pressure over sea water at a given temperature,
e_w = saturation vapor pressure over a plane surface of pure water at the same temperature,
S = salinity in parts per thousand (‰).

Values of e_s computed for a salinity of 35‰ are given in the table.

Temperature	Vapor pressure	Temperature	Vapor pressure	Temperature	Vapor pressure	Temperature	Vapor pressure
°C.	mb.	°C.	mb.	°C.	mb.	°C.	mb.
−2	5.19	7	9.83	16	17.85	25	31.12
−1	5.57	8	10.52	17	19.02	26	33.01
0	5.99	9	11.26	18	20.26	27	35.02
1	6.44	10	12.05	19	21.57	28	37.13
2	6.92	11	12.88	20	22.96	29	39.33
3	7.43	12	13.76	21	24.42	30	41.68
4	7.98	13	14.70	22	25.96	31	44.13
5	8.56	14	15.69	23	27.59	32	46.71
6	9.17	15	16.74	24	2930		

[1] Sverdrup, H. U., Johnson, M. W., and Fleming, R. H., The oceans, p. 116. Copyright 1942, by Prentice-Hall, Inc., New York.

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS[1]

Effect of curvature.—Kelvin[2] has shown that the curvature of water droplets tends to increase the equilibrium vapor pressure over the droplet in accordance with the equation

$$\log_e \frac{e'_w}{e_w} = \frac{2\gamma}{\rho R_v T r} \qquad (1)$$

where

e_w = equilibrium vapor pressure over a flat water surface,
e'_w = equilibrium vapor pressure over a curved water surface,
γ = surface tension of water,
R_v = gas constant for water vapor,
ρ = density of water,
T = temperature, °K.,
r = radius of curvature of the water surface.

Effect of dissolved substances.—According to Raoult's Law, which is valid for solutions dilute enough to be almost wholly dissociated, the vapor pressure over a solution is given by

$$\frac{e''_w - e_w}{e_w} = -\frac{M'}{M + M'} \qquad (2)$$

where

e''_w = equilibrium vapor pressure over a flat surface of solution,
M = number of mols of the solvent,
M' = number of mols of the solute.

Howell shows that the order of magnitude of the molecular concentration present in atmospheric droplets at high relative humidities is such that the validity of Raoult's Law can be presumed for any nucleus likely to be activated during atmospheric processes.

Combined effect of curvature and dissolved substance.—Howell has computed the equilibrium vapor pressure over solution droplets by combining equations (1) and (2). The percent supersaturation relative to a plane surface of pure water is given for $T = 273$, 263, 253, 243, and 233 °K. as a function of $\log_{10} r$ and n, where r is the radius of the droplet in centimeters and n the mass of the condensation nucleus, in gram molecular weights (mols). Since the molecular weights of the commonest hygroscopic substances in the atmosphere occupy a much narrower range than do the masses of the nuclei, it may be said in general that the activity of soluble nucleus at condensation depends primarily on its mass and only to a minor degree on its chemical composition.

In the range of relative humidities occurring during its natural formation and dissolution of fog and cloud, the variations of relative humidity from equilibrium are of the same order of magnitude as the degrees of supersaturation indicated in the table. Therefore the vapor pressure in the cloudy air is equal to the equilibrium vapor pressure derivable from the tables only when the droplets are of uniform size and are not undergoing growth or evaporation.

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[1] Howell, W. E., The growth of cloud droplets in uniformly cooled air, Sc.D. dissertation, Mass. Inst. Techn., 1948. Also Journ. Meteorol., vol. 6, p. 134, 1949.
[2] Kelvin, Lord, Proc. Roy. Soc. Edinburgh, vol. 7, p. 63, 1870.

(*continued*)

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS

$T = 273$ °K.

$\log_{10} r$ (cm.)	Mass of condensation nucleus—mols: 0	10^{-20}	10^{-19}	10^{-18}	10^{-17}	10^{-16}	10^{-15}	10^{-14}	10^{-13}
	%	%	%	%	%	%	%	%	%
−2.5	0.003796	0.003796	0.003796	0.003796	0.003796	0.003795	0.003792	0.003660	0.002435
−2.6	.00478	.00478	.00478	.00478	.00478	.00478	.00475	.00450	.00194
−2.7	.00602	.00602	.00602	.00602	.00602	.00601	.00597	.00548	0.00060
−2.8	.00757	.00757	.00757	.00757	.00757	.00756	.00747	.00649	−0.00324
−2.9	.00954	.00954	.00954	.00954	.00954	.00952	.00932	.00739	−0.01201
−3.0	0.01200	0.01200	0.01200	0.01200	0.01200	0.01196	0.01157	0.00770	−0.0310
−3.1	.01511	.01511	.01511	.01511	.01510	.01502	.01425	.00693	−.0707
−3.2	.01902	.01902	.01902	.01902	.01900	.01885	.01731	0.00189	−.1523
−3.3	.02395	.02395	.02395	.02395	.02392	.02361	.02053	−0.01021	−.3176
−3.4	.03018	.03018	.03018	.03017	.03011	.02950	.02336	−.0380	−.652
−3.5	0.03796	0.03796	0.03796	0.03795	0.03782	0.03660	0.02435	−0.0981	−1.323
−3.6	.0478	.0478	.0478	.0478	.0475	.0450	.0194	−.2363	−2.793
−3.7	.0602	.0602	.0602	.0601	.0597	.0548	0.0060	−0.4813	−5.355
−3.8	.0757	.0757	.0757	.0756	.0746	.0649	−0.0324	−1.005	−10.73
−3.9	.0954	.0954	.0954	.0952	.0932	.0739	−.1201	−2.060	−21.45
−4.0	0.1200	0.1200	0.1200	0.1196	0.1157	0.0770	−0.310	−4.18	−42.9
−4.1	.1511	.1511	.1510	.1502	.1425	.0653	−.707	−8.43	
−4.2	1902	.1902	.1900	.1885	.1731	0.0189	−1.523	−16.94	
−4.3	.2395	.2395	.2392	.2361	.2053	−0.1021	−3.176	−33.92	
−4.4	.3018	.3017	.3011	.2950	.2336	−.360	−6.52		
−4.5	0.3799	0.3798	0.3785	0.3663	0.2438	−0.981	−13.23		
−4.6	.479	.479	.476	.451	.198	−2.335	−27.66		
−4.7	.604	.603	.599	.550	0.062	−4.82	−53.6		
−4.8	.760	.759	.749	.652	−0.321	−10.05			
−4.9	.958	.956	.936	.742	−1.197	−20.59			
−5.0	1.207	1.203	1.164	0.777	−3.09	−41.8			
−5.1	1.523	1.514	1.437	0.765	−7.08				
−5.2	1.920	1.903	1.749	0.207	−15.21				
−5.3	2.424	2.390	2.082	−0.992	−31.74				
−5.4	3.064	2.996	2.382	−3.76					
−5.5	3.868	3.732	2.507	−9.74					
−5.6	4.90	4.62	1.81	−23.24					
−5.7	6.21	5.67	0.25						
−5.8	7.84	6.76	−4.05						
−5.9	9.92	7.77	−13.78						
−6.0	12.75	8.45	−34.6						
−6.1	16.30	7.72							
−6.2	20.94	3.81							
−6.3	27.06	−7.10							
−6.4	35.2	−33.0							
−6.5	46.2								
−6.6	61.3								
−6.7	82.5								
−6.8	113.2								
−6.9	159.5								
−7.0	232.0								

(*continued*)

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS

$T = 263$ °K.

$\log_{10} r$ (cm.)	Mass of condensation nucleus—mols								
	0	10^{-20}	10^{-19}	10^{-18}	10^{-17}	10^{-16}	10^{-15}	10^{-14}	10^{-13}
	%	%	%	%	%	%	%	%	%
—2.5	0.003980	0.003980	0.003980	0.003980	0.003979	0.003979	0.003966	0.003844	0.02319
—2.6	.00501	.00501	.00501	.00501	.00501	.00501	.00498	.00473	.00090
—2.7	.00631	.00631	.00631	.00631	.00631	.00631	.00626	.00577	— 0.00287
—2.8	.00794	.00794	.00794	.00794	.00794	.00793	.00783	.00686	— .01155
—2.9	.01000	.01000	.01000	.01000	.01000	.00998	.00978	.00784	— .01155
—3.0	0.01259	0.01259	0.01259	0.01259	0.01259	0.01255	0.01216	0.00829	— 0.0314
—3.1	.01584	.01584	.01584	.01584	.01583	.01576	.01497	.00726	— .0700
—3.2	.01995	.01995	.01995	.01995	.01993	.01978	.01824	.00282	— .1513
—3.3	.02510	.02510	.02510	.02510	.02507	.02476	.02168	— 0.00906	— .365
—3.4	.03160	.03160	.03160	.03159	.03153	.03092	.02478	— .0366	— .650
—3.5	0.03980	0.03980	0.03980	0.03979	0.03966	0.03844	0.02319	— 0.0963	— 1.321
—3.6	.0501	.0501	.0501	.0501	.0498	.0473	.0220	— .2313	— 2.764
—3.7	.0631	.0631	.0631	.0631	.0626	.0577	0.0090	— 0.4784	— 5.452
—3.8	.0794	.0794	.0794	.0793	.0783	.0686	— 0.0287	— 1.002	—10.73
—3.9	.1000	.1000	.1000	.0998	.0978	.0784	— .1155	— 2.055	—21.45
—4.0	0.1259	0.1259	0.1259	0.1255	0.1216	0.0829	— 0.314	— 4.17	
—4.1	.1584	.1584	.1583	.1576	.1497	.0726	— .700	— 8.24	
—4.2	.1995	.1995	.1993	.1978	.1824	0.0282	— 1.513	—16.70	
—4.3	.2510	.2510	.2507	.2476	.2168	— 0.0906	— 3.65	—33.91	
—4.4	.3160	.3159	.3153	.3092	.2478	— .366	— 6.50		
—4.5	0.3985	0.3984	0.3971	0.3849	0.2624	— 0.963	—15.91		
—4.6	.403	.403	.400	.875	.122	— 2.411	—27.74		
—4.7	.634	.634	.629	.580	0.092	— 4.79			
—4.8	0.798	.797	.787	.692	— 0.283	—10.01			
—4.9	1.006	1.004	.984	.790	— 1.149	—20.54			
—5.0	1.277	1.278	1.234	0.847	— 2.02	—42.9			
—5.1	1.597	1.588	1.511	.737	— 6.98				
—5.2	2.016	1.999	1.945	.303	—15.11				
—5.3	2.543	2.509	2.201	— 0.873	—31.62				
—5.4	3.215	3.147	2.533	— 3.60					
—5.5	4.060	3.924	2.699	— 9.55					
—5.6	5.14	4.86	2.83	—23.00					
—5.7	6.51	5.97	1.09	—47.64					
—5.8	8.27	7.19	— 2.53						
—5.9	11.03	8.87	—10.52						
—6.0	13.43	9.13	—29.6						
—6.1	17.17	8.59							
—6.2	22.08	4.95							
—6.3	28.53	— 5.63							
—6.4	37.20	—31.0							
—6.5	48.85								
—6.6	65.1								
—6.7	87.9								
—6.8	121.8								
—6.9	171.8								
—7.0	252.2								

(continued)

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS

$T = 253$ °K.

$\log_{10} r$ (cm.)	Mass of condensation nucleus—mols								
	0	10^{-20}	10^{-19}	10^{-18}	10^{-17}	10^{-16}	10^{-15}	10^{-14}	10^{-13}
	%	%	%	%	%	%	%	%	%
—2.5	0.00426	0.00426	0.00426	0.00426	0.00426	0.00426	0.00425	0.00412	0.00289
—2.6	.00536	.00536	.00536	.00536	.00536	.00536	.00533	.00509	.00263
—2.7	.00676	.00676	.00676	.00676	.00676	.00675	.00671	.00622	0.00132
—2.8	.00851	.00851	.00851	.00851	.00851	.00850	.00840	.00742	— 0.00225
—2.9	.01072	.01072	.01072	.01072	.01072	.01070	.01050	.00855	— .01094
—3.0	0.01348	0.01348	0.01348	0.01348	0.01348	0.01344	0.01305	0.00916	— 0.0297
—3.1	.01698	.01698	.01698	.01698	.01697	.01689	.01612	.00836	— .0690
—3.2	.02137	.02137	.02137	.02137	.02135	.02119	.01965	0.00416	— .1507
—3.3	.02690	.02690	.02690	.02690	.02687	.02656	.02347	— 0.00742	— .3163
—3.4	.03387	.03387	.03387	.03386	.03381	.03319	.02702	— .0346	— .651
—3.5	0.0426	0.0426	0.0426	0.0426	0.0425	0.0412	0.0289	— 0.0941	— 1.324
—3.6	.0536	.0536	.0536	.0536	.0533	.0509	.0263	— .2191	— 2.673
—3.7	.0676	.0676	.0676	.0675	.0671	.0622	0.0132	— 0.4764	— 5.372
—3.8	.0851	.0851	.0851	.0850	.0840	.0742	— 0.0225	— 1.001	—10.75
—3.9	.1072	.1072	.1072	.1070	.1050	.0855	— .1094	— 2.059	—21.55
—4.0	0.1348	0.1348	0.1348	0.1344	0.1305	0.0916	— 0.297	— 4.19	—43.1
—4.1	.1698	.1698	.1697	.1689	.1612	.0836	— 0.690	— 8.45	
—4.2	.2137	.2137	.2135	.2119	.1965	0.0416	— 1.507	—17.00	
—4.3	.2690	.2690	.2687	.2656	.2347	0.0742	— 3.163	—34.05	
—4.4	.3387	.3386	.3381	.3319	.2702	— .346	— 6.51		
—4.5	0.426	0.426	0.425	0.412	0.285	— 0.941	—13.24		
—4.6	.538	.538	.535	.511	.265	— 2.189	—26.63		
—4.7	.677	.677	.672	.623	0.133	— 4.763			
—4.8	0.853	0.852	0.842	.744	— 0.233	—10.01			
—4.9	1.077	1.075	1.055	.838	— 1.089	—20.58			
—5.0	1.358	1.354	1.315	0.926	— 2.96	—41.8			
—5.1	1.713	1.704	1.627	.851	— 6.91				
—5.2	2.160	2.143	1.988	0.439	—15.05				
—5.3	2.827	2.793	2.484	— 0.605	—31.49				
—5.4	3.444	3.376	2.759	— 3.41	—65.1				
—5.5	4.357	4.220	3.990	— 9.10					
—5.6	5.52	5.25	2.79	—21.75					
—5.7	6.99	6.45	1.55	—47.4					
—5.8	8.88	7.79	— 1.98						
—5.9	11.31	9.14	—10.35						
—6.0	14.43	10.11	—28.8						
—6.1	18.50	8.88	—67.7						
—6.2	23.82	6.61							
—6.3	80.86	— 3.46							
—6.4	40.3	—28.2							
—6.5	53.2								
—6.6	71.1								
—6.7	96.6								
—6.8	134.2								
—6.9	190.2								
—7.0	285.4								

(continued)

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS

$T = 243$ °K.

$\log_{10} r$ (cm.)	Mass of condensation nucleus—mols								
	0	10^{-20}	10^{-19}	10^{-18}	10^{-17}	10^{-16}	10^{-15}	10^{-14}	10^{-13}
	%	%	%	%	%	%	%	%	%
—2.5	0.00455	0.00455	0.00455	0.00455	0.00455	0.00455	0.00454	0.00441	0.00317
—2.6	.00573	.00573	.00573	.00573	.00573	.00573	.00570	.00545	.00298
—2.7	.00721	.00721	.00721	.00721	.00721	.00720	.00716	.00666	.00173
—2.8	.00907	.00907	.00907	.00907	.00907	.00906	.00896	.00797	— 0.00189
—2.9	.01143	.01143	.01143	.01143	.01143	.01141	.01121	.00925	— .01042
—3.0	0.01439	0.01439	0.01439	0.01439	0.01439	0.01435	0.01395	0.01003	— 0.0288
—3.1	.01811	.01811	.01811	.01811	.01810	.01802	.01724	.00941	— .0689
—3.2	.02279	.02279	.02279	.02279	.02277	.02262	.02105	0.00542	— .1509
—3.3	.02870	.02870	.02870	.02870	.02867	.02835	.02524	— 0.00593	— .3176
—3.4	.03615	.03615	.03614	.03614	.03608	.03546	.02924	— .0329	— .655
—3.5	0.0455	0.0455	0.0455	0.0455	0.0454	0.0441	0.0317	— 0.0925	— 1.344
—3.6	.0573	.0573	.0573	.0573	.0570	.0545	.0298	— .2178	— 2.694
—3.7	.0721	.0721	.0721	.0720	.0716	.0666	0.0173	— 0.4764	— 5.413
—3.8	.0907	.0907	.0907	.0906	.0896	.0797	— 0.0189	— 1.005	—10.86
—3.9	.1143	.1143	.1143	.1141	.1121	.0925	— .1042	— 2.071	—21.74
—4.0	0.1439	0.1439	0.1439	0.1435	0.1395	0.1003	— 0.288	— 4.22	—43.5
—4.1	.1811	.1811	.1810	.1802	.1724	0.0941	— 0.689	— 8.52	
—4.2	.2279	.2279	.2277	.2262	.2105	— 0.0542	— 1.509	—17.14	
—4.3	.2870	.2870	.2867	.2835	.2524	— .0593	— 3.176	—34.34	
—4.4	.3615	.3614	.3608	.3546	.2924	— .329	— 6.55		
—4.5	0.455	0.455	0.454	0.441	0.317	— 0.925	—13.44		
—4.6	.574	.574	.571	.546	.299	— 2.177	—26.94		
—4.7	.722	.721	.717	.667	0.174	— 4.763			
—4.8	.910	.909	.899	.800	— 0.186	—10.05			
—4.9	1.149	1.147	1.127	.931	— 1.035	—20.70			
—5.0	1.449	1.445	1.405	1.013	— 2.91	—42.1			
—5.1	1.828	1.819	1.741	.958	— 6.97				
—5.2	2.306	2.289	2.132	0.569	—15.06				
—5.3	2.913	2.878	2.567	— 0.550	—31.72				
—5.4	3.680	3.611	2.989	— 3.23					
—5.5	4.655	4.517	3.275	— 9.14					
—5.6	5.79	5.51	3.04	—21.72					
—5.7	7.48	6.93	2.00	—47.37					
—5.8	9.51	8.41	— 1.45						
—5.9	12.10	9.92	— 9.75						
—6.0	15.47	11.11	—28.1						
—6.1	19.85	11.15							
—6.2	25.60	8.23							
—6.3	33.23	— 1.40							
—6.4	43.50	—25.6							
—6.5	57.6	—70.4							
—6.6	77.3								
—6.7	111.2								
—6.8	147.8								
—6.9	213.5								
—7.0	321.5								

(*continued*)

EQUILIBRIUM SUPERSATURATION OVER SOLUTION DROPLETS

$T = 233$ °K.

$\log_{10} r$ (cm.)	Mass of condensation nucleus—mols 0	10^{-20}	10^{-19}	10^{-18}	10^{-17}	10^{-16}	10^{-15}	10^{-14}	10^{-13}
	%	%	%	%	%	%	%	%	%
—2.5	0.00491	0.00491	0.00491	0.00491	0.00491	0.00491	0.00490	0.00477	0.00350
—2.6	.00617	.00617	.00617	.00617	.00617	.00617	.00614	.00589	.00336
—2.7	.00777	.00777	.00777	.00777	.00777	.00776	.00771	.00720	0.00207
—2.8	.00979	.00979	.00979	.00979	.00979	.00978	.00968	.00867	— 0.00139
—2.9	.01233	.01233	.01233	.01233	.01233	.01231	.01211	.01010	— .01997
—3.0	0.01552	0.01552	0.01552	0.01552	0.01552	0.01548	0.01508	0.01107	— 0.0290
—3.1	.01954	.01954	.01954	.01954	.01953	.01945	.01865	.01066	— .0693
—3.2	.02459	.02459	.02459	.02459	.02457	.02441	.02182	0.00687	— .1526
—3.3	.03095	.03095	.03095	.03095	.03092	.03060	.02742	— 0.00439	— .3224
—3.4	.03896	.03896	.03896	.03895	.03889	.03826	.03191	— .0315	— .666
—3.5	0.0491	0.0491	0.0491	0.0491	0.0490	0.0477	0.0350	— 0.0916	— 1.358
—3.6	.0617	.0617	.0617	.0617	.0614	.0589	.0336	— .2190	— 2.745
—3.7	.0777	.0777	.0777	.0776	.0771	.0720	0.0207	— 0.493	— 5.62
—3.8	.0979	.0979	.0979	.0978	.0968	.0867	— 0.0139	— 1.020	—11.08
—3.9	.1233	.1233	.1233	.1231	.1211	.1010	— .1997	— 2.107	—22.18
—4.0	0.1552	0.1552	0.1552	0.1548	0.1508	0.1107	— 0.290	— 4.29	—44.4
—4.1	.1954	.1954	.1953	.1945	.1865	.1066	— 0.693	— 8.19	
—4.2	.2459	.2459	.2457	.2441	.2182	0.0687	— 1.526	—17.47	
—4.3	.3095	.3095	.3092	.3060	.2742	— 0.0439	— 3.224	—34.03	
—4.4	.3896	.3895	.3889	.3826	.3191	— .315	— 6.66		
—4.5	0.491	0.491	0.490	0.477	0.350	— 0.916	—13.58		
—4.6	.619	.619	.616	.581	.338	— 2.188	—27.45		
—4.7	.780	.779	.774	.723	0.210	— 4.92	—56.2		
—4.8	0.982	0.981	0.971	0.870	— 0.136	—10.20			
—4.9	1.241	1.239	1.219	1.018	— 0.989	—21.06			
—5.0	1.565	1.561	1.521	1.120	— 2.88	—44.3			
—5.1	1.972	1.963	1.883	1.084	— 6.91				
—5.2	2.490	2.472	2.313	0.718	—15.23				
—5.3	3.145	3.110	2.792	— 0.389	—32.20				
—5.4	3.976	3.906	3.275	— 3.07					
—5.5	5.02	4.88	3.61	— 9.05					
—5.6	6.37	6.09	3.56	—21.70					
—5.7	8.09	7.57	2.39	—48.9					
—5.8	10.29	9.17	— 0.89						
—5.9	13.12	10.89	— 9.18						
—6.0	16.88	12.43	—27.6						
—6.1	21.58	12.70	—67.2						
—6.2	28.88	11.16							
—6.3	36.30	— 0.96							
—6.4	47.65	—22.9							
—6.5	63.4	—77.8							
—6.6	85.5								
—6.7	117.7								
—6.8	158.0								
—6.9	243.4								
—7.0	372								

Table 107

RELATIVE HUMIDITY OVER SATURATED SALT SOLUTIONS[1]

A convenient method for calibrating hygrometers is by use of certain saturated salt solutions in a sealed chamber. The chamber should be kept free from water-absorbing materials, such as wood. The salt solution is made up as a slushy mixture, with the solution spreading over as large an area as possible, and a method should be provided for circulating the air within the chamber. Distilled water and chemically pure salts must be used. Even with these precautions it is emphasized that the tabulated values of relative humidity can be considered as only approximate, and for precision work must be checked by independent measurements.

Temperature	Potassium nitrate KNO_3	Sodium chloride NaCl	Magnesium nitrate $Mg(NO_3)_2.6H_2O$	Magnesium chloride $MgCl_2.6H_2O$	Lithium chloride * LiCl
°C.	%	%	%	%	%
0	96	76	54	30	16
5	96	76	54	30	16
10	95	76	53	31	16
15	95	76	53	31	16
20	95	75	53	32	16
25	95	75	52	32	16
30	94	75	52	33	16
35	92	75	51	33	16
40	90	75	51	33	16

* Values given for LiCl are probably too high, since they do not precisely check vapor-pressure data.

[1] Nat. Bur. Stand. Letter Circ. LC 946, March 31, 1949. For a more complete table see O'Brien, F. E. M., Journ. Sci. Instr., vol. 25, p. 73, 1948.

DENSITY OF PURE WATER VAPOR AT SATURATION

The density of pure water vapor (vapor unadmixed with air) at saturation over a plane surface of liquid water, ρ_w, in cgs units is

$$\rho_w = \frac{e_w}{C_v R_w T} \tag{1}$$

where

R_w = gas constant for water vapor, 4.6150×10^6 erg g.$^{-1}$ °K.$^{-1}$,
T = temperature of the vapor, °K.,
e_w = saturation vapor pressure over water at temperature T,
C_v = "compressibility factor" for water vapor (Table 91).

The factor C_v is introduced into equation (1) to correct for the deviations of water vapor from ideal gas laws.

For pressures measured in millibars, the density ρ_w in g. m.$^{-3}$ (1 g. m.$^{-3} = 10^{-6}$ g. cm.$^{-3}$) is

$$\rho_w = 216.68 \frac{e_w\,(\text{mb.})}{C_v T} \tag{2}$$

In a similar manner, the density of pure water vapor at saturation over a plane surface of ice, ρ_i, is found by substituting e_i, the saturation vapor pressure over ice, for e_w in equations (1) or (2).

Concentrations of the constitutents of moist air.—It is necessary to distinguish between the density of a gas or vapor unadmixed and the concentrations of the constituents of a mixture; this is especially true in dealing with real gases. The vapor concentration d_v and the dry-air concentration d_a are defined as the ratios of the masses of vapor m_v and of dry air m_a, respectively, to the volume V occupied by the mixture

$$d_v = \frac{m_v}{V} \tag{3}$$

$$d_a = \frac{m_a}{V} \tag{4}$$

Since the mixing ratio $r = m_v/m_a$ and the density of moist air $\rho = d_a + d_v$, equation (3) becomes

$$d_v = \frac{r}{1+r}\rho \tag{5}$$

On introducing the mixing ratio at saturation over water r_w, where $r = Ur_w$ and U is the relative humidity, equation (5) becomes

$$d_v = \frac{Ur_w}{1+Ur_w}\rho \tag{6}$$

Using values of ρ and r_w from Tables 71 and 73, respectively, d_v may be readily computed from (6).

(continued)

TABLE 108

DENSITY OF PURE WATER VAPOR AT SATURATION OVER WATER

(Explanation on p. 381.)

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³	g. m.⁻³
−50	0.06171									
−49	0.06886	0.06812	0.06738	0.06664	0.06592	0.06520	0.06449	0.06378	0.06309	0.06240
−48	0.07675	0.07592	0.07510	0.07430	0.07350	0.07270	0.07191	0.07115	0.07038	0.06961
−47	0.08544	0.08453	0.08364	0.08274	0.08187	0.08099	0.08013	0.07927	0.07842	0.07758
−46	0.09501	0.09402	0.09303	0.09205	0.09107	0.09011	0.08915	0.08822	0.08728	0.08635
−45	0.1055	0.1044	0.1033	0.1022	0.1011	0.1001	0.09912	0.09812	0.09702	0.09601
−44	0.1172	0.1160	0.1148	0.1136	0.1124	0.1112	0.1101	0.1090	0.1078	0.1066
−43	0.1298	0.1285	0.1272	0.1258	0.1246	0.1233	0.1220	0.1208	0.1196	0.1183
−42	0.1438	0.1424	0.1409	0.1395	0.1380	0.1367	0.1353	0.1339	0.1325	0.1312
−41	0.1590	0.1574	0.1559	0.1543	0.1528	0.1512	0.1497	0.1482	0.1468	0.1452
−40	0.1757	0.1740	0.1723	0.1706	0.1690	0.1673	0.1656	0.1640	0.1623	0.1606
−39	0.1940	0.1922	0.1902	0.1884	0.1866	0.1847	0.1829	0.1811	0.1793	0.1775
−38	0.2141	0.2119	0.2099	0.2079	0.2058	0.2038	0.2019	0.1998	0.1979	0.1960
−37	0.2359	0.2336	0.2314	0.2291	0.2269	0.2247	0.2225	0.2204	0.2183	0.2162
−36	0.2597	0.2572	0.2548	0.2523	0.2499	0.2475	0.2451	0.2428	0.2405	0.2382
−35	0.2856	0.2829	0.2802	0.2776	0.2750	0.2723	0.2697	0.2672	0.2647	0.2621
−34	0.3138	0.3108	0.3080	0.3050	0.3022	0.2993	0.2966	0.2938	0.2910	0.2883
−33	0.3445	0.3413	0.3382	0.3350	0.3320	0.3289	0.3258	0.3228	0.3198	0.3167
−32	0.3779	0.3744	0.3710	0.3675	0.3642	0.3608	0.3574	0.3542	0.3510	0.3477
−31	0.4141	0.4104	0.4067	0.4029	0.3992	0.3956	0.3920	0.3884	0.3849	0.3814
−30	0.4534	0.4493	0.4453	0.4413	0.4373	0.4334	0.4295	0.4256	0.4218	0.4179
−29	0.4960	0.4916	0.4872	0.4829	0.4785	0.4743	0.4700	0.4659	0.4617	0.4575
−28	0.5422	0.5374	0.5327	0.5280	0.5234	0.5187	0.5141	0.5096	0.5050	0.5006
−27	0.5922	0.5871	0.5820	0.5768	0.5718	0.5668	0.5618	0.5568	0.5519	0.5470
−26	0.6463	0.6407	0.6351	0.6296	0.6242	0.6187	0.6133	0.6079	0.6026	0.5974
−25	0.7047	0.6986	0.6927	0.6867	0.6808	0.6749	0.6691	0.6633	0.6576	0.6519
−24	0.7678	0.7612	0.7548	0.7483	0.7420	0.7357	0.7294	0.7232	0.7170	0.7108
−23	0.8359	0.8289	0.8218	0.8150	0.8081	0.8012	0.7944	0.7877	0.7810	0.7743
−22	0.9093	0.9017	0.8941	0.8867	0.8792	0.8719	0.8645	0.8573	0.8501	0.8429
−21	0.9884	0.9802	0.9720	0.9640	0.9560	0.9481	0.9402	0.9323	0.9246	0.9170
−20	1.074	1.065	1.056	1.047	1.039	1.030	1.022	1.013	1.005	0.9966
−19	1.165	1.156	1.146	1.137	1.128	1.119	1.109	1.100	1.091	1.082
−18	1.264	1.253	1.243	1.233	1.223	1.214	1.204	1.194	1.184	1.175
−17	1.369	1.359	1.348	1.337	1.326	1.316	1.305	1.295	1.284	1.274
−16	1.483	1.471	1.460	1.448	1.437	1.425	1.414	1.403	1.392	1.381
−15	1.605	1.592	1.580	1.568	1.555	1.543	1.531	1.519	1.507	1.495
−14	1.736	1.722	1.709	1.696	1.682	1.669	1.656	1.643	1.630	1.618
−13	1.876	1.861	1.847	1.833	1.819	1.805	1.791	1.777	1.763	1.749
−12	2.026	2.010	1.995	1.980	1.965	1.949	1.934	1.920	1.905	1.890
−11	2.186	2.170	2.153	2.137	2.121	2.105	2.089	2.073	2.057	2.041
−10	2.358	2.340	2.323	2.305	2.288	2.271	2.254	2.237	2.220	2.203
− 9	2.541	2.522	2.504	2.485	2.466	2.448	2.430	2.412	2.394	2.376
− 8	2.737	2.717	2.697	2.677	2.657	2.638	2.618	2.599	2.579	2.560
− 7	2.946	2.925	2.903	2.882	2.861	2.840	2.819	2.798	2.778	2.758
− 6	3.169	3.146	3.123	3.101	3.078	3.056	3.034	3.012	2.990	2.968
− 5	3.407	3.383	3.358	3.334	3.310	3.286	3.263	3.239	3.216	3.193
− 4	3.660	3.634	3.609	3.583	3.557	3.532	3.507	3.481	3.456	3.432
− 3	3.930	3.902	3.875	3.847	3.820	3.793	3.766	3.740	3.713	3.687
− 2	4.217	4.188	4.159	4.129	4.100	4.072	4.043	4.015	3.986	3.958
− 1	4.523	4.491	4.460	4.429	4.398	4.368	4.337	4.307	4.277	4.247
− 0	4.847	4.814	4.781	4.748	4.715	4.683	4.650	4.618	4.586	4.554
0	4.847	4.881	4.915	4.948	4.983	5.017	5.052	5.087	5.122	5.157
1	5.192	5.228	5.264	5.300	5.336	5.373	5.409	5.446	5.483	5.521
2	5.559	5.597	5.635	5.673	5.711	5.750	5.789	5.828	5.868	5.907
3	5.947	5.987	6.028	6.068	6.109	6.150	6.192	6.233	6.275	6.317
4	6.360	6.402	6.445	6.488	6.531	6.575	6.619	6.663	6.707	6.752

(continued)

DENSITY OF PURE WATER VAPOR AT SATURATION OVER WATER

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$
5	6.797	6.842	6.887	6.933	6.979	7.025	7.071	7.118	7.165	7.212
6	7.260	7.307	7.355	7.404	7.452	7.501	7.550	7.600	7.649	7.699
7	7.750	7.801	7.851	7.902	7.954	8.006	8.058	8.110	8.163	8.216
8	8.270	8.324	8.377	8.431	8.485	8.540	8.595	8.650	8.706	8.762
9	8.819	8.875	8.932	8.989	9.046	9.104	9.163	9.221	9.280	9.339
10	9.399	9.459	9.519	9.579	9.641	9.702	9.763	9.825	9.887	9.949
11	10.01	10.08	10.14	10.20	10.27	10.33	10.40	10.46	10.53	10.59
12	10.66	10.73	10.79	10.86	10.93	11.00	11.07	11.14	11.21	11.27
13	11.35	11.42	11.49	11.56	11.63	11.70	11.77	11.85	11.92	11.99
14	12.07	12.14	12.22	12.29	12.37	12.44	12.52	12.60	12.67	12.75
15	12.83	12.91	12.99	13.07	13.14	13.23	13.31	13.39	13.47	13.55
16	13.63	13.72	13.80	13.88	13.97	14.05	14.14	14.22	14.31	14.39
17	14.48	14.57	14.65	14.74	14.83	14.92	15.01	15.10	15.19	15.28
18	15.37	15.46	15.55	15.65	15.74	15.83	15.93	16.02	16.12	16.21
19	16.31	16.41	16.50	16.60	16.70	16.80	16.90	17.00	17.10	17.20
20	17.30	17.40	17.50	17.60	17.71	17.81	17.91	18.02	18.12	18.23
21	18.34	18.44	18.55	18.66	18.77	18.88	18.99	19.10	19.21	19.32
22	19.43	19.54	19.65	19.77	19.88	20.00	20.11	20.23	20.34	20.46
23	20.58	20.70	20.81	20.93	21.05	21.17	21.29	21.42	21.54	21.66
24	21.78	21.91	22.03	22.16	22.28	22.41	22.54	22.66	22.79	22.92
25	23.05	23.18	23.31	23.44	23.58	23.71	23.84	23.97	24.11	24.24
26	24.38	24.52	24.66	24.79	24.93	25.07	25.21	25.35	25.49	25.63
27	25.78	25.92	26.06	26.21	26.35	26.50	26.65	26.79	26.94	27.09
28	27.24	27.39	27.54	27.69	27.85	28.00	28.15	28.31	28.46	28.62
29	28.78	28.93	29.09	29.25	29.41	29.57	29.73	29.89	30.05	30.22
30	30.38	30.55	30.71	30.88	31.05	31.22	31.38	31.55	31.72	31.89
31	32.07	32.24	32.41	32.59	32.76	32.94	33.11	33.29	33.47	33.65
32	33.83	34.01	34.19	34.38	34.56	34.74	34.93	35.11	35.30	35.49
33	35.68	35.87	36.06	36.25	36.44	36.63	36.83	37.02	37.22	37.41
34	37.61	37.81	38.01	38.21	38.41	38.61	38.81	39.01	39.22	39.42
35	39.63	39.84	40.05	40.26	40.47	40.68	40.89	41.10	41.31	41.53
36	41.75	41.96	42.18	42.40	42.62	42.84	43.06	43.28	43.50	43.73
37	43.96	44.18	44.41	44.64	44.87	45.09	45.33	45.56	45.79	46.02
38	46.26	46.50	46.74	46.97	47.21	47.45	47.69	47.94	48.18	48.42
39	48.67	48.92	49.17	49.42	49.66	49.92	50.17	50.42	50.67	50.93
40	51.19	51.45	51.70	51.96	52.22	52.49	52.75	53.01	53.28	53.54
41	53.82	54.09	54.36	54.63	54.90	55.17	55.44	55.72	56.00	56.27
42	56.56	56.84	57.12	57.40	57.68	57.97	58.25	58.54	58.83	59.12
43	59.41	59.70	60.00	60.29	60.59	60.88	61.18	61.48	61.78	62.08
44	62.39	62.70	63.00	63.31	63.62	63.92	64.23	64.55	64.86	65.17
45	65.50	65.81	66.13	66.45	66.77	67.10	67.42	67.74	68.07	68.40
46	68.73	69.06	69.39	69.73	70.06	70.40	70.73	71.07	71.41	71.75
47	72.10	72.45	72.79	73.13	73.49	73.84	74.18	74.53	74.89	75.25
48	75.61	75.96	76.33	76.69	77.05	77.41	77.77	78.14	78.51	78.88
49	79.26	79.63	80.01	80.38	80.76	81.14	81.52	81.90	82.28	82.67
50	83.06	83.45	83.84	84.23	84.62	85.01	85.41	85.81	86.20	86.60
51	87.01	87.41	87.82	88.22	88.63	89.04	89.45	89.86	90.27	90.69
52	91.12	91.54	91.96	92.38	92.80	93.23	93.66	94.09	94.52	94.95
53	95.39	95.83	96.27	96.71	97.14	97.59	98.03	98.47	98.92	99.37
54	99.83	100.3	100.7	101.2	101.7	102.1	102.6	103.0	103.5	104.0
55	104.4	104.9	105.4	105.9	106.3	106.8	107.3	107.8	108.2	108.7
56	109.2	109.7	110.2	110.7	111.2	111.7	112.2	112.7	113.2	113.7
57	114.2	114.7	115.2	115.7	116.2	116.8	117.3	117.8	118.3	118.8
58	119.4	119.9	120.4	121.0	121.5	122.0	122.6	123.1	123.6	124.2
59	124.7	125.3	125.8	126.4	126.9	127.5	128.0	128.6	129.1	129.7
60	130.3									

DENSITY OF PURE WATER VAPOR AT SATURATION OVER ICE

(Explanation on p. 381.)

Temperature	Density	Temperature	Density	Temperature	Density	Temperature	Density
°C.	g. m.$^{-3}$	°C.	g. m.$^{-3}$	°C.	g. m.$^{-3}$	°C.	g. m.$^{-3}$
—100	0.00001756	—87	0.0001930	—74	0.001550	—61	0.009633
— 99	.00002139	—86	.0002289	—73	.001799	—60	.01098
— 98	.00002599	—85	.0002710	—72	.002085	—59	.01251
— 97	.00003150	—84	.0003203	—71	.002414	—58	.01423
— 96	.00003812	—83	.0003778	—70	.002789	—57	.01616
— 95	0.00004602	—82	0.0004449	—69	0.003218	—56	0.01834
— 94	.00005544	—81	.0005230	—68	.003708	—55	.02078
— 93	.00006665	—80	.0006138	—67	.004267	—54	.02353
— 92	.00007996	—79	.0007191	—66	.004903	—53	.02660
— 91	.00009574	—78	.0008413	—65	.005627	—52	.03005
— 90	0.0001144	—77	0.0009824	—64	0.006449	—51	0.03390
— 89	.0001365	—76	.001145	—63	.007381	—50	.03821
— 88	.0001624	—75	.001334	—62	.008438		

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$
— 49	0.04301	0.04250	0.04200	0.04151	0.04102	0.04054	0.04007	0.03959	0.03912	0.03867
— 48	.04837	.04780	.04724	.04670	.04616	.04562	.04509	.04456	.04404	.04352
— 47	.05433	.05371	.05309	.05248	.05188	.05127	.05068	.05009	.04952	.04893
— 46	.06098	.06028	.05959	.05891	.05824	.05757	.05691	.05625	.05561	.05497
— 45	.06836	.06758	.06682	.06606	.06531	.06457	.06383	.06311	.06239	.06168
— 44	0.07656	0.07570	0.07485	0.07401	0.07317	0.07235	0.07154	0.07072	0.06993	0.06914
— 43	.08565	.08470	.08376	.08282	.08190	.08099	.08008	.07919	.07831	.07742
— 42	.09570	.09471	.09364	.09260	.09158	.09057	.08956	.08857	.08759	.08661
— 41	.1069	.1057	.1045	.1035	.1023	.1012	.1001	.09895	.09787	.09679
— 40	.1192	.1179	.1166	.1154	.1141	.1129	.1116	.1105	.1092	.1080
— 39	0.1329	0.1315	0.1300	0.1287	0.1273	0.1259	0.1246	0.1233	0.1219	0.1206
— 38	.1480	.1464	.1449	.1433	.1418	.1403	.1388	.1372	.1358	.1343
— 37	.1646	.1628	.1612	.1595	.1578	.1561	.1544	.1529	.1512	.1496
— 36	.1829	.1810	.1791	.1773	.1754	.1736	.1718	.1700	.1681	.1664
— 35	.2032	.2011	.1990	.1969	.1949	.1928	.1908	.1888	.1869	.1849
— 34	0.2254	0.2231	0.2208	0.2185	0.2163	0.2140	0.2118	0.2096	0.2075	0.2053
— 33	.2498	.2473	.2448	.2423	.2398	.2373	.2349	.2325	.2301	.2278
— 32	.2767	.2739	.2710	.2684	.2656	.2629	.2602	.2576	.2550	.2524
— 31	.3061	.3030	.3000	.2970	.2940	.2911	.2881	.2852	.2824	.2795
— 30	.3385	.3351	.3318	.3284	.3252	.3219	.3187	.3155	.3124	.3092
— 29	0.3739	0.3703	0.3666	0.3629	0.3593	0.3557	0.3522	0.3487	0.3452	0.3419
— 28	.4127	.4086	.4046	.4006	.3967	.3928	.3890	.3852	.3813	.3776
— 27	.4551	.4507	.4463	.4419	.4377	.4334	.4291	.4250	.4208	.4168
— 26	.5015	.4967	.4919	.4871	.4824	.4777	.4731	.4686	.4641	.4595
— 25	.5521	.5469	.5417	.5365	.5313	.5263	.5213	.5162	.5113	.5064
— 24	0.6075	0.6018	0.5961	0.5904	0.5848	0.5792	0.5737	0.5682	0.5628	0.5574
— 23	.6678	.6616	.6553	.6492	.6431	.6370	.6310	.6250	.6192	.6134
— 22	.7336	.7267	.7200	.7133	.7066	.7000	.6935	.6870	.6805	.6741
— 21	.8053	.7979	.7904	.7831	.7758	.7686	.7615	.7544	.7474	.7405
— 20	.8835	.8752	.8670	.8588	.8512	.8434	.8357	.8280	.8204	.8128

(continued)

DENSITY OF PURE WATER VAPOR AT SATURATION OVER ICE

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$	g. m.$^{-3}$
−19	0.9678	0.9588	0.9506	0.9416	0.9326	0.9244	0.9162	0.9081	0.8999	0.8917
−18	1.060	1.050	1.041	1.031	1.022	1.013	1.004	0.9948	0.9858	0.9768
−17	1.160	1.149	1.139	1.129	1.119	1.109	1.099	1.089	1.080	1.070
−16	1.269	1.258	1.247	1.235	1.225	1.213	1.203	1.192	1.181	1.171
−15	1.387	1.375	1.363	1.351	1.339	1.326	1.314	1.303	1.292	1.281
−14	1.515	1.502	1.488	1.475	1.462	1.450	1.437	1.424	1.412	1.399
−13	1.653	1.639	1.624	1.610	1.596	1.582	1.568	1.555	1.541	1.527
−12	1.803	1.787	1.772	1.756	1.741	1.726	1.711	1.697	1.682	1.667
−11	1.964	1.948	1.931	1.914	1.898	1.881	1.865	1.849	1.834	1.818
−10	2.139	2.121	2.103	2.085	2.067	2.050	2.032	2.015	1.998	1.981
− 9	2.328	2.308	2.289	2.270	2.251	2.232	2.213	2.194	2.176	2.157
− 8	2.532	2.511	2.489	2.469	2.449	2.428	2.408	2.388	2.368	2.348
− 7	2.752	2.729	2.707	2.684	2.662	2.640	2.618	2.597	2.575	2.553
− 6	2.990	2.965	2.941	2.917	2.893	2.869	2.845	2.821	2.798	2.775
− 5	3.246	3.219	3.193	3.167	3.140	3.115	3.089	3.064	3.039	3.015
− 4	3.521	3.493	3.464	3.436	3.409	3.381	3.353	3.326	3.299	3.272
− 3	3.817	3.786	3.756	3.726	3.696	3.666	3.637	3.608	3.579	3.550
− 2	4.136	4.103	4.070	4.038	4.006	3.973	3.942	3.910	3.879	3.848
− 1	4.479	4.444	4.408	4.374	4.339	4.304	4.270	4.236	4.202	4.169
− 0	4.847	4.809	4.771	4.734	4.696	4.659	4.623	4.586	4.551	4.515

Section VIII

TABLES OF MISCELLANEOUS PHYSICAL PROPERTIES OF AIR AND AIR-BORNE PARTICLES

TABLE 110

COMPOSITION OF DRY AIR UP TO ABOUT 25 KILOMETERS

Constituent gas	Formula	Mol fraction %	Molecular weight [1]
Nitrogen	N_2	78.09	28.016
Oxygen	O_2	20.95	32.000
Argon	Ar	.93	39.944
Carbon Dioxide *	CO_2	.03	44.010
Neon	Ne	1.8×10^{-3}	20.183
Helium	He	5.24×10^{-4}	4.003
Krypton	Kr	1.0×10^{-4}	83.7
Hydrogen	H_2	5.0×10^{-5}	2.0160
Xenon	Xe	8.0×10^{-6}	131.3
Ozone †	O_3	1.0×10^{-6}	48.000
Radon ‡	Rn	6.0×10^{-18}	222

* Variable: see Carpenter, T. M., Journ. Amer. Chem. Soc., vol. 59, p. 358, 1937.
Haldane, J. B. S., Nature, vol. 1037, p. 575, 1936.
Callendar, G. S., Quart. Journ. Roy. Meteorol. Soc., vol. 66, p. 395, 1947.
† Variable: increasing with height.
‡ Variable: decreasing with height.

[1] Baxter, G. P., Guichard, & Whytlaw-Gray, Thirteenth report of the committee on atomic weights of the International Union of Chemistry. Journ. Amer. Chem. Soc., vol. 69, p. 731, 1947.

For composition of the upper atmosphere see:

Dobson, G. M. B., Proc. Roy. Soc. London, A. Bakerian Lecture, 1946.
Paneth, F. A., Glückauf, E., Proc. Roy. Soc. London, A, vol. 185, p. 89, 1946.
Paneth, F. A., et al., The upper atmosphere. Quart. Journ. Roy. Meteorol. Soc., vol. 65, pp. 303-336, 1939.

TABLE 111

INDEX OF REFRACTION OF AIR

Barrell and Sears[1] give the following values for the index of refraction of dry CO_2-free[2] air at normal pressure in the visible spectrum:

Wave length [3] μ	Color	Index of refraction 15 °C.	Index of refraction 20 °C.
0.6438	red	1.0002763	1.0002716
0.5876	yellow	1.0002771	1.0002724
0.5461	green	1.0002779	1.0002731
0.5086	blue-green	1.0002787	1.0002739
0.4800	blue	1.0002795	1.0002747
0.4678	violet-blue	1.0002799	1.0002751
0.4471	violet	1.0002806	1.0002758
0.4358	violet	1.0002810	1.0002762

Barrell and Sears found for the index of refraction of moist normal air in the range 10-30 °C., 720-800 mm. Hg.

$$(n-1)10^6 = \left[0.378125 + \frac{0.0021414}{\lambda^2} + \frac{0.00001793}{\lambda^4}\right] \times$$

$$\frac{p\{1 + (1.049 - 0.0157t)\, p \times 10^{-6}\}}{1 + 0.003661t} - \left[0.0624 - \frac{0.000680}{\lambda^2}\right] \frac{f}{1 + 0.003661t} .$$

where λ is the wave length of the radiation, t is the air temperature in °C., p is the barometric pressure and f is the vapor pressure, both measured in millimeters of mercury.

The variation of the index of refraction n with density ρ is best represented by the Lorenz-Lorentz[4] formula

$$\frac{n^2 - 1}{(n^2 + 2)\rho} = \text{constant}$$

For a study of the index of refraction of air in connection with microwave frequencies see: Committee on Propagation, Wave Propagation Experiments, Summary Technical Report of NDRC, vol. 2, 1947.

[1] Barrell, H., and Sears, J. E., The refraction and dispersion of air for the visible spectrum, Phil. Trans. Roy. Soc. London, A, vol. 238, pp. 1-64, 1939.
[2] See Barrell and Sears for evaluation of small correction necessary due to CO_2.
[3] Wave length in normal, dry air at 760 mm. Hg. and 15 °C.
[4] Lorentz, H. A., Collected papers, vol. 2, The Hague, 1936.

TABLE 112

VELOCITY OF SOUND IN AIR *

Symbols referring to given gas:

$A_{aa}(T)$ = second virial coefficient of dry air, a pure temperature function
$A_{aaa}(T)$ = third virial coefficient of dry air, a pure temperature function
$A_{aw}(T)$ = interaction coefficient of dry air and water vapor, a pure temperature function
$A_{ww}(T)$ = second virial coefficient of water vapor, a pure temperature function
$A_{www}(T)$ = third virial coefficient of water vapor, a pure temperature function
c = velocity of sound under existing conditions
c_0 = velocity of sound at temperature T_0 (and usually at one atmosphere pressure)
C_p = specific heat at constant pressure
C_v = specific heat at constant volume
$C_{v\infty}$ = specific heat at constant volume as the volume approaches infinity
e = aqueous vapor pressure
$E_A = -V\left(\frac{\partial p}{\partial V}\right)_s$ = adiabatic elasticity
$E_T = -V\left(\frac{\partial p}{\partial V}\right)_T$ = isothermal elasticity
M = molecular weight
p = pressure (barometric)
R = universal gas constant
s = entropy
T = absolute temperature (°K.)
T_0 = absolute temperature of the ice point (273.16 °K.)
V = volume of one mol
x = mol fraction of water vapor in moist air
$\gamma = \frac{C_p}{C_v}$ = ratio of specific heats
ρ = density

Subscript $_0$ denotes standard conditions of pressure and temperature. (The algebraic sign convention used here for the virial and interaction coefficients is opposite to that found in many texts; it is consistent with that adopted by Goff and Gratch, see reference 3, p. 391.)

Basic Formula:

When the amplitude of sound vibrations is not too large, the velocity of sound in a gas is given by the relation (Laplace, 1816)

$$c = \sqrt{\frac{E_A}{\rho}} = \sqrt{\gamma\frac{E_T}{\rho}} \tag{1}$$

From the definition of E_T it follows that

$$c = \sqrt{\gamma\left(\frac{\partial p}{\partial \rho}\right)_T} \tag{2}$$

If the medium through which the sound propagated were a perfect gas (so that the equation of state is $pV = RT$), then equation (2) would become

$$c = \sqrt{\gamma\frac{RT}{M}} = \sqrt{\left(\gamma\frac{RT_0}{M}\right)\left(\frac{T}{T_0}\right)} \tag{3}$$

* Prepared especially for the *Smithsonian Meteorological Tables* by L. P. Harrison, U. S. Weather Bureau.

(*continued*)

VELOCITY OF SOUND IN AIR

Therefore on the assumption that the medium behaves as a perfect gas,

$$c_0 = \sqrt{\gamma \frac{RT_0}{M}} \tag{4}$$

and

$$c = c_0 \sqrt{\frac{T}{T_0}} \tag{5}$$

In the case where the perfect-gas law does not apply, the equation of state for one component (dry air) may be written

$$pV = RT - A_{aa}p - A_{aaa}p^2 - \text{etc.} \tag{6}$$

The corresponding equation for pure water vapor unadmixed with air is similar to equation (6) except that A_{ww} replaces A_{aa}, A_{www} replaces A_{aaa}, etc., where p then denotes the pressure exerted by the vapor. For dry air the third (A_{aaa}) and higher virial coefficients are negligible in the range of ordinary atmospheric temperatures and pressures. When these terms are neglected, equation (6) yields for dry air [1]

$$\left(\frac{\partial p}{\partial \rho}\right)_T = \left(\frac{RT}{M}\right)\left(1 - \frac{A_{aa}p}{RT}\right)^2 \tag{7}$$

For the case of dry air this expression may be substituted in equation (2) to provide a relation for c more exact than equation (3).

Table 112 B presents values of the second virial coefficient A_{aa} for dry air; the second and third virial coefficients A_{ww} and A_{www}, respectively, for water vapor; and the interaction coefficient A_{aw} for a mixture of dry air and water vapor, based on the formulation of Goff and Gratch.[2,3]

Neglecting the third virial coefficient for dry air and the interaction coefficient A_{aaw} and A_{aww} which are of higher order than A_{aw}, the equation of state of moist air according to Goff and Gratch [3] may be written

$$pV = RT \quad [x^2A_{aa} + x(1-x)2A_{aw} + (1-x)^2A_{ww}]p - [(1-x)^3A_{www}]p^2 \tag{8}$$

where p is in atmosphere. Since $\rho = M/V$, this equation is applicable for the evaluation of $\left(\frac{\partial p}{\partial \rho}\right)_T$ in the case of moist air.

Hardy, Telfair, and Pielemeier,[4] taking account of the fact that

$$\gamma = 1 - \frac{T}{C_v}\left(\frac{\partial p}{\partial T}\right)_v^2 \left(\frac{\partial V}{\partial p}\right)_T, \tag{9}$$

have shown that equation (1) becomes

$$c = \sqrt{\frac{RT}{M}\left[f + \frac{gR}{hC_{v\infty}}\right]} \tag{10}$$

where the quantities f, g, and h are defined by the equations

$$f = -(V^2/RT)\left(\frac{\partial p}{\partial V}\right)_T \tag{11}$$

$$g = \left(\frac{V\partial p}{R\partial T}\right)_V^2 \tag{12}$$

$$h = \frac{C_v}{C_{v\infty}} = 1 + \frac{T}{C_{v\infty}}\int_\infty^V \left(\frac{\partial^2 p}{\partial T^2}\right)_V dv \tag{13}$$

---

[1] Roberts, J. K., Heat and Thermodynamics, 3d ed., p. 141, 1940.

[2] Goff, J. A., Standardization of thermodynamic properties of moist air. Final report of the Working Subcommittee of the International Joint Committee on Psychrometric Data, ASHVE Journal Section, Heating, Piping and Air Conditioning, pp. 118-128, November 1949.

[3] Goff, J. A., and Gratch, S., Thermodynamic properties of moist air, Trans. Amer. Soc. Heat. and Vent. Eng., vol. 51, pp. 125-158, 1945.

[4] Hardy, H. C., Telfair, D., and Pielemeier, W. H., The velocity of sound in air, Journ. Acous. Soc. Amer., vol. 13, pp. 226-233, 1942.

(*continued*)

VELOCITY OF SOUND IN AIR

Hardy, Telfair, and Pielemeier have deduced expressions for f, g, and h as functions of T, V, and $C_{v\infty}$, based on the equation of state in the virial form, and the reader is referred to the original article[4] for details. These investigators[4] have made observations of the velocity of sound in dry air and have also calculated its value under standard conditions on the basis of the thermodynamic equations. The results, based on these two methods of determination, were $c_0 = 331.44 \pm 0.05$ meter sec.$^{-1}$ and $c_0 = 331.45 \pm 0.05$ meter sec.$^{-1}$, respectively, for the velocity of sound of small amplitude in dry air with 0.03 percent carbon dioxide at 0°C. and at one standard normal atmosphere pressure, as the frequency of the sound approaches zero. The mean of results deduced from the observations of other investigators was found to be $c_0 = 331.46 \pm 0.05$ meter sec.$^{-1}$

We adopt as the best value $c_0 = 331.45$ meter sec.$^{-1}$ for dry air under the stipulated conditions.

For rough calculations of the velocity of sound in air under conditions in the neighborhood of one atmosphere pressure one may use equation (5), with $c_0 = 331.45$ meter sec.$^{-1}$. To take account of the presence of water vapor in air for such calculations, equation (3) may be rewritten (assuming the mixture a perfect gas)

$$c = \sqrt{\gamma \frac{p}{\rho}} \tag{14}$$

or

$$c = c_0 \sqrt{\frac{\gamma}{\gamma_0}\left(\frac{p}{p_0}\right)\left(\frac{\rho_0}{\rho}\right)} \tag{15}$$

Reliable observations of dry air with 0.03 percent CO_2 have yielded $\rho_0 = 0.001293$ gm.cm.$^{-3}$, where $p_0 = 1013.250$ mb. (1 atmosphere pressure).

Elsewhere in this volume (Table 84) there will be found data permitting the accurate computation of ρ for moist air as a function of temperature, pressure and relative humidity, making use of the compressibility factor of moist air.

For γ_0 we may use the value given by Hardy, Telfair, and Pielemeier, namely $\gamma_0 = 1.4028$ for dry air at 0° C. and one atmosphere pressure. γ for dry air changes relatively slowly with temperature and pressure, under ordinary atmospheric conditions.

In taking account of the effect of water vapor on γ when making rough calculations of c, use may be made of the following approximate relation for ordinary conditions[5]

$$\gamma = \gamma_0 - 0.1 \frac{e}{p} \tag{16}$$

Description of Table:

Table 112 A is based on equation (5), taking $c_0 = 331.45$ m.sec.$^{-1}$ as previously explained. Strictly speaking, the table is only valid for dry air considered as a perfect gas, and shows the variation of c with temperature on this assumption. It is, therefore, strictly applicable only in rough calculations.

[5] Woolf, Wm L., Acoustical tables for air and sea water, Journ. Acous. Soc. Amer., vol. 15, p. 83, 1943.

(continued)

VELOCITY OF SOUND IN AIR

TABLE 112A.—Velocity of sound in dry air as a function of temperature, according to classical theory

Temp. °C.	0 m. sec.$^{-1}$	1 m. sec.$^{-1}$	2 m. sec.$^{-1}$	3 m. sec.$^{-1}$	4 m. sec.$^{-1}$	5 m. sec.$^{-1}$	6 m. sec.$^{-1}$	7 m. sec.$^{-1}$	8 m. sec.$^{-1}$	9 m. sec.$^{-1}$
60	366.05	366.60	367.14	367.69	368.24	368.78	369.33	369.87	370.42	370.96
50	360.51	361.07	361.62	362.18	362.74	363.29	363.84	364.39	364.95	365.50
40	354.89	355.46	356.02	356.58	357.15	357.71	358.27	358.83	359.39	359.95
30	349.18	349.75	350.33	350.90	351.47	352.04	352.62	353.19	353.75	354.32
20	343.37	343.95	344.54	345.12	345.70	346.29	346.87	347.44	348.02	348.60
10	337.46	338.06	338.65	339.25	339.84	340.43	341.02	341.61	342.20	342.78
0	331.45	332.06	332.66	333.27	333.87	334.47	335.07	335.67	336.27	336.87
−0	331.45	330.84	330.23	329.62	329.01	328.40	327.79	327.18	326.56	325.94
−10	325.33	324.71	324.09	323.47	322.84	322.22	321.60	320.97	320.34	319.72
−20	319.09	318.45	317.82	317.19	316.55	315.92	315.28	314.64	314.00	313.36
−30	312.72	312.08	311.43	310.78	310.14	409.49	308.84	308.19	307.53	306.88
−40	306.22	305.56	304.91	304.25	303.58	302.92	302.26	301.59	300.92	300.25
−50	299.58	298.91	298.24	297.56	296.89	296.21	295.53	294.85	294.16	293.48
−60	292.79	292.11	291.42	290.73	290.03	289.34	288.64	287.95	287.25	286.55
−70	285.84	285.14	284.43	283.73	283.02	282.30	281.59	280.88	280.16	279.44
−80	278.72	278.00	277.27	276.55	275.82	275.09	274.36	273.62	272.89	272.15
−90	271.41	270.67	269.92	269.18	268.43	267.68	266.93	266.17	265.42	264.66

TABLE 112B.—Virial and interaction coefficients of dry air and water vapor

The following table gives the virial and interaction coefficients involved in equation (8), where the data are based on the Goff-Gratch[2,3] formulation:

Temperature t °C.	Second virial coefficient of dry air A_{aa} cm.^{3} gmol.$^{-1}$	Second virial coefficient of water vapor A_{ww} cm.^{3} gmol.$^{-1}$	Third virial coefficient of water vapor A_{www} cm.^{3} (gmol. atm.)$^{-1}$	Interaction coefficient for mixture of dry air and water vapor A_{aw} cm.^{3} gmol.$^{-1}$
90	−2.07	501	33	23.7
80	−0.84	558	48	25.2
70	0.49	625	72	26.8
60	1.91	705	110	28.5
50	3.44	803	*	30.4
40	5.09	924		32.3
30	6.87	1074		34.5
20	8.81	1260		36.8
10	10.9	1510		39.3
0	13.2	1830		42.0
−10	15.7	2300		45.0
−20	18.5			48.2
−30	21.6			51.8
−40	25.0			55.8
−50	28.9			60.2
−60	33.2			65.1
−70	38.2			70.7
−80	43.9			77.0
−90	50.4			84.2

* Probable errors exceed half the computed values at lower temperatures.

VISCOSITY AND THERMAL CONDUCTIVITY OF AIR AND DIFFUSIVITY OF WATER VAPOR IN AIR[1]

The **dynamic viscosity** may be defined as the ratio of shearing stress to shear,

$$\tau = \mu \frac{\partial u}{\partial z}$$

where τ is the shearing stress and $\partial u/\partial z$ is the shear (u is the velocity normal to the direction z). The basic cgs unit is 1 poise = 1 g. cm.$^{-1}$s.$^{-1}$. The dynamic viscosity of a gas is independent of pressure except at very low pressures. Its temperature dependence was computed from Sutherland's equation:

$$\frac{\mu}{\mu_0} = \frac{T_0 + C}{T + C} \left(\frac{T}{T_0} \right)^{\frac{3}{2}}$$

where T is the absolute temperature, μ_0 is the dynamic viscosity at absolute temperature T_0 and C is Sutherland's constant, assumed to have the value 120 °C. At $T_0 = 296.16$ °K. (23 °C.), $\mu_0 = (1.8325 \pm 0.0010) \times 10^{-4}$ g. cm.$^{-1}$s.$^{-1}$ according to Birge.[2]

The **thermal conductivity** k is defined by

$$H = -k \frac{\partial T}{\partial z}$$

where H is the rate of heat conduction per unit area and $\partial T/\partial z$ is the temperature gradient. k at 0 °C. is given by Chapman and Cowling[3] as 5.80×10^{-5} cal. cm.$^{-1}$s.$^{-1}$ °C.$^{-1}$ and it is estimated that the probable error is $\pm 0.02 \times 10^{-5}$. Values at other temperatures are assumed proportional to μ.

Kinematic viscosity, thermometric conductivity, and **diffusivity of water vapor in dry air** are functions of both temperature and pressure. A pressure of 1000 mb. is assumed in computing these quantities. (See original article for corresponding values of density used in the computations.) The kinematic viscosity ν is the ratio of the dynamic viscosity μ to the density ρ; $\nu = \mu/\rho$. It is the factor occurring in the relation giving the acceleration du/dt due to fluid friction. In the simplest case this relation is of the type

$$\frac{du}{dt} = \nu \frac{\partial^2 u}{\partial z^2}$$

The **thermometric conductivity** $\nu_c = k/(c_p \rho)$ determines the rate of heating due to a given temperature distribution:

$$\frac{dT}{dt} = \nu_c \frac{\partial^2 T}{\partial z^2}$$

where c_p is the specific heat at constant pressure. A value of 0.1895 cm.^{2}s.$^{-1}$ has been computed for 0 °C. and the ratio ν/ν_c has been assumed constant for other temperatures.

A substance having the concentration (mass per total mass) q in a mixture of density ρ is diffused at the rate, in mass per unit area and time,

$$E = -\rho D \frac{\partial q}{\partial z}$$

where D is the **diffusivity**. The corresponding rate of change of concentration is

$$\frac{dq}{dt} = D \frac{\partial^2 q}{\partial z^2}$$

[1] Montgomery, R. B., Journ. Meteorol., vol. 4, pp. 193-196, 1947.

[2] Birge, R. T., The 1944 values of certain atomic constants with particlar reference to the electronic charge. Amer. Journ. Phys., vol. 13, pp. 63-73, 1945.

[3] Chapman, Sydney, and Cowling, T. G., The mathematical theory of non-uniform gases. 404 pp. Cambridge Univ. Press, 1939.

(*continued*)

VISCOSITY AND THERMAL CONDUCTIVITY OF AIR AND DIFFUSIVITY OF WATER VAPOR IN AIR

For gases the dependence of diffusivity on pressure and temperature is represented by [4]

$$\frac{D}{D_0} = \left(\frac{T}{T_0}\right)^n \frac{p_0}{p}$$

where D_0 is the diffusivity at absolute temperature T_0 and pressure p_0. Schirmer [5] gives $n = 1.81$ and the value of D at 0 °C., the values at other temperature have been computed from the kinematic viscosity, to which they are proportional.

Temperature	Dynamic viscosity	Thermal conductivity		Kinematic viscosity p = 1000 mb.	Thermometric conductivity p = 1000 mb.	Diffusivity of water vapor in air p = 1000 mb.
	μ	k		ν	ν_o	D
°C.	g. cm.$^{-1}$s.$^{-1}$ = poise	cal. cm.$^{-1}$s.$^{-1}$°C.$^{-1}$	erg. cm.$^{-1}$s.$^{-1}$°C.$^{-1}$	cm.^{2}s.$^{-1}$	cm.^{2}s.$^{-1}$	cm.^{2}s.$^{-1}$
−20	1.615 × 10^{-4}	5.45 × 10^{-5}	2.28 × 10^3	0.1173	0.165	0.197
−10	1.667	5.63	2.36	.1259	.177	.211
0	1.718	5.80	2.43	.1346	.189	.226
10	1.768	5.97	2.50	.1437	.202	.241
20	1.818	6.14	2.57	.1529	.215	.257
30	1.866	6.30	2.64	.1623	.228	.273
40	1.914	6.46	2.70	.1720	.242	.289

[4] Boynton, W. P., and Brattain, W. H., Interdiffusion of gases and vapors. International Critical Tables, vol. 5, pp. 62-63, McGraw-Hill Book Co., New York, 1929.

[5] Schirmer, Robert, Die Diffusionszahl von Wasserdamf-Luft-Gemischen und die Verdampfungsgeschwindigkeit. Zeitschr. Ver. deutsch. Ing., Beihefte Verfahrenstecknik, Heft 6, pp. 170-177, 1938.

TABLE 114

TERMINAL VELOCITY OF FALL FOR DISTILLED WATER DROPLETS IN STAGNANT AIR[1]

Pressure, 760 mm. Hg., temperature, 20 °C., relative humidity, 50 percent.

$$\text{Reynolds number} = \frac{\text{(air density) (equivalent drop diameter) (measured velocity)}}{\text{(viscosity)}}$$

$$\text{Drag coefficient} = \frac{\text{8 (accel. of gravity) (air density) (mass of drop)}}{\pi\text{(viscosity)}^2\ \text{(Reynolds number)}^2}$$

Equivalent drop diameters are calculated from the mass.

Equivalent drop diameter cm.	Terminal velocity cm. sec.$^{-1}$	Mass of drop micrograms	Reynolds number (calculated)	Drag coefficient (calculated)
0.01 *	27 *	0.524	1.80	15.0
0.02	72	4.19	9.61	4.2
0.03	117	14.14	23.4	2.4
0.04	162	33.5	43.2	1.66
0.05	206	65.5	68.7	1.28
0.06	247	113.1	98.9	1.07
0.07	287	179.6	134	0.926
0.08	327	268	175	.815
0.09	367	382	220	.729
0.10	403	524	269	.671
0.12	464	905	372	0.607
0.14	517	1,437	483	.570
0.16	565	2,140	603	.545
0.18	609	3,050	731	.528
0.20	649	4,190	866	.517
0.22	690	5,580	1,013	0.504
0.24	727	7,240	1,164	.495
0.26	757	9,200	1,313	.494
0.28	782	11,490	1,461	.498
0.30	806	14,140	1,613	.503
0.32	826	17,160	1,764	0.511
0.34	844	20.600	1,915	.520
0.36	860	24,400	2,066	.529
0.38	872	28,700	2,211	.544
0.40	883	33,500	2,357	.559
0.42	892	38,800	2,500	0.575
0.44	898	44,600	2,636	.594
0.46	903	51,000	2,772	.615
0.48	907	57,900	2,905	.635
0.50	909	65,500	3,033	.660
0.52	912	73,600	3,164	0.681
0.54	914	82,400	3,293	.700
0.56	916	92,000	3,423	.727
0.58	917	102,200	3,549	.751

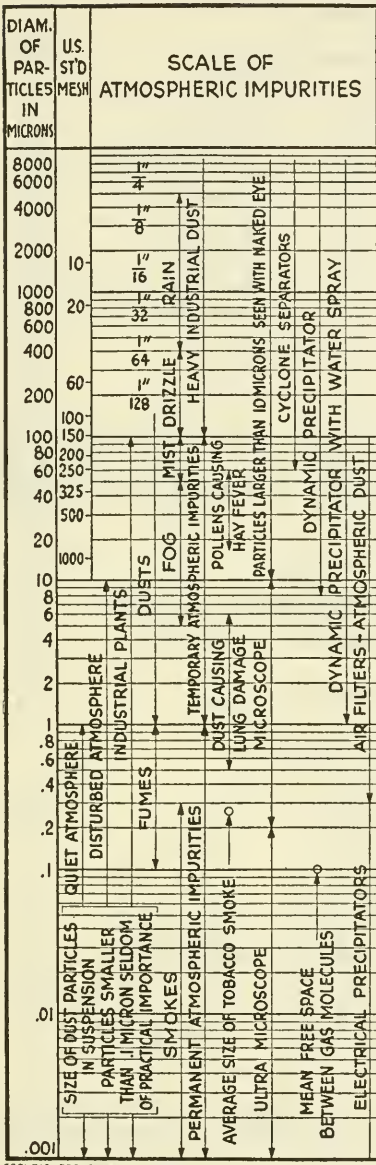
* Drops with diameters less than 0.008 cm. obey Stokes' Law.

[1] Gunn, R., and Kinzer, G. D., Journ. Meteorol., vol. 6, p. 243, 1949.

TABLE 115

SIZE AND CHARACTERISTICS OF AIR-BORNE SOLIDS

COMPILED BY W. G. FRANK



RATE OF SETTLING IN F.P.M. FOR SPHERES SPEC. GRAV. 1 AT 70°F.	DUST PARTICLES CONTAINED IN 1 CUB. FT. OF AIR (See Foot Note): NUMBER	SURFACE AREA IN SQ. IN.
1750		
790	.075	.000365
555	.6	.00073
59.2	75	.00365≅
14.8	600	1/16 IN. SQ. .0073
.592	75000	.0365≅
.148	600,000	3/16 IN. SQ. .073
.007=	75×10⁶	.365≅
5" PER HR. .002=	60×10⁷	5/8 IN. SQ. .73
1.4" PER HR. .00007=	75×10⁹	3.65≅
3/64" PER HR. 0	60×10¹⁰	1.9 IN. SQ. 7.3
0	75×10¹²	36.5≅
0	60×10¹³	1/4 SQ. FT. 73.0
0	75×10¹⁵	365≅ 2.53 SQ. FT.

LAWS OF SETTLING IN RELATION TO PARTICLE SIZE (Lines of Demarcation approx.)

PARTICLES FALL WITH INCREASING VELOCITY

$$c = \sqrt{\frac{2gds_1}{3Ks_2}}$$

$$C = 24.9\sqrt{Ds_1}$$

PARTICLES SETTLE WITH CONSTANT VELOCITY

STOKES LAW

$$c = \frac{2r^2 g}{9}\,\frac{s_1 - s_2}{\eta}$$

FOR AIR AT 70°F.

$$c = 300{,}460\, s_1 d^2$$

$$C = .00592\, s_1 D^2$$

CUNNINGHAM'S FACTOR

$$c = c'\left(1 + K\frac{\lambda}{r}\right)$$

c' = c OF STOKES LAW

K = .8 TO .86

- c = Velocity cm./sec.
- C = Velocity ft./min.
- d = Diam. of particle in cm.
- D = Diam. of particle in Microns
- r = Radius of particle in cm.
- g = 981 cm./sec.² acceleration
- s_1 = Density of particle
- s_2 = Density of Air (Very Small relative to s_1)
- η = Viscosity of air in poises = 1814×10^{-7} for air at 70°F.
- $\lambda = 10^{-5}$ cm. (Mean free path of gas molecules)

PARTICLES MOVE LIKE GAS MOLECULES

BROWNIAN MOVEMENT

$$A = \sqrt{\frac{RT}{N}\,\frac{t}{3\pi\eta r}}$$

- A = Distance of motion in time t
- R = Gas constant = 8.316×10^7
- T = Absolute Temperature
- N = Number of Gas molecules in one mol = 6.06×10^{23}

IT IS ASSUMED THAT THE PARTICLES ARE OF UNIFORM SPHERICAL SHAPE HAVING SPECIFIC GRAVITY ONE AND THAT THE DUST CONCENTRATION IS 0.6 GRAINS PER 1000 CU. FT. OF AIR, THE AVERAGE OF METROPOLITAN DISTRICTS.

SIZES OF ATMOSPHERIC PARTICLES

The following data are taken from an article and accompanying chart prepared by Simpson.[1] For spherical particles, diameters are given.

Rain drops	$>2\times10^{-2}$ cm.
Limit of unaided vision	5×10^{-3} cm.
Cloud particles	$2\times10^{-3}-4\times10^{-4}$ cm.
Wright's salt nuclei at 80% rel. hum.	1×10^{-4} cm.
Wave length of visible light	$7\times10^{-5}-4\times10^{-5}$ cm.
Smoke particles	$1\times10^{-4}-1\times10^{-5}$ cm.
Lower limit of microscopic vision	2×10^{-5} cm.
Ultra-large ions	$2\times10^{-5}-1\times10^{-5}$ cm.
Mean free path of molecules in air at N. T. P.	9×10^{-6} cm.
Langevin ions	$1\times10^{-5}-5\times10^{-6}$ cm.
Large medium ions	$5\times10^{-6}-1.5\times10^{-6}$ cm.
Small medium ions	$1.5\times10^{-6}-7\times10^{-7}$ cm.
Lower limit of ultra-microscope	5×10^{-7} cm.
Small ions	1×10^{-7} cm.
Molecules (2 atoms)	3×10^{-8} cm.

Findeisen[2] has shown that there is a physical difference between a cloud particle and a rain drop which fixes the boundary with a fair amount of precision, namely, a rain drop must be able to reach the ground without completely evaporating. Findeisen derives a formula which shows that the distance traveled in an atmosphere not completely saturated varies as r^4 and gives the following table:

Distance of fall before evaporation

Pressure 900 mb., temperature 5 °C., relative humidity 90 percent.

Radius of drop, r (cm.)	Distance of fall before evaporation	
10^{-4}	3.3×10^{-4} cm.	cloud particles
10^{-3}	3.3 cm.	cloud particles
10^{-2}	150 m.	rain drops
10^{-1}	42 km.	rain drops
2.5×10^{-1}	280 km.	rain drops

[1] Simpson, G. C., Quart. Journ. Roy. Meteorol. Soc., vol. 67, p. 99, 1941.
[2] Findeisen, W., Meteorol. Zeitschr., vol. 56, p. 453, 1939.

TABLE 117

EVAPORATION OF FREELY FALLING WATER DROPS[1]

The mass evaporation rate dM/dt is the product of two factors that may be extracted from table 117 A and table 117 B.

$$\frac{dM}{dt}=\left[4\pi a\left(1+\frac{Fa}{s}\right)\right][D(\rho_a-\rho_b)] \text{ g. sec.}^{-1}$$

where a is the radius of the drop, s is the equivalent thickness of the transition shell outside the drop, F is a dimensionless factor, D is the coefficient of diffusion, ρ_a is the saturated vapor density at the surface of the drop and ρ_b is the vapor density of the environment.

Table 117 A gives the first factor when entered with the droplet diameter $2a$ and the ambient temperature.

Table 117 B gives the second factor when entered with the ambient temperature and relative humidity.

Probable uncertainty, based on precision of measurements, is less than 4 percent.

[1] Kinzer, G. D., and Gunn, Ross, Journ. Meteorol., vol. 8, p. 71, 1951.

(continued)

EVAPORATION OF FREELY FALLING WATER DROPS

TABLE 117 A.—$4\pi a\left(1+\frac{Fa}{s}\right)$*

Drop diameter, 2a	Ambient Temperature—°C. 0°C.	10°C.	20°C.	30°C.	40°C.
cm.	cm.	cm.	cm.	cm.	cm.
0.01	0.086	0.082	0.079	0.076	0.073
0.02	0.29	0.29	0.29	0.28	0.28
0.03	0.49	0.48	0.48	0.47	0.47
0.04	0.73	0.72	0.71	0.70	0.69
0.05	1.01	0.99	0.97	0.96	0.94
0.06	1.31	1.29	1.27	1.25	1.24
0.07	1.66	1.63	1.61	1.58	1.55
0.08	2.03	2.00	1.97	1.94	1.91
0.09	2.5	2.4	2.4	2.3	2.3
0.10	2.9	2.8	2.8	2.7	2.7
0.12	3.9	3.8	3.7	3.6	3.6
0.14	4.9	4.8	4.7	4.6	4.5
0.16	6.0	5.9	5.8	5.7	5.6
0.18	7.3	7.2	7.0	6.9	6.8
0.20	8.8	8.5	8.3	8.1	8.0
0.22	10.5	10.1	9.9	9.6	9.4
0.24	12.4	12.0	11.7	11.3	11.0
0.26	14.7	14.2	13.8	13.3	12.8
0.28	17.2	16.6	16.0	15.4	14.9
0.30	20.1	19.3	18.5	17.8	17.2
0.32	23	22	21	21	20
0.34	27	26	25	24	23
0.36	31	30	28	27	26
0.38	35	34	32	31	29
0.40			36	35	33
0.42				39	37
0.44					

TABLE 117 B.—$D(\rho_a - \rho_b)$ †

Relative humidity	Ambient Temperature—°C. 0°	10°	20°	30°	40°
%	g. cm.$^{-1}$ sec.$^{-1}$	g. cm.$^{-1}$ sec.$^{-1}$	g. cm.$^{-1}$ sec.$^{-1}$	g. cm.$^{-1}$ sec.$^{-1}$	g. cm.$^{-1}$ sec.$^{-1}$
10	0.61×10^{-6}	0.98×10^{-6}	1.47×10^{-6}	2.06×10^{-6}	2.68×10^{-6}
20	0.54×10^{-6}	0.87×10^{-6}	1.29×10^{-6}	1.79×10^{-6}	2.36×10^{-6}
30	0.48×10^{-6}	0.76×10^{-6}	1.12×10^{-6}	1.55×10^{-6}	2.05×10^{-6}
40	0.41×10^{-6}	0.65×10^{-6}	0.95×10^{-6}	1.32×10^{-6}	1.75×10^{-6}
50	0.34×10^{-6}	0.54×10^{-6}	0.78×10^{-6}	1.09×10^{-6}	1.45×10^{-6}
60	0.27×10^{-6}	0.43×10^{-6}	0.63×10^{-6}	0.86×10^{-6}	1.15×10^{-6}
70	0.20×10^{-6}	0.32×10^{-6}	0.46×10^{-6}	0.64×10^{-6}	0.85×10^{-6}
80	0.135×10^{-6}	0.21×10^{-6}	0.31×10^{-6}	0.42×10^{-6}	0.56×10^{-6}
90	0.067×10^{-6}	0.109×10^{-6}	0.159×10^{-6}	0.21×10^{-6}	0.28×10^{-6}
100	0	0	0	0	0

* Measured at 20 °C., values of other temperatures by extrapolation.
† At a total pressure of one atmosphere.

Section IX

TABLES OF MISCELLANEOUS PROPERTIES OF WATER SUBSTANCE AND SOILS

TABLE 118

DENSITY OF WATER

Values of the density of pure water under a pressure of one atmosphere, expressed here in g. cm.$^{-3}$, have been taken from the compilation or Dorsey [1] based on the results of various investigators.

Temperature	Density	Temperature	Density	Temperature	Density	Temperature	Density
°C.	g. cm.$^{-3}$	°C.	g. cm.$^{-3}$	°C.	g. cm.$^{-3}$	°C.	g. cm.$^{-3}$
−13	0.99690	1	0.99990	15	0.99910	29	0.99595
−12	.99727	2	.99994	16	.99895	30	.99565
−11	.99761	3	.99997	17	.99878	31	.99535
−10	.99791	4	.99997	18	.99860	32	.99503
− 9	.99822	5	.99996	19	.99841	33	.99471
− 8	0.99847	6	0.99994	20	0.99821	34	0.99438
− 7	.99869	7	.99990	21	.99800	35	.99404
− 6	.99892	8	.99985	22	.99777	36	.99369
− 5	.99915	9	.99978	23	.99754	37	.99333
− 4	.99935	10	.99970	24	.99730	38	.99297
− 3	0.99953	11	0.99961	25	0.99705	39	0.99260
− 2	.99965	12	.99950	26	.99679	40	.99222
− 1	.99975	13	.99938	27	.99652	41	.99183
0	.99984	14	.99925	28	.99624	42	.99144

The presence of dissolved air decreases the density of water. Marek [2] reports the following differences in density between water which has been freed of air by exhaustion just prior to measurement and water at the same temperature which has been exposed to air for intervals of 1 to 3 days:

at 0 °C., a difference of 0.0000025 g. cm.$^{-3}$
" 5 °C., " " " 0.0000033 " "
" 10 °C., " " " 0.0000032 " "
" 15 °C., " " " 0.0000022 " "
" 20 °C., " " " 0.0000004 " "

[1] Dorsey, N. E., Properties of ordinary water substance, pp. 199-201, Reinhold Publ. Corp., New York, 1940.
[2] Marek, W. J., Ann. d. Physik (Wied.), vol. 44, pp. 171-172, 1891.

TABLE 119

THERMAL CONDUCTIVITY OF WATER

Compiled by Dorsey [1] from the investigation of Schmidt and Sellschopp.[2] All values are for a pressure of one atmosphere.

Temperature	Thermal conductivity	Temperature	Thermal conductivity
°C.	cal. cm.$^{-1}$ sec.$^{-1}$ °C.$^{-1}$	°C.	cal. cm.$^{-1}$ sec.$^{-1}$ °C.$^{-1}$
0	0.00132	60	0.00156
10	.00138	70	.00159
20	.00143	80	.00160
30	.00147	90	.00161
40	.00151	100	.00162
50	.00154		

[1] Dorsey, N. E., Properties of ordinary water substance, p. 273, Reinhold Publ. Corp., New York, 1940.
[2] Schmidt, E., and Sellschopp, W., Forsch., Gebiete Ingenieurw., vol. 3, p. 277, 1932.

TABLE 120

THERMAL CONDUCTIVITY AND THERMAL DIFFUSIVITY OF ICE

Compiled by Dorsey[1] from the works of various investigators.

Temperature °C.	Thermal conductivity cal. cm.$^{-1}$ sec.$^{-1}$ °C.$^{-1}$	Temperature °C.	Thermal conductivity cal. cm.$^{-1}$ sec.$^{-1}$ °C.$^{-1}$
0	5.35×10^{-3}	− 60	6.95×10^{-3}
− 10	5.54	− 70	7.29
− 20	5.81	− 80	7.60
− 30	6.09	− 90	7.91
− 40	6.35	−100	8.29
− 50	6.64		

Thermal diffusivity, $k/\rho c$; (k = thermal conductivity, ρ = density, c = specific heat), is 0.011 cm.^{2} sec.$^{-1}$ if $t > -30$ °C. and is 0.0114 cm.^{2} sec.$^{-1}$ at $t = 0$. °C. Dorsey states that the best values for the density of ordinary ice at one atmosphere and 0 °C. vary from 0.916 to 0.918 g. cm.$^{-3}$ Values of the specific heat are given in Table 92.

[1] Dorsey, N. E., Properties of ordinary water substance, p. 482, Reinhold Publ. Corp., New York, 1940.

TABLE 121

THERMAL CONDUCTIVITY AND THERMAL DIFFUSIVITY OF SNOW

Values of the thermal conductivity k of snow as computed from the formulas of three investigators are given as a function of the density ρ of the snow in g. cm.$^{-3}$ The last column gives the average of the three. The formulas, for k in cal. cm.$^{-2}$ sec.$^{-1}$ °C.$^{-1}$ cm., are

Jansson[1]	$k = .00005 + .0019\rho + .006\rho^4$
Van Dusen[2]	$k = .000050 + .00100\rho + .00516\rho^3$
Devaux[3]	$k = .000069 + .0069\rho^2$

Density g. cm.$^{-3}$	Conductivity—cal. cm.$^{-2}$ sec.$^{-1}$ °C.$^{-1}$ cm. Jansson	Van Dusen	Devaux	Average
0.1	0.00024	0.00016	0.00014	0.00018
0.2	.00044	.00029	.00034	.00036
0.3	.00067	.00049	.00069	.00062
0.4	.00096	.00078	.00117	.00097
0.5	.00138	.00120	.00179	.00146
0.6	.00197	.00177	.00255	.00210
0.7	.00282	.00252	.00345	.00293
0.8	.00403	.00350	.00448	.00400
0.9	.00570	.00472	.00566	.00536

Thermal diffusivity $D = k/\rho c_i$, values of the specific heat c_i are given in Table 92.

[1] Jansson, M., Öfvers. of K. Svenska Akad., Förh., vol. 58, p. 207. 1901.
[2] Van Dusen, M. S., Int. Crit. Tables, vol. 5, p. 216, 1929.
[3] Devaux, J., Ann. de Phys., vol. 20, p. 5, 1933.

TABLE 122

THERMAL CONDUCTIVITY, SPECIFIC HEAT, AND DENSITY OF SOILS AND ROCKS

Table 122 contains values of the *thermal conductivity k*, *specific heat c*, *density ρ*, and *thermal diffusivity* (*thermometric conductivity*) $a[=k/(c\rho)]$ for various rocks and soils, from "Heat Conduction," by Ingersoll, Zobel, and Ingersoll,[1] 1948, courtesy of McGraw-Hill Book Co.

Material	Temperature *	Thermal conductivity k	Specific heat c	Density ρ	Thermal diffusivity a
	°C.	cal. sec.$^{-1}$ cm.$^{-1}$ °C.$^{-1}$	cal. g.$^{-1}$ °C.$^{-1}$	g. cm.$^{-3}$	cm.^{2} sec.$^{-1}$
Soils:					
Calcareous earth, 43% water	..	0.0017	0.53	1.67	0.0019
Quartz sand, medium fine, dry	..	0.00063	0.19	1.65	0.0020
Quartz sand, 8.3% moisture	..	0.0014	0.24	1.75	0.0033
Sandy clay, 15% moisture	..	0.0022	0.33	1.78	0.0037
Soil, very dry	..	0.0004–0.0008	...	...	0.002–.003
Some wet soils	..	0.003 –0.008	...	...	0.004–.010
Wet mud	..	0.0020	0.60	1.50	0.0022
Rocks and building materials:					
Brick masonry	20	0.0015	0.20	1.7	0.0044
Concrete, av. stone	..	0.0022	0.20	2.3	0.0048
Concrete, dams	..	0.0058	0.22	2.47	0.0107
Granite	0	0.0065	0.19	2.7	0.0127
Limestone	0	0.0048	0.22	2.7	0.0081
Marble	..	0.0055	0.21	2.7	0.0097
Sandstone	..	0.0062	0.21	2.6	0.0113
Traprock	..	...	...	...	0.0075
Rock material av. for earth	..	...	...	...	0.010

* Where temperature is not specified, ordinary room temperature may generally be assumed.

[1] Ingersoll, L. R., Zobel, O. J., and Ingersoll, A. C., Heat conduction, p. 243, McGraw-Hill Book Co. Inc., New York, 1948.

TABLE 123

LATENT HEAT OF MELTING OF SEA ICE[1]

Let S be the salinity of the ice and t_s the freezing point of a sea water with the salinity S. If the temperature t lies in the neighborhood of 0 °C. the heat of fusion of pure ice between t and t_s can be considered constant and equal to 80 gram calories. The amount of heat required to melt the sea ice is then the sum of the heat required to melt all the pure ice in one gram of sea ice $(80[1-S(1-A_t)])$ and the amount of heat required to increase the temperature of the pure ice and brine from t to t_s (approximately $=0.5(t_s-t)$), where A_t is the weight of all the pure ice in 1 gram of sea ice with salinity 1‰ and temperature t and is equal to $1-1/S_t$, where S_t is the salinity of the brine at t. Thus

$$U=80\left(1-\frac{S}{S_t}\right)+0.5(t_s-t;)$$

where $U=$ number of calories required to melt 1 gram sea ice of the temperature t and the salinity S.

Temperature	Salinity—‰ 0	2	4	6	8	10	15
°C.	cal.	cal.	cal.	cal.	cal.	cal.	cal.
−1	80	72	63	55	46	37	16
−2	81	77	72	68	63	59	48

[1] Malmgren, F., On the properties of sea ice, The Norwegian North Polar Expedition with the *Maud*, 1918-1925, Scientific results, vol. 1, No. 5, 1927.

Table 124

SPECIFIC HEAT OF SEA WATER[1]

Table 123 gives the specific heat of sea water at a temperature of 17.5 °C. and a pressure of 1 atmosphere.

Salinity	Specific heat	Salinity	Specific heat	Salinity	Specific heat
‰		‰		‰	
0	1.000	15	0.958	30	0.939
5	0.982	20	0.951	35	0.932
10	0.968	25	0.945	40	0.926

[1] Krummel, O., Handb. d. Ozeanographie, p. 279, Stuttgart, 1907.

Table 125

SPECIFIC HEAT OF SEA ICE

The specific heat of pure ice depends upon its temperature and varies within narrow limits, but that of sea ice is a much more variable property, depending upon the salt or brine content and the temperature. Changing the temperature of sea ice will generally involve either melting or freezing, and the amount of heat required will depend upon the salinity of the ice, as shown in the table. It should be noted that the specific heat of pure ice is less than half that of pure water. Near the initial freezing point, the extremely high specific heat of ice of high salinity is, of course, due to the formation of ice from the enclosed brine or its melting.[1]

Malmgren[2] has computed the data in Table 124 from observations made in the Polar Sea.

Salinity	Temperature (°C.)										
‰	−2°	−4°	−6°	−8°	−10°	−12°	−14°	−16°	−18°	−20°	−22°
2	2.57	1.00	0.73	0.63	0.57	0.55	0.54	0.53	0.53	0.52	0.52
4	4.63	1.50	0.96	0.76	0.64	0.59	0.57	0.57	0.56	0.55	0.54
6	6.70	1.99	1.20	0.88	0.71	0.64	0.61	0.60	0.58	0.57	0.56
8	8.76	2.49	1.43	1.01	0.78	0.68	0.64	0.64	0.61	0.60	0.58
10	10.83	2.99	1.66	1.14	0.85	0.73	0.68	0.67	0.64	0.62	0.60
15	16.01	4.24	2.24	1.46	1.02	0.85	0.77	0.76	0.71	0.68	0.65

[1] Sverdrup, H. U., Johnson, M. W., and Fleming, R. H., The oceans, p. 73. Copyright, 1942, by Prentice-Hall, Inc., New York.
[2] Malmgren, F., On the properties of sea ice, The Norwegian North Polar Expedition with the *Maud*, 1918-1925, Scientific results, vol. 1, No. 5, 1927.

Table 126

MELTING POINT IN SEA WATER[1]

The melting point is the temperature at equilibrium between pure ice and sea water of indicated salinity under a pressure of 1 atmosphere.

Salinity	Melting-point	Salinity	Melting-point	Salinity	Melting-point	Salinity	Melting-point
‰	°C.	‰	°C.	‰	°C.	‰	°C.
1	−0.055	11	−0.587	21	−1.129	31	−1.683
2	−0.108	12	−0.640	22	−1.184	32	−1.740
3	−0.161	13	−0.694	23	−1.239	33	−1.797
4	−0.214	14	−0.748	24	−1.294	34	−1.853
5	−0.267	15	−0.802	25	−1.349	35	−1.910
6	−0.320	16	−0.856	26	−1.405	36	−1.967
7	−0.373	17	−0.910	27	−1.460	37	−2.024
8	−0.427	18	−0.965	28	−1.516	38	−2.081
9	−0.480	19	−1.019	29	−1.572	39	−2.138
10	−0.534	20	−1.074	30	−1.627	40	−2.196

[1] Krummel, O., Handb. d. Ozeanographie, vol. 1, 241, Stuttgart, 1907.

Table 127

DEPTH OF WATER CORRESPONDING TO THE WEIGHT OF SNOW OR RAIN COLLECTED IN GAGES OF VARIOUS DIAMETERS

A.—8-inch gage, 1 pound = 0.5507 inch of water.

Weight pounds	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05
.10	.06	.06	.07	.07	.08	.08	.09	.09	.10	.10
.20	.11	.12	.12	.13	.13	.14	.14	.15	.15	.16
.30	.17	.17	.18	.18	.19	.19	.20	.20	.21	.22
.40	.22	.23	.23	.24	.24	.25	.25	.26	.26	.27
0.50	0.28	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.32	0.33
.60	.33	.34	.34	.35	.35	.36	.36	.37	.38	.38
.70	.39	.39	.40	.40	.41	.41	.42	.43	.43	.44
.80	.44	.45	.45	.46	.46	.47	.47	.48	.49	.49
.90	.50	.50	.51	.51	.52	.52	.53	.54	.54	.55

1 lb.=0.55 in.
2 lb.=1.10 in.
3 lb.=1.65 in.
4 lb.=2.20 in.
5 lb.=2.75 in.
6 lb.=3.30 in.
7 lb.=3.85 in.
8 lb.=4.40 in.
9 lb.=4.96 in.
10 lb.=5.51 in.

B.—Other diameter gages.

Diam. in.	in. lb.$^{-1}$	lbs. in.$^{-1}$
4	2.204	0.454
6	.979	1.021
10	.353	2.836
12	.245	4.084

Table 128

QUANTITY OF RAINFALL CORRESPONDING TO GIVEN DEPTHS

Depth in.	acre-ft. mi.$^{-2}$	sec.-ft.-day mi.$^{-2}$	tons * acre^{-1}	U. S. gal. acre^{-1}
0.01	.5	.3	1	272
.02	1.1	.5	2	543
.03	1.6	.8	3	815
.04	2.1	1.1	5	1086
0.05	2.7	1.3	6	1358
.06	3.2	1.6	7	1629
.07	3.7	1.9	8	1901
.08	4.3	2.2	9	2172
.09	4.8	2.4	10	2444
0.10	5.3	2.7	11	2715
.20	10.7	5.4	23	5431
.30	16.0	8.1	34	8146
.40	21.3	10.8	45	10862
0.50	26.7	13.4	57	13577
.60	32.0	16.1	68	16292
.70	37.3	18.8	79	19008
.80	42.7	21.5	91	21723
.90	48.0	24.2	102	24439
1.00	53.3	26.9	113	27154
2.00	106.7	53.8	227	54308
3.00	160.0	80.7	340	81462
4.00	213.3	107.6	453	108616
5.00	266.7	134.4	566	135770
6.00	320.0	161.3	680	162924
7.00	373.3	188.2	793	190078
8.00	426.7	215.1	906	217232
9.00	480.0	242.0	1019	244386

* Density of water assumed to be 62.4 lbs. ft.$^{-3}$

Section X

RADIATION AND VISIBILITY TABLES

BLACKBODY RADIATION

Planck's formula for the spectral radiant emittance[1] W_λ of a complete radiator (blackbody) is

$$W_\lambda = c_1 \lambda^{-5} \left(e^{\frac{c_2}{\lambda T}} - 1\right)^{-1} \quad (1)$$

where λ is the wave length, T is the absolute temperature (°K.) and c_1 and c_2 are constants. The most probable values of the constants (for λ in cm.) are:[2] $c_1 = 3.740 \times 10^{-5}$ erg cm.^{2} sec.$^{-1}$ and $c_2 = 1\ 4385$ cm. °K. This gives W_λ in ergs per second per square centimeter per centimeter of wave length.

Table 129 A[3] gives values of the ratio $W_{0-\lambda}/W_{0-\infty}$ as a function of the parameter λT (cm. °K.) where $W_{0-\lambda} = \int_0^\lambda W_\lambda \, d\lambda$ and $W_{0-\infty}$ (or W) $= \int_0^\infty W_\lambda \, d\lambda$.

Table 129 B gives values of the (total) radiant emittance W computed from the Stefan-Boltzmann law

$$W = \sigma T^4 \quad (2)$$

where the Stefan-Boltzmann constant σ is 5.673×10^{-5} erg cm.$^{-2}$ °K.$^{-4}$ sec.$^{-1}$ or 8.132×10^{-11} cal. cm.$^{-2}$ °K.$^{-4}$ min.$^{-1}$ The wave length of maximum emittance λ_m for a specified temperature is given by Wien's displacement law

$$\lambda_m T = 0.2897 \text{ cm. °K.} \quad (3)$$

Table 129 C gives the distribution of energy radiated from a blackbody in various wave-length intervals for a few typical earth temperatures, computed from parts A and B of this table.

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[1] The energy emitted per unit area and per unit time in the solid angle 2π steradians (hemisphere).

[2] Birge, R. T., Rev. Mod. Phys., vol. 13, p. 233, 1941.

[3] Miscellaneous Physical Tables, Planck's radiation functions and electronic functions, WPA project sponsored by the National Bureau of Standards, New York, 1941. The values of c_1 and c_2 used in this table differ slightly from the accepted values given above. The table is computed with $c_1 = 3.732 \times 10^{-5}$ erg cm.^{2} sec.$^{-1}$ and $c_2 = 1.436$ cm. °K.

(*continued*)

BLACKBODY RADIATION

TABLE 129 A.—Values of $\frac{W_{0-\lambda}}{W_{0-\infty}}$, where $W_\lambda = c_1\lambda^{-5}(e^{c_2/\lambda T} - 1)^{-1}$ and $W_{0-\lambda} = \int_0^\lambda W_\lambda d\lambda$

λT	$\frac{W_{0-\lambda}}{W_{0-\infty}} = F \times 10^{-p}$		λT	$\frac{W_{0-\lambda}}{W_{0-\infty}} = F \times 10^{-p}$		λT	$\frac{W_{0-\lambda}}{W_{0-\infty}} = F \times 10^{-p}$		λT	$\frac{W_{0-\lambda}}{W_{0-\infty}} = F \times 10^{-p}$	
cm. K.°	F	p	cm. K.°	F	p	cm. K.°	F	p	cm. K.°	F	p
0.050	1.3652	9	0.095	1.7772	4	0.300	2.7454	1	0.700	8.0885	1
.051	2.2642	9	.096	2.0204	4	.305	2.8585	1	.720	8.1993	1
.052	3.6788	9	.097	2.2901	4	.310	2.9712	1	.740	8.3020	1
.053	5.8629	9	.098	2.5885	4	.315	3.0833	1	.760	8.3974	1
.054	9.1749	9	.099	2.9179	4	.320	3.1947	1	.780	8.4861	1
0.055	1.4113	8	0.100	3.2804	4	0.325	3.3053	1	0.800	8.5687	1
.056	2.1358	8	.105	5.6770	4	.330	3.4150	1	.820	8.6455	1
.057	3.1829	8	.110	9.2957	4	.335	3.5237	1	.840	8.7172	1
.058	4.6745	8	.115	1.4510	3	.340	3.6314	1	.860	8.7840	1
.059	6.7710	8	.120	2.1727	3	.345	3.7379	1	.880	8.8465	1
0.060	9.6798	8	0.125	3.1370	3	0.350	3.8432	1	0.900	8.9048	1
.061	1.3667	7	.130	4.3866	3	.355	3.9474	1	.920	8.9594	1
.062	1.9069	7	.135	5.9631	3	.360	4.0502	1	.940	9.0105	1
.063	2.6307	7	.140	7.9053	3	.365	4.1517	1	.960	9.0584	1
.064	3.5907	7	.145	1.0248	2	.370	4.2518	1	.980	9.1033	1
0.065	4.8510	7	0.150	1.3023	2	0.375	4.3506	1	1.00	9.1455	1
.066	6.4902	7	.155	1.6254	2	.380	4.4479	1	1.05	9.2402	1
.067	8.6028	7	.160	1.9962	2	.385	4.5438	1	1.10	9.3217	1
.068	1.1302	6	.165	2.4161	2	.390	4.6382	1	1.15	9.3921	1
.069	1.4723	6	.170	2.8858	2	.395	4.7312	1	1.20	9.4532	1
0.070	1.9025	6	0.175	3.4056	2	0.400	4.8227	1	1.25	9.5065	1
.071	2.4393	6	.180	3.9754	2	.410	5.0012	1	1.30	9.5531	1
.072	3.1045	6	.185	4.5944	2	.420	5.1738	1	1.35	9.5942	1
.073	3.9230	6	.190	5.2613	2	.430	5.3404	1	1.40	9.6304	1
.074	4.9236	6	.195	5.9749	2	.440	5.5012	1	1.45	9.6624	1
0.075	6.1392	6	0.200	6.7331	2	0.450	5.6563	1	1.50	9.6909	1
.076	7.6070	6	.205	7.5339	2	.460	5.8057	1	1.55	9.7163	1
.077	9.3692	6	.210	8.3750	2	.470	5.9495	1	1.60	9.7390	1
.078	1.1473	5	.215	9.2538	2	.480	6.0880	1	1.65	9.7594	1
.079	1.3971	5	.220	1.0168	1	.490	6.2212	1	1.70	9.7777	1
0.080	1.6923	5	0.225	1.1114	1	0.500	6.3494	1	1.75	9.7942	1
.081	2.0393	5	.230	1.2091	1	.510	6.4727	1	1.80	9.8091	1
.082	2.4453	5	.235	1.3094	1	.520	6.5912	1	1.85	9.8226	1
.083	2.9183	5	.240	1.4122	1	.530	6.7051	1	1.90	9.8349	1
.084	3.4668	5	.245	1.5171	1	.540	6.8146	1	1.95	9.8461	1
0.085	4.1002	5	0.250	1.6239	1	0.550	6.9198	1	2.00	9.8563	1
.086	4.8287	5	.255	1.7324	1	.560	7.0209	1			
.087	5.6633	5	.260	1.8423	1	.570	7.1182	1			
.088	6.6159	5	.265	1.9533	1	.580	7.2116	1			
.089	7.6993	5	.270	2.0653	1	.590	7.3014	1			
0.090	8.9269	5	0.275	2.1780	1	0.600	7.3877	1			
.091	1.0314	4	.280	2.2911	1	.620	7.5505	1			
.092	1.1874	4	.285	2.4047	1	.640	7.7010	1			
.093	1.3626	4	.290	2.5183	1	.660	7.8402	1			
.094	1.5586	4	.295	2.6320	1	.680	7.9691	1			

(*continued*)

BLACKBODY RADIATION

TABLE 129 B.—Values of the radiant emittance $W = \sigma T^4$, where $\sigma = 8.132 \times 10^{-11}$ cal. cm.$^{-2}$ °K.$^{-4}$ min.$^{-1}$

Temperature °K.	0	1	2	3	4	5	6	7	8	9
	cal. cm.$^{-2}$ min.$^{-1}$									
170	0.0679	0.0695	0.0712	0.0728	0.0745	0.0763	0.0780	0.0798	0.0816	0.0835
180	.0854	.0873	.0892	.0912	.0932	.0953	.0973	.0994	.1016	.1038
190	.1060	.1082	.1105	.1128	.1152	.1176	.1200	.1225	.1250	.1275
200	0.1301	0.1327	0.1354	0.1381	0.1408	0.1436	0.1464	0.1493	0.1522	0.1552
210	.1582	.1612	.1643	.1674	.1706	.1738	.1770	.1803	.1837	.1871
220	.1905	.1940	.1975	.2011	.2047	.2084	.2122	.2159	.2198	.2236
230	.2276	.2316	.2356	.2397	.2438	.2480	.2523	.2566	.2609	.2653
240	.2698	.2743	.2789	.2836	.2882	.2930	.2978	.3027	.3076	.3126
250	0.3177	0.3228	0.3280	0.3332	0.3385	0.3439	0.3493	0.3548	0.3603	0.3659
260	.3716	.3774	.3832	.3891	.3950	.4010	.4071	.4133	.4195	.4258
270	.4322	.4386	.4451	.4517	.4584	.4651	.4719	.4788	.4857	.4927
280	.4998	.5070	.5143	.5216	.5290	.5365	.5441	.5517	.5595	.5673
290	.5752	.5831	.5912	.5993	.6076	.6159	.6243	.6327	.6413	.6500
300	0.6587	0.6675	0.6764	0.6854	0.6945	0.7037	0.7130	0.7224	0.7318	0.7414
310	.7510	.7608	.7706	.7805	.7905	.8007	.8109	.8212	.8316	.8421
320	.8527	.8634	.8742	.8852	.8962	.9073	.9185	.9298	.9412	.9528
330	.9644	.9762	.9880	.9999	1.012	1.024	1.037	1.049	1.061	1.074
340	1.087	1.100	1.113	1.126	1.139	1.152	1.165	1.179	1.193	1.206
350	1.220	1.234	1.248	1.263	1.277	1.292	1.306	1.321	1.336	1.351
360	1.366	1.381	1.397	1.412	1.428	1.443	1.459	1.475	1.491	1.508
370	1.524	1.541	1.557	1.574	1.591	1.608	1.625	1.643	1.660	1.678

TABLE 129 C.—Spectral distribution of energy radiated from a blackbody

Wave-length interval	Temperature—°K.			Wave-length interval	Temperature—°K.		
	200	250	300		200	250	300
μ	cal. cm.$^{-2}$ min.$^{-1}$			μ	cal. cm.$^{-2}$ min.$^{-1}$		
3.0–3.5	0.0000	0.0000	0.0003	15–16	0.0058	0.0150	0.0284
3.5–4.0	.0000	.0001	.0011	16–17	.0057	.0138	.0253
4.0–4.5	.0000	.0003	.0025	17–18	.0054	.0127	.0225
4.5–5.0	.0000	.0006	.0046	18–19	.0052	.0115	.0200
5.0–5.5	.0001	.0012	.0073	19–20	.0049	.0105	.0177
5.5–6.0	0.0002	0.0019	0.0103	20–22	0.0088	0.0181	0.0298
6.0–6.5	.0003	.0029	.0132	22–24	.0076	.0149	.0236
6.5–7.0	.0005	.0038	.0158	24–26	.0065	.0121	.0189
7.0–7.5	.0007	.0048	.0180	26–28	.0056	.0101	.0152
7.5–8.0	.0009	.0057	.0198	28–30	.0048	.0083	.0124
8.0–8.5	0.0012	0.0066	0.0211	30–40	0.0154	0.0252	0.0361
8.5–9.0	.0014	.0073	.0219	40–50	.0075	.0115	.0157
9.0–9.5	.0017	.0079	.0223	50–60	.0040	.0059	.0078
9.5–10	.0019	.0084	.0224	60–70	.0023	.0033	
10–11	.0045	.0176	.0441	70–80	.0014	.0020	
11–12	0.0051	0.0180	0.0418	80–90	0.0009		
12–13	.0056	.0178	.0387	90–100	.0006		
13–14	.0058	.0171	.0353				
14–15	.0059	.0161	.0318				

SOLAR RADIATION OUTSIDE THE ATMOSPHERE

From a long series of measurements by the Smithsonian Institution the value of the *solar constant,* the total solar radiation at normal incidence outside the atmosphere at the mean solar distance, was calculated in 1913[1] to be 1.9408 ly. min.$^{-1}$ (1 langley (ly.) = 1 gram-calorie per square centimeter (cal. cm.$^{-2}$)). Later investigations[2] showed that the standard used in these measurements gave results about 2.4 percent too high and that the adjusted value is about 1.89 ly. min.$^{-1}$ In determining the solar constant, corrections must be made for ultraviolet and infrared radiations which cannot be measured at the base of the atmosphere. Recent observations (see below) indicate that the correction employed for the unmeasured ultraviolet radiation may have been too low; also solar radiation in the infrared region beyond about 2.5μ is still imperfectly known. In view of this uncertainty and since the value 1.94 ly. min.$^{-1}$ has long been used in meteorological literature as the best value of the solar constant, it has been retained in this volume for all calculations involving the solar constant. It should be clearly understood that this value is subject to revision as more data concerning the ultraviolet and infrared portions of the solar spectrum are obtained. It should also be pointed out that there is evidence[3] that the solar constant fluctuates as much as $\pm$1.5 percent. In addition, the varying distance between the sun and earth (see Table 169) produces a change in the actual solar radiation at the top of the atmosphere of about $\pm$3.5 percent from the mean value.

On the basis of the Smithsonian and other observations, Moon[4] in 1940 proposed a spectral solar radiation curve at normal incidence outside the atmosphere at the mean solar distance. More recently a rocket observation[5] has given a direct measurement (at 55 km.) of the ultraviolet spectrum of the sun at wave lengths below 0.34μ. Since less than 1 percent of atmospheric ozone is above this level, this observation should be closely representative of ultraviolet solar radiation at wave lengths above 0.22μ at the top of the atmosphere. Tables 130 and 131 are therefore constructed using Moon's values for wave lengths above 0.33μ and data from the rocket observation for wave lengths below 0.33μ.

Table 130 gives for various wave lengths the intensity of solar radiation outside the atmosphere in relative units. Table 131 gives the energy contained in various narrow spectral bands at normal incidence, in cal. cm.$^{-2}$ min.$^{-1}$, assuming a solar constant of 1.94 cal. cm.$^{-2}$ min.$^{-1}$

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1 Smithsonian Inst., Ann. Astrophys. Obs., vol. 3, p. 134, 1913.
2 Aldrich, L. B., and Abbot, C. G., Smithsonian pyrheliometry and the standard scale of solar radiation, Smithsonian Misc. Coll., vol. 110, No. 5, 1948.
3 Abbot, C. G., Solar radiation and weather studies, Smithsonian Misc. Coll., vol. 94, No. 10, 1935.
4 Moon, P., Journ. Franklin Inst., vol. 230, p. 583, 1940.
5 Hulbert, E. O., Journ. Opt. Soc. Amer., vol. 37, p. 405, 1947.

(*continued*)

TABLE 130

INTENSITY OF SOLAR RADIATION OUTSIDE THE ATMOSPHERE

Wave length	Intensity	Wave length	Intensity	Wave length	Intensity	Wave length	Intensity
μ	Relative units	μ	Relative units	μ	Relative units	μ	Relative units
0.220	14	0.420	1766	0.68	1473	2.5	50
.230	33	.424	1742	.69	1439	2.6	43
.240	40	.430	1788	.70	1405	2.7	38
.250	55	.44	1939	.71	1371	2.8	33
.260	126	.45	2036	.72	1337	2.9	30
0.266	174	0.46	2096	0.73	1304	3.0	26
.270	162	.47	2119	.74	1270	3.1	23
.275	136	.48	2127	.75	1236	3.2	21
.280	145	.49	2103	.80	1097	3.3	19
.290	378	.50	2061	.85	976	3.4	17
0.294	418	0.51	2000	0.90	871	3.5	15
.300	386	.52	1954	.95	781	3.6	14
.310	538	.53	1912	1.0	706	3.7	12
.320	621	.54	1894	1.1	590	3.8	11
.330	796	.55	1878	1.2	488	3.9	10
0.335	826	0.56	1861	1.3	395	4.0	9
.340	856	.57	1841	1.4	319	4.1	8
.345	886	.58	1819	1.5	260	4.2	8
.350	916	.59	1795	1.6	214	4.3	7
.360	976	.60	1762	1.7	177	4.4	6
0.370	1046	0.61	1727	1.8	148	4.5	6
.380	1121	.62	1690	1.9	124	4.6	5
.390	1202	.63	1653	2.0	105	4.7	5
.400	1304	.64	1616	2.1	89	4.8	5
.405	1427	.65	1579	2.2	76	4.9	4
0.410	1728	0.66	1543	2.3	66	5.0	4
.413	1803	.67	1508	2.4	57		

TABLE 131

ENERGY DISTRIBUTION OF SOLAR RADIATION OUTSIDE THE ATMOSPHERE

(Explanation on p. 414.)

At normal incidence and at mean solar distance, assuming a solar constant of 1.94 cal. cm.$^{-2}$ min.$^{-1}$

Wave-length interval	Energy	Wave-length interval	Energy	Wave-length interval	Energy	Wave-length interval	Energy
μ	cal. cm.$^{-2}$ min.$^{-1}$	μ	cal. cm.$^{-2}$ min.$^{-1}$	μ	cal. cm.$^{-2}$ min.$^{-1}$	μ	cal. cm.$^{-2}$ min.$^{-1}$
0.22–0.23	0.0004	0.45–0.46	0.0303	0.68–0.69	0.0213	0.91–0.92	0.0123
0.23–0.24	.0006	0.46–0.47	.0309	0.69–0.70	.0208	0.92–0.93	.0121
0.24–0.25	.0010	0.47–0.48	.0312	0.70–0.71	.0203	0.93–0.94	.0118
0.25–0.26	.0011	0.48–0.49	.0311	0.71–0.72	.0198	0.94–0.95	.0116
0.26–0.27	.0025	0.49–0.50	.0306	0.72–0.73	.0194	0.95–0.96	.0113
0.27–0.28	0.0021	0.50–0.51	0.0299	0.73–0.74	0.0189	0.96–0.97	0.0111
0.28–0.29	.0029	0.51–0.52	.0290	0.74–0.75	.0183	0.97–0.98	.0109
0.29–0.30	.0059	0.52–0.53	.0283	0.75–0.76	.0179	0.98–0.99	.0107
0.30–0.31	.0067	0.53–0.54	.0279	0.76–0.77	.0175	0.99–1.0	.0105
0.31–0.32	.0085	0.54–0.55	.0277	0.77–0.78	.0171	1.0 –1.1	.0948
0.32–0.33	0.0107	0.55–0.56	0.0274	0.78–0.79	0.0167	1.1 –1.2	0.0792
0.33–0.34	.0121	0.56–0.57	.0271	0.79–0.80	.0163	1.2 –1.3	.0643
0.34–0.35	.0130	0.57–0.58	.0268	0.80–0.81	.0159	1.3 –1.4	.0518
0.35–0.36	.0138	0.58–0.59	.0264	0.81–0.82	.0155	1.4 –1.5	.0424
0.36–0.37	.0149	0.59–0.60	.0260	0.82–0.83	.0152	1.5 –1.6	.0348
0.37–0.38	0.0159	0.60–0.61	0.0255	0.83–0.84	0.0148	1.6 –1.7	0.0288
0.38–0.39	.0171	0.61–0.62	.0251	0.84–0.85	.0145	1.7 –1.8	.0240
0.39–0.40	.0184	0.62–0.63	.0245	0.85–0.86	.0142	1.8 –1.9	.0197
0.40–0.41	.0212	0.63–0.64	.0240	0.86–0.87	.0138	1.9 –2.0	.0168
0.41–0.42	.0262	0.64–0.65	.0234	0.87–0.88	.0135	2.0 –3.0	.0719
0.42–0.43	0.0256	0.65–0.66	0.0229	0.88–0.89	0.0132	3.0 –4.0	0.0227
0.43–0.44	.0276	0.66–0.67	.0224	0.89–0.90	.0129	4.0 –5.0	.0084
0.44–0.45	.0292	0.67–0.68	.0219	0.90–0.91	.0126		

TOTAL SOLAR RADIATION AT THE TOP OF THE ATMOSPHERE

The values given in Tables 132–134 are based on the computations of Milankovitch,[1] revised on the basis of a solar constant $J_0 = 1.94$ cal. cm.$^{-2}$ min.$^{-1}$ (see p. 414).

The basic formula for computing the amount of solar radiation I_0 reaching a unit horizontal area at the top of the atmosphere in time t is

$$\frac{dI_0}{dt} = \frac{J_0}{r^2} \cos z \qquad (1)$$

where r is the radius vector of the earth (Table 169) and z is the sun's zenith distance; z is given by

$$\cos z = \sin \phi \sin \delta + \cos \phi \cos \delta \cos h \qquad (2)$$

where ϕ is the latitude, δ is the sun's declination and h is the sun's hour angle. The values of Table 132 were computed by substituting for t its value in terms of h and integrating equation (1) for the period sunrise to sunset with the minor approximation that δ and r are constant during the day.

To obtain the seasonal and annual values given in Table 133, δ and r cannot be considered constant, and Milankovitch evaluated the radiation by expanding certain expressions in series.

Table 132 gives the total solar radiation in cal. cm.$^{-2}$ falling on a horizontal surface at the top of the atmosphere during *one day* as a function of the terrestrial latitude and the solar longitude (or date).

Table 134, prepared by Leighly,[2] presents the same data in a more convenient graphical form as a direct function of the date rather than of the solar longitude.

Table 133 gives the total solar radiation in cal. cm.$^{-2}$ falling on a horizontal surface at the top of the atmosphere during the *whole year* and also the amounts for the summer and winter half-year. Summer is defined here as the period from the vernal to the autumnal equinox (March 21 to September 23) and winter as the period from the autumnal to the vernal equinox.

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[1] Milankovitch, M., Mathematische Klimalehre, Berlin, 1930. Handbuch der Klimatologie, Band I, Teil A.

[2] Leighly, J. B., private communication, 1948.

(*continued*)

Table 132

TOTAL DAILY SOLAR RADIATION AT THE TOP OF THE ATMOSPHERE

(Explanation on p. 417.)

The solar constant J_0 is assumed to be 1.94 cal. cm.$^{-2}$ min.$^{-1}$ Values apply to a horizontal surface.

	Longitude of the sun															
	0°	22½°	45°	67½°	90°	112½°	135°	157½°	180°	202½°	225°	247½°	270°	292½°	315°	337½°
	Approximate date															
	Mar. 21	Apr. 13	May 6	May 29	June 22	July 15	Aug. 8	Aug. 31	Sept. 23	Oct. 16	Nov. 8	Nov. 30	Dec. 22	Jan. 13	Feb. 4	Feb. 26
Latitude	cal. cm.$^{-2}$															
90°		423	772	999	1077	994	765	418								
80	155	423	760	984	1060	980	754	418	153	7						7
70	307	525	749	939	1012	934	742	519	303	129	24				24	131
60	447	635	809	934	979	929	801	629	442	273	146	72	49	73	146	276
50	575	732	867	958	989	954	859	725	568	414	286	204	176	205	289	419
40	686	807	910	972	991	967	901	798	677	545	429	348	317	350	434	553
30	775	865	929	967	975	960	921	856	765	663	564	492	466	494	568	670
20	841	894	923	935	935	930	916	884	831	760	685	627	605	630	691	769
10	882	897	893	881	873	877	886	887	871	835	789	748	733	752	795	845
0	895	873	837	804	790	800	830	863	885	886	870	851	843	855	878	896
−10	882	824	760	707	687	704	753	814	871	910	927	931	933	936	936	921
−20	841	750	660	593	567	590	654	741	831	907	959	988	999	993	968	918
−30	775	654	543	465	436	463	538	646	765	877	964	1020	1041	1025	973	888
−40	686	538	413	329	297	328	409	533	677	819	944	1027	1059	1032	953	828
−50	575	408	276	193	165	192	274	404	568	743	901	1014	1056	1018	909	752
−60	447	269	140	68	47	68	139	266	442	644	840	987	1046	992	847	652
−70	307	127	23				23	126	303	532	778	993	1081	998	785	539
−80	155	7						7	153	429	790	1041	1132	1046	796	434
−90										429	801	1056	1149	1062	809	434

Table 133

TOTAL ANNUAL AND SEASONAL SOLAR RADIATION AT THE TOP OF THE ATMOSPHERE

(Explanation on p. 417.)

The solar constant J_0 is assumed to be 1.94 cal. cm.$^{-2}$ min.$^{-1}$ Values apply to a horizontal surface.

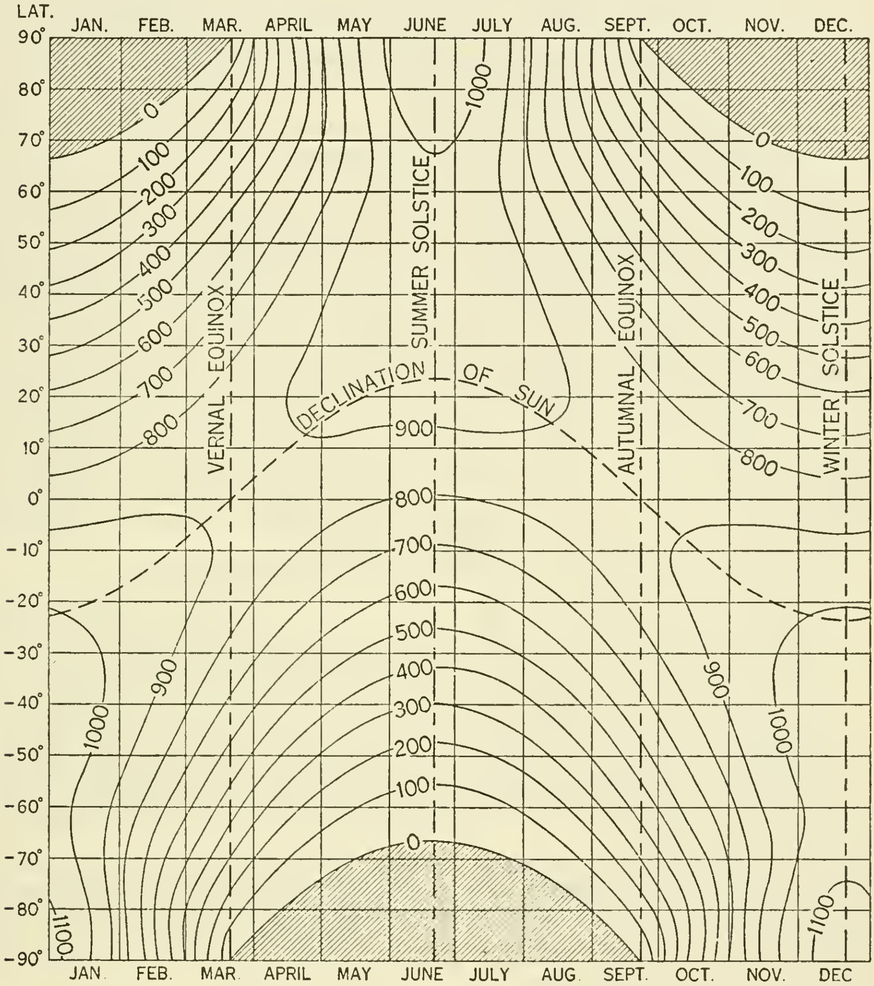
Latitude	Summer half-year	Winter half-year	Total	Latitude	Summer half-year	Winter half-year	Total
	cal. cm.$^{-2}$	cal. cm.$^{-2}$	cal. cm.$^{-2}$	cal. cm.$^{-2}$	cal. cm.$^{-2}$	cal. cm.$^{-2}$	cal. cm.$^{-2}$
0°	155760	155760	311520	50°	156030	56980	213010
5	160880	149610	310490	55	150640	44720	195360
10	164850	142400	307250	60	144610	32610	177220
15	167670	134210	301880	65	138710	21510	160220
20	169330	125110	294440	70	134540	13040	147580
25	169880	115220	285100	75	132070	7160	139230
30	169220	104570	273790	80	130480	3140	133620
35	167470	93300	260770	85	129580	720	130300
40	164620	81510	246130	90	129300	0	129300
45	160790	69360	230150				

CHART OF THE TOTAL DAILY SOLAR RADIATION AT THE TOP OF THE ATMOSPHERE

(Explanation on p. 417.)

The solar constant J_0 is assumed to be 1.94 cal. cm.$^{-2}$ min.$^{-1}$

The solid curves represent total daily solar radiation on a horizontal surface at the top of the atmosphere, measured in cal. cm.$^{-2}$ Shaded areas represent regions of continuous darkness.



TOTAL DIRECT SOLAR RADIATION REACHING THE GROUND WITH VARIOUS ATMOSPHERIC TRANSMISSION COEFFICIENTS

The basic formula for computing the direct solar radiation I which falls on a unit *horizontal* area at the earth's surface in time t is

$$\frac{dI}{dt} = \frac{J_0}{r^2} a^{\sec z} \cos z \qquad (1)$$

where a is the transmission coefficient of the atmosphere, r is the radius vector of the earth, J_0 is the solar constant and z is the sun's zenith distance. The development based on the computations of Milankovitch[1] is similar to the case for the radiation at the top of the atmosphere (p. 414) except that numerical integration is used instead of analytical integration. J_0 is assumed to be 1.94 cal. cm^{-2} min.$^{-1}$

Some approximations have been made, namely:

(a) Equation (1) is assumed to apply to total solar radiation although its derivation is applicable strictly only to monochromatic radiation.

(b) Refraction by the earth's atmosphere has been neglected.

Table 135 gives the *direct* solar radiation in cal. cm.$^{-2}$ which reaches a horizontal area at the surface of the earth during *one day* with various atmospheric transmission coefficients, as a function of terrestrial latitude and solar longitude (or date).

Table 136 gives the direct solar radiation in cal. cm.$^{-2}$ which reaches a horizontal area at the surface of the earth during the *whole year* with various atmospheric transmission coefficients, and also the amounts for the summer and winter half-year (March 21 to September 23 and September 23 to March 21 respectively).

Computation of diffuse sky radiation.[2]—Table 135 gives only the component of the direct solar radiation which reaches a horizontal surface. To estimate the total radiation (direct plus sky) which reaches a horizontal surface under cloudless conditions, the diffuse sky radiation must be added to the values given. The sky radiation may be approximated roughly by use of the following assumption:[3] Of the radiation which is scattered from the direct solar beam, half is scattered forward (downward) and half is scattered back. This assumption is strictly correct only when the scattering particles are small by comparison with the wave length of light.

The procedure for estimating the sky radiation under this assumption is:

(1) Find the extra-terrestrial radiation I_0 for the latitude and date desired from Table 132.

(2) Decrease I_0 by 9 percent to allow for water vapor absorption[4] (7 percent) and for ozone absorption[5] (2 percent). The remaining radiation is given by 0.91 I_0.

(3) Find the appropriate value of the direct radiation reaching the surface of the earth from Table 135 and substract from 0.91 I_0. The resulting difference, S, approximates the energy scattered out of the solar beam.

(4) Compute $S/2$. $S/2$ is the diffuse sky radiation and is to be added to the value from Table 135 to give the total radiation reaching the surface of the earth.

The annual and seasonal values given in Table 136 may be treated in a similar manner with the aid of Table 133.

Another estimate of the average diffuse radiation for middle latitudes may be obtained from Kimball's[6] measurement as a function of air mass. To apply these to Table 135, Kimball's data should be integrated over the day.

[1] Milankovitch, M., Mathematische Klimalehre, Berlin, 1930. Handbuch der Klimatologie, Band I, Teil A.
[2] Fritz, S., private communication, 1949.
[3] Kimball, H. H., Month. Weath. Rev., vol. 63, p. 1, 1935.
[4] See Tables 139 and 140.
[5] Fritz, S., Journ. Meteorol., vol. 6, p. 277, 1949.
[6] Kimball, H. H., Month. Weath. Rev., vol. 47, p. 769, 1919.

(*continued*)

TOTAL DAILY DIRECT SOLAR RADIATION REACHING THE GROUND WITH VARIOUS ATMOSPHERIC TRANSMISSION COEFFICIENTS

The solar constant J_0 is assumed to be 1.94 cal. cm.$^{-2}$ min.$^{-1}$ Values apply to a horizontal surface.

Transmission coefficient $a = 0.6$ (cal. cm.$^{-2}$)

Latitude	0° Mar. 21	45° May 6	90° June 22	135° Aug. 8	180° Sept. 23	225° Nov. 8	270° Dec. 22	315° Feb. 4
90°		127	299	125				
80	6	158	309	156	5			
70	47	234	349	232	46			
60	120	312	406	308	118	10		10
50	202	376	450	372	199	58	19	58
40	282	426	477	421	278	130	75	131
30	350	453	481	449	345	213	152	215
20	404	459	465	454	398	293	237	296
10	436	444	428	439	430	366	323	370
0	447	407	372	404	440	422	397	427
−10	436	353	303	349	430	461	457	465
−20	404	282	222	279	398	475	497	480
−30	350	206	143	204	345	470	514	475
−40	282	125	70	124	278	441	509	445
−50	202	56	18	55	199	391	481	395
−60	120	10		10	118	323	434	327
−70	47				46	242	373	245
−80	6				5	164	330	166
−90						131	319	133

Transmission coefficient $a = 0.7$ (cal. cm.$^{-2}$)

Latitude	0° Mar. 21	45° May 6	90° June 22	135° Aug. 8	180° Sept. 23	225° Nov. 8	270° Dec. 22	315° Feb. 4
90°		217	440	215				
80	13	243	442	242	13			
70	80	324	467	321	79			
60	174	408	520	404	172	22	1	23
50	272	477	563	472	268	91	37	92
40	363	529	587	524	358	182	111	184
30	440	556	588	550	434	281	210	283
20	499	561	568	556	491	374	309	378
10	534	542	524	537	527	456	408	460
0	546	501	462	496	538	519	493	524
−10	534	439	382	436	527	563	560	568
−20	499	361	290	357	491	582	606	588
−30	440	271	196	268	434	576	628	582
−40	363	176	103	174	358	548	627	554
−50	272	88	34	87	268	495	601	500
−60	174	22	1	21	172	423	555	427
−70	80				79	337	499	340
−80	13				13	253	472	255
−90						226	469	228

Transmission coefficient $a = 0.8$

Latitude	0° Mar. 21	45° May 6	90° June 22	135° Aug. 8	180° Sept. 23	225° Nov. 8	270° Dec. 22	315° Feb. 4
90°		349	615	346				
80	29	365	608	361	29			
70	128	434	605	429	126	1		1
60	242	520	650	515	240	44	5	44
50	356	591	686	585	350	136	64	137
40	456	641	708	635	449	247	164	249
30	539	668	706	662	532	360	277	363
20	601	669	678	663	593	463	393	468
10	639	649	630	643	630	555	503	560
0	652	602	560	597	643	626	598	631
−10	639	534	471	530	630	673	672	680
−20	601	446	369	442	593	695	725	700
−30	539	347	260	343	532	694	754	700
−40	456	239	153	236	449	665	756	671
−50	356	131	60	130	350	612	732	619
−60	242	42	4	42	240	539	694	544
−70	128	1		1	126	449	646	454
−80	29				29	378	649	381
−90						363	656	366

Transmission coefficient $a = 0.9$

Latitude	0° Mar. 21	45° May 6	90° June 22	135° Aug. 8	180° Sept. 23	225° Nov. 8	270° Dec. 22	315° Feb. 4
90°		532	826	526				
80	67	528	813	523	66			
70	199	571	774	566	196	5		5
60	333	650	799	643	328	80	16	81
50	455	718	828	711	449	200	107	201
40	562	766	841	759	554	328	229	331
30	651	791	831	783	641	453	362	458
20	715	789	799	781	705	566	491	571
10	755	763	744	756	744	664	610	670
0	768	714	668	707	757	740	713	748
−10	755	640	571	634	744	792	794	799
−20	715	545	460	539	705	819	853	826
−30	651	436	340	433	641	820	888	828
−40	562	316	214	313	554	794	898	802
−50	455	192	100	190	449	745	884	752
−60	333	77	15	76	328	674	854	681
−70	199	5		4	196	593	826	598
−80	67				66	547	867	553
−90						551	883	556

Table 136

TOTAL ANNUAL AND SEASONAL DIRECT RADIATION REACHING THE GROUND WITH VARIOUS ATMOSPHERIC TRANSMISSION COEFFICIENTS

(Explanation on p. 420.)

The solar constant J_0 is assumed to be 1.94 cal. cm.$^{-2}$ min.$^{-1}$ Values apply to a horizontal surface.

Latitude	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Transmission coefficient $a = 0.6$									
	cal. cm.$^{-2}$									
Summer half-year	75710	81630	83570	81830	76120	66830	55000	41320	29800	25200
Winter half-year	75710	66430	54280	40510	26330	13680	5000	1020	0	
Total	151420	148060	137850	122340	102450	80510	60000	42340	29800	25200
	Transmission coefficient $a = 0.7$									
Summer half-year	93050	99790	102340	100610	94790	84990	72030	57240	44790	39990
Winter half-year	93050	82640	68870	53160	36120	20410	8170	2140	110	
Total	186100	182430	171210	153770	130910	105400	80200	59380	44900	39990
	Transmission coefficient $a = 0.8$									
Summer half-year	112040	119380	122440	121320	115400	105400	92140	76630	65100	60610
Winter half-year	112040	100500	85300	67440	48260	29080	12960	3880	310	
Total	224080	219880	207740	188760	163660	134480	105100	80510	65410	60610
	Transmission coefficient $a = 0.9$									
Summer half-year	132650	140710	144580	143870	138360	128660	115810	101220	92440	89890
Winter half-year	132650	120190	103660	84490	62950	40820	20210	6940	1020	
Total	265300	260900	248240	228360	201310	169480	136020	108160	93460	89890

Table 137

OPTICAL AIR MASS CORRESPONDING TO DIFFERENT ZENITH DISTANCES OF THE SUN

The optical air mass m (also called the "air mass") is the length of the atmospheric path traversed by the sun's rays in reaching the earth, measured in terms of the length of this path when the sun is in the zenith. For a zenith distance z of the sun less than 80° the optical air mass is approximately equal to sec. z. At greater zenith distances the secant gives values which are increasingly too high, because of errors due to atmospheric refraction, curvature of the earth, etc. Table 137 is based on the widely used computations of Bemporad,[1] who gives the formula

$$m = \frac{\text{atmospheric refraction in seconds}}{58''.36 \sin z}$$

If the pressure at the surface p is different from the standard sea-level pressure p_0, the values of m are to be multiplied by p/p_0.

Sun's zenith distance	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
	Optical air mass									
0°	1.00									
10	1.02					1.04				
20	1.06	1.07	1.08	1.09	1.09	1.10	1.11	1.12	1.13	1.14
30	1.15	1.17	1.18	1.19	1.20	1.22	1.23	1.25	1.27	1.28
40	1.30	1.32	1.34	1.37	1.39	1.41	1.44	1.46	1.49	1.52
50	1.55	1.59	1.62	1.66	1.70	1.74	1.78	1.83	1.88	1.94
60	2.00	2.06	2.12	2.19	2.27	2.36	2.45	2.55	2.65	2.77
70	2.90	3.05	3.21	3.39	3.59	3.82	4.07	4.37	4.72	5.12
80	5.60	6.18	6.88	7.77	8.90	10.39	12.44	15.36	19.79	26.96

[1] Bemporad, A., Rend. Acc. Lincei., Roma, ser. 5, vol. 16, pp. 66-71, 1907. See also Linke, F., Handbuch der Geophysik, Band VIII, pp. 240-245, Gebrüder Borntraeger, Berlin-Zehlenday, 1943.

ABSORPTION OF RADIATION BY WATER VAPOR, 10-25μ

There is an unfortunate lack of suitable laboratory data on the absorption spectrum of water vapor. For many years the work of Hettner [1] on the infrared absorption spectrum of steam at atmospheric pressure had been widely used in meteorology. In 1932 Weber and Randall [2] redetermined the percentage absorption (not absorption coefficients) for steam (10–16μ) and for saturated water vapor at "room temperature" (16–25μ). The latter authors found smaller absorptions and a more complex spectrum than did Hettner, though the data are not strictly comparable, owing to different laboratory techniques and to the higher resolutions used by Weber and Randall. However, the primary purpose of their research was to determine the positions and the relative intensities of the various absorption lines, and the data given are insufficient for the accurate determination of the absorption coefficients. The element in doubt is the path length of water vapor employed, which depends on the "room temperature" appropriate to the tabulated absorptions and on the length of the absorption cell used, although it seems probable that the latter was 3 meters.

The confusion arising from the failure to specify the temperature is apparent in the literature. Ramanathan and Ramdas [3] computed the absorption coefficients assuming the room temperature to be 26.3 °C., a value obtained from the record of another experiment described in Weber and Randall's article. Also, Wexler [4] points out that owing to a typographical error in the original article,[2] the absorption lines from 21.39μ to 22.55μ were ascribed to steam rather than to saturated vapor at room temperature; therefore the absorption coefficients computed by Ramanathan and Ramdas are much too low in this region. Wexler,[4] through correspondence with Professor Randall, obtained the value 22.5 °C. for the room temperature and attempted to correct the Ramanathan and Ramdas data accordingly; but Wexler assumed that they had used 30 °C. in their computations rather than 26.3 °C. Although this was pointed out in a later article,[5] the earlier data presented by Wexler have found their way into meteorological literature,[6] as have the data of Ramanathan and Ramdas.[7]

Elsasser [8] discusses the concept of the absorption coefficient in the case of overlapping absorption lines, as occurs in the water vapor spectrum.

The Weber and Randall data are given below.

NOTE.—There has been considerable recent research on the problem of water-vapor absorption, but the results were not available in time to be included here. See, for example: Chapman, R. M., Howard, J. N., and Miller, V. A., Atmospheric transmission of infrared, Summary report. Ohio State Univ. Res. Found., Columbus, June 30, 1949. Drummeter, L. F., and Strong, J., Infrared absorption of water vapor at 1.8 microns. Johns Hopkins Univ. Rep., Baltimore, 1949.

[1] Hettner, G., Ann. d. Physik, vol. 55, p. 476, 1917.
[2] Weber, L. R., and Randall, H. M., Phys. Rev., vol. 40, p. 835, 1932.
[3] Ramanathan, K. R., and Ramdas, L. A., Proc. Ind. Acad. Sci., vol. 1A, p. 822, 1935.
[4] Wexler, H., Month. Weath. Rev., vol. 64, p. 122, 1936.
[5] Wexler, H., Month. Weath. Rev., vol. 65, p. 102, 1937.
[6] See Schnaidt, F., Gerl. Beitr. Geophys., vol. 56, p. 230, 1939.
[7] See Brunt, D., Physical and dynamical meteorology, p. 117, Cambridge, 1941.
[8] Elsasser, W. M., Harvard Meteorological Studies No. 6, p. 35, Milton, 1940.

(*continued*)

TABLE 138 (CONCLUDED)

ABSORPTION OF RADIATION BY WATER VAPOR, 10-25μ

Wave length	Steam	Wave length	Steam	Sat. vapor *	Wave length	Sat. vapor *	Wave length	Sat. vapor *
μ	%	μ	%	%	μ	%	μ	%
10.13	1	14.39	31		17.72	6	20.94	12
10.20	1	14.46	32		17.84	4	21.12	53
10.42	9	14.54	39		17.95	6	21.14	43
10.85	1	14.76	21		18.06	9	21.18	23
11.06	5	15.17	25		18.21	14	21.29	22
11.22	1	15.34	17		18.29	8	21.34	26
11.32	1	15.40	23†		18.34	19	21.39	12
11.55	1	15.55	23		18.39	7	21.66	24
11.58	1	15.62	24		18.52	5	21.74	39
11.65	2	15.73	32		18.66	8	21.81	65
11.77	7	15.92	22	1	18.74	3	21.85	42
11.97	4	15.991	40	4	18.97	4	21.89	21
12.14	7	16.08	19	1	19.023	21	22.07	35
12.34	2	16.11		6	19.10	5	22.37	42
12.41	4	16.190	25†	10†	19.25	24	22.39	42
12.48	10	16.38	9	2	19.32	32	22.55	17
12.58	11	16.53	14	1	19.41	6	22.62	31
12.65	15	16.58		2	19.56	9	22.88	21
12.82	6	16.667		5	19.69	23	22.98	9
12.92	9	16.69		3	19.79	20	23.16	10
13.06	17	16.82		7	19.87	30	23.44	24
13.22	16	16.893		14	20.10	3	23.59	42
13.32	15	17.102		6	20.29	24	23.81	66
13.50	17	17.220		13	20.42	4	24.61	28
13.74	9	17.360		14	20.53	7	24.72	38
13.95	18†	17.50		4	20.55	18	24.91	25
14.07	13	17.57		16	20.62	28		
14.23	32	17.64		9	20.76	9		

* "Room temperature."
† CO_2.

Table 139

ABSORPTION OF RADIATION BY WATER VAPOR, 1.3-9μ

Fowle[1] made a series of laboratory measurements on the infrared absorption spectrum of water vapor for wave lengths up to about 22μ. His results for the band 1.3 to 8.0μ and the band 5 to 9μ are tabulated below. The 1.3 to 8.0μ band was investigated using a 60° rock-salt prism; the 5 to 9μ band using a 15° rock-salt prism. The latter gives smaller dispersions and the measurements are more difficult.

Part A.—Percent absorption by water vapor, 1.3-8.0μ.

Band	Wave-length interval	Precipitable water, mm. 0.08	0.82
	μ	%	%
Ψ	1.3 –1.75	6.1	18
Ω	1.75–2.2	13.6	29
X	2.2 –3.2	23.6	41
—	3.2 –4.0	21.7	37
Y	4.0 –4.9	32.5	50
Z	4.9 –5.4	18	42
"	5.4 –5.9	47	85
"	5.9 –6.4	64	97
"	6.4 –7.0	68	97
"	7.0 –8.0	25	62

Part B.—Percent absorption by water vapor, 5-9μ.

Wave-length interval	Precipitable water, mm. 0.035	0.047	0.12	0.28	1.25	1.6	2.5
μ	%	%	%	%	%	%	%
5–6	18	22	25	43	55	59	65
6–7	48	54	69	85	95	95	95
7–8	15	19	34	42	66	76	83
8–9	0	0	2	2	8	13	35

[1] Fowle, F. E., Smithsonian Misc. Coll., vol. 68, No. 8, 1917.

Table 140

TRANSMISSION OF SOLAR RADIATION BY WATER VAPOR, 0.7-2.2μ

Fowle[1] determined the fractional transmission of energy in the ϕ and ψ bands by laboratory experiment over short water-vapor paths. By intercomparison with solar spectra, he was able to extend the path length to greater values, and to relate the transmission in the ϕ band to that in other bands as a function of the amount of water vapor, considering only depletion due to selective absorption and neglecting scattering (see Table 145). These values are given in the chart[2] below for various wave-length bands defined as follows:

Band	Wave-length interval (microns)
a	0.70–0.74
.8μ	0.79–0.84
ρ	0.86–0.99
φ	1.03–1.23
Ψ	1.24–1.53
Ω	1.53–2.10

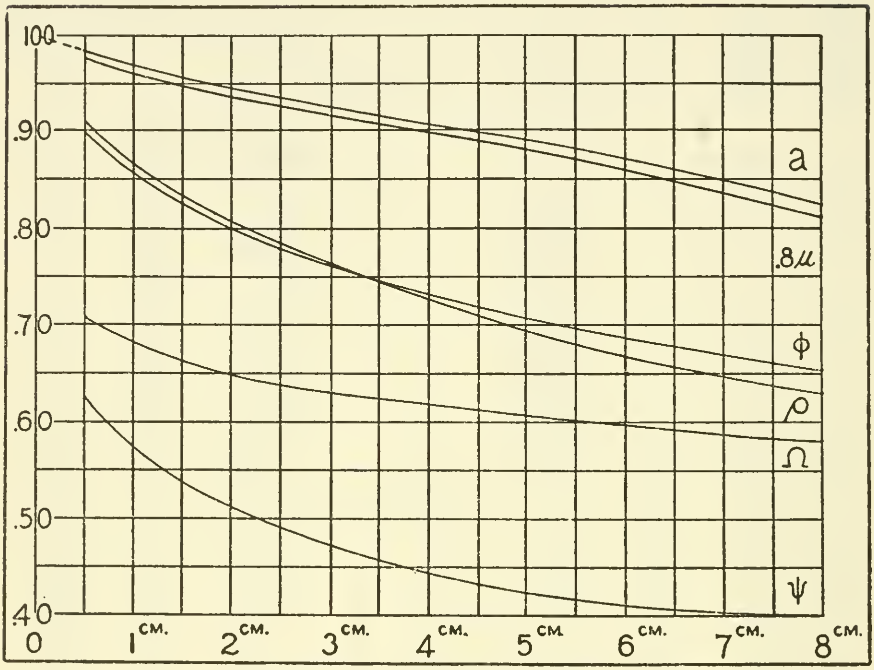
[1] Fowle, F. E., Astrophys. Journ., vol. 35, p. 149, 1912.
[2] Fowle, F. E., Astrophys. Journ., vol. 42, p. 394, 1915.

(*continued*)

TABLE 140 (CONCLUDED)

TRANSMISSION OF SOLAR RADIATION BY WATER VAPOR

Fractional transmission



Amounts of precipitable water.

ABSORPTION OF RADIATION BY CARBON DIOXIDE

A.—Mean percentage absorption by carbon dioxide (CO_2) from parallel beams of various wave-length intervals, under laboratory conditions of pressure and temperature.[1]

CO_2 path length *	14-16	13-14 or 16-17	12.5-13 or 17-17.5	9-11	Observer
cm.	%	%	%	%	
0.004	1.				M
0.05	8.0				M
0.23	20.0				M
0.68	38.7				M
1.00	48.0	8			R
1.58	57.7	..			M
4	73.3	17	2		R
20	91.2	39	5		R
25	...	40	..		M
100	98.0	63	12	2	R
400	100.	83	23		R

* Reduced to normal pressure and temperature.

Observers: M—Martin, P., and Barker, E., Phys. Rev., vol. 41, p. 176, 1932.
R—Rubens, H., and Ladenberg, E., Verh. Phys. Ges., vol. 7, p. 170, 1905.

Data on the variation with pressure and temperature of absorption by carbon dioxide is inconclusive. Brooks[2] reports that Bruinenburg[3] and Möller[4] assume the variation with pressure to be proportional to $p^{0.73}$, while Elsasser[5] uses the factor $p^{0.5}$. Variation with temperature (°K.) is usually assumed to be small, approximately proportional to $T^{-0.25}$.

Carbon dioxide also has an absorption band in the region of 4.3 microns, but this band is not generally considered to be meteorologically significant. The mean absorption in the region 4.0-4.5μ is about 67 percent for 1 centimeter of CO_2.

B.—Absorption by CO_2 from parallel beam of equal light intensity from 14 to 16 microns, calculated from quantum mechanics for stratospheric conditions ($p = 203$ mb., $T = 218$ °K.).[6, 7]

CO_2 path length *	Air thickness †	Absorption
cm.	mb.	%
0.004	0.0098	0.62
.05	.123	5.2
1.	2.46	29.4
4.	9.84	51.1
20.	49.2	75.1

* Reduced to 1013.25 mb. and 0 °C.
† For a concentration of 3.0×10^{-4} parts of carbon dioxide by volume. Since in atmospheric problems the flux of radiation is diffuse, rather than in parallel beams, the figures in the first column were divided by 1.66 before computing the corresponding air thickness in the second column.[6]

[1] Callendar, G. S., Quart. Journ. Roy. Meteorol. Soc., vol. 67, p. 263, 1941.
[2] Brooks, D. L., Measurements of atmospheric radiation applied to the heat transfer by infrared radiation in the free atmosphere, Sc. D. dissertation, M. I. T., 1948.
[3] Bruinenburg, A., Koninlijk Ned. Met. Inst. de Bilt, ser. B, Deel I, 1946.
[4] Möller, F., Meteorol. Zeitschr., vol. 61, p. 37, 1944.
[5] Elsasser, W. M., Harvard Meteorol. Series, No. 6, 1942.
[6] Kaplan, L. D., Journ. Chem. Phys., vol. 15, p. 809, 1947.
[7] Kaplan, L. D., private communication, July 1949.

ABSORPTION OF RADIATION BY OZONE

Parts A and B of this table give values of the "decimal" absorption coefficient of ozone, O_3, in the ultraviolet and in the visible bands as determined in the laboratory by Ny and Choong [1] and by Colange [2] respectively. The average absorption coefficient for narrow wave-length intervals has been taken from curves in the references cited. The pressure dependence is small for these bands.[3,4] Evidence indicates a temperature effect on the absorption coefficients in the ultraviolet bands,[5,6,7] but there is conflicting evidence concerning a possible temperature effect in the visible band.[8,9,10]

The "decimal" absorption coefficient a and the "Naperian" absorption coefficient k are defined by the following expressions

$$I_\lambda = I_{0\lambda}\, 10^{-ax} = I_{0\lambda}\, e^{-kx}$$

where $I_{0\lambda}$ is the initial intensity of a parallel beam of radiation of wave length in the neighborhood of λ and I_λ is the intensity after passing through a layer of ozone x centimeters thick at normal pressure and temperature (0 °C. and 760 mm. Hg.); e is the base of the natural logarithms. Values of a are tabulated, and corresponding values of k may be obtained from the relationship

$$k = a \log_e 10 = 2.3026\, a.$$

Part C gives the percentage absorption by ozone under laboratory conditions for a path of ozone 1 centimeter long at 0 °C. and 760 mm. Hg. as given by Sutherland and Callendar.[11] Strong [4] states that the absorption by ozone in the infrared is proportional to the fourth root of the total pressure.

[1] Ny Tsi-Ze and Choong Shin-Piaw, Chinese Journ. Phys., vol. 1, p. 38, 1933.
[2] Colange, G., Journ. d. Physique, vol. 8, p. 254, 1927.
[3] Vassy, E., Conference on atmospheric ozone held at Oxford, Sept. 9-11, 1936, p. 26, published by the Royal Meteorological Society, London, 1936.
[4] Strong, J., Journ. Franklin Inst., vol. 231, p. 121, 1941.
[5] Wulf, O. R., and Melvin, E. H., Phys. Rev., vol. 38, p. 330, 1931.
[6] Vassy, E., Ann. Phys., vol. 8, p. 679, 1937.
[7] Gotz, F. W. P., Beitr. Geophys., Ergebnisse der Kosmischen Physik, vol. 3, p. 253, 1938.
[8] Humphrey, G. L., and Badger, R. M., Journ. Chem. Phys., vol. 15, p. 794, 1947.
[9] Vigroux, E., Compte Rend., vol. 227, p. 272, 1948.
[10] Vassy, A., and Vassy, E., Journ. Chem. Phys., vol. 16, p. 1163, 1948.
[11] Sutherland, G. B. B. M., and Callendar, G. S., Reports on progress in physics, vol. IX, The Physical Review, London, 1943.

(*continued*)

ABSORPTION OF RADIATION BY OZONE

A.—Decimal absorption coefficients of ozone in the ultraviolet.

Wave length	Absorption coefficient	Wave length	Absorption coefficient	Wave length	Absorption coefficient
μ	cm.$^{-1}$	μ	cm.$^{-1}$	μ	cm.$^{-1}$
.210–.220	16.5	.306–.307	2.32	.323–.324	0.192
.220–.230	41.5	.307–.308	2.00	.324–.325	0.189
.230–.240	86	.308–.309	1.83	.325–.326	0.187
.240–.250	126	.309–.310	1.56	.326–.327	0.124
.250–.260	141	.310–.311	1.34	.327–.328	0.133
.260–.270	122	.311–.312	1.17	.328–.329	0.119
.270–.280	71	.312–.313	1.03	.329–.330	0.073
.280–.285	36.1	.313–.314	0.94	.330–.331	0.090
.285–.290	26.0	.314–.315	0.77	.331–.332	0.091
.290–.295	14.9	.315–.316	0.70	.332–.333	0.050
.295–.300	6.4	.316–.317	0.575	.333–.334	0.064
.300–.301	4.58	.317–.318	0.545	.334–.335	0.052
.301–.302	4.02	.318–.319	0.405	.335–.336	0.031
.302–.303	3.55	.319–.320	0.400	.336–.337	0.039
.303–.304	3.18	.320–.321	0.315	.337–.338	0.040
.304–.305	2.85	.321–.322	0.265	.338–.339	0.022
.305–.306	2.56	.322–.323	0.260	.339–.340	0.025

B.—Decimal absorption coefficients of ozone in the visible.

Wave length	Absorption coefficient	Wave length	Absorption coefficient	Wave length	Absorption coefficient
μ	cm.$^{-1}$	μ	cm.$^{-1}$	μ	cm.$^{-1}$
.44–.45	0.002	.51–.52	0.018	.58–.59	0.043
.45–.46	.002	.52–.53	.025	.59–.60	.043
.46–.47	.004	.53–.54	.031	.60–.61	.049
.47–.48	.004	.54–.55	.031	.61–.62	.044
.48–.49	.008	.55–.56	.036	.62–.63	.037
.49–.50	0.012	.56–.57	0.043	.63–.64	0.030
.50–.51	.016	.57–.58	.045		

C.—Percentage absorption of radiation by ozone in the infrared, (for 1 cm. path length at N.T.P.)

Wave length	Absorption
μ	%
4.5– 5.0	75
9.4– 9.8	75
12.5–15.5	17

ABSORPTION COEFFICIENTS OF OXYGEN

Table 143 gives values of the "decimal" absorption coefficient of molecular oxygen, O_2, in the region 0.13-0.24μ, the region of meteorological interest. The values have been taken from a curve by Craig[1] based on the investigations of Ladenburg,[2] Buisson et al.,[3] Granath,[4] and Gotz and Maier-Leibnitz.[5] Craig states that pressure dependence is negligible at wave lengths up to about 0.175μ, but that Heilpern[6] has found a marked pressure dependence in the region of 0.214μ and above.

The "decimal" absorption coefficient a and the "Naperian" absorption coefficient k are defined by the following expressions

$$I_\lambda = I_{0\lambda} 10^{-ax} = I_{0\lambda} e^{-kx}$$

where $I_{0\lambda}$ is the initial intensity of a parallel beam of radiation of wave length in the neighborhood of λ and I_λ is the intensity after passing through a layer of oxygen x centimeters thick at normal pressure and temperature (0 °C. and 760 mm. Hg.); e is the base of the natural logarithms. Values of a are tabulated, and corresponding values of k may be obtained from the relationship

$$k = a \log_e 10 = 2.3026a.$$

Wave length	Absorption coefficient	Wave length	Absorption coefficient
μ	a	μ	a
0.13	8.7	0.19	0.0019
.14	151.	.20	.00022
.146	217.	.21	.00014
.15	176.	.22	.000091
.16	74.	.23	.000056
.17	17.	.24	.000026
.18	0.38		

[1] Craig, R. A., The observations and photochemistry of atmospheric ozone and their meteorological significance, Sc. D. dissertation, M. I. T., 1948.
[2] Ladenburg, R., and Van Voorhis, C. C., Phys. Rev., vol. 43, p. 315, 1933.
[3] Buisson, H., Jausserau, C., and Rouard, P., Rev. d'Optique, vol. 12, p. 70, 1933.
[4] Granath, L. P., Phys. Rev., vol. 34, p. 1045, 1929.
[5] Gotz, F. W. P., and Maier-Leibnitz, H., Zeitschr. Geophys., vol. 9, p. 253, 1933.
[6] Heilpern, W., Helv. Phys. Acta., vol. 14, p. 329, 1941.

TRANSMISSION OF RADIATION THROUGH PURE, DRY AIR

Fowle[1] has shown that on high mountains above the dust of the lower levels, atmospheric transmission by dry air $a_{a\lambda}$ agrees closely with the theoretical equation developed by King[2] from Rayleigh's[3] classical equations for molecular scattering.

King's equations are

$$a_{a\lambda} = e^{-k_\lambda} \qquad (1)$$

and

$$k_\lambda = \frac{32}{3}\left[\pi^3 (n_\lambda - 1)^2 \frac{H}{N\lambda^4} + bH\right]\frac{p}{p_0} + D, \qquad (2)$$

where

n_λ = index of refraction of air for wave length λ,
H = height of the homogeneous atmosphere, cm.,
p_0 = standard sea-level pressure,
p = observed pressure,
λ = wave length of the radiation, cm.,
N = number of molecules per cm.^{3} in the homogeneous atmosphere,
b = energy absorbed by the permanent gases,
D = depletion by dust.

Here $a_{a\lambda}$ represents the transmission factor for optical air mass unity when $p = p_0$.

Linke[4] has computed k_λ and $a_{a\lambda}$ for dust-free air ($D = 0$) assuming $N = 2.70 \times 10^{19}$, $H = 799100$ cm., $p = p_0$, and using values of n, given by Traub.[5] The absorption by permanent gases was considered to be negligible ($b = 0$).

Table 144 gives values of k_λ and $a_{a\lambda}$ for various wave lengths.

[1] Fowle, F. E., Astrophys. Journ., vol. 38, p. 392, 1913.
[2] King, L. V., Philos. Trans. Roy. Soc. London, A, vol. 212, p. 375, 1913.
[3] Rayleigh, Lord, Philos. Mag., vol. 47, p. 375, 1899.
[4] Linke, F., Meteorologisches Taschenbuch, vol. 4, Leipzig, 1939.
[5] Traub, W., Ann. Phys., vol. 61, 1920.

TRANSMISSION OF RADIATION THROUGH PURE, DRY AIR

Wave length	k_λ	$a_{a\lambda}$	Wave length	k_λ	$a_{a\lambda}$	Wave length	k_λ	$a_{a\lambda}$
μ			μ			μ		
0.28	1.555	0.211	0.46	0.190	0.827	0.80	0.0201	0.980
0.29	1.335	0.263	0.48	0.160	0.852	0.85	0.0158	0.984
						0.90	0.0125	0.988
0.30	1.15	0.316	0.50	0.135	0.874	0.95	0.0101	0.990
0.31	1.00	0.368	0.52	0.115	0.891			
0.32	0.872	0.418	0.54	0.0988	0.906	1.00	0.00821	0.992
0.33	0.768	0.464	0.55	0.0915	0.913	1.10	0.00560	0.995
0.34	0.676	0.508	0.56	0.0852	0.918	1.20	0.00395	0.996
			0.58	0.0738	0.929	1.40	0.00213	0.998
0.35	0.598	0.551				1.50	0.00162	0.998
0.36	0.530	0.589	0.60	0.0645	0.938	1.60	0.00125	0.999
0.37	0.472	0.623	0.62	0.0564	0.945	1.80	0.00078	0.999
0.38	0.422	0.656	0.64	0.0497	0.952			
0.39	0.378	0.685	0.65	0.0466	0.955	2.00	0.00051	1.000
			0.66	0.0438	0.957	2.50	0.000208	1.000
0.40	0.340	0.712	0.68	0.0388	0.962	3.00	0.000100	1.000
0.42	0.277	0.758				3.50	0.000054	1.000
0.44	0.229	0.795	0.70	0.0345	0.966	4.00	0.000032	1.000
0.45	0.208	0.812	0.75	0.0262	0.974			

Table 145

SCATTERING OF SOLAR RADIATION BY WATER VAPOR

From the Smithsonian Institution spectral observations at Mt. Wilson, Fowle[1] measured the spectral transmission of solar radiation by a cloudless atmosphere (assumed dust-free) and computed the spectral transmission coefficient a_λ for a vertical path. Assuming

$$a_\lambda = a_{a\lambda} a_{w\lambda}^{w} \qquad (1)$$

where $a_{a\lambda}$ is the vertical transmission considering only the effect of scattering by pure dry air, $a_{w\lambda}$ is the transmission considering only the effect of scattering by 1 centimeter of precipitable water vapor, and w is the amount of precipitable water in the path, Fowle plotted log a_λ against w (measured spectroscopically). The slope of the best-fitting straight line gives log $a_{w\lambda}$, from which $a_{w\lambda}$ is computed. Table 145 gives $a_{w\lambda}$ as a function of wave length; values are averages for the years 1910, 1911, and 1913.[2]

Wave length	$a_{w\lambda}$	Wave length	$a_{w\lambda}$	Wave length	$a_{w\lambda}$	Wave length	$a_{w\lambda}$
μ		μ		μ		μ	
0.342	0.920	0.431	0.957	0.686	0.981	1.603	0.987
.350	.926	.452	.961	.764	.984	1.738	.987
.360	.934	.475	.964	.864	.986	1.870	.987
.371	.940	.503	.968	.987	.987	2.000	.986
.384	.945	.535	.972	1.146	.987	2.123	.985
.397	.949	.574	.970	1.302	.987	2.242	.984
.413	.953	.624	.975	1.452	.987	2.348	.983

[1] Fowle, F. E., Astrophys. Journ., vol. 38, p. 392, 1913.
[2] Fowle, F. E., Smithsonian Misc. Coll., vol. 68, No. 8, p. 45, 1917. Additional data for $\lambda < .574\mu$ are given in Smithsonian Misc. Coll., vol. 69, No. 3, 1918.

TRANSMISSION OF SOLAR RADIATION BY THE ATMOSPHERE, 5.5-22μ

Adel and Lampland[1] investigated the atmospheric transmission of solar radiation at the Lowell Observatory, Flagstaff, Ariz., for varying amounts of precipitable water in the atmosphere. The latter was determined spectroscopically by the method of Fowle.[2] The term precipitable water as used here refers to the water-vapor content along the path traversed by the radiation.

Part A.—Percent transmission in the region 5.5-8.0μ.

Wave length	I	II	III	IV	V	VI
μ	%	%	%	%	%	%
5.5	1.0	2.0	3.0	7.0	10.0	11.6
5.6	0.8	0.8	0.9	2.3	4.0	5.2
5.7	0.0	0.2	0.3	0.4	1.0	1.1
5.8	0.0	0.0	0.1	0.0	0.2	0.3
5.9	0.0	0.0	0.0	0.0	0.0	0.0
6.0	0.0	0.0	0.0	0.0	0.0	0.0
6.1	0.0	0.0	0.0	0.0	0.0	0.0
6.2	0.0	0.0	0.0	0.1	0.0	1.2
6.3	0.0	0.0	0.0	0.3	0.7	2.4
6.4	0.0	0.0	0.0	0.3	0.3	1.2
6.5	0.0	0.0	0.0	0.0	0.0	0.0
6.6	0.0	0.0	0.0	0.0	0.0	0.0
6.7	0.0	0.0	0.0	0.0	0.0	0.0
6.8	0.0	0.0	0.0	0.0	0.0	0.7
6.9	0.0	0.0	0.0	0.2	1.2	3.1
7.0	0.0	0.0	0.0	1.6	3.5	6.3
7.1	0.0	0.0	0.9	3.6	7.1	11.3
7.2	0.0	1.2	2.1	6.2	11.5	17.0
7.3	0.8	4.4	5.9	10.8	18.4	24.0
7.4	4.3	10.9	14.0	20.6	27.2	34.2
7.5	10.5	19.5	22.7	29.6	31.4	42.0
7.6	8.0	15.2	17.0	24.5	28.8	29.0
7.7	13.3	17.4	19.6	19.7	24.4	26.6
7.8	19.9	25.7	26.6	27.3	32.4	36.3
7.9	18.7	26.4	26.7	27.4	32.8	38.8
8.0	44.6	47.8	54.8	52.4	60.7	63.1

NOTES:

Column I, precipitable water 10.2–10.0 mm., optical air mass not specified.
" II, " " 6.0– 5.9 " , " " " " " .
" III, " " 4.7– 4.6 " , " " " " " .
" IV, " " 3.1– 3.0 " , " " " " " .
" V, " " 2.1 " , " " " " " .
" VI, " " 1.1– 1.0 " , " " " " " .

Decrease in transmission due principally to H_2O; above 7.5μ bands due to nitrogen oxides are superimposed.

[1] Adel, A., and Lampland, C. O., Astrophys. Journ., vol. 91, p. 1 and p. 481, 1940.
[2] Fowle, F. E., Smithsonian Misc. Coll., vol. 68, No. 8, 1917.

(*continued*)

TRANSMISSION OF SOLAR RADIATION BY THE ATMOSPHERE, 5.5-22μ

Part B.—Percent transmission in the region 8.0-11.0μ.

Wave length	VII	VIII	IX	X	XI	XII
μ	%	%	%	%	%	%
8.0	20.3	25.6	44.6	47.8	52.4	60.7
8.1	37.6	44.2	65.8	73.3	70.8	79.5
8.2	34.4	47.2	68.7	76.5	80.5	85.9
8.3	47.1	52.7	78.1	82.7	89.5	91.4
8.4	49.5	64.8	83.7	89.7	93.7	97.3
8.5	47.5	63.2	82.5	88.3	93.3	96.6
8.6	54.8	70.0	84.8	90.5	93.6	97.1
8.7	53.1	71.5	83.3	89.8	93.4	95.6
8.8	51.8	69.5	81.6	88.0	91.7	94.3
8.9	56.5	75.1	86.2	92.7	95.7	97.9
9.0	54.0	72.3	82.8	91.0	95.2	97.6
9.1	57.6	74.2	85.2	91.4	94.7	97.1
9.2	58.2	73.7	84.2	90.8	91.8	95.0
9.3	51.2	62.4	77.6	84.7	85.7	88.5
9.4	26.2	30.7	42.7	43.2	40.4	41.9
9.5	21.5	23.2	32.0	34.7	27.3	28.5
9.6	24.6	27.8	35.1	39.8	31.6	32.6
9.7	24.6	27.3	35.3	41.8	33.1	34.3
9.8	30.0	34.2	43.3	50.8	43.0	45.4
9.9	40.8	45.8	57.6	65.8	60.9	64.2
10.0	49.6	59.2	74.2	82.3	80.2	82.7
10.1	57.5	69.2	83.8	92.5	91.7	94.8
10.2	56.7	70.0	83.8	93.9	94.2	98.5
10.3	53.3	68.5	82.2	92.5	94.5	98.7
10.4	56.4	71.5	80.6	91.0	95.1	99.0
10.5	52.3	68.5	78.4	89.0	91.6	97.0
10.6	55.1	70.7	80.8	92.3	93.8	97.7
10.7	56.3	72.7	82.0	93.5	94.2	97.8
10.8	50.0	66.3	75.4	90.5	92.3	96.6
10.9	53.0	70.5	78.8	93.6	94.7	96.2
11.0	51.0	64.4	78.9	92.0	93.6	96.6

NOTES:

Column	VII.	precipitable water *	44.0–39.0	mm., mean optical air mass	1.6.
"	VIII,	" "	22.2–20.5	" , " " " "	1.6.
"	IX,	" "	11.2–10.4	" , " " " "	1.4.
"	X,	" "	6.2– 6.0	" , " " " "	1.3.
"	XI,	" "	3.3– 3.1	" , " " " "	1.6.
"	XIII,	" "	2.1	" , " " " "	1.5.

* The first figure corresponds to 11.0μ, the second to 8.0μ.

Decrease in transmission in band 9.0-10.0μ due principally to ozone; decrease elswhere due principally to H_2O.

(continued)

TRANSMISSION OF SOLAR RADIATION BY THE ATMOSPHERE, 5.5-22μ

Part C.—Percent transmission in the region 11.0-14.0μ.

Wave length	XIII	XIV	XV	XVI	XVII	XVIII
μ	%	%	%	%	%	%
11.0	67.7	71.3	75.5	89.5	92.2	97.4
11.1	71.3	75.0	78.5	91.3	94.2	97.5
11.2	70.3	73.1	77.1	90.3	92.2	96.6
11.3	63.7	68.0	71.7	86.7	90.7	95.2
11.4	67.3	70.8	73.5	88.1	92.5	95.8
11.5	68.7	71.4	73.7	88.1	92.2	95.7
11.6	67.0	70.8	73.0	87.2	91.3	94.8
11.7	65.7	71.7	72.5	87.6	88.5	93.3
11.8	55.4	59.5	63.3	76.8	87.0	93.4
11.9	70.2	72.5	75.0	86.7	90.8	95.5
12.0	65.5	72.1	72.6	85.7	91.2	95.7
12.1	67.5	72.5	74.5	89.1	89.9	96.2
12.2	68.8	72.1	74.5	85.2	91.7	95.5
12.3	64.1	67.5	70.3	86.8	88.5	95.7
12.4	62.2	64.8	68.1	84.5	87.3	94.5
12.5	55.0	57.0	59.3	79.2	80.4	91.6
12.6	36.2	40.4	43.5	63.1	70.3	85.7
12.7	63.1	65.2	65.4	78.1	83.2	93.0
12.8	54.8	59.0	60.1	77.5	85.1	96.6
12.9	51.3	56.3	57.7	79.3	82.7	95.6
13.0	63.3	64.8	64.8	84.9	86.1	96.7
13.1	62.0	60.3	60.1	79.1	80.6	90.4
13.2	52.2	52.0	50.3	72.8	67.1	76.7
13.3	23.2	24.9	22.8	42.3	45.4	56.0
13.4	22.6	24.9	18.5	39.0	35.0	39.0
13.5	6.5	8.7	2.8	17.3	14.7	18.3
13.6	9.9	9.0	0.0	13.5	14.9	16.3
13.7	3.8	5.0	0.0	7.1	10.0	13.7
13.8	12.5	12.9	0.0	16.4	15.9	17.1
13.9	0.0	0.0	0.0	0.0	0.0	0.0
14.0	0.0	0.0	0.0	0.0	0.0	0.0

NOTES:

Column	XIII,	precipitable water*	24.2–22.5	mm.,	mean optical air mass	1.2.
"	XIV,	" "	21.5–19.1	" ,	" " " "	1.3.
"	XV,	" "	19.6–16.2	" ,	" " " "	2.1.
"	XVI,	" "	6.7– 6.3	" ,	" " " "	1.3.
"	XVII,	" "	4.1	" ,	" " " "	1.4.
"	XVIII,	" "	1.3	" ,	" " " "	1.4.

* The first figure corresponds to 14.0μ, the second to 11.0μ.

Decrease in transmission below about 13μ due principally to H_2O; above 13μ to CO_2.

(continued)

TRANSMISSION OF SOLAR RADIATION BY THE ATMOSPHERE, 5.5-22μ

Part D.—Average percent transmission in the region 16-19μ and 16-22μ.[3]

Wave-length interval	Precipitable water	Transmission
μ	mm.	%
16–19	10	3.3
16–19	1	14.3
16–22	1	12.6

NOTES:

Absorption due principally to H_2O and CO_2.
Estimates of transmission in this region are provisional.

[3] Adel, A., Journ. Opt. Soc. Amer., vol. 37, p. 769, 1947.

TABLE 147

TRANSMISSION OF SOLAR RADIATION THROUGH MOIST AIR

The chart indicates the atmospheric transmission of solar radiation at normal incidence to the sun and was constructed by Kimball[1] as follows:

1. The extra-terrestrial relative spectral intensity $I_{0\lambda}$ of sunlight was obtained from Abbot.[2]
2. From Rayleigh's scattering law, Kimball computed transmission factors for dry air $a_{a\lambda}$ for the same wave lengths for which $I_{0\lambda}$ were given by Fowle.
3. To account for scattering of solar radiation by water vapor, Kimball used Fowle's water-vapor scattering transmission factors $a_{w\lambda}$ (see Table 145).
4. The transmission a'_m for optical air mass m and precipitable water vapor w is given by

$$a'_m = \frac{\Sigma I_{0\lambda}(a_{a\lambda} a_{w\lambda}{}^{w})^m}{\Sigma I_{0\lambda}} \qquad (1)$$

   where the summation is performed over the range of wave lengths in the solar spectrum. This considers only scattering and not absorption. Curves (1)-(8) (dashed lines) give values of a'_m as a function of the optical air mass m. The amount of precipitable water vapor involved in the scattering is indicated on the individual curves.
5. With the aid of Fowle's curves showing fractional absorption of solar radiation by water vapor (see Table 140), Kimball computed the effect of absorption and subtracted that from a'_m to get the transmission a''_m, which thus takes into account absorption by water vapor and dry air as well as molecular scattering. Curves (9)-(15) (solid lines) for a''_m are similarly labeled with the amount of precipitable water vapor involved.

The fraction of energy absorbed by water vapor is given in curve (16) as a function of the product of precipitable water vapor w and optical air mass m.

[1] Kimball, H. H., Month. Weath. Rev., vol. 55, p. 167, 1927; vol. 56, p. 394, 1928; vol. 58, p. 43, 1930.
[2] Abbot, C. G., Smithsonian Misc. Coll., vol. 74, No. 7, 1923.

(*continued*)

TRANSMISSION OF SOLAR RADIATION THROUGH MOIST AIR

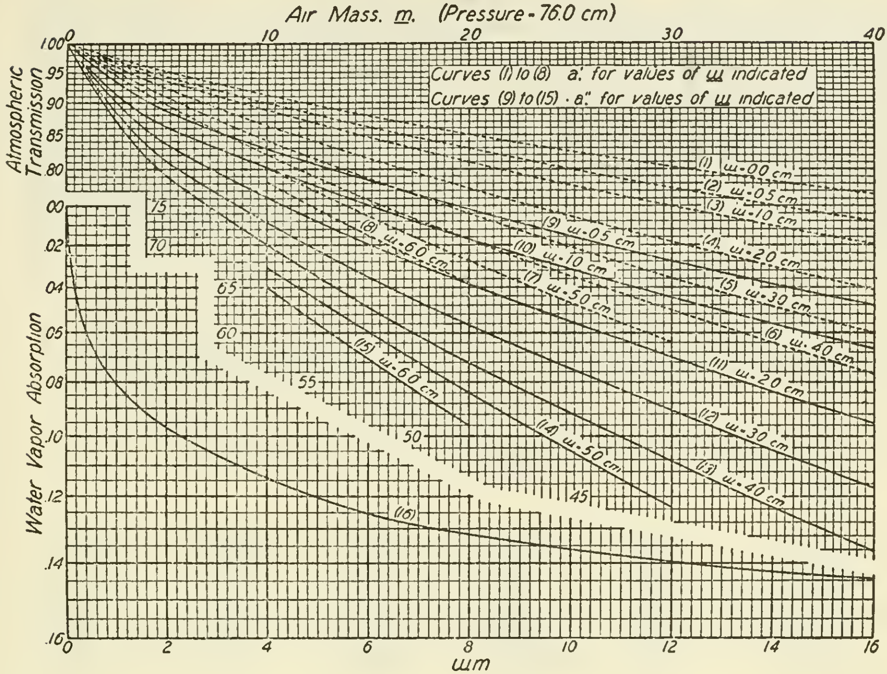


TABLE 148

SPECTRAL DISTRIBUTION OF SOLAR RADIATION AT SEA LEVEL

Using Fowle's[1] data for scattering of solar radiation by water vapor and by air, Moon[2] calculated the spectral transmission factors at sea level with 20 mm. of precipitable water vapor in the atmosphere. By comparing these with the mean values of observed transmission, he calculated a spectral transmission for dust.[3] He also evaluated the extraterrestrial solar radiation (see Table 130).

By combining the extraterrestrial solar radiation with the scattering by water vapor, air, and dust, and with the absorptions by water vapor and ozone, Moon calculated the solar radiation which reaches sea level for various optical air masses (see Table 137 for corresponding solar altitudes). The data were computed for a pressure of 1 atmosphere on the basis of arbitrary average values of water vapor, dust, and ozone content. These values are:

water vapor, 20 mm. precipitable water,
dust, 300 particles cm.$^{-3}$ near the ground,
ozone, 2.8 mm. path length at N. T. P.

The results given here have been adjusted to a solar constant of 1.94 cal. cm.$^{-2}$ min.$^{-1}$

Optical air mass

Wave length	Optical air mass 1	2	3	4	5
μ	cal. cm.$^{-2}$ min.$^{-1}$				
0.29–0.40	0.059	0.029	0.015	0.008	0.004
0.40–0.70	.616	.481	.379	.302	.240
0.70–1.1	.454	.393	.343	.301	.266
1.1 –1.5	.140	.103	.084	.071	.060
1.5 –1.9	.075	.066	.060	.056	.052
1.9 –∞	.019	.014	.011	.010	.009
Total	1.363	1.086	0.892	0.748	0.631

[1] Fowle, F. E., Smithsonian Misc. Coll., vol. 69, No. 3, 1918.
[2] Moon, P., Journ. Franklin Inst., vol. 5, p. 583, 1940.
[3] This assumes that 20 mm. of precipitable water vapor was representative of these observed transmissions, which may not have been the case. Any error so introduced would be small, however.

TABLE 149

TOTAL SOLAR AND SKY RADIATION ON A HORIZONTAL SURFACE DURING CLOUDLESS CONDITIONS

Klein[1] gives equations which permit the evaluation of the total solar and sky radiation Q on a horizontal surface for a cloudless, dust-free atmosphere as a function of the atmospheric transmission obtained from Kimball's chart (Table 147) and the solar zenith distance. Fritz[2] combined Klein's equations and constructed the chart given below. The isopleths give values of Q in cal. cm.$^{-2}$ min.$^{-1}$ as a function of optical air mass m_p (abscissa) and precipitable water vapor w centimeters (ordinate), when the sun is at its mean distance from the earth. To correct for the sun's actual distance from the earth, divide the values by the square of the appropriate radius vector (Table 169). For elevated stations, multiply the values given in the chart by $p/1013$, where p is the barometric pressure in millibars at the place of observation. Dashed lines indicate extrapolated values. indicate extrapolated values.

[1] Klein, W. H., Journ. Meteorol., vol. 5, p. 119, 1948.
[2] Fritz, S., Heating and Ventilating, vol. 46, p. 69, 1949.

(*continued*)

TOTAL SOLAR AND SKY RADIATION ON A HORIZONTAL SURFACE DURING CLOUDLESS CONDITIONS

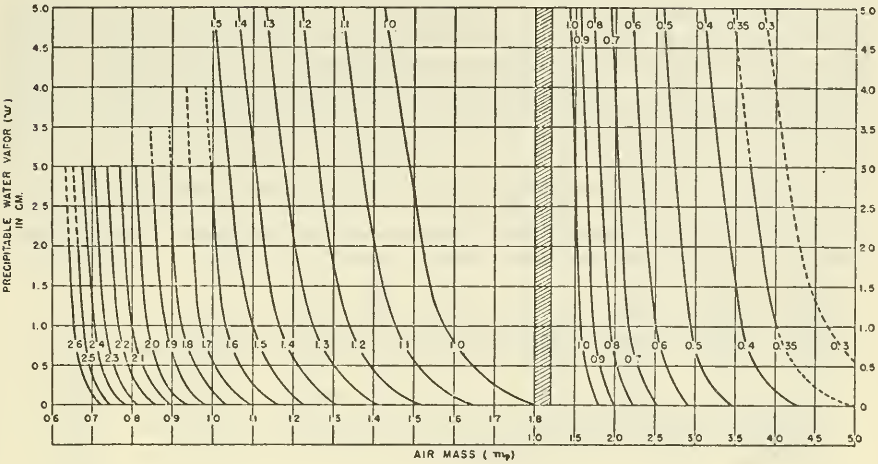


TABLE 150

RELATION BETWEEN THE VERTICAL COMPONENT OF DIRECT SOLAR RADIATION AND TOTAL SOLAR AND SKY RADIATION ON A HORIZONTAL SURFACE

By means of pyrheliometers Kimball[1] measured the vertical component of direct solar radiation and also the total solar and sky radiation on a horizontal surface for cloudless skies. Table 150 gives the ratio of the vertical component of direct solar radiation to the total radiation received on a horizontal surface as a function of the sun's zenith distance, based on the weighted mean of measurements at Washington, D. C., Lincoln, Nebr., and Madison, Wis.

	Sun's zenith distance									
	30.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
Ratio	0.84	0.84	0.80	0.78	0.76	0.72	0.69	0.67	0.65	0.63

[1] Kimball, H. H., Month. Weath. Rev., vol. 47, p. 769, 1919. For variation with height see Klein, W. H., Journ. Meteorol., vol. 5, p. 119, 1948.

TABLE 151

RELATION BETWEEN AVERAGE SUNSHINE AND SOLAR RADIATION ON A HORIZONTAL SURFACE

Ångström[1] has suggested that an equation of the form $Q/Q_0 = a + bS$ would express the relation between sunshine S (expressed as a fraction of the possible number of hours) and the ratio of average radiation, Q, on a horizontal surface to the corresponding average radiation, Q_0, during cloudless days, where a and b are constants. Fritz[2] determined average monthly values of Q_0, by combining computation with an examination of the highest value of radiation recorded at several stations in the United States. These average values of Q_0 were combined by Fritz and MacDonald[3] with observed averages of the monthly values of Q for 11 stations in the United States for each of which at least 10 years of data were available. The plot of the resulting Q/Q_0 against the corresponding S is given in the scatter diagram below, together with the least square linear regression equation.[4] The correlation coefficient between S and Q/Q_0 is 0.88.

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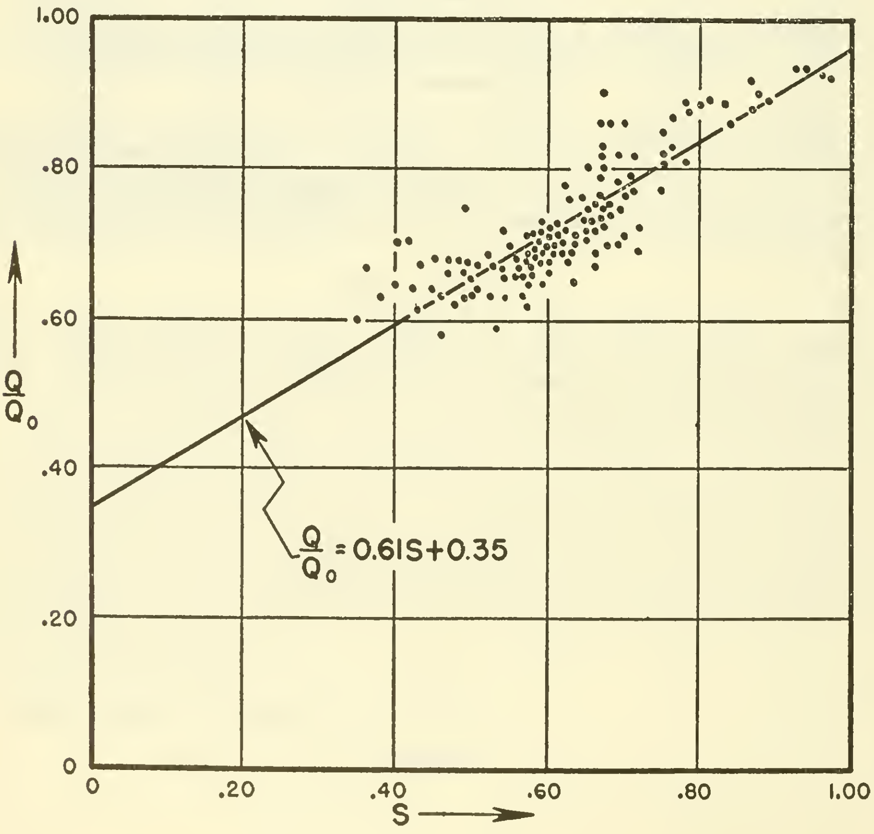
[1] Ångström, A., Medd. Stat. Met. Hydr. Anst., vol. 4, No. 3, 1928.
[2] Fritz, S., Heating and Ventilating, vol. 46, p. 69, 1949.
[3] Fritz, S., and MacDonald, T. H., Heating and Ventilating, vol. 46, p. 61, 1949.
[4] The coefficients a and b have also been determined by several other investigators:

	a	b
Kimball, H. H., Month. Weath. Rev., vol. 55, p. 157, 1927	.22	.78
Ångström, A., (reference 1)	.235	.765
Haurwitz, H., Harvard Meteorol. Studies, No. 1, 1934	.22–.30	
Mossby, H., Norwegian North Polar Expedition with the *Maud*, 1918-25, Scientific Results, vol. 1, No. 7, 1932	.54	.46

RELATION BETWEEN AVERAGE SUNSHINE AND SOLAR RADIATION ON A HORIZONTAL SURFACE



TRANSMISSION OF SOLAR RADIATION THROUGH CLOUDS (OVERCAST)

Haurwitz[1] made a study of the relation between solar radiation received on a horizontal surface at the ground and the type of cloud present during overcast conditions at Blue Hill, Mass. The diagram shows the results of this investigation, giving the insolation received at the ground as a function of optical air mass for various overcast cloud types. The curve of clear-day insolation was added from an earlier paper.[2]

The table shows the percent of clear-day radiation received for various optical air masses and overcast cloud types.

Ratio of insolation with overcast sky to insolation with cloudless sky

Optical air mass	Cloud type							
	Ci	*Cs*	*Ac*	*As*	*Sc*	*St*	*Ns*	Fog
	%	%	%	%	%	%	%	%
1.1	85	84	52	41	35	25	15	17
1.5	84	81	51	41	34	25	17	17
2.0	84	78	50	41	34	25	19	17
2.5	83	74	49	41	33	25	21	18
3.0	82	71	47	41	32	24	25	18
3.5	81	68	46	41	31	24		18
4.0	80	65	45	41	31			18
4.5					30			19
5.0					29			19

[1] Haurwitz, B., Journ. Meteorol., vol. 5, p. 110, 1948. For the effect of snow see Kalitin, N. N., Strahlentherapie, vol. 39, p. 717, 1931.

[2] Haurwitz, B., Journ. Meteorol., vol. 2, p. 154, 1945. This paper and Journ. Meteorol., vol. 3, p. 123, 1946, also discuss the insolation as a function of cloud amount and cloud density.

TRANSMISSION OF SOLAR RADIATION THROUGH CLOUDS (OVERCAST)

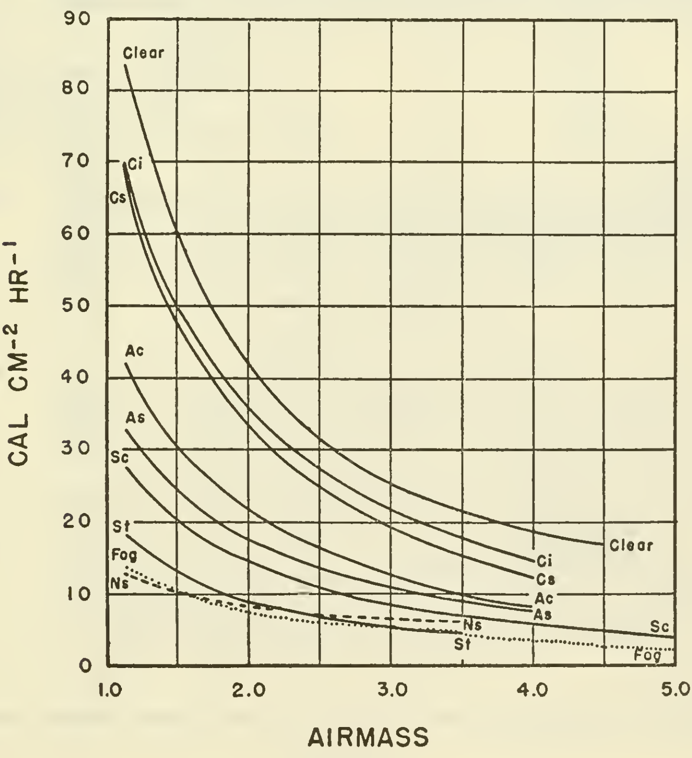


Table 153

RELATION BETWEEN ILLUMINATION AND TOTAL RADIATION

In the spring and summer of 1924, Kimball[1] made comparisons at Washington, D. C., between the illumination on a horizontal surface as measured with a photometer and the total solar and sky radiation falling on a horizontal surface as measured with a thermoelectric pyrheliometer. Table 153 gives the illumination in foot-candles corresponding to a total solar and sky radiation of 1 calorie per square centimeter per minute as a function of the sun's zenith distances, for cloudless skies. For overcast conditions Kimball obtained a mean value of 7440 foot-candles for each calorie per square centimeter per minute. He concludes that with cloudless skies the factor 6700 will on the average give the daylight intensity within ± 5 percent. With cloudy skies the factor averages higher, probably not far from 7000.

Illumination equivalent of 1 calorie per square centimeter per minute

	Sun's zenith distance								
	25°	47.3°	60.0°	67.6°	70.7°	73.6°	75.7°	77.4°	78.7°
Illumination equivalent (ft.-c.)	7000	6740	6470	6320	6260	6220	6200	6200	6200

[1] Kimball, H. H., Month. Weath. Rev., vol. 52, p. 473, 1924.

Table 154

ALBEDO OF VARIOUS SURFACES

Table 154 presents a summary of values of the albedo of various surfaces obtained by a representative group of observers. In the column headed "Type of observation," measurements of the albedo in the visible spectrum made with photometers are indicated by *v*, measurements of the total albedo made with pyrheliometers, pyranometers, etc., are indicated by *t*, measurements made from aircraft by *a*, and measurements made on the ground by *g*. Richardson[1] gives a theoretical discussion of the use of photometers.

Descriptive terms follow the usage of the individual writers.

Surface	Type of observation	Albedo	Observer
		%	
Bay	*va*	3–4	KH
" and river	*va*	6–10	TH
Inland waters	*va*	5–10	L
Ocean	*va*	3–7	TH
" , deep	*va*	3–5	L
" , near shore, solar elevation 47°	*tg*	4	A
" , " " , " " 43°	*tg*	6	A
" , " " , " " 20°	*tg*	14	A
" , " " , " " 12°	*tg*	30	A
" , " " , " " 5½°	*tg*	46	A
(Also see Table 155, Reflectivity of a Water Surface.)			
Forest, green	*va*	3–6	KH
"	*va*	4–10	TH
"	*va*	3–5	L
" , snow-covered ground	*va*	10–25	KH
Ground, bare	*va*	10–20	L
" , " , very white	*va*	11	KH
" , " , some trees	*va*	7	KH
" , wet, 70–85% bare	*ta*	8–9	F
" , moist, 70–95% bare	*ta*	9–12	F
Black mold, dry	*tg*	14	A
" " , wet	*tg*	8	A
Sand, dry	*tg*	18	A

[1] Richardson, L. F., U. G. G. I. Sect. d. Météor., Troisième Assemblée Générale, Prague, 1927. University Press, Cambridge, 1928.

(*continued*)

ALBEDO OF VARIOUS SURFACES

Surface	Type of observation	Albedo	Observer
		%	
Desert, Mojave	*ta*	24–28	M
" , Death Valley	*ta*	25	M
Sand, wet	*tg*	9	A
Fields, dry plowed	*va*	20–25	TH
" , green	*va*	10–15	TH
" , "	*va*	3–6	KH
" , wheat	*va*	7	KH
" , unspecified	*va*	5–10	L
Grass, dry	*va*	15–25	TH
" , high dry	*tg*	31–33	A
" , dry, no sun	*tg*	19–22	K
" , high fresh	*tg*	26	A
" , " wet	*tg*	22	A
" , wet, no sun	*tg*	14–26	K
" , " , sun	*tg*	33–37	K
Snow, fresh	*tg*	81	A
" , several days old, white, smooth	*tg*	70	A
" , fresh (highest value)	*tg*	87	K
" , old (lowest value)	*tg*	46	K
" , white field	*va*	70–86	KH
Ice, sparse snow cover	*ta*	69	M
Clouds, stratus overcast, 0–500 feet thick	*ta*	5–63	N
" , " " , 500–1,000 feet thick	*ta*	31–75	N
" , " " , 1,000–2,000 feet thick	*ta*	59–84	N
" , dense, opaque	*va*	55–78	L
" , " , nearly opaque	*va*	44	L
" , thin	*va*	36–40	L
" , stratus, 600–1,600 feet thick	*ta*	78	Al
" , stratocumulus overcast	*ta*	56–81	F
" , altostratus, occasional breaks	*ta*	17–36	F
" , altostratus overcast	*ta*	39–59	F
" , cirrostratus and altostratus overcast	*ta*	49–64	F
" , cirrostratus overcast	*ta*	44–50	F

Whole earth: From measurements on the bright and dark portions of the moon, Danjon (reference D) has calculated the albedo of the earth in the visible portion of the spectrum at 39 percent. Fritz (reference F) has extended the calculation to include infrared and ultraviolet radiation, obtaining a total albedo of the earth of 35 percent. Baur and Philipps (reference B) have calculated the total albedo to be 41.5 percent.

Observers:

A—Ångström, A., Geograf. Ann., vol. 7, p. 321, 1925.
Al—Aldrich, L. B., Smithsonian Misc. Coll., vol. 69, No. 10, 1919.
B—Baur, F., and Philipps, H., Gerl. Beitr. Geophys., vol. 42, p. 160.
D—Danjon, A., Ann. l'Obs. Strasbourg 3, No. 3, p. 139, 1936.
F—Fritz, S., Bull. Amer. Meteorol. Soc., vol. 29, p. 303, 1948; vol. 31, p. 251, 1950; Journ. Meteorol., vol. 6, p. 277, 1949.
K—Kalitin, N. N., Month. Weath. Rev., vol. 58, p. 59, 1930.
KH—Kimball, H. H., and Hand, I. F., Month. Weath. Rev., vol. 58, p. 280, 1930.
L—Luckiesh, M., Astrophys. Journ., vol. 49, p. 108, 1919.
M—MacDonald, T. H., private communication, 1949.
N—Neiburger, M., U. C. L. A., Dep. of Meteorol., Papers in Meteorol., No. 9, 1948; also Journ. Meteorol., vol. 6, p. 98, 1949.
TH—Tousey, R., and Hulburt, E. O., Journ. Opt. Soc. Amer., vol. 37, p. 78, 1947.

Table 155

REFLECTIVITY OF A WATER SURFACE

The reflectivity of a plane water surface for unpolarized light is a function of the angle of incidence of the light and the index of refraction of the water and may be computed from the reflection law of Fresnel

$$R = \frac{1}{2}\left[\frac{\sin^2(i-r)}{\sin^2(i+r)} + \frac{\tan^2(i-r)}{\tan^2(i+r)}\right]$$

where

R = reflectivity,
i = angle of incidence,
r = angle of refraction,

i and r are related to the index of refraction n of the water by $n = \sin i / \sin r$. Although the values given are valid only for a plane undisturbed water surface, Ångström[1] states: ". . . . it is evident that the observed reflection from disturbed water-surfaces only shows small deviations from the values which are to be expected from the Fresnel formula. . . . . Some investigations which I have carried out on artificially disturbed surfaces seem to indicate that the deviation from the Fresnel formula is positive for slight disturbances of the surface, but negative when the amplitude gets large compared with the wave-length of the water waves. The measurements give strong support to the view that in the average case in geophysical discussions we may base computations of the reflection, absorption, and emission power of water-surfaces on the validity of the Fresnel formula."

Values in Table 155 are computed on the assumption that $n = 1.333$, the value of the index of refraction for pure water. The value for sea water is slightly larger, about 1.3398 for sea water of salinity 35‰, but the difference is negligible.

In considering direct solar radiation, the angle of incidence i = sun's zenith distance.

i	0°	10°	20°	30°	40°	50°	60°	70°	80°	85°	90°
R(%)	2.0	2.0	2.1	2.1	2.5	3.4	6.0	13.4	34.8	58.4	100.0

[1] Ångström, A., Geograf. Ann., vol. 7, p. 323, 1925.

TABLE 156

ABSORPTION OF RADIATION BY PURE LIQUID WATER

The decrease in intensity of a parallel beam of radiation of wave length λ (i.e., of a small wave-length interval in the neighborhood of λ) in the direction of the beam by passing through a slab of pure water of thickness x is expressed by

$$I_\lambda = I_{0\lambda} e^{-k_\lambda x}$$

where $I_{0\lambda}$ is the intensity of the beam entering the slab and I_λ the intensity after passing through the slab. k_λ is called the *absorption coefficient.* The term*absorption* refers here to the depletion of energy both by absorption and scattering.

There is disagreement among various investigators as to the values of k_λ for pure water. The values presented here are those summarized by Dietrich[1] from the following sources:

0.310 to 0.650, W. R. Sawyer, Contr. Canadian Biol. Fish., vol. 7, p. 73, 1931.
0.700 to 2.650, J. R. Collins, Phys. Rev., vol. 26, p. 277, 1925.

Dietrich also indicates the results of other investigators.

The temperature dependence of the absorption produces an increase of about 0.5 percent in k_λ for every 1 °C. rise in temperature in certain portions of the infrared near 0.73μ, but over a large portion of the spectrum is much smaller. The values ascribed to Collins have been interpolated by Dietrich for 18 °C. He also notes that the effect on the absorption coefficient of the presence of dissolved salts in the concentrations found in sea water has been found to be negligible.

[1] Dietrich, G., Ann. d. Hydrogr. u. Mar. Meteorol., vol. 67, pp. 411-17, 1939.

ABSORPTION OF RADIATION BY PURE LIQUID WATER

Wave length	Absorption coefficient	Wave length	Absorption coefficient	Wave length	Absorption coefficient	Wave length	Absorption coefficient
μ	cm.$^{-1}$	μ	cm.$^{-1}$	μ	cm.$^{-1}$	μ	cm.$^{-1}$
0.310	0.0084	0.650	0.0021	1.100	0.203	1.700	7.3
0.320	0.0058			1.1125	0.253	1.725	8.4
0.330	0.00461	0.700	0.0084	1.125	0.359	1.750	10.1
0.340	0.00382	0.7125	0.0128	1.1375	0.572	1.775	12
0.350	0.00333	0.725	0.0166	1.150	0.848		
0.360	0.00281	0.7375	0.0260	1.1625	1.070	1.800	17
0.370	0.00200	0.750	0.0272	1.175	1.198	1.825	27
0.380	0.00148	0.7625	0.0286	1.1875	1.226	1.850	41
0.390	0.00099	0.775	0.0277			1.875	57
		0.7875	0.0262	1.200	1.232		
0.400	0.00072			1.2125	1.232	1.900	73
0.410	0.00050	0.800	0.0240	1.225	1.210	1.925	91
0.420	0.00041	0.8125	0.0238	1.2375	1.173	1.950	106
0.430	0.00030	0.825	0.0271	1.250	1.153	1.975	102
0.440	0.00023	0.8375	0.0365	1.2625	1.133		
0.450	0.00018	0.850	0.0412	1.275	1.168	2.000	85
0.460	0.00015	0.8625	0.0449	1.2875	1.20	2.025	72
0.470	0.00015	0.875	0.0495			2.050	60
0.480	0.00015	0.8875	0.0546	1.300	1.50	2.075	48
0.490	0.00015			1.325	2.18		
		0.900	0.0655	1.350	3.86	2.100	39
0.500	0.00016	0.9125	0.0824	1.375	8.5	2.150	25
0.510	0.00017	0.925	0.111			2.200	21
0.520	0.00019	0.9375	0.182	1.400	16.0	2.250	21
0.530	0.00021	0.950	0.288	1.425	26.9	2.300	24
0.540	0.00024	0.9625	0.406	1.450	28.9	2.350	31
0.550	0.00027	0.975	0.454	1.475	24.5		
0.560	0.00030	0.9875	0.444			2.400	42
0.570	0.00038			1.500	19.4	2.450	60
0.580	0.00055	1.000	0.397	1.525	15.4	2.500	85
0.590	0.00085	1.0125	0.339	1.550	12.0	2.550	100
		1.025	0.275	1.575	9.4	2.600	100
0.600	0.00125	1.0375	0.217			2.650	121
0.610	0.00160	1.050	0.177	1.600	8.0		
0.620	0.00178	1.0625	0.154	1.625	7.5		
0.630	0.00181	1.075	0.153	1.650	7.2		
0.640	0.0020	1.0875	0.174	1.675	7.1		

Table 157

ABSORPTION OF RADIATION BY SEA WATER

Utterback[1] has made observations of the *extinction coefficient* of typical oceanic waters, defined in the same manner as the absorption coefficient k of Table 142. Sverdrup, Johnson, and Fleming[2] have summarized Utterback's observations as follows:

He has made numerous observations in the shallow waters near islands in the inner part of Juan de Fuca Strait and at four stations in the open oceanic waters off the coast of Washington, and these can be considered typical of coastal and oceanic water, respectively. Table 157 contains the absorption coefficients of pure water at the wave lengths used by Utterback, the minimum, average, and maximum average, and maximum coefficients observed in oceanic water, and the minimum, average, and maximum coefficients observed in coastal water. The minimum and maximum coefficients have all been computed from the four lowest and the four highest values in each group.

Type of water		Wave length *—μ						
		0.46	0.48	0.515	0.53	0.565	0.60	0.66
		cm.$^{-1}$	cm.$^{-1}$	cm.$^{-1}$	cm.$^{-1}$	cm.$^{-1}$	cm.$^{-1}$	cm.$^{-1}$
Pure water (from Table 156)		.00015	.00015	.00018	.00021	.00033	.00125	.00280
Oceanic water	lowest	.00038	.00026	.00035	.00038	.00074	.00199	
	average	.00086	.00076	.00078	.00084	.00108	.00272	
	highest	.00160	.00154	.00143	.00140	.00167	.00333	
Coastal water	lowest	.00224	.00230	.00192	.00169		.00375	.00477
	average	.00362	.00334	.00276	.00269		.00437	.00623
	highest	.00510	.00454	.00398	.00348		.00489	.00760

* It should be understood that the wave length actually stands for a spectral band of finite width.

[1] Utterback, C. L., Cons. Perm. Intern. l'Explor. de la Mer, Rapp. et Proc.-Verb., vol. 101, pt. 2, No. 4, 15 pp., 1936.
[2] Sverdrup, H. U., Johnson, M. W., and Fleming, R. H., The oceans, p. 84, copyright 1942 by Prentice-Hall, Inc., New York.

Table 158

SCATTERING AREA COEFFICIENTS FOR WATER DROPS IN AIR

Table 158 gives values of the scattering area coefficient K_s as a function of the parameter $\alpha = 2\pi r/\lambda$, where r is the radius of the scattering particle (sphere) and λ the wave length of the incident light in the medium surrounding the sphere. All data and the following discussion are from the work of Houghton and Chalker.[1]

The scattering area coefficient K_s is a measure of the total light scattered by the sphere regardless of the state of polarization of the incident light. (The angular distribution of the scattered light, which is not considered here, is dependent on the polarization of the incident light.) The total light scattered by a number of spheres is equal to the sum of the portions scattered by the individual spheres so long as the spheres are far enough apart to insure that the scattering is incoherent. This requires a mean particle spacing large compared to the wave length. This condition is met by all natural aerosols and by all stable aerosols. The scattering area coefficient is most useful in determining the transmission of a parallel beam of light through an aerosol or other colloid. The values computed here are for nonabsorbing spheres of index of refraction 4/3 as compared to the index of refraction of the medium. These conditions were selected specifically for the case of water drops in air and for the spectral interval within which the index of water is substantially 4/3 and the absorption is negligible (roughly from the near ultraviolet to the very near infrared).

The transmission of a parallel beam through such an aerosol is given by:

$$\text{Tranmission} = E/E_0 = e^{-\Sigma \pi n r^2 K_s Z} \qquad (1)$$

where E_0 is the flux density of the incident parallel beam, E is the flux density of the parallel beam after passing a distance Z through the aerosol, n is the number of spheres of radius r per unit volume of the medium and K_s is the appropriate scattering area coefficient. The summation is taken over all sizes of spheres present. Equation (1) holds for a single wave length. If the incident beam is not monochromatic, equation (1) must be integrated over the spectral interval involved.

The computations for Table 158 are based on the equations developed by Mie[2] from Maxwell's electromagnetic theory; for a concise theoretical treatment see Stratton.[3] The

[1] Houghton, H. G., and Chalker, W. R., Journ. Opt. Soc. Amer., vol. 39, p. 955, 1949.
[2] Mie, G., Ann. Phys., vol. 25, p. 277, 1908.
[3] Stratton, J. A., Electromagnetic theory, p. 563, McGraw-Hill Book Co., N. Y., 1941.

(*continued*)

SCATTERING AREA COEFFICIENTS FOR WATER DROPS IN AIR

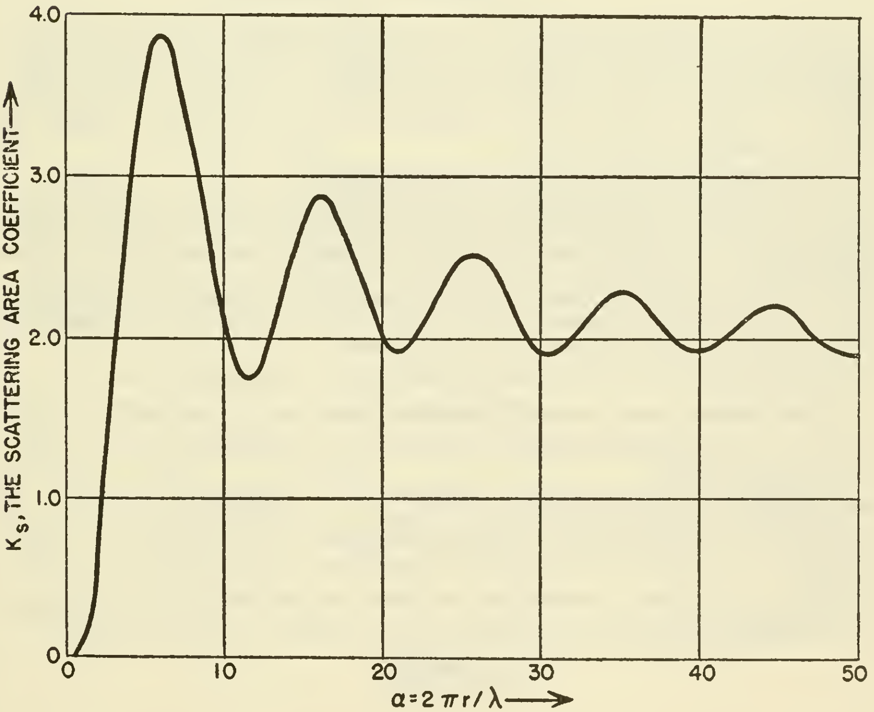
data presented for $\alpha \leqq 6.0$ were computed by the National Bureau of Standards,[4] the remaining data were computed by Houghton and Chalker and constitute a revision of an earlier work by Stratton and Houghton.[5]

Houghton and Chalker have fitted a *smoothed* curve of the type suggested by Van de Hulst[6] to the computed points and then extended it somewhat. This curve is given below.

[4] Nat. Bur. Stand., Tables of scattering functions for spherical particles, Appl. Math. ser. 4, 1949.
[5] Stratton, J. A., and Houghton, H. G., Phys. Rev., vol. 38, p. 159, 1931.
[6] Van de Hulst, H. C., Dissertation, Utrecht, 1946.

SCATTERING AREA COEFFICIENTS FOR WATER DROPS IN AIR

α	K_s	α	K_s	α	K_s	α	K_s
0.5	0.00676	8.0	3.282	12.125	1.776	17.0	2.632
0.6	0.0138	9.0	2.738	12.250	1.892	17.125	2.704
1.0	0.0938	9.5	2.394	12.333	1.936	17.25	2.822
1.2	0.171	10.0	2.152	12.5	1.938	17.375	2.820
1.5	0.322	10.25	2.052	12.6	1.822	17.5	2.738
1.8	0.522	10.5	1.886	12.75	1.850	18.0	2.598
2.0	0.710	10.625	1.918	13.0	2.012	18.5	2.432
2.4	1.126	10.75	1.930	13.5	2.192	19.0	2.218
2.5	1.212	10.875	1.832	14.0	2.474	19.25	2.090
3.0	1.754	11.0	1.740	14.5	2.528	19.5	1.998
3.6	2.376	11.125	1.728	15.0	2.744	19.75	1.976
4.0	2.826	11.333	1.734	15.5	2.740	20.0	2.092
4.8	3.490	11.4	1.768	16.0	2.870	20.25	2.180
5.0	3.592	11.5	1.858	16.25	2.872	20.5	2.078
6.0	3.888	11.75	1.758	16.5	2.850	21.0	1.834
7.0	3.722	12.0	1.670	16.75	2.810	22.0	1.922
						24.0	2.438



RELATIVE SPECTRAL LUMINOSITY FOR THE HUMAN EYE AT VARIOUS LUMINANCE LEVELS *

Weaver[1] has published provisional data on relative spectral luminosity ($\bar{y}_\lambda$) for observer adaptation to various values of luminance[2] covering a wide range, and his tabulation forms the basis for Table 159-A.

Relative spectral luminosity is inversely proportional to the spectral radiance required to produce for a normal observer a constant brightness sensation throughout the spectrum. The values are functions of wave length (λ) of the radiation and of the luminance (B) to which the observer's eyes are adapted. By definition, the maximum value of the relative spectral luminosity is unity.

Definitions:[3, 4, 5]

N = radiance of a source
= radiant flux radiated by unit projected area of the source into unit solid angle (m.k.s. unit: watts per steradian per square meter). (Note: N refers to radiant flux over the entire range of wave lengths.)

N_λ = spectral radiance of a source
= radiant flux radiated at wave length λ by unit projected area of the source into unit solid angle per unit length used in wave length specification (m.k.s. unit: watts per steradian per square meter per millimicron of wave length).

B = luminance of a source (formerly called "brightness")
= luminous flux (lumens) emitted by unit projected area of the source into unit solid angle (m.k.s. unit: lumens per steradian per square meter; or candle per square meter). The c.g.s. unit is the candle per square centimeter.
Other relationships: 1 candle/m.^{2} = 10^{-4} candle/cm.^{2}
1 lambert = $1/\pi$ candle/cm.^{2}
1 footlambert = 0.0003426 candle/cm.^{2}
1 footlambert = $1/\pi$ candle/ft.^{2}
1 meterlambert = $1/\pi$ candle/m.^{2})

Consider an observed surface subjected to irradiation of one wave length so as to produce a radiance having any desired level of luminance. Suppose the wave length of the radiant flux emitted by the surface and the radiance of the surface be varied simultaneously in such a way as to maintain the luminance constantly at the given level. Then there exists a particular wave length, λ_m, for which the radiance required to yield this luminance is a minimum.

Let N_{λ_m} = radiance of the surface at the wave length λ_m,
and N_λ = radiance of the surface at the wave length λ,
where the luminance is maintained constant at all wave lengths, then the ratio N_{λ_m}/N_λ is called the *relative spectral luminosity* for the given level of luminance. Its symbol is $\bar{y}_\lambda = N_{\lambda_m}/N_\lambda$.

The term "luminosity" is recommended[4] in reference to the "capacities (reciprocals of the required radiance) of radiant energy of the various wave lengths to evoke for a particular observer visual sensation of equal brightness."

Experimental procedures actually used to measure $\bar{y}_\lambda$ are cited in the literature.[4, 6]

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* Prepared especially for the Smithsonian Meteorological Tables, by L. P. Harrison, U.S. Weather Bureau.

[1] Weaver, K. S., A provisional standard observer for low level photometry, Journ. Opt. Soc. Amer., vol. 39, pp. 278-291, 1949.

[2] Terminology is in conformity with that recommended by the Committee on Colorimetry of the Optical Society of America. See references 3, 4, 5.

[3] Committee on Colorimetry, Physical concepts: radiant energy and its measurement, Journ. Opt. Soc. Amer., vol. 34, pp. 183-218, 1944.

[4] Committee on Colorimetry, The psycho-physics of color, Journ. Opt. Soc. Amer., vol. 34, pp. 245-266, 1944.

[5] Committee on Colorimetry, Quantitative data and methods for colorimetry, Journ. Opt. Soc. Amer., vol. 34, pp. 633-688, 1944.

[6] Bur. Standards Sci. Papers 303 and 475.

(*continued*)

RELATIVE SPECTRAL LUMINOSITY FOR THE HUMAN EYE AT VARIOUS LUMINANCE LEVELS

In many cases different observers do not yield identically the same values of $\bar{y}_\lambda$ even if their color vision is normal.[4] However, the mean value of $\bar{y}_\lambda$ yielded by a large number of observers having normal color vision provides a reference datum of great utility.

In conjunction with $\bar{y}_\lambda$ it is necessary to consider some other related quantities, the first of which is K_{max} = maximum attainable luminous efficiency, a function of luminance, B, to which the observer's eyes are adapted, and defined as luminous flux (in lumens) emitted per unit radiant flux (in watts) at wave length λ_m, at the given adaptation level of luminance. Values of K_{max} for various values of B are given in Table 159 B, based on Weaver's data.[1] In adopting this table we take as the best value of K_{max} *for high adaptation levels of luminance* (0.55 footlambert or more; photopic vision) the quantity 680 (new) lumens/watt.[7] This datum is based on the following values of constants for Planck's radiation formula, viz, $c_1 = 3.740 \times 10^{-5}$ erg cm.^{2} per second, and $c_2 = 1.438$ cm. deg., where the luminance of a blackbody radiator at the temperature of freezing platinum (2042° K.) is taken to be 60 candela (new candles) per square centimeter.

The following relationships and terminology obtain, where the indicated units are in the m.k.s. system:

(1) $$N = \int_0^\infty N_\lambda \, d\lambda,$$ radiance (watts per steradian per square meter);

(2) $$\bar{y} = \frac{\int_0^\infty \bar{y}_\lambda N_\lambda \, d\lambda}{\int_0^\infty N_\lambda \, d\lambda},$$ relative luminous efficiency or relative luminosity;

(3) $$K_\lambda = K_{max} \, \bar{y}_\lambda,$$ absolute spectral luminosity (lumens/watt);

(4) $$B = K_{max} \int_0^\infty \bar{y}_\lambda N_\lambda \, d\lambda = \int_0^\infty K_\lambda N_\lambda \, d\lambda = K N,$$ luminance (lumens per steradian per square meter);

(5) $$K = \frac{K_{max} \int_0^\infty \bar{y}_\lambda N_\lambda \, d\lambda}{\int_0^\infty N_\lambda \, d\lambda} = \frac{B}{N},$$ absolute luminous efficiency or absolute luminosity (lumens/watt).

It should be noted that $\bar{y}_\lambda$ is a function of λ and the luminance B to which the observer's eyes are adapted, while K_{max} is a function of B alone.

If t_λ and r_λ are the spectral transmittance and spectral reflectance, respectively, and H_λ is the spectral irradiance of surface (watts/m.^{2} per millimicron), for specified angular (spatial) conditions of irradiation, then the luminous transmittance, T, and luminous reflectance, R, of non-fluorescent materials under these conditions are given by the equations

(6) $$T = \frac{\int_0^\infty t_\lambda \bar{y}_\lambda H_\lambda \, d\lambda}{\int_0^\infty \bar{y}_\lambda H_\lambda \, d\lambda},$$ luminous transmittance,

(7) $$R = \frac{\int_0^\infty r_\lambda \bar{y}_\lambda H_\lambda \, d\lambda}{\int_0^\infty \bar{y}_\lambda H_\lambda \, d\lambda},$$ luminous reflectance.

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[7] Sears, F. W., Principles of Physics, III, Optics 1949.

(continued)

RELATIVE SPECTRAL LUMINOSITY FOR THE HUMAN EYE AT VARIOUS LUMINANCE LEVELS

Basis of Table:

The relative spectral luminosity data in Table 159 A are given for wave-length intervals of 10 millimicrons. Those data presented in column 2 are applicable for normal vision under good lighting conditions; that is, with high luminance, viz, about 0.55 footlambert or more[8] (logarithm of the luminance in footlamberts = 0.25 or more). The values of $\bar{y}_\lambda$ in column 2 are those adopted by the International Commission on Illumination (I.C.I.) in 1924,[9] and apply only in the case of photopic vision (approaching cone vision; observer adapted to high luminance as specified above). The maximum ordinate (unity) of the relative spectral luminosity curve for photopic vision occurs at a wave length of 555 millimicrons.

At extremely low levels of luminance, the human observer uses scotopic vision (rod vision), while in the intermediate levels of luminance he uses mesopic vision (mixed rod and cone vision).

According to the well-known Purkinje effect, the abscissa at which the maximum of the relative spectral luminosity curve occurs is displaced towards shorter wave lengths as the level of luminance to which the observer is adapted falls below about 0.55 footlambert (see columns 3-10, compared with column 2).

Weaver[1] states: "Because of the shift of the luminosity function with luminance, it is necessary to choose arbitrarily a light source of specified spectral composition as a standard for the specification of the luminance scale through the mesopic and scotopic regions. The illuminance or luminance obtained from sources of different spectral composition may be evaluated by comparison with the standard source, by means of a suitable photometer, or by computation, using a set of tables, such as are described here." Weaver has adopted and employed a tungsten lamp at a color temperature of 2370° K. for $C_2 = 1.438$ cm. deg. (2360 °K. for $C_2 = 1.432$ cm. deg.) as the standard source for low level photometry and this standard underlies the data in columns 3-10. For reduction of the given data to radiant sources at other color temperatures the reader is referred to Weaver's original article[1] (especially Figure 2).

The values of the luminosity data in columns 3-10 must be regarded as provisional, since Weaver derived them by interpolation and extrapolation. He had on the one hand the I.C.I. luminosity curve with its maximum at a wave length of 555 millimicrons for log luminance −0.25 (where luminance is in footlamberts). And, on the other hand, he had a luminosity curve for scotopic vision based on the average of observational data obtained by Hecht and Williams,[10] and by Weaver[11] for a luminance of 6.5×10^{-5} footlambert (log luminance −4.187). In addition Weaver[1] had some unpublished data for the upper luminance range. Weaver[1] by means of interpolation and extrapolation based on the above-mentioned observational data obtained the values presented in columns 3-10.

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[8] See reference 4, pp. 249-250.

[9] Proceedings of the Sixth Session, International Commission on Illumination (Geneva, 1924), p. 67. See also Judd, D. B., Journ. Opt. Soc. Amer., vol. 23, p. 359, 1933.

[10] Hecht, S., and Williams, R. E., Visibility of monochromatic radiation and the absorption spectrum of the visual purple, Journ. Gen. Physiol., vol. 5, p. 1, 1922-23.

[11] Weaver, K. S., The visibility of radiation at low intensities, Journ. Opt. Soc. Amer., vol. 27, p. 36, 1937.

(*continued*)

RELATIVE SPECTRAL LUMINOSITY FOR THE HUMAN EYE AT VARIOUS LUMINANCE LEVELS

TABLE 159 A.—Relative spectral luminosity ($\bar{y}_\lambda$) of the human eye as a function of wave length (λ) and log luminance ($\log_{10} B$)

	Column number								
1	2	3	4	5	6	7	8	9	10
Wave length	Log luminance (footlamberts)								
	−0.25 I.C.I.	−0.5	−1.0	−1.5	−2.0	−2.5	−3.0	−4.0	−5.0
milli-microns									
350								0.0002	0.0003
360							0.0003	0.0007	0.0008
370					0.0002	0.0005	0.0009	0.0018	0.0022
380			0.0001	0.0002	0.0008	0.0015	0.0025	0.0045	0.0055
390	0.0001	0.0001	0.0002	0.0008	0.0022	0.0040	0.0063	0.0104	0.0127
400	0.0004	0.0004	0.0008	0.0022	0.0059	0.0098	0.0147	0.0228	0.0270
410	0.0012	0.0014	0.0023	0.0062	0.0140	0.0227	0.0305	0.0452	0.0530
420	0.0040	0.0044	0.0069	0.0152	0.0280	0.0427	0.0580	0.0820	0.0950
430	0.0116	0.0121	0.0165	0.0292	0.0505	0.0755	0.101	0.138	0.157
440	0.023	0.0240	0.0300	0.0496	0.0850	0.123	0.160	0.216	0.239
450	0.038	0.0395	0.0490	0.0810	0.136	0.187	0.237	0.310	0.339
460	0.060	0.0627	0.0775	0.127	0.202	0.277	0.339	0.423	0.455
470	0.091	0.0960	0.118	0.191	0.301	0.394	0.467	0.551	0.576
480	0.139	0.146	0.180	0.288	0.432	0.540	0.604	0.685	0.714
490	0.208	0.220	0.274	0.426	0.592	0.687	0.734	0.814	0.842
500	0.323	0.340	0.416	0.603	0.744	0.826	0.864	0.930	0.948
510	0.503	0.524	0.617	0.766	0.876	0.935	0.962	0.992	0.999
520	0.710	0.726	0.792	0.894	0.965	0.992	0.999	0.974	0.953
530	0.862	0.872	0.910	0.972	1.000	0.982	0.951	0.883	0.848
540	0.954	0.959	0.979	1.000	0.969	0.909	0.842	0.744	0.697
550	0.995	0.997	1.000	0.971	0.886	0.785	0.698	0.583	0.531
560	0.995	0.992	0.973	0.898	0.760	0.640	0.543	0.419	0.365
570	0.952	0.944	0.907	0.782	0.617	0.485	0.384	0.281	0.243
580	0.870	0.860	0.802	0.648	0.468	0.340	0.259	0.182	0.155
590	0.757	0.742	0.673	0.509	0.333	0.227	0.166	0.112	0.0945
600	0.631	0.616	0.544	0.374	0.224	0.145	0.101	0.0670	0.0560
610	0.502	0.490	0.416	0.257	0.142	0.0870	0.0600	0.0388	0.0324
620	0.381	0.366	0.296	0.168	0.0845	0.0504	0.0344	0.0225	0.0188
630	0.265	0.250	0.197	0.102	0.0480	0.0282	0.0194	0.0127	0.0105
640	0.175	0.162	0.122	0.0590	0.0270	0.0146	0.0107	0.0070	0.0058
650	0.107	0.0990	0.0710	0.0327	0.0147	0.0084	0.0058	0.0037	0.0032
660	0.061	0.0560	0.0390	0.0174	0.0078	0.0045	0.0031	0.0020	0.0017
670	0.032	0.0303	0.0206	0.0090	0.0041	0.0024	0.0017	0.0011	0.0009
680	0.017	0.0153	0.0103	0.0046	0.0022	0.0014	0.0009	0.0006	0.0005
690	0.0082	0.0076	0.0052	0.0024	0.0011	0.0007	0.0004	0.0003	0.0002
700	0.0041	0.0038	0.0026	0.0012	0.0006	0.0003	0.0002	0.0001	0.0001
710	0.0021	0.0019	0.0014	0.0006	0.0003	0.0002	0.0001		
720	0.0011	0.0010	0.0007	0.0003	0.0001				
730	0.0005	0.0005	0.0003	0.0001					
740	0.0003	0.0002	0.0002						
750	0.0001	0.0001							
760	0.0001								
770	0.0000								

(*continued*)

RELATIVE SPECTRAL LUMINOSITY FOR THE HUMAN EYE AT VARIOUS LUMINANCE LEVELS

TABLE 159 B.—Maximum luminous efficiency (K_{max}) as a function of log luminance ($\log_{10} B$) for a standard light source at 2360 °K.

$\log_{10} B$ (B in footlamberts)	K_{max} lumens watt^{-1}
−0.25	680
−0.5	690
−1.0	734
−1.5	850
−2.0	991
−2.5	1110
−3.0	1211
−3.5	1272
−4.0	1337
−4.5	1374
−5.0	1399

NOTE.—B is the luminance to which the observer's eyes are adapted.

TABLE 160

HORIZONTAL VISIBILITY *

General:

The following tables pertaining to horizontal visibility may be considered to be subdivided into three classes: (1) tables for converting extinction coefficient[1] (σ) to transmissivity (T), and tables for converting transmissivity to extinction coefficient; (2) tables giving extinction coefficient as a function of daytime visual range of black objects viewed against the horizon sky. [Angular dimensions of objects are assumed to be in range 0.5° to 5°. Data are presented for two possible values of threshold of luminance contrast, ϵ, viz, $\epsilon = 0.02$ and $\epsilon = 0.05$, corresponding to the respective visual ranges denoted by V_2 and V_5.] (3) Tables applicable to the visual range of point sources of light, and permitting computation of any one of the four variables involved if the other three are known (see equations 11 and 12).

Units:

The kilometer is the unit used here for distance (x, D and R) and for visual range (V_2 and V_5); the unit of extinction coefficient (σ) is the reciprocal of the kilometer (km^{-1}); the unit of illuminance or flux-density (E) is the lumen kilometer^{-2}; and the unit of luminous intensity (I_0 for a point source) is the candle (candela). The transmissivity, T, is defined as the base of natural logarithms (e) raised to the power ($-\sigma$). T^x and T^D (that is, $e^{-\sigma x}$ and $e^{-\sigma D}$) must be dimensionless, hence the dimension of x and D must be reciprocal to that of σ.

* Prepared especially for the Smithsonian Meteorological Tables by L. P. Harrison, U.S. Weather Bureau.

[1] This entity is sometimes called the atmospheric attenuation coefficient and has been denoted as β by some authors (Duntley, reference 4).

(*continued*)

HORIZONTAL VISIBILITY

TABLES 160-A1 and 160-A2.—Transmissivity as a function of extinction coefficient, and extinction coefficient as a function of transmissivity

Assumptions and Computations:

Assuming uniform conditions regarding scattering of available light toward the observer along the path of sight and attenuation of light emanating from the object under view by scattering and absorption of luminous flux through the action of the atmospheric aerosol, the capacity of the atmosphere for transmitting such flux may be expressed either in terms of the (generalized) *extinction coefficient*, σ, or of the *transmissivity*, T.

In defining these quantities we consider a ray of light propagated along the x-axis in an atmosphere having uniform optical properties (homogeneous in composition, density and concentration of suspensoids). Since the quantities represent the attenuation of luminous flux in the medium, they relate to the ratio of illumination on two imaginary surfaces placed normal to the x-axis and separated by unit distance. Thus

let E = illuminance (luminous flux incident per unit area of surface) at distance x from the chosen origin;
E_0 = illuminance at the origin $x = 0$. (This is generally taken immediately in front of the light source or object being viewed, on the observer's side.)

Then the extinction coefficient and transmissivity are related to these two quantities by the equations:

$$E = E_0 e^{-\sigma x} = E_0 T^x \qquad (1)$$

Hence

$$T = e^{-\sigma} \qquad (2)$$

$$\sigma = -\log_e T \qquad (3)$$

Description:

Table 160–A1 gives values of T as a function of σ, in accord with equation (2), and Table 160–A2 gives values of σ as a function of T or of logarithms to the base 10 of T, whichever is most convenient, in accord with equation (3).

Certain conventions have been adopted to conserve space. In Table 160–A1, with regard to the range of σ from 0.00 to 10.0, the tabular values are to be appended to the quantities in the indicial column which immediately follows the column of arguments headed "Extinction Coefficient."

The superscript associated with quantities in the indicial column indicates the total number of ciphers to be placed following the decimal point. If the tabular value is prefixed by an asterisk, the tabular value is to be appended to the quantity in the next lower line of the indicial column.

Examples:

σ	T
0.00	1.0000
0.01	0.9900
4.60	0.01005
4.61	0.009952
6.90	0.001008
7.00	0.0009119

In the lower portion of the second page of Table 160–A1, giving T as a function of σ in the range from $\sigma = 1$ to 1000 km^{-1}, the value of T is found by multiplying the tabular value by the factor 10 raised to the power shown in parentheses.

Examples:

σ	T
1	3.679×10^{-1}
3	4.979×10^{-2}
40	4.248×10^{-18}

Table 160–A2 gives values of σ as a function of T or P where $T = 10^P$, ($P = \log_{10} T$).

Examples:

T	σ
2×10^{-4}	8.5172
0.75	0.2877
10^{-240}	552.620
10^{-5}	11.513

(continued)

HORIZONTAL VISIBILITY

TABLES 160-B1 and 160-B2.—Extinction coefficient as a function of visual range of black objects of standard angular dimensions viewed against the horizon sky in daytime

Assumptions and Computations:

According to Koschmieder,[2] and others[3,4,5] under certain conditions, the apparent luminance (photometric brightness), B_r, of a black object at a distance R from the observer when viewed horizontally against the horizon sky is given by the equation

$$B_r = (1 - e^{-\sigma R}) B_b(A) \tag{4}$$

where σ = extinction coefficient as previously defined;
$B_b(A)$ = luminance of the horizon background of the black object.

The (A) is inserted to indicate that the luminance is a function of the azimuth referred to a vertical through the sun. It will, of course, be understood that the azimuth of the background is the same as that of the object.

Equation (4) is *not* reliable in any azimuth near that of the rising or setting sun.

Duntley[4] has derived a more general relationship which, for achromatic objects and backgrounds, expresses the fact that the difference of luminance between object and background attenuates exponentially with distance. Equation (5) gives this relationship written in a form representative for a horizontal line of sight in an atmosphere which is homogeneous in its lighting and composition (i.e., scattering, absorption, and attenuation coefficients are constant along the path of sight):

$$\frac{B_r - B_b(A)}{B_0 - B_{b0}(A)} = e^{-\sigma R} \tag{5}$$

where B_r = apparent luminance of the object at range R;
B_0 = inherent luminance of the object (i.e., at zero range);
$B_b(A)$ = apparent luminance of the background of the object at range R;
$B_{b0}(A)$ = apparent luminance of the background of the object at zero range (i.e., at the location of the object);
R = distance between the object and the point of observation.

The last equation reduces to equation (4) when one applies the condition for a black object $B_0 = 0$, and when $B_b(A) = B_{b0}(A)$. The latter relation is rigorously valid for a horizon background or for a background at infinity.

Middleton[3,6] has derived theoretical relationships applicable to the visual range of colored objects.

From equation (4) one obtains

$$\frac{B_r - B_b(A)}{B_b(A)} = -e^{-\sigma R} \tag{6}$$

When the distance R is equal to the visual range of the object, the apparent contrast of luminance represented by the left-hand member of equation (6) becomes equal to the negative of ϵ, where ϵ = threshold of luminance (brightness) contrast. (The negative sign is indicative of the condition that the object appears darker than the horizon.)

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[2] Koschmieder, H., Theorie der horizontalen Sichtweite, Beitr. Phys. freien Atmos., vol. 12, pp. 33-53, 171-181, 1924.
[3] Middleton, W. E. K., Visibility in meteorology, 2d ed., Toronto, 1941.
[4] (a) Duntley, S. Q., The reduction of apparent contrast by the atmosphere, Journ. Opt. Soc. Amer., vol. 38, pp. 179-191, 1948.
(b) Duntley, S. Q., The visibility of distant objects, Journ. Opt. Soc. Amer., vol. 38, pp. 237-249, 1948.
[5] (a) Coleman, H. S., Morris, F. J., Rosenberger, H. E., and Walker, M. J., A photo-electric method of measuring the atmospheric attenuation of brightness contrast along a horizontal path for the visible region of the spectrum, Journ. Opt. Soc. Amer., vol. 39, pp. 515-521, 1949.
(b) Coleman, H. S., and Rosenberger, H. E., A comparison of photographic and photo-electric measurements of atmospheric attenuation of brightness contrast, Journ. Opt. Soc. Amer., vol. 39, pp. 990-993, 1949.
[6] (a) Middleton, W. E. K., On the colours of distant objects, and the visual range of colored objects, Trans. Roy. Soc. Canada, Sect. III, vol. 29, pp. 127-154, 1935.
(b) Middleton, W. E. K., The colors of distant objects, Journ. Opt. Soc. Amer., vol. 40, pp. 373-376, 1950.

(*continued*)

Thus if R becomes V, the visual range of a black object viewed against the horizon sky, the contrast of luminance is expressed by

$$\frac{B_r - B_b(A)}{B_b(A)} = -\epsilon = -e^{-\sigma V} \tag{7}$$

From equation (7)

$$V = \frac{1}{\sigma} \log_e \frac{1}{+\epsilon} \tag{8}$$

Although equation (8) was derived on the assumption that the object is black and is viewed against the horizon sky, the equation is also valid to a close degree of approximation for the case in which an intrinsically dark object is viewed against an intrinsically dark, terrestrial background, *provided* that the background is at a distance at least twice as great as the visual range of the object.

The actual value of the threshold of luminance contrast, ϵ, in practice depends on a number of factors such as angular dimensions of object, degree of confidence of the observer that he has detected the object, and the pattern of luminance in the visual field surrounding the object. The value of ϵ is greater if the observer endeavors to recognize the object rather than merely to detect it with some definite degree of confidence. At low levels of illuminance, the adaptation of the observer's vision to the existing conditions also plays a role in determining ϵ.[7]

The value of ϵ may possibly range from about 0.006 for large objects and almost certain detection to a value of the order of 0.1 for small objects. Koschmieder[2] has used the value 0.02 for ϵ, apparently following Helmholtz, while another value sometimes used is 0.055,[8] although we shall employ 0.05 in round numbers, as well as 0.02.

Let V_2 = visual range as defined by equation (8) when $\epsilon = 0.02$
and V_5 = visual range as defined by equation (8) when $\epsilon = 0.05$;

then since $\log_e 1/0.02 = 3.912$
and $\log_e 1/0.05 = 2.996$,

$$V_2 = \frac{3.912}{\sigma}, \tag{9}$$

$$V_5 = \frac{2.996}{\sigma}. \tag{10}$$

Description:

Tables 160–B1 and 160–B2 give values of σ as functions of V_2 and V_5 in accord with equations (9) and (10), respectively.

TABLES 160–C1 and 160–C2.—Visual range of point sources of light

Assumptions and Computations:

Tables 160–C1 and 160–C2 based on equation (11), below, relate to the visual range of light perceived as a point source; that is, this equation is valid under the condition that the particles of the atmospheric aerosol are small; namely, of the sizes not exceeding those found in haze or thin fog.

Equation (11) must be used with reservation if the light is not far enough away from the observer to appear as a point source. When fog, cloud, or other light-scattering particles are present in the neighborhood of light sources, the particles will give rise to

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[7] Blackwell, H. R., Contrast thresholds of the human eye, Journ. Opt. Soc. Amer., vol. 36, pp. 624-643, 1946.

[8] Douglas, C. A., and Young, L. L., Development of a transmissometer for determining visual range, Civil Aeronautics Administration, Technical Development Report No. 47, February 1945.

Note: These investigators used principally 4-foot-square black boards as visibility marks at distances between 0.15 and 1.0 kilometer, corresponding to angles subtended at the eye between 0.46° and 0.07°.

(*continued*)

a diffuse luminance of the atmosphere. In general, this will affect the threshold of illuminance for detection of the lights.[8]

The basic equation, due to Allard, commonly used in regard to the visual range of point sources is

$$E = I_0 D^{-2} e^{-\sigma D} \qquad (11)$$

where D = visual range of point-source light,
I_0 = luminous intensity (candlepower) of light in direction of observer,
σ = atmospheric extinction coefficient,
E = threshold of illuminance (luminous flux incident per unit area just detectable) at the observer's eye, owing to luminous flux emitted by the light.

The appropriate value of E depends greatly on the degree of dark adaptation of the observer. Among the controlling factors are the time history of illuminance to which the observer's eyes have been exposed prior to the observation, the luminance of the horizon sky and background in the direction of observed lights, and the illuminance on a horizontal plane at the point of observation. Presence of other light sources in vicinity of the target light, intermittency of the light, and color of the light also effect the value of E[3].

As a guide regarding choice of the proper value of E, the following data are provided:

E (threshold illuminance) lumens/km.^{2}	Condition
1	Twilight, or appreciable light from artificial sources.
2×10^{-1}	Average illuminance on surface and background luminance during night at typical airport.
3×10^{-2} (about $10^{-1.5}$)	Observer's eyes fairly well dark-adapted. No light other than starlight. Foveal threshold against dark background.

To permit evaluation of equation (11) by means of tables, it is rewritten

$$(\log_e I_0 - \log_e E) = (\sigma D + 2 \log_e D) \qquad (12)$$

Description:

Table 160–C1 gives values of the left-hand member $(\log_e I_0 - \log_e E)$ as a function of E and I_0, while Table 160–C2 gives values of the right-hand member, $(\sigma D + 2 \log_e D)$, as a function of σ and D.

These tables permit the computation of any one of the four variables as a function of the other three, provided that equation (12) is satisfied.

Examples:

Given: $E = 2 \times 10^{-1}$ lumens/km.^{2}
$I_0 = 30$ candles
$D = 5.0$ km.

To find: σ.

From Table 160–C1, we find

$$(\log_e I_0 - \log_e E) = 5.011.$$

Referring to Table 160–C2, which gives $(\sigma D + 2 \log_e D)$, and running along the line for $D = 5.0$ km., we find by interpolation for σ that the tabular value 5.011 occurs when $\sigma = 0.358$, which is the required result.

Given: Assuming $\epsilon = 0.02$, the daytime visual range of a black object viewed against the horizon sky is $V_2 = 3.2$ km.

To find: σ; then, to find D or a light observed at night for this value of σ under the condition that

$$E = 1 \text{ lumen/km.}^2 \text{ and } I_0 = 100 \text{ candles.}$$

From Table 160–B1, we find $\sigma = 1.222$ km.$^{-1}$ corresponding to $V_2 = 3.2$ km.

From Table 160–C1, $(\log_e I_0 - \log_e E) = 4.605$.

Referring to Table 160–C2, with this tabular value $4.605 = (\sigma D + 2 \log_e D)$ in accord with equation (12), and $\sigma = 1.222$ km.$^{-1}$, we find by double interpolation that $D = 2.36$ km.

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–A1.—Transmissivity as a function of extinction coefficient

$T = e^{-\sigma}$

Extinction coefficient σ km.⁻¹		.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	1.	0000	*9900	*9802	*9704	*9608	*9512	*9418	*9324	*9231	*9139
0.1	0.	9048	8958	8869	8781	8694	8607	8521	8437	8353	8270
0.2	0.	8187	8106	8025	7945	7866	7788	7711	7634	7558	7483
0.3	0.	7408	7334	7261	7189	7118	7047	6977	6907	6839	6771
0.4	0.	6703	6636	6570	6505	6440	6376	6313	6250	6188	6126
0.5	0.	6065	6005	5945	5886	5827	5770	5712	5655	5599	5543
0.6	0.	5488	5434	5379	5326	5273	5220	5169	5117	5066	5016
0.7	0.	4966	4916	4868	4819	4771	4724	4677	4630	4584	4538
0.8	0.	4493	4449	4404	4360	4317	4274	4232	4190	4148	4107
0.9	0.	4066	4025	3985	3946	3906	3867	3829	3791	3753	3716
1.0	0.	3679	3642	3606	3570	3535	3499	3465	3430	3396	3362
1.1	0.	3329	3296	3263	3230	3198	3166	3135	3104	3073	3042
1.2	0.	3012	2982	2952	2923	2894	2865	2837	2808	2780	2753
1.3	0.	2725	2698	2671	2645	2618	2592	2567	2541	2516	2491
1.4	0.	2466	2441	2417	2393	2369	2346	2322	2299	2276	2254
1.5	0.	2231	2209	2187	2165	2144	2122	2101	2080	2060	2039
1.6	0.	2019	1999	1979	1959	1940	1920	1901	1882	1864	1845
1.7	0.	1827	1809	1791	1773	1755	1738	1720	1703	1686	1670
1.8	0.	1653	1637	1620	1604	1588	1572	1557	1541	1526	1511
1.9	0.	1496	1481	1466	1451	1437	1423	1409	1395	1381	1367
2.0	0.	1353	1340	1327	1313	1300	1287	1275	1262	1249	1237
2.1	0.	1225	1212	1200	1188	1177	1165	1153	1142	1130	1119
2.2	0.	1108	1097	1086	1075	1065	1054	1044	1033	1023	1013
2.3	0.	1003	*9926	*9827	*9730	*9633	*9537	*9442	*9348	*9255	*9163
2.4	0.0	9072	8982	8892	8804	8716	8629	8544	8458	8374	8291
2.5	0.0	8208	8127	8046	7966	7887	7808	7730	7654	7577	7502
2.6	0.0	7427	7354	7280	7208	7136	7065	6995	6925	6856	6788
2.7	0.0	6721	6654	6588	6522	6457	6393	6329	6266	6204	6142
2.8	0.0	6081	6020	5961	5901	5843	5784	5727	5670	5614	5558
2.9	0.0	5502	5448	5393	5340	5287	5234	5182	5130	5079	5029
3.0	0.0	4979	4929	4880	4832	4784	4736	4689	4642	4596	4550
3.1	0.0	4505	4460	4416	4372	4328	4285	4243	4200	4159	4117
3.2	0.0	4076	4036	3996	3956	3916	3877	3839	3801	3763	3725
3.3	0.0	3688	3652	3615	3579	3544	3508	3474	3439	3405	3371
3.4	0.0	3337	3304	3271	3239	3206	3175	3143	3112	3081	3050
3.5	0.0	3020	2990	2960	2930	2901	2872	2844	2816	2788	2760
3.6	0.0	2732	2705	2678	2652	2625	2599	2573	2548	2522	2497
3.7	0.0	2472	2448	2423	2399	2375	2352	2328	2305	2282	2260
3.8	0.0	2237	2215	2193	2171	2149	2128	2107	2086	2065	2044
3.9	0.0	2024	2004	1984	1964	1945	1926	1906	1887	1869	1850
4.0	0.0	1832	1813	1795	1777	1760	1742	1725	1708	1691	1674
4.1	0.0	1657	1641	1624	1608	1592	1576	1561	1545	1530	1515
4.2	0.0	1500	1485	1470	1455	1441	1426	1412	1398	1384	1370
4.3	0.0	1357	1343	1330	1317	1304	1291	1278	1265	1252	1240
4.4	0.0	1228	1216	1203	1191	1180	1168	1156	1145	1133	1122
4.5	0.0	1111	1100	1089	1078	1067	1057	1046	1036	1026	1015
4.6	0.0	1005	*9952	*9853	*9755	*9658	*9562	*9466	*9372	*9279	*9187
4.7	0.0^2	9095	9005	8915	8826	8739	8652	8566	8480	8396	8312
4.8	0.0^2	8230	8148	8067	7987	7907	7828	7750	7673	7597	7521
4.9	0.0^2	7447	7372	7299	7227	7155	7083	7013	6943	6874	6806
5.0	0.0^2	6738	6671	6605	6539	6474	6409	6346	6282	6220	6158

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–A1.—Transmissivity as a function of extinction coefficient

$$T = e^{-\sigma}$$

Extinction coefficient σ km.⁻¹		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
5.0	0.0^2	6738	6097	5517	4992	4517	4087	3698	3346	3028	2739
6.0	0.0^2	2479	2243	2029	1836	1662	1503	1360	1231	1114	1008
7.0	0.0^3	9119	8251	7466	6755	6113	5531	5005	4528	4097	3707
8.0	0.0^3	3355	3035	2747	2485	2249	2035	1841	1666	1507	1364
9.0	0.0^3	1234	1117	1010	*9142	*8272	*7485	*6773	*6128	*5545	*5017
10.0	0.0^4	4540									

Extinction coefficient σ km.⁻¹		$e^{-\sigma}$	Extinction coefficient σ km.⁻¹		$e^{-\sigma}$	Extinction coefficient σ km.⁻¹		$e^{-\sigma}$
1	(− 1)	3.679	41	(−18)	1.563	81	(− 36)	6.640
2	(− 1)	1.353	42	(−19)	5.750	82	(− 36)	2.443
3	(− 2)	4.979	43	(−19)	2.115	83	(− 37)	8.986
4	(− 2)	1.832	44	(−20)	7.781	84	(− 37)	3.306
5	(− 3)	6.738	45	(−20)	2.863	85	(− 37)	1.216
6	(− 3)	2.479	46	(−20)	1.053	86	(− 38)	4.474
7	(− 4)	9.119	47	(−21)	3.874	87	(− 38)	1.646
8	(− 4)	3.355	48	(−21)	1.425	88	(− 39)	6.055
9	(− 4)	1.234	49	(−22)	5.243	89	(− 39)	2.227
10	(− 5)	4.540	50	(−22)	1.929	90	(− 40)	8.194
11	(− 5)	1.670	51	(−23)	7.095	91	(− 40)	3.014
12	(− 6)	6.144	52	(−23)	2.610	92	(− 40)	1.109
13	(− 6)	2.260	53	(−24)	9.603	93	(− 41)	4.080
14	(− 7)	8.315	54	(−24)	3.533	94	(− 41)	1.501
15	(− 7)	3.059	55	(−24)	1.300	95	(− 42)	5.521
16	(− 7)	1.125	56	(−25)	4.781	96	(− 42)	2.031
17	(− 8)	4.140	57	(−25)	1.759	97	(− 43)	7.472
18	(− 8)	1.523	58	(−26)	6.470	98	(− 43)	2.749
19	(− 9)	5.603	59	(−26)	2.380	99	(− 43)	1.011
20	(− 9)	2.061	60	(−27)	8.757	100	(− 44)	3.720
21	(−10)	7.583	61	(−27)	3.221			
22	(−10)	2.789	62	(−27)	1.185			
23	(−10)	1.026	63	(−28)	4.360			
24	(−11)	3.775	64	(−28)	1.604			
25	(−11)	1.389	65	(−29)	5.900			
26	(−12)	5.109	66	(−29)	2.171	100	(− 44)	3.720
27	(−12)	1.880	67	(−30)	7.985	200	(− 87)	1.384
28	(−13)	6.914	68	(−30)	2.937	300	(−131)	5.148
29	(−13)	2.544	69	(−30)	1.081	400	(−174)	1.915
30	(−14)	9.358	70	(−31)	3.975	500	(−218)	7.125
31	(−14)	3.442	71	(−31)	1.462	600	(−261)	2.650
32	(−14)	1.266	72	(−32)	5.380	700	(−305)	9.860
33	(−15)	4.659	73	(−32)	1.979	800	(−348)	3.668
34	(−15)	1.714	74	(−33)	7.281	900	(−391)	1.364
35	(−16)	6.305	75	(−33)	2.679	1000	(−435)	5.076
36	(−16)	2.320	76	(−34)	9.854			
37	(−17)	8.533	77	(−34)	3.625			
38	(−17)	3.139	78	(−34)	1.334			
39	(−17)	1.155	79	(−35)	4.906			
40	(−18)	4.248	80	(−35)	1.805			

NOTE.—The numbers in parentheses indicate the power of 10 by which the tabulated values are to be multiplied.

(continued)

HORIZONTAL VISIBILITY

TABLE 160–A2.—Extinction coefficient as a function of transmissivity

$$\sigma = -\log_e T = -\log_e 10^P$$

Transmissivity N T	1 km.⁻¹	2 km.⁻¹	3 km.⁻¹	4 km.⁻¹	5 km.⁻¹	6 km.⁻¹	7 km.⁻¹	8 km.⁻¹	9 km.⁻¹
$N \times 10^{-10}$	23.0259	22.3327	21.9272	21.6396	21.4164	21.2341	21.0799	20.9464	20.8286
$N \times 10^{-9}$	20.7233	20.0301	19.6247	19.3370	19.1138	18.9315	18.7774	18.6438	18.5260
$N \times 10^{-8}$	18.4207	17.7275	17.3221	17.0344	16.8112	16.6289	16.4748	16.3412	16.2235
$N \times 10^{-7}$	16.1181	15.4249	15.0195	14.7318	14.5087	14.3263	14.1722	14.0387	13.9209
$N \times 10^{-6}$	13.8155	13.1224	12.7169	12.4292	12.2061	12.0238	11.8696	11.7361	11.6183
$N \times 10^{-5}$	11.5129	10.8198	10.4143	10.1266	9.9035	9.7212	9.5670	9.4335	9.3157
$N \times 10^{-4}$	9.2103	8.5172	8.1117	7.8241	7.6009	7.4186	7.2644	7.1309	7.0131
$N \times 10^{-3}$	6.9078	6.2146	5.8091	5.5215	5.2983	5.1160	4.9618	4.8283	4.7105
$N \times 10^{-2}$	4.6052	3.9120	3.5066	3.2189	2.9957	2.8134	2.6593	2.5257	2.4079
$N \times 10^{-1}$	2.3026	1.6094	1.2040	0.9163	0.6931	0.5108	0.3567	0.2231	0.1054

Transmissivity T	.00 km.⁻¹	.01 km.⁻¹	.02 km.⁻¹	.03 km.⁻¹	.04 km.⁻¹	.05 km.⁻¹	.06 km.⁻¹	.07 km.⁻¹	.08 km.⁻¹	.09 km.⁻¹
0.0	+∞	4.6052	3.9120	3.5066	3.2189	2.9957	2.8134	2.6593	2.5257	2.4079
0.1	2.3026	2.2073	2.1203	2.0402	1.9661	1.8971	1.8326	1.7720	1.7148	1.6607
0.2	1.6094	1.5606	1.5141	1.4697	1.4271	1.3863	1.3471	1.3093	1.2730	1.2379
0.3	1.2040	1.1712	1.1394	1.1087	1.0788	1.0498	1.0217	0.9943	0.9676	0.9416
0.4	0.9163	0.8916	0.8675	0.8440	0.8210	0.7985	0.7765	0.7550	0.7340	0.7133
0.5	0.6931	0.6733	0.6539	0.6349	0.6162	0.5978	0.5798	0.5621	0.5447	0.5276
0.6	0.5108	0.4943	0.4780	0.4620	0.4463	0.4308	0.4155	0.4005	0.3857	0.3711
0.7	0.3567	0.3425	0.3285	0.3147	0.3011	0.2877	0.2744	0.2614	0.2485	0.2357
0.8	0.2231	0.2107	0.1985	0.1863	0.1744	0.1625	0.1508	0.1393	0.1278	0.1165
0.9	0.1054	0.0943	0.0834	0.0726	0.0619	0.0513	0.0408	0.0305	0.0202	0.0101
1.0	0.0000									

P	0 km.⁻¹	10 km.⁻¹	20 km.⁻¹	30 km.⁻¹	40 km.⁻¹	50 km.⁻¹	60 km.⁻¹	70 km.⁻¹	80 km.⁻¹	90 km.⁻¹
−400	921.034	944.060	967.086	990.112						
−300	690.776	713.801	736.827	759.853	782.879	805.905	828.931	851.956	874.982	898.008
−200	460.517	483.543	506.569	529.595	552.620	575.646	598.672	621.698	644.724	667.750
−100	230.259	253.284	276.310	299.336	322.362	345.388	368.414	391.439	414.465	437.491

P	0 km.⁻¹	1 km.⁻¹	2 km.⁻¹	3 km.⁻¹	4 km.⁻¹	5 km.⁻¹	6 km.⁻¹	7 km.⁻¹	8 km.⁻¹	9 km.⁻¹
−100	230.259	232.561	234.864	237.166	239.469	241.771	244.074	246.377	248.679	250.982
− 90	207.233	209.535	211.838	214.140	216.443	218.746	221.048	223.351	225.653	227.956
− 80	184.207	186.509	188.812	191.115	193.417	195.720	198.022	200.325	202.627	204.930
− 70	161.181	163.484	165.786	168.089	170.391	172.694	174.996	177.299	179.602	181.904
− 60	138.155	140.458	142.760	145.063	147.365	149.668	151.971	154.273	156.576	158.878
− 50	115.129	117.432	119.734	122.037	124.340	126.642	128.945	131.247	133.550	135.853
− 40	92.103	94.406	96.709	99.011	101.314	103.616	105.919	108.221	110.524	112.827
− 30	69.078	71.380	73.683	75.985	78.288	80.590	82.893	85.196	87.498	89.801
− 20	46.052	48.354	50.657	52.959	55.262	57.565	59.867	62.170	64.472	66.775
− 10	23.026	25.328	27.631	29.934	32.236	34.539	36.841	39.144	41.447	43.749
− 0	0.000	2.303	4.605	6.908	9.210	11.513	13.816	16.118	18.421	20.723

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–B1.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.02

$$\sigma = \frac{3.912}{V_2}$$

Visual range V_2 km.	0.000 km.⁻¹	0.001 km.⁻¹	0.002 km.⁻¹	0.003 km.⁻¹	0.004 km.⁻¹	0.005 km.⁻¹	0.006 km.⁻¹	0.007 km.⁻¹	0.008 km.⁻¹	0.009 km.⁻¹
0.00	.	.	.	.	978.0	782.4	652.0	558.9	489.0	434.7
0.01	391.2	355.6	326.0	300.9	279.4	260.8	244.5	230.1	217.3	205.9
0.02	195.6	186.3	177.8	170.1	163.0	156.5	150.5	144.9	139.7	134.9
0.03	130.4	126.2	122.2	118.5	115.1	111.8	108.7	105.7	102.9	100.3
0.04	97.80	95.41	93.14	90.98	88.91	86.93	85.04	83.23	81.50	79.84
0.05	78.24	76.71	75.23	73.81	72.44	71.13	69.86	68.63	67.45	66.31
0.06	65.20	64.13	63.10	62.10	61.12	60.18	59.27	58.39	57.53	56.70
0.07	55.89	55.10	54.33	53.59	52.86	52.16	51.47	50.81	50.15	49.52
0.08	48.90	48.30	47.71	47.13	46.57	46.02	45.49	44.97	44.45	43.96
0.09	43.47	42.99	42.52	42.06	41.62	41.18	40.75	40.33	39.92	39.52
0.10	39.12	38.73	38.35	37.98	37.62	37.26	36.91	36.56	36.22	35.89
0.11	35.56	35.24	34.93	34.62	34.32	34.02	33.72	33.44	33.15	32.87
0.12	32.60	32.33	32.07	31.80	31.55	31.30	31.05	30.80	30.56	30.33
0.13	30.09	29.86	29.64	29.41	29.19	28.98	28.76	28.55	28.35	28.14
0.14	27.94	27.74	27.55	27.36	27.17	26.98	26.79	26.61	26.43	26.26
0.15	26.08	25.91	25.74	25.57	25.40	25.24	25.08	24.92	24.76	24.60
0.16	24.45	24.30	24.15	24.00	23.85	23.71	23.57	23.43	23.29	23.15
0.17	23.01	22.88	22.74	22.61	22.48	22.35	22.23	22.10	21.98	21.85
0.18	21.73	21.61	21.49	21.38	21.26	21.15	21.03	20.92	20.81	20.70
0.19	20.59	20.48	20.37	20.27	20.16	20.06	19.96	19.86	19.76	19.66
0.20	19.56	19.46	19.37	19.27	19.18	19.08	18.99	18.90	18.81	18.72
0.21	18.63	18.54	18.45	18.37	18.28	18.20	18.11	18.03	17.94	17.86
0.22	17.78	17.70	17.62	17.54	17.46	17.39	17.31	17.23	17.16	17.08
0.23	17.01	16.94	16.86	16.79	16.72	16.65	16.58	16.51	16.44	16.37
0.24	16.30	16.23	16.17	16.10	16.03	15.97	15.90	15.84	15.77	15.71
0.25	15.65	15.59	15.52	15.46	15.40	15.34	15.28	15.22	15.16	15.10
0.26	15.05	14.99	14.93	14.87	14.82	14.76	14.71	14.65	14.60	14.54
0.27	14.49	14.44	14.38	14.33	14.28	14.23	14.17	14.12	14.07	14.02
0.28	13.97	13.92	13.87	13.82	13.77	13.73	13.68	13.63	13.58	13.54
0.29	13.49	13.44	13.40	13.35	13.31	13.26	13.22	13.17	13.13	13.08
0.30	13.04	13.00	12.95	12.91	12.87	12.83	12.78	12.74	12.70	12.66
0.31	12.62	12.58	12.54	12.50	12.46	12.42	12.38	12.34	12.30	12.26
0.32	12.22	12.19	12.15	12.11	12.07	12.04	12.00	11.96	11.93	11.89
0.33	11.85	11.82	11.78	11.75	11.71	11.68	11.64	11.61	11.57	11.54
0.34	11.51	11.47	11.44	11.41	11.37	11.34	11.31	11.27	11.24	11.21
0.35	11.18	11.15	11.11	11.08	11.05	11.02	10.99	10.96	10.93	10.90
0.36	10.87	10.84	10.81	10.78	10.75	10.72	10.69	10.66	10.63	10.60
0.37	10.57	10.54	10.52	10.49	10.46	10.43	10.40	10.38	10.35	10.32
0.38	10.29	10.27	10.24	10.21	10.19	10.16	10.13	10.11	10.08	10.06
0.39	10.03	10.01	9.980	9.954	9.929	9.904	9.879	9.854	9.829	9.805

(continued)

HORIZONTAL VISIBILITY

TABLE 160–B1.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.02

$$\sigma = \frac{3.912}{V_2}$$

Visual range V_2 km.	0.00 km.⁻¹	0.01 km.⁻¹	0.02 km.⁻¹	0.03 km.⁻¹	0.04 km.⁻¹	0.05 km.⁻¹	0.06 km.⁻¹	0.07 km.⁻¹	0.08 km.⁻¹	0.09 km.⁻¹
0.40	9.780	9.541	9.314	9.098	8.891	8.693	8.504	8.323	8.150	7.984
0.50	7.824	7.671	7.523	7.381	7.244	7.113	6.986	6.863	6.745	6.631
0.60	6.520	6.413	6.310	6.210	6.112	6.018	5.927	5.839	5.753	5.670
0.70	5.589	5.510	5.433	5.359	5.286	5.216	5.147	5.081	5.015	4.952
0.80	4.890	4.830	4.771	4.713	4.657	4.602	4.549	4.497	4.445	4.396
0.90	4.347	4.299	4.252	4.206	4.162	4.118	4.075	4.033	3.992	3.952
1.00	3.912	3.873	3.835	3.798	3.762	3.726	3.691	3.656	3.622	3.589
1.10	3.556	3.524	3.493	3.462	3.432	3.402	3.372	3.344	3.315	3.287
1.20	3.260	3.233	3.207	3.180	3.155	3.130	3.105	3.080	3.056	3.033
1.30	3.009	2.986	2.964	2.941	2.919	2.898	2.876	2.855	2.835	2.814
1.40	2.794	2.774	2.755	2.736	2.717	2.698	2.679	2.661	2.643	2.626
1.50	2.608	2.591	2.574	2.557	2.540	2.524	2.508	2.492	2.476	2.460
1.60	2.445	2.430	2.415	2.400	2.385	2.371	2.357	2.343	2.329	2.315
1.70	2.301	2.288	2.274	2.261	2.248	2.235	2.223	2.210	2.198	2.185
1.80	2.173	2.161	2.149	2.138	2.126	2.115	2.103	2.092	2.081	2.070
1.90	2.059	2.048	2.037	2.027	2.016	2.006	1.996	1.986	1.976	1.966
2.00	1.956	1.946	1.937	1.927	1.918	1.908	1.899	1.890	1.881	1.872
2.10	1.863	1.854	1.845	1.837	1.828	1.820	1.811	1.803	1.794	1.786
2.20	1.778	1.770	1.762	1.754	1.746	1.739	1.731	1.723	1.716	1.708
2.30	1.701	1.694	1.686	1.679	1.672	1.665	1.658	1.651	1.644	1.637
2.40	1.630	1.623	1.617	1.610	1.603	1.597	1.590	1.584	1.577	1.571
2.50	1.565	1.559	1.552	1.546	1.540	1.534	1.528	1.522	1.516	1.510
2.60	1.505	1.499	1.493	1.487	1.482	1.476	1.471	1.465	1.460	1.454
2.70	1.449	1.444	1.438	1.433	1.428	1.423	1.417	1.412	1.407	1.402
2.80	1.397	1.392	1.387	1.382	1.377	1.373	1.368	1.363	1.358	1.354
2.90	1.349	1.344	1.340	1.335	1.331	1.326	1.322	1.317	1.313	1.308

Visual range V_2 km.	.0 km.⁻¹	.1 km.⁻¹	.2 km.⁻¹	.3 km.⁻¹	.4 km.⁻¹	.5 km.⁻¹	.6 km.⁻¹	.7 km.⁻¹	.8 km.⁻¹	.9 km.⁻¹
3.0	1.304	1.262	1.222	1.185	1.151	1.118	1.087	1.057	1.029	1.003
4.0	0.9780	0.9541	0.9314	0.9098	0.8891	0.8693	0.8504	0.8323	0.8150	0.7984
5.0	0.7824	0.7671	0.7523	0.7381	0.7244	0.7113	0.6986	0.6863	0.6745	0.6631
6.0	0.6520	0.6413	0.6310	0.6210	0.6112	0.6018	0.5927	0.5839	0.5753	0.5670
7.0	0.5589	0.5510	0.5433	0.5359	0.5286	0.5216	0.5147	0.5081	0.5015	0.4952
8.0	0.4890	0.4830	0.4771	0.4713	0.4657	0.4602	0.4549	0.4497	0.4445	0.4396
9.0	0.4347	0.4299	0.4252	0.4206	0.4162	0.4118	0.4075	0.4033	0.3992	0.3952
10.0	0.3912	0.3873	0.3835	0.3798	0.3762	0.3726	0.3691	0.3656	0.3622	0.3589

(continued)

HORIZONTAL VISIBILITY

TABLE 160–B1.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.02

$$\sigma = \frac{3.912}{V_2}$$

Visual range V_2 km.	0 km.⁻¹	1 km.⁻¹	2 km.⁻¹	3 km.⁻¹	4 km.⁻¹	5 km.⁻¹	6 km.⁻¹	7 km.⁻¹	8 km.⁻¹	9 km.⁻¹
10	.3912	.3556	.3260	.3009	.2794	.2608	.2445	.2301	.2173	.2059
20	.1956	.1863	.1778	.1701	.1630	.1565	.1505	.1449	.1397	.1349
30	.1304	.1262	.1222	.1185	.1151	.1118	.1087	.1057	.1029	.1003
40	.09780	.09541	.09314	.09098	.08891	.08693	.08504	.08323	.08150	.07984
50	.07824	.07671	.07523	.07381	.07244	.07113	.06986	.06863	.06745	.06631
60	.06520	.06413	.06310	.06210	.06112	.06018	.05927	.05839	.05753	.05670
70	.05589	.05510	.05433	.05359	.05286	.05216	.05147	.05081	.05015	.04952
80	.04890	.04830	.04771	.04713	.04657	.04602	.04549	.04497	.04445	.04396
90	.04347	.04299	.04252	.04206	.04162	.04118	.04075	.04033	.03992	.03952
100	.03912	.03873	.03835	.03798	.03762	0.3726	.03691	.03656	.03622	.03589
110	.03556	.03524	.03493	.03462	.03432	.03402	.03372	.03344	.03315	.03287
120	.03260	.03233	.03207	.03180	.03155	.03130	.03105	.03080	.03056	.03033
130	.03009	.02986	.02964	.02941	.02919	.02898	.02876	.02855	.02835	.02814
140	.02794	.02774	.02755	.02736	.02717	.02698	.02679	.02661	.02643	.02626
150	.02608	.02591	.02574	.02557	.02540	.02524	.02508	.02492	.02476	.02460
160	.02445	.02430	.02415	.02400	.02385	.02371	.02357	.02343	.02329	.02315
170	.02301	.02288	.02274	.02261	.02248	.02235	.02223	.02210	.02198	.02185
180	.02173	.02161	.02149	.02138	.02126	.02115	.02103	.02092	.02081	.02070
190	.02059	.02048	.02037	.02027	.02016	.02006	.01996	.01986	.01976	.01966
200	.01956	.01946	.01937	.01927	.01918	.01908	.01899	.01890	.01881	.01872
210	.01863	.01854	.01845	.01837	.01828	.01820	.01811	.01803	.01794	.01786
220	.01778	.01770	.01762	.01754	.01746	.01739	.01731	.01723	.01716	.01708
230	.01701	.01694	.01686	.01679	.01672	.01665	.01658	.01651	.01644	.01637
240	.01630	.01623	.01617	.01610	.01603	.01597	.01590	.01584	.01577	.01571
250	.01565	.01559	.01552	.01546	.01540	.01534	.01528	.01522	.01516	.01510

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–B2.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.05

$$\sigma = \frac{2.996}{V_5}$$

Visual range V_5 km.	0.000 km.⁻¹	0.001 km.⁻¹	0.002 km.⁻¹	0.003 km.⁻¹	0.004 km.⁻¹	0.005 km.⁻¹	0.006 km.⁻¹	0.007 km.⁻¹	0.008 km.⁻¹	0.009 km.⁻¹
0.00				998.7	749.0	599.2	499.3	428.0	374.5	332.9
0.01	299.6	272.4	249.7	230.5	214.0	199.7	187.3	176.2	166.4	157.7
0.02	149.8	142.7	136.2	130.3	124.8	119.8	115.2	111.0	107.0	103.3
0.03	99.87	96.65	93.63	90.79	88.12	85.60	83.22	80.97	78.84	76.82
0.04	74.90	73.07	71.33	69.67	68.09	66.58	65.13	63.74	62.42	61.14
0.05	59.92	58.75	57.62	56.53	55.48	54.47	53.50	52.56	51.66	50.78
0.06	49.93	49.11	48.32	47.56	46.81	46.09	45.39	44.72	44.06	43.42
0.07	42.80	42.20	41.61	41.04	40.49	39.95	39.42	38.91	38.41	37.92
0.08	37.45	36.99	36.54	36.10	35.67	35.25	34.84	34.44	34.05	33.66
0.09	33.29	32.92	32.57	32.22	31.87	31.54	31.21	30.89	30.57	30.26
0.10	29.96	29.66	29.37	29.09	28.81	28.53	28.26	28.00	27.74	27.49
0.11	27.24	26.99	26.75	26.51	26.28	26.05	25.83	25.61	25.39	25.18
0.12	24.97	24.76	24.56	24.36	24.16	23.97	23.78	23.59	23.41	23.22
0.13	23.05	22.87	22.70	22.53	22.36	22.19	22.03	21.87	21.71	21.55
0.14	21.40	21.25	21.10	20.95	20.81	20.66	20.52	20.38	20.24	20.11
0.15	19.97	19.84	19.71	19.58	19.45	19.33	19.21	19.08	18.96	18.84
0.16	18.73	18.61	18.49	18.38	18.27	18.16	18.05	17.94	17.83	17.73
0.17	17.62	17.52	17.42	17.32	17.22	17.12	17.02	16.93	16.83	16.74
0.18	16.64	16.55	16.46	16.37	16.28	16.19	16.11	16.02	15.94	15.85
0.19	15.77	15.69	15.60	15.52	15.44	15.36	15.29	15.21	15.13	15.06
0.20	14.98	14.91	14.83	14.76	14.69	14.61	14.54	14.47	14.40	14.33
0.21	14.27	14.20	14.13	14.07	14.00	13.93	13.87	13.81	13.74	13.68
0.22	13.62	13.56	13.50	13.43	13.38	13.32	13.26	13.20	13.14	13.08
0.23	13.03	12.97	12.91	12.86	12.80	12.75	12.69	12.64	12.59	12.54
0.24	12.48	12.43	12.38	12.33	12.28	12.23	12.18	12.13	12.08	12.03
0.25	11.98	11.94	11.89	11.84	11.80	11.75	11.70	11.66	11.61	11.57
0.26	11.52	11.48	11.44	11.39	11.35	11.31	11.26	11.22	11.18	11.14
0.27	11.10	11.06	11.01	10.97	10.93	10.89	10.86	10.82	10.78	10.74
0.28	10.70	10.66	10.62	10.59	10.55	10.51	10.48	10.44	10.40	10.37
0.29	10.33	10.30	10.26	10.23	10.19	10.16	10.12	10.09	10.05	10.02
0.30	9.987	9.953	9.921	9.888	9.855	9.823	9.791	9.759	9.727	9.696
0.31	9.665	9.633	9.603	9.572	9.541	9.511	9.481	9.451	9.421	9.392
0.32	9.363	9.333	9.304	9.276	9.247	9.218	9.190	9.162	9.134	9.106
0.33	9.079	9.051	9.024	8.997	8.970	8.943	8.917	8.890	8.864	8.838
0.34	8.812	8.786	8.760	8.735	8.709	8.684	8.659	8.634	8.609	8.585
0.35	8.560	8.536	8.511	8.487	8.463	8.439	8.416	8.392	8.369	8.345
0.36	8.322	8.299	8.276	8.253	8.231	8.208	8.186	8.163	8.141	8.119
0.37	8.097	8.075	8.054	8.032	8.011	7.989	7.968	7.947	7.926	7.905
0.38	7.884	7.864	7.843	7.822	7.802	7.782	7.762	7.742	7.722	7.702
0.39	7.682	7.662	7.643	7.623	7.604	7.585	7.566	7.547	7.528	7.509

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160-B2.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.05

$$\sigma = \frac{2.996}{V_5}$$

Visual range V_5 km.	0.00 km.$^{-1}$	0.01 km.$^{-1}$	0.02 km.$^{-1}$	0.03 km.$^{-1}$	0.04 km.$^{-1}$	0.05 km.$^{-1}$	0.06 km.$^{-1}$	0.07 km.$^{-1}$	0.08 km.$^{-1}$	0.09 km.$^{-1}$
0.40	7.490	7.307	7.133	6.967	6.809	6.658	6.513	6.374	6.242	6.114
0.50	5.992	5.875	5.762	5.653	5.548	5.447	5.350	5.256	5.166	5.078
0.60	4.993	4.911	4.832	4.756	4.681	4.609	4.539	4.472	4.406	4.342
0.70	4.280	4.220	4.161	4.104	4.049	3.995	3.942	3.891	3.841	3.792
0.80	3.745	3.699	3.654	3.610	3.567	3.525	3.484	3.444	3.405	3.366
0.90	3.329	3.292	3.257	3.222	3.187	3.154	3.121	3.089	3.057	3.026
1.00	2.996	2.966	2.937	2.909	2.881	2.853	2.826	2.800	2.774	2.749
1.10	2.724	2.699	2.675	2.651	2.628	2.605	2.583	2.561	2.539	2.518
1.20	2.497	2.476	2.456	2.436	2.416	2.397	2.378	2.359	2.341	2.322
1.30	2.305	2.287	2.270	2.253	2.236	2.219	2.203	2.187	2.171	2.155
1.40	2.140	2.125	2.110	2.095	2.081	2.066	2.052	2.038	2.024	2.011
1.50	1.997	1.984	1.971	1.958	1.945	1.933	1.921	1.908	1.896	1.884
1.60	1.873	1.861	1.849	1.838	1.827	1.816	1.805	1.794	1.783	1.773
1.70	1.762	1.752	1.742	1.732	1.722	1.712	1.702	1.693	1.683	1.674
1.80	1.664	1.655	1.646	1.637	1.628	1.619	1.611	1.602	1.594	1.585
1.90	1.577	1.569	1.560	1.552	1.544	1.536	1.529	1.521	1.513	1.506
2.00	1.498	1.491	1.483	1.476	1.469	1.461	1.454	1.447	1.440	1.433
2.10	1.427	1.420	1.413	1.407	1.400	1.393	1.387	1.381	1.374	1.368
2.20	1.362	1.356	1.350	1.343	1.338	1.332	1.326	1.320	1.314	1.308
2.30	1.303	1.297	1.291	1.286	1.280	1.275	1.269	1.264	1.259	1.254
2.40	1.248	1.243	1.238	1.233	1.228	1.223	1.218	1.213	1.208	1.203
2.50	1.198	1.194	1.189	1.184	1.180	1.175	1.170	1.166	1.161	1.157
2.60	1.152	1.148	1.144	1.139	1.135	1.131	1.126	1.122	1.118	1.114
2.70	1.110	1.106	1.101	1.097	1.093	1.089	1.086	1.082	1.078	1.074
2.80	1.070	1.066	1.062	1.059	1.055	1.051	1.048	1.044	1.040	1.037
2.90	1.033	1.030	1.026	1.023	1.019	1.016	1.012	1.009	1.005	1.002

Visual range V_5 km.	.0 km.$^{-1}$	.1 km.$^{-1}$	.2 km.$^{-1}$	.3 km.$^{-1}$	.4 km.$^{-1}$	.5 km.$^{-1}$	.6 km.$^{-1}$	.7 km.$^{-1}$	.8 km.$^{-1}$	.9 km.$^{-1}$
3.0	.9987	.9665	.9363	.9079	.8812	.8560	.8322	.8097	.7884	.7682
4.0	.7490	.7307	.7133	.6967	.6809	.6658	.6513	.6374	.6242	.6114
5.0	.5992	.5875	.5762	.5653	.5548	.5447	.5350	.5256	.5166	.5078
6.0	.4994	.4911	.4832	.4756	.4681	.4609	.4539	.4472	.4406	.4342
7.0	.4280	.4220	.4161	.4104	.4049	.3995	.3942	.3891	.3841	.3792
8.0	.3745	.3699	.3654	.3610	.3567	.3525	.3484	.3444	.3405	.3366
9.0	.3329	.3292	.3257	.3222	.3187	.3154	.3121	.3089	.3057	.3026
10.0	.2996	.2966	.2937	.2909	.2881	.2853	.2826	.2800	.2774	.2749

(*continued*)

TABLE 160–B2.—Extinction coefficient as a function of visual range of black objects viewed against horizon sky in daytime where threshold of luminance contrast, ε, is 0.05

$$\sigma = \frac{2.996}{V_5}$$

Visual range V_5 km.	0 km.⁻¹	1 km.⁻¹	2 km.⁻¹	3 km.⁻¹	4 km.⁻¹	5 km.⁻¹	6 km.⁻¹	7 km.⁻¹	8 km.⁻¹	9 km.⁻¹
10	.2996	.2724	.2497	.2305	.2140	.1997	.1873	.1762	.1664	.1577
20	.1498	.1427	.1362	.1303	.1248	.1198	.1152	.1110	.1070	.1033
30	.09987	.09665	.09363	.09079	.08812	.08560	.08322	.08097	.07884	.07682
40	.07490	.07307	.07133	.06967	.06809	.06658	.06513	.06374	.06242	.06114
50	.05992	.05875	.05762	.05653	.05548	.05447	.05350	.05256	.05166	.05078
60	.04993	.04911	.04832	.04756	.04681	.04609	.04539	.04472	.04406	.04342
70	.04280	.04220	.04161	.04104	.04049	.03995	.03942	.03891	.03841	.03792
80	.03745	.03699	.03654	.03610	.03567	.03525	.03484	.03444	.03405	.03366
90	.03329	.03292	.03257	.03222	.03187	.03154	.03121	.03089	.03057	.03026
100	.02996	.02966	.02937	.02909	.02881	.02853	.02826	.02800	.02774	.02749
110	.02724	.02699	.02675	.02651	.02628	.02605	.02583	.02561	.02539	.02518
120	.02497	.02476	.02456	.02436	.02416	.02397	.02378	.02359	.02341	.02322
130	.02305	.02287	.02270	.02253	.02236	.02219	.02203	.02187	.02171	.02155
140	.02140	.02125	.02110	.02095	.02081	.02066	.02052	.02038	.02024	.02011
150	.01997	.01984	.01971	.01958	.01945	.01933	.01921	.01908	.01896	.01884
160	.01873	.01861	.01849	.01838	.01827	.01816	.01805	.01794	.01783	.01773
170	.01762	.01752	.01742	.01732	.01722	.01712	.01702	.01693	.01683	.01674
180	.01664	.01655	.01646	.01637	.01628	.01619	.01611	.01602	.01594	.01585
190	.01577	.01569	.01560	.01552	.01544	.01536	.01529	.01521	.01513	.01506
200	.01498	.01491	.01483	.01476	.01469	.01461	.01454	.01447	.01440	.01433
210	.01427	.01420	.01413	.01407	.01400	.01393	.01387	.01381	.01374	.01368
220	.01362	.01356	.01350	.01343	.01338	.01332	.01326	.01320	.01314	.01308
230	.01303	.01297	.01291	.01286	.01280	.01275	.01269	.01264	.01259	.01254
240	.01248	.01243	.01238	.01233	.01228	.01223	.01218	.01213	.01208	.01203
250	.01198	.01194	.01189	.01184	.01180	.01175	.01170	.01166	.01161	.01157

(*continued*)

HORIZONTAL VISIBILITY

Table 160–C1.—Visual range of point sources of light

Function $(\log_e I_0 - \log_e E)$

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10^{-3}	2×10^{-3}	3×10^{-3}	4×10^{-3}	5×10^{-3}	6×10^{-3}	7×10^{-3}	8×10^{-3}	9×10^{-3}
5×10^{-3}	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
10^{-2}	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
5×10^{-2}	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
10^{-1}	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
5×10^{-1}	6.215	5.521	5.116	4.828	4.605	4.423	4.269	4.135	4.017
1	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
2	7.601	6.908	6.502	6.215	5.991	5.809	5.655	5.521	5.404
3	8.006	7.313	6.908	6.620	6.397	6.215	6.060	5.927	5.809
4	8.294	7.601	7.195	6.908	6.685	6.502	6.348	6.215	6.097
5	8.517	7.824	7.419	7.131	6.908	6.725	6.571	6.438	6.320
6	8.700	8.006	7.601	7.313	7.090	6.908	6.754	6.620	6.502
7	8.854	8.161	7.755	7.467	7.244	7.062	6.908	6.774	6.656
8	8.987	8.294	7.889	7.601	7.378	7.195	7.041	6.908	6.790
9	9.105	8.412	8.006	7.719	7.496	7.313	7.159	7.026	6.908
10	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
15	9.616	8.923	8.517	8.230	8.006	7.824	7.670	7.536	7.419
20	9.903	9.210	8.805	8.517	8.294	8.112	7.958	7.824	7.706
25	10.127	9.433	9.028	8.740	8.517	8.335	8.181	8.047	7.929
30	10.309	9.616	9.210	8.923	8.700	8.517	8.363	8.230	8.112
35	10.463	9.770	9.364	9.077	8.854	8.671	8.517	8.384	8.266
40	10.597	9.903	9.498	9.210	8.987	8.805	8.651	8.517	8.399
45	10.714	10.021	9.616	9.328	9.105	8.923	8.769	8.635	8.517
50	10.820	10.127	9.721	9.433	9.210	9.028	8.874	8.740	8.623
55	10.915	10.222	9.816	9.529	9.306	9.123	8.969	8.836	8.718
60	11.002	10.309	9.903	9.616	9.393	9.210	9.056	8.923	8.805
65	11.082	10.389	9.984	9.696	9.473	9.290	9.136	9.003	8.885
70	11.156	10.463	10.058	9.770	9.547	9.364	9.210	9.077	8.959
75	11.225	10.532	10.127	9.839	9.616	9.433	9.279	9.146	9.028
80	11.290	10.597	10.191	9.903	9.680	9.498	9.344	9.210	9.093
85	11.350	10.657	10.252	9.964	9.741	9.559	9.404	9.271	9.153
90	11.408	10.714	10.309	10.021	9.798	9.616	9.462	9.328	9.210
95	11.462	10.768	10.363	10.075	9.852	9.670	9.516	9.382	9.264
100	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
200	12.206	11.513	11.107	10.820	10.597	10.414	10.260	10.127	10.009
300	12.612	11.918	11.513	11.225	11.002	10.820	10.666	10.532	10.414
400	12.899	12.206	11.801	11.513	11.290	11.107	10.953	10.820	10.702
500	13.122	12.429	12.024	11.736	11.513	11.331	11.176	11.043	10.925
600	13.305	12.612	12.206	11.918	11.695	11.513	11.359	11.225	11.107
700	13.459	12.766	12.360	12.073	11.849	11.667	11.513	11.379	11.262
800	13.592	12.899	12.494	12.206	11.983	11.801	11.646	11.513	11.395
900	13.710	13.017	12.612	12.324	12.101	11.918	11.764	11.631	11.513
1000	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
2000	14.509	13.816	13.410	13.122	12.899	12.717	12.563	12.429	12.311
3000	14.914	14.221	13.816	13.528	13.305	13.122	12.968	12.835	12.717
4000	15.202	14.509	14.103	13.816	13.592	13.410	13.256	13.122	13.005
5000	15.425	14.732	14.326	14.039	13.816	13.633	13.479	13.346	13.228
6000	15.607	14.914	14.509	14.221	13.998	13.816	13.661	13.528	13.410
7000	15.761	15.068	14.663	14.375	14.152	13.970	13.816	13.682	13.564
8000	15.895	15.202	14.796	14.509	14.286	14.103	13.949	13.816	13.698
9000	16.013	15.320	14.914	14.626	14.403	14.221	14.067	13.933	13.816
10000	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$ 1×10^{-2}	2×10^{-2}	3×10^{-2}	4×10^{-2}	5×10^{-2}	6×10^{-2}	7×10^{-2}	8×10^{-2}	9×10^{-2}
5×10^{-3}	−0.693	−1.386	−1.792	−2.079	−2.303	−2.485	−2.639	−2.773	−2.890
10^{-2}	0.000	−0.693	−1.099	−1.386	−1.609	−1.792	−1.946	−2.079	−2.197
5×10^{-2}	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
10^{-1}	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
5×10^{-1}	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
1	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
2	5.298	4.605	4.200	3.912	3.689	3.507	3.352	3.219	3.101
3	5.704	5.011	4.605	4.317	4.094	3.912	3.758	3.624	3.507
4	5.991	5.298	4.893	4.605	4.382	4.200	4.046	3.912	3.794
5	6.215	5.521	5.116	4.828	4.605	4.423	4.269	4.135	4.017
6	6.397	5.704	5.298	5.011	4.787	4.605	4.451	4.317	4.200
7	6.551	5.858	5.452	5.165	4.942	4.759	4.605	4.472	4.354
8	6.685	5.991	5.586	5.298	5.075	4.893	4.739	4.605	4.487
9	6.802	6.109	5.704	5.416	5.193	5.011	4.856	4.723	4.605
10	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
15	7.313	6.620	6.215	5.927	5.704	5.521	5.367	5.234	5.116
20	7.601	6.908	6.502	6.215	5.991	5.809	5.655	5.521	5.404
25	7.824	7.131	6.725	6.438	6.215	6.032	5.878	5.745	5.627
30	8.006	7.313	6.908	6.620	6.397	6.215	6.060	5.927	5.809
35	8.161	7.467	7.062	6.774	6.551	6.369	6.215	6.081	5.963
40	8.294	7.601	7.195	6.908	6.685	6.502	6.348	6.215	6.097
45	8.412	7.719	7.313	7.026	6.802	6.620	6.466	6.332	6.215
50	8.517	7.824	7.419	7.131	6.908	6.725	6.571	6.438	6.320
55	8.613	7.919	7.514	7.226	7.003	6.821	6.667	6.533	6.415
60	8.700	8.006	7.601	7.313	7.090	6.908	6.754	6.620	6.502
65	8.780	8.086	7.681	7.393	7.170	6.988	6.834	6.700	6.582
70	8.854	8.161	7.755	7.467	7.244	7.062	6.908	6.774	6.656
75	8.923	8.230	7.824	7.536	7.313	7.131	6.977	6.843	6.725
80	8.987	8.294	7.889	7.601	7.378	7.195	7.041	6.908	6.790
85	9.048	8.355	7.949	7.662	7.438	7.256	7.102	6.968	6.851
90	9.105	8.412	8.006	7.719	7.496	7.313	7.159	7.026	6.908
95	9.159	8.466	8.060	7.773	7.550	7.367	7.213	7.080	6.962
100	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
200	9.903	9.210	8.805	8.517	8.294	8.112	7.958	7.824	7.706
300	10.309	9.616	9.210	8.923	8.700	8.517	8.363	8.230	8.112
400	10.597	9.903	9.498	9.210	8.987	8.805	8.651	8.517	8.399
500	10.820	10.127	9.721	9.433	9.210	9.028	8.874	8.740	8.623
600	11.002	10.309	9.903	9.616	9.393	9.210	9.056	8.923	8.805
700	11.156	10.463	10.058	9.770	9.547	9.364	9.210	9.077	8.959
800	11.290	10.597	10.191	9.903	9.680	9.498	9.344	9.210	9.093
900	11.408	10.714	10.309	10.021	9.798	9.616	9.462	9.328	9.210
1000	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
2000	12.206	11.513	11.107	10.820	10.597	10.414	10.260	10.127	10.009
3000	12.612	11.918	11.513	11.225	11.002	10.820	10.666	10.532	10.414
4000	12.899	12.206	11.801	11.513	11.290	11.107	10.953	10.820	10.702
5000	13.122	12.429	12.024	11.736	11.513	11.331	11.176	11.043	10.925
6000	13.305	12.612	12.206	11.918	11.695	11.513	11.359	11.225	11.107
7000	13.459	12.766	12.360	12.073	11.849	11.667	11.513	11.379	11.262
8000	13.592	12.899	12.494	12.206	11.983	11.801	11.646	11.513	11.395
9000	13.710	13.017	12.612	12.324	12.101	11.918	11.764	11.631	11.513
10000	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10^{-1}	2×10^{-1}	3×10^{-1}	4×10^{-1}	5×10^{-1}	6×10^{-1}	7×10^{-1}	8×10^{-1}	9×10^{-1}
5×10^{-3}	−2.996	−3.689	−4.094	−4.382	−4.605	−4.787	−4.942	−5.075	−5.193
10^{-2}	−2.303	−2.996	−3.401	−3.689	−3.912	−4.094	−4.248	−4.382	−4.500
5×10^{-2}	−0.693	−1.386	−1.792	−2.079	−2.303	−2.485	−2.639	−2.773	−2.890
10^{-1}	0.000	−0.693	−1.099	−1.386	−1.609	−1.792	−1.946	−2.079	−2.197
5×10^{-1}	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
1	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
2	2.996	2.303	1.897	1.609	1.386	1.204	1.050	0.916	0.799
3	3.401	2.708	2.303	2.015	1.792	1.609	1.455	1.322	1.204
4	3.689	2.996	2.590	2.303	2.079	1.897	1.743	1.609	1.492
5	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
6	4.094	3.401	2.996	2.708	2.485	2.303	2.148	2.015	1.897
7	4.248	3.555	3.150	2.862	2.639	2.457	2.303	2.169	2.051
8	4.382	3.689	3.283	2.996	2.773	2.590	2.436	2.303	2.185
9	4.500	3.807	3.401	3.114	2.890	2.708	2.554	2.420	2.303
10	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
15	5.011	4.317	3.912	3.624	3.401	3.219	3.065	2.931	2.813
20	5.298	4.605	4.200	3.912	3.689	3.507	3.352	3.219	3.101
25	5.521	4.828	4.423	4.135	3.912	3.730	3.576	3.442	3.324
30	5.704	5.011	4.605	4.317	4.094	3.912	3.758	3.624	3.507
35	5.858	5.165	4.759	4.472	4.248	4.066	3.912	3.778	3.661
40	5.991	5.298	4.893	4.605	4.382	4.200	4.046	3.912	3.794
45	6.109	5.416	5.011	4.723	4.500	4.317	4.163	4.030	3.912
50	6.215	5.521	5.116	4.828	4.605	4.423	4.269	4.135	4.017
55	6.310	5.617	5.211	4.924	4.700	4.518	4.364	4.230	4.113
60	6.397	5.704	5.298	5.011	4.787	4.605	4.451	4.317	4.200
65	6.477	5.784	5.378	5.091	4.868	4.685	4.531	4.398	4.280
70	6.551	5.858	5.452	5.165	4.942	4.759	4.605	4.472	4.354
75	6.620	5.927	5.521	5.234	5.011	4.828	4.674	4.541	4.423
80	6.685	5.991	5.586	5.298	5.075	4.893	4.739	4.605	4.487
85	6.745	6.052	5.647	5.359	5.136	4.953	4.799	4.666	4.548
90	6.802	6.109	5.704	5.416	5.193	5.011	4.856	4.723	4.605
95	6.856	6.163	5.758	5.470	5.247	5.065	4.911	4.777	4.659
100	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
200	7.601	6.908	6.502	6.215	5.991	5.809	5.655	5.521	5.404
300	8.006	7.313	6.908	6.620	6.397	6.215	6.060	5.927	5.809
400	8.294	7.601	7.195	6.908	6.685	6.502	6.348	6.215	6.097
500	8.517	7.824	7.419	7.131	6.908	6.725	6.571	6.438	6.320
600	8.700	8.006	7.601	7.313	7.090	6.908	6.754	6.620	6.502
700	8.854	8.161	7.755	7.467	7.244	7.062	6.908	6.774	6.656
800	8.987	8.294	7.889	7.601	7.378	7.195	7.041	6.908	6.790
900	9.105	8.412	8.006	7.719	7.496	7.313	7.159	7.026	6.908
1000	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
2000	9.903	9.210	8.805	8.517	8.294	8.112	7.958	7.824	7.706
3000	10.309	9.616	9.210	8.923	8.700	8.517	8.363	8.230	8.112
4000	10.597	9.903	9.498	9.210	8.987	8.805	8.651	8.517	8.399
5000	10.820	10.127	9.721	9.433	9.210	9.028	8.874	8.740	8.623
6000	11.002	10.309	9.903	9.616	9.393	9.210	9.056	8.923	8.805
7000	11.156	10.463	10.058	9.770	9.547	9.364	9.210	9.077	8.959
8000	11.290	10.597	10.191	9.903	9.680	9.498	9.344	9.210	9.093
9000	11.408	10.714	10.309	10.021	9.798	9.616	9.462	9.328	9.210
10000	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1	2	3	4	5	6	7	8	9
5×10^{-3}	−5.298	−5.991	−6.397	−6.685	−6.908	−7.090	−7.244	−7.378	−7.496
10^{-2}	−4.605	−5.298	−5.704	−5.991	−6.215	−6.397	−6.551	−6.685	−6.802
5×10^{-2}	−2.996	−3.689	−4.094	−4.382	−4.605	−4.787	−4.942	−5.075	−5.193
10^{-1}	−2.303	−2.996	−3.401	−3.689	−3.912	−4.094	−4.249	−4.382	−4.500
5×10^{-1}	−0.693	−1.386	−1.792	−2.079	−2.303	−2.485	−2.639	−2.773	−2.890
1	0.000	−0.693	−1.099	−1.386	−1.609	−1.792	−1.946	−2.079	−2.197
2	0.693	0.000	−0.405	−0.693	−0.916	−1.099	−1.253	−1.386	−1.504
3	1.099	0.405	0.000	−0.288	−0.511	−0.693	−0.847	−0.981	−1.099
4	1.386	0.693	0.288	0.000	−0.223	−0.405	−0.560	−0.693	−0.811
5	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
6	1.792	1.099	0.693	0.405	0.182	0.000	−0.154	−0.288	−0.405
7	1.946	1.253	0.847	0.560	0.336	0.154	0.000	−0.134	−0.251
8	2.079	1.386	0.981	0.693	0.470	0.288	0.134	0.000	−0.118
9	2.197	1.504	1.099	0.811	0.588	0.405	0.251	0.118	0.000
10	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
15	2.708	2.015	1.609	1.322	1.099	0.916	0.762	0.629	0.511
20	2.996	2.303	1.897	1.609	1.386	1.204	1.050	0.916	0.799
25	3.219	2.526	2.120	1.833	1.609	1.427	1.273	1.139	1.022
30	3.401	2.708	2.303	2.015	1.792	1.609	1.455	1.322	1.204
35	3.555	2.862	2.457	2.169	1.946	1.764	1.609	1.476	1.358
40	3.689	2.996	2.590	2.303	2.079	1.897	1.743	1.609	1.492
45	3.807	3.114	2.708	2.420	2.197	2.015	1.861	1.727	1.609
50	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
55	4.007	3.314	2.909	2.621	2.398	2.216	2.061	1.928	1.810
60	4.094	3.401	2.996	2.708	2.485	2.303	2.148	2.015	1.897
65	4.174	3.481	3.076	2.788	2.565	2.383	2.228	2.095	1.977
70	4.249	3.555	3.150	2.862	2.639	2.457	2.303	2.169	2.051
75	4.317	3.624	3.219	2.931	2.708	2.526	2.372	2.238	2.120
80	4.382	3.689	3.283	2.996	2.773	2.590	2.436	2.303	2.185
85	4.443	3.750	3.344	3.056	2.833	2.651	2.497	2.363	2.245
90	4.500	3.807	3.401	3.114	2.890	2.708	2.554	2.420	2.303
95	4.554	3.861	3.455	3.168	2.944	2.762	2.608	2.474	2.357
100	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
200	5.298	4.605	4.200	3.912	3.689	3.507	3.352	3.219	3.101
300	5.704	5.011	4.605	4.317	4.094	3.912	3.758	3.624	3.507
400	5.991	5.298	4.893	4.605	4.382	4.200	4.046	3.912	3.794
500	6.215	5.521	5.116	4.828	4.605	4.423	4.269	4.135	4.017
600	6.397	5.704	5.298	5.011	4.787	4.594	4.440	4.307	4.189
700	6.551	5.858	5.452	5.165	4.942	4.759	4.605	4.472	4.354
800	6.685	5.991	5.586	5.298	5.075	4.893	4.739	4.605	4.487
900	6.802	6.109	5.704	5.416	5.193	5.011	4.856	4.723	4.605
1000	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
2000	7.601	6.908	6.502	6.215	5.991	5.809	5.655	5.521	5.404
3000	8.006	7.313	6.908	6.620	6.397	6.215	6.060	5.927	5.809
4000	8.294	7.601	7.195	6.908	6.685	6.502	6.348	6.215	6.097
5000	8.517	7.824	7.419	7.131	6.908	6.725	6.571	6.438	6.320
6000	8.700	8.006	7.601	7.313	7.090	6.908	6.754	6.620	6.502
7000	8.854	8.161	7.755	7.467	7.244	7.062	6.908	6.774	6.656
8000	8.987	8.294	7.889	7.601	7.378	7.195	7.041	6.908	6.790
9000	9.105	8.412	8.006	7.719	7.496	7.313	7.159	7.026	6.908
10000	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10	2×10	3×10	4×10	5×10	6×10	7×10	8×10	9×10
5×10^{-3}	−7.601	−8.294	−8.700	−8.987	−9.210	−9.393	−9.547	−9.680	−9.798
· 10^{-2}	−6.908	−7.601	−8.006	−8.294	−8.517	−8.700	−8.854	−8.987	−9.105
5×10^{-2}	−5.298	−5.991	−6.397	−6.685	−6.908	−7.090	−7.244	−7.378	−7.496
10^{-1}	−4.605	−5.298	−5.704	−5.991	−6.215	−6.397	−6.551	−6.685	−6.802
5×10^{-1}	−2.996	−3.689	−4.094	−4.382	−4.605	−4.787	−4.942	−5.075	−5.193
1	−2.303	−2.996	−3.401	−3.689	−3.912	−4.094	−4.249	−4.382	−4.500
2	−1.609	−2.303	−2.708	−2.996	−3.219	−3.401	−3.555	−3.689	−3.807
3	−1.204	−1.897	−2.303	−2.590	−2.813	−2.996	−3.150	−3.283	−3.401
4	−0.916	−1.609	−2.015	−2.303	−2.526	−2.708	−2.862	−2.996	−3.114
5	−0.693	−1.386	−1.792	−2.079	−2.303	−2.485	−2.639	−2.773	−2.890
6	−0.511	−1.204	−1.609	−1.897	−2.120	−2.303	−2.457	−2.590	−2.708
7	−0.357	−1.050	−1.455	−1.743	−1.966	−2.148	−2.303	−2.436	−2.554
8	−0.223	−0.916	−1.322	−1.609	−1.833	−2.015	−2.169	−2.303	−2.420
9	−0.105	−0.799	−1.204	−1.492	−1.715	−1.897	−2.051	−2.185	−2.303
10	0.000	−0.693	−1.099	−1.386	−1.609	−1.792	−1.946	−2.079	−2.197
15	0.405	−0.288	−0.693	−0.981	−1.204	−1.386	−1.540	−1.674	−1.792
20	0.693	0.000	−0.405	−0.693	−0.916	−1.099	−1.253	−1.386	−1.504
25	0.916	0.223	−0.182	−0.470	−0.693	−0.875	−1.030	−1.163	−1.281
30	1.099	0.405	0.000	−0.288	−0.511	−0.693	−0.847	−0.981	−1.099
35	1.253	0.560	0.154	−0.134	−0.357	−0.539	−0.693	−0.827	−0.944
40	1.386	0.693	0.288	0.000	−0.223	−0.405	−0.560	−0.693	−0.811
45	1.504	0.811	0.405	0.118	−0.105	−0.288	−0.442	−0.575	−0.693
50	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
55	1.705	1.012	0.606	0.318	0.095	−0.087	−0.241	−0.375	−0.492
60	1.792	1.099	0.693	0.405	0.182	0.000	−0.154	−0.288	−0.405
65	1.872	1.179	0.773	0.486	0.262	0.080	−0.074	−0.208	−0.325
70	1.946	1.253	0.847	0.560	0.336	0.154	0.000	−0.134	−0.251
75	2.015	1.322	0.916	0.629	0.405	0.223	0.069	−0.065	−0.182
80	2.079	1.386	0.981	0.693	0.470	0.288	0.134	0.000	−0.118
85	2.140	1.447	1.041	0.754	0.531	0.348	0.194	0.061	−0.057
90	2.197	1.504	1.099	0.811	0.588	0.405	0.251	0.118	0.000
95	2.251	1.558	1.153	0.865	0.642	0.460	0.305	0.172	0.054
100	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
200	2.996	2.303	1.897	1.609	1.386	1.204	1.050	0.916	0.799
300	3.401	2.708	2.303	2.015	1.792	1.609	1.455	1.322	1.204
400	3.689	2.996	2.590	2.303	2.079	1.897	1.743	1.609	1.492
500	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
600	4.094	3.401	2.996	2.708	2.485	2.303	2.148	2.015	2.103
700	4.248	3.555	3.150	2.862	2.639	2.457	2.303	2.169	2.051
800	4.382	3.689	3.283	2.996	2.773	2.590	2.436	2.303	2.185
900	4.500	3.807	3.401	3.114	2.890	2.708	2.554	2.420	2.303
1000	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
2000	5.298	4.605	4.200	3.912	3.689	3.507	3.352	3.219	3.101
3000	5.704	5.011	4.605	4.317	4.094	3.912	3.758	3.624	3.507
4000	5.991	5.298	4.893	4.605	4.382	4.200	4.046	3.912	3.794
5000	6.215	5.521	5.116	4.828	4.605	4.423	4.269	4.135	4.017
6000	6.397	5.704	5.298	5.011	4.787	4.605	4.451	4.317	4.200
7000	6.551	5.858	5.452	5.165	4.942	4.759	4.605	4.472	4.354
8000	6.685	5.991	5.586	5.298	5.075	4.893	4.739	4.605	4.487
9000	6.802	6.109	5.704	5.416	5.193	5.011	4.856	4.723	4.605
10000	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10^2	2×10^2	3×10^2	4×10^2	5×10^2	6×10^2	7×10^2	8×10^2	9×10^2
5×10^{-3}	−9.903	−10.597	−11.002	−11.290	−11.513	−11.695	−11.849	−11.983	−12.101
10^{-2}	−9.210	−9.903	−10.309	−10.597	−10.820	−11.002	−11.156	−11.290	−11.408
5×10^{-2}	−7.601	−8.294	−8.700	−8.987	−9.210	−9.393	−9.547	−9.680	−9.798
10^{-1}	−6.908	−7.601	−8.006	−8.294	−8.517	−8.700	−8.854	−8.987	−9.105
5×10^{-1}	−5.298	−5.991	−6.397	−6.685	−6.908	−7.090	−7.244	−7.378	−7.496
1	−4.605	−5.298	−5.704	−5.991	−6.215	−6.397	−6.551	−6.685	−6.802
2	−3.912	−4.605	−5.011	−5.298	−5.521	−5.704	−5.858	−5.991	−6.109
3	−3.507	−4.200	−4.605	−4.893	−5.116	−5.298	−5.452	−5.586	−5.704
4	−3.219	−3.912	−4.317	−4.605	−4.828	−5.011	−5.165	−5.298	−5.416
5	−2.996	−3.689	−4.094	−4.382	−4.605	−4.787	−4.942	−5.075	−5.193
6	−2.813	−3.507	−3.912	−4.200	−4.423	−4.605	−4.759	−4.893	−5.011
7	−2.659	−3.352	−3.758	−4.046	−4.269	−4.451	−4.605	−4.739	−4.856
8	−2.526	−3.219	−3.624	−3.912	−4.135	−4.317	−4.472	−4.605	−4.723
9	−2.408	−3.101	−3.507	−3.794	−4.017	−4.200	−4.354	−4.487	−4.605
10	−2.303	−2.996	−3.401	−3.689	−3.912	−4.094	−4.248	−4.382	−4.500
15	−1.897	−2.590	−2.996	−3.283	−3.507	−3.689	−3.843	−3.977	−4.094
20	−1.609	−2.303	−2.708	−2.996	−3.219	−3.401	−3.555	−3.689	−3.807
25	−1.386	−2.079	−2.485	−2.773	−2.996	−3.178	−3.332	−3.466	−3.584
30	−1.204	−1.897	−2.303	−2.590	−2.813	−2.996	−3.150	−3.283	−3.401
35	−1.050	−1.743	−2.148	−2.436	−2.659	−2.842	−2.996	−3.129	−3.247
40	−0.916	−1.609	−2.015	−2.303	−2.526	−2.708	−2.862	−2.996	−3.114
45	−0.799	−1.492	−1.897	−2.185	−2.408	−2.590	−2.744	−2.878	−2.996
50	−0.693	−1.386	−1.792	−2.079	−2.303	−2.485	−2.639	−2.773	−2.890
55	−0.598	−1.291	−1.696	−1.984	−2.207	−2.390	−2.544	−2.677	−2.795
60	−0.511	−1.204	−1.609	−1.897	−2.120	−2.303	−2.457	−2.590	−2.708
65	−0.431	−1.124	−1.529	−1.817	−2.040	−2.223	−2.377	−2.510	−2.628
70	−0.357	−1.050	−1.455	−1.743	−1.966	−2.148	−2.303	−2.436	−2.554
75	−0.288	−0.981	−1.386	−1.674	−1.897	−2.079	−2.234	−2.367	−2.485
80	−0.223	−0.916	−1.322	−1.609	−1.833	−2.015	−2.169	−2.303	−2.420
85	−0.163	−0.856	−1.261	−1.549	−1.772	−1.954	−2.108	−2.242	−2.360
90	−0.105	−0.799	−1.204	−1.492	−1.715	−1.897	−2.051	−2.185	−2.303
95	−0.051	−0.744	−1.150	−1.438	−1.661	−1.843	−1.997	−2.131	−2.249
100	0.000	−0.693	−1.099	−1.386	−1.609	−1.792	−1.946	−2.079	−2.197
200	0.693	0.000	−0.405	−0.693	−0.916	−1.099	−1.253	−1.386	−1.504
300	1.099	0.405	0.000	−0.288	−0.511	−0.693	−0.847	−0.981	−1.099
400	1.386	0.693	0.288	0.000	−0.223	−0.405	−0.560	−0.693	−0.811
500	1.609	0.916	0.511	0.223	0.000	−0.182	−0.336	−0.470	−0.588
600	1.792	1.099	0.693	0.405	0.182	0.000	−0.154	−0.288	−0.405
700	1.946	1.253	0.847	0.560	0.336	0.154	0.000	−0.134	−0.251
800	2.079	1.386	0.981	0.693	0.470	0.288	0.134	0.000	−0.118
900	2.197	1.504	1.099	0.811	0.588	0.405	0.251	0.118	0.000
1000	2.303	1.609	1.204	0.916	0.693	0.511	0.357	0.223	0.105
2000	2.996	2.303	1.897	1.609	1.386	1.204	1.050	0.916	0.799
3000	3.401	2.708	2.303	2.015	1.792	1.609	1.455	1.322	1.204
4000	3.689	2.996	2.590	2.303	2.079	1.897	1.743	1.609	1.492
5000	3.912	3.219	2.813	2.526	2.303	2.120	1.966	1.833	1.715
6000	4.094	3.401	2.996	2.708	2.485	2.303	2.148	2.015	1.897
7000	4.249	3.555	3.150	2.862	2.639	2.457	2.303	2.169	2.051
8000	4.382	3.689	3.283	2.996	2.773	2.590	2.436	2.303	2.185
9000	4.500	3.807	3.401	3.114	2.890	2.708	2.554	2.420	2.303
10000	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Luminous intensity I_0 candles (candela)	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10^2	2×10^2	3×10^2	4×10^2	5×10^2	6×10^2	7×10^2	8×10^2	9×10^2
10^4	4.605	3.912	3.507	3.219	2.996	2.813	2.659	2.526	2.408
2×10^4	5.298	4.605	4.200	3.912	3.689	3.507	3.352	3.219	3.101
4×10^4	5.991	5.298	4.893	4.605	4.382	4.200	4.046	3.912	3.794
6×10^4	6.397	5.704	5.298	5.011	4.787	4.605	4.451	4.317	4.200
8×10^4	6.685	5.991	5.586	5.298	5.075	4.893	4.739	4.605	4.487
10^5	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
5×10^5	8.517	7.824	7.419	7.131	6.908	6.725	6.571	6.438	6.320
10^6	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
5×10^6	10.820	10.127	9.721	9.433	9.210	9.028	8.874	8.740	8.623
10^7	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
5×10^7	13.122	12.429	12.024	11.736	11.513	11.331	11.176	11.043	10.925
10^8	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
5×10^8	15.425	14.732	14.326	14.039	13.816	13.633	13.479	13.346	13.228
10^9	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
5×10^9	17.728	17.034	16.629	16.341	16.118	15.936	15.782	15.648	15.530

	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1×10	2×10	3×10	4×10	5×10	6×10	7×10	8×10	9×10
10^4	6.908	6.215	5.809	5.521	5.298	5.116	4.962	4.828	4.711
2×10^4	7.601	6.908	6.502	6.215	5.991	5.809	5.655	5.521	5.404
4×10^4	8.294	7.601	7.195	6.908	6.685	6.502	6.348	6.215	6.097
6×10^4	8.700	8.006	7.601	7.313	7.090	6.908	6.754	6.620	6.502
8×10^4	8.987	8.294	7.889	7.601	7.378	7.195	7.041	6.908	6.790
10^5	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
5×10^5	10.820	10.127	9.721	9.433	9.210	9.028	8.874	8.740	8.623
10^6	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
5×10^6	13.122	12.429	12.024	11.736	11.513	11.331	11.176	11.043	10.925
10^7	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
5×10^7	15.425	14.732	14.326	14.039	13.816	13.633	13.479	13.346	13.228
10^8	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
5×10^8	17.728	17.034	16.629	16.341	16.118	15.936	15.782	15.648	15.530
10^9	18.421	17.728	17.322	17.034	16.811	16.629	16.475	16.341	16.223
5×10^9	20.030	19.337	18.932	18.644	18.421	18.238	18.084	17.951	17.833

	Threshold illuminance (flux-density), E, lumens km.$^{-2}$								
	1	2	3	4	5	6	7	8	9
10^4	9.210	8.517	8.112	7.824	7.601	7.419	7.264	7.131	7.013
2×10^4	9.903	9.210	8.805	8.517	8.294	8.112	7.958	7.824	7.706
4×10^4	10.597	9.903	9.498	9.210	8.987	8.805	8.651	8.517	8.399
6×10^4	11.002	10.309	9.903	9.616	9.393	9.210	9.056	8.923	8.805
8×10^4	11.290	10.597	10.191	9.903	9.680	9.498	9.344	9.210	9.093
10^5	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
5×10^5	13.122	12.429	12.024	11.736	11.513	11.331	11.176	11.043	10.925
10^6	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
5×10^6	15.425	14.732	14.326	14.039	13.816	13.633	13.479	13.346	13.228
10^7	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
5×10^7	17.728	17.034	16.629	16.341	16.118	15.936	15.782	15.648	15.530
10^8	18.421	17.728	17.322	17.034	16.811	16.629	16.475	16.341	16.223
5×10^8	20.030	19.337	18.932	18.644	18.421	18.238	18.084	17.951	17.833
10^9	20.723	20.030	19.625	19.337	19.114	18.932	18.777	18.644	18.526
5×10^9	22.333	21.640	21.234	20.946	20.723	20.541	20.387	20.253	20.135

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C1.—Visual range of point sources of light

Function ($\log_e I_0 - \log_e E$)

Threshold illuminance (flux-density), E, lumens km.$^{-2}$

Luminous intensity I_0 candles (candela)	1×10^{-1}	2×10^{-1}	3×10^{-1}	4×10^{-1}	5×10^{-1}	6×10^{-1}	7×10^{-1}	8×10^{-1}	9×10^{-1}
10^4	11.513	10.820	10.414	10.127	9.903	9.721	9.567	9.433	9.316
2×10^4	12.206	11.513	11.107	10.820	10.597	10.414	10.260	10.127	10.009
4×10^4	12.899	12.206	11.801	11.513	11.290	11.107	10.953	10.820	10.702
6×10^4	13.305	12.612	12.206	11.918	11.695	11.513	11.359	11.225	11.107
8×10^4	13.592	12.899	12.494	12.206	11.983	11.801	11.646	11.513	11.395
10^5	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
5×10^5	15.425	14.732	14.326	14.039	13.816	13.633	13.479	13.346	13.228
10^6	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
5×10^6	17.728	17.034	16.629	16.341	16.118	15.936	15.782	15.648	15.530
10^7	18.421	17.728	17.322	17.034	16.811	16.629	16.475	16.341	16.223
5×10^7	20.030	19.337	18.932	18.644	18.421	18.238	18.084	17.951	17.833
10^8	20.723	20.030	19.625	19.337	19.114	18.932	18.777	18.644	18.526
5×10^8	22.333	21.640	21.234	20.946	20.723	20.541	20.387	20.253	20.135
10^9	23.026	22.333	21.927	21.640	21.416	21.234	21.080	20.946	20.829
5×10^9	24.635	23.942	23.537	23.249	23.026	22.844	22.689	22.556	22.438

Threshold illuminance (flux-density), E, lumens km.$^{-2}$

	1×10^{-2}	2×10^{-2}	3×10^{-2}	4×10^{-2}	5×10^{-2}	6×10^{-2}	7×10^{-2}	8×10^{-2}	9×10^{-2}
10^4	13.816	13.122	12.717	12.429	12.206	12.024	11.870	11.736	11.618
2×10^4	14.509	13.816	13.410	13.122	12.899	12.717	12.563	12.429	12.311
4×10^4	15.202	14.509	14.103	13.816	13.592	13.410	13.256	13.122	13.005
6×10^4	15.607	14.914	14.509	14.221	13.998	13.816	13.661	13.528	13.410
8×10^4	15.895	15.202	14.796	14.509	14.286	14.103	13.949	13.816	13.698
10^5	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
5×10^5	17.728	17.034	16.629	16.341	16.118	15.936	15.782	15.648	15.530
10^6	18.421	17.728	17.322	17.034	16.811	16.629	16.475	16.341	16.223
5×10^6	20.030	19.337	18.932	18.644	18.421	18.238	18.084	17.951	17.833
10^7	20.723	20.030	19.625	19.337	19.114	18.932	18.777	18.644	18.526
5×10^7	22.333	21.640	21.234	20.946	20.723	20.541	20.387	20.253	20.135
10^8	23.026	22.333	21.927	21.640	21.416	21.234	21.080	20.946	20.829
5×10^8	24.635	23.942	23.537	23.249	23.026	22.844	22.689	22.556	22.438
10^9	25.328	24.635	24.230	23.942	23.719	23.537	23.383	23.249	23.131
5×10^9	26.938	26.245	25.839	25.552	25.328	25.146	24.992	24.858	24.741

Threshold illuminance (flux-density), E, lumens km.$^{-2}$

	1×10^{-3}	2×10^{-3}	3×10^{-3}	4×10^{-3}	5×10^{-3}	6×10^{-3}	7×10^{-3}	8×10^{-3}	9×10^{-3}
10^4	16.118	15.425	15.019	14.732	14.509	14.326	14.172	14.039	13.921
2×10^4	16.811	16.118	15.713	15.425	15.202	15.019	14.865	14.731	14.614
4×10^4	17.504	16.811	16.406	16.118	15.895	15.713	15.558	15.425	15.307
6×10^4	17.910	17.217	16.811	16.524	16.300	16.118	15.964	15.830	15.713
8×10^4	18.198	17.504	17.099	16.811	16.588	16.406	16.252	16.118	16.000
10^5	18.421	17.728	17.322	17.034	16.811	16.629	16.475	16.341	16.223
5×10^5	20.030	19.337	18.932	18.644	18.421	18.238	18.084	17.951	17.833
10^6	20.723	20.030	19.625	19.337	19.114	18.932	18.777	18.644	18.526
5×10^6	22.333	21.640	21.234	20.946	20.723	20.541	20.387	20.253	20.135
10^7	23.026	22.333	21.927	21.640	21.416	21.234	21.080	20.946	20.829
5×10^7	24.635	23.942	23.537	23.249	23.026	22.844	22.689	22.556	22.438
10^8	25.328	24.635	24.230	23.942	23.719	23.537	23.383	23.249	23.131
5×10^8	26.938	26.245	25.839	25.552	25.328	25.146	24.992	24.858	24.741
10^9	27.631	26.938	26.532	26.245	26.022	25.839	25.685	25.552	25.434
5×10^9	29.240	28.547	28.142	27.854	27.631	27.449	27.295	27.161	27.043

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C2.—Visual range of point sources of light

Function $(\sigma D + 2 \log_e D)$

Visual range D km.	Extinction coefficient, σ, km.⁻¹									
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.004										
0.005										
0.006										
0.007	−9.924	−9.923	−9.922	−9.922	−9.921	−9.920	−9.920	−9.919	−9.918	−9.917
0.008	−9.657	−9.656	−9.655	−9.654	−9.653	−9.653	−9.652	−9.651	−9.650	−9.649
0.009	−9.421	−9.420	−9.419	−9.418	−9.418	−9.417	−9.416	−9.415	−9.414	−9.413
0.01	−9.210	−9.209	−9.208	−9.207	−9.206	−9.205	−9.204	−9.203	−9.202	−9.201
0.02	−7.824	−7.822	−7.820	−7.818	−7.816	−7.814	−7.812	−7.810	−7.808	−7.806
0.03	−7.013	−7.010	−7.007	−7.004	−7.001	−6.998	−6.995	−6.992	−6.989	−6.986
0.04	−6.438	−6.434	−6.430	−6.426	−6.422	−6.418	−6.414	−6.410	−6.406	−6.402
0.05	−5.991	−5.986	−5.981	−5.976	−5.971	−5.966	−5.961	−5.956	−5.951	−5.946
0.06	−5.627	−5.621	−5.615	−5.609	−5.603	−5.597	−5.591	−5.585	−5.579	−5.573
0.07	−5.319	−5.312	−5.305	−5.298	−5.291	−5.284	−5.277	−5.270	−5.263	−5.256
0.08	−5.051	−5.043	−5.035	−5.027	−5.019	−5.011	−5.003	−4.995	−4.987	−4.979
0.09	−4.816	−4.807	−4.798	−4.789	−4.780	−4.771	−4.762	−4.753	−4.744	−4.735
0.1	−4.605	−4.595	−4.585	−4.575	−4.565	−4.555	−4.545	−4.535	−4.525	−4.515
0.2	−3.219	−3.199	−3.179	−3.159	−3.139	−3.119	−3.099	−3.079	−3.059	−3.039
0.3	−2.408	−2.378	−2.348	−2.318	−2.288	−2.258	−2.228	−2.198	−2.168	−2.138
0.4	−1.833	−1.793	−1.753	−1.713	−1.673	−1.633	−1.593	−1.553	−1.513	−1.473
0.5	−1.386	−1.336	−1.286	−1.236	−1.186	−1.136	−1.086	−1.036	−0.986	−0.936
0.6	−1.022	−0.962	−0.902	−0.842	−0.782	−0.722	−0.662	−0.602	−0.542	−0.482
0.7	−0.713	−0.643	−0.573	−0.503	−0.433	−0.363	−0.293	−0.223	−0.153	−0.083
0.8	−0.446	−0.366	−0.286	−0.206	−0.126	−0.046	0.034	0.114	0.194	0.274
0.9	−0.211	−0.121	−0.031	0.059	0.149	0.239	0.329	0.419	0.509	0.599
1.0	0.000	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900
1.1	0.191	0.301	0.411	0.521	0.631	0.741	0.851	0.961	1.071	1.181
1.2	0.365	0.485	0.605	0.725	0.845	0.965	1.085	1.205	1.325	1.445
1.3	0.525	0.655	0.785	0.915	1.045	1.175	1.305	1.435	1.565	1.695
1.4	0.673	0.813	0.953	1.093	1.233	1.373	1.513	1.653	1.793	1.933
1.5	0.811	0.961	1.111	1.261	1.411	1.561	1.711	1.861	2.011	2.161
1.6	0.940	1.100	1.260	1.420	1.580	1.740	1.900	2.060	2.220	2.380
1.7	1.061	1.231	1.401	1.571	1.741	1.911	2.081	2.251	2.421	2.591
1.8	1.176	1.356	1.536	1.716	1.896	2.076	2.256	2.436	2.616	2.796
1.9	1.284	1.474	1.664	1.854	2.044	2.234	2.424	2.614	2.804	2.994
2.0	1.386	1.586	1.786	1.986	2.186	2.386	2.586	2.786	2.986	3.186
2.1	1.484	1.694	1.904	2.114	2.324	2.534	2.744	2.954	3.164	3.374
2.2	1.577	1.797	2.017	2.237	2.457	2.677	2.897	3.117	3.337	3.557
2.3	1.666	1.896	2.126	2.356	2.586	2.816	3.046	3.276	3.506	3.736
2.4	1.751	1.991	2.231	2.471	2.711	2.951	3.191	3.431	3.671	3.911
2.5	1.833	2.083	2.333	2.583	2.833	3.083	3.333	3.583	3.833	4.083
2.6	1.911	2.171	2.431	2.691	2.951	3.211	3.471	3.731	3.991	4.251
2.7	1.986	2.256	2.526	2.796	3.066	3.336	3.606	3.876	4.146	4.416
2.8	2.059	2.339	2.619	2.899	3.179	3.459	3.739	4.019	4.299	4.579
2.9	2.129	2.419	2.709	2.999	3.289	3.579	3.869	4.159	4.449	4.739
3.0	2.197	2.497	2.797	3.097	3.397	3.697	3.997	4.297	4.597	4.897
3.2	2.326	2.646	2.966	3.286	3.606	3.926	4.246	4.566	4.886	5.206
3.4	2.448	2.788	3.128	3.468	3.808	4.148	4.488	4.828	5.168	5.508
3.6	2.562	2.922	3.282	3.642	4.002	4.362	4.722	5.082	5.442	5.802
3.8	2.670	3.050	3.430	3.810	4.190	4.570	4.950	5.330	5.710	6.090
4.0	2.773	3.173	3.573	3.973	4.373	4.773	5.173	5.573	5.973	6.373

(*continued*)

HORIZONTAL VISIBILITY

TABLE 160–C2.—Visual range of point sources of light

Function ($\sigma D + 2 \log_e D$)

Visual range D km.	Extinction coefficient, σ, km.⁻¹ 0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
4.0	2.773	3.173	3.573	3.973	4.373	4.773	5.173	5.573	5.973	6.373
4.2	2.870	3.290	3.710	4.130	4.550	4.970	5.390	5.810	6.230	6.650
4.4	2.963	3.403	3.843	4.283	4.723	5.163	5.603	6.043	6.483	6.923
4.6	3.052	3.512	3.972	4.432	4.892	5.352	5.812	6.272	6.732	7.192
4.8	3.137	3.617	4.097	4.577	5.057	5.537	6.017	6.497	6.977	7.457
5.0	3.219	3.719	4.219	4.719	5.219	5.719	6.219	6.719	7.219	7.719
5.2	3.297	3.817	4.337	4.857	5.377	5.897	6.417	6.937	7.457	7.977
5.4	3.373	3.913	4.453	4.993	5.533	6.073	6.613	7.153	7.693	8.233
5.6	3.446	4.006	4.566	5.126	5.686	6.246	6.806	7.366	7,926	8.486
5.8	3.516	4.096	4.676	5.256	5.836	6.416	6.996	7.576	8.156	8.736
6.0	3.584	4.184	4.784	5.384	5.984	6.584	7.184	7.784	8.384	8.984
6.2	3.649	4.269	4.889	5.509	6.129	6.749	7.369	7.989	8.609	9.229
6.4	3.713	4.353	4.993	5.633	6.273	6.913	7.553	8.193	8.833	9.473
6.6	3.774	4.434	5.094	5.754	6.414	7.074	7.734	8.394	9.054	9.714
6.8	3.834	4.514	5.194	5.874	6.554	7.234	7.914	8.594	9.274	9.954
7.0	3.892	4.592	5.292	5.992	6.692	7.392	8.092	8.792	9.492	10.192
7.2	3.948	4.668	5.388	6.108	6.828	7.548	8.268	8.988	9.708	10.428
7.4	4.003	4.743	5.483	6.223	6.963	7.703	8.443	9.183	9.923	10.663
7.6	4.056	4.816	5.576	6.336	7.096	7.856	8.616	9.376	10.136	10.896
7.8	4.108	4.888	5.668	6.448	7.228	8.008	8.788	9.568	10.348	11.128
8.0	4.159	4.959	5.759	6.559	7.359	8.159	8.959	9.759	10.559	11.359
8.2	4.208	5.028	5.848	6.668	7.488	8.308	9.128	9.948	10.768	11.588
8.4	4.256	5.096	5.936	6.776	7.616	8.456	9.296	10.136	10.976	11.816
8.6	4.304	5.164	6.024	6.884	7.744	8.604	9.464	10.324	11.184	12.044
8.8	4.350	5.230	6.110	6.990	7.870	8.750	9.630	10.510	11.390	12.270
9.0	4.394	5.294	6.194	7.094	7.994	8.894	9.794	10.694	11.594	12.494
9.2	4.438	5.358	6.278	7.198	8.118	9.038	9.958	10.878	11.798	12.718
9.4	4.481	5.421	6.361	7.301	8.241	9.181	10.121	11.061	12.001	12.941
9.6	4.524	5.484	6.444	7.404	8.364	9.324	10.284	11.244	12.204	13.164
9.8	4.565	5.545	6.525	7.505	8.485	9.465	10.445	11.425	12.405	13.385
10.0	4.605	5.605	6.605	7.605	8.605	9.605	10.605	11.605	12.605	13.605
11.0	4.796	5.896	6.996	8.096	9.196	10.296	11.396	12.496	13.596	14.696
12.0	4.970	6.170	7.370	8.570	9.770	10.970	12.170	13.370	14.570	15.770
13.0	5.130	6.430	7.730	9.030	10.330	11.630	12.930	14.230	15.530	16.830
14.0	5.278	6.678	8.078	9.478	10.878	12.278	13.678	15.078	16.478	17.878
15.0	5.416	6.916	8.416	9.916	11.416	12.916	14.416	15.916	17.416	18.916
16.0	5.545	7.145	8.745	10.345	11.945	13.545	15.145	16.745	18.345	19.945
17.0	5.666	7.366	9.066	10.766	12.466	14.166	15.866	17.566	19.266	20.966
18.0	5.781	7.581	9.381	11.181	12.981	14.781	16.581	18.381	20.181	21.981
19.0	5.889	7.789	9.689	11.589	13.489	15.389	17.289	19.189	21.089	22.989
20.0	5.991	7.991	9.991	11.991	13.991	15.991	17.991	19.991	21.991	23.991
25.0	6.438	8.938	11.438	13.938	16.438	18.938	21.438	23.938	26.438	28.938
30.0	6.802	9.802	12.802	15.802	18.802	21.802	24.802	27.802	30.802	33.802
40.0	7.378	11.378	15.378	19.378	23.378	27.378	31.378	35.378	39.378	43.378
50.0	7.824	12.824	17.824	22.824	27.824	32.824	37.824	42.824		
75.0	8.635	16.135	23.635	31.135	38.635	46.135				
100.0	9.210	19.210	29.210	39.210	49.210					
150.0	10.021	25.021	40.021							
200.0	10.597	30.597	50.597							
250.0	11.043	36.043	61.043							

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C2.—Visual range of point sources of light

Function $(\sigma D + 2 \log_e D)$

Visual range D km.	Extinction coefficient, σ, km.⁻¹ 0	1	2	3	4	5	6	7	8	9
0.004										
0.005										
0.006										
0.007	−9.924	−9.917	−9.910	−9.903	−9.896	−9.889	−9.882	−9.875	−9.868	−9.861
0.008	−9.657	−9.649	−9.641	−9.633	−9.625	−9.617	−9.609	−9.601	−9.593	−9.585
0.009	−9.421	−9.412	−9.403	−9.394	−9.385	−9.376	−9.367	−9.358	−9.349	−9.340
0.01	−9.210	−9.200	−9.190	−9.180	−9.170	−9.160	−9.150	−9.140	−9.130	−9.120
0.02	−7.824	−7.804	−7.784	−7.764	−7.744	−7.724	−7.704	−7.684	−7.664	−7.644
0.03	−7.013	−6.983	−6.953	−6.923	−6.893	−6.863	−6.833	−6.803	−6.773	−6.743
0.04	−6.438	−6.398	−6.358	−6.318	−6.278	−6.238	−6.198	−6.158	−6.118	−6.078
0.05	−5.991	−5.941	−5.891	−5.841	−5.791	−5.741	−5.691	−5.641	−5.591	−5.541
0.06	−5.627	−5.567	−5.507	−5.447	−5.387	−5.327	−5.267	−5.207	−5.147	−5.087
0.07	−5.319	−5.249	−5.179	−5.109	−5.039	−4.969	−4.899	−4.829	−4.759	−4.689
0.08	−5.051	−4.971	−4.891	−4.811	−4.731	−4.651	−4.571	−4.491	−4.411	−4.331
0.09	−4.816	−4.726	−4.636	−4.546	−4.456	−4.366	−4.276	−4.186	−4.096	−4.006
0.1	−4.605	−4.505	−4.405	−4.305	−4.205	−4.105	−4.005	−3.905	−3.805	−3.705
0.2	−3.219	−3.019	−2.819	−2.619	−2.419	−2.219	−2.019	−1.819	−1.619	−1.419
0.3	−2.408	−2.108	−1.808	−1.508	−1.208	−0.908	−0.608	−0.308	−0.008	0.292
0.4	−1.833	−1.433	−1.033	−0.633	−0.233	0.167	0.567	0.967	1.367	1.767
0.5	−1.386	−0.886	−0.386	0.114	0.614	1.114	1.614	2.114	2.614	3.114
0.6	−1.022	−0.422	0.178	0.778	1.378	1.978	2.578	3.178	3.778	4.378
0.7	−0.713	−0.013	0.687	1.387	2.087	2.787	3.487	4.187	4.887	5.587
0.8	−0.446	0.354	1.154	1.954	2.754	3.554	4.354	5.154	5.954	6.754
0.9	−0.211	0.689	1.589	2.489	3.389	4.289	5.189	6.089	6.989	7.889
1.0	0.000	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000
1.1	0.191	1.291	2.391	3.491	4.591	5.691	6.791	7.891	8.991	10.091
1.2	0.365	1.565	2.765	3.965	5.165	6.365	7.565	8.765	9.965	11.165
1.3	0.525	1.825	3.125	4.425	5.725	7.025	8.325	9.625	10.925	12.225
1.4	0.673	2.073	3.473	4.873	6.273	7.673	9.073	10.473	11.873	13.273
1.5	0.811	2.311	3.811	5.311	6.811	8.311	9.811	11.311	12.811	14.311
1.6	0.940	2.540	4.140	5.740	7.340	8.940	10.540	12.140	13.740	15.340
1.7	1.061	2.761	4.461	6.161	7.861	9.561	11.261	12.961	14.661	16.361
1.8	1.176	2.976	4.776	6.576	8.376	10.176	11.976	13.776	15.576	17.376
1.9	1.284	3.184	5.084	6.984	8.884	10.784	12.684	14.584	16.484	18.384
2.0	1.386	3.386	5.386	7.386	9.386	11.386	13.386	15.386	17.386	19.386
2.1	1.484	3.584	5.684	7.784	9.884	11.984	14.084	16.184	18.284	20.384
2.2	1.577	3.777	5.977	8.177	10.377	12.577	14.777	16.977	19.177	21.377
2.3	1.666	3.966	6.266	8.566	10.866	13.166	15.466	17.766	20.066	22.366
2.4	1.751	4.151	6.551	8.951	11.351	13.751	16.151	18.551	20.951	23.351
2.5	1.833	4.333	6.833	9.333	11.833	14.333	16.833	19.333	21.833	24.333
2.6	1.911	4.511	7.111	9.711	12.311	14.911	17.511	20.111	22.711	25.311
2.7	1.986	4.686	7.386	10.086	12.786	15.486	18.186	20.886	23.586	26.286
2.8	2.059	4.859	7.659	10.459	13.259	16.059	18.859	21.659	24.459	27.259
2.9	2.129	5.029	7.929	10.829	13.729	16.629	19.529	22.429	25.329	28.229
3.0	2.197	5.197	8.197	11.197	14.197	17.197	20.197	23.197	26.197	29.197
3.2	2.326	5.526	8.726	11.926	15.126	18.326	21.526	24.726	27.926	31.126
3.4	2.448	5.848	9.248	12.648	16.048	19.448	22.848	26.248	29.648	33.048
3.6	2.562	6.162	9.762	13.362	16.962	20.562	24.162	27.762	31.362	34.962
3.8	2.670	6.470	10.270	14.070	17.870	21.670	25.470	29.270	33.070	
4.0	2.773	6.773	10.773	14.773	18.773	22.773	26.773	30.773		

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C2.—Visual range of point sources of light

Function ($\sigma D + 2 \log_e D$)

Visual range D km.	Extinction coefficient, σ, km.⁻¹ 0	1	2	3	4	5	6	7	8	9
4.0	2.773	6.773	10.773	14.773	18.773	22.773	26.773	30.773		
4.2	2.870	7.070	11.270	15.470	19.670	23.870	28.070	32.270		
4.4	2.963	7.363	11.763	16.163	20.563	24.963	29.363	33.763		
4.6	3.052	7.652	12.252	16.852	21.452	26.052	30.652			
4.8	3.137	7.937	12.737	17.537	22.337	27.137	31.937			
5.0	3.219	8.219	13.219	18.219	23.219	28.219	33.219			
5.2	3.297	8.497	13.697	18.897	24.097	29.297	34.497			
5.4	3.373	8.773	14.173	19.573	24.973	30.373				
5.6	3.446	9.046	14.646	20.246	25.846	31.446				
5.8	3.516	9.316	15.116	20.916	26.716	32.516				
6.0	3.584	9.584	15.584	21.584	27.584	33.584				
6.2	3.649	9.849	16.049	22.249	28.449	34.649				
6.4	3.713	10.113	16.513	22.913	29.313	35.713				
6.6	3.774	10.374	16.974	23.574	30.174					
6.8	3.834	10.634	17.434	24.234	31.034					
7.0	3.892	10.892	17.892	24.892	31.892					
7.2	3.948	11.148	18.348	25.548	32.748					
7.4	4.003	11.403	18.803	26.203	33.603					
7.6	4.056	11.656	19.256	26.856	34.456					
7.8	4.108	11.908	19.708	27.508	35.308					
8.0	4.159	12.159	20.159	28.159	36.159					
8.2	4.208	12.408	20.608	28.808	37.008					
8.4	4.256	12.656	21.056	29.456	37.856					
8.6	4.304	12.904	21.504	30.104						
8.8	4.350	13.150	21.950	30.750						
9.0	4.394	13.394	22.394	31.394						
9.2	4.438	13.638	22.838	32.038						
9.4	4.481	13.881	23.281	32.681						
9.6	4.524	14.124	23.724	33.324						
9.8	4.565	14.365	24.165	33.965						
10.0	4.605	14.605	24.605	34.605						
11.0	4.796	15.796	26.796	37.796						
12.0	4.970	16.970	28.970	40.970						
13.0	5.130	18.130	31.130							
14.0	5.278	19.278	33.278							
15.0	5.416	20.416	35.416							
16.0	5.545	21.545	37.545							
17.0	5.666	22.666	39.666							
18.0	5.781	23.781	41.781							
19.0	5.889	24.889	43.889							
20.0	5.991	25.991	45.991							
25.0	6.438	31.438								
30.0	6.802	36.802								
40.0	7.378	47.378								
50.0	7.824	57.824								
75.0	8.635	83.635								
100.0	9.210									
150.0	10.021									
200.0	10.597									
250.0	11.043									

(continued)

HORIZONTAL VISIBILITY

TABLE 160–C2.—Visual range of point sources of light

Function $(\sigma D + 2 \log_e D)$

Visual range D km.	Extinction coefficient, σ, km.⁻¹ 0	10	15	20	30	40	50	100	500	1000
0.004									−9.043	−7.043
0.005									−8.097	−5.597
0.006						−9.992	−9.932	−9.632	−7.232	−4.232
0.007	−9.924	−9.854	−9.819	−9.784	−9.714	−9.644	−9.574	−9.224	−6.424	−2.924
0.008	−9.657	−9.577	−9.537	−9.497	−9.417	−9.337	−9.257	−8.857	−5.657	−1.657
0.009	−9.421	−9.331	−9.286	−9.241	−9.151	−9.061	−8.971	−8.521	−4.921	−0.421
0.01	−9.210	−9.110	−9.060	−9.010	−8.910	−8.810	−8.710	−8.210	−4.210	0.790
0.02	−7.824	−7.624	−7.524	−7.424	−7.224	−7.024	−6.824	−5.824	2.176	12.176
0.03	−7.013	−6.713	−6.563	−6.413	−6.113	−5.813	−5.513	−4.013	7.987	22.987
0.04	−6.438	−6.038	−5.838	−5.638	−5.238	−4.838	−4.438	−2.438	13.562	33.562
0.05	−5.991	−5.491	−5.241	−4.991	−4.491	−3.991	−3.491	−0.991	19.009	44.009
0.06	−5.627	−5.027	−4.727	−4.427	−3.827	−3.227	−2.627	0.373	24.373	54.373
0.07	−5.319	−4.619	−4.269	−3.919	−3.219	−2.519	−1.819	1.681	29.681	64.681
0.08	−5.051	−4.251	−3.851	−3.451	−2.651	−1.851	−1.051	2.949	34.949	
0.09	−4.816	−3.916	−3.466	−3.016	−2.116	−1.216	−0.316	4.184	40.184	
0.1	−4.605	−3.605	−3.105	−2.605	−1.605	−0.605	0.395	5.395	45.395	
0.2	−3.219	−1.219	−0.219	0.781	2.781	4.781	6.781	16.781	96.781	
0.3	−2.408	0.592	2.092	3.592	6.592	9.592	12.592	27.592		
0.4	−1.833	2.167	4.167	6.167	10.167	14.167	18.167	38.167		
0.5	−1.386	3.614	6.114	8.614	13.614	18.614	23.614	48.614		
0.6	−1.022	4.978	7.978	10.978	16.978	22.978	28.978	58.978		
0.7	−0.713	6.287	9.787	13.287	20.287	27.287	34.287			
0.8	−0.446	7.554	11.554	15.554	23.554	31.554				
0.9	−0.211	8.789	13.289	17.789	26.789	35.789				
1.0	0.000	10.000	15.000	20.000	30.000					
1.1	0.191	11.191	16.691	22.191	33.191					
1.2	0.365	12.365	18.365	24.365	36.365					
1.3	0.525	13.525	20.025	26.525	39.525					
1.4	0.673	14.673	21.673	28.673	42.673					
1.5	0.811	15.811	23.311	30.811						
1.6	0.940	16.940	24.940	32.940						
1.7	1.061	18.061	26.561	35.061						
1.8	1.176	19.176	28.176	37.176						
1.9	1.284	20.284	29.784	39.284						
2.0	1.386	21.386	31.386							
2.1	1.484	22.484	32.984							
2.2	1.577	23.577	34.577							
2.3	1.666	24.666	36.166							
2.4	1.751	25.751	37.751							
2.5	1.833	26.833	39.333							
2.6	1.911	27.911	40.911							
2.7	1.986	28.986	42.486							
2.8	2.059	30.059								
2.9	2.129	31.129								
3.0	2.197	32.197								
3.2	2.326	34.326								
3.4	2.448	36.448								
3.6	2.562	38.562								
3.8	2.670	40.670								
4.0	2.773	42.773								

Section XI

GEODETIC AND ASTRONOMICAL TABLES

GEODETIC AND ASTRONOMICAL CONSTANTS

Dimensions of the earth:

	International ellipsoid of reference [1]	Clarke spheroid of 1866 [2]
Semimajor axis $= a$	6378388 m.	6378206.4 m.
Semiminor axis $= b$	6356911.946 m.	6356583.8 m.
Mean radius $= \frac{2a+b}{3}$	6371229.315 m.	
Radius of sphere of same area	6371227.709 m.	
Radius of sphere of same volume	6371221.266 m.	
Length of meridian quadrant	10002288.299 m.	
Length of equatorial quadrant	10019148.4 m.	
Area of ellipsoid	510100934 $km.^2$	
Volume of ellipsoid	1083319.78×10^6 $km.^3$	
Flattening $= f$	1/297	

NOTE.—The Clarke spheroid of 1866 is the reference spheroid for triangulation in the United States, Canada, and Mexico. The International Ellipsoid of Reference is used in South America and in parts of western Europe. It was adopted in 1924 by the International Union of Geodesy and Geophysics and its use is recommended by that body wherever practicable. (See Encyclopedia Britannica, 1947 edition, article on Geodesy, for data concerning other spheroids.)

Mass of the earth [3]	5.975×10^{24} kg.
Mean distance earth to sun (astronomical unit) [3]	1.4968×10^8 km.
Mean linear velocity of the earth in its orbit	29.77 km. $sec.^{-1}$
Mean linear velocity of the surface of the earth at the equator	465.1 m. $sec.^{-1}$
Obliquity of the ecliptic	23°27′

(Also see Table 1, section D, Time.)

[1] U. S. Coast and Geodetic Survey, Spec. Publ. No. 200, 1935.
[2] Ibid., Spec. Publ. No. 5, 1946.
[3] Russell, H. N., Dugan, R. S., and Stewart, J. Q., Astronomy, Ginn and Co., 1945.

TABLE 162

LENGTH OF ONE DEGREE OF THE MERIDIAN

Latitude	International ellipsoid	Clarke spheroid of 1866			Latitude	International ellipsoid	Clarke spheroid of 1866		
	Meters	Meters	Statute miles	Nautical miles		Meters	Meters	Statute miles	Nautical miles
0–1°	110575.6	110567.3	68.703	59.661	45–46	111145.2	111140.8	69.060	59.971
1–2	110576.3	110568.0	68.704	59.662	46–47	111164.8	111160.5	69.072	59.981
2–3	110577.6	110569.4	68.705	59.662	47–48	111184.4	111180.2	69.084	59.992
3–4	110579.7	110571.4	68.706	59.664	48–49	111203.9	111199.9	69.096	60.003
4–5	110582.4	110574.1	68.707	59.665	49–50	111223.4	111219.5	69.108	60.013
5–6	110585.8	110577.6	68.710	59.667	50–51	111242.7	111239.0	69.121	60.024
6–7	110589.8	110581.6	68.712	59.669	51–52	111261.9	111258.3	69.133	60.034
7–8	110594.5	110586.4	68.715	59.672	52–53	111281.0	111277.6	69.145	60.045
8–9	110599.9	110591.8	68.718	59.675	53–54	111299.9	111296.6	69.156	60.055
9–10	110605.9	110597.8	68.722	59.678	54–55	111318.6	111315.4	69.168	60.065
10–11	110612.5	110604.5	68.726	59.681	55–56	111337.1	111334.0	69.180	60.075
11–12	110619.8	110611.9	68.731	59.685	56–57	111355.4	111352.4	69.191	60.085
12–13	110627.8	110619.8	68.736	59.690	57–58	111373.4	111370.5	69.202	60.095
13–14	110636.3	110628.4	68.741	59.694	58–59	111391.1	111388.4	69.213	60.104
14–15	110645.4	110637.6	68.747	59.699	59–60	111408.5	111405.9	69.224	60.114
15–16	110655.2	110647.5	68.753	59.705	60–61	111425.5	111423.1	69.235	60.123
16–17	110665.5	110657.8	68.759	59.710	61–62	111442.3	111439.9	69.246	60.132
17–18	110676.4	110668.8	68.766	59.716	62–63	111458.6	111456.4	69.256	60.141
18–19	110687.9	110680.4	68.773	59.722	63–64	111474.6	111472.4	69.266	60.150
19–20	110699.9	110692.4	68.781	59.729	64–65	111490.1	111488.1	69.275	60.158
20–21	110712.4	110705.1	68.789	59.736	65–66	111505.2	111503.3	69.285	60.166
21–22	110725.4	110718.2	68.797	59.743	66–67	111519.9	111518.0	69.294	60.174
22–23	110739.0	110731.8	68.805	59.750	67–68	111534.1	111532.3	69.303	60.182
23–24	110753.0	110746.0	68.814	59.758	68–69	111547.8	111546.2	69.311	60.190
24–25	110767.5	110760.6	68.823	59.765	69–70	111561.0	111559.5	69.320	60.197
25–26	110782.5	110775.6	68.833	59.774	70–71	111573.7	111572.2	69.328	60.204
26–27	110797.9	110791.1	68.842	59.782	71–72	111585.9	111584.5	69.335	60.210
27–28	110813.7	110807.0	68.852	59.791	72–73	111597.5	111596.2	69.343	60.217
28–29	110829.9	110823.3	68.862	59.800	73–74	111608.5	111607.3	69.349	60.223
29–30	110846.4	110840.0	68.873	59.808	74–75	111619.0	111617.9	69.356	60.228
30–31	110863.3	110857.0	68.883	59.818	75–76	111628.9	111627.8	69.362	60.234
31–32	110880.6	110874.4	68.894	59.827	76–77	111638.2	111637.1	69.368	60.239
32–33	110898.2	110892.1	68.905	59.837	77–78	111646.8	111645.9	69.373	60.243
33–34	110916.0	110910.1	68.916	59.846	78–79	111654.9	111653.9	69.378	60.248
34–35	110934.2	110928.3	68.928	59.856	79–80	111662.3	111661.4	69.383	60.252
35–36	110952.6	110946.9	68.939	59.866	80–81	111669.1	111668.2	69.387	60.255
36–37	110971.2	110965.6	68.951	59.876	81–82	111675.2	111674.4	69.391	60.259
37–38	110990.0	110984.5	68.962	59.886	82–83	111680.6	111679.9	69.395	60.262
38–39	111009.0	111003.7	68.974	59.897	83–84	111685.4	111684.7	69.398	60.264
39–40	111028.2	111023.0	68.986	59.907	84–85	111689.5	111688.9	69.400	60.268
40–41	111047.5	111042.4	68.998	59.918	85–86	111693.0	111692.3	69.402	60.268
41–42	111066.9	111061.9	69.011	59.928	86–87	111695.7	111695.1	69.404	60.270
42–43	111086.4	111081.6	69.023	59.939	87–88	111697.8	111697.2	69.405	60.271
43–44	111105.9	111101.3	69.035	59.949	88–89	111699.2	111698.6	69.406	60.272
44–45	111125.5	111121.0	69.047	59.960	89–90	111699.9	111699.3	69.407	60.272

TABLE 163

LENGTH OF ONE DEGREE OF THE PARALLEL

Latitude	International ellipsoid	Clarke spheroid of 1866			Latitude	International ellipsoid	Clarke spheroid of 1866		
	Meters	Meters	Statute miles	Nautical miles		Meters	Meters	Statute miles	Nautical miles
0°	111324	111321	69.172	60.068	45	78850	78849	48.995	42.546
1	111307	111304	69.162	60.059	46	77467	77466	48.136	41.801
2	111257	111253	69.130	60.031	47	76060	76058	47.261	41.041
3	111172	111169	69.078	59.986	48	74629	74628	46.372	40.268
4	111055	111051	69.005	59.922	49	73175	73174	45.469	39.484
5	110903	110900	68.911	59.840	50	71699	71698	44.552	38.688
6	110718	110715	68.795	59.741	51	70201	70200	43.621	37.880
7	110500	110497	68.660	59.622	52	68681	68680	42.676	37.060
8	110248	110245	68.504	59.487	53	67140	67140	41.719	36.229
9	109962	109959	68.326	59.333	54	65579	65578	40.749	35.386
10	109644	109641	68.129	59.161	55	63997	63996	39.766	34.532
11	109292	109289	67.910	58.971	56	62396	62395	38.771	33.668
12	108907	108904	67.670	58.764	57	60775	60774	37.764	32.794
13	108489	108486	67.410	58.538	58	59136	59135	36.745	31.909
14	108038	108036	67.131	58.295	59	57478	57478	35.716	31.015
15	107555	107553	66.830	58.034	60	55803	55802	34.674	30.110
16	107039	107036	66.510	57.756	61	54110	54110	33.623	29.197
17	106490	106487	66.169	57.459	62	52401	52400	32.560	28.275
18	105909	105906	65.808	57.146	63	50675	50675	31.488	27.344
19	105296	105294	65.427	56.816	64	48934	48934	30.406	26.404
20	104651	104649	65.026	56.468	65	47178	47177	29.315	25.456
21	103975	103972	64.606	56.102	66	45407	45407	28.215	24.501
22	103266	103264	64.166	55.720	67	43622	43622	27.106	23.538
23	102527	102524	63.706	55.321	68	41824	41823	25.988	22.567
24	101756	101754	63.228	54.905	69	40012	40012	24.862	21.590
25	100954	100952	62.729	54.473	70	38189	38188	23.729	20.606
26	100122	100119	62.212	54.024	71	36353	36353	22.589	19.616
27	99259	99257	61.676	53.558	72	34506	34506	21.441	18.619
28	98366	98364	61.122	53.076	73	32648	32648	20.287	17.617
29	97443	97441	60.548	52.578	74	30781	30781	19.127	16.609
30	96490	96488	59.956	52.064	75	28904	28903	17.960	15.596
31	95508	95506	59.345	51.534	76	27017	27017	16.788	14.578
32	94497	94495	58.716	50.989	77	25123	25123	15.611	13.556
33	93457	93455	58.071	50.428	78	23220	23220	14.428	12.529
34	92389	92387	57.407	49.851	79	21311	21311	13.242	11.499
35	91292	91290	56.725	49.259	80	19395	19394	12.051	10.465
36	90168	90166	56.027	48.653	81	17472	17472	10.857	9.428
37	89016	89014	55.311	48.031	82	15545	15545	9.659	8.388
38	87836	87835	54.579	47.395	83	13612	13612	8.458	7.345
39	86630	86629	53.829	46.744	84	11675	11675	7.255	6.300
40	85398	85396	53.063	46.079	85	9735	9735	6.049	5.253
41	84139	84137	52.281	45.399	86	7792	7792	4.842	4.205
42	82855	82853	51.483	44.706	87	5846	5846	3.632	3.154
43	81545	81543	50.669	44.000	88	3898	3898	2.422	2.103
44	80210	80208	49.840	43.280	89	1949	1949	1.211	1.052

Table 164

DISTRIBUTION OF WATER AND LAND IN VARIOUS LATITUDE BELTS[1]

Latitude	Northern Hemisphere Water 10^6 km.^{2}	Northern Hemisphere Land 10^6 km.^{2}	Northern Hemisphere Water %	Northern Hemisphere Land %	Southern Hemisphere Water 10^6 km.^{2}	Southern Hemisphere Land 10^6 km.^{2}	Southern Hemisphere Water %	Southern Hemisphere Land %
90–85°	0.979	—	100.0	—	—	0.978	—	100.0
85–80	2.545	0.384	86.9	13.1	—	2.929	—	100.0
80–75	3.742	1.112	77.1	22.9	0.522	4.332	10.7	89.3
75–70	4.414	2.326	65.5	34.5	2.604	4.136	38.6	61.4
70–65	2.456	6.116	28.7	71.3	6.816	1.756	79.5	20.5
65–60	3.123	7.210	31.2	69.8	10.301	0.032	99.7	0.3
60–55	5.399	6.613	45.0	55.0	12.006	0.006	99.9	0.1
55–50	5.529	8.066	40.7	59.3	13.388	0.207	98.5	1.5
50–45	6.612	8.458	43.8	56.2	14.693	0.377	97.5	2.5
45–40	8.411	8.016	51.2	48.8	15.833	0.594	96.4	3.6
40–35	10.029	7.627	56.8	43.2	16.483	1.173	93.4	6.6
35–30	10.806	7.943	57.7	42.3	15.782	2.967	84.2	15.8
30–25	11.747	7.952	59.6	40.4	15.438	4.261	78.4	21.6
25–20	13.354	7.145	65.2	34.8	15.450	5.049	75.4	24.6
20–15	14.981	6.164	70.8	29.2	16.147	4.998	76.4	23.6
15–10	16.553	5.080	76.5	23.5	17.211	4.422	79.6	20.4
10– 5	16.628	5.332	75.7	24.3	16.898	5.062	76.9	23.1
5– 0	17.387	4.737	78.6	21.4	16.792	5.332	75.9	24.1
90– 0°	154.695	100.281	60.7	39.3	206.364	48.611	80.9	19.1

All oceans and seas 361.059×10^6 km.^{2}, 70.8 percent.
All land 148.892×10^6 km.^{2}, 29.2 percent.

[1] Kossinna, Erwin, Die Tiefen des Weltmeeres. Berlin Univ., Inst. f. Meereskunde, Veroff., N. F., A. Geogr.-naturwiss. Reihe, Heft 9, 1921.

SCALE VARIATION FOR STANDARD MAP PROJECTIONS[1]

Three map projections are widely used in meteorology, the polar stereographic, the Lambert conformal conic, and the Mercator, each of which is conformal. That is, the shape of any small area on the map is the same as the shape of the corresponding small area of the earth, all angles are preserved (except at the pole on the Lambert and Mercator projections), and the scale is the same in all directions at any point, a function only of the latitude of the point for a given assumed figure of the earth.

$$\Delta m = sk\Delta n$$

where:

$\Delta n =$ (small) distance on the earth,
$\Delta m =$ corresponding (small) distance on the map,
$s =$ map scale at standard parallel,
$k =$ scale factor for latitude in question.

Values of k are tabulated below assuming the figure of the earth to be spherical and assuming the figure to be that of the International Ellipsoid of Reference.

Latitude	Mercator projection Standard parallel 22½°		Lambert conformal conic projection Standard parallels 30° and 60°		Polar stereographic projection Standard parallel 60°	
	Sphere	International ellipsoid	Sphere	International ellipsoid	Sphere	International ellipsoid
	k	k	k	k	k	k
0°	0.924	0.924	1.283	1.281	1.866	1.860
5	0.927	0.928	1.210	1.208	1.716	1.712
10	0.938	0.938	1.149	1.148	1.590	1.586
15	0.956	0.957	1.099	1.098	1.482	1.480
20	0.983	0.983	1.058	1.058	1.390	1.388
25	1.019	1.019	1.025	1.025	1.312	1.310
30	1.067	1.066	1.000	1.000	1.244	1.243
35	1.128	1.127	0.982	0.982	1.186	1.185
40	1.206	1.205	0.970	0.970	1.136	1.136
45	1.307	1.305	0.966	0.966	1.093	1.093
50	1.437	1.435	0.968	0.969	1.057	1.057
55	1.611	1.608	0.979	0.979	1.026	1.026
60	1.848	1.844	1.000	1.000	1.000	1.000
65	2.186	2.181	1.033	1.033	0.979	0.979
70	2.701	2.694	1.084	1.083	0.962	0.962
75	3.570	3.560	1.162	1.162	0.949	0.949
80	5.320	5.306	1.293	1.292	0.940	0.940
85	10.600	10.570	1.566	1.564	0.935	0.936

[1] Gregg, W. R., and Tannehill, I. R., Month. Weath. Rev., vol. 65, p. 415, 1937. (Some values in the original paper have been corrected by recomputation.)

RADIUS OF CURVATURE ON A POLAR STEREOGRAPHIC PROJECTION

In computing gradient wind speeds (Table 40) and in other problems it is necessary to determine a factor r which depends on curvature of the trajectory. This factor arises in taking account of the horizontal component of the centrifugal force acting on a particle. The problem is twofold: (1) to determine the trajectory of the particle on a map, and (2) to determine the required value of r if the trajectory on the map is known. The first problem is of such nature that it cannot be treated adequately here. (NOTE.—In many cases an approximation is made from the curvature of the isobars or streamlines.) The second problem has been solved for the case of a polar stereographic projection, since on this projection a "small circle" on the earth projects as a circle on the map. Table 40 provides a means for computing the desired r for trajectories on a polar stereographic projection.

Let R be the radius of the earth, r' the true radius of the "small circle" on which the particle is assumed to be traveling at a given instant, and α its angular radius (as seen from the center of the earth). Then $r' = R \sin \alpha$. Since we are concerned with the horizontal component of the centrifugal force, the effective horizontal radius of the curvature required in the gradient wind equation is given by $r = r' \sec \alpha = R \tan \alpha$. If an arc on a map representing the instantaneous trajectory of a particle of air is determined, this arc may be regarded as a portion of a "small circle."

To determine r for a given arc of a trajectory on the map:

1. Complete the circle by extending the arc (a set of circular templates will prove very useful).
2. Find the meridian which passes through the center of this circle.
3. Determine the latitudes ϕ_1 and ϕ_2 of the points where this meridian intersects the circle (extend the meridian across the pole if necessary).

4A. If the circle found in step 1 *does not* contain the pole, find the difference between ϕ_1 and ϕ_2 and enter part A of the table with this difference as the argument. The corresponding tabular value is the required radius r in statute miles, from the formula $r = R \tan \frac{1}{2}(\phi_1 - \phi_2)$.

4B. If the circle found in step 1 contains the pole, find the sum $(\phi_1 + \phi_2)$ and enter part B of the table with this sum as the argument. The corresponding tabular value is the required radius r in statute miles, from the formula $r = R \tan [90° - \frac{1}{2}(\phi_1 + \phi_2)]$.

(*continued*)

RADIUS OF CURVATURE ON A POLAR STEREOGRAPHIC PROJECTION

A. Circle not including pole.

$\phi_1 - \phi_2$	0	1	2	3	4	5	6	7	8	9
	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.
0°	0	35	69	104	138	173	207	242	277	311
10	346	381	416	451	486	521	556	591	627	662
20	698	733	769	805	841	877	914	950	987	1023
30	1060	1097	1135	1172	1210	1248	1286	1324	1363	1401
40	1440	1479	1519	1559	1599	1639	1680	1721	1762	1803
50	1845	1887	1930	1973	2016	2060	2104	2148	2193	2239
60	2285	2331	2378	2425	2473	2521	2570	2619	2669	2720
70	2771	2822	2875	2928	2982	3036	3092	3148	3204	3262
80	3320	3380	3440	3501	3563	3626	3690	3755	3821	3889
90	3957									

B. Circle including pole.

$\phi_1 + \phi_2$	0	1	2	3	4	5	6	7	8	9
	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.	mi.
0°		453433	226697	151110	113313	90631	75504	64697	56589	50278
10	45229	41093	37648	34730	32227	30057	28156	26477	24984	23646
20	22441	21350	20357	19449	18616	17849	17140	16482	15871	15301
30	14768	14269	13800	13358	12943	12550	12178	11826	11492	11174
40	10872	10583	10308	10045	9794	9553	9322	9100	8887	8683
50	8486	8296	8113	7937	7766	7601	7442	7288	7138	6994
60	6854	6718	6586	6457	6332	6211	6093	5978	5867	5757
70	5651	5547	5446	5347	5251	5157	5065	4975	4886	4800
80	4716	4633	4552	4473	4395	4318	4243	4170	4097	4027
90	3957	3889	3821	3755	3690	3626	3563	3501	3440	3380
100	3320	3262	3204	3148	3092	3036	2982	2928	2875	2822
110	2771	2720	2669	2619	2570	2521	2473	2425	2378	2331
120	2285	2239	2193	2148	2104	2060	2016	1973	1930	1887
130	1845	1803	1762	1721	1680	1639	1599	1559	1519	1479
140	1440	1401	1363	1324	1286	1248	1210	1172	1135	1097
150	1060	1023	987	950	914	877	841	805	769	733
160	698	662	627	591	556	521	486	451	416	381
170	346	311	277	242	207	173	138	104	69	35

ACCELERATION OF GRAVITY

Acceleration of gravity at sea level.—The International Association of Geodesy (Stockholm, 1930) adopted the International Gravity Formula[1] to represent the acceleration of gravity at sea level. This formula assumes the figure of the earth to be that of the International Ellipsoid of Reference[2] and the value of sea-level gravity at latitude 45° (g_{45}) to be 980.629 cm. sec.$^{-2}$ (Potsdam system).[3] Later summaries and investigations by Dryden[3] and Jeffreys[4] have indicated that this value is too high by from 12 to 20 parts per million. The best value of g_{45} seems to be in the neighborhood of 980.616 cm. sec.$^{-2}$ This latter has been published by Birge[5] in 1929 and 1941, and has been generally accepted by physicists and others.

Resolution 77 of the I. M. O. Conference of Directors (Washington, 1947) states:

The conference recommends that the International Meteorological Organization request the International Geodetic Association to advise on the value that should be adopted for g_{45} and on the form of the equation connecting g with latitude and height.

In 1949, in response to this request, W. D. Lambert, President of the International Association of Geodesy, prepared a report on Gravity Formulas for Meteorological Purposes, and made the following recommendations:

(1) That meteorologists adopt either 980.616 or 980.62 cm. sec.$^{-2}$ to represent gravity at sea level in geographic latitude 45°.

My own personal preference is for 980.616 cm. sec.$^{-2}$ and for two reasons:

(a) It seems on the whole, as far as an outsider like myself can judge, to have been more frequently used than the round figure 980.62.

(b) It represents a correction of -0.013 cm. sec.$^{-2}$ to the Potsdam system, which seems more in line with our present ideas as to the ultimate correction to the Potsdam system than the correction of -0.009 cm. sec.$^{-2}$ implied by the adoption of 980.62.

(2) That meteorologists make every effort to obtain gravity observations at their weather stations, so as to rid themselves of the inevitable uncertainty of predicted values.

(3) That they apply the correction of -0.013 or -0.009 cm. sec.$^{-2}$ to such observed values, since these latter will for the present be on the Potsdam system.

(4) That it be made very plain in all meteorological publications, especially in those likely to be read by non-meteorologists, that all gravity values, observed or theoretical, are on what might be called "The Meteorological Gravity System" and therefore require corrections of $+0.013$ or $+0.009$ cm. sec.$^{-2}$ to reduce them back to the Potsdam system for comparison with other values in general use.

(5) That the coefficients in the formulas for theoretical gravity at sea level and for the decrease of gravity with elevation and for geopotential be based with mathematical rigor on whatever standard gravity may be adopted and on the dimensions of the International Ellipsoid of Reference.

(6) That, whenever an observed value of gravity is not available at the meteorological station, a value of gravity should be predicted by interpolation between other gravity stations in the vicinity and computed according to equation (2). (See below.)

(7) That, whenever observed values of gravity are not available for either the meteorological station or any other points within 25 to 50 miles from the meteorological station, a value of gravity should be predicted by computation according to equations (3) or (4). (See below.)

Sea-level gravity formula.—In view of the above, a value of $g_{45} = 980.616$ cm. sec.$^{-2}$ has been adopted for this volume. The equation recommended by Lambert for the variation of sea-level gravity with latitude in the "Meteorological Gravity System," based on the International Ellipsoid of Reference, is

$$g_\phi = 978.0356\ (1 + 0.0052885 \sin^2\phi - 0.0000059 \sin^2 2\phi)$$
$$= 980.6160\ (1 - 0.0026373 \cos 2\phi + 0.0000059 \cos^2 2\phi) \qquad (1)$$

[1] Lambert, W. D., Amer. Journ. Sci., vol. 243-A, Daly volume, p. 360, 1945.

[2] Lambert, W. D., and Swick, C. H., Formulas and tables for the computation of geodetic positions on the International Ellipsoid, Spec. Publ. 200, U. S. Coast and Geod. Surv., Washington, 1935.

[3] Dryden, H. L., Nat. Bur. Stand. Journ. Res., vol. 29, p. 303, 1942.

[4] Jeffreys, H., Monthly Notices, Roy. Astron. Soc., Geophys. Suppl., vol. 5, No. 7, July, 1948.

[5] Birge, R. T., Rev. Mod. Phys., vol. 13, p. 233, 1941, and Phys. Rev. Suppl., vol. 1, No. 1, 1929.

(*continued*)

where g_ϕ is the sea-level acceleration of gravity in cm. sec.$^{-2}$, at latitude ϕ. Tables 167 and 168 have been computed from equation (1).

It is emphasized that all values of g_ϕ in this system are 0.013 cm. sec.$^{-2}$ lower than those given by the Potsdam System ($g_{45} = 980.629$ cm. sec.$^{-2}$) which is now in universal use by geodesists.

A discussion of the value of standard gravity to be used in reducing meteorological observations appears in the Introduction, page 3.

Local acceleration of gravity.—Three methods, in order of preference, for obtaining the local value of gravity g_1 at a given station are:

1. Observe gravity with a gravimeter or any other type of gravity apparatus.
2. Compute gravity by interpolation of Bouguer anomalies. (Equation (2).)
3. Compute theoretical gravity using a combination of the free-air and Bouguer reductions. (Equations (3) or (4).)

Use of gravimeters.—The rapid development of gravimeters in recent years has completely changed the problem of values of gravity at meteorological stations. Over large parts of the land area of the globe it is no longer necessary to depend on theoretical values of gravity, with all their uncertainties. Nets of gravity stations are so widespread that existing meteorological stations can be readily tied into them. The determination of gravity differences by means of gravimeters is very rapid. (From the report to the I. M. O., by W. D. Lambert.)

It is again to be emphasized that allowance must be made for the difference between the Potsdam system, the basis for the gravity station network, and the gravity system adopted by the meteorologist. In accordance with the system adopted in this volume, the correction to be applied to the Potsdam system is -0.013 cm. sec.$^{-2}$

Interpolation methods.[6]—For interpolation from known gravity values, the methods of using free-air anomalies, Bouguer anomalies, and isostatic anomalies will be the only ones considered here. Gravity anomaly data can be secured from the various national geodetic surveys. The free-air and the Bouguer anomalies are simple to compute: the gravity data furnished for any gravimetric survey includes either one of these two types of anomalies or both. The *free-air anomaly* is obtained by reducing the theoretical value of gravity at sea level for the latitude of the station to the elevation of the station, and then taking the difference between the observed and the theoretical values. The *Bouguer anomaly* is obtained by applying an additional correction for the horizontal slab of topography above sea level. Either the actual density of the terrain or some assumed average density is used to compute the effect of the topography. The *isostatic anomaly* includes, besides the correction for the elevation of station, the effect of the topography and some assumed distribution of compensating mass over the entire earth.

Using either the interpolated isostatic anomalies or the interpolated Bouguer anomalies leads to gravity values which agree much better with the observed gravity values than using the interpolated free-air anomalies. There does not seem to be much choice between using the isostatic or the Bouguer anomalies. However since the Bouguer anomalies are much more generally available and since they are simpler to compute than the isostatic, the Bouguer interpolation method of obtaining gravity may be considered as the most satisfactory.

Computation by interpolated Bouguer anomalies.—The expression for local gravity, g_1, using interpolated Bouguer anomalies is

$$g_1 = g_\phi - 0.0001968h + A_B \tag{2}$$

where g_ϕ is the sea-level value of gravity at the latitude of the station, h is the elevation of the station above sea level in meters, and A_B is the interpolated Bouguer anomaly.

If the gravity stations are spaced at a density greater than one station per 2,500 square miles, interpolation is usually fairly satisfactory. For a lower density of stations, theoretical values of gravity are probably as good as or better than values of gravity derived from interpolation.

[6] Duerksen, J. A., U. S. Coast and Geodetic Survey, private communication, 1948.
See also Swick, C. H., Pendulum gravity measurement and isostatic reductions. Spec. Publ. 232. U. S. Coast and Geod. Surv., Washington, 1942.

(*continued*)

ACCELERATION OF GRAVITY

Computation of theoretical gravity for surface stations.[7]—Three types of reduction, corresponding to the three types of interpolated gravity anomalies mentioned above, may be considered for the computation of theoretical values of gravity.

A combination of using the free-air and the Bouguer reductions turns out to give the best results. This combination method consists of making a free-air reduction for the elevation of the station, and a Bouguer reduction for the difference of elevation of the station and the elevation of the general terrain. The equation is

$$g_1 = g_\phi - 0.0003086h + 0.0001118(h - h') \qquad (3)$$

where h' is the elevation of the general terrain for a radius of 100 miles, and the other symbols have the same meaning as in equation (2). A similar formula for sea stations is

$$g_1 = g_\phi - 0.0003086h - 0.0000688(D - D') \qquad (4)$$

where D is the depth of water in meters below the station and D' is the depth of water in meters of the general level of the sea bottom for a radius of 100 miles.

Acceleration of gravity in the free air.—Lambert[8] gives the following equation for computing the acceleration of gravity g (cm. sec.$^{-2}$) at height Z meters above sea level in the free air:

$$\begin{aligned} g = g_\phi &- (3.085462 \times 10^{-4} + 2.27 \times 10^{-7} \cos 2\phi) Z \\ &+ (7.254 \times 10^{-11} + 1.0 \times 10^{-13} \cos 2\phi) Z^2 \\ &- (1.517 \times 10^{-17} + 6 \times 10^{-20} \cos 2\phi) Z^3 \end{aligned} \qquad (5)$$

[7] Computation of theoretical gravity in the free air is also discussed in Table 49.
[8] Lambert, W. D., Formula for the geopotential including the effects of elevation and of the flattening of the earth, unpublished manuscript, Oct. 15, 1946.

TABLE 167

ACCELERATION OF GRAVITY AT SEA LEVEL

$$g_\phi = 978.0356\,(1 + 0.0052885 \sin^2 \phi - 0.0000059 \sin^2 2\phi)$$
$$= 980.6160\,(1 - 0.0026373 \cos 2\phi + 0.0000059 \cos^2 2\phi)$$

Latitude	0′	10′	20′	30′	40′	50′
	cm. sec.$^{-2}$	cm. sec.$^{-2}$	cm. sec.$^{-2}$	cm. sec.$^{-2}$	cm. sec.$^{-2}$	cm. sec.$^{-2}$
0°	978.036	978.036	978.036	978.036	978.036	978.037
1	978.037	978.038	978.038	978.039	978.040	978.041
2	978.042	978.043	978.044	978.045	978.047	978.048
3	978.050	978.051	978.053	978.055	978.057	978.059
4	978.061	978.063	978.065	978.067	978.070	978.072
5	978.075	978.077	978.080	978.083	978.086	978.089
6	978.092	978.095	978.098	978.102	978.105	978.109
7	978.112	978.116	978.120	978.123	978.127	978.131
8	978.135	978.140	978.144	978.148	978.153	978.157
9	978.162	978.166	978.171	978.176	978.181	978.186
10	978.191	978.196	978.201	978.207	978.212	978.218
11	978.223	978.229	978.234	978.240	978.246	978.252
12	978.258	978.264	978.271	978.277	978.283	978.290
13	978.296	978.303	978.310	978.316	978.323	978.330
14	978.337	978.344	978.351	978.358	978.366	978.373
15	978.381	978.388	978.396	978.403	978.411	978.419
16	978.427	978.435	978.443	978.451	978.459	978.468
17	978.476	978.484	978.493	978.501	978.510	978.519
18	978.528	978.536	978.545	978.554	978.563	978.572
19	978.582	978.591	978.600	978.610	978.619	978.629
20	978.638	978.648	978.658	978.667	978.677	978.687
21	978.697	978.707	978.717	978.728	978.738	978.748
22	978.759	978.769	978.780	978.790	978.801	978.812
23	978.822	978.833	978.844	978.855	978.866	978.877
24	978.888	978.899	978.911	978.922	978.933	978.945
25	978.956	978.968	978.979	978.991	979.002	979.014
26	979.026	979.038	979.050	979.062	979.074	979.086
27	979.098	979.110	979.122	979.135	979.147	979.159
28	979.172	979.184	979.197	979.209	979.222	979.234
29	979.247	979.260	979.273	979.286	979.298	979.311
30	979.324	979.337	979.350	979.364	979.377	979.390
31	979.403	979.416	979.430	979.443	979.456	979.470
32	979.483	979.497	979.510	979.524	979.538	979.551
33	979.565	979.579	979.593	979.606	979.620	979.634
34	979.648	979.662	979.676	979.690	979.704	979.718
35	979.732	979.746	979.760	979.775	979.789	979.803
36	979.817	979.832	979.846	979.860	979.875	979.889
37	979.904	979.918	979.933	979.947	979.962	979.976
38	979.991	980.005	980.020	980.035	980.049	980.064
39	980.079	980.093	980.108	980.123	980.138	980.152
40	980.167	980.182	980.197	980.212	980.226	980.241
41	980.256	980.271	980.286	980.301	980.316	980.331
42	980.346	980.361	980.376	980.391	980.406	980.421
43	980.436	980.451	980.466	980.481	980.496	980.511
44	980.526	980.541	980.556	980.571	980.586	980.601
45	980.616	980.631	980.646	980.661	980.676	980.691
46	980.706	980.721	980.736	980.751	980.766	980.781
47	980.796	980.811	980.826	980.841	980.856	980.871
48	980.886	980.901	980.916	980.931	980.946	980.961
49	980.976	980.991	981.006	981.021	981.036	981.050
50	981.065	981.080	981.095	981.110	981.124	981.139

(continued)

TABLE 167 (CONCLUDED)

ACCELERATION OF GRAVITY AT SEA LEVEL

$$g_\phi = 978.0356\,(1 + 0.0052885 \sin^2\phi - 0.0000059 \sin^2 2\phi)$$
$$= 980.6160\,(1 - 0.0026373 \cos 2\phi + 0.0000059 \cos^2 2\phi)$$

Latitude	0′ cm. sec.$^{-2}$	10′ cm. sec.$^{-2}$	20′ cm. sec.$^{-2}$	30′ cm. sec.$^{-2}$	40′ cm. sec.$^{-2}$	50′ cm. sec.$^{-2}$
50°	981.065	981.080	981.095	981.110	981.124	981.139
51	981.154	981.169	981.183	981.198	981.213	981.227
52	981.242	981.257	981.271	981.286	981.300	981.315
53	981.329	981.344	981.358	981.373	981.387	981.401
54	981.416	981.430	981.444	981.459	981.473	981.487
55	981.501	981.515	981.529	981.544	981.558	981.572
56	981.586	981.600	981.613	981.627	981.641	981.655
57	981.669	981.683	981.696	981.710	981.724	981.737
58	981.751	981.764	981.778	981.791	981.805	981.818
59	981.831	981.845	981.858	981.871	981.884	981.897
60	981.911	981.924	981.937	981.950	981.962	981.975
61	981.988	982.001	982.014	982.026	982.039	982.051
62	982.064	982.076	982.089	982.101	982.114	982.126
63	982.138	982.150	982.162	982.175	982.187	982.198
64	982.210	982.222	982.234	982.246	982.258	982.269
65	982.281	982.292	982.304	982.315	982.327	982.338
66	982.349	982.360	982.371	982.382	982.393	982.404
67	982.415	982.426	982.437	982.448	982.458	982.469
68	982.479	982.490	982.500	982.511	982.521	982.531
69	982.541	982.551	982.561	982.571	982.581	982.591
70	982.601	982.610	982.620	982.629	982.639	982.648
71	982.658	982.667	982.676	982.685	982.694	982.703
72	982.712	982.721	982.730	982.738	982.747	982.756
73	982.764	982.772	982.781	982.789	982.797	982.805
74	982.813	982.821	982.829	982.837	982.845	982.852
75	982.860	982.868	982.875	982.882	982.890	982.897
76	982.904	982.911	982.918	982.925	982.932	982.938
77	982.945	982.952	982.958	982.965	982.971	982.977
78	982.983	982.990	982.996	983.001	983.007	983.013
79	983.019	983.024	983.030	983.035	983.041	983.046
80	983.051	983.056	983.061	983.066	983.071	983.076
81	983.081	983.085	983.090	983.094	983.099	983.103
82	983.107	983.111	983.116	983.119	983.123	983.127
83	983.131	983.134	983.138	983.141	983.145	983.148
84	983.151	983.154	983.157	983.160	983.163	983.166
85	983.168	983.171	983.174	983.176	983.178	983.181
86	983.183	983.185	983.187	983.189	983.190	983.192
87	983.194	983.195	983.197	983.198	983.199	983.201
88	983.202	983.203	983.204	983.204	983.205	983.206
89	983.206	983.207	983.207	983.208	983.208	983.208
90	983.208					

RELATIVE ACCELERATION OF GRAVITY AT SEA LEVEL

Ratio of the acceleration of gravity at sea level for each 10′ of latitude, to its acceleration at latitude 45°

$$\frac{g_\phi}{g_{45}} = \frac{g_\phi}{980.616} = 1 - 0.0026373 \cos 2\phi + 0.0000059 \cos^2 2\phi$$

Latitude	0′	10′	20′	30′	40′	50′
0°	0.997369	0.997369	0.997369	0.997369	0.997369	0.997370
1	.997370	.997371	.997371	.997372	.997373	.997374
2	.997375	.997376	.997377	.997379	.997380	.997381
3	.997383	.997385	.997386	.997388	.997390	.997392
4	.997394	.997396	.997399	.997401	.997403	.997406
5	0.997408	0.997411	0.997414	0.997417	0.997420	0.997423
6	.997426	.997429	.997433	.997436	.997439	.997443
7	.997447	.997450	.997454	.997458	.997462	.997466
8	.997470	.997475	.997479	997483	.997488	.997492
9	.997497	.997502	.997507	.997512	.997517	.997522
10	0.997527	0.997532	0.997538	0.997543	0.997549	0.997554
11	.997560	.997566	.997571	.997577	.997583	.997589
12	.997596	.997602	.997608	.997615	.997621	.997628
13	.997634	.997641	.997648	.997655	.997662	.997669
14	.997676	.997683	.997691	.997698	.997705	.997713
15	0.997720	0.997728	0.997736	0.997744	0.997752	0.997760
16	.997768	.997776	.997784	.997792	.997801	.997809
17	.997818	.997826	.997835	.997844	.997852	.997861
18	.997870	.997879	.997888	.997898	.997907	.997916
19	.997925	.997935	.997944	.997954	.997964	.997973
20	0.997983	0.997993	0.998003	0.998013	0.998023	0.998033
21	.998043	.998054	.998064	.998074	.998085	.998095
22	.998106	.998117	.998127	.998138	.998149	.998160
23	.998171	.998182	.998193	.998204	.998215	.998227
24	.998238	.998249	.998261	.998272	.998284	.998296
25	0.998307	0.998319	0.998331	0.998343	0.998355	0.998367
26	.998379	.998391	.998403	.998415	.998427	.998440
27	.998452	.998464	.998477	.998489	.998502	.998514
28	.998527	.998540	.998553	.998565	.998578	.998591
29	.998604	.998617	.998630	.998643	.998656	.998670
30	0.998683	0.998696	0.998709	0.998723	0.998736	0.998750
31	.998763	.998777	.998790	.998804	.998818	.998831
32	.998845	.998859	.998873	.998886	.998900	.998914
33	.998928	.998942	.998956	.998970	.998985	.998999
34	.999013	.999027	.999041	.999056	.999070	.999084
35	0.999099	0.999113	0.999128	0.999142	0.999156	0.999171
36	.999186	.999200	.999215	.999229	.999244	.999259
37	.999274	.999288	.999303	.999318	.999333	.999347
38	.999362	.999377	.999392	.999407	.999422	.999437
39	.999452	.999467	.999482	.999497	.999512	.999527
40	0.999542	0.999557	0.999572	0.999588	0.999603	0.999618
41	.999633	.999648	.999663	.999679	.999694	.999709
42	.999724	.999740	.999755	.999770	.999785	.999801
43	.999816	.999831	.999847	.999862	.999877	.999893
44	.999908	.999923	.999939	.999954	.999969	.999985
45	1.000000	1.000015	1.000031	1.000046	1.000061	1.000077

(continued)

RELATIVE ACCELERATION OF GRAVITY AT SEA LEVEL

Ratio of the acceleration of gravity at sea level for each 10′ of latitude, to its acceleration at latitude 45°

$$\frac{g_\phi}{g_{45}} = \frac{g_\phi}{980.616} = 1 - 0.0026373 \cos 2\phi + 0.0000059 \cos^2 2\phi$$

Latitude	0′	10′	20′	30′	40′	50′
45°	1.000000	1.000015	1.000031	1.000046	1.000061	1.000077
46	1.000092	1.000107	1.000123	1.000138	1.000153	1.000169
47	1.000184	1.000199	1.000215	1.000230	1.000245	1.000260
48	1.000276	1.000291	1.000306	1.000322	1.000337	1.000352
49	1.000367	1.000382	1.000398	1.000413	1.000428	1.000443
50	1.000458	1.000473	1.000488	1.000503	1.000518	1.000534
51	1.000549	1.000564	1.000579	1.000594	1.000609	1.000623
52	1.000638	1.000653	1.000668	1.000683	1.000698	1.000713
53	1.000727	1.000742	1.000757	1.000772	1.000786	1.000801
54	1.000816	1.000830	1.000845	1.000859	1.000874	1.000888
55	1.000903	1.000917	1.000932	1.000946	1.000960	1.000975
56	1.000989	1.001003	1.001017	1.001031	1.001046	1.001060
57	1.001074	1.001088	1.001102	1.001116	1.001130	1.001143
58	1.001157	1.001171	1.001185	1.001199	1.001212	1.001226
59	1.001239	1.001253	1.001267	1.001280	1.001293	1.001307
60	1.001320	1.001333	1.001347	1.001360	1.001373	1.001386
61	1.001399	1.001412	1.001425	1.001438	1.001451	1.001464
62	1.001477	1.001489	1.001502	1.001515	1.001527	1.001540
63	1.001552	1.001565	1.001577	1.001589	1.001602	1.001614
64	1.001626	1.001638	1.001650	1.001662	1.001674	1.001686
65	1.001698	1.001709	1.001721	1.001733	1.001744	1.001756
66	1.001767	1.001779	1.001790	1.001801	1.001813	1.001824
67	1.001835	1.001846	1.001857	1.001868	1.001879	1.001889
68	1.001900	1.001911	1.001921	1.001932	1.001942	1.001953
69	1.001963	1.001973	1.001984	1.001994	1.002004	1.002014
70	1.002024	1.002034	1.002043	1.002053	1.002063	1.002072
71	1.002082	1.002091	1.002101	1.002110	1.002119	1.002128
72	1.002137	1.002146	1.002155	1.002164	1.002173	1.002182
73	1.002190	1.002199	1.002208	1.002216	1.002224	1.002233
74	1.002241	1.002249	1.002257	1.002265	1.002273	1.002281
75	1.002288	1.002296	1.002304	1.002311	1.002319	1.002326
76	1.002333	1.002340	1.002348	1.002355	1.002361	1.002368
77	1.002375	1.002382	1.002388	1.002395	1.002402	1.002408
78	1.002414	1.002420	1.002427	1.002433	1.002439	1.002445
79	1.002450	1.002456	1.002462	1.002467	1.002473	1.002478
80	1.002483	1.002489	1.002494	1.002499	1.002504	1.002509
81	1.002514	1.002518	1.002523	1.002527	1.002532	1.002536
82	1.002541	1.002545	1.002549	1.002553	1.002557	1.002561
83	1.002565	1.002568	1.002572	1.002575	1.002579	1.002582
84	1.002585	1.002588	1.002592	1.002595	1.002597	1.002600
85	1.002603	1.002606	1.002608	1.002611	1.002613	1.002615
86	1.002617	1.002620	1.002622	1.002623	1.002625	1.002627
87	1.002629	1.002630	1.002632	1.002633	1.002634	1.002636
88	1.002637	1.002638	1.002639	1.002640	1.002640	1.002641
89	1.002642	1.002642	1.002642	1.002643	1.002643	1.002643
90	1.002643					

EPHEMERIS OF THE SUN[1]

All data are for 0^h Greenwich Civil Time in the year 1950. Variations of these data from year to year are negligible for most meteorological purposes, the largest variation occurs through the 4-year leap-year cycle. The year 1950 was selected to represent a mean condition in this cycle.

The *declination* of the sun is its angular distance north (+) or south (−) of the celestial equator.

The *longitude* of the sun is the angular distance of the meridian of sun from the vernal equinox (mean equinox of 1950.0) measured eastward along the ecliptic.

The *equation of time* (apparent — mean) is the correction to be applied to mean solar time in order to obtain apparent (true) solar time.

The *radius vector* of the earth is the distance from the center of the earth to the center of the sun expressed in terms of the length of the semimajor axis of the earth's orbit.

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[1] U. S. Naval Observatory, The American ephemeris and nautical almanac for the year 1950, Washington, 1948.

EPHEMERIS OF THE SUN

Date	Declination		Longitude		Equation of time		Radius vector	Date	Declination		Longitude		Equation of time		Radius vector
	°	′	°	′	m.	s.			°	′	°	′	m.	s.	
Jan. 1	−23	4	280	1	− 3	14	0.98324	Feb. 1	−17	19	311	34	−13	34	0.98533
5	22	42	284	5	5	6	.98324	5	16	10	315	37	14	2	.98593
9	22	13	288	10	6	50	.98333	9	14	55	319	40	14	17	.98662
13	21	37	292	14	8	27	.98352	13	13	37	323	43	14	20	.98738
17	20	54	296	19	9	54	.98378	17	12	15	327	46	14	10	.98819
21	20	5	300	23	11	10	.98410	21	10	50	331	48	13	50	.98903
25	19	9	304	27	12	14	.98448	25	9	23	335	49	13	19	.98991
29	18	8	308	31	13	5	.98493								
Mar. 1	− 7	53	339	51	−12	38	0.99084	Apr. 1	+ 4	14	10	42	− 4	12	0.99928
5	6	21	343	51	11	48	.99182	5	5	46	14	39	3	1	1.00043
9	4	48	347	51	10	51	.99287	9	7	17	18	35	1	52	1.00160
13	3	14	351	51	9	49	.99396	13	8	46	22	30	− 0	47	1.00276
17	1	39	355	50	8	42	.99508	17	10	12	26	25	+ 0	13	1.00390
21	− 0	5	359	49	7	32	.99619	21	11	35	30	20	1	6	1.00500
25	+ 1	30	3	47	6	20	.99731	25	12	56	34	14	1	53	1.00606
29	3	4	7	44	5	7	.99843	29	14	13	38	7	2	33	1.00708

(*continued*)

EPHEMERIS OF THE SUN

Date	Declination °	Declination ′	Longitude °	Longitude ′	Equation of time m.	Equation of time s.	Radius vector	Date	Declination °	Declination ′	Longitude °	Longitude ′	Equation of time m.	Equation of time s.	Radius vector
May 1	+14	50	40	4	+ 2	50	1.00759	June 1	+21	57	69	56	+ 2	27	1.01405
5	16	2	43	56	3	17	1.00859	5	22	28	73	46	1	49	1.01465
9	17	9	47	48	3	35	1.00957	9	22	52	77	36	1	6	1.01518
13	18	11	51	40	3	44	1.01051	13	23	10	81	25	+ 0	18	1.01564
17	19	9	55	32	3	44	1.01138	17	23	22	85	15	− 0	33	1.01602
21	20	2	59	23	3	34	1.01218	21	23	27	89	4	1	25	1.01630
25	20	49	63	14	3	16	1.01291	25	23	25	92	53	2	17	1.01649
29	21	30	67	4	2	51	1.01358	29	23	17	96	41	3	7	1.01662
July 1	+23	10	98	36	− 3	31	1.01667	Aug. 1	+18	14	128	11	− 6	17	1.01494
5	22	52	102	24	4	16	1.01671	5	17	12	132	0	5	59	1.01442
9	22	28	106	13	4	56	1.01669	9	16	6	135	50	5	33	1.01384
13	21	57	110	2	5	30	1.01659	13	14	55	139	41	4	57	1.01318
17	21	21	113	51	5	57	1.01639	17	13	41	143	31	4	12	1.01244
21	20	38	117	40	6	15	1.01610	21	12	23	147	22	3	19	1.01163
25	19	50	121	29	6	24	1.01573	25	11	2	151	14	2	18	1.01076
29	18	57	125	19	6	23	1.01530	29	9	39	155	5	1	10	1.00986
Sept. 1	+ 8	35	157	59	− 0	15	1.00917	Oct. 1	− 2	53	187	14	+10	1	1.00114
5	7	7	161	52	+ 1	2	1.00822	5	4	26	191	11	11	17	1.00001
9	5	37	165	45	2	22	1.00723	9	5	58	195	7	12	27	0.99888
13	4	6	169	38	3	45	1.00619	13	7	29	199	5	13	30	.99774
17	2	34	173	32	5	10	1.00510	17	8	58	203	3	14	25	.99659
21	+ 1	1	177	26	6	35	1.00397	21	10	25	207	1	15	10	.99544
25	− 0	32	181	21	8	0	1.00283	25	11	50	211	0	15	46	.99433
29	2	6	185	16	9	22	1.00170	29	13	12	214	59	16	10	.99326
Nov. 1	−14	11	217	59	+16	21	0.99249	Dec. 1	−21	41	248	13	+11	16	0.98604
5	15	27	222	0	16	23	.99150	5	22	16	252	16	9	43	.98546
9	16	38	226	1	16	12	.99054	9	22	45	256	20	8	1	.98494
13	17	45	230	2	15	47	.98960	13	23	6	260	24	6	12	.98446
17	18	48	234	4	15	10	.98869	17	23	20	264	28	4	17	.98405
21	19	45	238	6	14	18	.98784	21	23	26	268	32	2	19	.98372
25	20	36	242	8	13	15	.98706	25	23	25	272	37	+ 0	20	.98348
29	21	21	246	11	11	59	.98636	29	23	17	276	41	− 1	39	.98334

TABLE 170

SOLAR ALTITUDE AND AZIMUTH

The altitude and azimuth of the sun are given by

$$\sin a = \sin \phi \sin \delta + \cos \phi \cos \delta \cos h \qquad (1)$$

and

$$\sin \alpha = -\cos \delta \sin h / \cos a \qquad (2)$$

where

a = altitude of the sun (angular elevation above the horizon),
ϕ = latitude of the observer,
δ = declination of the sun,
h = hour angle of sun (angular distance from the meridian of the observer),
α = azimuth of the sun (measured eastward from north).

From equations (1) and (2) it can be seen that the altitude and azimuth of the sun are functions of the latitude of the observer, the time of day (hour angle) and the date (declination).

Table 170 provides a series of charts, one for each 5 degrees of latitude (except 5°, 15°, 75°, and 85°) giving the altitude and azimuth of the sun as a function of the true solar time and the declination of the sun in a form originally suggested by Hand.[1] Linear interpolation for intermediate latitudes will give results within the accuracy to which the charts can be read.

On these charts, a point corresponding to the projected position of the sun is determined from the heavy lines corresponding to declination and solar time.

To find the solar altitude and azimuth:

1. Select the chart or charts appropriate to the latitude.
2. Find the solar declination δ corresponding to the date in question from Table 169.
3. Determine the *true solar time* as follows:
   (a) To the *local standard time* (zone time) add 4 minutes for each degree of longitude the station is east of the standard meridian or subtract 4 minutes for each degree west of the standard meridian to get the *local mean solar time.*
   (b) To the *local mean solar time* add algebraically the equation of time obtained from Table 169; the sum is the required *true solar time.*
4. Read the required altitude and azimuth at the point determined by the declination and the true solar time. Interpolate linearly between two charts for intermediate latitudes.

It should be emphasized that the solar altitude determined from these charts is the true geometric position of the center of the sun. At low solar elevations terrestrial refraction may considerably alter the apparent position of sun. Under average atmospheric refraction the sun will appear on the horizon when it actually is about 34′ below the horizon; the effect of refraction decreases rapidly with increasing solar elevation. Since sunset or sunrise is defined as the time when the upper limb of the sun appears on the horizon, and the semidiameter of the sun is 16′, sunset or sunrise occurs under average atmospheric refraction when the sun is 50′ below the horizon. In polar regions especially, unusual atmospheric refraction can make considerable variation in the time of sunset or sunrise.

The 90° N. chart is included for interpolation purposes, the azimuths lose their directional significance at the pole.

Altitude and azimuth in southern latitudes.—To compute solar altitude and azimuth for southern latitudes, change the sign of the solar declination and proceed as above. The resulting azimuths will indicate angular distance from *south* (measured eastward) rather than from north.

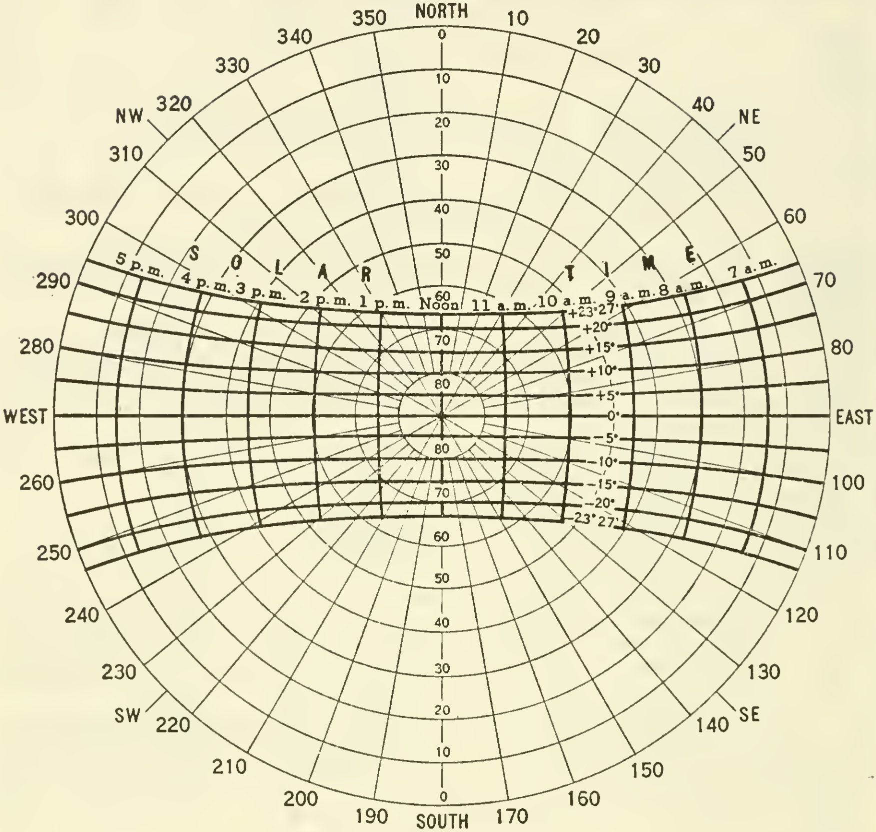
[1] Hand, I. F., Heating and Ventilating, vol. 45, p. 86, 1948.

(*continued*)

TABLE 170 (CONTINUED)

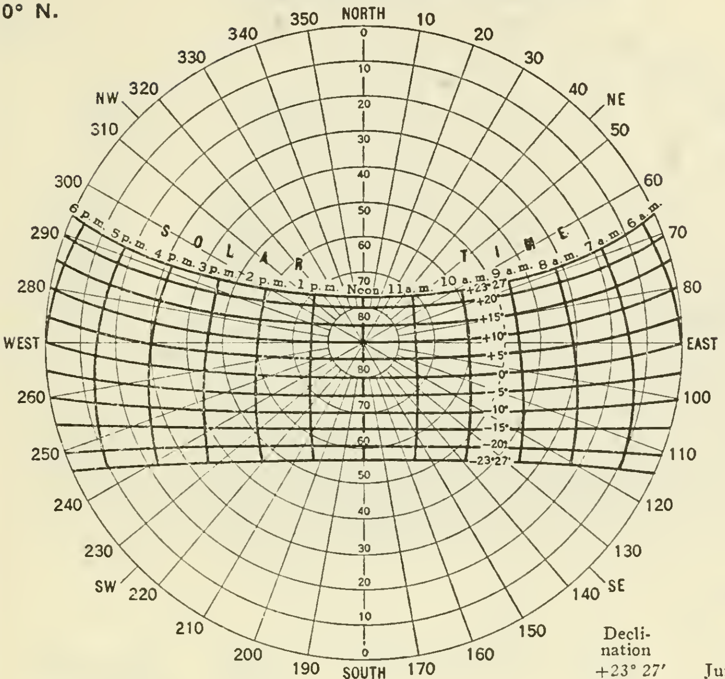
SOLAR ALTITUDE AND AZIMUTH

0°



SOLAR ALTITUDE AND AZIMUTH

10° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Complete data in Table 169.

20° N.

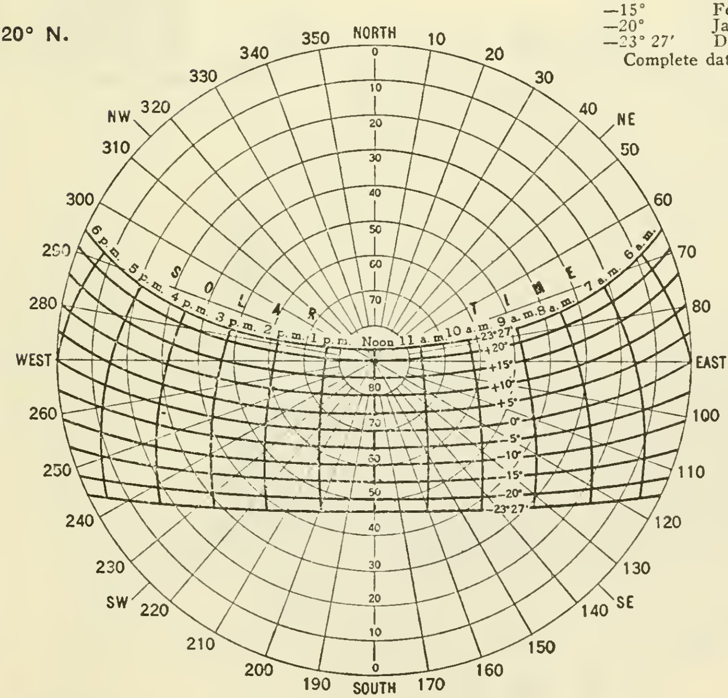
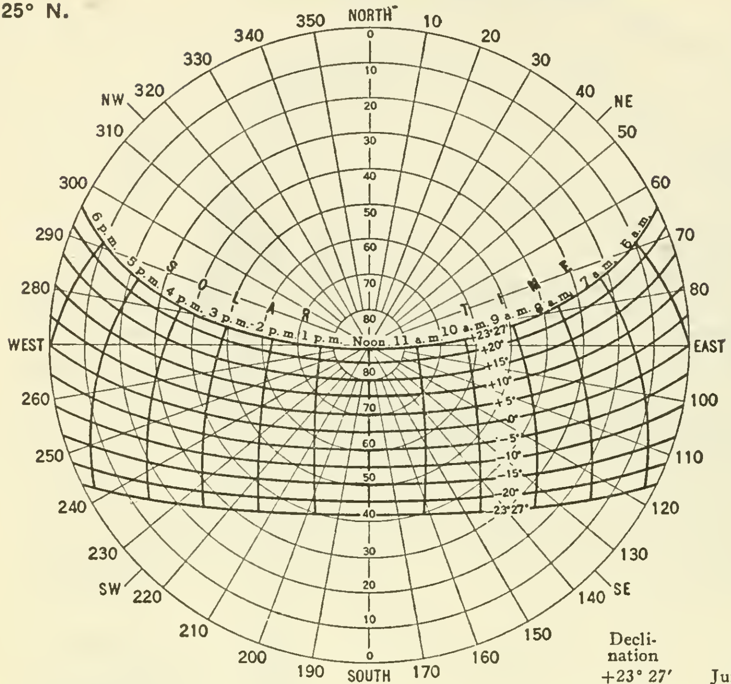


Table 170 (continued)

SOLAR ALTITUDE AND AZIMUTH

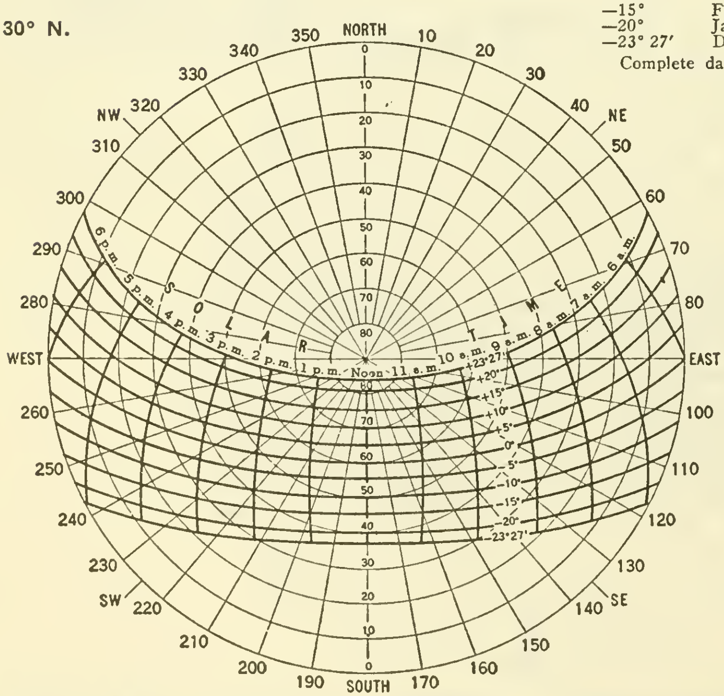
25° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

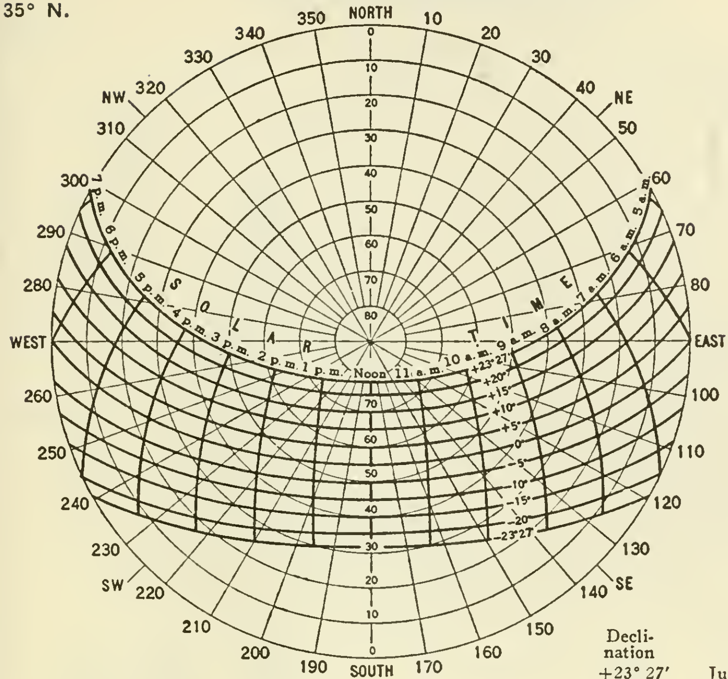
Complete data in Table 169.

30° N.



SOLAR ALTITUDE AND AZIMUTH

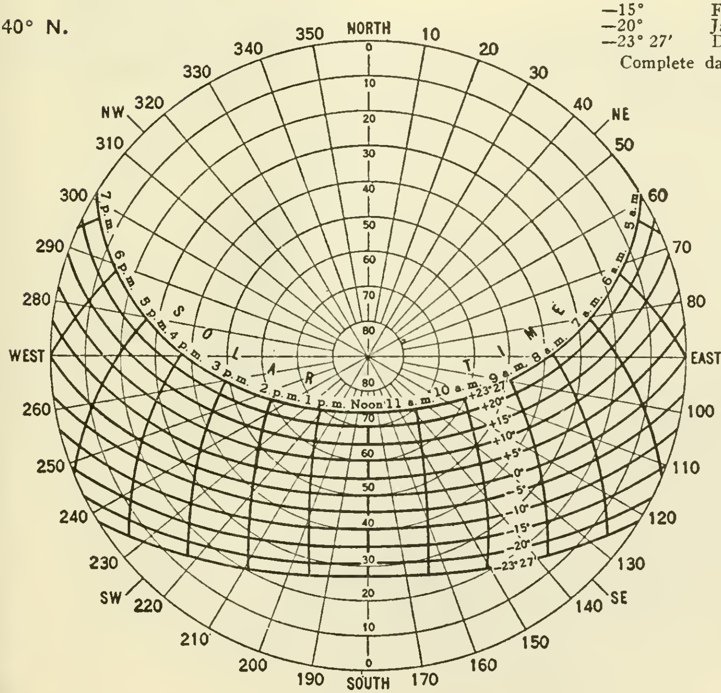
35° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
−10°	Feb. 23, Oct. 20
−15°	Feb. 9, Nov. 3
−20°	Jan. 21, Nov. 22
−23° 27′	Dec. 22

Complete data in Table 169.

40° N.

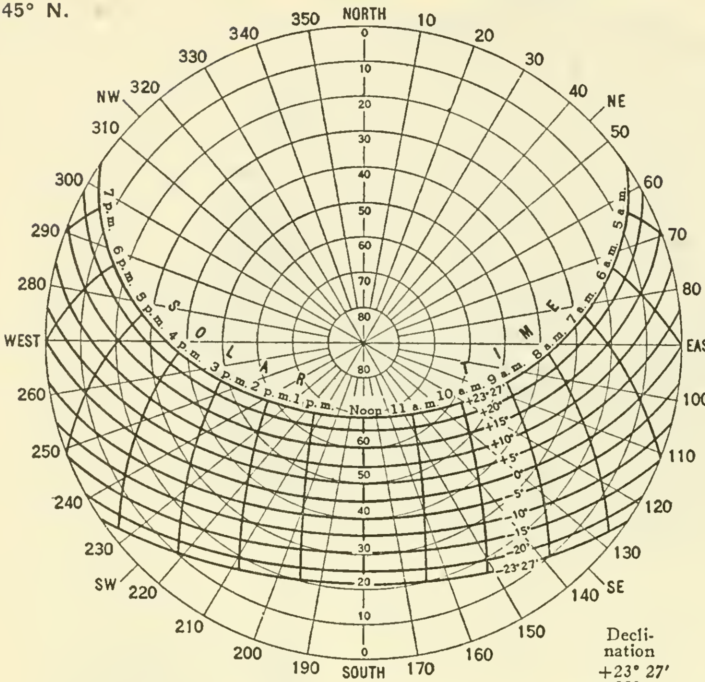


(*continued*)

TABLE 170 (CONTINUED)

SOLAR ALTITUDE AND AZIMUTH

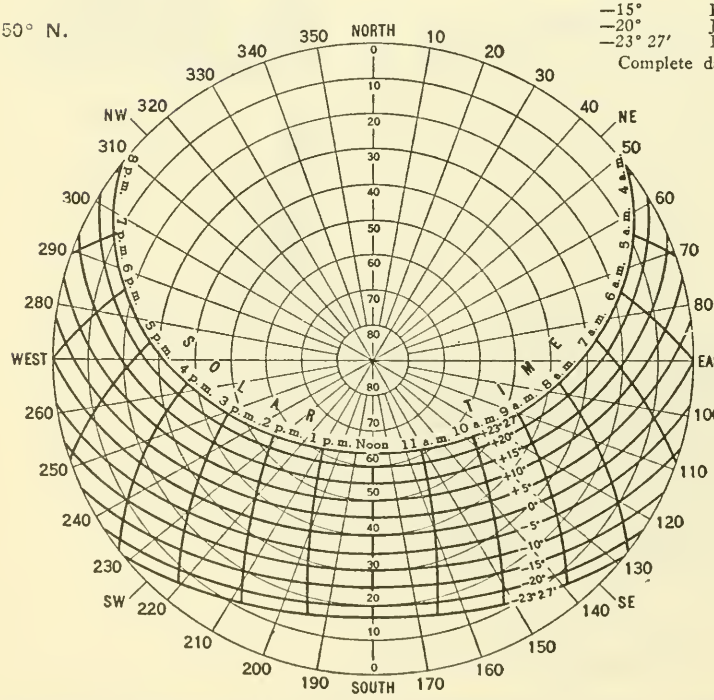
45° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Complete data in Table 169.

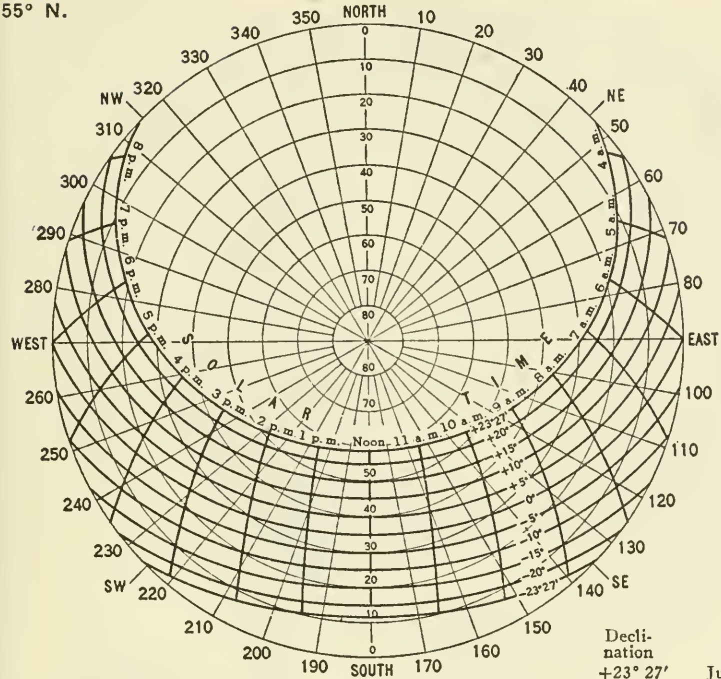
50° N.



 (continued)

SOLAR ALTITUDE AND AZIMUTH

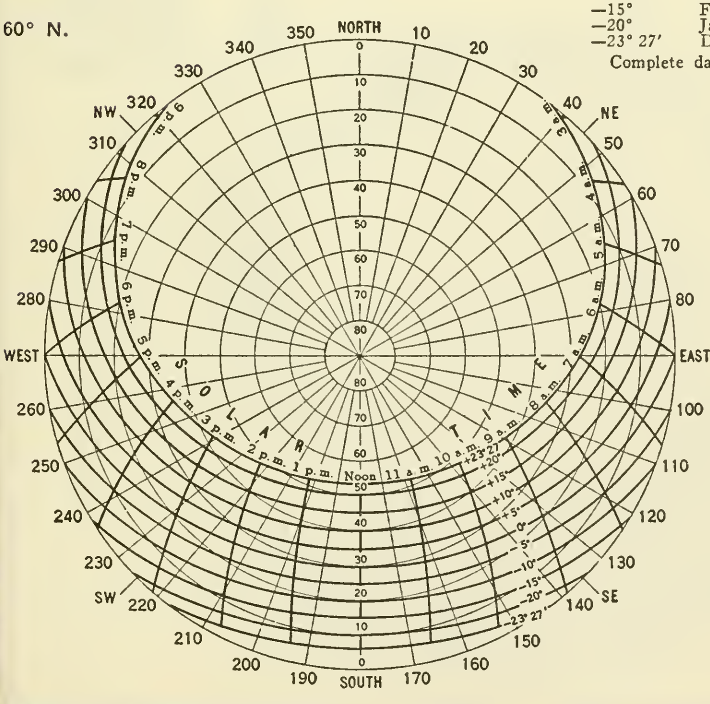
55° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Complete data in Table 169.

60° N.

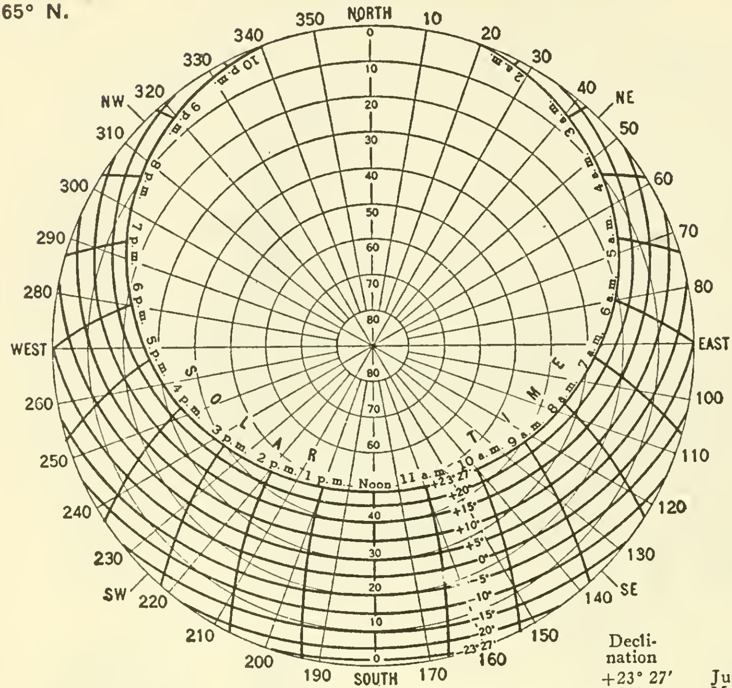


 (continued)

Table 170 (continued)

SOLAR ALTITUDE AND AZIMUTH

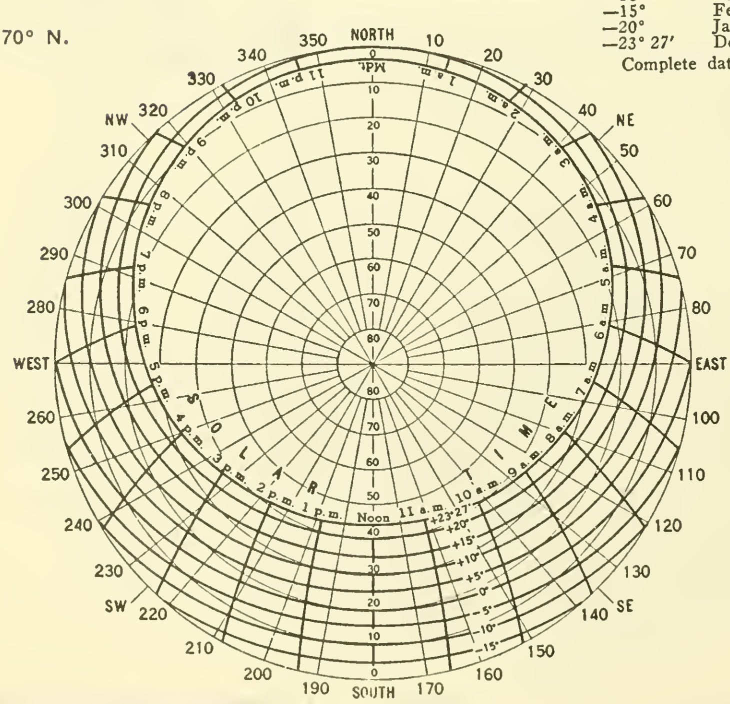
65° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Complete data in Table 169.

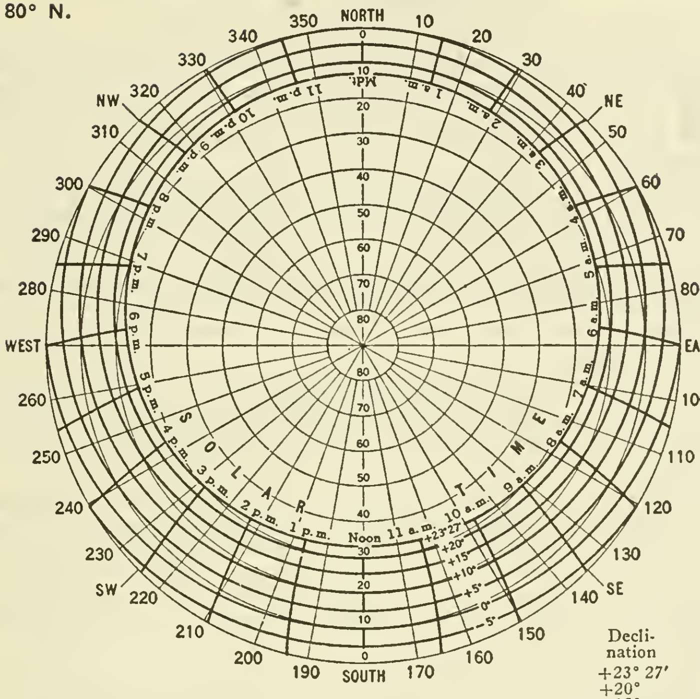
70° N.



(continued)

SOLAR ALTITUDE AND AZIMUTH

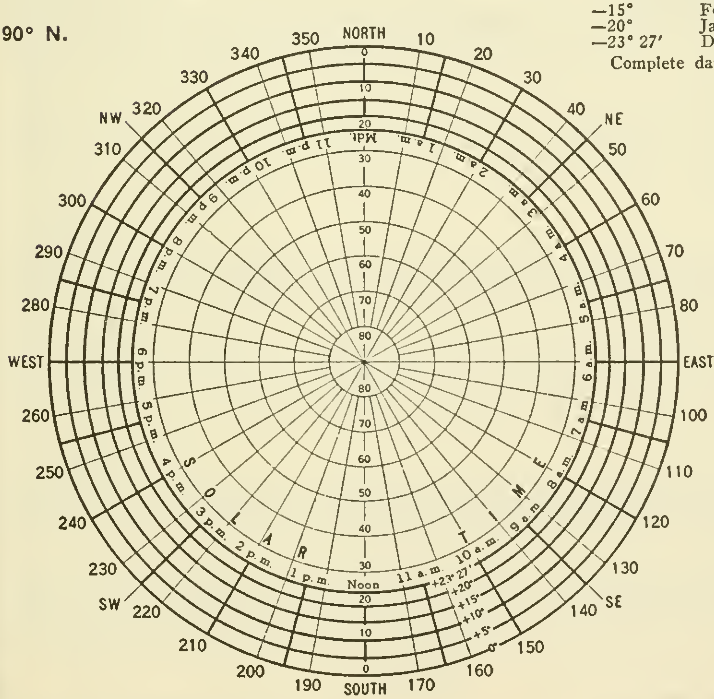
80° N.



Declination	Approx. dates
+23° 27′	June 22
+20°	May 21, July 24
+15°	May 1, Aug. 12
+10°	Apr. 16, Aug. 28
+ 5°	Apr. 3, Sept. 10
0°	Mar. 21, Sept. 23
— 5°	Mar. 8, Oct. 6
—10°	Feb. 23, Oct. 20
—15°	Feb. 9, Nov. 3
—20°	Jan. 21, Nov. 22
—23° 27′	Dec. 22

Complete data in Table 169.

90° N.



DURATION OF DAYLIGHT, CIVIL TWILIGHT, AND ASTRONOMICAL TWILIGHT

Daylight is defined as the interval between sunrise and sunset. The latter are considered to occur when the upper edge of the disk of the sun appears to be exactly on the horizon with an unobstructed horizon and normal atmospheric refraction. It is assumed that the upper edge of the sun appears on the horizon when the true center of the sun's disk is 50′ below the horizon, this corresponds to assuming a semidiameter of 16′ and a constant refraction of 34′.

Civil twilight is defined as the interval between sunrise or sunset and the time when the true position of the center of the sun is 6° below the horizon, at which time stars and planets of the first magnitude are just visible and darkness forces the suspension of normal outdoor activities.

Astronomical twilight is defined as the interval between sunrise or sunset and the time when the true position of the center of the sun is 18° below the horizon, at which time stars of the sixth magnitude are visible near the zenith and generally there is no trace on the horizon of the twilight glow.

Tables 171-174 (including graphs) have been extracted from a publication of the Nautical Almanac Office.[1] The data were computed for longitude 90° W. for the year 1966; however, there will be no appreciable error in using these tables for other localities or for other years during the remainder of the twentieth century in determining the *duration* of daylight or twilight.

For latitudes greater than 65° the data are given in graphical form. At these higher latitudes the data become increasingly uncertain, small changes in atmospheric refraction can cause relatively large changes in the actual phenomena, as can small errors in latitude, and the graphs give a clearer picture of the phenomena. Where the graphs are difficult to read accurately the phenomenon itself is uncertain. These large uncertainties are inevitable consequences of the physical circumstances and are not due to the inadequacy of the graphs.

Tables 171-173 may be used for **Southern Latitudes** by entering the tables not with the actual date but with a date about 6 months earlier or later as given in Table 174.

For a historical summary of the various definitions of twilight and a description of associated phenomena see Kimball.[2]

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[1] Tables of sunrise, sunset and twilight, Supplement to the American ephemeris, 1946, U. S. Naval Observatory, Washington, 1945.

[2] Kimball, Herbert H., Month. Weath. Rev., vol. 44, pp. 614-620, 1916.

TABLE 171

DURATION OF DAYLIGHT

(See p. 506 for discussion and explanation of table.)

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
	Latitude 0°											
1	12 07	12 07	12 07	12 06	12 06	12 07	12 07	12 07	12 06	12 06	12 07	12 08
5	12 07	12 07	12 07	12 07	12 07	12 07	12 07	12 06	12 07	12 07	12 07	12 07
9	12 07	12 07	12 07	12 07	12 07	12 08	12 07	12 07	12 07	12 07	12 07	12 07
13	12 07	12 07	12 07	12 07	12 07	12 08	12 07	12 06	12 06	12 07	12 07	12 07
17	12 07	12 07	12 07	12 07	12 07	12 07	12 08	12 06	12 07	12 07	12 08	12 08
21	12 07	12 07	12 07	12 07	12 07	12 07	12 07	12 06	12 06	12 07	12 07	12 07
25	12 07	12 07	12 06	12 06	12 07	12 07	12 07	12 06	12 06	12 07	12 08	12 08
29	12 07	12 07	12 06	12 07	12 07	12 07	12 07	12 06	12 07	12 07	12 07	12 08
	Latitude 5° N.											
1	11 51	11 55	12 01	12 10	12 18	12 24	12 24	12 20	12 12	12 04	11 57	11 52
5	11 51	11 56	12 03	12 11	12 19	12 24	12 25	12 20	12 11	12 03	11 55	11 51
9	11 51	11 57	12 03	12 12	12 19	12 24	12 24	12 19	12 11	12 02	11 55	11 51
13	11 52	11 57	12 05	12 13	12 21	12 24	12 23	12 18	12 10	12 01	11 54	11 50
17	11 52	11 58	12 05	12 14	12 21	12 25	12 23	12 16	12 09	12 01	11 54	11 50
21	11 53	11 59	12 07	12 15	12 22	12 25	12 22	12 16	12 07	11 59	11 52	11 50
25	11 53	12 00	12 08	12 16	12 22	12 25	12 21	12 14	12 06	11 58	11 52	11 50
29	11 54	12 01	12 09	12 17	12 23	12 25	12 21	12 14	12 05	11 57	11 51	11 50
	Latitude 10° N.											
1	11 33	11 42	11 56	12 14	12 29	12 40	12 42	12 33	12 18	12 02	11 47	11 36
5	11 33	11 44	11 58	12 16	12 31	12 41	12 41	12 32	12 16	12 00	11 45	11 35
9	11 35	11 46	12 00	12 18	12 33	12 42	12 40	12 30	12 14	11 58	11 42	11 33
13	11 36	11 48	12 03	12 20	12 34	12 42	12 40	12 28	12 12	11 56	11 41	11 33
17	11 37	11 50	12 05	12 22	12 35	12 42	12 38	12 26	12 09	11 53	11 40	11 32
21	11 39	11 52	12 07	12 24	12 37	12 43	12 37	12 24	12 08	11 51	11 38	11 32
25	11 39	11 54	12 09	12 26	12 38	12 43	12 36	12 22	12 05	11 50	11 36	11 32
29	11 41	11 56	12 12	12 27	12 39	12 43	12 35	12 20	12 03	11 48	11 36	11 33
	Latitude 15° N.											
1	11 15	11 30	11 51	12 16	12 40	12 58	13 00	12 47	12 24	12 00	11 35	11 18
5	11 17	11 32	11 54	12 20	12 43	12 59	12 59	12 44	12 21	11 57	11 33	11 17
9	11 18	11 35	11 57	12 23	12 45	13 00	12 58	12 42	12 18	11 53	11 30	11 16
13	11 19	11 38	12 01	12 27	12 49	13 00	12 57	12 39	12 15	11 50	11 27	11 15
17	11 21	11 41	12 04	12 30	12 51	13 01	12 56	12 36	12 11	11 47	11 25	11 14
21	11 23	11 44	12 07	12 33	12 53	13 01	12 53	12 34	12 08	11 43	11 23	11 14
25	11 25	11 47	12 11	12 36	12 54	13 01	12 51	12 30	12 05	11 40	11 21	11 14
29	11 27	11 51	12 14	12 39	12 57	13 01	12 49	12 27	12 02	11 38	11 19	11 15
	Latitude 20° N.											
1	10 57	11 16	11 45	12 20	12 52	13 16	13 19	13 02	12 32	11 57	11 25	11 00
5	10 59	11 20	11 49	12 25	12 56	13 17	13 19	12 58	12 27	11 53	11 21	10 59
9	11 00	11 23	11 54	12 30	13 00	13 19	13 16	12 55	12 23	11 49	11 17	10 57
13	11 02	11 27	11 59	12 34	13 03	13 20	13 15	12 51	12 18	11 44	11 13	10 56
17	11 05	11 32	12 03	12 38	13 07	13 20	13 12	12 48	12 13	11 40	11 10	10 56
21	11 07	11 36	12 07	12 42	13 09	13 21	13 10	12 42	12 08	11 35	11 07	10 55
25	11 11	11 41	12 12	12 46	13 12	13 21	13 07	12 38	12 05	11 32	11 04	10 56
29	11 13	11 45	12 17	12 51	13 14	13 20	13 05	12 34	12 00	11 27	11 02	10 56
	Latitude 25° N.											
1	10 37	11 02	11 39	12 24	13 05	13 35	13 40	13 18	12 38	11 55	11 13	10 42
5	10 39	11 07	11 45	12 30	13 10	13 37	13 39	13 13	12 33	11 49	11 07	10 39
9	10 41	11 11	11 50	12 36	13 15	13 40	13 36	13 09	12 27	11 44	11 03	10 38
13	10 44	11 17	11 56	12 42	13 19	13 40	13 35	13 04	12 22	11 38	10 58	10 36
17	10 47	11 22	12 02	12 47	13 23	13 42	13 32	12 58	12 15	11 33	10 54	10 36
21	10 51	11 28	12 09	12 52	13 27	13 41	13 28	12 54	12 10	11 27	10 50	10 35
25	10 55	11 33	12 14	12 58	13 30	13 41	13 25	12 48	12 04	11 22	10 46	10 36
29	10 59	11 39	12 20	13 03	13 33	13 41	13 21	12 42	11 58	11 16	10 44	10 36

(*continued*)

Table 171 (continued)

DURATION OF DAYLIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m
	Latitude 30° N.											
1	10 15	10 46	11 33	12 29	13 20	13 57	14 03	13 34	12 46	11 53	10 59	10 2
5	10 17	10 53	11 40	12 36	13 26	13 59	14 01	13 29	12 39	11 46	10 53	10 1
9	10 21	10 59	11 47	12 43	13 31	14 02	13 58	13 23	12 32	11 38	10 48	10 1
13	10 24	11 05	11 54	12 50	13 37	14 04	13 55	13 17	12 25	11 32	10 42	10 1
17	10 27	11 12	12 02	12 57	13 42	14 04	13 52	13 11	12 18	11 25	10 36	10 1
21	10 33	11 18	12 09	13 04	13 47	14 05	13 48	13 04	12 10	11 17	10 32	10 1
25	10 37	11 25	12 16	13 10	13 50	14 05	13 43	12 58	12 03	11 11	10 28	10 1
29	10 43	11 33	12 24	13 17	13 55	14 03	13 39	12 51	11 56	11 05	10 24	10 1
	Latitude 35° N.											
1	09 51	10 30	11 26	12 34	13 35	14 21	14 29	13 54	12 55	11 50	10 45	10 0
5	09 53	10 37	11 34	12 42	13 43	14 25	14 27	13 47	12 47	11 41	10 37	09 5
9	09 57	10 45	11 44	12 52	13 50	14 27	14 24	13 40	12 38	11 32	10 31	09 5
13	10 02	10 53	11 52	13 00	13 57	14 30	14 19	13 33	12 29	11 24	10 24	09 5
17	10 06	11 01	12 01	13 08	14 03	14 30	14 16	13 25	12 21	11 16	10 18	09 4
21	10 11	11 08	12 09	13 16	14 09	14 31	14 10	13 18	12 12	11 07	10 11	09 4
25	10 17	11 17	12 19	13 24	14 14	14 31	14 05	13 09	12 03	11 00	10 06	09 4
29	10 25	11 26	12 27	13 32	14 19	14 29	13 59	13 01	11 54	10 51	10 01	09 5
	Latitude 40° N.											
1	09 23	10 10	11 18	12 39	13 54	14 49	14 58	14 16	13 05	11 47	10 29	09 3
5	09 27	10 19	11 28	12 50	14 02	14 53	14 55	14 08	12 55	11 36	10 20	09 2
9	09 31	10 28	11 38	13 00	14 11	14 57	14 52	14 00	12 44	11 26	10 11	09 2
13	09 36	10 37	11 50	13 10	14 19	15 00	14 47	13 51	12 34	11 16	10 03	09 2
17	09 42	10 47	12 00	13 20	14 27	15 00	14 42	13 41	12 24	11 06	09 55	09 2
21	09 49	10 58	12 11	13 30	14 34	15 01	14 36	13 32	12 13	10 55	09 48	09 2
25	09 56	11 07	12 21	13 40	14 40	15 01	14 29	13 22	12 03	10 46	09 42	09 2
29	10 03	11 18	12 32	13 49	14 45	14 59	14 22	13 13	11 52	10 37	09 36	09 2
	Latitude 42° N.											
1	09 11	10 02	11 14	12 42	14 02	15 02	15 11	14 26	13 09	11 45	10 22	09 2
5	09 15	10 11	11 26	12 53	14 12	15 07	15 09	14 17	12 58	11 34	10 13	09 1
9	09 19	10 21	11 36	13 04	14 21	15 10	15 04	14 08	12 48	11 24	10 03	09 1
13	09 24	10 31	11 48	13 16	14 29	15 12	14 59	13 59	12 36	11 12	09 54	09 1
17	09 31	10 41	12 00	13 26	14 37	15 14	14 54	13 49	12 25	11 02	09 46	09 0
21	09 39	10 52	12 11	13 37	14 45	15 15	14 48	13 38	12 45	10 51	09 38	09 0
25	09 46	11 03	12 23	13 47	14 52	15 15	14 40	13 28	12 03	10 40	09 30	09 0
29	09 55	11 14	12 34	13 57	14 57	15 13	14 32	13 17	11 52	10 29	09 24	09 0
	Latitude 44° N.											
1	08 58	09 52	11 10	12 45	14 11	15 16	15 26	14 36	13 14	11 45	10 15	09 0
5	09 01	10 03	11 22	12 57	14 21	15 21	15 23	14 27	13 02	11 32	10 04	09 0
9	09 06	10 13	11 34	13 08	14 31	15 24	15 18	14 17	12 50	11 20	09 54	08 5
13	09 12	10 24	11 46	13 20	14 40	15 28	15 13	14 07	12 39	11 08	09 44	08 5
17	09 19	10 35	11 59	13 32	14 49	15 29	15 07	13 56	12 26	10 57	09 35	08 5
21	09 27	10 47	12 11	13 44	14 47	15 29	15 00	13 45	12 14	10 45	09 27	08 5
25	09 35	10 59	12 23	13 55	15 04	15 29	14 52	13 34	12 03	10 34	09 19	08 5
29	09 45	11 10	12 36	14 06	15 11	15 27	14 44	13 23	11 50	10 23	09 12	08 5
	Latitude 46° N.											
1	08 43	09 42	11 06	12 47	14 21	15 30	15 41	14 48	13 19	11 43	10 07	08 5
5	08 47	09 53	11 20	13 00	14 31	15 35	15 38	14 37	13 06	11 30	09 55	08 4
9	08 53	10 05	11 32	13 14	14 42	15 40	15 34	14 27	12 54	11 18	09 44	08 4
13	09 00	10 17	11 46	13 26	14 52	15 42	15 27	14 15	12 41	11 04	09 34	08 4
17	09 07	10 29	11 58	13 38	15 01	15 44	15 21	14 05	12 28	10 52	09 24	08 4
21	09 15	10 42	12 12	13 51	15 10	15 45	15 13	13 53	12 15	10 39	09 15	08 3
25	09 25	10 53	12 25	14 03	15 18	15 45	15 04	13 41	12 02	10 27	09 06	08 3
29	09 35	11 06	12 38	14 14	15 25	15 43	14 56	13 29	11 50	10 15	08 59	08 4

(continued)

DURATION OF DAYLIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Latitude 48° N.												
1	08 27	09 32	11 02	12 51	14 31	15 46	15 59	15 00	13 25	11 41	09 57	08 40
5	08 32	09 43	11 16	13 05	14 42	15 52	15 55	14 49	13 11	11 28	09 45	08 35
9	08 38	09 56	11 30	13 18	14 54	15 57	15 50	14 38	12 57	11 14	09 33	08 29
13	08 44	10 09	11 44	13 32	15 05	16 00	15 43	14 25	12 43	11 00	09 22	08 26
17	08 53	10 21	11 58	13 46	15 15	16 02	15 36	14 13	12 30	10 46	09 12	08 23
21	09 02	10 35	12 12	13 59	15 24	16 03	15 28	14 01	12 16	10 33	09 02	08 22
25	09 12	10 49	12 27	14 11	15 33	16 03	15 18	13 47	12 02	10 20	08 52	08 22
29	09 23	11 02	12 40	14 24	15 41	16 00	15 08	13 35	11 48	10 07	08 44	08 24
Latitude 50° N.												
1	08 10	09 20	10 58	12 55	14 41	16 04	16 18	15 14	13 31	11 39	09 48	08 24
5	08 15	09 33	11 12	13 09	14 54	16 11	16 13	15 03	13 16	11 24	09 35	08 17
9	08 21	09 46	11 28	13 24	15 07	16 16	16 08	14 50	13 01	11 10	09 22	08 12
13	08 30	10 00	11 42	13 38	15 19	16 20	16 01	14 37	12 47	10 56	09 10	08 08
17	08 38	10 15	11 58	13 53	15 30	16 22	15 53	14 23	12 32	10 40	08 58	08 06
21	08 48	10 28	12 13	14 07	15 40	16 23	15 44	14 09	12 17	10 26	08 47	08 04
25	08 59	10 43	12 28	14 21	15 50	16 21	15 34	13 55	12 02	10 12	08 38	08 05
29	09 11	10 58	12 43	14 34	15 59	16 20	15 22	13 41	11 47	09 59	08 29	08 07
Latitude 52° N.												
1	07 51	09 08	10 52	12 57	14 53	16 24	16 39	15 29	13 37	11 38	09 38	08 07
5	07 56	09 21	11 09	13 14	15 08	16 31	16 34	15 16	13 21	11 22	09 23	07 59
9	08 03	09 36	11 25	13 30	15 22	16 37	16 28	15 02	13 05	11 06	09 09	07 53
13	08 12	09 51	11 42	13 46	15 34	16 41	16 21	14 48	12 49	10 50	08 56	07 48
17	08 21	10 05	11 58	14 01	15 46	16 43	16 11	14 33	12 34	10 34	08 43	07 46
21	08 33	10 21	12 14	14 17	15 58	16 44	16 02	14 19	12 17	10 19	08 32	07 44
25	08 45	10 37	12 29	14 31	16 09	16 43	15 50	14 03	12 02	10 04	08 21	07 46
29	08 57	10 52	12 45	14 46	16 18	16 41	15 38	13 48	11 46	09 49	08 12	07 48
Latitude 54° N.												
1	07 29	08 53	10 48	13 02	15 07	16 46	17 03	15 46	13 43	11 36	09 26	07 47
5	07 35	09 09	11 04	13 19	15 23	16 54	16 58	15 31	13 27	11 18	09 11	07 39
9	07 43	09 24	11 22	13 36	15 38	17 01	16 51	15 16	13 10	11 02	08 55	07 32
13	07 52	09 40	11 40	13 53	15 52	17 05	16 43	15 01	12 53	10 44	08 40	07 26
17	08 03	09 57	11 56	14 10	16 05	17 08	16 33	14 45	12 36	10 28	08 27	07 24
21	08 15	10 14	12 14	14 27	16 18	17 09	16 22	14 29	12 19	10 11	08 15	07 22
25	08 28	10 30	12 31	14 43	16 29	17 08	16 10	14 13	12 02	09 55	08 02	07 23
29	08 42	10 48	12 49	15 00	16 39	17 06	15 56	13 56	11 44	09 38	07 52	07 26
Latitude 56° N.												
1	07 05	08 38	10 42	13 07	15 22	17 12	17 31	16 05	13 51	11 34	09 14	07 24
5	07 11	08 53	11 00	13 25	15 39	17 21	17 25	15 49	13 34	11 16	08 56	07 15
9	07 20	09 11	11 19	13 43	15 56	17 28	17 17	15 32	13 15	10 57	08 40	07 07
13	07 30	09 29	11 38	14 02	16 11	17 33	17 08	15 16	12 57	10 38	08 24	07 02
17	07 43	09 47	11 56	14 20	16 26	17 36	16 57	14 59	12 38	10 20	08 09	06 58
21	07 56	10 05	12 15	14 39	16 40	17 37	16 44	14 41	12 19	10 02	07 55	06 57
25	08 10	10 23	12 34	14 56	16 53	17 37	16 31	14 23	12 01	09 44	07 42	06 58
29	08 25	10 42	12 53	15 14	17 04	17 34	16 16	14 05	11 43	09 27	07 30	07 00
Latitude 58° N.												
1	06 36	08 20	10 35	13 11	15 39	17 42	18 03	16 27	14 00	11 31	08 59	06 58
5	06 44	08 37	10 55	13 31	15 57	17 52	17 56	16 09	13 40	11 12	08 41	06 49
9	06 53	08 56	11 15	13 51	16 16	18 01	17 47	15 51	13 21	10 52	08 23	06 39
13	07 06	09 16	11 36	14 11	16 34	18 06	17 37	15 32	13 01	10 32	08 04	06 33
17	07 19	09 35	11 56	14 31	16 50	18 10	17 25	15 13	12 41	10 12	07 48	06 29
21	07 33	09 55	12 16	14 51	17 05	18 11	17 10	14 54	12 21	09 52	07 33	06 27
25	07 49	10 15	12 36	15 11	17 19	18 10	16 55	14 35	12 01	09 33	07 18	06 28
29	08 07	10 35	12 57	15 30	17 33	18 06	16 39	14 15	11 41	09 13	07 05	06 32

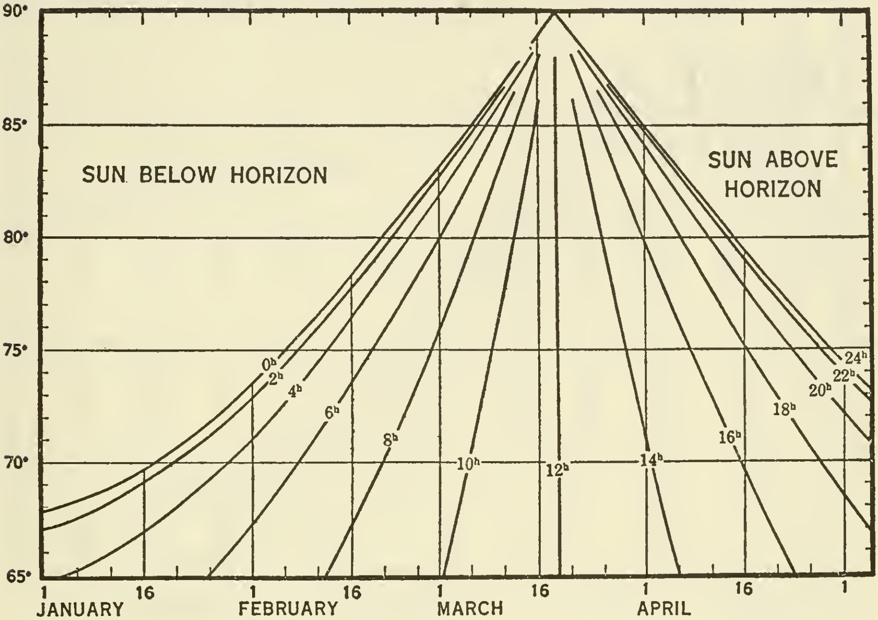
(*continued*)

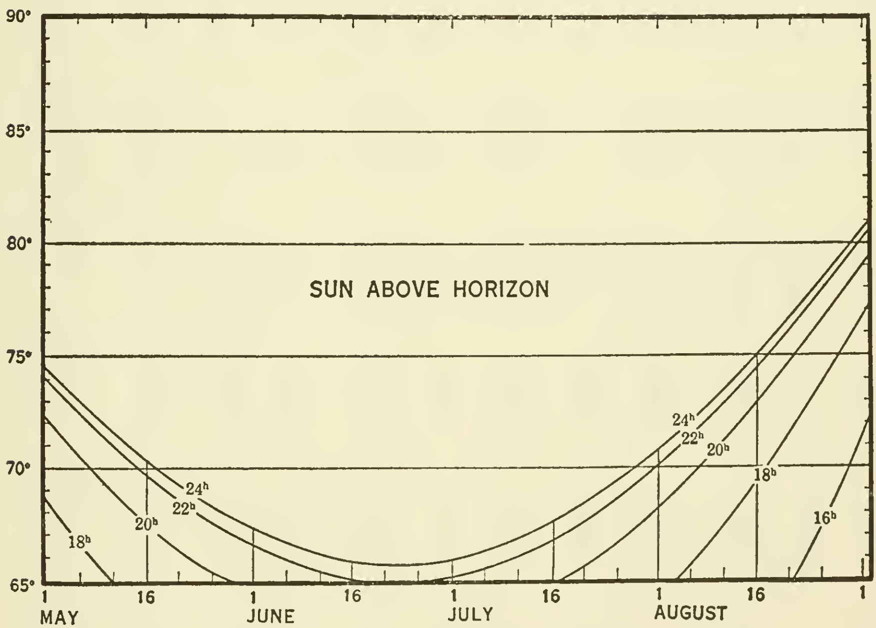
DURATION OF DAYLIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
	Latitude 60° N.											
1	06 03	08 00	10 28	13 17	15 58	18 17	18 43	16 51	14 10	11 28	08 43	06 2[illegible]
5	06 11	08 19	10 49	13 39	16 19	18 30	18 36	16 32	13 48	11 07	08 23	06 1[illegible]
9	06 23	08 40	11 11	14 01	16 39	18 39	18 25	16 11	13 27	10 46	08 03	06 0[illegible]
13	06 36	09 01	11 33	14 23	16 59	18 46	18 12	15 50	13 06	10 24	07 44	05 5[illegible]
17	06 51	09 23	11 55	14 45	17 18	18 50	17 57	15 30	12 44	10 02	07 24	05 5[illegible]
21	07 08	09 44	12 18	15 05	17 35	18 53	17 41	15 09	12 23	09 41	07 07	05 5[illegible]
25	07 26	10 06	12 39	15 27	17 52	18 51	17 24	14 48	12 01	09 20	06 50	05 5[illegible]
29	07 45	10 28	13 01	15 48	18 08	18 46	17 05	14 26	11 39	08 59	06 35	05 5[illegible]
	Latitude 61° N.											
1	05 43	07 48	10 24	13 20	16 10	18 39	19 07	17 05	14 16	11 27	08 34	06 1[illegible]
5	05 53	08 09	10 46	13 43	16 31	18 52	18 58	16 44	13 54	11 05	08 12	05 5[illegible]
9	06 05	08 31	11 09	14 05	16 53	19 03	18 47	16 23	13 31	10 42	07 51	05 4[illegible]
13	06 20	08 53	11 32	14 29	17 14	19 10	18 32	16 02	13 08	10 20	07 30	05 3[illegible]
17	06 35	09 15	11 55	14 51	17 34	19 16	18 16	15 39	12 46	09 58	07 11	05 3[illegible]
21	06 53	09 38	12 18	15 13	17 53	19 17	17 59	15 17	12 23	09 35	06 53	05 3[illegible]
25	07 12	10 01	12 40	15 36	18 11	19 15	17 41	14 55	12 01	09 13	06 34	05 3[illegible]
29	07 33	10 24	13 03	15 59	18 28	19 10	17 21	14 32	11 39	08 51	06 18	05 3[illegible]
	Latitude 62° N.											
1	05 21	07 36	10 19	13 24	16 21	19 03	19 34	17 21	14 22	11 26	08 24	05 5[illegible]
5	05 32	07 59	10 43	13 47	16 44	19 16	19 24	16 58	13 58	11 02	08 02	05 3[illegible]
9	05 45	08 22	11 07	14 11	17 07	19 29	19 11	16 35	13 35	10 39	07 39	05 2[illegible]
13	06 00	08 44	11 31	14 35	17 29	19 38	18 55	16 12	13 11	10 15	07 18	05 1[illegible]
17	06 19	09 08	11 54	14 59	17 51	19 44	18 38	15 50	12 48	09 52	06 57	05 1[illegible]
21	06 38	09 32	12 18	15 22	18 11	19 45	18 19	15 26	12 25	09 28	06 37	05 0[illegible]
25	06 58	09 56	12 42	15 46	18 32	19 43	17 59	15 03	12 00	09 05	06 17	05 1[illegible]
29	07 19	10 19	13 06	16 09	18 50	19 38	17 37	14 39	11 37	08 42	06 00	05 1[illegible]
	Latitude 63° N.											
1	04 56	07 22	10 14	13 27	16 34	19 29	20 06	17 37	14 28	11 24	08 14	05 3[illegible]
5	05 08	07 47	10 39	13 52	16 58	19 46	19 54	17 14	14 03	11 00	07 50	05 1[illegible]
9	05 23	08 11	11 05	14 17	17 23	20 00	19 39	16 49	13 39	10 35	07 27	05 0[illegible]
13	05 40	08 36	11 29	14 41	17 47	20 11	19 21	16 25	13 14	10 11	07 04	04 5[illegible]
17	05 59	09 00	11 54	15 07	18 11	20 16	19 02	16 00	12 50	09 46	06 41	04 4[illegible]
21	06 20	09 25	12 19	15 32	18 33	20 19	18 40	15 36	12 25	09 22	06 19	04 4[illegible]
25	06 42	09 50	12 44	15 56	18 54	20 17	18 18	15 11	12 00	08 57	05 58	04 4[illegible]
29	07 05	10 14	13 08	16 21	19 15	20 10	17 55	14 46	11 37	08 33	05 40	04 4[illegible]
	Latitude 64° N.											
1	04 28	07 08	10 10	13 31	16 48	20 01	20 46	17 56	14 34	11 22	08 03	05 0[illegible]
5	04 41	07 33	10 36	13 57	17 14	20 21	20 31	17 30	14 09	10 57	07 38	04 4[illegible]
9	04 57	08 00	11 01	14 23	17 41	20 38	20 12	17 04	13 43	10 31	07 13	04 3[illegible]
13	05 17	08 26	11 27	14 49	18 07	20 51	19 51	16 38	13 18	10 05	06 48	04 2[illegible]
17	05 39	08 51	11 54	15 15	18 33	20 59	19 30	16 12	12 52	09 40	06 23	04 1[illegible]
21	06 01	09 17	12 20	15 42	18 57	21 01	19 06	15 46	12 26	09 14	05 59	04 1[illegible]
25	06 24	09 44	12 46	16 08	19 22	20 59	18 41	15 20	12 00	08 48	05 37	04 1[illegible]
29	06 49	10 10	13 12	16 35	19 45	20 51	18 15	14 54	11 35	08 22	05 16	04 2[illegible]
	Latitude 65° N.											
1	03 54	06 52	10 04	13 35	17 03	20 40	21 38	18 17	14 42	11 20	07 51	04 3[illegible]
5	04 09	07 19	10 32	14 02	17 32	21 05	21 18	17 49	14 15	10 54	07 24	04 1[illegible]
9	04 29	07 47	10 59	14 30	18 00	21 28	20 55	17 21	13 47	10 27	06 57	04 0[illegible]
13	04 50	08 14	11 26	14 57	18 29	21 46	20 29	16 53	13 20	10 00	06 30	03 4[illegible]
17	05 15	08 42	11 53	15 25	18 57	21 58	20 02	16 25	12 54	09 33	06 03	03 3[illegible]
21	05 39	09 09	12 20	15 52	19 26	22 03	19 34	15 56	12 27	09 06	05 37	03 3[illegible]
25	06 05	09 37	12 48	16 21	19 53	21 58	19 06	15 30	12 00	08 39	05 13	03 3[illegible]
29	06 32	10 04	13 14	16 49	20 21	21 47	18 38	15 02	11 34	08 11	04 49	03 4[illegible]

(continued)

DURATION OF DAYLIGHT





(continued)

TABLE 171 (CONCLUDED)

DURATION OF DAYLIGHT

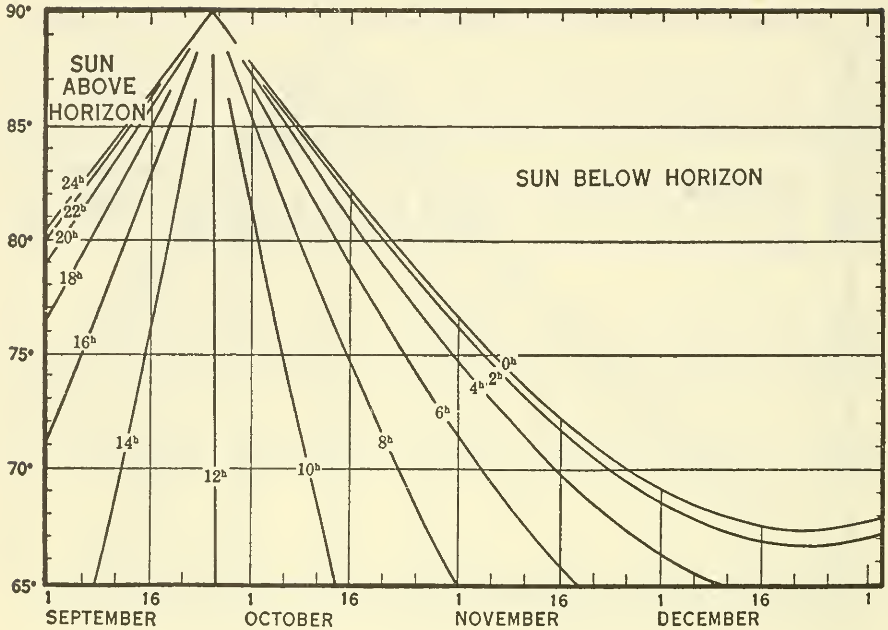


Table 172

DURATION OF CIVIL TWILIGHT

(See p. 506 for discussion and explanation of table.)

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Latitude 0°												
1	23	22	21	21	22	22	23	22	21	21	21	22
9	22	21	21	21	22	23	22	21	21	21	22	23
17	22	21	21	21	22	23	22	21	21	21	22	23
25	22	21	21	21	22	23	22	21	21	21	22	23
Latitude 5° N.												
1	22	22	21	21	22	22	23	22	21	21	21	22
9	22	21	21	21	22	23	23	22	21	21	22	23
17	22	21	21	21	22	23	22	21	21	21	22	23
25	22	21	21	21	22	23	22	21	21	21	22	23
Latitude 10° N.												
1	23	22	21	21	22	23	23	22	21	21	22	23
9	23	22	21	21	22	23	23	22	21	21	22	23
17	22	21	21	21	22	23	23	22	21	21	22	23
25	22	21	21	22	23	23	22	21	21	22	22	23
Latitude 15° N.												
1	23	22	22	22	22	23	24	23	22	21	22	23
9	23	22	21	22	23	24	24	22	22	22	22	23
17	23	22	21	22	23	24	23	22	21	22	23	23
25	23	22	21	22	23	24	23	22	21	22	23	23
Latitude 20° N.												
1	24	23	22	22	23	24	25	24	22	22	23	24
9	24	23	22	22	23	25	24	23	22	22	23	24
17	24	22	22	23	24	25	24	23	22	22	23	24
25	23	22	22	23	24	25	24	23	22	22	24	24
Latitude 25° N.												
1	25	24	23	23	24	26	26	25	23	23	24	25
9	25	24	23	23	25	26	26	24	23	23	24	25
17	25	23	23	23	25	26	25	24	23	23	24	25
25	24	23	23	24	25	26	25	23	23	23	25	25
Latitude 30° N.												
1	26	25	24	24	25	27	27	26	24	24	25	26
9	26	25	24	24	26	27	27	25	24	24	25	26
17	26	24	24	25	26	28	27	25	24	24	25	26
25	25	24	24	25	27	27	26	25	24	24	26	26
Latitude 35° N.												
1	28	27	25	26	27	29	30	28	26	25	26	28
9	28	26	25	26	28	30	29	27	26	25	27	28
17	27	26	25	26	28	30	29	27	25	26	27	28
25	27	26	25	27	29	30	28	26	25	26	27	28
Latitude 40° N.												
1	30	29	27	27	29	32	33	30	28	27	28	30
9	30	28	27	28	30	33	32	30	27	27	29	30
17	30	28	27	28	31	33	32	29	27	27	29	31
25	29	27	27	29	32	33	31	28	27	28	30	31
Latitude 42° N.												
1	32	30	28	28	31	34	34	32	29	28	29	31
9	31	29	28	29	31	34	34	31	28	28	30	32
17	31	29	28	29	32	34	33	30	28	28	30	32
25	30	28	28	30	33	35	32	29	28	29	31	32

(continued)

DURATION OF CIVIL TWILIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m
	Latitude 44° N.											
1	33	31	29	29	32	35	36	33	30	29	30	3
9	33	30	29	30	33	36	36	32	29	29	31	3
17	32	30	29	30	34	36	35	31	29	29	31	3
25	31	29	29	31	35	36	34	30	29	30	32	3
	Latitude 46° N.											
1	34	32	30	30	33	38	38	35	31	30	31	3
9	34	31	30	31	34	38	38	34	30	30	32	3
17	33	31	30	32	36	39	37	32	30	30	33	3
25	33	30	30	33	37	39	36	32	30	31	33	3
	Latitude 48° N.											
1	36	33	31	32	35	40	41	36	32	31	33	3
9	36	33	31	32	36	41	40	35	32	31	33	3
17	35	32	31	33	38	41	39	34	31	31	34	3
25	34	31	31	34	39	41	38	33	31	32	35	3
	Latitude 50° N.											
1	38	35	33	33	37	43	44	39	34	32	34	3
9	38	34	32	34	38	44	43	37	33	32	35	3
17	37	33	32	35	40	45	42	36	32	33	36	3
25	36	33	33	36	42	45	40	34	32	33	37	3
	Latitude 52° N.											
1	41	37	34	34	39	47	48	41	35	34	36	4
9	40	36	34	35	41	48	47	39	34	34	37	4
17	39	35	34	36	43	49	45	38	34	34	38	4
25	38	34	34	38	45	49	43	36	34	35	39	4
	Latitude 54° N.											
1	43	39	36	36	42	51	54	44	37	35	38	4
9	43	38	35	37	44	53	52	42	36	35	39	4
17	41	37	35	38	46	55	49	40	36	36	40	4
25	40	36	36	40	49	54	47	38	35	37	41	4
	Latitude 56° N.											
1	47	41	38	38	45	58	1 01	48	39	37	40	4
9	46	40	37	39	48	1 01	58	45	38	37	41	4
17	44	39	37	41	51	1 03	55	43	37	38	43	4
25	43	38	38	43	55	1 02	51	41	37	39	44	4
	Latitude 58° N.											
1	51	44	40	40	49	1 08	1 13	53	42	39	42	4
9	50	42	39	42	53	1 13	1 08	49	41	39	44	5
17	48	41	39	44	57	1 16	1 03	46	40	40	46	5
25	46	40	40	46	1 03	1 15	57	44	39	41	48	5
	Latitude 60° N.											
1	57	48	42	43	54	1 25	1 38	1 00	45	41	45	5
9	55	45	42	45	59	1 36	1 26	54	43	42	47	5
17	52	44	42	47	1 06	1 46	1 15	50	42	42	50	5
25	50	42	42	50	1 15	1 45	1 06	47	41	44	52	5
	Latitude 61° N.											
1	1 00	49	43	45	57	1 40	*	1 05	47	43	47	5
9	58	47	43	46	1 03	2 19	1 44	58	45	43	49	1 0
17	55	45	43	49	1 12	*	1 25	53	43	44	52	1 0
25	52	44	43	53	1 25	*	1 13	49	43	45	55	1 0

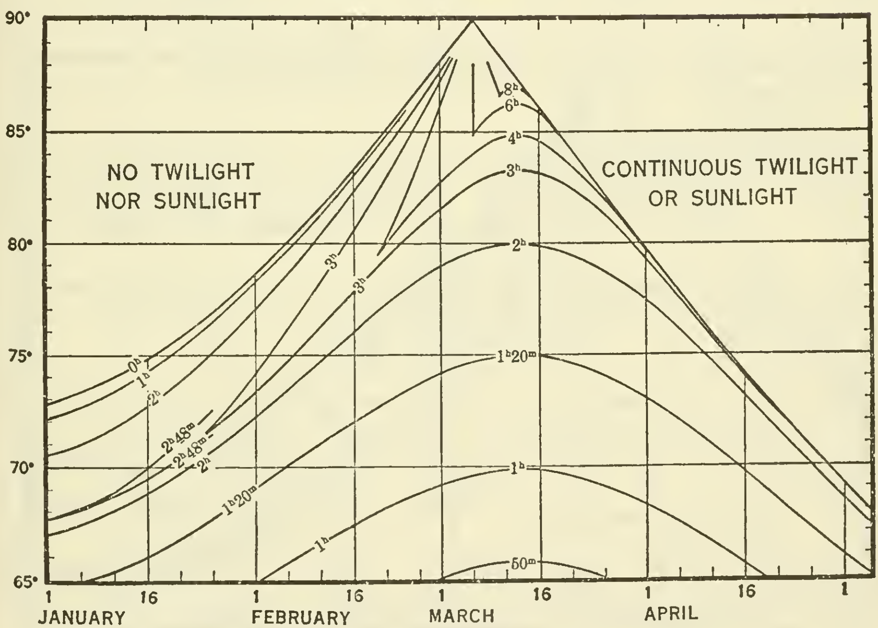
* Twilight lasts all night.

(continued)

DURATION OF CIVIL TWILIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
	Latitude 62° N.											
1	1 04	52	45	46	1 00	*	*	1 10	48	44	49	1 01
9	1 01	49	44	48	1 08	*	*	1 01	46	44	51	1 04
17	58	47	44	51	1 20	*	1 41	55	45	45	54	1 06
25	54	45	45	56	1 40	*	1 21	51	44	47	58	1 06
	Latitude 63° N.											
1	1 09	54	46	48	1 04	*	*	1 17	51	45	51	1 05
9	1 06	51	46	50	1 15	*	*	1 06	48	46	54	1 08
17	1 01	49	46	54	1 32	*	*	59	46	47	57	1 11
25	57	47	47	59	*	*	1 33	54	46	49	1 01	1 11
	Latitude 64° N.											
1	1 15	57	48	50	1 09	*	*	1 27	53	47	53	1 10
9	1 11	53	47	53	1 23	*	*	1 11	50	48	56	1 15
17	1 06	51	47	57	1 53	*	*	1 02	48	49	1 01	1 18
25	1 01	49	48	1 03	*	*	1 56	56	47	51	1 06	1 18
	Latitude 65° N.											
1	1 24	1 00	50	52	1 16	*	*	1 42	55	49	55	1 16
9	1 17	56	49	55	1 36	*	*	1 18	52	49	59	1 22
17	1 11	53	49	1 00	*	*	*	1 07	50	51	1 04	1 27
25	1 04	51	50	1 07	*	*	*	1 00	49	53	1 11	1 27

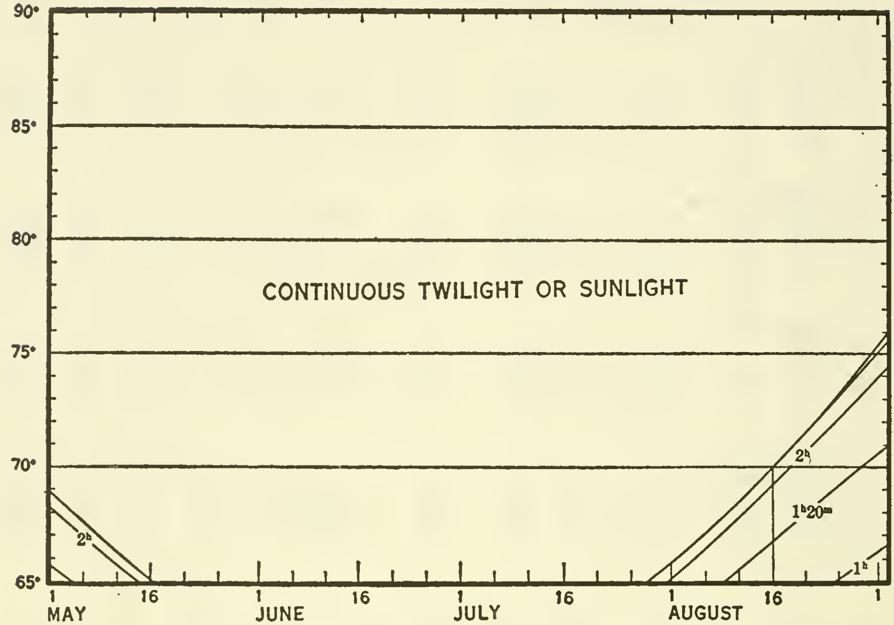
* Twilight lasts all night.



(continued)

TABLE 172 (CONCLUDED)

DURATION OF CIVIL TWILIGHT



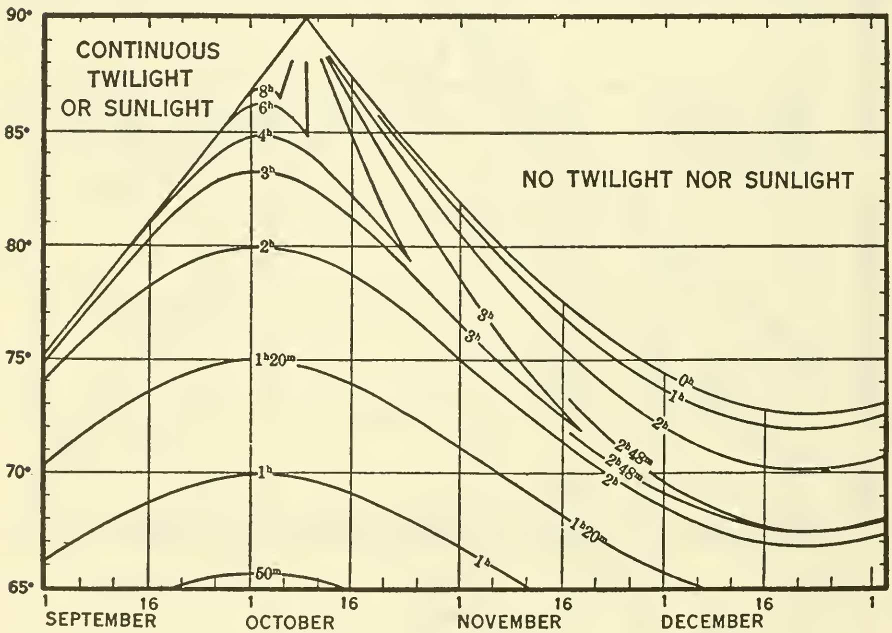


Table 173

DURATION OF ASTRONOMICAL TWILIGHT

(See p. 506 for discussion and explanation of table.)

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
Latitude 0°												
1	1 15	1 12	1 09	1 09	1 11	1 14	1 15	1 12	1 09	1 09	1 11	1 14
9	1 14	1 11	1 09	1 09	1 12	1 15	1 15	1 11	1 09	1 09	1 12	1 15
17	1 14	1 10	1 09	1 10	1 13	1 15	1 14	1 11	1 09	1 10	1 13	1 15
25	1 13	1 10	1 09	1 11	1 14	1 15	1 13	1 10	1 09	1 10	1 14	1 15
Latitude 5° N.												
1	1 15	1 12	1 09	1 09	1 12	1 15	1 16	1 13	1 10	1 09	1 11	1 14
9	1 14	1 11	1 09	1 10	1 13	1 16	1 15	1 12	1 09	1 09	1 12	1 15
17	1 14	1 10	1 09	1 10	1 14	1 16	1 15	1 11	1 09	1 10	1 13	1 15
25	1 13	1 10	1 09	1 11	1 15	1 16	1 14	1 10	1 09	1 10	1 14	1 15
Latitude 10° N.												
1	1 15	1 13	1 10	1 10	1 13	1 17	1 18	1 14	1 11	1 10	1 12	1 15
9	1 15	1 12	1 10	1 11	1 14	1 17	1 17	1 13	1 10	1 10	1 13	1 15
17	1 14	1 11	1 10	1 12	1 15	1 18	1 16	1 12	1 10	1 10	1 13	1 15
25	1 13	1 10	1 10	1 12	1 16	1 18	1 15	1 11	1 10	1 11	1 14	1 15
Latitude 15° N.												
1	1 16	1 14	1 11	1 12	1 15	1 19	1 20	1 17	1 13	1 11	1 13	1 16
9	1 16	1 13	1 11	1 12	1 16	1 20	1 20	1 15	1 12	1 11	1 14	1 16
17	1 15	1 12	1 11	1 13	1 17	1 20	1 19	1 14	1 11	1 12	1 15	1 17
25	1 15	1 12	1 11	1 14	1 19	1 20	1 18	1 13	1 11	1 12	1 15	1 17
Latitude 20° N.												
1	1 18	1 16	1 13	1 14	1 18	1 23	1 24	1 20	1 15	1 13	1 15	1 18
9	1 18	1 15	1 13	1 15	1 19	1 24	1 23	1 18	1 14	1 13	1 16	1 18
17	1 17	1 14	1 13	1 16	1 21	1 24	1 22	1 17	1 13	1 14	1 16	1 19
25	1 16	1 14	1 14	1 17	1 22	1 24	1 21	1 16	1 13	1 14	1 17	1 19
Latitude 25° N.												
1	1 21	1 18	1 16	1 17	1 22	1 28	1 29	1 24	1 18	1 16	1 17	1 21
9	1 21	1 18	1 16	1 18	1 24	1 29	1 28	1 22	1 17	1 16	1 18	1 21
17	1 20	1 17	1 16	1 19	1 25	1 29	1 27	1 21	1 16	1 16	1 19	1 22
25	1 19	1 16	1 16	1 21	1 27	1 29	1 25	1 19	1 16	1 17	1 20	1 22
Latitude 30° N.												
1	1 25	1 22	1 20	1 21	1 27	1 35	1 36	1 30	1 22	1 19	1 21	1 25
9	1 25	1 21	1 19	1 22	1 29	1 36	1 35	1 27	1 21	1 19	1 22	1 25
17	1 24	1 20	1 20	1 24	1 31	1 37	1 33	1 25	1 20	1 20	1 23	1 26
25	1 23	1 20	1 20	1 26	1 33	1 37	1 31	1 24	1 20	1 20	1 24	1 26
Latitude 35° N.												
1	1 30	1 27	1 24	1 26	1 34	1 44	1 46	1 37	1 28	1 24	1 26	1 30
9	1 30	1 26	1 24	1 28	1 37	1 46	1 45	1 35	1 26	1 24	1 27	1 30
17	1 29	1 25	1 24	1 30	1 40	1 47	1 42	1 32	1 25	1 24	1 28	1 31
25	1 28	1 24	1 25	1 32	1 42	1 47	1 40	1 30	1 24	1 25	1 29	1 31
Latitude 40° N.												
1	1 37	1 33	1 30	1 33	1 44	1 59	2 02	1 48	1 35	1 30	1 32	1 36
9	1 36	1 32	1 30	1 35	1 48	2 02	2 00	1 44	1 33	1 30	1 33	1 37
17	1 35	1 31	1 31	1 38	1 52	2 03	1 56	1 41	1 32	1 30	1 34	1 38
25	1 34	1 30	1 32	1 41	1 56	2 03	1 52	1 38	1 30	1 31	1 35	1 38
Latitude 42° N.												
1	1 41	1 36	1 33	1 36	1 49	2 07	2 11	1 54	1 39	1 33	1 34	1 39
9	1 40	1 35	1 33	1 39	1 53	2 11	2 08	1 49	1 36	1 33	1 36	1 40
17	1 39	1 34	1 34	1 42	1 58	2 13	2 03	1 45	1 35	1 33	1 37	1 41
25	1 37	1 33	1 35	1 45	2 03	2 13	1 59	1 42	1 33	1 34	1 38	1 41

(*continued*)

DURATION OF ASTRONOMICAL TWILIGHT

Day of month	Jan. h. m.	Feb. h. m.	Mar. h. m.	Apr. h. m.	May h. m.	June h. m.	July h. m.	Aug. h. m.	Sept. h. m.	Oct. h. m.	Nov. h. m.	Dec. h. m.
Latitude 44° N.												
1	1 44	1 39	1 36	1 40	1 55	2 18	2 23	2 01	1 43	1 36	1 38	1 43
9	1 43	1 38	1 36	1 43	2 00	2 23	2 19	1 56	1 40	1 36	1 39	1 44
17	1 42	1 37	1 37	1 46	2 06	2 25	2 13	1 50	1 38	1 36	1 40	1 45
25	1 41	1 36	1 38	1 51	2 13	2 25	2 07	1 46	1 37	1 37	1 42	1 45
Latitude 46° N.												
1	1 49	1 43	1 39	1 44	2 01	2 32	2 40	2 10	1 48	1 40	1 41	1 47
9	1 48	1 41	1 40	1 47	2 08	2 39	2 33	2 03	1 44	1 39	1 43	1 48
17	1 46	1 40	1 40	1 52	2 16	2 43	2 25	1 56	1 42	1 39	1 44	1 49
25	1 44	1 40	1 42	1 57	2 25	2 43	2 17	1 51	1 40	1 40	1 46	1 49
Latitude 48° N.												
1	1 53	1 47	1 43	1 49	2 10	2 54	3 09	2 21	1 53	1 44	1 45	1 52
9	1 52	1 45	1 44	1 53	2 19	3 08	2 56	2 11	1 49	1 43	1 47	1 53
17	1 51	1 44	1 45	1 58	2 29	3 18	2 43	2 04	1 46	1 43	1 49	1 54
25	1 49	1 43	1 46	2 04	2 42	3 17	2 30	1 57	1 44	1 44	1 51	1 54
Latitude 50° N.												
1	1 59	1 52	1 48	1 54	2 20	*	*	2 35	1 59	1 48	1 50	1 57
9	1 57	1 50	1 48	1 59	2 32	*	*	2 22	1 55	1 47	1 51	1 59
17	1 56	1 48	1 49	2 05	2 49	*	3 13	2 12	1 51	1 48	1 53	2 00
25	1 53	1 48	1 51	2 13	3 12	*	2 49	2 05	1 49	1 48	1 56	2 00
Latitude 52° N.												
1	2 05	1 57	1 52	2 01	2 34	*	*	2 57	2 07	1 53	1 55	2 03
9	2 04	1 55	1 53	2 06	2 52	*	*	2 37	2 01	1 52	1 57	2 05
17	2 01	1 53	1 54	2 14	3 25	*	*	2 23	1 57	1 52	1 59	2 06
25	1 59	1 52	1 57	2 24	*	*	3 28	2 13	1 54	1 53	2 01	2 06
Latitude 54° N.												
1	2 13	2 03	1 58	2 08	2 53	*	*	3 49	2 15	1 59	2 00	2 10
9	2 11	2 01	1 59	2 15	3 31	*	*	2 58	2 08	1 58	2 03	2 12
17	2 08	1 59	2 00	2 24	*	*	*	2 37	2 03	1 58	2 05	2 13
25	2 05	1 58	2 04	2 38	*	*	*	2 24	2 00	1 59	2 08	2 14
Latitude 56° N.												
1	2 21	2 10	2 04	2 17	3 29	*	*	*	2 26	2 05	2 07	2 18
9	2 19	2 07	2 05	2 25	*	*	*	3 43	2 17	2 04	2 09	2 21
17	2 16	2 05	2 07	2 38	*	*	*	2 57	2 11	2 04	2 13	2 22
25	2 12	2 04	2 11	2 59	*	*	*	2 37	2 07	2 05	2 16	2 22
Latitude 58° N.												
1	2 32	2 18	2 11	2 27	*	*	*	*	2 40	2 12	2 14	2 28
9	2 29	2 14	2 12	2 38	*	*	*	*	2 28	2 11	2 17	2 31
17	2 25	2 12	2 15	2 57	*	*	*	3 34	2 20	2 11	2 21	2 33
25	2 21	2 11	2 20	3 37	*	*	*	2 56	2 15	2 12	2 25	2 33
Latitude 60° N.												
1	2 44	2 27	2 19	2 40	*	*	*	*	2 58	2 21	2 23	2 40
9	2 41	2 23	2 21	2 56	*	*	*	*	2 41	2 19	2 26	2 44
17	2 36	2 20	2 24	3 28	*	*	*	*	2 30	2 19	2 31	2 46
25	2 31	2 19	2 31	*	*	*	*	3 26	2 24	2 20	2 36	2 46
Latitude 61° N.												
1	2 52	2 32	2 24	2 47	*	*	*	*	3 10	2 26	2 27	2 46
9	2 48	2 28	2 25	3 07	*	*	*	*	2 49	2 24	2 31	2 51
17	2 42	2 25	2 30	3 59	*	*	*	*	2 37	2 23	2 37	2 54
25	2 37	2 24	2 37	*	*	*	*	3 54	2 29	2 25	2 42	2 54

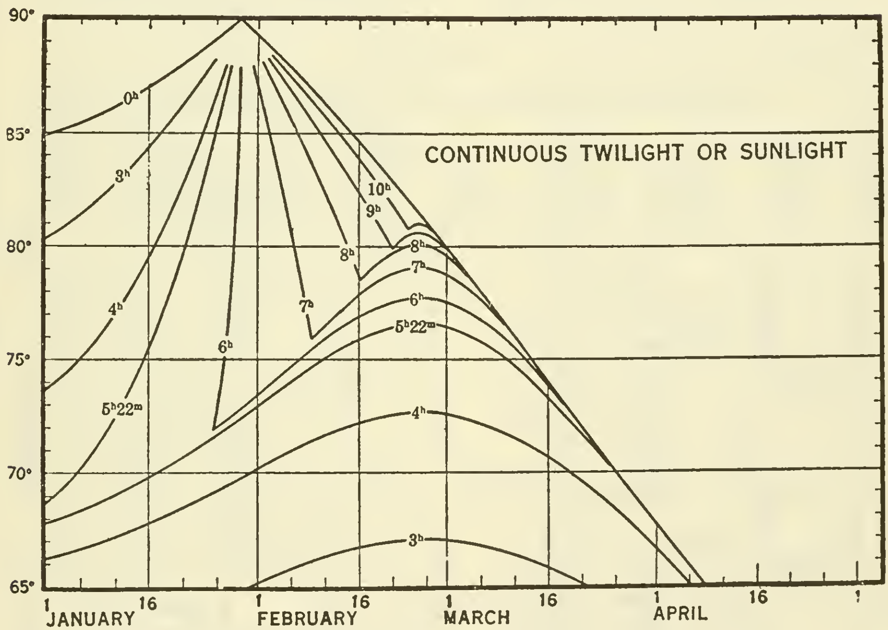
* Twilight lasts all night.

(*continued*)

DURATION OF ASTRONOMICAL TWILIGHT

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
	Latitude 62° N.											
1	3 00	2 38	2 29	2 56	*	*	*	*	3 25	2 31	2 33	2 54
9	2 55	2 33	2 31	3 22	*	*	*	*	2 58	2 28	2 37	2 59
17	2 49	2 30	2 35	*	*	*	*	*	2 43	2 28	2 43	3 03
25	2 43	2 29	2 44	*	*	*	*	*	2 35	2 30	2 49	3 03
	Latitude 63° N.											
1	3 10	2 44	2 34	3 06	*	*	*	*	3 47	2 37	2 38	3 03
9	3 05	2 39	2 36	3 42	*	*	*	*	3 09	2 34	2 43	3 09
17	2 57	2 35	2 42	*	*	*	*	*	2 51	2 33	2 50	3 13
25	2 50	2 34	2 52	*	*	*	*	*	2 41	2 35	2 57	3 13
	Latitude 64° N.											
1	3 22	2 51	2 40	3 19	*	*	*	*	*	2 43	2 44	3 13
9	3 15	2 45	2 42	4 18	*	*	*	*	3 22	2 40	2 50	3 21
17	3 06	2 41	2 49	*	*	*	*	*	3 00	2 39	2 57	3 26
25	2 58	2 40	3 00	*	*	*	*	*	2 48	2 41	3 06	3 26
	Latitude 65° N.											
1	3 37	2 59	2 46	3 34	*	*	*	*	*	2 50	2 51	3 25
9	3 27	2 52	2 49	*	*	*	*	*	3 39	2 46	2 58	3 35
17	3 16	2 48	2 56	*	*	*	*	*	3 10	2 45	3 06	3 41
25	3 06	2 46	3 10	*	*	*	*	*	2 56	2 47	3 17	3 42

* Twilight lasts all night.



(continued)

TABLE 173 (CONCLUDED)

DURATION OF ASTRONOMICAL TWILIGHT

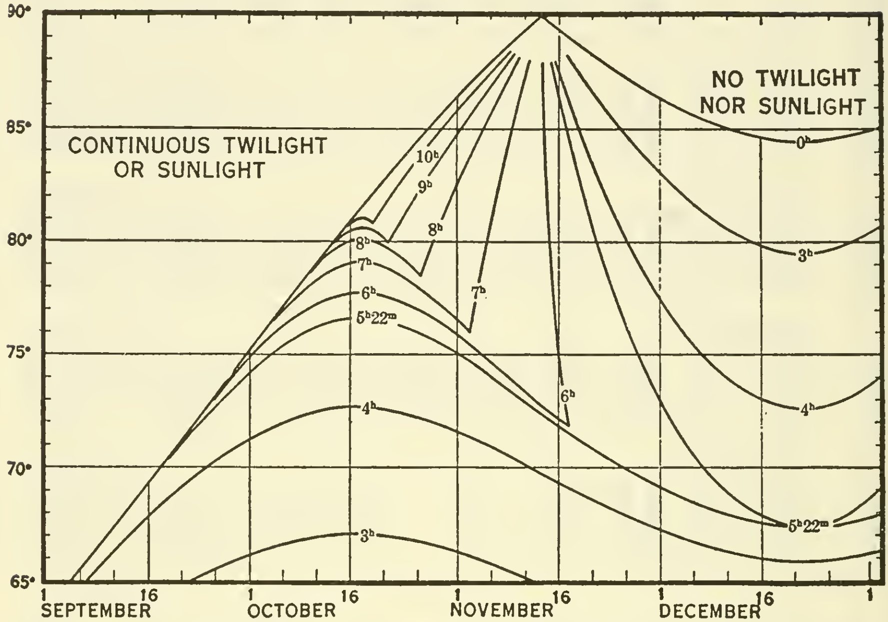


TABLE 174

DAYLIGHT AND TWILIGHT FOR SOUTHERN LATITUDES

Southern latitude date	Corre-sponding date northern latitude	Southern latitude date	Corre-sponding date northern latitude	Southern latitude date	Corre-sponding date northern latitude	Southern latitude date	Corre-sponding date northern latitude	Southern latitude date	Cor- sponc dat north latit
Jan. 3	July 5	Mar. 19	Sept. 21	May 28	Nov. 29	Aug. 5	Feb. 1	Oct. 20	Apr
7	9	23	25	30	Dec. 1	9	5	24	
11	13	27	29			13	9	28	
15	17	29	Oct. 1	June 3	5	17	13		
18	21			4	5	21	17	Nov. 1	
22	25	Apr. 1	5	8	9	26	21	3	May
26	29	5	9	12	13	30	25	7	
29	Aug. 1	6	9	16	17			11	
		10	13	20	21	Sept. 3	Mar. 1	15	
Feb. 1	5	14	17	25	25	7	5	18	
5	9	18	21	29	29	11	9	22	
9	13	22	25			15	13	26	
13	17	26	29	July 2	Jan. 1	19	17	30	
17	21	29	Nov. 1	3	1	23	21		
20	25			7	5	27	25	Dec. 3	June
24	29	May 3	5	11	9			6	
27	Sept. 1	7	9	15	13	Oct. 1	29	10	
		11	13	20	17	2	29	14	
Mar. 3	5	15	17	24	21	5	Apr. 1	18	
7	9	16	17	28	25	9	5	25	
11	13	20	21			12	9	29	
15	17	24	25	Aug. 1	29	16	13	31	July

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