Back-Pressure Testing of Gas Wells

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Table of Nomenclature

AOF = absolute open flow, Mcfd
C = coefficient of the particular back-pressure equation
D = deliverability of well at back pressure, P_d, Mcfd
F_b = basic orifice factor, $\text{Mcfd} / \sqrt{h_w P_m}$
F_c = combined friction, temperature, and compressibility factor, F_r T Z
F_d = meter factor for direct reading L-10 chart

$$= 0.01\sqrt{R_h R_p}$$

F_e = energy loss factor = $(F_r Q_m)^2$
F_g = specific gravity factor, dimensionless
F_p = basic critical flow prover or positive nonadjustable choke factor, Mcfd/psia
F_{pv} = supercompressibility factor = $\sqrt{1/Z}$, dimensionless
F_r = friction factor, $\left[\frac{2.6665\, f}{d^5}\right]^{0.5}$
F_s = pressure loss factor

$$= (L/H)(F_c Q_m)^2 (e^s - 1) = P_s^{\,2} - e^s P_t^{\,2}$$

F_t = flowing temperature factor, dimensionless
F_w = pressure loss factor

$$= (L/H)(F_c Q_m)^2 (1 - e^{-s}) = P_w^{\,2} - P_t^{\,2}$$

G = specific gravity of flowing fluid (air = 1.000), dimensionless
G_g = specific gravity of separator gas (air = 1.000), dimensionless
G_l = specific gravity of separator liquid (water = 1.000), dimensionless
GOR = gas-liquid ratio, cu ft of gas (14.65 psia and 60ºF) per barrel of hydrocarbon liquid (60ºF)

H = vertical depth corresponding to L, feet
I_n = value of the right hand member of the flow equation corresponding to P_n
I_{n-1} = value of the right hand member of the flow equation corresponding to P_{n-1}
L = length of flow channel, feet
M = computational aid
Mcfd = thousand cubic feet per day (14.65 psia and 60ºF)
M^2cfd = million cubic feet per day (14.65 psia and 60ºF)
N = computational aid
P = pressure, psia
P^2 = $(psia)^2$ /1,000
P_L = static pressure reading, L-10 chart
P_a = field barometric pressure, psia
P_b = pressure at base conditions, psia
P_c = shut-in wellhead pressure, psia
P_{cr} = pseudocritical pressure, psia
P_d = designated deliverability pressure, psia
P_f = shut-in pressure at vertical depth H, psia
P_m = static pressure at point of gas measurement, psia
P_n = pressure in the flow channel at a given point, psia
P_{n-1} = pressure in the flow channel at the preceding point, psia
P_r = reduced pressure, dimensionless
P_s = flowing pressure at vertical depth H, psia
P_t = flowing wellhead pressure, psia
P_w = static column wellhead pressure corresponding to P_t, psia
Q = rate of flow, Mcfd (14.65 psia and 60ºF)
Q_m = rate of flow, M^2cfd (14.65 psia and 60ºF)
R_b = meter differential range, inches of water
R_p = meter pressure range, psia
R_t = meter temperature range, ºF
T = absolute temperature, ºR
T_b = absolute temperature at base conditions, ºR
T_{cr} = absolute pseudocritical temperature, ºR

T_m	=	absolute temperature of fluid at point of gas measurement, ºR
T_r	=	reduced temperature, dimensionless
T_s	=	absolute temperature at vertical depth H, ºR
T_w	=	absolute temperature of fluid at wellhead, ºR
V_1	=	cu ft of vapor (14.65 psia and 60ºF) equivalent to 1 barrel of hydrocarbon liquid (60ºF)
Z	=	compressibility factor, dimensionless
d	=	inside diameter, inches
d_o	=	outside pipe diameter, inches
e	=	natural logarithm base = 2.71828+
e^s	=	weight of column factor, dimensionless
f	=	coefficient of friction, dimensionless
h_d	=	differential reading, L-10 chart
h_w	=	meter differential pressure, inches of water
n	=	exponent of the particular back-pressure equation, dimensionless
psia	=	pounds per square inch absolute
psig	=	pounds per square inch gauge
s	=	0.0375 GH/TZ
t_d	=	temperature reading, L-10 chart

NOTE: "ºF" as used in this Table of Nomenclature and throughout this manual is the symbol for degrees Fahrenheit.

"ºR" as used in this Table of nomenclature and throughout this manual is the symbol for degrees Rankine (degrees Fahrenheit absolute).

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Recommended Form of Rules of Procedure for Back-Pressure Tests Required by State Regulatory Bodies

General Instructions

All back-pressure tests required by the state regulatory body shall be conducted in accordance with the procedures set out below except for the wells in pools where special testing procedures are applicable.

Calculations shall be made in the manner prescribed in the appropriate test examples. The observed data and calculations shall be reported on the prescribed forms.

Gas produced from wells connected to a gas transportation facility should not be vented to the atmosphere during testing. When an accurate test can be obtained only under conditions requiring venting, the volume vented shall be the minimum required to obtain an accurate test.

All surface pressure readings shall be taken with a dead weight gauge. Under special conditions where the use of a dead weight gauge is not practical, a properly calibrated spring gauge may be used when authorized by the state regulatory body. Subsurface pressures determined by the use of a properly calibrated pressure bomb are acceptable.

The temperature of the gas column must be accurately known to obtain correct test results; therefore, a thermometer well should be installed in the wellhead. Under shut-in or low flow rate conditions, the observed wellhead temperature might be distorted by the external temperature. Whenever this situation exists, the mean annual temperature should be used.

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Multipoint Back-Pressure Test Procedures

A multipoint back-pressure test should be taken for the purpose of determining the absolute open flow and exponent "n" from the plot of the equation

$$Q = C\left(P_f^{\,2} - P_s^{\,2}\right)^n \qquad \text{Equation 1}$$

or, under certain conditions as prescribed herein,

$$Q = C\left(P_c^{\,2} - P_w^{\,2}\right)^n \qquad \text{Equation 2}$$

Stabilized Multipoint Test

Shut-In Pressure

Wells with a pipeline connection should be produced for a sufficient length of time at a flow rate large enough to clear the well bore of accumulated liquids prior to the shut-in period. If the well bore cannot be cleared of accumulated liquids while producing into a pipeline, the well should be blown to the atmosphere to remove these liquids.

Wells without pipeline connections should be blown to the atmosphere to remove accumulated liquids.

The well should be shut in until the rate of pressure buildup is less than 1/10 of 1 per cent of the previously recorded pressure, psig, in 30 minutes. This pressure should be recorded.

Flow Tests

After recording the shut-in pressure, a series of at least four stabilized flow rates and the pressures corresponding to each flow rate should be taken. Any shut-in time between flow rates should be held to a minimum. These rates should be run in the increasing flow-rate sequence. In the case of high liquid ratio wells or unusual temperature conditions, a decreasing flow-rate sequence may be used if the increasing sequence method did not result in point alignment. If the decreasing sequence method is used, a statement giving the reasons necessitating the use of such method together with a copy of the data taken by the increasing sequence method, should be furnished to the state regulatory body.
If experience has shown that the use of the decreasing sequence method is necessary for an accurate test, a test by the increasing sequence method will not be required.

The lowest flow rate should be a rate sufficient to keep the well clear of all liquids.

One criterion as to the acceptability of the test is a good spread of data points. In order to ensure a good spread of points, the wellhead flowing pressure, psig, at the lowest flow rate should not be more than 95 per cent of the well's shut-in pressure, psig, and at the highest flow rate not more than 75 per cent of the well's shut-in pressure, psig. If data cannot be obtained in accordance with the foregoing provisions, an explanation should be furnished to the state regulatory body.

All flow-rate measurements should be obtained by the use of an orifice meter, critical flow prover, positive choke, or other authorized metering device in good operating condition. When an orifice meter is used as the metering device, the meter should be calibrated and the diameters of the orifice plate and meter run verified as to size, condition and compliance with acceptable standards. The differential pen should be zeroed under operating pressure before beginning the test.

The field barometric pressure should be determined.

The specific gravity of the separator gas and of the produced liquid should be determined.

During each flow rate, wellhead flowing pressures and flow-rate data should be recorded periodically and liquid production rate should be observed to aid in determining when stabilization has been attained. A constant flowing wellhead pressure or static column wellhead pressure and rate of flow for a period of at least 15 minutes should constitute stabilization for this test.

At the end of each flow rate the following information should be recorded:

- Flowing wellhead pressure.
- Static column wellhead pressure if it can be obtained.
- Rate of liquid production.
- Flowing wellhead temperature.
- All data pertinent to the gas metering device.

Calculations

General

A wellhead absolute open flow as determined from the wellhead equation, (Equation 2, page 7), $Q = C\left(P_c^{\,2} - P_w^{\,2}\right)^n$, is normally found to be equivalent to the bottom-hole absolute open flow as determined from the bottom hole equation, (Equation 1, page 7) $Q = C\left(P_f^{\,2} - P_s^{\,2}\right)^n$, where the wellhead shut-in pressure of all wells in a given reservoir is lower than 2,000 psig. Under this condition the wellhead absolute open flow is acceptable instead of the bottom-hole absolute open flow.

Bottom-Hole Calculations

Bottom-hole pressures should be calculated to a datum at the midpoint of the producing section open to flow. The point of entry into the tubing may be used as the datum if it is not more than 100 feet above or below the midpoint of the producing section open to flow.

Under all shut-in conditions and under flowing conditions, when the static column wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When only the flowing wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When the bottom-hole pressures are recorded by use of a properly calibrated bottom-hole pressure bomb and corrected to the proper datum, these pressures may be used in the bottom-hole formula.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, the calculation of the bottom-hole pressure should be made.

Wellhead Calculations

The static column wellhead pressure must be obtained if possible.

When only the flowing wellhead pressures can be obtained, the static column wellhead pressures should be calculated.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, appropriate correction of the surface pressure should be made.

Plotting

The points for the back-pressure curve should be accurately and neatly plotted on equal scale log-log paper (3-inch cycles are recommended) and a straight line drawn through the best average of three or more points. When no reasonable relationship can be established between three or more points, there should be a retest of the well.

The cotangent of the angle this line makes with the volume coordinate is the exponent "n" which is used in the back-pressure equation (Equation 1 or 2, page 7). The exponent "n" should always be calculated as shown in Basic Calculations (page 35).

If the exponent "n" is greater than 1.000 or less than 0.500, a retest of the well should be performed.

If no reasonable alignment is established between three or more points after a retesting of the well, then a straight line should be drawn through the best average of at least three points of the retest.

If the exponent "n" is greater than 1.000 , a straight line with an exponent "n" of 1.000 should be drawn through the point corresponding to the highest flow rate utilized in establishing the line.

If the exponent "n" is less than 0.500, a straight line with an exponent "n" of 0.500 should be drawn through the point corresponding to the lowest flow rate utilized in establishing the line.

Non-Stabilized Multipoint Test

When well stabilization is impractical to obtain for a series of points, or when gas must be flared during the test, the exponent “n” of the back-pressure curve should be established by either the Constant Time Multipoint Test or the Isochronal Multipoint Test. The exponent “n” so determined should then be applied to a stabilized one-point test to determine the absolute open flow. (See Stabilized One-Point Back-Pressure Test Procedure, page 25). The flow during this one-point test should be for a period adequate to reach stabilized conditions unless determination is made in conjuction with the state regulatory body that it would be impractical to continue flow until complete stabilization is reached.

Constant Time Multipoint Test

Shut-In Pressure

Wells with a pipeline connection should be produced for a sufficient length of time at a flow rate large enough to clear the well bore of accumulated liquids prior to the shut-in period. If the well bore cannot be cleared of accumulated liquids while producing into a pipeline, the well should be blown to the atmosphere to remove these liquids.

Wells without pipeline connections should be blown to the atmosphere to remove accumulated liquids.

The well should be shut in until the rate of pressure buildup is less than 1/10 of 1 per cent of the previously recorded pressure, psig, in 30 minutes. This pressure should be recorded.

Flow Tests

After recording the shut-in pressure, a series of at least four flow rates of the same duration and the pressures corresponding to each flow rate should be taken. Any shut-in time between flow rates should be held to a minimum. These rates should be run in the increasing flow-rate sequence. In the case of high liquid ratio wells or unusual temperature conditions, a decreasing flow-rate sequence may be used if the increasing sequence method did not result in the alignment of points. If the decreasing sequence method is used, a statement giving the reasons necessitating the use of such method, together with a copy of the data taken by the increasing sequence method, should be furnished to the state regulatory body. If experience has shown that the use of the decreasing sequence method is necessary for an accurate test, a test by the increasing sequence method will not be required.

The lowest flow rate should be a rate sufficient to keep the well clear of all liquids.

One criterion as to the acceptability of the test is a good spread of data points. To ensure a good spread of points, the wellhead flowing pressure, psig, at the lowest flow rate should not be more than 95 per cent of the well's shut-in pressure, psig, and at the highest flow rate not more than 75 per cent of the well's shut-in pressure, psig. If data cannot be obtained in accordance with the foregoing provisions, an explanation should be furnished to the state regulatory body.

All flow rate measurements should be obtained by the use of an orifice meter, critical flow prover, positive choke, or other authorized metering device in good operating condition. When an orifice meter is used as the metering device, the meter should be calibrated and the diameters of the orifice plate and meter run verified as to size, condition and compliance with acceptable standards. The differential pen should be zeroed under operating pressure before beginning the test.

The field barometric pressure should be determined.

The specific gravity of the separator gas and of the produced liquid should be determined.

At the end of each flow rate the following information should be recorded:

- Flowing wellhead pressure.
- Static column wellhead pressure if it can be obtained.
- Rate of liquid production.
- Flowing wellhead temperature.
- All data pertinent to the gas metering device.

The stabilized one-point test data may be obtained by continuation of the last flow rate in the manner prescribed for Flow Test in the Stabilized One-Point Back-Pressure Test Procedure (page 25).

Calculations

General

A wellhead absolute open flow as determined from the wellhead equation, (Equation 2, page 7), $Q = C\left(P_c^{\,2} - P_w^{\,2}\right)^n$, is normally found to be equivalent to the bottom-hole absolute open flow as determined from the bottom-hole pressure of all wells in a given reservoir is lower than 2,000 psig. Under this condition the wellhead absolute open flow is acceptable instead of the bottom-hole absolute open flow.

Bottom-Hole Calculations

Bottom-hole pressures should be calculated to a datum at the midpoint of the producing section open to flow. The point of entry into the tubing may be used as the datum if it is not more than 100 feet above or below the midpoint of the producing section open to flow.

Under all shut-in conditions and under flowing conditions when the static column wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When only the flowing wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When the bottom-hole pressures are recorded by use of a properly calibrated bottom-hole pressure bomb and corrected to the proper datum, these pressures may be used in the bottom-hole formula.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, the calculation of the bottom-hole pressure should be made.

Wellhead Calculations

The static column wellhead pressure must be obtained if possible.

When only the flowing wellhead pressures can be obtained, the static column wellhead pressures should be calculated.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, appropriate correction of the surface pressure should be made.

Plotting

The points for the back-pressure curve should be accurately plotted on equal scale log-log paper (3-inch cycles are recommended) and a straight line drawn through the best average of three or more points. When no reasonable relationship can be established between three or more points, the well should be retested.

The cotangent of the angle this line makes with the volume coordinate is the exponent "n" which is used in the back-pressure equation (Equation 1 or 2, page 7). The exponent "n" should always be calculated as shown in Basic Calculation 5 (page 39).

If the exponent "n" is greater than 1.000 or less than 0.500, the well should be retested.

If no reasonable alignment is established between three or more points subsequent to a retest of the well, then a straight line should be drawn through the best average of at least three points of the retest.

If the exponent “n” is greater than 1.000, a straight line with an exponent “n” of 1.000 should be drawn through the point corresponding to the highest rate of flow utilized in establishing the line.

If the exponent “n” is less than 0.500, a straight line with an exponent “n” of 0.500 should be drawn through the point corresponding to the lowest rate of flow utilized in establishing the line.

The constant time data points are used only to determine the value of the exponent “n”. The back-pressure curve should be drawn through the stabilized data point and parallel to the line established by the constant time data points. The absolute open flow may be determined from this back-pressure curve or calculated.

Isochronal Multipoint Test

Shut-In Pressure

Wells with a pipeline connection should be produced for a sufficient length of time at a flow rate large enough to clear the well bore of accumulated liquids prior to the shut-in period. If the well bore cannot be cleared of accumulated liquids while producing into a pipeline, the well should be blown to the atmosphere to remove these liquids.

Wells without pipeline connections should be blown to the atmosphere to remove accumulated liquids.

Prior to each flow test as described below, the well should be shut in until the rate of pressure buildup is less than 1/10 of 1 per cent of the previously recorded pressure, psig, in 30 minutes. This pressure should be recorded and used with the data from the subsequent flow test.

Flow Tests

After recording the initial shut-in pressure, a series of at least four flow rates of the same duration and the pressure corresponding to each flow rate should be taken. Each flow rate should be preceded by a shut-in pressure as prescribed above.

The lowest flow rate should be a rate sufficient to keep the well clear of all liquids.

One criterion as to the acceptability of the test is a good spread of data points. To ensure a good spread of points, the wellhead flowing pressure, psig, at the lowest flow rate should not be more than 95 per cent of the well's shut-in pressure, psig, and at the highest flow rate not more than 75 per cent of the well's shut-in pressure, psig. If data cannot be obtained in accordance with the foregoing provisions, an explanation should be furnished to the state regulatory body.

All flow rate measurements should be obtained by the use of an orifice meter, critical flow prover, positive choke, or other authorized metering device in good operating condition. When an orifice meter is used as the metering device, the meter should be calibrated and the diameters of the orifice plate and meter run verified as to size, condition and compliance with acceptable standards. The differential pen should be zeroed under operating pressure before beginning the test.

The field barometric pressure, the specific gravity of the separator gas, and the produced liquid should be determined.

At the end of each flow rate the following information should be recorded:

- Flowing wellhead pressure.
- Static column wellhead pressure if it can be obtained.
- Rate of liquid production.
- Flowing wellhead temperature.
- All data pertinent to the gas metering device.

The stabilized one-point test data may be obtained by continuation of the last flow rate in the manner prescribed for Flow Test in the Stabilized One-Point Back-Pressure Test Procedure (page 25).

Calculations

General

A wellhead absolute open flow as determined from the wellhead equation, (Equation 2, page 7), $Q = C\left(P_c^{\,2} - P_w^{\,2}\right)^n$, is normally found to be equivalent to the bottom-hole absolute open flow as determined from the bottom-hole equation, (Equation 1, page 7), $Q = C\left(P_f^{\,2} - P_s^{\,2}\right)^n$, where the wellhead shut-in pressure of all wells in a given reservoir is lower than 2,000 psig. Under this condition, the wellhead absolute open flow is acceptable instead of the bottom-hole absolute open flow.

Shut-In Pressure

The shut-in pressure preceding each flow rate should be used in conjunction with the static column wellhead pressure corresponding to that flow rate.

Bottom-Hole Calculations

Bottom-hole pressures should be calculated to a datum at the midpoint of the producing section open to flow. The point of entry into the tubing may be used as the datum if it is not more than 100 feet above or below the midpoint of the producing section open to flow.

Under all shut-in conditions and under flowing conditions, when the static column wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When only the flowing wellhead pressures can be obtained, the bottom-hole pressures should be calculated.

When the bottom-hole pressures are recorded by use of a properly calibrated bottom-hole pressure bomb and corrected to the proper datum, these pressures may be used in the bottom-hole formula.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, the calculation of the bottom-hole pressure should be made.

Wellhead Calculations

If possible, the static column wellhead pressure must be obtained.

When only the flowing wellhead pressures can be obtained, the static column wellhead pressures should be calculated.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, appropriate correction of the surface pressure should be made.

Plotting

The points for the back-pressure curve should be accurately plotted on equal scale log-log paper (3-inch cycles are recommended) and a straight line drawn through the best average of three or more points. When no reasonable relationship can be established between three or more points, there should be a retest of the well.

The cotangent of the angle this line makes with the volume coordinate is the exponent "n" which is used in the back-pressure equation (Equation 1 or 2, page 7). The exponent "n" should always be calculated.

If the exponent “n” is greater than 1.000 or less than 0.500, the well should be retested.

If, after retesting the well, no reasonable alignment is established between three or more points, then a straight line should be drawn through the best average of at least three points of the retest.

If the exponent “n” is greater than 1.000, a straight line with an exponent “n” of 1.000 should be drawn through the point corresponding to the highest rate of flow utilized in establishing the line.

If the exponent “n” is less than 0.500, a straight line with an exponent "n" of 0.500 should be drawn through the point corresponding to the lowest rate of flow utilized in establishing the line.

The Isochronal data points are used only to determine the value of the exponent “n”. The back pressure curve should be drawn through the stabilized data point and parallel to the line established by the Isochronal data points. The absolute open flow may be determined from this back-pressure curve or calculated.

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Stabilized One-Point Back-Pressure Test Procedure

The most recently determined exponent “n” established by a Stabilized Multipoint Back-Pressure Test (page 8), a Constant Time Multipoint Test (page 13), or an Isochronal Multipoint Test (page 19) should be used with this stabilized one-point test to determine the absolute open flow.

The Flow Test portion of this test may be used in conjunction with the Constant Time Multipoint Test (page 13) or the Isochronal Multipoint Test (page 9) to determine the absolute open flow.

Determination of Absolute Open Flow

Shut-In Pressure

Wells with a pipeline connection should be produced for a sufficient length of time at a flow rate large enough to clear the well bore of accumulated liquids prior to the shut-in period. If the well bore cannot be cleared of accumulated liquids while producing into a pipeline, the well should be blown to the atmosphere to remove these liquids.

Wells without pipeline connections should be blown to the atmosphere to remove accumulated liquids.

The well should be shut in until the rate of pressure buildup is less than 1/10 of 1 per cent of the previously recorded pressure, psig, in 30 minutes. This pressure should be recorded.

Flow Test

After recording the shut-in pressure, a stabilized flow rate and its corresponding pressures should be taken.

This flow rate should be a rate sufficient to keep the well clear of all liquids.

The wellhead flowing pressure, psig, should not be more than 95 per cent of the well's shut-in pressure, psig. If the data cannot be obtained in accordance with the foregoing provision, an explanation should be furnished to the state regulatory body.

The flow rate measurement should be obtained by the use of an orifice meter, critical flow prover, positive choke, or other authorized metering device in good operating condition. When an orifice meter is used as the metering device, the meter should be calibrated and the diameters of the orifice plate and meter run verified as to size, condition and compliance with acceptable standards. The differential pen should be zeroed under operating pressure before beginning the test.

The field barometric pressure, the specific gravity of the separator gas, and the produced liquid should be determined.

Periodically during the flow rate, wellhead flowing pressures and flow-rate data should be recorded and liquid production rate should be observed to aid in determining when stabilization has been attained. A constant flowing wellhead pressure or static column wellhead pressure and rate of flow for a period of at least 15 minutes should constitute stabilization for this test.

At the end of the flow rate, the following information should be recorded:

- Flowing wellhead pressure.
- Static column wellhead pressure if it can be obtained.
- Rate of liquid production.
- Flowing wellhead temperature.
- All data pertinent to the gas metering device.

Calculations

General

A wellhead absolute open flow as determined from the wellhead equation, (Equation 2, page 7), $Q = C(P_c^2 - P_w^2)^n$, is normally found to be equivalent to the bottom-hole absolute open flow as determined from the bottom-hole equation, (Equation 1, page 7), $Q = C(P_f^2 - P_s^2)^n$, where the wellhead shut-in pressure of all wells in a given reservoir is lower than 2,000 psig. Under this condition the wellhead absolute open flow is acceptable instead of the bottom-hole absolute open flow.

Bottom-Hole Calculations

Bottom-hole pressures should be calculated to a datum at the midpoint of the producing section open to flow. The point of entry into the tubing may be used as the datum if it is not more than 100 feet above or below the midpoint of the producing section open to flow.

Under all shut-in conditions and under flowing conditions, when the static column wellhead pressures can be obtained, the bottom-hole pressure should be calculated.

When only the flowing wellhead pressure can be obtained, the bottom-hole pressure should be calculated.

When the bottom-hole pressures are recorded by use of a properly calibrated bottom-hole pressure bomb, and corrected to the proper datum, these pressures may be used in the bottom-hole formula.

When liquid accumulation in the well bore during the shut-in period appreciably affects the wellhead shut-in pressure, the calculation of the bottom-hole pressure should be made.

Wellhead Calculations

The static column wellhead pressure must be obtained if possible.

When only the flowing wellhead pressure can be obtained, the static column wellhead pressure should be calculated.

When liquid accumulation in the well bore during the shut-in period appreciably affects the well head shut-in pressure, appropriate correction of the surface pressure should be made.

Plotting

A back-pressure curve should be accurately drawn on equal scale log-log paper (3-inch cycles are recommended). This curve should be drawn through the point established by the stabilized one-point test data and parallel to the most recent curve that has been established for the well by a Stabilized MultipointTest (page 8), a Constant Time Multipoint Test (page 13), or an Isochronal Multipoint Test (page 19). The absolute open flow may be determined from this back-pressure curve or calculated.

Determination of Deliverability

Shut-In Pressure

Wells with a pipeline connection should be produced for a sufficient length of time at a flow rate large enough to clear the well bore of accumulated liquids prior to the shut-in period. If the well bore cannot be cleared of accumulated liquids while producing into a pipeline, the well should be blown to the atmosphere to remove these liquids.

Wells without pipeline connections should be blown to the atmosphere to remove accumulated liquids.

The well should be shut in until the rate of pressure buildup is less than 1/10 of 1 per cent of the previously recorded pressure, psig, in 30 minutes. This pressure should be recorded.

Flow Test

After recording the shut-in pressure, a stabilized flow rate and its corresponding pressures should be taken.

This flow rate should be a rate sufficient to keep the well clear of all liquids.

The static column wellhead pressure should be maintained as nearly as possible at the designated deliverability pressure and within specified tolerances. Any deviation from the specified tolerances must be specifically approved by the state regulatory body.

The flow rate measurement should be obtained by the use of an orifice meter, critical flow prover, positive choke, or other authorized metering device in good operating condition. When an orifice meter is used as the metering device, the meter should be calibrated and the diameters of the orifice plate and meter run verified as to size, condition and compliance with acceptable standards. The differential pen should be zeroed before beginning the test.

The field barometric pressure, the specific gravity of the separator gas, and the produced liquid should be determined.

During the flow rate, wellhead flowing pressures and flow rate data should be recorded periodically and liquid production rates should be observed to aid in determining when stabilization has been attained. A constant flowing wellhead pressure or static column wellhead pressure and rate of flow for a period of at least 15 minutes should constitute stabilization.

At the end of the flow rate the following information should be recorded:

- Flowing wellhead pressure.
- Static column wellhead pressure if it can be obtained.
- Rate of liquid production.
- Flowing wellhead temperature.
- All data pertinent to the gas metering device.

Calculations

The deliverability should be determined at the designated deliverability pressure by the use of the following formula:

$$D = Q\left[\frac{P_c^{\,2} - P_d^{\,2}}{P_c^{\,2} - P_w^{\,2}}\right]^n$$

The static column wellhead pressure should be obtained if possible.

When only the flowing wellhead pressure can be obtained, the static column wellhead pressure should be calculated.

When liquid accumulation in the wellbore during the shut-in period appreciably affects the wellhead shut-in pressure, appropriate correction of the surface pressure should be made.

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Rules of Calculation

The tables in this manual are limited to four significant figures. Significant figures refer to all integers in a number, plus zeros, except those zeros that are in a number for the purpose of indicating the position of the decimal point. Therefore, calculated values should be rounded off to four significant figures, using the procedure of increasing the last significant figure by one, if followed by a digit of 5, or larger. If the last significant figure is followed by a digit smaller than 5, it should remain the same. In calculations involving two or more multipliers, intermediate products should be rounded to five significant figures with the final product being rounded to four significant figures.

Rounding-Off Procedure
Significant Figures

Five	Four	Three	Two
1.4567	1.457	1.46	1.5
1.4321	1.432	1.43	1.4
0.093451	0.09345	0.0935	0.093*

* based on four significant figures

In reporting open-flow and deliverability figures, use only whole numbers, limited to four significant figures, for example 590 Mcfd and 63,750 Mcfd. Squared pressures, and the differences in squared pressures, should be expressed in thousands, limited to the nearest tenth; for example, 1,033.1 and 99.9.

Values of "n" should be calculated to four significant figures, and rounded off to three; for example, the calculated value of 0.7583 should be reported as 0.758.

Values of GH/TZ should be calculated to the fourth figure following the decimal point and rounded off to the third figure following the decimal point.

Values of P_r and T_r should be calculated to four significant figures and rounded off to two significant figures following the decimal point before determining the Z value from Table 9. For example, a P_r of 0.3556 would be rounded off to 0.36, a T_r of 1.423 would be rounded off to 1.42.

Exception – High Pressure Wells

An exception from the rules of calculation and significant figures set out above should be made when making calculations for high pressure wells. To provide the necessary accuracy, use five or six significant figures.

BASIC CALCULATIONS

Number 1.

Determination of compressibility factor (Z) and supercompressibility factor (F_{pv}):

Using the data:

G_g	=	0.625
Carbon dioxide	=	2 %
Nitrogen	=	3 %

From Table 9 determine P_{cr} and T_{cr} and make appropriate corrections for carbon dioxide and nitrogen content as determined from Table 10, thus:

$P_{cr} = 671 + 8 - 5 = 674$
$T_{cr} = 365 - 3 - 9 = 353$

Using the 3-hour data obtained from the first flow:

$P_r = P_m/P_{cr} = 735/674 = 1.09$
$T_r = T_m/T_{cr} = 526/353 = 1.49$

From Table 11 for $P_r = 1.09$ and $T_r = 1.49$,

$Z = 0.891$

From Table 12 for $Z = 0.891$,

$F_{pv} = 1.059$

Number 2.

Calculation of the rate of flow using meter data:

$$Q = F_b \times \sqrt{(h_w \times P_m)} \times F_t \times F_g \times F_{pv}$$

Using the 3-hour data obtained from the first flow,

$$Q = (17.23)\sqrt{(8.3)(735)}(0.9943)(1.265)(1.059)$$

$$Q = (17.23)(78.10)(0.9943)(1.265)(1.059)$$

$$Q = 1793$$

Source of factors:

F_b = 17.23 (from Table 2 for 4-inch meter run and 1.750 inch orifice)

Note: Use Table 1 for flange tap meters.

$$\sqrt{(8.3)(735)} = (2.881)(27.11) \text{ (from Table 3)}$$

$$= 78.10$$

F_t = 0.9943 (from Table 7 for temperature of 66ºF)
F_g = 1.265 (from Table 8 for G_g = 0.625)
F_{pv} =1.059 (from Basic Calculation Number 1)

Number 3.

Calculation of the rate of flow using critical flow prover data:

$$Q = F_p \times P_m \times F_t \times F_g \times F_{pv}$$

Source of factors:

F_p (from Table 5 for appropriate prover size and orifice diameter)

P_m (prover pressure, psia)

Note: Other factors are determined in the same manner as in Basic Calculation Number 2 (page 36).

Number 4.

Calculation of the rate of flow using positive choke data:

$$Q = F_p \times P_m \times F_t \times F_g \times F_{pv}$$

Source of factors:

F_p (from Table 6 for appropriate choke size and type)
P_m (choke pressure, psia)

Note: Other factors are determined in the same manner as in Basic Calculation Number 2 (page 36).

Number 5.

Determination of the exponent “n” of the back-pressure equation:

The exponent of the back-pressure, “n”, may be determined as follows:

$$n = \frac{\log Q_2 - \log Q_1}{\log\left(P_f^{\ 2} - P_s^{\ 2}\right)_2 - \log\left(P_f^{\ 2} - P_s^{\ 2}\right)_1}$$

If $(P_f^2 - P_s^2)_2$ is selected from the back-pressure curve at a point one cycle greater than $(P_f^2 - P_s^2)_1$, then:

$n = \log Q_2 - \log Q_1$, or

$n = \log Q_2/Q_1$

Using the back-pressure curve:

at $(P_f^2 - P_s^2)_2 = 3{,}000$, $Q_2 = 8{,}750$ and $\log Q_2 = 3.9420$

and

at $(P_f^2 - P_s^2)_1 = 300$, $Q_1 = 1{,}450$ and
$\log Q_1 = 3.1614/0.7806$

and n = 0.781

When the back-pressure curve is plotted on equal cycle log-log paper, the exponent “n” is equal to the tangent of the angle formed with the $(P_f^2 - P_s^2)$-axis or the cotangent of the angle formed with the “Q”-axis.

The exponent “n” may also be determined by the use of curve fitting methods such as that of least squares.

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APPENDIX A

The Flow Equations and The Friction Factor (F_r)

The general flow equation may be expressed as follows: [(1)]

$$\frac{1{,}000\ GL}{53.33} = \int_{P_2}^{P_1} \frac{P/TZ\ d(P)}{\frac{2.6665 f Q_m{}^2}{d^5} + H/L\ (P/TZ)^2} \qquad \text{A-1}$$

In order to utilize equation A-1, the coefficient of friction “f” must be evaluated. It may be obtained from various correlations; however, for the purpose of this report the coefficient of friction “f” as determined from the “complete turbulence” portion of Moody’s[(2)] curves has been adopted. Moody’s curves were calculated by means of the Colebrook[(3)] equation and are equivalent to the Nikuradse[(4)] equation where the coefficient of friction is independent of the Reynolds Number and depends only on the relative roughness.

The values for various sizes of pipe are shown below:

d in.	Relative Roughness(*)	Moody f(**)	f(**)
0.60	0.00100	0.0196	0.004900
0.75	0.00080	0.0187	0.004675
1.00	0.00060	0.0175	0.004375
1.50	0.00040	0.0159	0.003975
3.00	0.00020	0.0137	0.003425
6.00	0.00010	0.0120	0.003000
12.00	0.00005	0.0106	0.002650
60.00	0.00001	0.0082	0.002050

(*) Based on an absolute roughness of 0.0006 inches. (For roughness other than 0.0006 inches, see Equations A-23 and A-24).

(**) The numerical value of the coefficient of friction "f" as used in this report is equal to ¼ of the numerical value of the term "f" as used by Moody.

The log-log plot of the coefficient of friction "f" versus the corresponding internal diameter "d" for the values shown above indicates a straight line relationship for pipe diameters less than 4.277 inches and a different straight line relationship for pipe diameters greater than 4.277 inches. These straight lines may be expressed by the form $f = ad^b$, where "a" and "b" are constants.

Application of the method of least squares to the above data results in the following expressions for the coefficient of friction "f":

$$f = \frac{4.372 \times 10^{-3}}{d^{0.224}} \qquad \text{A-2}$$

for internal diameters less than 4.277 inches, and:

$$f = \frac{4.007 \times 10^{-3}}{d^{0.164}} \qquad \text{A-3}$$

for internal diameters greater than 4.277 inches.

For convenience, it is desirable to introduce two new terms F_r and F_e where:

$$(F_r Q_m)^2 = F_e = \frac{2.6665 f Q_m{}^2}{d^5} \qquad \text{A-4}$$

Substitution of the right hand term of equation A-2 and equation A-3 for “f” in equation A-4 results in:

$$F_r = \frac{0.10797}{d^{2.612}} \qquad \text{A-5}$$

for internal diameters less than 4.277 inches, and:

$$F_r = \frac{0.10337}{d^{2.582}} \qquad \text{A-6}$$

A table of values of F_r for various sizes of pipe is shown in Table 15.

For non-circular cross-sections, it is necessary to determine an effective value of the internal diameter "d" for substitution in equation A-5 and equation A-6.

The term d^5 in the general flow equation is from the expression:

$$d_e^{\,5} = \frac{\left(\dfrac{4\ \text{area}}{\pi}\right)^3}{\dfrac{\text{perimeter}}{\pi}} \qquad \text{A-7}$$

The terms $d^{0.224}$ in equation A-2 and $d^{0.164}$ in equation A-3 are a result of an empirical relationship and are from the equivalent diameter formula:

$$d_e = \frac{4\ \text{area}}{\text{perimeter}} \qquad \text{A-8}$$

Thus, the effective diameter "d" for noncircular cross-sections for use with equation A-5 above is:

$$d_e^{\,2.612} = \left[\frac{\left(\dfrac{4\ \text{area}}{\pi}\right)^3}{\dfrac{\text{perimeter}}{\pi}} \times \left(\frac{4\ \text{area}}{\text{perimeter}}\right)^{0.224}\right]^{\frac{1}{2}} \qquad \text{A-9}$$

and for use with equation A-6 above is:

$$d_e^{2.582} = \left[\frac{\left(\frac{4\ \text{area}}{\pi}\right)^3}{\frac{\text{perimeter}}{\pi}} \times \left(\frac{4\ \text{area}}{\text{perimeter}}\right)^{0.164} \right]^{\frac{1}{2}} \qquad \text{A-10}$$

The term perimeter, as used in equations A-7 through A-10, refers to the total wetted perimeter in contact with the fluid, that is, for annular flow the wetted perimeter would be the sum of the internal perimeter of the larger flow string and external perimeter of the smaller. Thus:

$$d_e^{2.612} = (d - d_o)^{1.612}(d + d_o) \qquad \text{A-11}$$

and:

$$d_e^{2.582} = (d - d_o)^{1.582}(d + d_o) \qquad \text{A-12}$$

for flow through an annular space.

For inclined static column or flow calculations, equation A-1 may be simplified as follows:

$$18.75\ GH = \int_{P_t}^{P_s} \frac{P/TZ\ d(P)}{L/HF_e\ (P/TZ)^2} \qquad \text{A-13}$$

It should be noted that the term “L/H” in equation A-13 is positive when the flow is upward as in a producing gas well and is negative when the flow is downward as in a gas injection well.

Equation A-13 does not lend itself to mathematical integration unless conditions are such that it can be assumed that the temperature “T” and compressibility factor “Z” are constant. In many cases this assumption does not introduce appreciable error and equation A-13 may be simplified with the result that:

$$P_f^{\,2} = e^s P_c^{\,2} \qquad \text{A-14}$$

for the static column, and:

$$P_s^{\,2} = e^s P_t^{\,2} + L/H\,[F_r Q_m TZ]^2 \left(e^s - 1\right) \qquad \text{A-15}$$

where:

$$s = 0.0375\ GH/TZ$$

Often it is desired to convert the flowing pressure “P_t” to a corresponding static column pressure “P_w”. In this case equation A-15 becomes:

$$P_w^{\,2} = P_t^{\,2} + L/H\,[F_r Q_m TZ]^2 \left(1 - e^{-s}\right) \qquad \text{A-16}$$

It should be noted that the additional assumption has been made that the temperature "T" and the compressibility factor "Z" are not only constant but that they are the same in both flowing and static columns.

In those cases (usually in deep high-pressure gas wells) when the assumption of constant temperature "T" and compressibility factor "Z" introduces appreciable error, equation A-13 may be evaluated by means of a numerical stepwise procedure. The equation for stepwise calculation of subsurface pressures in shut-in gas wells is:

$$37.5\ GH = \left[\left(P_1 - P_c\right)\left(I_1 + I_c\right) + \left(P_2 - P_1\right)\left(I_2 + I_1\right)\right] \qquad \text{A-17}$$

where the subscripts "c", "1", and "2" indicate conditions at the wellhead, at "H/2," and at "H", respectively.

The final evaluation of the shut-in pressure "P_f" at a vertical depth of "H" in the well is computed by:

$$P_f = P_c + \Delta P \qquad \text{A-18}$$

where:

$$\Delta P = \frac{3\left(37.5\ GH\right)}{I_c + 4I_1 + I_2} \qquad \text{A-19}$$

The equation for stepwise calculation of subsurface pressures in flowing gas wells is:

$$37.5\ GH = (P_1 - P_t)(I_1 + I_t) + (P_2 - P_1)(I_2 + I_1) \qquad \text{A-20}$$

where the subscripts “t”, “1”, and “2” indicate conditions at the wellhead, at “H/2” and at “H”, respectively.

The final evaluation of the flowing pressure “P_s” at a vertical depth of “H” in the well is computed by:

$$P_s = P_t + \Delta P \qquad \text{A-21}$$

and:

$$\Delta P = \frac{3\,(37.5\ GH)}{I_t + 4I_1 + I_2} \qquad \text{A-22}$$

If the Nikuradse[4] equation relating relative roughness with pipe diameter were used instead of Moody’s relationship, F_r for an absolute roughness of 0.0006 inches can be expressed as a function of pipe diameter as follows:

$$F_r = \frac{1.63294}{(15.1603 + 4\log d)\,d^{\frac{5}{2}}} \qquad \text{A-23}$$

In using F_r values based on an absolute roughness of 0.0006 inches, a few wells will be found where flowing bottom-hole pressures are calculated to be more than the shut-in pressure. This is probably caused by the extremely smooth condition of the tubing or a combination of physical conditions which caused the tubing to act as a completely smooth pipe with a resultant low pressure drop due to friction. In those rare instances where there is evidence that the tubing is smoother than normal, the use of F_r values based on an absolute roughness of 0.0001 inches is suggested. F_r values based on an absolute roughness of 0.0001 inches may be calculated as follows:

$$F_r = \frac{1.63294}{(18.2728 + 4 \log d)\, d^{\frac{5}{2}}} \qquad \text{A-24}$$

Table of Authorities

(1) Cullender, M.H. and Smith, R.V.: *Practical Solution of Gas-Flow Equations for Wells and Pipelines with Large Temperature Gradients*, AIME Trans. v. 207, pp. 281, 1956.

(2) Moody, L.F.: *Friction Factors for Pipe Flow*, ASME Trans. v. 66, pp. 671, 1944.

(3) Colebrook, C.F.: *Turbulent Flow in Pipes, with Particular Reference to the Transition Region between the Smooth and Rough Pipe Laws*, J. Inst. Civil Engr. (London) v. 11, pp. 133, 1938 – 1939.

(4) Nikuradse, J.: *Stromungsgesetze in Rauhen Rohren*, V.D.I. Forschungsheft 361 (Aug., 1933), Translation, Pet. Engr. (March, May, June, July, Aug., 1940), v. 11.

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APPENDIX B

Corrections for Deviations from Ideal Gas Laws

As a part of the problem of determining the characteristics and capacity of a gas well to produce, the volume of gas flowing and its flowing density must be computed.

The volume of gas flowing must be calculated to base conditions from flowing conditions at the point of metering, and the density of the gas in the flowing column must be calculated from atmospheric conditions to those existing in the flowing string. This is done by the use of the Ideal Gas Law:[(1)]

$$PV = nRT \qquad \text{B-1}$$

At relatively low pressure or high temperature the deviation of natural gas from this relation is small, but at high pressures or low temperatures this deviation might be considerable. With pure gaseous elements corrections can be made with relatively small error by use of an equation of state. However, with gaseous compounds and mixtures of these gaseous compounds, these equations of state for the mixture become extremely complicated and difficult to handle mathematically. By using the "Law of Corresponding States," calculations of volumes and densities can be made with relatively small error at any pressure and temperature. This is: "That the ratio of the value of any intensive properties to the value of that property at the critical state is related to the ratios of the prevailing absolute temperature and pressure to the critical temperature and pressure by the same function for all similar substances." [(2)]

The reduced volume $V_r = \frac{V}{V_{cr}}$

The reduced pressure $P_r = \frac{P}{P_{cr}}$

The reduced temperature $T_r = \frac{T}{T_{cr}}$

These relations, developed for pure elements and compounds, have been extended to apply to mixtures using a method devised by Kay[3]. In this method, the molal average critical pressure and molal average critical temperature are used rather than the true critical pressure and true critical temperature. The molal average critical pressure and molal average critical temperature are called pseudocritical pressure and pseudocritical temperature to distinguish them from the true critical pressure and true critical temperature. The pseudocritical pressure and pseudocritical temperature are used to compute the pseudo-reduced pressure and pseudo-reduced temperature for mixtures.

By using the pseudo-reduced pressure and pseudo-reduced temperature, the desired compressibility factor can be obtained from Table 11 or from a compressibility chart.

The conventional compressibility chart is a plot of Z versus P_r at constant T_r obtained from the equation:

$$Z = \frac{PV}{nRT} = \frac{P_r V_r}{nRT_r} \qquad \text{B-2}$$

Thus, Z is the factor necessary to correct for the deviation from the Ideal Gas Law of the gas under investigation.

When no analysis of the gas is available, the pseudocritical properties can be estimated from the gas gravity. In general, carbon dioxide (CO_2), nitrogen (N_2), and hydrogen sulfide (H_2S) will materially affect the pseudocritical properties.

These effects can be approximated by use of Table 10. When the quantities of CO_2 or N_2 are beyond the range of Table 10, or when appreciable quantities of H_2S are present, the compressibility factors should be determined experimentally.

Table 9 is a tabulation of the values for hydrocarbon gases free from carbon dioxide, nitrogen, and hydrogen sulphide.

Table 10 is a tabulation of corrections of these values for various amounts of carbon dioxide and nitrogen.

The relationship of pseudocritical properties also can be computed from the following equations devised by A. E. Sweeney, Jr.:

$$P_{cr} = 693 - 35.0G + 432.9X_c - 167.3X_n + 654X_{H_2S} \qquad \text{B-3}$$

$$T_{cr} = 158 - 33.0G + 167.3X_c - 279.9X_n + 127X_{H_2S} \qquad \text{B-4}$$

Table of Authorities

(1) Brown, G. G., Katz, D. L., Oberfell, G. C., and Alden, R. C., *Natural Gasoline and the Volatile Hydrocarbons*, Natural Gasoline Association of America, Tulsa, 1948.

(2) Sage, B. H. and Lacey, W. N., *Volumetric and Phase Behavior of Hydrocarbons*, Stanford University Press, 1939.

(3) Kay, W. B., *Industrial Engineering Chemistry*, v. 28, pp. 1,014, 1036

Table 1
Basic Orifice Factors - Flange Taps

$$- \text{Mcfd}/\sqrt{h_w P_m} - F_b$$

$$T_b = 520\,R\ (60°F)$$

$$T_m = 520\,R\ (60°F)$$

$$P_b = 14.65\ \text{psia}$$

$$G = 1.000$$

All other factors = 1.000

Table 1 adapted from American Gas Association Gas Measurement Committee Report No. 3.

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Table 1 – Basic Orifice Factors – Flange Taps

* *Use this column if only the nominal diameter is known*

Nom. Diameter, inches	2			3				4			
ASA Schedule	160	80	40	xxHvy	160	80	40	xxHvy	160	80	40
Inside Diameter, inches	1.689	1.939	2.067	2.300	2.626	2.900	3.068	3.152	3.438	3.286	4.026
Orifice Diameter, inches			*				*				*
0.25	0.3064	0.3066	0.3067	0.3068	0.3068	0.3067	0.3066	0.3065	0.3064	0.3062	0.3061
0.375	0.6871	0.6863	0.686	0.6856	0.6852	0.6849	0.6848	0.6847	0.6845	0.6842	0.6841
0.5	1.225	1.221	1.219	1.217	1.215	1.214	1.214	1.213	1.213	1.212	1.212
0.625	1.933	1.919	1.914	1.908	1.902	1.899	1.897	1.897	1.895	1.893	1.892
0.75	2.826	2.79	2.779	2.764	2.751	2.744	2.74	2.739	2.735	2.731	2.729
0.875	3.932	3.851	3.824	3.792	3.765	3.75	3.744	3.741	3.733	3.726	3.723
1	5.303	5.127	5.073	5.006	4.951	4.924	4.912	4.907	4.893	4.879	4.874
1.125	7.022	6.665	6.557	6.428	6.324	6.237	6.251	6.242	6.217	6.194	6.186
1.25	9.31	8.533	8.329	8.087	7.901	7.81	7.771	7.755	7.713	7.675	7.661
1.375	------	10.82	10.46	10.03	9.705	9.551	9.486	9.459	9.388	9.326	9.303
1.5	------	------	13.09	12.33	11.78	11.52	11.41	11.37	11.25	11.16	11.12
1.625	------	------	------	15.06	14.16	13.75	13.58	13.51	13.33	13.17	13.12
1.75	------	------	------	------	16.92	16.28	16.01	15.9	15.63	15.39	15.31
1.875	------	------	------	------	20.15	19.16	18.75	18.59	18.18	17.83	17.71
2	------	------	------	------	------	22.46	21.86	21.62	21.01	20.5	20.32
2.125	------	------	------	------	------	26.33	25.4	25.05	24.17	23.43	23.18
2.25	------	------	------	------	------	------	29.52	28.96	27.7	26.66	26.3
2.375	------	------	------	------	------	------	------	------	31.65	30.22	29.72
2.5	------	------	------	------	------	------	------	------	36.16	34.15	33.48
2.625	------	------	------	------	------	------	------	------	------	38.5	37.6

Table 1 – Basic Orifice Factors – Flange Taps

* *Use this column if only the nominal diameter is known*

Nom. Diameter, inches	2			3				4			
ASA Schedule	160	80	40	xxHvy	160	80	40	xxHvy	160	80	40
Inside Diameter, inches	1.689	1.939	2.067	2.300	2.626	2.900	3.068	3.152	3.438	3.286	4.026
Orifice Diameter, inches			*				*				*
2.75	------	------	------	------	------	------	------	------	------	43.37	42.15
2.875	------	------	------	------	------	------	------	------	------	------	47.19
3	------	------	------	------	------	------	------	------	------	------	52.97
3.125	------	------	------	------	------	------	------	------	------	------	------
3.25	------	------	------	------	------	------	------	------	------	------	------
3.375	------	------	------	------	------	------	------	------	------	------	------
3.5	------	------	------	------	------	------	------	------	------	------	------
3.625	------	------	------	------	------	------	------	------	------	------	------
3.75	------	------	------	------	------	------	------	------	------	------	------
3.875	------	------	------	------	------	------	------	------	------	------	------
4	------	------	------	------	------	------	------	------	------	------	------
4.25	------	------	------	------	------	------	------	------	------	------	------
4.5	------	------	------	------	------	------	------	------	------	------	------
4.75	------	------	------	------	------	------	------	------	------	------	------
5	------	------	------	------	------	------	------	------	------	------	------
5.25	------	------	------	------	------	------	------	------	------	------	------
5.5	------	------	------	------	------	------	------	------	------	------	------
5.75	------	------	------	------	------	------	------	------	------	------	------
6	------	------	------	------	------	------	------	------	------	------	------

Table 1 – Basic Orifice Factors – Flange Taps

* *Use this column if only the nominal diameter is known*

6				8			Nom. Diameter, inches
xxHvy	160	80	40	80	40	30	ASA Schedule
4.897	5.189	5.761	6.065	7.625	7.981	8.071	Inside Diameter, inches
			*				Orifice Diameter, inches
------	------	------	------	------	------	------	0.25
------	------	------	------	------	------	------	0.375
1.211	1.211	1.211	1.211	------	------	------	0.5
1.89	1.89	1.889	1.889	------	------	------	0.625
2.724	2.723	2.721	2.72	------	------	------	0.75
3.713	3.711	3.707	3.706	3.7	3.7	3.7	0.875
4.859	4.855	4.85	4.847	4.838	4.836	4.836	1
6.161	6.156	6.147	6.143	6.129	6.127	6.126	1.125
7.622	7.613	7.6	7.595	7.575	7.572	7.571	1.25
9.242	9.23	9.211	9.203	9.176	9.172	9.171	1.375
11.03	11.01	10.98	10.97	10.93	10.93	10.93	1.5
12.98	12.95	12.91	12.9	12.84	12.84	12.84	1.625
15.1	15.06	15.01	14.98	14.91	14.9	14.9	1.75
17.4	17.34	17.26	17.23	17.14	17.13	17.13	1.875
19.88	19.8	19.69	19.65	19.53	19.51	19.51	2
22.56	22.45	22.3	22.24	22	22.05	22.05	2.125
25.44	25.29	25.09	25.01	24.7	24.76	24.75	2.25
28.55	28.34	28.06	27.95	27.66	27.62	27.61	2.375
31.88	31.6	31.22	31.09	30.7	30.65	30.64	2.5
33.45	35.09	34.59	34.41	33.92	33.85	33.84	2.625

Table 1 – Basic Orifice Factors – Flange Taps

* *Use this column if only the nominal diameter is known*

6				8			Nom. Diameter, inches
xxHvy	160	80	40	80	40	30	ASA Schedule
4.897	5.189	5.761	6.065	7.625	7.981	8.071	Inside Diameter, inches
			*				Orifice Diameter, inches
39.31	38.82	38.18	37.94	37.3	37.22	37.21	2.75
43.46	42.82	41.99	41.69	40.87	40.77	40.74	2.875
47.94	47.12	46.04	45.66	44.61	44.49	44.46	3
52.78	51.72	50.35	49.86	48.54	48.39	48.36	3.125
58.02	56.68	54.94	54.32	52.67	52.48	52.44	3.25
63.7	62.01	59.83	59.05	56.99	56.76	56.71	3.375
69.87	67.77	65.04	64.04	64.07	61.24	61.17	3.5
76.76	73.97	70.6	69.4	66.28	65.92	65.85	3.625
------	80.73	76.55	75.08	71.25	70.82	70.73	3.75
------	88.27	82.91	81.12	76.46	75.94	75.83	3.875
------	------	89.73	87.56	81.91	81.29	81.15	4
------	------	105.01	101.8	93.62	92.72	92.53	4.25
------	------	------	118.3	106.5	105.2	105	4.5
------	------	------	------	120.7	118.9	118.5	4.75
------	------	------	------	136.3	134	133.4	5
------	------	------	------	153.7	150.5	149.8	5.25
------	------	------	------	173	168.7	167.8	5.5
------	------	------	------	------	189	187.7	5.75
------	------	------	------	------	------	210.1	6

Table 2
Basic Orifice Factors - Pipe Taps

- $\text{Mcfd}/\sqrt{h_w P_m} - F_b$

$$T_b = 520\ R\ (60°F)$$

$$T_m = 520\ R\ (60°F)$$

$$P_b = 14.65\ \text{psia}$$

$$G = 1.000$$

All other factors = 1.000.

Table 2 adapted from American Gas Association Gas Measurement Committee Report No. 3.

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Table 2 - Basic Orifice Factors – Pipe Taps

* *Use this column if only the nominal diameter is known.*

Nom. Diameter, inches	2			3				4			
ASA Schedule	160	80	40	xxHvy	160	80	40	xxHvy	160	80	40
Inside Diameter, inches	1.689	1.939	2.067	2.300	2.626	2.900	3.068	3.152	3.438	3.826	4.026
Orifice Diameter, inches			*				*				*
0.25	0.31	0.31	0.31	0.3085	0.308	0.3078	0.3076	0.3076	0.3074	0.3071	0.307
0.375	0.71	0.7	0.7	0.697	0.6943	0.6928	0.6921	0.6918	0.691	0.6901	0.6898
0.5	1.3	1.28	1.27	1.255	1.245	1.239	1.237	1.235	1.232	1.229	1.228
0.625	2.11	2.05	2.03	2.001	2.974	1.958	1.951	1.948	1.939	1.93	1.927
0.75	3.19	3.06	3.02	2.955	2.897	2.864	2.848	2.84	2.82	2.801	2.793
0.875	4.65	4.37	4.27	4.149	4.036	3.972	3.941	3.928	3.889	3.851	3.836
1	6.65	6.06	5.87	5.63	5.419	5.303	5.249	5.226	5.159	5.093	5.066
1.125	9.46	8.28	7.92	7.467	7.09	6.889	6.797	6.756	6.645	6.537	6.494
1.25	------	11.2	10.6	9.762	9.106	8.77	8.618	8.554	8.375	8.202	8.134
1.375	------	------	14.1	12.66	11.55	11	10.76	10.65	10.37	10.11	10
1.5	------	------	------	16.39	14.54	13.65	13.27	13.11	12.68	12.28	12.12
1.625	------	------	------	------	18.23	16.83	16.24	15.99	15.34	14.75	14.52
1.75	------	------	------	------	22.85	20.67	19.77	19.4	18.43	17.56	17.23
1.875	------	------	------	------	------	25.35	23.99	23.44	22.01	20.76	20.3
2	------	------	------	------	------	31.15	29.09	28.28	26.2	24.41	23.77
2.125	------	------	------	------	------	------	35.36	34.15	31.12	28.6	27.71
2.25	------	------	------	------	------	------	------	------	36.97	33.43	32.2
2.375	------	------	------	------	------	------	------	------	43.99	39.02	37.34
2.5	------	------	------	------	------	------	------	------	------	45.55	43.25
2.625	------	------	------	------	------	------	------	------	------	53.24	50.1

Table 2 - Basic Orifice Factors – Pipe Taps

* *Use this column if only the nominal diameter is known.*

Nom. Diameter, inches	2			3				4			
ASA Schedule	160	80	40	xxHvy	160	80	40	xxHvy	160	80	40
Inside Diameter, inches	1.689	1.939	2.067	2.300	2.626	2.900	3.068	3.152	3.438	3.826	4.026
Orifice Diameter, inches			*				*				*
2.75	------	------	------	------	------	------	------	------	------	------	58.09
2.875	------	------	------	------	------	------	------	------	------	------	------
3	------	------	------	------	------	------	------	------	------	------	------
3.125	------	------	------	------	------	------	------	------	------	------	------
3.25	------	------	------	------	------	------	------	------	------	------	------
3.375	------	------	------	------	------	------	------	------	------	------	------
3.5	------	------	------	------	------	------	------	------	------	------	------
3.625	------	------	------	------	------	------	------	------	------	------	------
3.75	------	------	------	------	------	------	------	------	------	------	------
3.875	------	------	------	------	------	------	------	------	------	------	------
4	------	------	------	------	------	------	------	------	------	------	------
4.25	------	------	------	------	------	------	------	------	------	------	------
4.5	------	------	------	------	------	------	------	------	------	------	------
4.75	------	------	------	------	------	------	------	------	------	------	------
5	------	------	------	------	------	------	------	------	------	------	------
5.25	------	------	------	------	------	------	------	------	------	------	------
5.5	------	------	------	------	------	------	------	------	------	------	------

Table 2 - Basic Orifice Factors – Pipe Taps

* *Use this column if only the nominal diameter is known.*

6				8			Nom. Diameter, inches
xxHvy	160	80	40	80	40	30	ASA Schedule
4.897	5.189	5.761	6.065	7.625	7.981	8.071	Inside Diameter, inches
			*			*	Orifice Diameter, inches
------	------	------	------	------	------	------	0.25
------	------	------	------	------	------	------	0.375
1.224	1.224	1.222	1.222	------	------	------	0.5
1.917	1.915	1.912	1.91	------	------	------	0.625
2.771	2.766	2.759	2.756	------	------	------	0.75
3.791	3.782	3.768	3.762	3.743	3.74	3.739	0.875
4.986	4.969	4.943	4.933	4.899	4.894	4.893	1
6.364	6.335	6.291	6.274	6.217	6.209	6.207	1.125
7.933	7.888	7.819	7.791	7.701	7.687	7.685	1.25
9.703	0.636	9.534	9.492	9.354	9.334	9.33	1.375
11.68	11.59	11.44	11.38	11.18	11.15	11.15	1.5
13.89	13.76	13.56	13.47	13.19	13.15	13.14	1.625
16.35	16.16	15.88	15.77	15.38	15.33	15.32	1.75
19.06	18.81	18.43	18.28	17.77	17.69	17.68	1.875
22.07	21.73	21.22	21.02	20.35	20.25	20.23	2
25.39	24.93	24.27	24	23.14	23.01	22.98	2.125
29.07	28.46	27.59	27.24	26.13	25.98	25.94	2.25
33.14	32.34	31.21	30.76	29.35	29.15	29.11	2.375
37.66	36.61	35.15	34.57	32.8	32.55	32.49	2.5
42.67	41.32	39.44	38.71	36.49	36.18	36.11	2.625

Table 2 - Basic Orifice Factors – Pipe Taps

* *Use this column if only the nominal diameter is known.*

6				8			Nom. Diameter, inches
xxHvy	160	80	40	80	40	30	ASA Schedule
4.897	5.189	5.761	6.065	7.625	7.981	8.071	Inside Diameter, inches
			*			*	Orifice Diameter, inches
48.26	46.52	44.12	43.2	40.43	40.05	39.97	2.75
54.5	52.27	49.23	48.08	44.64	44.18	44.07	2.875
61.5	58.65	54.81	53.37	49.13	48.57	48.44	3
69.38	65.75	60.91	59.13	53.93	53.24	53.09	3.125
78.3	73.67	67.61	65.4	59.04	58.22	58.03	3.25
88.46	82.55	74.98	72.23	64.49	63.51	63.28	3.375
------	92.56	83.09	79.71	70.31	69.13	68.87	3.5
------	103.9	92.05	87.9	76.52	75.12	74.8	3.625
------	------	102	96.89	83.16	81.48	81.11	3.75
------	------	113.1	106.8	90.25	88.27	87.82	3.875
------	------	125.4	117.7	97.84	95.49	94.96	4
------	------	------	------	114.7	111.4	110.7	4.25
------	------	------	------	134	129.6	128.6	4.5
------	------	------	------	156.5	150.4	149	4.75
------	------	------	------	182.7	174.3	172.5	5
------	------	------	------	213.6	202.1	199.7	5.25
------	------	------	------	------	234.7	231.3	5.5

Table 3
Square Roots

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Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
0	0	0.317	0.447	0.548	0.632	0.707	0.775	0.837	0.894	0.949	0
1	1	1.049	1.095	1.140	1.183	1.225	1.265	1.304	1.342	1.378	1
2	1.414	1.449	1.483	1.517	1.549	1.581	1.612	1.643	1.673	1.703	2
3	1.732	1.761	1.789	1.817	1.844	1.871	1.897	1.923	1.949	1.975	3
4	2	2.025	2.049	2.074	2.098	2.121	2.145	2.168	2.191	2.214	4
5	2.236	2.258	2.280	2.302	2.324	2.345	2.366	2.387	2.408	2.429	5
6	2.449	2.470	2.490	2.501	2.530	2.550	2.569	2.588	2.608	2.627	6
7	2.646	2.665	2.683	2.702	2.720	2.739	2.757	2.775	2.793	2.811	7
8	2.828	2.846	2.864	2.881	2.898	2.915	2.933	2.950	2.966	2.983	8
9	3	3.017	3.033	3.050	3.066	3.082	3.098	3.114	3.130	3.146	9
10	3.162	3.178	3.194	3.209	3.225	3.240	3.256	3.271	3.286	3.302	10
11	3.317	3.332	3.347	3.362	3.376	3.391	3.406	3.421	3.435	3.450	11
12	3.464	3.479	3.493	3.507	3.521	3.536	3.550	3.564	3.578	3.592	12
13	3.606	3.619	3.633	3.647	3.661	3.674	3.688	3.701	3.715	3.728	13
14	3.742	3.755	3.768	3.782	3.795	3.808	3.821	3.834	3.847	3.860	14

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
15	3.873	3.886	3.899	3.912	3.924	3.937	3.950	3.962	3.975	3.987	15
16	4	4.012	4.025	4.037	4.050	4.062	4.074	4.087	4.099	4.111	16
17	4.123	4.135	4.147	4.159	4.171	4.183	4.195	4.207	4.219	4.231	17
18	4.243	4.254	4.266	4.278	4.290	4.301	4.313	4.324	4.336	4.347	18
19	4.359	4.370	4.382	4.393	4.405	4.416	4.427	4.438	4.450	4.461	19
20	4.472	4.483	4.494	4.506	4.517	4.528	4.539	4.550	4.561	4.572	20
21	4.583	4.593	4.604	4.615	4.626	4.637	4.648	4.658	4.669	4.680	21
22	4.690	4.701	4.712	4.722	4.733	4.743	4.754	4.764	4.775	4.785	22
23	4.796	4.806	4.817	4.827	4.337	4.848	4.858	4.868	4.879	4.889	23
24	4.899	4.909	4.919	4.930	4.940	4.950	4.960	4.970	4.980	4.990	24
25	5	5.010	5.020	5.030	5.040	5.050	5.060	5.070	5.079	5.089	25
26	5.099	5.109	5.119	5.128	5.138	5.148	5.158	5.167	5.177	5.187	26
27	5.196	5.206	5.215	5.225	5.235	5.244	5.254	5.263	5.273	5.282	27
28	5.292	5.301	5.310	5.320	5.329	5.339	5.348	5.357	5.367	5.376	28
29	5.385	5.394	5.404	5.413	5.422	5.431	5.441	5.450	5.459	5.468	29

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
30	5.477	5.486	5.495	5.505	5.514	5.523	5.532	5.541	5.550	5.559	30
31	5.568	5.577	5.586	5.595	5.604	5.612	5.621	5.630	5.639	5.648	31
32	5.657	5.666	5.675	5.683	5.692	5.701	5.710	5.718	5.727	5.736	32
33	5.745	5.753	5.762	5.771	5.779	5.788	5.797	5.805	5.814	5.822	33
34	5.831	5.840	5.848	5.857	5.865	5.874	5.882	5.891	5.899	5.908	34
35	5.916	5.925	5.933	5.941	5.950	5.958	5.967	5.975	5.983	5.992	35
36	6	6.008	6.017	6.025	6.033	6.042	6.050	6.058	6.066	6.075	36
37	6.083	6.091	6.099	6.107	6.116	6.124	6.132	6.140	6.148	6.156	37
38	6.164	6.173	6.181	6.189	6.197	6.205	6.213	6.221	6.229	6.237	38
39	6.245	6.253	6.261	6.269	6.277	6.285	6.293	6.301	6.309	6.317	39
40	6.325	6.332	6.340	6.348	6.356	6.364	6.372	6.380	6.387	6.395	40
41	6.403	6.411	6.419	6.427	6.434	6.442	6.450	6.458	6.465	6.473	41
42	6.481	6.488	6.496	6.504	6.512	6.519	6.527	6.535	6.542	6.550	42
43	6.557	6.565	6.573	6.580	6.588	6.595	6.603	6.611	6.618	6.626	43
44	6.633	6.641	6.648	6.656	6.663	6.671	6.678	6.686	6.693	6.701	44

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
45	6.708	6.716	6.723	6.731	6.738	6.745	6.753	6.760	6.768	6.775	45
46	6.782	6.790	6.797	6.804	6.812	6.819	6.826	6.834	6.841	6.848	46
47	6.856	6.863	6.870	6.877	6.885	6.892	6.899	6.907	6.914	6.921	47
48	6.982	6.935	6.943	6.950	6.957	6.964	6.971	6.979	6.986	6.993	48
49	7	7.007	7.014	7.021	7.029	7.036	7.043	7.050	7.057	7.064	49
50	7.071	7.141	7.211	7.280	7.348	7.416	7.483	7.550	7.616	7.681	50
60	7.746	7.810	7.874	7.937	8.000	8.062	8.124	8.185	8.246	8.307	60
70	8.367	8.426	8.485	8.544	8.602	8.660	8.718	8.775	8.832	8.888	70
80	8.944	9.000	9.055	9.110	9.165	9.220	9.274	9.327	9.381	9.434	80
90	9.487	9.539	9.592	9.644	9.695	9.747	9.798	9.849	9.899	9.950	90
100	10	10.050	10.100	10.150	10.200	10.250	10.300	10.340	10.390	10.440	100
110	10.490	10.540	10.580	10.630	10.680	10.720	10.770	10.820	10.860	10.910	110
120	10.950	11.000	11.050	11.090	11.140	11.180	11.220	11.270	11.310	11.360	120
130	11.400	11.450	11.490	11.530	11.580	11.620	11.660	11.700	11.750	11.790	130
140	11.830	11.870	11.920	11.960	12.000	12.040	12.080	12.120	12.170	12.210	140

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
150	12.250	12.290	12.330	12.370	12.410	12.450	12.490	12.530	12.570	12.610	150
160	12.650	12.690	12.730	12.770	12.810	12.850	12.880	12.920	12.960	13.000	160
170	13.040	13.080	13.110	13.150	13.190	13.230	13.270	13.300	13.340	13.380	170
180	13.420	13.450	13.490	13.530	13.560	13.600	13.640	13.670	13.710	13.750	180
190	13.780	13.820	13.860	13.890	13.930	13.960	14.000	14.040	14.070	14.110	190
200	14.140	14.180	14.210	14.250	14.280	14.320	14.350	14.390	14.420	14.460	200
210	14.490	14.530	14.560	14.590	14.630	14.660	14.700	14.730	14.760	14.800	210
220	14.830	14.870	14.900	14.930	14.970	15.000	15.030	15.070	15.100	15.130	220
230	15.170	15.200	15.230	15.260	15.300	15.330	15.360	15.390	15.430	15.460	230
240	15.490	15.520	15.560	15.590	15.620	15.650	15.680	15.720	15.750	15.780	240
250	15.810	15.840	15.870	15.910	15.940	15.970	16.000	16.030	16.060	16.090	250
260	16.120	16.160	16.190	16.220	16.250	16.280	16.310	16.340	16.370	16.400	260
270	16.430	16.460	16.490	16.520	16.550	16.580	16.610	16.640	16.670	16.700	270
280	16.730	16.760	16.790	16.820	16.850	16.880	16.910	16.940	16.970	17.000	280
290	17.030	17.060	17.090	17.120	17.150	17.180	17.200	17.230	17.260	17.290	290

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
300	17.320	17.350	17.380	17.410	17.440	17.460	17.490	17.520	17.550	17.580	300
310	17.610	17.640	17.660	17.690	17.720	17.750	17.780	17.800	17.830	17.860	310
320	17.890	17.920	17.940	17.970	18.000	18.030	18.060	18.080	18.110	18.140	320
330	18.170	18.190	18.220	18.250	18.280	18.300	18.330	18.360	18.380	18.410	330
340	18.440	18.470	18.490	18.520	18.550	18.570	18.600	18.630	18.650	18.680	340
350	18.710	18.730	18.760	18.790	18.810	18.840	18.870	18.890	18.920	18.950	350
360	18.970	19.000	19.030	19.050	19.080	19.100	19.130	19.160	19.180	19.210	360
370	19.240	19.260	19.290	19.310	19.340	19.360	19.390	19.420	19.440	19.470	370
380	19.490	19.520	19.540	19.570	19.600	19.620	19.650	19.670	19.700	19.720	380
390	19.740	19.770	19.800	19.820	19.850	19.870	19.900	19.920	19.950	19.970	390
400	20	20.020	20.050	20.070	20.100	20.120	20.150	20.170	20.200	20.220	400
410	20.250	20.270	20.300	20.320	20.350	20.370	20.400	20.420	20.450	20.470	410
420	20.490	20.520	20.540	20.570	20.590	20.620	20.640	20.660	20.690	20.710	420
430	20.740	20.760	20.780	20.810	20.830	20.860	20.880	20.900	20.930	20.950	430
440	20.980	21.000	21.020	21.050	21.070	21.100	21.120	21.140	21.170	21.190	440

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
450	21.210	21.240	21.260	21.280	21.310	21.330	21.350	21.380	21.400	21.420	450
460	21.450	21.470	21.490	21.560	21.540	21.560	21.590	21.610	21.630	21.660	460
470	21.680	21.700	21.730	21.750	21.770	21.790	21.820	21.840	21.860	21.890	470
480	21.910	21.930	21.950	21.980	22.000	22.020	22.050	22.070	22.090	22.110	480
490	22.140	22.160	22.180	22.200	22.230	22.250	22.270	22.290	22.320	22.340	490
500	22.360	22.380	22.410	22.430	22.450	22.470	22.490	22.520	22.540	22.560	500
510	22.580	22.610	22.630	22.650	22.670	22.690	22.720	22.740	22.760	22.780	510
520	22.800	22.830	22.850	22.870	22.890	22.910	22.930	22.960	22.980	23.000	520
530	23.020	23.040	23.070	23.090	23.110	23.130	23.150	23.170	23.190	23.220	530
540	23.240	23.260	23.280	23.300	23.320	23.350	23.370	23.390	23.410	23.430	540
550	23.450	23.470	23.490	23.520	23.540	23.560	23.580	23.600	23.620	23.640	550
560	23.660	23.690	23.710	23.730	23.750	23.770	23.790	23.810	23.830	23.850	560
570	23.870	23.900	23.920	23.940	23.960	23.980	24.000	24.020	24.040	24.060	570
580	24.080	24.100	24.120	24.150	24.170	24.190	24.210	24.230	24.250	24.270	580
590	24.290	24.310	24.330	24.350	24.370	24.390	24.410	24.430	24.450	24.470	590

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
600	24.490	24.520	24.540	24.560	24.580	24.600	24.620	24.640	24.660	24.680	600
610	24.700	24.720	24.740	24.760	24.780	24.800	24.820	24.840	24.860	24.880	610
620	24.900	24.920	24.940	24.960	24.980	25.000	25.020	25.040	25.060	25.080	620
630	25.100	25.120	25.140	25.160	25.180	25.200	25.220	25.240	25.260	25.280	630
640	25.300	25.320	25.340	25.360	25.380	25.400	25.420	25.440	25.460	25.480	640
650	25.500	25.510	25.530	25.550	25.570	25.590	25.610	25.630	25.650	25.670	650
660	25.690	25.710	25.730	25.750	25.770	25.790	25.810	25.830	25.850	25.870	660
670	25.880	25.900	25.920	25.940	25.960	25.980	26.000	26.020	26.040	26.060	670
680	26.080	26.100	26.120	26.130	26.150	26.170	26.190	26.210	26.230	26.250	680
690	26.270	26.290	26.310	26.320	26.340	26.360	26.380	26.400	26.420	26.440	690
700	26.460	26.480	26.500	26.510	26.530	26.550	26.570	26.590	26.610	26.630	700
710	26.650	26.660	26.680	26.700	26.720	26.740	26.760	26.780	26.800	26.810	710
720	26.830	26.850	26.870	26.890	26.910	26.930	26.940	26.960	26.980	27.000	720
730	27.020	27.040	27.060	27.070	27.090	27.110	27.130	27.150	27.170	27.180	730
740	27.200	27.220	26.240	27.260	27.280	27.290	27.310	27.330	27.350	27.370	740

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
750	27.390	27.400	27.420	27.440	27.460	27.480	27.500	27.510	27.530	27.550	750
760	27.570	27.590	27.600	27.620	27.640	27.660	27.680	27.690	27.710	27.730	760
770	27.750	27.770	27.780	27.800	27.820	27.840	27.860	27.870	27.890	27.910	770
780	27.930	27.950	27.960	27.980	28.000	28.020	28.040	28.050	28.070	28.090	780
790	28.110	28.120	28.140	28.160	28.180	28.200	28.210	28.230	28.250	28.270	790
800	28.280	28.300	28.320	28.340	28.350	28.370	28.390	28.410	28.430	28.440	800
810	28.460	28.480	28.500	28.510	28.530	28.550	28.570	28.580	28.600	28.620	810
820	28.640	28.650	28.670	28.690	28.710	28.720	28.740	28.760	28.770	28.790	820
830	28.810	28.830	28.840	28.860	28.880	28.900	28.910	28.930	28.950	28.970	830
840	28.980	29.000	29.020	29.030	29.050	29.070	29.090	29.100	29.120	29.140	840
850	29.150	29.170	29.190	29.210	29.220	29.240	29.260	29.270	29.290	29.310	850
860	29.330	29.340	29.360	29.380	29.390	29.410	29.430	29.440	29.460	29.480	860
870	29.500	29.510	29.530	29.550	29.560	29.580	29.600	29.610	29.630	29.650	870
880	29.660	29.680	29.700	29.720	29.730	29.750	29.770	29.780	29.800	29.820	880
890	29.930	29.850	29.870	29.880	29.900	29.920	29.930	29.950	29.970	29.980	890

Table 3 – Square Roots

N	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	N
900	30	30.020	30.030	30.050	30.070	30.080	30.100	30.120	30.130	30.150	900
910	30.170	30.180	30.200	30.220	30.230	30.250	30.270	30.280	30.300	30.320	910
920	30.330	30.350	30.360	30.380	30.400	30.410	30.430	30.450	30.460	30.480	920
930	30.500	30.510	30.530	30.550	30.560	30.580	30.590	30.610	30.630	30.640	930
940	30.660	30.680	30.690	30.710	30.720	30.740	30.760	30.770	30.790	30.810	940
950	30.820	30.840	30.850	30.870	30.890	30.900	30.920	30.940	30.950	30.970	950
960	30.980	31.000	31.020	31.030	31.050	31.060	31.080	31.100	31.110	31.130	960
970	31.140	31.160	31.180	31.190	31.210	31.220	31.240	31.260	31.270	31.290	970
980	31.300	31.320	31.340	31.350	31.370	31.380	31.400	31.420	31.430	31.450	980
990	31.460	31.480	31.500	31.510	31.530	31.540	31.560	31.580	31.590	31.610	990

Table 4
Meter Factors for
L-10 (Square Root) Charts (F_d)

$$F_d = 0.01\sqrt{R_h \bullet R_p}$$

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Table 4 – Meter Factors for L-10 (Square Root) Charts (F_d)

Meter Pressure Range psia-R_p	Meter Differential Range, inches -R_h				
	10	20	50	100	2000
24.7	0.1572	0.2223	0.3514	-----	-----
50.0	0.2236	0.3162	0.5	0.7071	1
100.0	0.3162	0.4472	0.7071	1	1.414
150.0	-----	0.5477	0.866	1.22	1.732
250.0	-----	0.7071	1.118	1.581	2.236
300.0	-----	0.7746	1.225	1.732	2.449
350.0	-----	0.8367	1.323	1.871	2.646
500.0	-----	1	1.581	2.236	3.162
750.0	-----	-----	1.936	2.739	3.873
1,000.0	-----	-----	2.236	3.162	4.472
1,500.0		-----	2.739	3.873	5.477
2,000.0	-----	-----	3.162	4.472	6.325
2,500.0	-----	-----	-----	5	7.071
3,000.0	-----	-----	-----	5.477	7.746
4,000.0	-----	-----	-----	6.325	8.944
5,000.0	-----	-----	-----	7.071	10
6,000.0	-----	-----	-----	7.746	10.95
10,000.0	-----	-----	-----	10	14.14

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Table 5
Basic Critical Flow Prover Factors

$$\text{-}\ \text{Mcfd}/\text{psia} - F_p$$

$$T_b = 520\,R\ (60°F)$$

$$T_m = 520\,R\ (60°F)$$

$$P = 14.65\ \text{psia}$$

$$G = 1.000$$

Based on data from USBM Monograph 7, Tables 26 and 27, pages 122 and 123.

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Table 5 – Basic Critical Flow Prover Factors - Mcfd/psia - F_p

Two-inch Prover		Four-inch Prover	
Orifice Dia., Inches	Factor - F_p	Orifice Dia., Inches	Factor - F_p
1/16	0.06569	1/4	1.074
3/32	0.1446	3/8	2.414
1/8	0.2716	1/2	4.319
3/16	0.6237	5/8	6.729
7/32	0.8608	3/4	9.643
1/4	1.115	7/8	13.11
5/16	1.714	1	17.08
3/8	2.439	1 1/8	21.52
7/16	3.495	1 1/4	26.57
1/2	4.388	1 3/8	31.99
5/8	6.638	1 1/2	38.12
3/4	9.694	1 3/4	52.07
7/8	13.33	2	68.8
1	17.53	2 1/4	88.19
1 1/8	22.45	2 1/2	110.6
1 1/4	28.34	2 3/4	136.9
1 3/8	34.82	3	168.3
1 1/2	43.19		

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Table 6
Basic Positive Choke Factors

- $\text{Mcfd}/\text{psia} - F_p$

$$T = 520\ R\ (60°F)$$

$$T = 520\ R\ (60°F)$$

$$P = 14.65$$

$$G = 1.000$$

Six-inch Choke Nipple [(1)] based on data published on page 294 of Diehl's Natural Gas Handbook.

Thornhill-Craver Positive Choke [(2)] based on data published in 1946 on page 15 of the "Report on the Calibration of Positive Flow Beans" by the Texas College of Arts and Industries, Kingsville, Texas.

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Table 6 – Basic Positive Choke Factors – Mcfd/psia – F_p

Nominal Choke Size, inches	Inside Diameter, inches	Factor - F_p	
		Six-inch Choke Nipple (1)	Thornhill-Craver Positive Choke (2)
1/8	0.125	0.2696	0.2478
9/64	0.1406	0.3438	0.3184
5/32	0.1563	0.4274	0.3984
11/64	0.1719	0.5204	0.488
3/16	0.1875	0.6228	0.5872
13/64	0.2031	0.7374	0.6952
7/32	0.2188	0.8623	0.8127
15/64	0.2344	0.9974	0.94
1/4	0.25	1.143	1.077
17/64	0.2656	1.296	1.217
9/32	0.2813	1.458	1.365
19/64	0.2969	1.631	1.522
5/16	0.3125	1.813	1.687
21/64	0.3281	2.005	1.864
11/32	0.3438	2.207	2.05

Table 6 – Basic Positive Choke Factors – Mcfd/psia – F_p

Nominal Choke Size, inches	Inside Diameter, inches	Factor - F_p Six-inch Choke Nipple [1]	Factor - F_p Thornhill-Craver Positive Choke [2]
23/64	0.3594	2.418	2.245
3/8	0.375	2.64	2.449
25/64	0.3906	2.881	2.653
13/32	0.4063	3.133	2.866
27/64	0.4219	3.397	3.086
7/16	0.4531	3.672	3.314
29/64	0.4531	3.953	3.549
15/32	0.4688	4.245	3.792
31/64	0.4844	4.547	4.043
1/2	0.5	4.861	4.301
9/16	0.5625	6.219	5.425
5/8	0.625	7.752	6.677
11/16	0.6875	9.423	8.182
3/4	0.75	11.26	9.85

Table 7
Flowing Temperature Factors (F_t)

$$F_t = \sqrt{\frac{520}{T_m}}$$

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Table 7 – Flowing Temperature (F_t)

Observed Temp. ºF	0	1	2	3	4	5	6	7	8	9	Observed Temp. ºF
0	1.0630	1.0620	1.0610	1.0600	1.0590	1.0570	1.0560	1.0550	1.0540	1.0530	0
10	1.0520	1.0510	1.0500	1.0490	1.0470	1.0460	1.0450	1.0440	1.0430	1.0420	10
20	1.0410	1.0400	1.0390	1.0380	1.0370	1.0350	1.0340	1.0330	1.0320	1.0310	20
30	1.0300	1.0290	1.0280	1.0270	1.0260	1.0250	1.0240	1.0230	1.0220	1.0210	30
40	1.0200	1.0190	1.0180	1.0170	1.0160	1.0150	1.0140	1.0130	1.0120	1.0110	40
50	1.0100	1.0090	1.0080	1.0070	1.0060	1.0050	1.0040	1.0030	1.0020	1.0010	50
60	1.0000	0.9990	0.9981	0.9971	0.9962	0.9952	0.9943	0.9933	0.9924	0.9915	60
70	0.9905	0.9896	0.9887	0.9877	0.9868	0.9859	0.9850	0.9840	0.9831	0.9822	70
80	0.9813	0.9804	0.9795	0.9786	0.9777	0.9768	0.9759	0.9750	0.9741	0.9732	80
90	0.9723	0.9715	0.9706	0.9697	0.9688	0.9680	0.9671	0.9662	0.9653	0.9645	90
100	0.9636	0.9628	0.9619	0.9610	0.9602	0.9594	0.9585	0.9577	0.9568	0.9560	100
110	0.9551	0.9543	0.9535	0.9526	0.9518	0.9510	0.9501	0.9493	0.9485	0.9477	110
120	0.9469	0.9460	0.9452	0.9444	0.9436	0.9428	0.9420	0.9412	0.9404	0.9396	120
130	0.9388	0.9380	0.9372	0.9364	0.9356	0.9349	0.9341	0.9333	0.9325	0.9317	130
140	0.9309	0.9302	0.9294	0.9286	0.9279	0.9271	0.9263	0.9256	0.9248	0.9240	140

Table 7 – Flowing Temperature (F_t)

Observed Temp. ºF	0	1	2	3	4	5	6	7	8	9	Observed Temp. ºF
150	0.9233	0.9225	0.9217	0.9210	0.9202	0.9195	0.9187	0.9180	0.9173	0.9165	150
160	0.9158	0.9150	0.9143	0.9135	0.9128	0.9121	0.9114	0.9106	0.9099	0.9092	160
170	0.9085	0.9077	0.9071	0.9063	0.9055	0.9048	0.9042	0.9035	0.9028	0.9020	170
180	0.9014	0.9007	0.9000	0.8992	0.8985	0.8979	0.8972	0.8965	0.8958	0.8951	180
190	0.8944	0.8937	0.8931	0.8923	0.8916	0.8910	0.8903	0.8896	0.8889	0.8882	190
200	0.8876	0.8870	0.8863	0.8856	0.8849	0.8836	0.8836	0.8830	0.8823	0.8816	200
210	0.8810	0.8803	0.8797	0.8790	0.8784	0.8777	0.8770	0.8764	0.8758	0.8751	210
220	0.8745	0.8738	0.8732	0.8725	0.8719	0.8713	0.8706	0.8700	0.8694	0.8687	220
230	0.8681	0.8675	0.8668	0.8662	0.8656	0.8650	0.8644	0.8637	0.8631	0.8625	230
240	0.8619	0.8613	0.8606	0.8600	0.8594	0.8588	0.8582	0.8576	0.8570	0.8564	240

Table 8
Specific Gravity Factors (F_g)

$$F_g = \sqrt{\frac{1}{G}}$$

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Table 8 – Specific Gravity Factors (F_g)

Specific Gravity G	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Specific Gravity G
0.550	1.348	1.347	1.346	1.345	1.344	1.342	1.341	1.340	1.339	1.338	0.550
0.560	1.336	1.335	1.334	1.333	1.332	1.330	1.329	1.328	1.327	1.326	0.560
0.570	1.325	1.323	1.322	1.321	1.320	1.319	1.318	1.316	1.315	1.314	0.570
0.580	1.313	1.312	1.311	1.310	1.309	1.307	1.306	1.305	1.304	1.303	0.580
0.590	1.302	1.301	1.300	1.299	1.298	1.296	1.295	1.294	1.293	1.292	0.590
0.600	1.291	1.290	1.289	1.288	1.287	1.286	1.285	1.284	1.282	1.281	0.600
0.610	1.280	1.279	1.278	1.277	1.276	1.275	1.274	1.273	1.272	1.271	0.610
0.620	1.270	1.269	1.268	1.267	1.266	1.265	1.264	1.263	1.262	1.261	0.620
0.630	1.260	1.259	1.258	1.257	1.256	1.255	1.254	1.253	1.252	1.251	0.630
0.640	1.250	1.249	1.248	1.247	1.246	1.245	1.244	1.243	1.242	1.241	0.640
0.650	1.240	1.239	1.238	1.237	1.237	1.236	1.235	1.234	1.233	1.232	0.650
0.660	1.231	1.230	1.229	1.228	1.227	1.226	1.225	1.224	1.224	1.223	0.660
0.670	1.222	1.221	1.220	1.219	1.218	1.217	1.216	1.215	1.214	1.214	0.670
0.680	1.213	1.212	1.211	1.210	1.209	1.208	1.207	1.206	1.206	1.205	0.680
0.690	1.204	1.203	1.202	1.201	1.200	1.200	1.199	1.198	1.197	1.196	0.690

Table 8 – Specific Gravity Factors (F_g)

Specific Gravity G	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Specific Gravity G
0.700	1.195	1.194	1.194	1.193	1.192	1.191	1.190	1.189	1.188	1.188	0.700
0.710	1.187	1.186	1.185	1.184	1.183	1.183	1.182	1.181	1.180	1.179	0.710
0.720	1.179	1.178	1.177	1.176	1.175	1.174	1.174	1.173	1.172	1.171	0.720
0.730	1.170	1.170	1.169	1.168	1.167	1.166	1.166	1.165	1.164	1.163	0.730
0.740	1.162	1.162	1.161	1.160	1.159	1.159	1.158	1.157	1.156	1.155	0.740
0.750	1.155	1.154	1.153	1.152	1.152	1.151	1.150	1.149	1.149	1.148	0.750
0.760	1.147	1.146	1.146	1.145	1.144	1.443	1.143	1.142	1.141	1.140	0.760
0.770	1.140	1.139	1.138	1.137	1.137	1.136	1.135	1.134	1.134	1.133	0.770
0.780	1.132	1.132	1.131	1.130	1.129	1.129	1.128	1.127	1.127	1.126	0.780
0.790	1.125	1.124	1.124	1.123	1.122	1.122	1.121	1.120	1.119	1.119	0.790
0.800	1.118	1.117	1.117	1.116	1.115	1.115	1.114	1.113	1.112	1.112	0.800
0.810	1.111	1.110	1.110	1.109	1.108	1.108	1.107	1.106	1.106	1.105	0.810
0.820	1.104	1.104	1.103	1.102	1.102	1.101	1.100	1.100	1.099	1.098	0.820
0.830	1.098	1.097	1.096	1.096	1.095	1.094	1.094	1.093	1.092	1.092	0.830
0.840	1.091	1.090	1.090	1.089	1.089	1.088	1.087	1.087	1.086	1.085	0.840

Table 8 – Specific Gravity Factors (F_g)

Specific Gravity G	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Specific Gravity G
0.850	1.085	1.084	1.083	1.083	1.082	1.081	1.081	1.080	1.080	1.079	0.850
0.860	1.078	1.078	1.077	1.076	1.076	1.075	1.075	1.074	1.073	1.073	0.860
0.870	1.072	1.072	1.071	1.070	1.070	1.069	1.068	1.068	1.067	1.067	0.870
0.880	1.066	1.065	1.065	1.064	1.064	1.063	1.062	1.062	1.061	1.061	0.880
0.890	1.060	1.059	1.059	1.058	1.058	1.057	1.056	1.056	1.055	1.055	0.890
0.900	1.054	1.054	1.053	1.052	1.052	1.051	1.051	1.050	1.049	1.049	0.900
0.910	1.048	1.048	1.047	1.047	1.046	1.045	1.045	1.044	1.044	1.043	0.910
0.920	1.043	1.042	1.041	1.041	1.040	1.040	1.039	1.039	1.038	1.038	0.920
0.930	1.037	1.036	1.036	1.035	1.035	1.034	1.034	1.033	1.033	1.032	0.930
0.940	1.031	1.031	1.030	1.030	1.029	1.029	1.028	1.028	1.027	1.027	0.940
0.950	1.026	1.025	1.025	1.024	1.024	1.023	1.023	1.022	1.022	1.021	0.950
0.960	1.021	1.020	1.020	1.019	1.019	1.018	1.017	1.017	1.016	1.016	0.960
0.970	1.015	1.015	1.014	1.014	1.013	1.013	1.012	1.012	1.011	1.011	0.970
0.980	1.010	1.010	1.009	1.009	1.008	1.008	1.007	1.007	1.006	1.006	0.980
0.990	1.005	1.005	1.004	1.004	1.003	1.003	1.002	1.002	1.001	1.001	0.990

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Table 9
Pseudocritical Properties of Hydrocarbon Gases (P_{cr} and T_{cr})

Do not interpolate. Values are inclusive to the next higher value.

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Table 9 – Pseudocritical Properties of Hydrocarbon Gases (P_{cr} and T_{cr})

G	P_{cr}	T_{cr}	G	P_{cr}	T_{cr}	G	P_{cr}	T_{cr}
0.55	673	336	0.75	667	408	0.95	660	474
0.56	673	341	0.76	667	411	0.96	660	477
0.57	672	346	0.77	666	415	0.97	659	481
0.58	672	350	0.78	666	418	0.98	659	484
0.59	672	354	0.79	666	421	0.99	659	487
0.60	671	358	0.80	665	424	1.00	658	491
0.61	671	362	0.81	665	428	1.01	658	494
0.62	671	365	0.82	665	431	1.02	657	497
0.63	670	368	0.83	665	434	1.03	656	500
0.64	670	372	0.84	664	438	1.04	656	504
0.65	670	375	0.85	664	441	1.05	655	507
0.66	670	378	0.86	664	444	1.06	655	510
0.67	669	382	0.87	663	448	1.07	654	514
0.68	669	385	0.88	663	451	1.08	654	517
0.69	669	388	0.89	662	454	1.09	653	520
0.70	668	392	0.90	662	457	1.10	652	524
0.71	668	395	0.91	662	461	1.11	652	527
0.72	668	398	0.92	662	464	1.12	651	530
0.73	668	401	0.93	661	467	1.13	651	534
0.74	667	405	0.94	661	471	1.14	650	537

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Table 10
Correction to Pseudocritical Properties of Hydrocarbon Gases for Carbon Dioxide and Nitrogen

Values given are to be added if positive, or subtracted if negative, from values taken from Table 9, Pseudocritical Properties of Hydrocarbon Gases.

Based on data from the California Natural Gasoline Association Bulletin No. TS – 461.

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Table 10 – Correction to Pseudocritical Properties of Hydrocarbon Gases for Carbon Dioxide (CO_2) and Nitrogen (N_2)

Volume Percent of CO_2 of N_2 in Gas	Carbon Dioxide, CO_2		Nitrogen, N_2	
	P_{cr}	T_{cr}	P_{cr}	T_{cr}
1	4	-1	-1	-3
2	8	-3	-3	-6
3	12	-5	-5	-9
4	17	-7	-7	-11
5	21	-9	-9	-14
6	25	-11	-11	-17
7	30	-12	-12	-20
8	34	-14	-14	-22
9	39	-16	-16	-25
10	44	-17	-17	-28
11	48	-19	-19	-30
12	53	-21	-21	-33
13	57	-22	-22	-36
14	61	-24	-24	-39
15	66	-26	-26	-42
16	70	-27	-27	-44
17	74	-29	-29	-47
18	79	-31	-31	-50
19	83	-32	-32	-52
20	87	-34	-34	-55

Table 10 – Correction to Pseudocritical Properties of Hydrocarbon Gases for Carbon Dioxide (CO_2) and Nitrogen (N_2)

Volume Percent of CO_2 of N_2 in Gas	Carbon Dioxide, CO_2		Nitrogen, N_2	
	P_{cr}	T_{cr}	P_{cr}	T_{cr}
21	92	-36	-36	-58
22	96	-37	-37	-60
23	100	-39	-39	-63
24	104	-41	-41	-66
25	109	-42	-42	-68
26	113	-44	-44	-71
27	117	-46	-46	-74
28	122	-47	-47	-77
29	126	-49	-49	-79
30	130	-51	-51	-82
31	134	-52	-52	-85
32	139	-54	-54	-87
33	143	-56	-56	-90
34	147	-57	-57	-93
35	152	-59	-59	-95
36	156	-61	-61	-98

Table 11
Compressibility Factors for Natural Gas

Expanded from Tables of Compressibility Factors and Integral Functions for Natural Gas as a Function of Pseudo-Reduced Pressure and Temperature, Table 3, The Multiphase Flow of Gas, Oil, and Water Through Vertical Flow Strings with Application to the Design of Gas-lift Installations; F. H. Poettmann and P. G. Carpenter, *Drilling and Production Practice*, pp. 279 – 291, 1952, American Petroleum Institute.

Interpolation between T_r values required.

Note: Values of P_r and T_r shall be calculated to four significant figures and rounded off to two significant figures following the decimal point before determining the Z value from Table 11.

P_r and T_r in Table 11 are pseudo-reduced pressure and pseudo-reduced temperature.

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Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
0.20	0.938	0.948	0.953	0.959	0.964	0.969	0.971	0.973	0.978	0.979	0.984	0.987	0.990	0.991	0.933	0.995	0.998	0.999	1.000	1.001	0.20
0.21	0.935	0.945	0.951	0.957	0.962	0.967	0.970	0.972	0.977	0.978	0.983	0.986	0.990	0.991	0.993	0.995	0.998	0.999	1.000	1.001	0.21
0.22	0.932	0.942	0.948	0.955	0.960	0.965	0.968	0.971	0.976	0.977	0.982	0.986	0.989	0.990	0.993	0.995	0.998	0.999	1.000	1.001	0.22
0.23	0.928	0.940	0.946	0.953	0.959	0.964	0.967	0.970	0.974	0.976	0.982	0.985	0.989	0.990	0.992	0.995	0.998	0.999	1.000	1.001	0.23
0.24	0.925	0.937	0.943	0.951	0.957	0.962	0.965	0.969	0.973	0.975	0.981	0.985	0.988	0.990	0.992	0.995	0.998	0.999	1.000	1.001	0.24
0.25	0.922	0.934	0.941	0.949	0.955	0.960	0.964	0.968	0.972	0.974	0.980	0.984	0.988	0.990	0.992	0.995	0.998	0.999	1.000	1.001	0.25
0.26	0.919	0.931	0.938	0.947	0.953	0.958	0.962	0.967	0.971	0.973	0.979	0.983	0.987	0.990	0.992	0.995	0.998	0.999	1.000	1.001	0.26
0.27	0.915	0.928	0.936	0.945	0.951	0.956	0.961	0.966	0.969	0.972	0.978	0.983	0.987	0.989	0.991	0.995	0.998	0.999	1.000	1.001	0.27
0.28	0.912	0.926	0.933	0.942	0.950	0.955	0.959	0.964	0.968	0.971	0.978	0.982	0.986	0.989	0.991	0.994	0.997	0.999	1.000	1.001	0.28
0.29	0.908	0.923	0.931	0.940	0.948	0.953	0.958	0.963	0.966	0.970	0.977	0.982	0.986	0.988	0.990	0.994	0.997	0.999	1.000	1.001	0.29
0.30	0.905	0.920	0.928	0.938	0.946	0.951	0.956	0.962	0.965	0.969	0.976	0.981	0.985	0.988	0.990	0.994	0.997	0.999	1.000	1.001	0.30
0.31	0.901	0.917	0.925	0.936	0.944	0.949	0.955	0.961	0.964	0.968	0.975	0.980	0.985	0.988	0.990	0.994	0.997	0.999	1.000	1.001	0.31
0.32	0.898	0.914	0.922	0.934	0.942	0.948	0.953	0.960	0.963	0.967	0.974	0.980	0.984	0.987	0.990	0.994	0.997	0.999	1.000	1.001	0.32
0.33	0.894	0.911	0.920	0.931	0.941	0.946	0.952	0.958	0.961	0.966	0.974	0.979	0.984	0.987	0.989	0.994	0.997	0.999	1.000	1.001	0.33
0.34	0.891	0.908	0.917	0.929	0.939	0.945	0.950	0.957	0.960	0.965	0.973	0.979	0.983	0.986	0.989	0.994	0.997	0.999	1.000	1.001	0.34
0.35	0.887	0.905	0.914	0.927	0.937	0.943	0.949	0.956	0.959	0.964	0.972	0.978	0.983	0.986	0.989	0.994	0.997	0.999	1.000	1.001	0.35
0.36	0.883	0.902	0.911	0.925	0.935	0.941	0.948	0.955	0.958	0.963	0.971	0.977	0.982	0.985	0.989	0.994	0.997	0.999	1.000	1.001	0.36
0.37	0.879	0.899	0.908	0.923	0.933	0.939	0.946	0.953	0.957	0.962	0.970	0.977	0.982	0.985	0.988	0.993	0.997	0.999	1.000	1.001	0.37
0.38	0.876	0.895	0.906	0.920	0.932	0.938	0.945	0.952	0.955	0.961	0.970	0.976	0.981	0.984	0.988	0.993	0.996	0.998	1.000	1.002	0.38
0.39	0.872	0.892	0.903	0.918	0.930	0.936	0.943	0.950	0.954	0.960	0.969	0.976	0.981	0.984	0.987	0.992	0.996	0.998	1.000	1.002	0.39
0.40	0.868	0.889	0.900	0.916	0.928	0.934	0.942	0.949	0.953	0.959	0.968	0.975	0.980	0.983	0.987	0.992	0.996	0.998	1.000	1.002	0.40
0.41	0.864	0.886	0.897	0.914	0.926	0.932	0.940	0.948	0.952	0.958	0.967	0.974	0.980	0.983	0.987	0.992	0.996	0.998	1.000	1.002	0.41
0.42	0.860	0.882	0.895	0.912	0.924	0.931	0.939	0.947	0.951	0.957	0.966	0.974	0.979	0.982	0.986	0.992	0.996	0.998	1.000	1.002	0.42
0.43	0.857	0.879	0.892	0.909	0.923	0.929	0.937	0.945	0.950	0.956	0.966	0.973	0.979	0.982	0.986	0.991	0.995	0.998	1.000	1.002	0.43
0.44	0.853	0.875	0.890	0.907	0.921	0.928	0.936	0.944	0.949	0.955	0.965	0.973	0.978	0.981	0.985	0.991	0.995	0.998	1.000	1.002	0.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
0.45	0.849	0.872	0.887	0.905	0.919	0.926	0.934	0.943	0.948	0.954	0.964	0.972	0.978	0.981	0.985	0.991	0.995	0.998	1.000	1.002	0.45
0.46	0.845	0.869	0.884	0.903	0.917	0.924	0.932	0.942	0.947	0.953	0.963	0.971	0.978	0.981	0.985	0.991	0.995	0.998	1.000	1.002	0.46
0.47	0.841	0.865	0.882	0.901	0.915	0.923	0.931	0.941	0.946	0.952	0.962	0.971	0.977	0.980	0.984	0.991	0.995	0.998	1.000	1.002	0.47
0.48	0.837	0.862	0.879	0.898	0.913	0.921	0.929	0.939	0.944	0.951	0.962	0.970	0.977	0.980	0.984	0.990	0.994	0.998	1.000	1.002	0.48
0.49	0.833	0.858	0.877	0.896	0.911	0.920	0.928	0.938	0.943	0.950	0.961	0.970	0.976	0.979	0.983	0.990	0.994	0.998	1.000	1.002	0.49
0.50	0.829	0.855	0.874	0.894	0.909	0.918	0.926	0.937	0.942	0.949	0.960	0.969	0.976	0.979	0.983	0.990	0.994	0.998	1.000	1.002	0.50
0.51	0.825	0.852	0.872	0.892	0.907	0.916	0.925	0.936	0.941	0.948	0.959	0.968	0.976	0.979	0.983	0.990	0.994	0.998	1.000	1.002	0.51
0.52	0.821	0.849	0.869	0.890	0.905	0.913	0.923	0.934	0.940	0.947	0.958	0.968	0.975	0.979	0.983	0.990	0.994	0.998	1.000	1.002	0.52
0.53	0.818	0.845	0.867	0.887	0.904	0.912	0.922	0.933	0.939	0.946	0.958	0.967	0.975	0.978	0.982	0.989	0.994	0.998	1.000	1.002	0.53
0.54	0.814	0.842	0.864	0.885	0.902	0.911	0.920	0.931	0.938	0.945	0.957	0.967	0.974	0.978	0.982	0.989	0.994	0.998	1.000	1.002	0.54
0.55	0.810	0.839	0.862	0.883	0.900	0.909	0.919	0.930	0.937	0.944	0.956	0.966	0.974	0.978	0.982	0.989	0.994	0.998	1.000	1.002	0.55
0.56	0.806	0.836	0.859	0.881	0.898	0.907	0.918	0.929	0.936	0.943	0.955	0.965	0.973	0.978	0.982	0.989	0.994	0.998	1.000	1.002	0.56
0.57	0.802	0.832	0.857	0.879	0.896	0.905	0.916	0.927	0.935	0.942	0.954	0.965	0.973	0.977	0.982	0.989	0.994	0.998	1.000	1.002	0.57
0.58	0.798	0.829	0.854	0.876	0.894	0.904	0.915	0.926	0.933	0.941	0.954	0.965	0.972	0.977	0.981	0.988	0.993	0.997	1.000	1.003	0.58
0.59	0.794	0.825	0.852	0.874	0.892	0.902	0.913	0.924	0.932	0.940	0.953	0.964	0.972	0.976	0.981	0.988	0.993	0.997	1.000	1.003	0.59
0.60	0.790	0.822	0.849	0.872	0.890	0.900	0.912	0.923	0.931	0.939	0.952	0.963	0.971	0.976	0.981	0.988	0.993	0.997	1.000	1.003	0.60
0.61	0.786	0.818	0.846	0.870	0.888	0.899	0.911	0.922	0.930	0.938	0.951	0.963	0.971	0.976	0.981	0.988	0.993	0.997	1.000	1.003	0.61
0.62	0.782	0.815	0.843	0.868	0.886	0.897	0.909	0.921	0.929	0.937	0.951	0.962	0.970	0.975	0.981	0.988	0.993	0.997	1.000	1.003	0.62
0.63	0.777	0.811	0.841	0.865	0.885	0.896	0.908	0.919	0.928	0.937	0.950	0.962	0.970	0.975	0.980	0.987	0.993	0.997	1.000	1.003	0.63
0.64	0.773	0.808	0.838	0.863	0.883	0.894	0.906	0.918	0.927	0.936	0.950	0.961	0.969	0.974	0.980	0.987	0.993	0.997	1.000	1.003	0.64
0.65	0.769	0.804	0.835	0.861	0.881	0.893	0.905	0.917	0.926	0.935	0.949	0.961	0.969	0.974	0.980	0.987	0.993	0.997	1.000	1.003	0.65
0.66	0.765	0.800	0.832	0.859	0.879	0.891	0.904	0.916	0.925	0.934	0.948	0.960	0.969	0.974	0.980	0.987	0.993	0.997	1.000	1.003	0.66
0.67	0.760	0.796	0.829	0.857	0.877	0.890	0.902	0.915	0.924	0.933	0.947	0.960	0.968	0.973	0.979	0.987	0.993	0.997	1.000	1.003	0.67
0.68	0.756	0.793	0.826	0.854	0.875	0.888	0.901	0.913	0.923	0.932	0.947	0.959	0.968	0.973	0.979	0.986	0.992	0.997	1.001	1.004	0.68
0.69	0.751	0.789	0.823	0.852	0.873	0.887	0.899	0.912	0.922	0.931	0.946	0.959	0.967	0.972	0.978	0.986	0.992	0.997	1.001	1.004	0.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
0.70	0.747	0.785	0.820	0.850	0.871	0.885	0.898	0.911	0.921	0.930	0.945	0.958	0.967	0.972	0.978	0.986	0.992	0.997	1.001	1.004	0.70
0.71	0.742	0.781	0.817	0.848	0.869	0.884	0.896	0.910	0.920	0.929	0.944	0.957	0.967	0.972	0.978	0.986	0.992	0.997	1.001	1.004	0.71
0.72	0.737	0.778	0.814	0.846	0.867	0.882	0.895	0.909	0.919	0.928	0.944	0.957	0.966	0.972	0.978	0.986	0.992	0.997	1.001	1.004	0.72
0.73	0.732	0.774	0.812	0.843	0.865	0.881	0.893	0.907	0.918	0.927	0.943	0.956	0.966	0.971	0.977	0.985	0.992	0.997	1.001	1.004	0.73
0.74	0.727	0.771	0.809	0.841	0.863	0.879	0.892	0.906	0.917	0.926	0.943	0.956	0.965	0.971	0.977	0.985	0.992	0.997	1.001	1.004	0.74
0.75	0.722	0.767	0.806	0.839	0.861	0.878	0.890	0.905	0.916	0.925	0.942	0.955	0.965	0.971	0.977	0.985	0.992	0.997	1.001	1.004	0.75
0.76	0.717	0.763	0.803	0.837	0.859	0.876	0.889	0.904	0.915	0.924	0.941	0.954	0.964	0.971	0.977	0.985	0.992	0.997	1.001	1.004	0.76
0.77	0.712	0.759	0.800	0.834	0.857	0.875	0.887	0.903	0.914	0.923	0.940	0.954	0.964	0.970	0.976	0.985	0.992	0.997	1.001	1.004	0.77
0.78	0.708	0.756	0.797	0.832	0.855	0.873	0.886	0.901	0.912	0.922	0.940	0.953	0.963	0.970	0.976	0.984	0.991	0.997	1.001	1.005	0.78
0.79	0.703	0.752	0.794	0.829	0.853	0.872	0.884	0.900	0.911	0.921	0.939	0.953	0.963	0.969	0.975	0.984	0.991	0.997	1.001	1.005	0.79
0.80	0.698	0.748	0.791	0.827	0.851	0.870	0.883	0.899	0.910	0.920	0.938	0.952	0.962	0.969	0.975	0.984	0.991	0.997	1.001	1.005	0.80
0.81	0.693	0.744	0.788	0.825	0.849	0.868	0.882	0.898	0.909	0.919	0.937	0.952	0.962	0.969	0.975	0.984	0.991	0.997	1.001	1.005	0.81
0.82	0.688	0.740	0.785	0.822	0.847	0.866	0.880	0.897	0.908	0.918	0.937	0.951	0.961	0.968	0.975	0.984	0.991	0.997	1.001	1.005	0.82
0.83	0.682	0.737	0.782	0.820	0.846	0.865	0.879	0.895	0.907	0.918	0.936	0.951	0.961	0.968	0.974	0.983	0.991	0.997	1.001	1.005	0.83
0.84	0.677	0.733	0.779	0.817	0.844	0.863	0.877	0.894	0.906	0.917	0.936	0.950	0.960	0.967	0.974	0.983	0.991	0.997	1.001	1.005	0.84
0.85	0.672	0.729	0.776	0.815	0.842	0.861	0.876	0.893	0.905	0.916	0.935	0.950	0.960	0.967	0.974	0.983	0.991	0.997	1.001	1.005	0.85
0.86	0.667	0.725	0.773	0.812	0.840	0.859	0.875	0.892	0.904	0.915	0.934	0.949	0.960	0.967	0.974	0.983	0.991	0.997	1.001	1.005	0.86
0.87	0.661	0.721	0.770	0.810	0.838	0.857	0.874	0.891	0.903	0.914	0.933	0.949	0.959	0.966	0.973	0.983	0.991	0.997	1.001	1.005	0.87
0.88	0.656	0.718	0.767	0.807	0.836	0.856	0.872	0.889	0.901	0.913	0.933	0.948	0.959	0.966	0.973	0.983	0.990	0.996	1.001	1.006	0.88
0.89	0.650	0.714	0.764	0.805	0.834	0.854	0.871	0.888	0.900	0.912	0.932	0.948	0.958	0.965	0.972	0.983	0.990	0.996	1.001	1.006	0.89
0.90	0.645	0.710	0.761	0.802	0.832	0.852	0.870	0.887	0.899	0.911	0.931	0.947	0.958	0.965	0.972	0.983	0.990	0.996	1.001	1.006	0.90
0.91	0.640	0.706	0.758	0.800	0.830	0.851	0.869	0.886	0.898	0.910	0.930	0.946	0.958	0.965	0.972	0.983	0.990	0.996	1.001	1.006	0.91
0.92	0.634	0.702	0.756	0.798	0.828	0.849	0.867	0.885	0.897	0.909	0.929	0.946	0.957	0.964	0.972	0.983	0.990	0.996	1.001	1.006	0.92
0.93	0.629	0.698	0.753	0.795	0.827	0.848	0.866	0.883	0.897	0.908	0.929	0.945	0.957	0.964	0.971	0.982	0.990	0.996	1.001	1.006	0.93
0.94	0.623	0.694	0.751	0.793	0.825	0.846	0.864	0.882	0.896	0.907	0.928	0.945	0.956	0.963	0.971	0.982	0.990	0.996	1.001	1.006	0.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
0.95	0.618	0.690	0.748	0.791	0.823	0.845	0.863	0.881	0.895	0.906	0.927	0.944	0.956	0.963	0.971	0.982	0.990	0.996	1.001	1.006	0.95
0.96	0.612	0.686	0.745	0.789	0.821	0.844	0.862	0.880	0.894	0.905	0.926	0.943	0.955	0.963	0.971	0.982	0.990	0.996	1.001	1.006	0.96
0.97	0.607	0.682	0.742	0.787	0.819	0.842	0.860	0.879	0.893	0.904	0.925	0.943	0.955	0.962	0.971	0.982	0.990	0.996	1.001	1.006	0.97
0.98	0.601	0.678	0.740	0.784	0.817	0.841	0.859	0.877	0.892	0.903	0.925	0.942	0.954	0.962	0.970	0.981	0.989	0.996	1.001	1.007	0.98
0.99	0.596	0.674	0.737	0.782	0.815	0.839	0.857	0.876	0.891	0.902	0.924	0.942	0.954	0.961	0.970	0.981	0.989	0.996	1.001	1.007	0.99
1.00	0.590	0.670	0.734	0.780	0.813	0.838	0.856	0.875	0.890	0.901	0.923	0.941	0.953	0.961	0.970	0.981	0.989	0.996	1.001	1.007	1.00
1.01	0.583	0.665	0.731	0.778	0.811	0.836	0.855	0.874	0.889	0.900	0.922	0.941	0.953	0.961	0.970	0.981	0.989	0.996	1.001	1.007	1.01
1.02	0.576	0.661	0.728	0.775	0.809	0.834	0.853	0.873	0.888	0.899	0.922	0.940	0.952	0.961	0.970	0.981	0.989	0.996	1.001	1.007	1.02
1.03	0.569	0.656	0.725	0.773	0.807	0.833	0.852	0.871	0.887	0.899	0.921	0.940	0.952	0.960	0.969	0.980	0.989	0.996	1.001	1.007	1.03
1.04	0.562	0.652	0.722	0.770	0.805	0.831	0.850	0.870	0.886	0.898	0.921	0.939	0.951	0.960	0.969	0.980	0.989	0.996	1.001	1.007	1.04
1.05	0.555	0.647	0.719	0.768	0.803	0.829	0.849	0.869	0.885	0.897	0.920	0.939	0.951	0.960	0.969	0.980	0.989	0.996	1.001	1.007	1.05
1.06	0.548	0.642	0.716	0.765	0.801	0.827	0.848	0.868	0.884	0.896	0.919	0.938	0.951	0.960	0.969	0.980	0.989	0.996	1.001	1.007	1.06
1.07	0.541	0.638	0.713	0.763	0.799	0.825	0.846	0.866	0.883	0.895	0.919	0.938	0.950	0.959	0.968	0.980	0.989	0.996	1.001	1.007	1.07
1.08	0.534	0.633	0.709	0.760	0.797	0.824	0.845	0.865	0.881	0.895	0.918	0.937	0.950	0.959	0.968	0.979	0.988	0.996	1.002	1.008	1.08
1.09	0.527	0.629	0.706	0.758	0.795	0.822	0.843	0.863	0.880	0.894	0.918	0.837	0.949	0.958	0.967	0.979	0.988	0.996	1.002	1.008	1.09
1.10	0.520	0.624	0.703	0.755	0.793	0.820	0.842	0.862	0.879	0.893	0.917	0.936	0.949	0.958	0.967	0.979	0.988	0.996	1.002	1.008	1.10
1.11	0.512	0.620	0.700	0.753	0.791	0.818	0.841	0.861	0.878	0.892	0.916	0.935	0.949	0.958	0.967	0.979	0.988	0.996	1.002	1.008	1.11
1.12	0.505	0.615	0.697	0.750	0.789	0.817	0.840	0.860	0.877	0.891	0.915	0.935	0.948	0.958	0.967	0.979	0.988	0.996	1.002	1.008	1.12
1.13	0.497	0.611	0.694	0.748	0.787	0.815	0.838	0.858	0.876	0.891	0.915	0.934	0.948	0.957	0.966	0.979	0.988	0.996	1.002	1.008	1.13
1.14	0.490	0.606	0.691	0.745	0.785	0.814	0.837	0.857	0.875	0.890	0.914	0.934	0.947	0.957	0.966	0.979	0.988	0.996	1.002	1.008	1.14
1.15	0.482	0.602	0.688	0.743	0.783	0.812	0.836	0.856	0.874	0.889	0.913	0.933	0.947	0.957	0.966	0.979	0.988	0.996	1.002	1.008	1.15
1.16	0.474	0.598	0.685	0.741	0.781	0.810	0.835	0.855	0.873	0.888	0.912	0.932	0.947	0.957	0.966	0.979	0.988	0.996	1.002	1.008	1.16
1.17	0.467	0.593	0.682	0.738	0.779	0.809	0.833	0.854	0.872	0.887	0.911	0.932	0.946	0.956	0.965	0.979	0.988	0.996	1.002	1.008	1.17
1.18	0.459	0.589	0.678	0.736	0.777	0.807	0.832	0.852	0.871	0.886	0.911	0.931	0.946	0.956	0.965	0.978	0.987	0.996	1.002	1.008	1.18
1.19	0.452	0.584	0.675	0.733	0.775	0.806	0.830	0.851	0.870	0.885	0.910	0.931	0.945	0.955	0.964	0.978	0.987	0.996	1.002	1.008	1.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
1.20	0.444	0.580	0.672	0.731	0.773	0.804	0.829	0.850	0.869	0.884	0.909	0.930	0.945	0.955	0.964	0.978	0.987	0.996	1.002	1.008	1.20
1.21	0.435	0.575	0.669	0.729	0.771	0.803	0.828	0.849	0.868	0.883	0.908	0.930	0.945	0.955	0.964	0.978	0.987	0.996	1.002	1.008	1.21
1.22	0.426	0.570	0.666	0.726	0.769	0.801	0.827	0.848	0.867	0.882	0.907	0.929	0.944	0.955	0.964	0.978	0.987	0.996	1.002	1.008	1.22
1.23	0.416	0.565	0.662	0.724	0.767	0.800	0.825	0.847	0.866	0.882	0.907	0.929	0.944	0.954	0.963	0.978	0.987	0.996	1.002	1.008	1.23
1.24	0.407	0.560	0.659	0.721	0.765	0.798	0.824	0.846	0.865	0.881	0.906	0.928	0.943	0.954	0.963	0.978	0.987	0.996	1.002	1.008	1.24
1.25	0.398	0.555	0.656	0.719	0.763	0.797	0.823	0.845	0.864	0.880	0.905	0.928	0.943	0.954	0.963	0.978	0.987	0.996	1.002	1.008	1.25
1.26	0.389	0.550	0.653	0.717	0.761	0.795	0.822	0.844	0.863	0.879	0.904	0.927	0.943	0.954	0.963	0.978	0.987	0.996	1.002	1.008	1.26
1.27	0.379	0.545	0.650	0.714	0.759	0.794	0.821	0.843	0.862	0.878	0.903	0.927	0.942	0.953	0.963	0.978	0.987	0.996	1.002	1.008	1.27
1.28	0.370	0.540	0.646	0.712	0.757	0.792	0.819	0.841	0.861	0.878	0.903	0.926	0.942	0.953	0.962	0.977	0.987	0.996	1.002	1.009	1.28
1.29	0.360	0.535	0.643	0.709	0.755	0.791	0.818	0.840	0.860	0.877	0.902	0.926	0.941	0.952	0.962	0.977	0.987	0.996	1.002	1.009	1.29
1.30	0.351	0.530	0.640	0.707	0.753	0.789	0.817	0.839	0.859	0.876	0.901	0.925	0.941	0.952	0.962	0.977	0.987	0.996	1.002	1.009	1.30
1.31	0.342	0.525	0.637	0.705	0.751	0.787	0.816	0.838	0.859	0.875	0.900	0.925	0.941	0.952	0.962	0.977	0.987	0.996	1.002	1.009	1.31
1.32	0.333	0.520	0.633	0.702	0.749	0.786	0.814	0.837	0.857	0.874	0.900	0.924	0.941	0.952	0.962	0.977	0.987	0.996	1.002	1.009	1.32
1.33	0.325	0.515	0.630	0.700	0.747	0.784	0.813	0.836	0.857	0.874	0.899	0.924	0.940	0.951	0.961	0.976	0.985	0.996	1.002	1.009	1.33
1.34	0.316	0.510	0.626	0.697	0.745	0.783	0.811	0.835	0.856	0.873	0.899	0.923	0.940	0.951	0.961	0.976	0.986	0.996	1.002	1.009	1.34
1.35	0.307	0.505	0.623	0.695	0.743	0.781	0.810	0.834	0.855	0.872	0.898	0.923	0.940	0.951	0.961	0.976	0.986	0.996	1.002	1.009	1.35
1.36	0.298	0.500	0.619	0.692	0.741	0.779	0.809	0.833	0.854	0.871	0.897	0.922	0.940	0.951	0.961	0.976	0.986	0.996	1.002	1.009	1.36
1.37	0.289	0.495	0.616	0.690	0.739	0.777	0.807	0.832	0.853	0.870	0.897	0.922	0.939	0.950	0.961	0.976	0.986	0.996	1.002	1.009	1.37
1.38	0.281	0.490	0.612	0.687	0.736	0.776	0.806	0.830	0.852	0.870	0.896	0.921	0.939	0.950	0.960	0.975	0.986	0.996	1.002	1.010	1.38
1.39	0.272	0.485	0.609	0.685	0.734	0.774	0.804	0.829	0.851	0.869	0.896	0.921	0.938	0.949	0.960	0.975	0.986	0.996	1.002	1.010	1.39
1.40	0.263	0.480	0.605	0.682	0.732	0.772	0.803	0.828	0.850	0.868	0.895	0.920	0.938	0.949	0.960	0.975	0.986	0.996	1.002	1.010	1.40
1.41	0.262	0.475	0.602	0.680	0.730	0.771	0.802	0.827	0.849	0.867	0.894	0.920	0.938	0.949	0.960	0.975	0.986	0.996	1.002	1.010	1.41
1.42	0.261	0.469	0.598	0.677	0.728	0.769	0.801	0.826	0.848	0.866	0.894	0.919	0.937	0.948	0.960	0.975	0.986	0.996	1.002	1.010	1.42
1.43	0.261	0.464	0.595	0.675	0.725	0.768	0.790	0.826	0.848	0.866	0.893	0.919	0.937	0.948	0.959	0.975	0.986	0.996	1.002	1.010	1.43
1.44	0.260	0.458	0.591	0.672	0.723	0.766	0.798	0.825	0.847	0.865	0.893	0.918	0.936	0.947	0.959	0.975	0.986	0.996	1.002	1.010	1.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
1.45	0.259	0.453	0.588	0.670	0.721	0.765	0.797	0.824	0.846	0.864	0.892	0.918	0.936	0.947	0.959	0.975	0.986	0.996	1.002	1.010	1.45
1.46	0.258	0.447	0.584	0.667	0.719	0.763	0.796	0.823	0.845	0.863	0.891	0.917	0.936	0.947	0.959	0.975	0.986	0.996	1.002	1.010	1.46
1.47	0.257	0.442	0.581	0.665	0.717	0.762	0.795	0.821	0.844	0.862	0.891	0.917	0.935	0.947	0.958	0.975	0.986	0.996	1.002	1.010	1.47
1.48	0.256	0.436	0.577	0.662	0.714	0.760	0.793	0.820	0.843	0.861	0.890	0.916	0.935	0.946	0.958	0.974	0.985	0.995	1.003	1.010	1.48
1.49	0.255	0.431	0.574	0.660	0.712	0.759	0.792	0.818	0.842	0.860	0.890	0.916	0.934	0.946	0.957	0.974	0.985	0.995	1.003	1.010	1.49
1.50	0.254	0.425	0.570	0.657	0.710	0.757	0.791	0.817	0.841	0.859	0.889	0.915	0.934	0.946	0.957	0.974	0.985	0.995	1.003	1.010	1.50
1.51	0.254	0.422	0.567	0.655	0.708	0.756	0.790	0.816	0.840	0.858	0.888	0.915	0.934	0.946	0.957	0.974	0.985	0.995	1.003	1.010	1.51
1.52	0.254	0.419	0.564	0.653	0.706	0.754	0.789	0.815	0.839	0.857	0.888	0.914	0.933	0.946	0.957	0.974	0.985	0.995	1.003	1.010	1.52
1.53	0.253	0.415	0.562	0.650	0.705	0.753	0.787	0.813	0.839	0.857	0.887	0.914	0.933	0.945	0.956	0.973	0.985	0.995	1.003	1.010	1.53
1.54	0.253	0.412	0.559	0.648	0.703	0.751	0.786	0.812	0.838	0.856	0.887	0.913	0.932	0.945	0.956	0.973	0.985	0.995	1.003	1.010	1.54
1.55	0.253	0.409	0.556	0.646	0.701	0.750	0.785	0.811	0.837	0.855	0.886	0.913	0.932	0.945	0.956	0.973	0.985	0.995	1.003	1.010	1.55
1.56	0.253	0.406	0.553	0.644	0.699	0.748	0.784	0.810	0.836	0.854	0.885	0.912	0.932	0.945	0.956	0.973	0.985	0.995	1.003	1.010	1.56
1.57	0.252	0.403	0.550	0.641	0.697	0.747	0.783	0.809	0.835	0.853	0.884	0.912	0.931	0.944	0.955	0.973	0.985	0.995	1.003	1.010	1.57
1.58	0.252	0.399	0.547	0.639	0.695	0.745	0.781	0.807	0.834	0.853	0.884	0.911	0.931	0.944	0.955	0.972	0.984	0.995	1.003	1.011	1.58
1.59	0.251	0.396	0.544	0.636	0.693	0.744	0.780	0.806	0.833	0.852	0.883	0.911	0.930	0.943	0.954	0.972	0.984	0.995	1.003	1.011	1.59
1.60	0.251	0.393	0.541	0.634	0.691	0.742	0.779	0.805	0.832	0.851	0.882	0.910	0.930	0.943	0.954	0.972	0.984	0.995	1.003	1.011	1.60
1.61	0.251	0.392	0.539	0.632	0.689	0.741	0.778	0.804	0.831	0.850	0.882	0.910	0.930	0.943	0.954	0.972	0.984	0.995	1.003	1.011	1.61
1.62	0.251	0.390	0.536	0.630	0.687	0.739	0.777	0.803	0.830	0.849	0.881	0.909	0.930	0.943	0.954	0.972	0.984	0.995	1.003	1.011	1.62
1.63	0.251	0.389	0.534	0.627	0.686	0.738	0.775	0.802	0.830	0.849	0.881	0.909	0.929	0.942	0.953	0.972	0.984	0.995	1.003	1.011	1.63
1.64	0.251	0.387	0.531	0.625	0.684	0.736	0.774	0.801	0.829	0.848	0.880	0.908	0.929	0.942	0.953	0.972	0.984	0.995	1.003	1.011	1.64
1.65	0.251	0.386	0.529	0.623	0.682	0.735	0.773	0.800	0.828	0.847	0.880	0.908	0.929	0.942	0.953	0.972	0.984	0.995	1.003	1.011	1.65
1.66	0.251	0.384	0.527	0.621	0.680	0.734	0.772	0.799	0.827	0.846	0.879	0.907	0.929	0.942	0.953	0.972	0.984	0.995	1.003	1.011	1.66
1.67	0.251	0.383	0.524	0.619	0.678	0.732	0.771	0.798	0.826	0.845	0.879	0.907	0.928	0.942	0.953	0.972	0.984	0.995	1.003	1.011	1.67
1.68	0.252	0.381	0.522	0.616	0.676	0.731	0.769	0.797	0.825	0.845	0.878	0.906	0.928	0.941	0.952	0.971	0.983	0.995	1.004	1.012	1.68
1.69	0.252	0.380	0.519	0.614	0.674	0.729	0.768	0.796	0.824	0.844	0.878	0.906	0.927	0.941	0.952	0.971	0.983	0.995	1.004	1.012	1.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
1.70	0.252	0.378	0.517	0.612	0.672	0.728	0.767	0.795	0.823	0.843	0.877	0.905	0.927	0.941	0.952	0.971	0.983	0.995	1.004	1.012	1.70
1.71	0.253	0.377	0.515	0.610	0.670	0.726	0.766	0.794	0.822	0.842	0.876	0.905	0.927	0.941	0.952	0.971	0.983	0.995	1.004	1.012	1.71
1.72	0.254	0.376	0.513	0.608	0.669	0.725	0.765	0.793	0.821	0.842	0.876	0.904	0.926	0.941	0.952	0.971	0.983	0.995	1.004	1.012	1.72
1.73	0.254	0.376	0.511	0.606	0.667	0.723	0.763	0.792	0.821	0.841	0.875	0.904	0.926	0.940	0.951	0.971	0.983	0.995	1.004	1.012	1.73
1.74	0.255	0.375	0.509	0.604	0.666	0.722	0.762	0.791	0.820	0.841	0.875	0.903	0.925	0.940	0.951	0.971	0.983	0.995	1.004	1.012	1.74
1.75	0.256	0.374	0.507	0.602	0.664	0.720	0.761	0.790	0.819	0.840	0.874	0.903	0.925	0.940	0.951	0.971	0.983	0.995	1.004	1.012	1.75
1.76	0.257	0.373	0.505	0.600	0.662	0.718	0.760	0.789	0.818	0.839	0.873	0.902	0.925	0.940	0.951	0.971	0.983	0.995	1.004	1.012	1.76
1.77	0.258	0.372	0.503	0.598	0.661	0.717	0.759	0.788	0.817	0.839	0.873	0.902	0.924	0.939	0.951	0.971	0.983	0.995	1.004	1.012	1.77
1.78	0.258	0.372	0.501	0.596	0.659	0.716	0.757	0.786	0.817	0.838	0.872	0.901	0.924	0.939	0.950	0.970	0.983	0.995	1.004	1.012	1.78
1.79	0.259	0.371	0.499	0.594	0.658	0.714	0.756	0.785	0.816	0.838	0.872	0.901	0.923	0.938	0.950	0.970	0.983	0.995	1.004	1.012	1.79
1.80	0.260	0.370	0.497	0.592	0.656	0.712	0.755	0.784	0.815	0.837	0.871	0.900	0.923	0.938	0.950	0.970	0.983	0.995	1.004	1.012	1.80
1.81	0.261	0.370	0.495	0.590	0.654	0.711	0.754	0.783	0.814	0.836	0.871	0.900	0.923	0.938	0.950	0.970	0.983	0.995	1.004	1.012	1.81
1.82	0.262	0.370	0.494	0.588	0.653	0.710	0.753	0.782	0.813	0.836	0.870	0.900	0.923	0.938	0.950	0.970	0.983	0.995	1.004	1.012	1.82
1.83	0.263	0.370	0.492	0.586	0.651	0.708	0.752	0.781	0.813	0.835	0.870	0.899	0.922	0.937	0.949	0.970	0.983	0.995	1.004	1.012	1.83
1.84	0.264	0.370	0.491	0.584	0.650	0.707	0.751	0.780	0.812	0.835	0.869	0.899	0.922	0.937	0.949	0.970	0.983	0.995	1.004	1.012	1.84
1.85	0.265	0.370	0.489	0.582	0.648	0.706	0.750	0.779	0.811	0.834	0.869	0.899	0.922	0.937	0.949	0.970	0.983	0.995	1.004	1.012	1.85
1.86	0.266	0.370	0.487	0.580	0.646	0.705	0.749	0.778	0.810	0.833	0.868	0.899	0.922	0.937	0.949	0.970	0.983	0.995	1.004	1.012	1.86
1.87	0.267	0.370	0.485	0.578	0.645	0.703	0.748	0.777	0.809	0.832	0.868	0.898	0.922	0.937	0.949	0.970	0.983	0.995	1.004	1.012	1.87
1.88	0.268	0.369	0.484	0.576	0.643	0.702	0.746	0.776	0.808	0.832	0.867	0.898	0.921	0.936	0.948	0.969	0.982	0.995	1.005	1.013	1.88
1.89	0.269	0.369	0.482	0.574	0.642	0.700	0.745	0.775	0.807	0.831	0.867	0.897	0.921	0.936	0.948	0.969	0.982	0.995	1.005	1.013	1.89
1.90	0.270	0.369	0.480	0.572	0.640	0.699	0.744	0.774	0.806	0.830	0.866	0.897	0.921	0.936	0.948	0.969	0.982	0.995	1.005	1.013	1.90
1.91	0.271	0.369	0.479	0.570	0.639	0.698	0.743	0.773	0.805	0.829	0.866	0.897	0.921	0.936	0.948	0.969	0.982	0.995	1.005	1.013	1.91
1.92	0.272	0.369	0.478	0.569	0.638	0.697	0.742	0.773	0.805	0.829	0.865	0.896	0.921	0.936	0.948	0.969	0.982	0.995	1.005	1.013	1.92
1.93	0.273	0.369	0.476	0.567	0.636	0.695	0.740	0.772	0.804	0.828	0.865	0.896	0.920	0.935	0.948	0.969	0.982	0.995	1.005	1.013	1.93
1.94	0.274	0.369	0.475	0.566	0.635	0.694	0.739	0.772	0.804	0.828	0.864	0.895	0.920	0.935	0.948	0.969	0.982	0.995	1.005	1.013	1.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
1.95	0.275	0.369	0.474	0.564	0.634	0.693	0.738	0.771	0.803	0.827	0.864	0.895	0.920	0.935	0.948	0.969	0.982	0.995	1.005	1.013	1.95
1.96	0.276	0.369	0.473	0.562	0.633	0.692	0.737	0.770	0.802	0.826	0.863	0.895	0.920	0.935	0.948	0.969	0.982	0.995	1.005	1.013	1.96
1.97	0.277	0.369	0.471	0.560	0.631	0.691	0.736	0.769	0.801	0.826	0.863	0.894	0.919	0.934	0.948	0.969	0.982	0.995	1.005	1.013	1.97
1.98	0.278	0.370	0.470	0.559	0.630	0.689	0.734	0.769	0.801	0.825	0.862	0.894	0.919	0.934	0.947	0.968	0.982	0.995	1.006	1.014	1.98
1.99	0.279	0.370	0.468	0.557	0.628	0.688	0.733	0.768	0.800	0.825	0.862	0.893	0.918	0.933	0.947	0.968	0.982	0.995	1.006	1.014	1.99
2.00	0.280	0.370	0.467	0.555	0.627	0.687	0.732	0.767	0.799	0.824	0.861	0.893	0.918	0.933	0.947	0.968	0.982	0.995	1.006	1.014	2.00
2.01	0.281	0.370	0.466	0.553	0.626	0.686	0.731	0.766	0.798	0.823	0.861	0.893	0.918	0.933	0.947	0.968	0.982	0.995	1.006	1.014	2.01
2.02	0.282	0.370	0.465	0.552	0.624	0.685	0.730	0.765	0.797	0.823	0.860	0.892	0.918	0.933	0.947	0.968	0.982	0.995	1.006	1.014	2.02
2.03	0.284	0.371	0.464	0.550	0.623	0.683	0.729	0.764	0.797	0.822	0.860	0.892	0.917	0.932	0.946	0.968	0.982	0.995	1.006	1.014	2.03
2.04	0.285	0.371	0.463	0.549	0.621	0.682	0.728	0.763	0.796	0.822	0.859	0.891	0.917	0.932	0.946	0.968	0.982	0.995	1.006	1.014	2.04
2.05	0.286	0.371	0.462	0.547	0.620	0.681	0.727	0.762	0.795	0.821	0.859	0.891	0.917	0.932	0.946	0.968	0.982	0.995	1.006	1.014	2.05
2.06	0.287	0.371	0.461	0.545	0.618	0.680	0.726	0.761	0.794	0.820	0.858	0.891	0.917	0.932	0.946	0.968	0.982	0.995	1.006	1.014	2.06
2.07	0.288	0.371	0.460	0.544	0.617	0.678	0.725	0.760	0.793	0.820	0.858	0.890	0.916	0.932	0.946	0.968	0.982	0.995	1.006	1.014	2.07
2.08	0.290	0.372	0.459	0.542	0.615	0.677	0.723	0.759	0.793	0.819	0.857	0.890	0.916	0.931	0.945	0.967	0.981	0.995	1.007	1.015	2.08
2.09	0.291	0.372	0.458	0.541	0.614	0.675	0.722	0.758	0.792	0.819	0.857	0.889	0.915	0.931	0.945	0.967	0.981	0.995	1.007	1.015	2.09
2.10	0.292	0.372	0.457	0.539	0.612	0.674	0.721	0.757	0.791	0.818	0.856	0.889	0.915	0.931	0.945	0.967	0.981	0.995	1.007	1.015	2.10
2.11	0.293	0.372	0.456	0.538	0.611	0.673	0.720	0.756	0.790	0.817	0.856	0.889	0.915	0.931	0.945	0.967	0.981	0.995	1.007	1.015	2.11
2.12	0.294	0.373	0.456	0.537	0.610	0.672	0.719	0.755	0.790	0.817	0.855	0.888	0.915	0.931	0.945	0.967	0.981	0.995	1.007	1.015	2.12
2.13	0.296	0.373	0.455	0.536	0.609	0.671	0.718	0.755	0.789	0.816	0.855	0.888	0.914	0.930	0.945	0.967	0.981	0.995	1.007	1.015	2.13
2.14	0.297	0.374	0.455	0.535	0.608	0.670	0.717	0.754	0.789	0.816	0.854	0.887	0.914	0.930	0.945	0.967	0.981	0.995	1.007	1.015	2.14
2.15	0.298	0.374	0.454	0.534	0.607	0.669	0.716	0.753	0.788	0.815	0.854	0.887	0.914	0.930	0.945	0.967	0.981	0.995	1.007	1.015	2.15
2.16	0.299	0.374	0.453	0.533	0.606	0.668	0.715	0.752	0.787	0.814	0.853	0.887	0.914	0.930	0.945	0.967	0.981	0.995	1.007	1.015	2.16
2.17	0.301	0.375	0.452	0.532	0.605	0.667	0.714	0.751	0.786	0.813	0.853	0.886	0.913	0.930	0.945	0.967	0.981	0.995	1.007	1.015	2.17
2.18	0.302	0.375	0.452	0.530	0.604	0.665	0.713	0.750	0.786	0.813	0.852	0.886	0.913	0.929	0.944	0.966	0.981	0.995	1.007	1.016	2.18
2.19	0.304	0.376	0.451	0.529	0.603	0.664	0.712	0.749	0.785	0.812	0.852	0.885	0.912	0.929	0.944	0.966	0.981	0.995	1.007	1.016	2.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
2.20	0.305	0.376	0.450	0.528	0.602	0.663	0.711	0.748	0.784	0.811	0.851	0.885	0.912	0.929	0.944	0.966	0.981	0.995	1.007	1.016	2.20
2.21	0.306	0.376	0.450	0.527	0.601	0.662	0.710	0.747	0.783	0.810	0.851	0.885	0.912	0.929	0.944	0.966	0.981	0.995	1.007	1.016	2.21
2.22	0.307	0.377	0.450	0.527	0.600	0.661	0.709	0.747	0.783	0.810	0.851	0.855	0.912	0.929	0.944	0.966	0.981	0.995	1.007	1.016	2.22
2.23	0.309	0.377	0.449	0.526	0.600	0.660	0.709	0.746	0.782	0.809	0.850	0.884	0.911	0.928	0.943	0.966	0.981	0.995	1.007	1.016	2.23
2.24	0.310	0.378	0.449	0.526	0.599	0.659	0.708	0.746	0.782	0.809	0.850	0.884	0.911	0.928	0.943	0.966	0.981	0.995	1.007	1.016	2.24
2.25	0.311	0.378	0.449	0.525	0.598	0.658	0.707	0.745	0.781	0.808	0.850	0.884	0.911	0.928	0.943	0.966	0.981	0.995	1.007	1.016	2.25
2.26	0.312	0.378	0.449	0.524	0.597	0.657	0.706	0.744	0.780	0.807	0.850	0.884	0.911	0.928	0.943	0.966	0.981	0.995	1.007	1.016	2.26
2.27	0.314	0.379	0.449	0.524	0.596	0.656	0.705	0.743	0.780	0.807	0.849	0.883	0.910	0.928	0.943	0.966	0.981	0.995	1.007	1.016	2.27
2.28	0.315	0.379	0.448	0.523	0.595	0.654	0.704	0.743	0.779	0.806	0.849	0.883	0.910	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.28
2.29	0.317	0.380	0.448	0.523	0.594	0.653	0.703	0.742	0.779	0.806	0.848	0.882	0.909	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.29
2.30	0.318	0.380	0.448	0.522	0.593	0.652	0.702	0.741	0.778	0.805	0.848	0.882	0.909	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.30
2.31	0.319	0.381	0.448	0.522	0.592	0.651	0.701	0.740	0.777	0.805	0.848	0.882	0.909	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.31
2.32	0.320	0.381	0.448	0.522	0.592	0.651	0.701	0.739	0.777	0.804	0.847	0.882	0.909	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.32
2.33	0.322	0.382	0.448	0.521	0.591	0.650	0.700	0.739	0.776	0.804	0.847	0.881	0.908	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.33
2.34	0.323	0.382	0.448	0.521	0.591	0.650	0.700	0.738	0.776	0.803	0.846	0.881	0.908	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.34
2.35	0.324	0.383	0.448	0.521	0.590	0.649	0.699	0.737	0.775	0.803	0.846	0.881	0.908	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.35
2.36	0.325	0.384	0.448	0.521	0.589	0.648	0.698	0.736	0.774	0.802	0.845	0.881	0.908	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.36
2.37	0.326	0.385	0.448	0.521	0.588	0.647	0.697	0.735	0.773	0.802	0.845	0.880	0.908	0.927	0.942	0.965	0.980	0.995	1.008	1.017	2.37
2.38	0.328	0.385	0.449	0.520	0.588	0.647	0.697	0.735	0.773	0.801	0.844	0.880	0.907	0.926	0.941	0.964	0.980	0.995	1.008	1.018	2.38
2.39	0.329	0.386	0.449	0.520	0.587	0.646	0.696	0.734	0.772	0.801	0.844	0.879	0.907	0.926	0.941	0.964	0.980	0.995	1.008	1.018	2.39
2.40	0.330	0.387	0.449	0.520	0.586	0.645	0.695	0.733	0.771	0.800	0.843	0.879	0.907	0.926	0.941	0.964	0.980	0.995	1.008	1.018	2.40
2.41	0.331	0.388	0.449	0.520	0.585	0.644	0.694	0.733	0.770	0.800	0.843	0.879	0.907	0.926	0.941	0.964	0.980	0.995	1.008	1.018	2.41
2.42	0.332	0.388	0.449	0.520	0.585	0.644	0.694	0.732	0.770	0.799	0.843	0.879	0.907	0.926	0.941	0.964	0.980	0.995	1.008	1.018	2.42
2.43	0.334	0.389	0.450	0.520	0.584	0.643	0.693	0.732	0.769	0.799	0.842	0.878	0.906	0.925	0.941	0.964	0.980	0.995	1.008	1.018	2.43
2.44	0.335	0.389	0.450	0.520	0.584	0.643	0.693	0.731	0.769	0.798	0.842	0.878	0.906	0.925	0.941	0.964	0.980	0.995	1.008	1.018	2.44

Table 11 – Compressibility Factors of Natural Gas
Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
2.45	0.336	0.390	0.450	0.520	0.583	0.642	0.692	0.731	0.768	0.798	0.842	0.878	0.906	0.925	0.941	0.964	0.980	0.995	1.008	1.018	2.45
2.46	0.337	0.391	0.450	0.520	0.583	0.641	0.691	0.730	0.767	0.798	0.842	0.878	0.906	0.925	0.941	0.964	0.980	0.995	1.008	1.018	2.46
2.47	0.339	0.392	0.450	0.520	0.582	0.640	0.690	0.730	0.767	0.797	0.841	0.877	0.905	0.925	0.941	0.964	0.980	0.995	1.008	1.018	2.47
2.48	0.340	0.392	0.451	0.519	0.582	0.640	0.690	0.729	0.767	0.797	0.841	0.877	0.905	0.924	0.941	0.963	0.980	0.995	1.009	1.019	2.48
2.49	0.342	0.393	0.451	0.519	0.581	0.639	0.689	0.729	0.767	0.796	0.840	0.876	0.904	0.924	0.941	0.963	0.980	0.995	1.009	1.019	2.49
2.50	0.343	0.394	0.451	0.519	0.581	0.638	0.688	0.728	0.765	0.796	0.840	0.876	0.904	0.924	0.941	0.963	0.980	0.995	1.009	1.019	2.50
2.51	0.344	0.395	0.452	0.519	0.581	0.638	0.687	0.727	0.765	0.795	0.840	0.876	0.904	0.924	0.941	0.963	0.980	0.995	1.009	1.019	2.51
2.52	0.345	0.396	0.452	0.519	0.581	0.637	0.687	0.727	0.764	0.795	0.840	0.876	0.904	0.924	0.941	0.963	0.980	0.995	1.009	1.019	2.52
2.53	0.347	0.396	0.453	0.519	0.581	0.637	0.686	0.726	0.764	0.794	0.839	0.875	0.903	0.923	0.941	0.963	0.980	0.995	1.009	1.019	2.53
2.54	0.348	0.397	0.453	0.519	0.581	0.636	0.686	0.726	0.763	0.794	0.839	0.875	0.903	0.923	0.941	0.963	0.980	0.995	1.009	1.019	2.54
2.55	0.349	0.398	0.454	0.519	0.581	0.636	0.685	0.725	0.763	0.793	0.839	0.875	0.903	0.923	0.941	0.963	0.980	0.995	1.009	1.019	2.55
2.56	0.350	0.399	0.455	0.519	0.581	0.635	0.684	0.724	0.762	0.793	0.839	0.875	0.903	0.923	0.941	0.963	0.980	0.995	1.009	1.019	2.56
2.57	0.352	0.400	0.456	0.519	0.581	0.635	0.684	0.724	0.762	0.792	0.838	0.874	0.903	0.923	0.941	0.963	0.980	0.995	1.009	1.019	2.57
2.58	0.353	0.400	0.456	0.520	0.580	0.634	0.683	0.723	0.761	0.792	0.838	0.874	0.902	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.58
2.59	0.355	0.401	0.457	0.520	0.580	0.634	0.683	0.723	0.761	0.791	0.837	0.873	0.902	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.59
2.60	0.356	0.402	0.458	0.520	0.580	0.633	0.682	0.722	0.760	0.791	0.837	0.873	0.902	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.60
2.61	0.357	0.403	0.458	0.520	0.580	0.633	0.682	0.722	0.760	0.791	0.837	0.873	0.902	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.61
2.62	0.358	0.404	0.459	0.520	0.580	0.632	0.681	0.721	1.759	0.790	0.836	0.873	0.902	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.62
2.63	0.360	0.404	0.459	0.521	0.580	0.632	0.681	0.721	0.759	0.790	0.836	0.872	0.901	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.63
2.64	0.361	0.405	0.460	0.521	0.580	0.631	0.680	0.720	0.758	0.789	0.835	0.872	0.901	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.64
2.65	0.362	0.406	0.460	0.521	0.580	0.631	0.680	0.720	0.758	0.789	0.835	0.872	0.901	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.65
2.66	0.363	0.407	0.461	0.521	0.580	0.631	0.680	0.720	0.758	0.789	0.835	0.872	0.901	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.66
2.67	0.365	0.408	0.461	0.521	0.580	0.630	0.679	0.719	0.757	0.788	0.834	0.872	0.901	0.922	0.940	0.963	0.980	0.995	1.009	1.020	2.67
2.68	0.366	0.408	0.462	0.522	0.579	0.630	0.679	0.719	0.757	0.788	0.834	0.871	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.68
2.69	0.368	0.409	0.462	0.522	0.579	0.629	0.678	0.718	0.756	0.787	0.833	0.871	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
2.70	0.369	0.410	0.463	0.522	0.579	0.629	0.678	0.718	0.756	0.787	0.833	0.871	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.70
2.71	0.370	0.411	0.464	0.522	0.579	0.629	0.678	0.718	0.756	0.787	0.833	0.871	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.71
2.72	0.371	0.412	0.465	0.523	0.579	0.629	0.677	0.717	0.755	0.786	0.833	0.871	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.72
2.73	0.373	0.412	0.465	0.523	0.579	0.628	0.677	0.717	0.755	0.786	0.832	0.870	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.73
2.74	0.374	0.413	0.466	0.524	0.579	0.628	0.676	0.716	0.754	0.785	0.832	0.870	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.74
2.75	0.375	0.414	0.467	0.524	0.579	0.628	0.676	0.716	0.754	0.785	0.832	0.870	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.75
2.76	0.376	0.415	0.468	0.524	0.579	0.628	0.675	0.715	0.754	0.785	0.832	0.870	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.76
2.77	0.377	0.416	0.469	0.525	0.579	0.628	0.675	0.715	0.753	0.784	0.831	0.870	0.900	0.921	0.939	0.962	0.980	0.996	1.010	1.021	2.77
2.78	0.379	0.417	0.470	0.525	0.579	0.627	0.674	0.714	0.753	0.784	0.831	0.869	0.899	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.78
2.79	0.380	0.418	0.471	0.526	0.579	0.627	0.674	0.714	0.752	0.783	0.830	0.869	0.899	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.79
2.80	0.381	0.419	0.472	0.526	0.579	0.627	0.673	0.713	0.752	0.783	0.830	0.869	0.899	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.80
2.81	0.382	0.420	0.473	0.526	0.579	0.627	0.673	0.713	0.752	0.783	0.830	0.869	0.899	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.81
2.82	0.383	0.421	0.474	0.527	0.579	0.627	0.673	0.713	0.751	0.782	0.830	0.869	0.899	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.82
2.83	0.385	0.422	0.474	0.527	0.579	0.626	0.672	0.712	0.751	0.782	0.829	0.868	0.898	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.83
2.84	0.386	0.423	0.475	0.528	0.579	0.626	0.672	0.712	0.750	0.781	0.829	0.868	0.898	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.84
2.85	0.387	0.424	0.476	0.528	0.579	0.626	0.672	0.712	0.750	0.781	0.829	0.868	0.898	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.85
2.86	0.388	0.425	0.477	0.528	0.579	0.626	0.672	0.712	0.750	0.781	0.829	0.868	0.898	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.86
2.87	0.390	0.426	0.478	0.529	0.579	0.626	0.671	0.711	0.749	0.780	0.829	0.868	0.898	0.920	0.938	0.962	0.980	0.996	1.010	1.022	2.87
2.88	0.391	0.427	0.479	0.529	0.580	0.625	0.671	0.711	0.749	0.780	0.829	0.867	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.88
2.89	0.393	0.428	0.480	0.530	0.580	0.625	0.670	0.710	0.748	0.779	0.828	0.867	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.89
2.90	0.394	0.429	0.481	0.530	0.580	0.625	0.670	0.710	0.748	0.779	0.828	0.867	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.90
2.91	0.395	0.430	0.482	0.530	0.580	0.625	0.670	0.710	0.748	0.779	0.828	0.867	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.91
2.92	0.397	0.431	0.483	0.531	0.580	0.625	0.670	0.710	0.748	0.779	0.828	0.867	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.92
2.93	0.398	0.432	0.483	0.531	0.580	0.625	0.670	0.709	0.747	0.778	0.827	0.866	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.93
2.94	0.400	0.433	0.484	0.532	0.580	0.625	0.670	0.709	0.747	0.778	0.827	0.866	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
2.95	0.401	0.434	0.485	0.532	0.580	0.625	0.670	0.709	0.747	0.778	0.827	0.866	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.95
2.96	0.402	0.435	0.486	0.532	0.580	0.625	0.670	0.709	0.747	0.778	0.827	0.866	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.96
2.97	0.403	0.436	0.487	0.533	0.580	0.625	0.670	0.708	0.746	0.778	0.826	0.865	0.897	0.919	0.938	0.962	0.980	0.997	1.011	1.023	2.97
2.98	0.405	0.438	0.487	0.533	0.581	0.624	0.669	0.708	0.746	0.777	0.826	0.865	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	2.98
2.99	0.406	0.439	0.488	0.534	0.581	0.624	0.669	0.707	0.745	0.777	0.825	0.864	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	2.99
3.00	0.407	0.440	0.489	0.534	0.581	0.624	0.669	0.707	0.745	0.777	0.825	0.864	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.00
3.01	0.408	0.441	0.490	0.535	0.581	0.624	0.669	0.707	0.745	0.777	0.825	0.864	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.01
3.02	0.409	0.442	0.491	0.535	0.581	0.624	0.669	0.707	0.745	0.777	0.824	0.864	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.02
3.03	0.411	0.444	0.492	0.536	0.582	0.624	0.669	0.706	0.744	0.776	0.824	0.863	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.03
3.04	0.412	0.445	0.493	0.536	0.582	0.624	0.669	0.706	0.744	0.776	0.823	0.863	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.04
3.05	0.413	0.446	0.494	0.537	0.582	0.624	0.669	0.706	0.744	0.776	0.823	0.863	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.05
3.06	0.414	0.447	0.495	0.538	0.582	0.624	0.669	0.706	0.744	0.776	0.823	0.863	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.06
3.07	0.416	0.448	0.496	0.538	0.583	0.624	0.669	0.706	0.743	0.776	0.823	0.863	0.896	0.918	0.938	0.962	0.981	0.997	1.012	1.024	3.07
3.08	0.417	0.450	0.497	0.539	0.583	0.625	0.668	0.705	0.743	0.775	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.08
3.09	0.419	0.451	0.498	0.539	0.584	0.625	0.668	0.705	0.742	0.775	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.09
3.10	0.420	0.452	0.499	0.540	0.584	0.625	0.668	0.705	0.742	0.775	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.10
3.11	0.421	0.453	0.500	0.541	0.584	0.625	0.668	0.705	0.742	0.775	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.11
3.12	0.422	0.454	0.501	0.541	0.585	0.625	0.668	0.705	0.742	0.775	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.12
3.13	0.424	0.455	0.501	0.542	0.585	0.625	0.668	0.704	0.742	0.774	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.13
3.14	0.425	0.456	0.502	0.542	0.586	0.625	0.668	0.704	0.742	0.774	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.14
3.15	0.426	0.457	0.503	0.543	0.586	0.625	0.668	0.704	0.742	0.774	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.15
3.16	0.427	0.458	0.504	0.544	0.586	0.625	0.668	0.704	0.742	0.774	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.16
3.17	0.428	0.459	0.505	0.544	0.587	0.625	0.668	0.704	0.742	0.774	0.822	0.862	0.895	0.917	0.937	0.962	0.981	0.998	1.013	1.025	3.17
3.18	0.430	0.461	0.505	0.545	0.587	0.626	0.668	0.703	0.741	0.773	0.821	0.861	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.18
3.19	0.431	0.462	0.506	0.545	0.588	0.626	0.668	0.703	0.741	0.773	0.821	0.861	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
3.20	0.432	0.463	0.507	0.546	0.588	0.626	0.668	0.703	0.741	0.773	0.821	0.861	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.20
3.21	0.433	0.464	0.508	0.546	0.588	0.626	0.668	0.703	0.741	0.773	0.821	0.861	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.21
3.22	0.434	0.465	0.509	0.547	0.589	0.626	0.668	0.702	0.741	0.773	0.821	0.861	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.22
3.23	0.436	0.467	0.509	0.547	0.589	0.627	0.668	0.702	0.741	0.773	0.820	0.860	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.23
3.24	0.437	0.468	0.510	0.548	0.590	0.627	0.668	0.701	0.741	0.773	0.820	0.860	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.24
3.25	0.438	0.469	0.511	0.548	0.590	0.627	0.668	0.701	0.741	0.773	0.820	0.860	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.25
3.26	0.439	0.470	0.512	0.549	0.590	0.627	0.668	0.701	0.741	0.773	0.820	0.860	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.26
3.27	0.441	0.471	0.513	0.549	0.591	0.627	0.668	0.701	0.741	0.773	0.820	0.860	0.894	0.917	0.937	0.962	0.982	0.998	1.014	1.026	3.27
3.28	0.442	0.473	0.514	0.550	0.591	0.628	0.668	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.28
3.29	0.444	0.474	0.515	0.550	0.592	0.628	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.29
3.30	0.445	0.475	0.516	0.551	0.592	0.628	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.30
3.31	0.446	0.476	0.517	0.552	0.592	0.628	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.31
3.32	0.447	0.477	0.518	0.553	0.593	0.628	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.32
3.33	0.449	0.479	0.518	0.553	0.593	0.629	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.33
3.34	0.450	0.480	0.519	0.554	0.594	0.629	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.34
3.35	0.451	0.481	0.520	0.555	0.594	0.629	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.35
3.36	0.452	0.482	0.521	0.556	0.595	0.629	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.36
3.37	0.454	0.484	0.522	0.557	0.595	0.630	0.669	0.702	0.740	0.772	0.819	0.859	0.893	0.916	0.937	0.962	0.982	0.999	1.015	1.027	3.37
3.38	0.455	0.485	0.523	0.557	0.596	0.630	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.028	3.38
3.39	0.457	0.487	0.524	0.558	0.596	0.631	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.028	3.39
3.40	0.458	0.488	0.525	0.559	0.597	0.631	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.028	3.40
3.41	0.459	0.489	0.526	0.560	0.597	0.631	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.028	3.41
3.42	0.460	0.490	0.527	0.560	0.598	0.631	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.028	3.42
3.43	0.462	0.492	0.528	0.561	0.598	0.632	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.029	3.43
3.44	0.463	0.493	0.529	0.561	0.599	0.632	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.029	3.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
3.45	0.464	0.494	0.530	0.562	0.599	0.632	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.029	3.45
3.46	0.465	0.495	0.531	0.563	0.600	0.632	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.029	3.46
3.47	0.467	0.496	0.532	0.564	0.600	0.632	0.670	0.703	0.739	0.771	0.818	0.858	0.892	0.916	0.937	0.963	0.983	1.000	1.016	1.029	3.47
3.48	0.468	0.498	0.533	0.564	0.601	0.633	0.670	0.704	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.48
3.49	0.470	0.499	0.534	0.565	0.601	0.633	0.670	0.704	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.49
3.50	0.471	0.500	0.535	0.566	0.602	0.633	0.670	0.704	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.50
3.51	0.472	0.501	0.536	0.567	0.603	0.633	0.670	0.704	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.51
3.52	0.473	0.502	0.537	0.567	0.603	0.634	0.671	0.704	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.52
3.53	0.475	0.503	0.537	0.568	0.604	0.634	0.671	0.705	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.53
3.54	0.476	0.504	0.538	0.568	0.604	0.635	0.672	0.705	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.54
3.55	0.477	0.505	0.539	0.569	0.605	0.635	0.672	0.705	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.55
3.56	0.478	0.506	0.540	0.570	0.606	0.635	0.672	0.705	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.56
3.57	0.479	0.507	0.541	0.570	0.606	0.636	0.672	0.705	0.739	0.771	0.817	0.858	0.891	0.915	0.937	0.963	0.984	1.000	1.017	1.030	3.57
3.58	0.481	0.509	0.542	0.571	0.607	0.636	0.673	0.706	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.018	1.031	3.58
3.59	0.482	0.510	0.543	0.571	0.607	0.637	0.673	0.706	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.018	1.031	3.59
3.60	0.483	0.511	0.544	0.572	0.608	0.637	0.673	0.706	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.018	1.031	3.60
3.61	0.484	0.512	0.545	0.573	0.609	0.637	0.673	0.706	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.018	1.031	3.61
3.62	0.486	0.513	0.546	0.574	0.609	0.638	0.674	0.706	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.018	1.031	3.62
3.63	0.487	0.515	0.546	0.575	0.610	0.638	0.674	0.707	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.019	1.031	3.63
3.64	0.489	0.516	0.547	0.576	0.610	0.639	0.675	0.707	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.019	1.031	3.64
3.65	0.490	0.517	0.548	0.577	0.611	0.639	0.675	0.707	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.019	1.031	3.65
3.66	0.491	0.518	0.549	0.578	0.612	0.639	0.675	0.707	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.019	1.031	3.66
3.67	0.493	0.519	0.550	0.579	0.612	0.640	0.676	0.707	0.740	0.771	0.816	0.857	0.890	0.915	0.937	0.964	0.985	1.001	1.019	1.031	3.67
3.68	0.494	0.521	0.551	0.580	0.613	0.640	0.676	0.708	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.68
3.69	0.496	0.522	0.552	0.581	0.613	0.641	0.677	0.708	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
3.70	0.497	0.523	0.553	0.582	0.614	0.641	0.677	0.708	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.70
3.71	0.498	0.524	0.554	0.583	0.615	0.641	0.677	0.708	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.71
3.72	0.499	0.525	0.555	0.583	0.615	0.641	0.677	0.708	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.72
3.73	0.501	0.527	0.556	0.584	0.616	0.642	0.678	0.709	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.73
3.74	0.502	0.528	0.557	0.585	0.616	0.642	0.678	0.709	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.74
3.75	0.503	0.529	0.558	0.586	0.617	0.642	0.678	0.709	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.75
3.76	0.504	0.530	0.559	0.587	0.618	0.642	0.678	0.709	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.76
3.77	0.505	0.531	0.560	0.588	0.618	0.643	0.679	0.709	0.741	0.772	0.816	0.856	0.890	0.916	0.937	0.965	0.986	1.002	1.019	1.032	3.77
3.78	0.507	0.533	0.561	0.588	0.619	0.643	0.679	0.710	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.987	1.003	1.020	1.033	3.78
3.79	0.508	0.534	0.562	0.589	0.619	0.644	0.680	0.710	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.987	1.003	1.020	1.033	3.79
3.80	0.509	0.535	0.563	0.590	0.620	0.644	0.680	0.710	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.987	1.003	1.020	1.033	3.80
3.81	0.510	0.536	0.564	0.591	0.621	0.644	0.680	0.710	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.987	1.003	1.020	1.033	3.81
3.82	0.511	0.537	0.565	0.592	0.621	0.645	0.680	0.710	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.987	1.003	1.020	1.033	3.82
3.83	0.513	0.539	0.566	0.592	0.622	0.645	0.681	0.711	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.988	1.004	1.021	1.033	3.83
3.84	0.514	0.540	0.567	0.593	0.622	0.646	0.681	0.711	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.988	1.004	1.021	1.033	3.84
3.85	0.515	0.541	0.568	0.594	0.623	0.646	0.681	0.711	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.988	1.004	1.021	1.033	3.85
3.86	0.516	0.542	0.569	0.595	0.624	0.647	0.681	0.711	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.988	1.004	1.021	1.033	3.86
3.87	0.518	0.543	0.570	0.596	0.625	0.647	0.682	0.712	0.742	0.773	0.816	0.855	0.891	0.916	0.937	0.966	0.988	1.004	1.021	1.033	3.87
3.88	0.519	0.545	0.571	0.597	0.625	0.648	0.682	0.712	0.743	0.774	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.005	1.022	1.034	3.88
3.89	0.521	0.546	0.572	0.598	0.626	0.648	0.683	0.713	0.743	0.774	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.005	1.022	1.034	3.89
3.90	0.522	0.547	0.573	0.599	0.627	0.649	0.683	0.713	0.743	0.774	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.005	1.022	1.034	3.90
3.91	0.523	0.548	0.574	0.600	0.628	0.649	0.683	0.713	0.743	0.774	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.005	1.022	1.034	3.91
3.92	0.524	0.549	0.575	0.601	0.628	0.650	0.684	0.713	0.743	0.774	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.005	1.022	1.034	3.92
3.93	0.526	0.550	0.575	0.601	0.629	0.650	0.684	0.714	0.744	0.775	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.006	1.022	1.034	3.93
3.94	0.527	0.551	0.576	0.602	0.629	0.651	0.685	0.714	0.744	0.775	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.006	1.022	1.034	3.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
3.95	0.528	0.552	0.577	0.603	0.630	0.651	0.685	0.714	0.744	0.775	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.006	1.022	1.034	3.95
3.96	0.529	0.553	0.578	0.604	0.631	0.651	0.685	0.714	0.744	0.775	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.006	1.022	1.034	3.96
3.97	0.530	0.554	0.579	0.605	0.631	0.652	0.686	0.715	0.745	0.775	0.817	0.855	0.891	0.917	0.938	0.967	0.989	1.006	1.022	1.034	3.97
3.98	0.532	0.556	0.580	0.606	0.632	0.652	0.686	0.715	0.745	0.776	0.818	0.856	0.892	0.917	0.939	0.968	0.990	1.007	1.023	1.035	3.98
3.99	0.533	0.557	0.581	0.607	0.632	0.653	0.687	0.716	0.746	0.776	0.818	0.856	0.892	0.917	0.939	0.968	0.990	1.007	1.023	1.035	3.99
4.00	0.534	0.558	0.582	0.608	0.633	0.653	0.687	0.716	0.746	0.776	0.818	0.856	0.892	0.917	0.939	0.968	0.990	1.007	1.023	1.035	4.00
4.01	0.535	0.559	0.583	0.609	0.634	0.654	0.687	0.716	0.746	0.776	0.818	0.856	0.892	0.917	0.939	0.968	0.990	1.007	1.023	1.035	4.01
4.02	0.536	0.560	0.584	0.610	0.634	0.654	0.688	0.716	0.746	0.776	0.818	0.856	0.892	0.917	0.939	0.968	0.990	1.007	1.023	1.035	4.02
4.03	0.538	0.562	0.585	0.610	0.635	0.655	0.688	0.717	0.747	0.777	0.819	0.856	0.892	0.917	0.939	0.968	0.991	1.008	1.023	1.035	4.03
4.04	0.539	0.563	0.586	0.611	0.635	0.655	0.689	0.717	0.747	0.777	0.819	0.856	0.892	0.917	0.939	0.968	0.991	1.008	1.023	1.035	4.04
4.05	0.540	0.564	0.587	0.612	0.636	0.656	0.689	0.717	0.747	0.777	0.819	0.856	0.892	0.917	0.939	0.968	0.991	1.008	1.023	1.035	4.05
4.06	0.541	0.565	0.588	0.613	0.637	0.657	0.690	0.717	0.747	0.777	0.819	0.856	0.892	0.917	0.939	0.968	0.991	1.008	1.023	1.035	4.06
4.07	0.543	0.566	0.589	0.614	0.638	0.657	0.690	0.718	0.748	0.778	0.819	0.856	0.892	0.917	0.939	0.968	0.991	1.008	1.023	1.035	4.07
4.08	0.544	0.568	0.590	0.614	0.638	0.658	0.691	0.718	0.748	0.778	0.820	0.857	0.893	0.918	0.940	0.969	0.992	1.009	1.024	1.036	4.08
4.09	0.546	0.569	0.591	0.615	0.639	0.658	0.691	0.719	0.749	0.779	0.820	0.857	0.893	0.918	0.940	0.969	0.992	1.009	1.024	1.036	4.09
4.10	0.547	0.570	0.592	0.616	0.640	0.659	0.692	0.719	0.749	0.779	0.820	0.857	0.893	0.918	0.940	0.969	0.992	1.009	1.024	1.036	4.10
4.11	0.548	0.571	0.593	0.617	0.641	0.660	0.693	0.719	0.749	0.779	0.820	0.857	0.893	0.918	0.940	0.969	0.992	1.009	1.024	1.036	4.11
4.12	0.549	0.572	0.594	0.618	0.642	0.660	0.693	0.719	0.749	0.779	0.820	0.857	0.893	0.918	0.940	0.969	0.992	1.009	1.024	1.036	4.12
4.13	0.551	0.573	0.594	0.618	0.642	0.661	0.694	0.720	0.750	0.780	0.821	0.857	0.894	0.918	0.940	0.970	0.993	1.010	1.025	1.036	4.13
4.14	0.552	0.574	0.595	0.619	0.643	0.661	0.694	0.720	0.750	0.780	0.821	0.857	0.894	0.918	0.940	0.970	0.993	1.010	1.025	1.036	4.14
4.15	0.553	0.575	0.596	0.620	0.644	0.662	0.694	0.720	0.750	0.780	0.821	0.857	0.894	0.918	0.940	0.970	0.993	1.010	1.025	1.036	4.15
4.16	0.554	0.576	0.597	0.621	0.645	0.663	0.695	0.720	0.750	0.780	0.821	0.857	0.894	0.918	0.940	0.970	0.993	1.010	1.025	1.036	4.16
4.17	0.556	0.577	0.598	0.622	0.646	0.663	0.696	0.721	0.751	0.780	0.821	0.858	0.894	0.918	0.940	0.970	0.993	1.010	1.025	1.036	4.17
4.18	0.557	0.579	0.599	0.622	0.646	0.664	0.696	0.721	0.751	0.781	0.822	0.858	0.895	0.919	0.941	0.971	0.994	1.011	1.026	1.037	4.18
4.19	0.559	0.580	0.600	0.623	0.647	0.664	0.697	0.722	0.752	0.781	0.822	0.859	0.895	0.919	0.941	0.971	0.994	1.011	1.026	1.037	4.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
4.20	0.560	0.581	0.601	0.624	0.648	0.665	0.697	0.722	0.752	0.781	0.822	0.859	0.895	0.919	0.941	0.971	0.994	1.011	1.026	1.037	4.20
4.21	0.561	0.582	0.602	0.625	0.649	0.666	0.697	0.722	0.752	0.781	0.822	0.859	0.895	0.919	0.941	0.971	0.994	1.011	1.026	1.037	4.21
4.22	0.562	0.583	0.603	0.626	0.649	0.666	0.698	0.723	0.752	0.781	0.822	0.859	0.895	0.919	0.941	0.971	0.994	1.011	1.026	1.037	4.22
4.23	0.564	0.585	0.604	0.626	0.650	0.667	0.698	0.723	0.753	0.782	0.823	0.859	0.896	0.919	0.941	0.972	0.995	1.012	1.026	1.037	4.23
4.24	0.565	0.586	0.605	0.627	0.650	0.667	0.699	0.724	0.753	0.782	0.823	0.859	0.896	0.919	0.941	0.972	0.995	1.012	1.026	1.037	4.24
4.25	0.566	0.587	0.606	0.628	0.651	0.668	0.699	0.724	0.753	0.782	0.823	0.859	0.896	0.919	0.941	0.972	0.995	1.012	1.026	1.037	4.25
4.26	0.567	0.588	0.607	0.629	0.652	0.669	0.699	0.724	0.753	0.782	0.823	0.859	0.896	0.919	0.941	0.972	0.995	1.012	1.026	1.037	4.26
4.27	0.568	0.589	0.608	0.630	0.653	0.669	0.700	0.725	0.754	0.783	0.823	0.860	0.896	0.919	0.941	0.972	0.995	1.012	1.026	1.037	4.27
4.28	0.570	0.591	0.609	0.630	0.653	0.670	0.700	0.725	0.754	0.783	0.824	0.860	0.897	0.920	0.942	0.973	0.996	1.013	1.027	1.038	4.28
4.29	0.571	0.592	0.610	0.631	0.654	0.670	0.701	0.726	0.755	0.784	0.824	0.861	0.897	0.920	0.942	0.973	0.996	1.013	1.027	1.038	4.29
4.30	0.572	0.593	0.611	0.632	0.655	0.671	0.701	0.726	0.755	0.784	0.824	0.861	0.897	0.920	0.942	0.973	0.996	1.013	1.027	1.038	4.30
4.31	0.573	0.594	0.612	0.633	0.656	0.672	0.701	0.726	0.755	0.784	0.824	0.861	0.897	0.920	0.942	0.973	0.996	1.013	1.027	1.038	4.31
4.32	0.575	0.595	0.613	0.634	0.656	0.672	0.702	0.727	0.756	0.784	0.824	0.861	0.897	0.920	0.942	0.973	0.996	1.013	1.027	1.038	4.32
4.33	0.576	0.596	0.614	0.634	0.657	0.673	0.702	0.727	0.756	0.785	0.825	0.861	0.897	0.921	0.942	0.973	0.997	1.013	1.028	1.039	4.33
4.34	0.578	0.597	0.615	0.635	0.657	0.673	0.703	0.728	0.757	0.785	0.825	0.861	0.897	0.921	0.942	0.973	0.997	1.013	1.028	1.039	4.34
4.35	0.579	0.598	0.616	0.636	0.658	0.674	0.703	0.728	0.757	0.785	0.825	0.861	0.897	0.921	0.942	0.973	0.997	1.013	1.028	1.039	4.35
4.36	0.580	0.599	0.617	0.637	0.659	0.675	0.704	0.728	0.757	0.785	0.825	0.861	0.897	0.921	0.942	0.973	0.997	1.013	1.028	1.039	4.36
4.37	0.582	0.600	0.618	0.638	0.660	0.676	0.704	0.729	0.758	0.786	0.825	0.861	0.897	0.921	0.942	0.973	0.997	1.013	1.028	1.039	4.37
4.38	0.583	0.602	0.619	0.639	0.660	0.676	0.705	0.729	0.758	0.786	0.826	0.862	0.898	0.922	0.943	0.974	0.998	1.014	1.029	1.040	4.38
4.39	0.585	0.603	0.620	0.640	0.661	0.677	0.705	0.730	0.759	0.787	0.826	0.862	0.898	0.922	0.943	0.974	0.998	1.014	1.029	1.040	4.39
4.40	0.586	0.604	0.621	0.641	0.662	0.678	0.706	0.730	0.759	0.787	0.826	0.862	0.898	0.922	0.943	0.974	0.998	1.014	1.029	1.040	4.40
4.41	0.587	0.605	0.622	0.642	0.663	0.678	0.707	0.730	0.759	0.787	0.826	0.862	0.898	0.922	0.943	0.974	0.998	1.014	1.029	1.040	4.41
4.42	0.588	0.606	0.623	0.643	0.664	0.679	0.707	0.731	0.760	0.787	0.826	0.862	0.898	0.922	0.943	0.974	0.998	1.014	1.029	1.040	4.42
4.43	0.590	0.608	0.624	0.643	0.664	0.679	0.708	0.731	0.760	0.788	0.827	0.862	0.899	0.922	0.943	0.975	0.999	1.015	1.029	1.040	4.43
4.44	0.591	0.609	0.625	0.644	0.665	0.680	0.708	0.732	0.761	0.788	0.827	0.862	0.899	0.922	0.943	0.975	0.999	1.015	1.029	1.040	4.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
4.45	0.592	0.610	0.626	0.645	0.666	0.680	0.709	0.732	0.761	0.788	0.827	0.862	0.899	0.922	0.943	0.975	0.999	1.015	1.029	1.040	4.45
4.46	0.593	0.611	0.627	0.646	0.667	0.681	0.710	0.732	0.761	0.788	0.827	0.862	0.899	0.922	0.943	0.975	0.999	1.015	1.029	1.040	4.46
4.47	0.595	0.612	0.628	0.647	0.668	0.681	0.710	0.733	0.762	0.789	0.828	0.863	0.899	0.922	0.943	0.976	0.999	1.015	1.029	1.040	4.47
4.48	0.596	0.614	0.629	0.648	0.668	0.682	0.711	0.734	0.762	0.789	0.828	0.863	0.900	0.923	0.944	0.976	1.000	1.016	1.030	1.041	4.48
4.49	0.598	0.615	0.630	0.649	0.669	0.682	0.711	0.734	0.763	0.790	0.828	0.864	0.900	0.923	0.944	0.977	1.000	1.016	1.030	1.041	4.49
4.50	0.599	0.616	0.631	0.650	0.670	0.683	0.712	0.734	0.763	0.790	0.829	0.864	0.900	0.923	0.944	0.977	1.000	1.016	1.030	1.041	4.50
4.51	0.600	0.617	0.632	0.651	0.671	0.684	0.713	0.734	0.763	0.790	0.829	0.864	0.900	0.923	0.944	0.977	1.000	1.016	1.030	1.041	4.51
4.52	0.601	0.618	0.633	0.652	0.671	0.685	0.713	0.735	0.764	0.791	0.829	0.864	0.900	0.923	0.944	0.977	1.000	1.016	1.030	1.041	4.52
4.53	0.603	0.619	0.634	0.652	0.672	0.685	0.714	0.735	0.764	0.791	0.830	0.865	0.901	0.924	0.945	0.977	1.001	1.017	1.031	1.042	4.53
4.54	0.604	0.620	0.635	0.653	0.672	0.686	0.714	0.735	0.764	0.791	0.830	0.865	0.901	0.924	0.945	0.977	1.001	1.017	1.031	1.042	4.54
4.55	0.605	0.621	0.636	0.654	0.673	0.687	0.715	0.736	0.765	0.792	0.830	0.865	0.901	0.924	0.945	0.977	1.001	1.017	1.031	1.042	4.55
4.56	0.606	0.622	0.637	0.655	0.674	0.688	0.716	0.737	0.766	0.792	0.830	0.865	0.901	0.924	0.945	0.977	1.001	1.017	1.031	1.042	4.56
4.57	0.608	0.623	0.638	0.656	0.675	0.689	0.716	0.737	0.766	0.793	0.831	0.866	0.901	0.924	0.945	0.977	1.001	1.017	1.031	1.042	4.57
4.58	0.609	0.625	0.639	0.657	0.675	0.689	0.717	0.738	0.767	0.793	0.831	0.866	0.902	0.925	0.946	0.978	1.002	1.018	1.032	1.043	4.58
4.59	0.611	0.626	0.640	0.658	0.676	0.690	0.717	0.738	0.767	0.794	0.832	0.867	0.902	0.925	0.946	0.978	1.002	1.018	1.032	1.043	4.59
4.60	0.612	0.627	0.641	0.659	0.677	0.691	0.718	0.739	0.768	0.794	0.832	0.867	0.902	0.925	0.946	0.978	1.002	1.018	1.032	1.043	4.60
4.61	0.613	0.628	0.642	0.660	0.678	0.692	0.718	0.739	0.768	0.794	0.832	0.867	0.902	0.925	0.946	0.978	1.002	1.018	1.032	1.043	4.61
4.62	0.614	0.629	0.643	0.661	0.679	0.692	0.719	0.740	0.769	0.795	0.832	0.867	0.902	0.925	0.946	0.978	1.002	1.018	1.032	1.043	4.62
4.63	0.615	0.631	0.644	0.661	0.679	0.693	0.719	0.740	0.769	0.795	0.833	0.868	0.903	0.926	0.947	0.979	1.003	1.019	1.033	1.043	4.63
4.64	0.616	0.632	0.645	0.662	0.680	0.693	0.720	0.741	0.770	0.796	0.833	0.868	0.903	0.926	0.947	0.979	1.003	1.019	1.033	1.043	4.64
4.65	0.617	0.633	0.646	0.663	0.681	0.694	0.720	0.741	0.770	0.796	0.833	0.868	0.903	0.926	0.947	0.979	1.003	1.019	1.033	1.043	4.65
4.66	0.618	0.634	0.647	0.664	0.682	0.695	0.721	0.741	0.770	0.796	0.833	0.868	0.903	0.926	0.947	0.979	1.003	1.019	1.033	1.043	4.66
4.67	0.619	0.635	0.648	0.665	0.683	0.696	0.721	0.742	0.771	0.797	0.834	0.868	0.903	0.926	0.947	0.980	1.003	1.019	1.033	1.043	4.67
4.68	0.621	0.637	0.649	0.666	0.683	0.696	0.722	0.742	0.771	0.797	0.834	0.869	0.904	0.927	0.948	0.980	1.004	1.020	1.034	1.044	4.68
4.69	0.622	0.638	0.650	0.667	0.684	0.697	0.722	0.743	0.772	0.798	0.835	0.869	0.904	0.927	0.948	0.981	1.004	1.020	1.034	1.044	4.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
4.70	0.623	0.639	0.651	0.668	0.685	0.698	0.723	0.743	0.772	0.798	0.835	0.869	0.904	0.927	0.948	0.981	1.004	1.020	1.034	1.044	4.70
4.71	0.624	0.640	0.652	0.669	0.686	0.699	0.724	0.744	0.772	0.798	0.835	0.869	0.904	0.927	0.948	0.981	1.004	1.020	1.034	1.044	4.71
4.72	0.626	0.641	0.653	0.970	0.687	0.699	0.724	0.744	0.773	0.799	0.835	0.869	0.904	0.927	0.948	0.981	1.004	1.020	1.034	1.044	4.72
4.73	0.627	0.642	0.653	0.670	0.687	0.700	0.725	0.745	0.773	0.799	0.836	0.870	0.905	0.928	0.949	0.982	1.005	1.021	1.035	1.045	4.73
4.74	0.629	0.643	0.654	0.671	0.688	0.700	0.725	0.745	0.774	0.800	0.836	0.870	0.905	0.928	0.949	0.982	1.005	1.021	1.035	1.045	4.74
4.75	0.630	0.644	0.655	0.672	0.689	0.701	0.726	0.746	0.774	0.800	0.836	0.870	0.905	0.928	0.949	0.982	1.005	1.021	1.035	1.045	4.75
4.76	0.631	0.645	0.656	0.673	0.690	0.702	0.727	0.747	0.775	0.800	0.836	0.870	0.905	0.928	0.949	0.982	1.006	1.021	1.035	1.045	4.76
4.77	0.633	0.646	0.658	0.674	0.691	0.703	0.727	0.747	0.775	0.801	0.837	0.871	0.906	0.928	0.950	0.983	1.006	1.022	1.036	1.046	4.77
4.78	0.634	0.648	0.659	0.675	0.691	0.703	0.728	0.748	0.776	0.801	0.837	0.871	0.906	0.929	0.950	0.983	1.006	1.022	1.036	1.046	4.78
4.79	0.636	0.649	0.661	0.676	0.692	0.704	0.728	0.748	0.776	0.802	0.838	0.872	0.907	0.929	0.950	0.983	1.007	1.022	1.036	1.046	4.79
4.80	0.637	0.650	0.662	0.677	0.693	0.705	0.729	0.749	0.777	0.802	0.838	0.872	0.907	0.929	0.950	0.983	1.007	1.022	1.036	1.046	4.80
4.81	0.638	0.651	0.663	0.678	0.694	0.706	0.730	0.749	0.777	0.802	0.838	0.872	0.907	0.929	0.950	0.983	1.007	1.022	1.036	1.046	4.81
4.82	0.639	0.652	0.664	0.679	0.695	0.706	0.730	0.750	0.778	0.803	0.839	0.872	0.907	0.929	0.950	0.983	1.007	1.022	1.036	1.046	4.82
4.83	0.641	0.653	0.665	0.679	0.695	0.707	0.731	0.750	0.778	0.803	0.839	0.873	0.908	0.930	0.951	0.984	1.008	1.023	1.037	1.047	4.83
4.84	0.642	0.654	0.666	0.680	0.696	0.707	0.731	0.751	0.779	0.804	0.840	0.873	0.908	0.930	0.951	0.984	1.008	1.023	1.037	1.047	4.84
4.85	0.643	0.655	0.667	0.681	0.697	0.708	0.732	0.751	0.779	0.804	0.840	0.873	0.908	0.930	0.951	0.984	1.008	1.023	1.037	1.047	4.85
4.86	0.644	0.656	0.668	0.682	0.698	0.709	0.733	0.751	0.780	0.804	0.840	0.873	0.908	0.930	0.951	0.984	1.008	1.023	1.037	1.047	4.86
4.87	0.646	0.657	0.669	0.683	0.699	0.710	0.734	0.752	0.780	0.805	0.841	0.874	0.909	0.931	0.951	0.984	1.008	1.023	1.037	1.047	4.87
4.88	0.647	0.659	0.670	0.684	0.699	0.710	0.734	0.752	0.781	0.805	0.841	0.874	0.909	0.931	0.951	0.984	1.009	1.024	1.038	1.048	4.88
4.89	0.649	0.660	0.671	0.685	0.700	0.711	0.735	0.753	0.781	0.806	0.842	0.875	0.910	0.932	0.952	0.985	1.009	1.024	1.038	1.048	4.89
4.90	0.650	0.661	0.672	0.686	0.701	0.712	0.736	0.753	0.782	0.806	0.842	0.875	0.910	0.932	0.952	0.985	1.009	1.024	1.038	1.048	4.90
4.91	0.651	0.662	0.673	0.687	0.702	0.713	0.737	0.754	0.782	0.806	0.842	0.875	0.910	0.932	0.952	0.985	1.009	1.024	1.038	1.048	4.91
4.92	0.652	0.663	0.674	0.688	0.703	0.714	0.737	0.754	0.783	0.807	0.843	0.876	0.910	0.932	0.952	0.985	1.009	1.024	1.038	1.048	4.92
4.93	0.654	0.664	0.675	0.688	0.703	0.715	0.738	0.755	0.783	0.807	0.843	0.876	0.911	0.933	0.953	0.986	1.010	1.025	1.038	1.048	4.93
4.94	0.655	0.665	0.676	0.689	0.704	0.715	0.738	0.755	0.784	0.808	0.844	0.877	0.911	0.933	0.953	0.986	1.010	1.025	1.038	1.048	4.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
4.95	0.656	0.666	0.677	0.690	0.705	0.716	0.739	0.756	0.784	0.808	0.844	0.877	0.911	0.933	0.953	0.986	1.010	1.025	1.038	1.048	4.95
4.96	0.657	0.667	0.678	0.691	0.706	0.717	0.740	0.757	0.785	0.808	0.844	0.877	0.911	0.933	0.953	0.986	1.010	1.025	1.038	1.048	4.96
4.97	0.659	0.668	0.679	0.692	0.707	0.718	0.740	0.758	0.785	0.809	0.845	0.878	0.911	0.933	0.953	0.987	1.010	1.026	1.038	1.048	4.97
4.98	0.660	0.670	0.681	0.692	0.707	0.718	0.741	0.758	0.786	0.809	0.845	0.878	0.912	0.934	0.954	0.987	1.011	1.026	1.039	1.049	4.98
4.99	0.662	0.671	0.682	0.693	0.708	0.719	0.741	0.759	0.786	0.810	0.846	0.879	0.912	0.934	0.954	0.988	1.011	1.027	1.039	1.049	4.99
5.00	0.663	0.672	0.683	0.694	0.709	0.720	0.742	0.760	0.787	0.810	0.846	0.879	0.912	0.934	0.954	0.988	1.011	1.027	1.039	1.049	5.00
5.01	0.664	0.673	0.684	0.695	0.710	0.721	0.743	0.761	0.787	0.810	0.846	0.879	0.912	0.934	0.954	0.988	1.011	1.027	1.039	1.049	5.01
5.02	0.665	0.674	0.685	0.696	0.711	0.721	0.743	0.761	0.788	0.811	0.847	0.879	0.913	0.934	0.954	0.988	1.011	1.027	1.039	1.049	5.02
5.03	0.667	0.675	0.686	0.696	0.711	0.722	0.744	0.762	0.788	0.811	0.847	0.880	0.913	0.935	0.955	0.989	1.012	1.028	1.040	1.050	5.03
5.04	0.668	0.676	0.687	0.697	0.712	0.722	0.744	0.762	0.789	0.812	0.848	0.880	0.914	0.935	0.955	0.989	1.012	1.028	1.040	1.050	5.04
5.05	0.669	0.677	0.688	0.698	0.713	0.723	0.745	0.763	0.789	0.812	0.848	0.880	0.914	0.935	0.955	0.989	1.012	1.028	1.040	1.050	5.05
5.06	0.670	0.678	0.689	0.699	0.714	0.724	0.746	0.764	0.790	0.812	0.848	0.880	0.914	0.935	0.955	0.989	1.012	1.028	1.040	1.050	5.06
5.07	0.671	0.679	0.690	0.700	0.715	0.725	0.747	0.764	0.790	0.813	0.849	0.881	0.915	0.936	0.956	0.989	1.012	1.028	1.040	1.050	5.07
5.08	0.673	0.681	0.691	0.701	0.715	0.725	0.747	0.765	0.791	0.813	0.849	0.881	0.915	0.936	0.956	0.990	1.013	1.029	1.041	1.050	5.08
5.09	0.674	0.682	0.692	0.702	0.716	0.726	0.748	0.765	0.791	0.814	0.850	0.882	0.916	0.937	0.957	0.990	1.013	1.029	1.041	1.051	5.09
5.10	0.675	0.683	0.693	0.703	0.717	0.727	0.749	0.766	0.792	0.814	0.850	0.882	0.916	0.937	0.957	0.990	1.013	1.029	1.041	1.051	5.10
5.11	0.676	0.684	0.694	0.704	0.718	0.728	0.750	0.767	0.793	0.815	0.850	0.882	0.916	0.937	0.957	0.990	1.013	1.029	1.041	1.051	5.11
5.12	0.677	0.685	0.695	0.705	0.719	0.729	0.750	0.767	0.793	0.815	0.850	0.883	0.916	0.937	0.957	0.990	1.013	1.029	1.041	1.051	5.12
5.13	0.679	0.687	0.696	0.706	0.719	0.729	0.751	0.768	0.794	0.816	0.851	0.883	0.917	0.938	0.958	0.991	1.014	1.030	1.042	1.051	5.13
5.14	0.680	0.688	0.697	0.707	0.720	0.730	0.751	0.768	0.794	0.816	0.851	0.884	0.917	0.938	0.958	0.991	1.014	1.030	1.042	1.051	5.14
5.15	0.681	0.689	0.698	0.708	0.721	0.731	0.752	0.769	0.795	0.817	0.851	0.884	0.917	0.938	0.958	0.991	1.014	1.030	1.042	1.051	5.15
5.16	0.682	0.690	0.699	0.709	0.722	0.732	0.753	0.770	0.796	0.818	0.851	0.884	0.917	0.938	0.958	0.991	1.014	1.030	1.042	1.051	5.16
5.17	0.684	0.691	0.700	0.710	0.723	0.733	0.753	0.770	0.796	0.818	0.852	0.885	0.918	0.939	0.959	0.991	1.015	1.030	1.042	1.051	5.17
5.18	0.685	0.693	0.701	0.711	0.723	0.733	0.754	0.771	0.797	0.819	0.852	0.885	0.918	0.939	0.959	0.992	1.015	1.031	1.043	1.052	5.18
5.19	0.687	0.694	0.702	0.712	0.724	0.734	0.754	0.771	0.797	0.819	0.853	0.886	0.919	0.940	0.960	0.992	1.016	1.031	1.043	1.052	5.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
5.20	0.688	0.695	0.703	0.713	0.725	0.735	0.755	0.772	0.798	0.820	0.853	0.886	0.919	0.940	0.960	0.992	1.016	1.031	1.043	1.052	5.20
5.21	0.689	0.696	0.704	0.714	0.726	0.736	0.756	0.773	0.798	0.820	0.853	0.886	0.919	0.940	0.960	0.992	1.016	1.031	1.043	1.052	5.21
5.22	0.690	0.697	0.705	0.715	0.727	0.737	0.756	0.773	0.799	0.821	0.854	0.886	0.919	0.940	0.960	0.992	1.016	1.031	1.043	1.052	5.22
5.23	0.692	0.698	0.706	0.715	0.727	0.737	0.757	0.774	0.799	0.821	0.854	0.887	0.920	0.941	0.961	0.993	1.017	1.032	1.044	1.052	5.23
5.24	0.693	0.699	0.707	0.716	0.728	0.738	0.757	0.774	0.800	0.822	0.855	0.887	0.920	0.941	0.961	0.993	1.017	1.032	1.044	1.052	5.24
5.25	0.694	0.700	0.708	0.717	0.729	0.739	0.758	0.775	0.800	0.822	0.855	0.887	0.920	0.941	0.961	0.993	1.017	1.032	1.044	1.052	5.25
5.26	0.695	0.701	0.709	0.718	0.730	0.740	0.759	0.776	0.801	0.823	0.856	0.887	0.920	0.941	0.961	0.993	1.017	1.032	1.044	1.052	5.26
5.27	0.697	0.702	0.710	0.719	0.731	0.741	0.760	0.776	0.802	0.823	0.856	0.888	0.920	0.942	0.962	0.994	1.017	1.032	1.044	1.052	5.27
5.28	0.698	0.704	0.711	0.720	0.732	0.741	0.760	0.777	0.802	0.824	0.857	0.888	0.921	0.942	0.962	0.994	1.018	1.033	1.045	1.053	5.28
5.29	0.700	0.705	0.712	0.721	0.733	0.742	0.761	0.777	0.803	0.824	0.857	0.889	0.921	0.943	0.963	0.995	1.018	1.033	1.045	1.053	5.29
5.30	0.701	0.706	0.713	0.722	0.734	0.743	0.762	0.778	0.803	0.825	0.858	0.889	0.921	0.943	0.963	0.995	1.018	1.033	1.045	1.053	5.30
5.31	0.702	0.707	0.714	0.723	0.735	0.744	0.763	0.779	0.804	0.825	0.858	0.889	0.921	0.943	0.963	0.995	1.018	1.033	1.045	1.053	5.31
5.32	0.703	0.708	0.715	0.724	0.736	0.745	0.763	0.779	0.805	0.826	0.859	0.890	0.922	0.943	0.963	0.995	1.018	1.033	1.045	1.053	5.32
5.33	0.705	0.710	0.716	0.724	0.736	0.745	0.764	0.780	0.805	0.826	0.859	0.890	0.922	0.944	0.964	0.996	1.019	1.034	1.046	1.053	5.33
5.34	0.706	0.711	0.717	0.725	0.737	0.746	0.764	0.780	0.805	0.827	0.860	0.891	0.923	0.944	0.964	0.996	1.019	1.034	1.046	1.053	5.34
5.35	0.707	0.712	0.718	0.726	0.738	0.747	0.765	0.781	0.806	0.827	0.860	0.891	0.923	0.944	0.964	0.996	1.019	1.034	1.046	1.053	5.35
5.36	0.708	0.713	0.719	0.727	0.739	0.748	0.766	0.782	0.807	0.828	0.860	0.891	0.923	0.944	0.964	0.996	1.019	1.034	1.046	1.053	5.36
5.37	0.709	0.714	0.720	0.728	0.740	0.749	0.767	0.783	0.808	0.828	0.861	0.892	0.924	0.945	0.965	0.997	1.020	1.034	1.046	1.054	5.37
5.38	0.711	0.716	0.721	0.729	0.740	0.749	0.767	0.783	0.808	0.829	0.861	0.892	0.924	0.945	0.965	0.997	1.020	1.035	1.047	1.054	5.38
5.39	0.712	0.717	0.722	0.730	0.741	0.750	0.768	0.784	0.808	0.829	0.862	0.893	0.925	0.946	0.966	0.998	1.021	1.035	1.047	1.055	5.39
5.40	0.713	0.718	0.723	0.731	0.742	0.751	0.769	0.785	0.809	0.830	0.862	0.893	0.925	0.946	0.966	0.998	1.021	1.035	1.047	1.055	5.40
5.41	0.714	0.719	0.724	0.732	0.743	0.752	0.770	0.786	0.810	0.830	0.863	0.893	0.925	0.946	0.966	0.998	1.021	1.035	1.047	1.055	5.41
5.42	0.716	0.720	0.725	0.733	0.744	0.753	0.770	0.786	0.810	0.831	0.863	0.894	0.925	0.946	0.966	0.998	1.021	1.035	1.047	1.055	5.42
5.43	0.717	0.721	0.726	0.733	0.744	0.753	0.771	0.787	0.811	0.831	0.864	0.894	0.926	0.947	0.967	0.999	1.022	1.036	1.048	1.056	5.43
5.44	0.719	0.722	0.727	0.734	0.745	0.754	0.771	0.787	0.811	0.832	0.864	0.895	0.926	0.947	0.967	0.999	1.022	1.036	1.048	1.056	5.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
5.45	0.720	0.723	0.728	0.735	0.746	0.755	0.772	0.788	0.812	0.832	0.865	0.895	0.926	0.947	0.967	0.999	1.022	1.036	1.048	1.056	5.45
5.46	0.721	0.724	0.729	0.736	0.747	0.756	0.773	0.789	0.813	0.833	0.866	0.895	0.926	0.947	0.967	0.999	1.022	1.036	1.048	1.056	5.46
5.47	0.723	0.725	0.730	0.737	0.748	0.757	0.774	0.790	0.813	0.833	0.866	0.896	0.927	0.948	0.968	0.999	1.022	1.037	1.048	1.056	5.47
5.48	0.724	0.727	0.731	0.738	0.749	0.757	0.774	0.790	0.814	0.834	0.867	0.896	0.927	0.948	0.968	1.000	1.023	1.037	1.049	1.057	5.48
5.49	0.726	0.728	0.732	0.739	0.750	0.758	0.775	0.791	0.814	0.834	0.867	0.897	0.928	0.949	0.969	1.000	1.023	1.038	1.049	1.057	5.49
5.50	0.727	0.729	0.733	0.740	0.751	0.759	0.776	0.792	0.815	0.835	0.868	0.897	0.928	0.949	0.969	1.000	1.023	1.038	1.049	1.057	5.50
5.51	0.728	0.730	0.734	0.741	0.752	0.760	0.777	0.793	0.816	0.836	0.868	0.897	0.928	0.949	0.969	1.000	1.023	1.038	1.049	1.057	5.51
5.52	0.729	0.731	0.735	0.742	0.753	0.761	0.777	0.793	0.816	0.837	0.869	0.898	0.928	0.949	0.969	1.000	1.023	1.038	1.049	1.057	5.52
5.53	0.731	0.732	0.736	0.743	0.753	0.761	0.778	0.794	0.817	0.837	0.869	0.898	0.929	0.950	0.970	1.001	1.024	1.039	1.050	1.058	5.53
5.54	0.732	0.733	0.737	0.744	0.754	0.762	0.778	0.794	0.817	0.838	0.870	0.899	0.929	0.950	0.970	1.001	1.024	1.039	1.050	1.058	5.54
5.55	0.733	0.734	0.738	0.745	0.755	0.763	0.779	0.795	0.818	0.837	0.870	0.899	0.929	0.950	0.970	1.001	1.024	1.039	1.050	1.058	5.55
5.56	0.734	0.735	0.739	0.746	0.756	0.764	0.780	0.796	0.819	0.838	0.870	0.899	0.929	0.950	0.970	1.001	1.024	1.039	1.050	1.058	5.56
5.57	0.735	0.736	0.740	0.747	0.757	0.765	0.781	0.797	0.819	0.838	0.871	0.899	0.930	0.951	0.971	1.002	1.025	1.039	1.050	1.058	5.57
5.58	0.737	0.738	0.742	0.748	0.758	0.766	0.781	0.797	0.820	0.839	0.871	0.900	0.930	0.951	0.971	1.002	1.025	1.040	1.051	1.058	5.58
5.59	0.738	0.739	0.743	0.749	0.759	0.767	0.782	0.798	0.820	0.839	0.872	0.900	0.931	0.952	0.972	1.003	1.026	1.040	1.051	1.058	5.59
5.60	0.739	0.740	0.744	0.750	0.760	0.768	0.783	0.799	0.821	0.840	0.872	0.900	0.931	0.952	0.972	1.003	1.026	1.040	1.051	1.058	5.60
5.61	0.740	0.741	0.745	0.751	0.761	0.769	0.784	0.800	0.822	0.841	0.872	0.900	0.931	0.952	0.972	1.003	1.026	1.040	1.051	1.058	5.61
5.62	0.741	0.742	0.746	0.752	0.762	0.770	0.785	0.800	0.822	0.841	0.873	0.901	0.932	0.952	0.973	1.003	1.026	1.040	1.051	1.058	5.62
5.63	0.743	0.743	0.747	0.753	0.762	0.770	0.785	0.801	0.823	0.842	0.873	0.901	0.932	0.953	0.973	1.004	1.027	1.041	1.052	1.059	5.63
5.64	0.744	0.744	0.748	0.754	0.763	0.771	0.786	0.801	0.823	0.842	0.874	0.902	0.933	0.953	0.974	1.004	1.027	1.041	1.052	1.059	5.64
5.65	0.745	0.745	0.749	0.755	0.764	0.772	0.787	0.802	0.824	0.843	0.874	0.902	0.933	0.953	0.974	1.004	1.027	1.041	1.052	1.059	5.65
5.66	0.746	0.746	0.750	0.756	0.765	0.773	0.788	0.803	0.825	0.844	0.875	0.903	0.933	0.953	0.974	1.004	1.027	1.041	1.052	1.059	5.66
5.67	0.747	0.747	0.751	0.757	0.766	0.774	0.789	0.804	0.825	0.844	0.875	0.903	0.934	0.954	0.975	1.005	1.027	1.041	1.052	1.059	5.67
5.68	0.749	0.749	0.752	0.758	0.767	0.775	0.789	0.804	0.826	0.845	0.876	0.904	0.934	0.954	0.975	1.005	1.028	1.042	1.053	1.060	5.68
5.69	0.750	0.750	0.753	0.759	0.768	0.776	0.790	0.805	0.826	0.845	0.876	0.904	0.935	0.955	0.976	1.006	1.028	1.042	1.053	1.060	5.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
5.70	0.751	0.751	0.754	0.760	0.769	0.777	0.791	0.806	0.827	0.846	0.877	0.905	0.935	0.955	0.976	1.006	1.028	1.042	1.053	1.060	5.70
5.71	0.752	0.752	0.755	0.761	0.770	0.778	0.792	0.807	0.828	0.846	0.877	0.905	0.935	0.955	0.976	1.006	1.028	1.042	1.053	1.060	5.71
5.72	0.753	0.753	0.756	0.762	0.771	0.779	0.793	0.807	0.828	0.847	0.878	0.906	0.936	0.956	0.976	1.006	1.028	1.042	1.053	1.060	5.72
5.73	0.755	0.754	0.757	0.762	0.771	0.779	0.793	0.808	0.829	0.847	0.878	0.906	0.936	0.956	0.977	1.007	1.029	1.043	1.054	1.061	5.73
5.74	0.756	0.755	0.758	0.763	0.772	0.780	0.794	0.808	0.829	0.848	0.879	0.907	0.937	0.957	0.977	1.007	1.029	1.043	1.054	1.061	5.74
5.75	0.757	0.756	0.759	0.764	0.773	0.781	0.795	0.809	0.830	0.848	0.879	0.907	0.937	0.957	0.977	1.007	1.029	1.043	1.054	1.061	5.75
5.76	0.758	0.757	0.760	0.765	0.774	0.782	0.796	0.810	0.831	0.849	0.880	0.907	0.937	0.957	0.977	1.007	1.029	1.043	1.054	1.061	5.76
5.77	0.759	0.758	0.761	0.766	0.775	0.783	0.797	0.811	0.831	0.849	0.880	0.908	0.938	0.958	0.978	1.007	1.030	1.044	1.054	1.061	5.77
5.78	0.761	0.760	0.762	0.767	0.776	0.783	0.797	0.811	0.832	0.850	0.881	0.908	0.938	0.958	0.978	1.008	1.030	1.044	1.055	1.062	5.78
5.79	0.762	0.761	0.763	0.768	0.777	0.784	0.798	0.812	0.832	0.850	0.881	0.909	0.939	0.959	0.979	1.008	1.031	1.045	1.055	1.062	5.79
5.80	0.763	0.762	0.764	0.769	0.778	0.785	0.799	0.813	0.833	0.851	0.882	0.909	0.939	0.959	0.979	1.008	1.031	1.045	1.055	1.062	5.80
5.81	0.764	0.763	0.765	0.770	0.779	0.786	0.800	0.814	0.834	0.852	0.882	0.909	0.939	0.959	0.979	1.008	1.031	1.045	1.055	1.062	5.81
5.82	0.765	0.764	0.766	0.771	0.780	0.787	0.801	0.815	0.834	0.852	0.883	0.910	0.939	0.960	0.979	1.008	1.031	1.045	1.055	1.062	5.82
5.83	0.767	0.766	0.768	0.772	0.780	0.787	0.801	0.815	0.835	0.853	0.883	0.910	0.940	0.960	0.980	1.009	1.032	1.046	1.056	1.063	5.83
5.84	0.768	0.767	0.769	0.773	0.781	0.788	0.802	0.816	0.835	0.853	0.884	0.911	0.940	0.961	0.980	1.009	1.032	1.046	1.056	1.063	5.84
5.85	0.769	0.768	0.770	0.774	0.782	0.789	0.803	0.817	0.836	0.854	0.884	0.911	0.940	0.961	0.980	1.009	1.032	1.046	1.056	1.063	5.85
5.86	0.770	0.769	0.771	0.775	0.783	0.790	0.804	0.818	0.837	0.855	0.885	0.911	0.940	0.961	0.980	1.009	1.032	1.046	1.056	1.063	5.86
5.87	0.771	0.770	0.773	0.776	0.784	0.791	0.805	0.819	0.837	0.855	0.885	0.912	0.941	0.962	0.981	1.010	1.032	1.047	1.056	1.063	5.87
5.88	0.773	0.772	0.774	0.777	0.785	0.792	0.805	0.819	0.838	0.856	0.886	0.912	0.941	0.962	0.981	1.010	1.033	1.047	1.057	1.064	5.88
5.89	0.774	0.773	0.776	0.778	0.786	0.793	0.806	0.820	0.838	0.856	0.886	0.913	0.942	0.963	0.982	1.011	1.033	1.048	1.057	1.064	5.89
5.90	0.775	0.774	0.777	0.779	0.787	0.794	0.807	0.821	0.839	0.857	0.887	0.913	0.942	0.963	0.982	1.011	1.033	1.048	1.057	1.064	5.90
5.91	0.776	0.775	0.778	0.780	0.788	0.795	0.808	0.822	0.840	0.858	0.887	0.913	0.942	0.963	0.982	1.011	1.033	1.048	1.057	1.064	5.91
5.92	0.777	0.776	0.779	0.781	0.789	0.796	0.808	0.822	0.840	0.858	0.888	0.914	0.943	0.964	0.983	1.011	1.033	1.048	1.057	1.064	5.92
5.93	0.779	0.777	0.780	0.782	0.790	0.796	0.809	0.823	0.841	0.859	0.888	0.914	0.943	0.964	0.983	1.012	1.034	1.049	1.058	1.065	5.93
5.94	0.780	0.778	0.781	0.783	0.791	0.797	0.809	0.823	0.841	0.859	0.889	0.915	0.944	0.965	0.984	1.012	1.034	1.049	1.058	1.065	5.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
5.95	0.781	0.779	0.782	0.784	0.792	0.798	0.810	0.824	0.842	0.860	0.889	0.915	0.944	0.965	0.984	1.012	1.034	1.049	1.058	1.065	5.95
5.96	0.782	0.780	0.783	0.785	0.793	0.799	0.811	0.825	0.843	0.861	0.890	0.916	0.944	0.965	0.984	1.012	1.034	1.049	1.058	1.065	5.96
5.97	0.784	0.781	0.784	0.786	0.794	0.800	0.812	0.826	0.843	0.861	0.890	0.916	0.945	0.966	0.985	1.012	1.035	1.049	1.058	1.065	5.97
5.98	0.785	0.783	0.785	0.788	0.795	0.801	0.812	0.826	0.844	0.862	0.891	0.917	0.945	0.966	0.985	1.013	1.035	1.050	1.059	1.066	5.98
5.99	0.787	0.784	0.786	0.789	0.796	0.802	0.813	0.827	0.844	0.862	0.891	0.917	0.946	0.967	0.986	1.013	1.036	1.050	1.059	1.066	5.99
6.00	0.788	0.785	0.787	0.790	0.797	0.803	0.814	0.828	0.845	0.863	0.892	0.918	0.946	0.967	0.986	1.013	1.036	1.050	1.059	1.066	6.00
6.01	0.789	0.786	0.788	0.791	0.798	0.804	0.815	0.829	0.846	0.864	0.892	0.918	0.946	0.967	0.986	1.013	1.036	1.050	1.059	1.066	6.01
6.02	0.790	0.787	0.789	0.792	0.799	0.805	0.816	0.829	0.846	0.864	0.893	0.919	0.947	0.967	0.986	1.014	1.036	1.050	1.059	1.066	6.02
6.03	0.792	0.788	0.790	0.793	0.799	0.805	0.816	0.830	0.847	0.865	0.893	0.919	0.947	0.968	0.987	1.014	1.037	1.051	1.060	1.067	6.03
6.04	0.793	0.789	0.791	0.794	0.800	0.806	0.817	0.830	0.847	0.865	0.894	0.920	0.948	0.968	0.987	1.015	1.037	1.051	1.060	1.067	6.04
6.05	0.794	0.790	0.792	0.795	0.801	0.807	0.818	0.831	0.848	0.865	0.894	0.920	0.948	0.968	0.987	1.015	1.037	1.051	1.060	1.067	6.05
6.06	0.795	0.791	0.793	0.796	0.802	0.808	0.819	0.832	0.849	0.866	0.895	0.920	0.948	0.968	0.987	1.015	1.037	1.051	1.060	1.067	6.06
6.07	0.796	0.792	0.794	0.797	0.803	0.809	0.820	0.833	0.850	0.866	0.895	0.921	0.949	0.969	0.988	1.016	1.037	1.051	1.060	1.067	6.07
6.08	0.798	0.794	0.795	0.798	0.803	0.810	0.820	0.833	0.850	0.867	0.896	0.921	0.949	0.969	0.988	1.016	1.038	1.052	1.061	1.068	6.08
6.09	0.799	0.795	0.796	0.799	0.804	0.811	0.821	0.834	0.851	0.867	0.896	0.922	0.950	0.970	0.989	1.017	1.038	1.052	1.061	1.068	6.09
6.10	0.800	0.796	0.797	0.800	0.805	0.812	0.822	0.835	0.852	0.868	0.897	0.922	0.950	0.970	0.989	1.017	1.038	1.052	1.061	1.068	6.10
6.11	0.801	0.797	0.798	0.801	0.806	0.813	0.823	0.836	0.853	0.868	0.897	0.922	0.950	0.970	0.989	1.017	1.038	1.052	1.061	1.068	6.11
6.12	0.802	0.798	0.799	0.802	0.807	0.814	0.824	0.836	0.853	0.869	0.898	0.923	0.951	0.970	0.990	1.017	1.038	1.052	1.061	1.068	6.12
6.13	0.803	0.799	0.800	0.803	0.807	0.814	0.824	0.837	0.854	0.869	0.898	0.923	0.951	0.971	0.990	1.018	1.039	1.052	1.062	1.069	6.13
6.14	0.804	0.800	0.801	0.804	0.808	0.815	0.825	0.837	0.854	0.870	0.899	0.924	0.952	0.971	0.991	1.018	1.039	1.053	1.062	1.069	6.14
6.15	0.805	0.801	0.802	0.805	0.809	0.816	0.826	0.838	0.855	0.870	0.899	0.924	0.952	0.971	0.991	1.018	1.039	1.053	1.062	1.069	6.15
6.16	0.806	0.802	0.803	0.806	0.810	0.817	0.827	0.839	0.856	0.871	0.900	0.925	0.952	0.971	0.991	1.018	1.039	1.053	1.062	1.069	6.16
6.17	0.807	0.803	0.804	0.807	0.811	0.818	0.828	0.840	0.856	0.871	0.900	0.925	0.953	0.972	0.992	1.018	1.040	1.054	1.062	1.069	6.17
6.18	0.809	0.805	0.806	0.808	0.812	0.818	0.828	0.840	0.857	0.872	0.901	0.926	0.953	0.972	0.992	1.019	1.040	1.054	1.063	1.070	6.18
6.19	0.810	0.806	0.807	0.809	0.813	0.819	0.829	0.841	0.857	0.872	0.901	0.926	0.954	0.973	0.993	1.019	1.041	1.055	1.063	1.070	6.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
6.20	0.811	0.807	0.808	0.810	0.814	0.820	0.830	0.842	0.858	0.873	0.902	0.927	0.954	0.973	0.993	1.019	1.041	1.055	1.063	1.070	6.20
6.21	0.812	0.808	0.809	0.811	0.815	0.821	0.831	0.843	0.859	0.874	0.902	0.928	0.954	0.973	0.993	1.019	1.041	1.055	1.063	1.070	6.21
6.22	0.813	0.809	0.810	0.812	0.816	0.822	0.832	0.844	0.859	0.874	0.903	0.928	0.955	0.974	0.994	1.019	1.041	1.055	1.063	1.070	6.22
6.23	0.814	0.810	0.811	0.813	0.816	0.822	0.832	0.844	0.860	0.875	0.903	0.929	0.955	0.974	0.994	1.020	1.042	1.056	1.064	1.071	6.23
6.24	0.815	0.811	0.812	0.814	0.817	0.823	0.833	0.845	0.860	0.875	0.904	0.929	0.956	0.975	0.995	1.020	1.042	1.056	1.064	1.071	6.24
6.25	0.816	0.812	0.813	0.815	0.818	0.824	0.834	0.846	0.861	0.876	0.904	0.930	0.956	0.975	0.995	1.020	1.042	1.056	1.064	1.071	6.25
6.26	0.817	0.813	0.814	0.816	0.819	0.825	0.835	0.847	0.862	0.877	0.905	0.930	0.956	0.975	0.995	1.020	1.042	1.056	1.064	1.071	6.26
6.27	0.818	0.814	0.815	0.817	0.820	0.826	0.836	0.848	0.862	0.878	0.905	0.930	0.957	0.976	0.996	1.021	1.042	1.056	1.064	1.071	6.27
6.28	0.820	0.816	0.816	0.818	0.821	0.827	0.837	0.848	0.863	0.878	0.906	0.931	0.957	0.976	0.996	1.022	1.043	1.057	1.065	1.072	6.28
6.29	0.821	0.817	0.817	0.819	0.822	0.828	0.838	0.849	0.863	0.879	0.906	0.931	0.958	0.977	0.997	1.022	1.043	1.057	1.065	1.072	6.29
6.30	0.822	0.818	0.818	0.820	0.823	0.829	0.839	0.850	0.864	0.880	0.907	0.931	0.958	0.977	0.997	1.022	1.043	1.057	1.065	1.072	6.30
6.31	0.823	0.819	0.819	0.821	0.824	0.830	0.840	0.851	0.865	0.881	0.907	0.931	0.958	0.977	0.997	1.022	1.043	1.057	1.065	1.072	6.31
6.32	0.250	0.820	0.820	0.822	0.825	0.831	0.841	0.851	0.865	0.881	0.908	0.931	0.959	0.978	0.997	1.022	1.044	1.057	1.065	1.072	6.32
6.33	0.826	0.822	0.821	0.823	0.826	0.831	0.841	0.852	0.866	0.882	0.908	0.932	0.959	0.978	0.998	1.023	1.044	1.058	1.066	1.072	6.33
6.34	0.828	0.823	0.822	0.824	0.827	0.832	0.842	0.852	0.866	0.882	0.909	0.932	0.960	0.979	0.998	1.023	1.045	1.058	1.066	1.072	6.34
6.35	0.829	0.824	0.823	0.825	0.828	0.833	0.843	0.853	0.867	0.883	0.909	0.932	0.960	0.979	0.998	1.023	1.045	1.058	1.066	1.072	6.35
6.36	0.830	0.825	0.824	0.826	0.829	0.834	0.844	0.854	0.868	0.884	0.910	0.933	0.960	0.979	0.998	1.023	1.045	1.058	1.066	1.072	6.36
6.37	0.831	0.826	0.825	0.827	0.830	0.835	0.845	0.855	0.869	0.884	0.910	0.934	0.961	0.980	0.999	1.024	1.046	1.058	1.066	1.072	6.37
6.38	0.833	0.828	0.827	0.828	0.831	0.836	0.846	0.855	0.869	0.885	0.911	0.934	0.961	0.980	0.999	1.024	1.046	1.059	1.067	1.073	6.38
6.39	0.834	0.829	0.828	0.829	0.832	0.837	0.847	0.856	0.870	0.885	0.911	0.935	0.962	0.981	1.000	1.025	1.047	1.059	1.067	1.073	6.39
6.40	0.835	0.830	0.829	0.830	0.833	0.838	0.848	0.857	0.871	0.886	0.912	0.936	0.962	0.981	1.000	1.025	1.047	1.059	1.067	1.073	6.40
6.41	0.836	0.831	0.830	0.831	0.834	0.839	0.849	0.858	0.872	0.887	0.913	0.936	0.962	0.981	1.000	1.025	1.047	1.059	1.067	1.073	6.41
6.42	0.837	0.832	0.831	0.832	0.835	0.840	0.850	0.859	0.872	0.887	0.913	0.937	0.963	0.982	1.000	1.025	1.047	1.059	1.067	1.073	6.42
6.43	0.839	0.833	0.832	0.833	0.835	0.840	0.850	0.859	0.873	0.888	0.914	0.937	0.963	0.982	1.001	1.026	1.048	1.060	1.068	1.074	6.43
6.44	0.840	0.834	0.833	0.834	0.836	0.841	0.851	0.860	0.873	0.888	0.914	0.938	0.964	0.983	1.001	1.026	1.048	1.060	1.068	1.074	6.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
6.45	0.841	0.835	0.834	0.835	0.837	0.842	0.852	0.861	0.874	0.889	0.915	0.938	0.964	0.983	1.001	1.026	1.048	1.060	1.068	1.074	6.45
6.46	0.842	0.836	0.835	0.836	0.838	0.843	0.853	0.862	0.875	0.890	0.916	0.939	0.964	0.983	1.001	1.026	1.048	1.060	1.068	1.074	6.46
6.47	0.844	0.837	0.836	0.837	0.839	0.844	0.854	0.863	0.876	0.890	0.916	0.939	0.965	0.984	1.002	1.027	1.048	1.061	1.068	1.074	6.47
6.48	0.845	0.839	0.837	0.838	0.840	0.845	0.854	0.863	0.876	0.891	0.917	0.940	0.965	0.984	1.002	1.027	1.049	1.061	1.069	1.075	6.48
6.49	0.847	0.840	0.838	0.839	0.841	0.846	0.855	0.864	0.877	0.891	0.917	0.940	0.966	0.985	1.003	1.028	1.049	1.062	1.069	1.075	6.49
6.50	0.848	0.841	0.839	0.840	0.842	0.847	0.856	0.865	0.878	0.892	0.918	0.941	0.966	0.985	1.003	1.028	1.049	1.062	1.069	1.075	6.50
6.51	0.849	0.842	0.840	0.841	0.843	0.848	0.857	0.866	0.879	0.893	0.918	0.941	0.966	0.985	1.003	1.028	1.049	1.062	1.069	1.075	6.51
6.52	0.850	0.843	0.841	0.842	0.844	0.849	0.858	0.866	0.879	0.893	0.919	0.942	0.967	0.986	1.004	1.028	1.049	1.062	1.069	1.075	6.52
6.53	0.851	0.844	0.842	0.843	0.844	0.085	0.858	0.867	0.880	0.894	0.919	0.942	0.967	0.986	1.004	1.029	1.050	1.063	1.070	1.076	6.53
6.54	0.852	0.845	0.843	0.844	0.845	0.850	0.859	0.867	0.880	0.894	0.920	0.943	0.968	0.987	1.005	1.029	1.050	1.063	1.070	1.076	6.54
6.55	0.853	0.846	0.844	0.845	0.846	0.851	0.860	0.868	0.881	0.895	0.920	0.943	0.968	0.987	1.005	1.029	1.050	1.063	1.070	1.076	6.55
6.56	0.854	0.847	0.845	0.846	0.847	0.852	0.861	0.869	0.882	0.896	0.921	0.943	0.968	0.987	1.005	1.029	1.050	1.063	1.070	1.076	6.56
6.57	0.855	0.848	0.846	0.847	0.848	0.853	0.862	0.869	0.882	0.896	0.921	0.944	0.969	0.988	1.006	1.030	1.051	1.063	1.071	1.076	6.57
6.58	0.856	0.850	0.848	0.849	0.849	0.853	0.862	0.870	0.883	0.897	0.922	0.944	0.969	0.988	1.006	1.030	1.051	1.064	1.071	1.077	6.58
6.59	0.857	0.851	0.849	0.850	0.850	0.854	0.863	0.870	0.883	0.897	0.922	0.945	0.970	0.989	1.007	1.031	1.052	1.064	1.072	1.077	6.59
6.60	0.858	0.852	0.850	0.851	0.851	0.855	0.864	0.871	0.884	0.898	0.923	0.945	0.970	0.989	1.007	1.031	1.052	1.064	1.072	1.077	6.60
6.61	0.859	0.853	0.851	0.852	0.852	0.856	0.865	0.872	0.885	0.898	0.923	0.945	0.970	0.989	1.007	1.031	1.052	1.064	1.072	1.077	6.61
6.62	0.860	0.854	0.852	0.853	0.853	0.857	0.866	0.873	0.886	0.899	0.924	0.946	0.971	0.990	1.007	1.031	1.052	1.064	1.072	1.077	6.62
6.63	0.862	0.855	0.853	0.854	0.854	0.857	0.866	0.873	0.886	0.899	0.924	0.946	0.971	0.990	1.008	1.032	1.053	1.065	1.073	1.078	6.63
6.64	0.863	0.856	0.854	0.855	0.855	0.858	0.867	0.874	0.887	0.900	0.925	0.947	0.972	0.991	1.008	1.032	1.053	1.065	1.073	1.078	6.64
6.65	0.864	0.857	0.855	0.856	0.856	0.859	0.868	0.875	0.888	0.900	0.925	0.947	0.972	0.991	1.008	1.032	1.053	1.065	1.073	1.078	6.65
6.66	0.865	0.858	0.856	0.857	0.857	0.860	0.869	0.876	0.889	0.901	0.926	0.948	0.972	0.991	1.008	1.032	1.053	1.065	1.073	1.078	6.66
6.67	0.866	0.859	0.857	0.858	0.858	0.861	0.870	0.877	0.890	0.901	0.926	0.948	0.973	0.992	1.009	1.033	1.053	1.066	1.073	1.079	6.67
6.68	0.868	0.861	0.858	0.859	0.859	0.861	0.870	0.878	0.890	0.902	0.927	0.949	0.973	0.992	1.009	1.033	1.054	1.066	1.074	1.079	6.68
6.69	0.869	0.862	0.859	0.860	0.860	0.862	0.871	0.879	0.891	0.902	0.927	0.949	0.974	0.993	1.010	1.034	1.054	1.067	1.074	1.080	6.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
6.70	0.870	0.863	0.860	0.861	0.861	0.863	0.872	0.880	0.892	0.903	0.928	0.950	0.974	0.993	1.010	1.034	1.054	1.067	1.074	1.080	6.70
6.71	0.871	0.864	0.861	0.862	0.862	0.864	0.873	0.881	0.893	0.904	0.928	0.950	0.974	0.993	1.010	1.034	1.054	1.067	1.074	1.080	6.71
6.72	0.872	0.865	0.862	0.863	0.863	0.865	0.874	0.882	0.893	0.904	0.929	0.951	0.975	0.994	1.010	1.035	1.054	1.067	1.074	1.080	6.72
6.73	0.873	0.866	0.863	0.864	0.863	0.865	0.874	0.882	0.894	0.905	0.929	0.951	0.975	0.994	1.011	1.035	1.055	1.068	1.075	1.081	6.73
6.74	0.874	0.867	0.864	0.865	0.864	0.866	0.875	0.883	0.894	0.905	0.930	0.952	0.976	0.995	1.011	1.036	1.055	1.068	1.075	1.081	6.74
6.75	0.875	0.868	0.865	0.866	0.865	0.867	0.876	0.884	0.895	0.906	0.930	0.952	0.976	0.995	1.011	1.036	1.055	1.068	1.075	1.081	6.75
6.76	0.876	0.869	0.866	0.867	0.866	0.868	0.877	0.885	0.896	0.907	0.931	0.953	0.977	0.995	1.011	1.036	1.055	1.068	1.075	1.081	6.76
6.77	0.877	0.870	0.867	0.868	0.867	0.869	0.878	0.886	0.897	0.908	0.931	0.953	0.977	0.996	1.012	1.037	1.056	1.068	1.076	1.081	6.77
6.78	0.879	0.872	0.869	0.870	0.868	0.870	0.878	0.886	0.897	0.908	0.932	0.954	0.978	0.996	1.012	1.037	1.056	1.069	1.076	1.082	6.78
6.79	0.880	0.873	0.870	0.871	0.869	0.871	0.879	0.887	0.898	0.909	0.932	0.954	0.978	0.997	1.013	1.038	1.057	1.069	1.077	1.082	6.79
6.80	0.881	0.874	0.871	0.872	0.870	0.872	0.880	0.888	0.899	0.910	0.933	0.955	0.979	0.997	1.013	1.038	1.057	1.069	1.077	1.082	6.80
6.81	0.882	0.875	0.872	0.873	0.871	0.873	0.881	0.889	0.900	0.911	0.934	0.955	0.979	0.997	1.013	1.038	1.057	1.069	1.077	1.082	6.81
6.82	0.883	0.876	0.873	0.874	0.872	0.874	0.882	0.889	0.900	0.911	0.934	0.956	0.980	0.997	1.014	1.039	1.057	1.069	1.077	1.082	6.82
6.83	0.884	0.877	0.874	0.875	0.873	0.875	0.882	0.890	0.901	0.912	0.935	0.956	0.980	0.998	1.014	1.039	1.058	1.070	1.078	1.083	6.83
6.84	0.885	0.878	0.875	0.876	0.874	0.876	0.883	0.890	0.901	0.912	0.935	0.957	0.981	0.998	1.015	1.040	1.058	1.070	1.078	1.083	6.84
6.85	0.886	0.879	0.876	0.877	0.875	0.877	0.884	0.891	0.902	0.913	0.936	0.957	0.981	0.998	1.015	1.040	1.058	1.070	1.078	1.083	6.85
6.86	0.887	0.880	0.877	0.878	0.876	0.878	0.885	0.892	0.903	0.914	0.937	0.958	0.981	0.998	1.015	1.040	1.058	1.070	1.078	1.083	6.86
6.87	0.888	0.881	0.878	0.879	0.877	0.879	0.886	0.893	0.904	0.915	0.937	0.958	0.982	0.999	1.016	1.040	1.058	1.070	1.078	1.083	6.87
6.88	0.890	0.883	0.879	0.879	0.879	0.879	0.886	0.893	0.904	0.915	0.938	0.959	0.982	0.999	1.016	1.041	1.059	1.071	1.079	1.084	6.88
6.89	0.891	0.884	0.880	0.880	0.880	0.880	0.887	0.894	0.905	0.916	0.938	0.959	0.983	1.000	1.017	1.041	1.059	1.071	1.079	1.084	6.89
6.90	0.892	0.885	0.881	0.881	0.881	0.881	0.888	0.895	0.906	0.917	0.939	0.960	0.983	1.000	1.017	1.041	1.059	1.071	1.079	1.084	6.90
6.91	0.893	0.886	0.882	0.882	0.882	0.882	0.889	0.896	0.907	0.917	0.939	0.960	0.983	1.000	1.017	1.041	1.059	1.071	1.079	1.084	6.91
6.92	0.894	0.887	0.883	0.883	0.088	0.883	0.890	0.896	0.907	0.918	0.940	0.961	0.984	1.001	1.017	1.041	1.059	1.071	1.079	1.084	6.92
6.93	0.895	0.888	0.884	0.883	0.883	0.883	0.890	0.897	0.908	0.918	0.940	0.961	0.984	1.001	1.018	1.042	1.060	1.072	1.080	1.085	6.93
6.94	0.896	0.889	0.885	0.884	0.884	0.884	0.891	0.897	0.909	0.919	0.941	0.962	0.985	1.002	1.018	1.042	1.060	1.072	1.080	1.085	6.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
6.95	0.897	0.890	0.886	0.885	0.885	0.885	0.892	0.898	0.909	0.919	0.941	0.962	0.985	1.002	1.018	1.042	1.060	1.072	1.080	1.085	6.95
6.96	0.898	0.891	0.887	0.886	0.886	0.886	0.893	0.899	0.910	0.920	0.942	0.963	0.986	1.002	1.018	1.042	1.060	1.072	1.080	1.085	6.96
6.97	0.899	0.892	0.888	0.887	0.887	0.887	0.894	0.900	0.911	0.920	0.942	0.963	0.986	1.003	1.019	1.043	1.061	1.072	1.080	1.085	6.97
6.98	0.901	0.894	0.890	0.888	0.888	0.888	0.894	0.900	0.911	0.921	0.943	0.964	0.987	1.003	1.019	1.043	1.061	1.073	1.081	1.086	6.98
6.99	0.902	0.895	0.891	0.889	0.889	0.889	0.895	0.901	0.911	0.921	0.943	0.964	0.987	1.004	1.020	1.044	1.062	1.073	1.081	1.086	6.99
7.00	0.903	0.896	0.892	0.890	0.890	0.890	0.896	0.902	0.913	0.922	0.944	0.965	0.988	1.004	1.020	1.044	1.062	1.073	1.081	1.086	7.00
7.01	0.904	0.897	0.893	0.891	0.891	0.891	0.897	0.903	0.914	0.923	0.945	0.965	0.988	1.004	1.020	1.044	1.062	1.073	1.081	1.086	7.01
7.02	0.905	0.898	0.894	0.892	0.892	0.892	0.897	0.904	0.914	0.923	0.945	0.966	0.989	1.005	1.021	1.044	1.062	1.074	1.081	1.086	7.02
7.03	0.907	0.899	0.895	0.893	0.892	0.892	0.898	0.904	0.915	0.924	0.946	0.966	0.989	1.005	1.021	1.045	1.063	1.074	1.082	1.087	7.03
7.04	0.908	0.900	0.896	0.894	0.893	0.893	0.898	0.905	0.915	0.924	0.946	0.967	0.990	1.006	1.022	1.045	1.063	1.075	1.082	1.087	7.04
7.05	0.909	0.901	0.897	0.895	0.894	0.894	0.899	0.906	0.916	0.925	0.947	0.967	0.990	1.006	1.022	1.045	1.063	1.075	1.082	1.087	7.05
7.06	0.910	0.902	0.898	0.896	0.895	0.895	0.900	0.907	0.917	0.926	0.948	0.968	0.990	1.006	1.022	1.045	1.063	1.075	1.082	1.087	7.06
7.07	0.911	0.903	0.899	0.897	0.896	0.896	0.901	0.908	0.918	0.927	0.948	0.968	0.991	1.007	1.023	1.046	1.064	1.076	1.082	1.087	7.07
7.08	0.913	0.905	0.901	0.898	0.897	0.897	0.901	0.908	0.918	0.927	0.949	0.969	0.991	1.007	1.023	1.046	1.064	1.076	1.083	1.088	7.08
7.09	0.914	0.906	0.902	0.899	0.898	0.898	0.902	0.909	0.919	0.928	0.949	0.969	0.992	1.008	1.024	1.047	1.065	1.077	1.083	1.088	7.09
7.10	0.915	0.907	0.903	0.900	0.899	0.899	0.903	0.910	0.920	0.929	0.950	0.970	0.992	1.008	1.024	1.047	1.065	1.077	1.083	1.088	7.10
7.11	0.916	0.908	0.904	0.901	0.900	0.900	0.904	0.911	0.921	0.930	0.951	0.970	0.992	1.008	1.024	1.047	1.065	1.077	1.083	1.088	7.11
7.12	0.917	0.909	0.905	0.902	0.901	0.901	0.905	0.912	0.921	0.930	0.951	0.971	0.993	1.009	1.025	1.047	1.065	1.077	1.083	1.088	7.12
7.13	0.919	0.910	0.906	0.903	0.901	0.901	0.905	0.912	0.922	0.931	0.952	0.971	0.993	1.009	1.025	1.048	1.066	1.078	1.084	1.089	7.13
7.14	0.920	0.911	0.907	0.904	0.902	0.902	0.906	0.913	0.922	0.931	0.952	0.972	0.994	1.010	1.026	1.048	1.066	1.078	1.084	1.089	7.14
7.15	0.921	0.912	0.908	0.905	0.903	0.903	0.907	0.914	0.923	0.932	0.953	0.972	0.994	1.010	1.026	1.048	1.066	1.078	1.084	1.089	7.15
7.16	0.924	0.913	0.909	0.906	0.904	0.904	0.908	0.915	0.924	0.933	0.954	0.973	0.995	1.010	1.026	1.048	1.066	1.078	1.084	1.089	7.16
7.17	0.925	0.914	0.910	0.907	0.905	0.905	0.909	0.916	0.925	0.933	0.954	0.973	0.995	1.011	1.027	1.049	1.066	1.078	1.085	1.090	7.17
7.18	0.926	0.916	0.911	0.908	0.906	0.905	0.909	0.916	0.925	0.934	0.955	0.974	0.996	1.011	1.027	1.049	1.067	1.079	1.085	1.090	7.18
7.19	0.927	0.917	0.912	0.909	0.907	0.906	0.910	0.917	0.926	0.934	0.955	0.974	0.996	1.012	1.028	1.050	1.067	1.079	1.086	1.091	7.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
7.20	0.928	0.918	0.913	0.910	0.908	0.907	0.911	0.918	0.927	0.935	0.956	0.975	0.997	1.012	1.028	1.050	1.067	1.079	1.086	1.091	7.20
7.21	0.929	0.919	0.914	0.911	0.909	0.908	0.912	0.919	0.928	0.936	0.957	0.975	0.997	1.012	1.028	1.050	1.067	1.079	1.086	1.091	7.21
7.22	0.930	0.920	0.915	0.912	0.910	0.908	0.913	0.919	0.928	0.936	0.957	0.976	0.998	1.013	1.028	1.050	1.067	1.079	1.086	1.091	7.22
7.23	0.931	0.921	0.916	0.913	0.910	0.909	0.913	0.920	0.929	0.937	0.958	0.976	0.998	1.013	1.029	1.051	1.068	1.080	1.087	1.092	7.23
7.24	0.932	0.922	0.917	0.914	0.911	0.909	0.914	0.920	0.929	0.937	0.958	0.977	0.999	1.014	1.029	1.051	1.068	1.080	1.087	1.092	7.24
7.25	0.933	0.923	0.918	0.915	0.912	0.910	0.915	0.921	0.930	0.938	0.959	0.977	0.999	1.014	1.029	1.051	1.068	1.080	1.087	1.092	7.25
7.26	0.934	0.924	0.919	0.916	0.913	0.911	0.916	0.922	0.931	0.939	0.960	0.978	0.999	1.015	1.029	1.051	1.068	1.080	1.087	1.092	7.26
7.27	0.935	0.925	0.920	0.917	0.914	0.912	0.917	0.923	0.932	0.939	0.960	0.978	1.000	1.015	1.030	1.052	1.069	1.080	1.087	1.092	7.27
7.28	0.936	0.927	0.921	0.918	0.915	0.912	0.917	0.923	0.932	0.940	0.961	0.979	1.000	1.016	1.030	1.052	1.069	1.081	1.088	1.093	7.28
7.29	0.937	0.928	0.922	0.919	0.916	0.913	0.918	0.924	0.933	0.940	0.961	0.979	1.001	1.016	1.031	1.053	1.070	1.081	1.088	1.093	7.29
7.30	0.938	0.929	0.923	0.920	0.917	0.914	0.919	0.925	0.934	0.942	0.962	0.980	1.001	1.017	1.031	1.053	1.070	1.081	1.088	1.093	7.30
7.31	0.939	0.930	0.924	0.921	0.918	0.915	0.920	0.926	0.935	0.943	0.963	0.980	1.001	1.017	1.031	1.053	1.070	1.081	1.088	1.093	7.31
7.32	0.940	0.931	0.925	0.922	0.919	0.916	0.921	0.926	0.935	0.944	0.963	0.981	1.002	1.018	1.032	1.054	1.070	1.081	1.088	1.093	7.32
7.33	0.941	0.932	0.926	0.922	0.919	0.916	0.921	0.927	0.936	0.944	0.964	0.981	1.002	1.018	1.032	1.054	1.071	1.082	1.089	1.094	7.33
7.34	0.942	0.933	0.927	0.923	0.920	0.917	0.922	0.927	0.936	0.945	0.964	0.982	1.003	1.019	1.033	1.055	1.071	1.082	1.089	1.094	7.34
7.35	0.943	0.934	0.928	0.924	0.921	0.918	0.923	0.928	0.937	0.946	0.965	0.982	1.003	1.019	1.033	1.055	1.071	1.082	1.089	1.094	7.35
7.36	0.944	0.935	0.929	0.925	0.922	0.919	0.924	0.929	0.938	0.947	0.966	0.983	1.003	1.019	1.033	1.055	1.071	1.082	1.089	1.094	7.36
7.37	0.945	0.936	0.930	0.926	0.923	0.920	0.925	0.930	0.939	0.948	0.966	0.983	1.004	1.020	1.034	1.056	1.072	1.083	1.090	1.094	7.37
7.38	0.095	0.938	0.931	0.927	0.924	0.921	0.925	0.930	0.939	0.948	0.967	0.984	1.004	1.020	1.034	1.056	1.072	1.083	1.090	1.095	7.38
7.39	0.948	0.939	0.932	0.928	0.925	0.922	0.926	0.931	0.940	0.949	0.967	0.984	1.005	1.021	1.035	1.057	1.073	1.084	1.091	1.095	7.39
7.40	0.949	0.940	0.933	0.929	0.926	0.923	0.927	0.932	0.941	0.950	0.968	0.985	1.005	1.021	1.035	1.057	1.073	1.084	1.091	1.095	7.40
7.41	0.950	0.941	0.934	0.930	0.927	0.924	0.928	0.933	0.942	0.951	0.968	0.986	1.005	1.021	1.035	1.057	1.073	1.084	1.091	1.095	7.41
7.42	0.951	0.942	0.935	0.931	0.928	0.925	0.929	0.934	0.942	0.951	0.969	0.986	1.006	1.022	1.036	1.057	1.073	1.084	1.091	1.095	7.42
7.43	0.953	0.943	0.936	0.932	0.928	0.925	0.929	0.934	0.943	0.952	0.969	0.987	1.006	1.022	1.036	1.058	1.074	1.085	1.092	1.096	7.43
7.44	0.954	0.944	0.937	0.933	0.929	0.926	0.930	0.935	0.943	0.952	0.970	0.987	1.007	1.023	1.037	1.058	1.074	1.085	1.092	1.096	7.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
7.45	0.955	0.945	0.938	0.934	0.930	0.927	0.931	0.936	0.944	0.953	0.970	0.988	1.007	1.023	1.037	1.058	1.074	1.085	1.092	1.096	7.45
7.46	0.956	0.946	0.939	0.935	0.931	0.928	0.932	0.937	0.945	0.954	0.971	0.989	1.008	1.023	1.037	1.058	1.074	1.085	1.092	1.096	7.46
7.47	0.957	0.946	0.940	0.936	0.932	0.929	0.933	0.938	0.946	0.954	0.971	0.989	1.008	1.024	1.038	1.059	1.075	1.086	1.093	1.097	7.47
7.48	0.959	0.949	0.941	0.937	0.933	0.930	0.933	0.938	0.946	0.955	0.972	0.990	1.009	1.024	1.038	1.059	1.075	1.086	1.093	1.097	7.48
7.49	0.960	0.950	0.942	0.938	0.934	0.931	0.934	0.939	0.947	0.955	0.972	0.990	1.009	1.025	1.039	1.060	1.076	1.087	1.093	1.098	7.49
7.50	0.961	0.951	0.943	0.939	0.935	0.932	0.935	0.940	0.948	0.956	0.973	0.991	1.010	1.025	1.039	1.060	1.076	1.087	1.093	1.098	7.50
7.51	0.962	0.952	0.944	0.940	0.936	0.933	0.936	0.941	0.949	0.957	0.974	0.991	1.010	1.025	1.039	1.060	1.076	1.087	1.093	1.098	7.51
7.52	0.963	0.953	0.945	0.941	0.937	0.934	0.937	0.942	0.949	0.957	0.974	0.992	1.011	1.026	1.040	1.060	1.076	1.087	1.093	1.098	7.52
7.53	0.964	0.954	0.946	0.942	0.937	0.934	0.937	0.942	0.950	0.958	0.975	0.992	1.011	1.026	1.040	1.061	1.077	1.088	1.094	1.099	7.53
7.54	0.965	0.955	0.947	0.943	0.938	0.935	0.938	0.943	0.950	0.958	0.975	0.993	1.012	1.027	1.041	1.061	1.077	1.088	1.094	1.099	7.54
7.55	0.966	0.956	0.948	0.944	0.939	0.936	0.939	0.944	0.951	0.959	0.976	0.993	1.012	1.027	1.041	1.061	1.077	1.088	1.094	1.099	7.55
7.56	0.967	0.957	0.949	0.945	0.940	0.937	0.940	0.945	0.952	0.960	0.977	0.994	1.013	1.027	1.041	1.061	1.077	1.088	1.094	1.099	7.56
7.57	0.968	0.958	0.950	0.946	0.941	0.938	0.941	0.946	0.953	0.960	0.977	0.994	1.013	1.028	1.042	1.062	1.078	1.088	1.095	1.099	7.57
7.58	0.970	0.959	0.951	0.947	0.942	0.939	0.941	0.947	0.953	0.961	0.978	0.995	1.014	1.028	1.042	1.062	1.078	1.089	1.095	1.100	7.58
7.59	0.971	0.960	0.952	0.948	0.943	0.940	0.942	0.948	0.954	0.961	0.978	0.995	1.014	1.029	1.043	1.063	1.079	1.089	1.096	1.100	7.59
7.60	0.972	0.961	0.953	0.949	0.944	0.941	0.943	0.949	0.955	0.962	0.979	0.996	1.015	1.029	1.043	1.063	1.079	1.089	1.096	1.100	7.60
7.61	0.973	0.962	0.954	0.950	0.945	0.942	0.944	0.950	0.956	0.963	0.979	0.996	1.015	1.029	1.043	1.063	1.079	1.089	1.096	1.100	7.61
7.62	0.974	0.963	0.955	0.951	0.946	0.943	0.945	0.950	0.956	0.963	0.980	0.997	1.016	1.030	1.044	1.064	1.079	1.089	1.096	1.100	7.62
7.63	0.975	0.964	0.956	0.952	0.947	0.943	0.945	0.951	0.957	0.964	0.980	0.997	1.016	1.030	1.044	1.064	1.080	1.090	1.097	1.101	7.63
7.64	0.976	0.965	0.957	0.953	0.948	0.944	0.946	0.951	0.957	0.964	0.981	0.998	1.017	1.031	1.045	1.065	1.080	1.090	1.097	1.101	7.64
7.65	0.977	0.966	0.958	0.954	0.949	0.945	0.947	0.952	0.958	0.965	0.981	0.998	1.017	1.031	1.045	1.065	1.080	1.090	1.097	1.101	7.65
7.66	0.978	0.967	0.959	0.955	0.950	0.946	0.948	0.953	0.959	0.966	0.982	0.999	1.017	1.031	1.045	1.065	1.080	1.090	1.097	1.101	7.66
7.67	0.979	0.968	0.960	0.956	0.951	0.947	0.949	0.954	0.960	0.967	0.982	0.999	1.018	1.032	1.046	1.066	1.081	1.091	1.097	1.101	7.67
7.68	0.981	0.970	0.961	0.957	0.952	0.948	0.950	0.954	0.960	0.967	0.983	1.000	1.018	1.032	1.046	1.066	1.081	1.091	1.098	1.102	7.68
7.69	0.982	0.971	0.962	0.958	0.953	0.949	0.951	0.955	0.961	0.968	0.983	1.000	1.019	1.033	1.047	1.067	1.082	1.092	1.098	1.102	7.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
7.70	0.983	0.972	0.963	0.959	0.954	0.950	0.952	0.956	0.962	0.969	0.984	1.001	1.019	1.033	1.047	1.067	1.082	1.092	1.098	1.102	7.70
7.71	0.984	0.973	0.964	0.960	0.955	0.951	0.953	0.957	0.963	0.970	0.985	1.001	1.019	1.033	1.047	1.067	1.082	1.092	1.098	1.102	7.71
7.72	0.985	0.974	0.965	0.961	0.956	0.952	0.954	0.957	0.963	0.970	0.985	1.002	1.020	1.034	1.048	1.067	1.082	1.092	1.098	1.102	7.72
7.73	0.987	0.975	0.966	0.961	0.956	0.952	0.954	0.958	0.964	0.971	0.986	1.002	1.020	1.034	1.048	1.068	1.083	1.093	1.099	1.103	7.73
7.74	0.988	0.976	0.967	0.962	0.957	0.953	0.955	0.958	0.964	0.971	0.986	1.003	1.021	1.035	1.049	1.068	1.083	1.093	1.099	1.103	7.74
7.75	0.989	0.977	0.968	0.963	0.958	0.954	0.956	0.959	0.965	0.972	0.987	1.003	1.021	1.035	1.049	1.068	1.083	1.093	1.099	1.103	7.75
7.76	0.990	0.978	0.969	0.964	0.959	0.955	0.957	0.960	0.966	0.973	0.988	1.004	1.022	1.036	1.049	1.068	1.083	1.093	1.099	1.103	7.76
7.77	0.991	0.979	0.970	0.965	0.960	0.956	0.958	0.961	0.967	0.974	0.988	1.004	1.022	1.036	1.050	1.069	1.083	1.094	1.099	1.103	7.77
7.78	0.993	0.981	0.971	0.966	0.960	0.957	0.958	0.961	0.967	0.974	0.989	1.005	1.023	1.037	1.050	1.069	1.084	1.094	1.100	1.104	7.78
7.79	0.994	0.982	0.972	0.967	0.961	0.958	0.959	0.962	0.968	0.975	0.989	1.005	1.023	1.037	1.051	1.070	1.084	1.095	1.100	1.104	7.79
7.80	0.995	0.983	0.973	0.968	0.962	0.959	0.960	0.963	0.969	0.976	0.990	1.006	1.024	1.038	1.051	1.070	1.084	1.095	1.100	1.104	7.80
7.81	0.996	0.984	0.974	0.969	0.962	0.960	0.961	0.964	0.970	0.977	0.991	1.007	1.024	1.038	1.051	1.070	1.084	1.095	1.100	1.104	7.81
7.82	0.997	0.985	0.975	0.970	0.963	0.961	0.962	0.965	0.971	0.977	0.991	1.007	1.025	1.039	1.052	1.070	1.084	1.095	1.100	1.104	7.82
7.83	0.998	0.986	0.976	0.971	0.963	0.961	0.962	0.965	0.971	0.978	0.992	1.008	1.025	1.039	1.052	1.071	1.085	1.096	1.101	1.105	7.83
7.84	0.999	0.987	0.977	0.972	0.964	0.962	0.963	0.966	0.972	0.978	0.992	1.008	1.026	1.040	1.053	1.071	1.085	1.096	1.101	1.105	7.84
7.85	1.000	0.988	0.978	0.973	0.966	0.963	0.964	0.967	0.973	0.979	0.993	1.009	1.026	1.040	1.053	1.071	1.085	1.096	1.101	1.105	7.85
7.86	1.001	0.989	0.979	0.974	0.967	0.964	0.965	0.968	0.974	0.980	0.994	1.010	1.027	1.040	1.053	1.071	1.085	1.096	1.101	1.105	7.86
7.87	1.002	0.990	0.980	0.975	0.968	0.965	0.966	0.969	0.975	0.980	0.995	1.010	1.027	1.041	1.054	1.072	1.086	1.097	1.102	1.106	7.87
7.88	1.003	0.991	0.982	0.976	0.968	0.966	0.966	0.970	0.975	0.981	0.995	1.011	1.028	1.041	1.054	1.072	1.086	1.097	1.102	1.106	7.88
7.89	1.004	0.992	0.983	0.977	0.969	0.967	0.967	0.971	0.976	0.981	0.996	1.011	1.028	1.042	1.055	1.073	1.087	1.098	1.103	1.107	7.89
7.90	1.005	0.993	0.984	0.978	0.970	0.968	0.968	0.972	0.977	0.982	0.997	1.012	1.029	1.042	1.055	1.073	1.087	1.098	1.103	1.107	7.90
7.91	1.006	0.994	0.985	0.979	0.971	0.969	0.969	0.973	0.978	0.983	0.997	1.013	1.029	1.042	1.055	1.073	1.087	1.098	1.103	1.107	7.91
7.92	1.007	0.994	0.986	0.980	0.972	0.970	0.970	0.974	0.978	0.984	0.998	1.013	1.030	1.043	1.056	1.074	1.087	1.098	1.103	1.107	7.92
7.93	1.009	0.997	0.987	0.981	0.972	0.970	0.970	0.974	0.979	0.984	0.998	1.014	1.030	1.043	1.056	1.074	1.088	1.099	1.104	1.108	7.93
7.94	1.010	0.998	0.988	0.982	0.973	0.971	0.971	0.975	0.979	0.985	0.999	1.014	1.031	1.044	1.057	1.075	1.088	1.099	1.104	1.108	7.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
7.95	1.011	0.999	0.989	0.983	0.974	0.972	0.972	0.976	0.980	0.986	0.999	1.015	1.031	1.044	1.057	1.075	1.088	1.099	1.104	1.108	7.95
7.96	1.012	1.000	0.990	0.984	0.975	0.973	0.973	0.977	0.981	0.987	0.999	1.016	1.031	1.045	1.057	1.076	1.088	1.099	1.104	1.108	7.96
7.97	1.013	1.001	0.991	0.985	0.976	0.974	0.974	0.978	0.982	0.988	1.000	1.016	1.032	1.045	1.058	1.076	1.089	1.099	1.105	1.109	7.97
7.98	1.015	1.003	0.993	0.986	0.977	0.975	0.974	0.978	0.982	0.988	1.000	1.017	1.032	1.046	1.058	1.077	1.089	1.100	1.105	1.109	7.98
7.99	1.016	1.004	0.994	0.987	0.978	0.976	0.975	0.979	0.983	0.989	1.001	1.017	1.033	1.046	1.059	1.077	1.090	1.100	1.106	1.110	7.99
8.00	1.017	1.005	0.995	0.988	0.979	0.977	0.976	0.980	0.984	0.990	1.001	1.018	1.033	1.047	1.059	1.078	1.090	1.100	1.106	1.110	8.00
8.01	1.018	1.006	0.996	0.989	0.980	0.978	0.977	0.981	0.985	0.991	1.002	1.018	1.033	1.047	1.059	1.078	1.090	1.100	1.106	1.110	8.01
8.02	1.019	1.007	0.997	0.990	0.981	0.979	0.978	0.982	0.986	0.992	1.002	1.019	1.034	1.048	1.059	1.078	1.090	1.100	1.106	1.110	8.02
8.03	1.020	1.008	0.998	0.991	0.981	0.980	0.978	0.982	0.986	0.992	1.003	1.019	1.034	1.048	1.060	1.078	1.091	1.101	1.107	1.111	8.03
8.04	1.021	1.009	0.999	0.992	0.982	0.981	0.979	0.983	0.987	0.993	1.003	1.020	1.035	1.049	1.060	1.079	1.091	1.101	1.107	1.111	8.04
8.05	1.022	1.010	1.000	0.993	0.983	0.982	0.980	0.984	0.988	0.994	1.004	1.020	1.035	1.049	1.060	1.079	1.091	1.101	1.107	1.111	8.05
8.06	1.023	1.011	1.001	0.994	0.984	0.983	0.981	0.985	0.989	0.995	1.005	1.020	1.036	1.049	1.060	1.079	1.091	1.101	1.107	1.111	8.06
8.07	1.024	1.012	1.002	0.995	0.985	0.984	0.982	0.986	0.990	0.996	1.006	1.021	1.036	1.050	1.061	1.080	1.092	1.101	1.108	1.111	8.07
8.08	1.025	1.014	1.004	0.996	0.985	0.985	0.982	0.987	0.990	0.996	1.006	1.021	1.037	1.050	1.061	1.080	1.092	1.102	1.108	1.112	8.08
8.09	1.026	1.015	1.005	0.997	0.986	0.986	0.983	0.988	0.991	0.997	1.007	1.022	1.037	1.051	1.062	1.081	1.093	1.102	1.109	1.112	8.09
8.10	1.027	1.016	1.006	0.998	0.987	0.987	0.984	0.989	0.992	0.998	1.008	1.022	1.038	1.051	1.062	1.081	1.093	1.102	1.109	1.112	8.10
8.11	1.028	1.017	1.007	0.999	0.988	0.988	0.985	0.990	0.993	0.998	1.009	1.023	1.038	1.051	1.062	1.081	1.093	1.102	1.109	1.112	8.11
8.12	1.029	1.018	1.008	1.000	0.989	0.989	0.986	0.990	0.994	0.999	1.009	1.023	1.039	1.052	1.063	1.081	1.094	1.102	1.109	1.112	8.12
8.13	1.030	1.019	1.009	1.000	0.989	0.989	0.986	0.991	0.994	0.999	1.010	1.024	1.039	1.052	1.063	1.082	1.095	1.103	1.110	1.113	8.13
8.14	1.031	1.020	1.010	1.001	0.990	0.990	0.987	0.991	0.995	1.000	1.010	1.024	1.040	1.053	1.064	1.082	1.095	1.103	1.110	1.113	8.14
8.15	1.032	1.021	1.011	1.002	0.991	0.991	0.988	0.992	0.996	1.000	1.011	1.025	1.040	1.053	1.064	1.082	1.095	1.103	1.110	1.113	8.15
8.16	1.033	1.022	1.012	1.003	0.992	0.992	0.989	0.993	0.997	1.001	1.012	1.026	1.041	1.053	1.064	1.082	1.095	1.103	1.110	1.113	8.16
8.17	1.034	1.023	1.013	1.004	0.993	0.993	0.990	0.994	0.998	1.001	1.012	1.026	1.041	1.054	1.065	1.083	1.096	1.104	1.110	1.114	8.17
8.18	1.036	1.024	1.014	1.005	0.994	0.994	0.990	0.994	0.998	1.002	1.013	1.027	1.042	1.054	1.065	1.083	1.096	1.104	1.111	1.114	8.18
8.19	1.037	1.025	1.015	1.006	0.995	0.995	0.991	0.995	0.999	1.002	1.013	1.027	1.042	1.055	1.066	1.084	1.097	1.105	1.111	1.115	8.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
8.20	1.038	1.026	1.016	1.007	0.996	0.996	0.992	0.996	1.000	1.003	1.014	1.028	1.043	1.055	1.066	1.084	1.097	1.105	1.111	1.115	8.20
8.21	1.039	1.027	1.017	1.008	0.997	0.997	0.993	0.997	1.001	1.004	1.015	1.028	1.043	1.055	1.066	1.084	1.097	1.105	1.111	1.115	8.21
8.22	1.040	1.028	1.018	1.009	0.998	0.998	0.994	0.997	1.002	1.005	1.015	1.029	1.044	1.056	1.067	1.085	1.097	1.105	1.111	1.115	8.22
8.23	1.042	1.029	1.019	1.010	0.998	0.998	0.994	0.998	1.002	1.005	1.016	1.029	1.044	1.056	1.067	1.085	1.098	1.106	1.112	1.116	8.23
8.24	1.043	1.030	1.020	1.011	0.999	0.999	0.995	0.998	1.003	1.006	1.016	1.030	1.045	1.057	1.068	1.086	1.098	1.106	1.112	1.116	8.24
8.25	1.044	1.031	1.021	1.012	1.000	1.000	0.996	0.999	1.004	1.007	1.017	1.030	1.045	1.057	1.068	1.086	1.098	1.106	1.112	1.116	8.25
8.26	1.045	1.032	1.022	1.013	1.001	1.001	0.997	1.000	1.005	1.008	1.018	1.031	1.046	1.058	1.068	1.086	1.098	1.106	1.112	1.116	8.26
8.27	1.046	1.033	1.023	1.014	1.002	1.002	0.998	1.001	1.006	1.009	1.019	1.031	1.046	1.058	1.069	1.087	1.099	1.107	1.112	1.117	8.27
8.28	1.048	1.035	1.024	1.015	1.003	1.002	0.999	1.001	1.006	1.009	1.019	1.032	1.047	1.059	1.069	1.087	1.099	1.107	1.113	1.117	8.28
8.29	1.049	1.036	1.025	1.016	1.004	1.003	1.000	1.002	1.007	1.010	1.020	1.032	1.047	1.059	1.070	1.088	1.100	1.108	1.113	1.118	8.29
8.30	1.050	1.037	1.026	1.017	1.005	1.004	1.001	1.003	1.008	1.011	1.021	1.033	1.048	1.060	1.070	1.088	1.100	1.108	1.113	1.118	8.30
8.31	1.051	1.038	1.027	1.018	1.006	1.005	1.002	1.004	1.009	1.012	1.022	1.034	1.048	1.060	1.070	1.088	1.100	1.108	1.113	1.118	8.31
8.32	1.052	1.039	1.028	1.019	1.007	1.006	1.003	1.005	1.009	1.012	1.022	1.034	1.049	1.061	1.071	1.088	1.100	1.108	1.114	1.118	8.32
8.33	1.053	1.040	1.029	1.019	1.008	1.006	1.003	1.005	1.010	1.013	1.023	1.035	1.049	1.061	1.071	1.089	1.101	1.109	1.114	1.119	8.33
8.34	1.054	1.041	1.030	1.020	1.009	1.007	1.004	1.006	1.010	1.013	1.023	1.035	1.050	1.062	1.072	1.089	1.101	1.109	1.115	1.119	8.34
8.35	1.055	1.042	1.031	1.021	1.010	1.008	1.005	1.007	1.011	1.014	1.024	1.036	1.050	1.062	1.072	1.089	1.101	1.109	1.115	1.119	8.35
8.36	1.056	1.043	1.032	1.022	1.011	1.009	1.006	1.008	1.012	1.015	1.025	1.037	1.050	1.062	1.072	1.089	1.101	1.109	1.115	1.119	8.36
8.37	1.057	1.044	1.033	1.023	1.012	1.010	1.007	1.009	1.013	1.016	1.025	1.037	1.051	1.063	1.073	1.090	1.101	1.110	1.116	1.119	8.37
8.38	1.058	1.046	1.034	1.024	1.013	1.010	1.008	1.010	1.013	1.016	1.026	1.038	1.051	1.063	1.073	1.090	1.102	1.110	1.116	1.120	8.38
8.39	1.059	1.047	1.035	1.025	1.014	1.011	1.009	1.011	1.014	1.017	1.026	1.038	1.052	1.064	1.074	1.091	1.102	1.111	1.117	1.120	8.39
8.40	1.060	1.048	1.036	1.026	1.015	1.012	1.010	1.012	1.015	1.018	1.027	1.039	1.052	1.064	1.074	1.091	1.102	1.111	1.117	1.120	8.40
8.41	1.061	1.049	1.037	1.027	1.016	1.013	1.011	1.013	1.016	1.019	1.027	1.039	1.053	1.064	1.074	1.091	1.102	1.111	1.117	1.120	8.41
8.42	1.062	1.050	1.038	1.028	1.017	1.014	1.012	1.014	1.017	1.019	1.028	1.040	1.053	1.065	1.075	1.091	1.102	1.111	1.117	1.120	8.42
8.43	1.063	1.051	1.039	1.028	1.017	1.014	1.012	1.014	1.017	1.020	1.028	1.040	1.054	1.065	1.075	1.092	1.103	1.112	1.118	1.121	8.43
8.44	1.064	1.052	1.040	1.029	1.018	1.015	1.013	1.015	1.018	1.020	1.029	1.041	1.054	1.066	1.076	1.092	1.103	1.112	1.118	1.121	8.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
8.45	1.065	1.053	1.041	1.030	1.019	1.016	1.014	1.016	1.019	1.021	1.029	1.041	1.055	1.066	1.076	1.092	1.103	1.112	1.118	1.121	8.45
8.46	1.066	1.054	1.042	1.031	1.020	1.017	1.015	1.017	1.020	1.022	1.030	1.042	1.056	1.067	1.076	1.092	1.103	1.112	1.118	1.121	8.46
8.47	1.067	1.055	1.043	1.032	1.021	1.018	1.016	1.018	1.021	1.023	1.030	1.042	1.056	1.067	1.077	1.093	1.104	1.112	1.118	1.122	8.47
8.48	1.068	1.056	1.044	1.033	1.022	1.019	1.017	1.018	1.021	1.023	1.031	1.043	1.057	1.068	1.077	1.093	1.104	1.113	1.119	1.122	8.48
8.49	1.069	1.057	1.045	1.034	1.023	1.020	1.018	1.019	1.022	1.024	1.031	1.043	1.057	1.068	1.078	1.094	1.105	1.113	1.119	1.123	8.49
8.50	1.070	1.058	1.046	1.035	1.024	1.021	1.019	1.020	1.023	1.025	1.032	1.044	1.058	1.069	1.078	1.094	1.105	1.113	1.119	1.123	8.50
8.51	1.071	1.059	1.047	1.036	1.025	1.022	1.020	1.021	1.024	1.026	1.033	1.045	1.058	1.069	1.078	1.094	1.105	1.113	1.119	1.123	8.51
8.52	1.072	1.060	1.048	1.037	1.026	1.023	1.021	1.022	1.024	1.026	1.033	1.045	1.059	1.070	1.079	1.095	1.106	1.114	1.119	1.123	8.52
8.53	1.073	1.061	1.049	1.038	1.027	1.023	1.021	1.022	1.025	1.027	1.034	1.046	1.059	1.070	1.079	1.095	1.106	1.114	1.120	1.124	8.53
8.54	1.074	1.062	1.050	1.039	1.028	1.024	1.022	1.023	1.025	1.027	1.034	1.046	1.060	1.071	1.080	1.096	1.107	1.115	1.120	1.124	8.54
8.55	1.075	1.063	1.051	1.040	1.029	1.025	1.023	1.024	1.026	1.028	1.035	1.047	1.060	1.071	1.080	1.096	1.107	1.115	1.120	1.124	8.55
8.56	1.076	1.064	1.052	1.041	1.030	1.026	1.024	1.025	1.027	1.029	1.036	1.048	1.061	1.071	1.080	1.096	1.107	1.115	1.120	1.124	8.56
8.57	1.077	1.065	1.053	1.042	1.031	1.027	1.025	1.026	1.028	1.029	1.037	1.048	1.061	1.072	1.081	1.097	1.108	1.116	1.121	1.125	8.57
8.58	1.079	1.066	1.054	1.043	1.032	1.028	1.026	1.026	1.028	1.030	1.037	1.049	1.062	1.072	1.081	1.097	1.108	1.116	1.121	1.125	8.58
8.59	1.080	1.067	1.055	1.044	1.033	1.029	1.027	1.027	1.029	1.030	1.038	1.049	1.062	1.073	1.082	1.098	1.109	1.117	1.122	1.126	8.59
8.60	1.081	1.068	1.056	1.045	1.034	1.030	1.028	1.028	1.030	1.031	1.039	1.050	1.063	1.073	1.082	1.098	1.109	1.117	1.122	1.126	8.60
8.61	1.082	1.069	1.057	1.046	1.035	1.031	1.029	1.029	1.031	1.032	1.040	1.050	1.063	1.073	1.082	1.098	1.109	1.117	1.122	1.126	8.61
8.62	1.083	1.070	1.058	1.047	1.036	1.032	1.030	1.030	1.032	1.033	1.040	1.051	1.064	1.074	1.083	1.098	1.109	1.117	1.122	1.126	8.62
8.63	1.084	1.071	1.059	1.047	1.037	1.032	1.030	1.030	1.032	1.033	1.041	1.051	1.064	1.074	1.083	1.099	1.110	1.118	1.123	1.127	8.63
8.64	1.085	1.072	1.060	1.048	1.038	1.033	1.031	1.031	1.033	1.034	1.041	1.052	1.065	1.075	1.084	1.099	1.110	1.118	1.123	1.127	8.64
8.65	1.086	1.073	1.061	1.049	1.039	1.034	1.032	1.032	1.034	1.035	1.042	1.052	1.065	1.075	1.084	1.099	1.110	1.118	1.123	1.127	8.65
8.66	1.087	1.074	1.062	1.050	1.040	1.035	1.033	1.033	1.035	1.036	1.043	1.053	1.066	1.076	1.085	1.099	1.110	1.118	1.123	1.127	8.66
8.67	1.088	1.075	1.063	1.051	1.041	1.036	1.034	1.034	1.036	1.037	1.044	1.053	1.066	1.076	1.085	1.100	1.111	1.119	1.124	1.128	8.67
8.68	1.090	1.076	1.064	1.052	1.042	1.037	1.035	1.034	1.036	1.037	1.044	1.054	1.067	1.077	1.086	1.100	1.111	1.119	1.124	1.128	8.68
8.69	1.091	1.077	1.065	1.053	1.043	1.038	1.036	1.035	1.037	1.038	1.045	1.054	1.067	1.077	1.086	1.101	1.112	1.120	1.125	1.129	8.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
8.70	1.092	1.078	1.066	1.054	1.044	1.039	1.037	1.036	1.038	1.039	1.046	1.055	1.068	1.078	1.087	1.101	1.112	1.120	1.125	1.129	8.70
8.71	1.093	1.079	1.067	1.055	1.045	1.040	1.038	1.037	1.039	1.040	1.046	1.056	1.068	1.078	1.087	1.101	1.112	1.120	1.125	1.129	8.71
8.72	1.094	1.080	1.068	1.056	1.046	1.041	1.039	1.038	1.039	1.041	1.047	1.056	1.069	1.079	1.088	1.102	1.112	1.120	1.125	1.129	8.72
8.73	1.095	1.081	1.068	1.056	1.047	1.041	1.039	1.038	1.040	1.041	1.047	1.057	1.069	1.079	1.088	1.102	1.113	1.121	1.126	1.130	8.73
8.74	1.096	1.082	1.069	1.057	1.048	1.042	1.040	1.039	1.040	1.042	1.048	1.057	1.070	1.080	1.089	1.103	1.113	1.121	1.126	1.130	8.74
8.75	1.097	1.083	1.070	1.058	1.049	1.043	1.041	1.040	1.041	1.043	1.048	1.058	1.070	1.080	1.089	1.103	1.113	1.121	1.126	1.130	8.75
8.76	1.098	1.084	1.071	1.059	1.050	1.044	1.042	1.041	1.042	1.044	1.049	1.059	1.071	1.080	1.089	1.103	1.113	1.121	1.126	1.130	8.76
8.77	1.099	1.085	1.072	1.060	1.051	1.045	1.043	1.042	1.043	1.045	1.049	1.059	1.071	1.081	1.090	1.104	1.114	1.121	1.126	1.131	8.77
8.78	1.100	1.086	1.073	1.061	1.052	1.046	1.043	1.042	1.043	1.045	1.050	1.060	1.072	1.081	1.090	1.104	1.114	1.122	1.127	1.131	8.78
8.79	1.101	1.087	1.074	1.062	1.053	1.047	1.044	1.043	1.044	1.046	1.050	1.060	1.072	1.082	1.091	1.105	1.115	1.122	1.127	1.132	8.79
8.80	1.102	1.088	1.075	1.063	1.054	1.048	1.045	1.044	1.045	1.047	1.051	1.061	1.073	1.082	1.091	1.105	1.115	1.122	1.127	1.132	8.80
8.81	1.103	1.089	1.076	1.064	1.055	1.049	1.046	1.045	1.046	1.047	1.052	1.062	1.073	1.082	1.091	1.105	1.115	1.122	1.127	1.132	8.81
8.82	1.104	1.090	1.077	1.065	1.056	1.050	1.047	1.046	1.046	1.048	1.053	1.062	1.074	1.083	1.092	1.106	1.115	1.123	1.128	1.132	8.82
8.83	1.106	1.092	1.078	1.066	1.056	1.050	1.047	1.046	1.047	1.048	1.053	1.063	1.074	1.083	1.092	1.106	1.116	1.123	1.128	1.133	8.83
8.84	1.107	1.093	1.079	1.067	1.057	1.051	1.048	1.047	1.047	1.049	1.054	1.063	1.075	1.084	1.093	1.107	1.116	1.124	1.129	1.133	8.84
8.85	1.108	1.094	1.080	1.068	1.058	1.052	1.049	1.048	1.048	1.049	1.055	1.064	1.075	1.084	1.093	1.107	1.116	1.124	1.129	1.133	8.85
8.86	1.109	1.095	1.081	1.069	1.059	1.053	1.050	1.049	1.049	1.050	1.056	1.065	1.076	1.085	1.093	1.107	1.116	1.124	1.129	1.133	8.86
8.87	1.110	1.096	1.082	1.070	1.060	1.054	1.051	1.050	1.050	1.050	1.056	1.065	1.076	1.085	1.094	1.108	1.117	1.125	1.130	1.134	8.87
8.88	1.111	1.097	1.083	1.071	1.061	1.054	1.051	1.050	1.050	1.051	1.057	1.066	1.077	1.086	1.094	1.108	1.117	1.125	1.130	1.134	8.88
8.89	1.112	1.098	1.084	1.072	1.062	1.055	1.052	1.051	1.051	1.051	1.057	1.066	1.077	1.086	1.095	1.109	1.118	1.126	1.131	1.135	8.89
8.90	1.113	1.099	1.085	1.073	1.063	1.056	1.053	1.052	1.052	1.052	1.058	1.067	1.078	1.087	1.095	1.109	1.118	1.126	1.131	1.135	8.90
8.91	1.114	1.100	1.086	1.074	1.064	1.057	1.054	1.053	1.053	1.053	1.059	1.067	1.078	1.087	1.095	1.109	1.118	1.126	1.131	1.135	8.91
8.92	1.115	1.101	1.087	1.075	1.065	1.058	1.055	1.053	1.054	1.054	1.059	1.068	1.079	1.088	1.096	1.110	1.119	1.126	1.131	1.135	8.92
8.93	1.116	1.101	1.088	1.075	1.065	1.058	1.055	1.054	1.054	1.054	1.060	1.068	1.079	1.088	1.096	1.110	1.119	1.127	1.132	1.136	8.93
8.94	1.117	1.102	1.089	1.076	1.066	1.059	1.056	1.055	1.055	1.055	1.060	1.069	1.080	1.089	1.097	1.111	1.120	1.127	1.132	1.136	8.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
8.95	1.118	1.103	1.090	1.077	1.067	1.060	1.057	1.056	1.056	1.056	1.061	1.069	1.080	1.089	1.097	1.111	1.120	1.127	1.132	1.136	8.95
8.96	1.119	1.104	1.091	1.078	1.068	1.061	1.058	1.057	1.057	1.057	1.062	1.070	1.081	1.090	1.098	1.111	1.120	1.127	1.132	1.136	8.96
8.97	1.120	1.105	1.092	1.079	1.069	1.062	1.059	1.058	1.058	1.058	1.062	1.070	1.081	1.090	1.098	1.112	1.121	1.128	1.133	1.137	8.97
8.98	1.122	1.106	1.093	1.080	1.070	1.062	1.059	1.058	1.058	1.058	1.063	1.071	1.082	1.091	1.099	1.112	1.121	1.128	1.133	1.137	8.98
8.99	1.123	1.107	1.094	1.081	1.071	1.063	1.060	1.059	1.059	1.059	1.063	1.071	1.082	1.091	1.099	1.113	1.122	1.129	1.134	1.138	8.99
9.00	1.124	1.108	1.095	1.082	1.072	1.064	1.061	1.060	1.060	1.060	1.064	1.072	1.083	1.092	1.100	1.113	1.122	1.129	1.134	1.138	9.00
9.01	1.125	1.109	1.096	1.083	1.073	1.065	1.062	1.061	1.061	1.061	1.065	1.073	1.083	1.092	1.100	1.113	1.122	1.129	1.134	1.138	9.01
9.02	1.126	1.110	1.097	1.084	1.074	1.066	1.063	1.062	1.062	1.062	1.065	1.073	1.084	1.093	1.101	1.114	1.123	1.129	1.134	1.138	9.02
9.03	1.127	1.111	1.098	1.084	1.074	1.066	1.063	1.062	1.062	1.062	1.066	1.074	1.084	1.093	1.101	1.114	1.123	1.130	1.135	1.139	9.03
9.04	1.128	1.112	1.099	1.085	1.075	1.067	1.064	1.063	1.063	1.063	1.066	1.074	1.085	1.094	1.102	1.115	1.124	1.130	1.135	1.139	9.04
9.05	1.129	1.113	1.100	1.086	1.076	1.068	1.065	1.064	1.064	1.064	1.067	1.075	1.085	1.094	1.102	1.115	1.124	1.130	1.135	1.139	9.05
9.06	1.130	1.114	1.101	1.087	1.077	1.069	1.066	1.065	1.065	1.065	1.068	1.076	1.086	1.095	1.102	1.115	1.124	1.130	1.135	1.139	9.06
9.07	1.131	1.115	1.102	1.088	1.078	1.070	1.067	1.066	1.066	1.066	1.068	1.076	1.086	1.095	1.103	1.116	1.125	1.131	1.136	1.139	9.07
9.08	1.133	1.116	1.103	1.089	1.079	1.071	1.067	1.066	1.066	1.066	1.069	1.077	1.087	1.096	1.103	1.116	1.125	1.131	1.136	1.140	9.08
9.09	1.134	1.117	1.104	1.090	1.080	1.072	1.068	1.067	1.067	1.067	1.069	1.077	1.087	1.096	1.104	1.117	1.126	1.132	1.137	1.140	9.09
9.10	1.135	1.118	1.105	1.091	1.081	1.073	1.069	1.068	1.068	1.068	1.070	1.078	1.088	1.097	1.104	1.117	1.126	1.132	1.137	1.140	9.10
9.11	1.136	1.119	1.106	1.092	1.082	1.074	1.070	1.069	1.069	1.069	1.071	1.079	1.089	1.097	1.104	1.117	1.126	1.132	1.137	1.140	9.11
9.12	1.137	1.120	1.107	1.093	1.083	1.075	1.071	1.069	1.069	1.069	1.072	1.079	1.089	1.098	1.105	1.118	1.127	1.132	1.137	1.140	9.12
9.13	1.138	1.121	1.107	1.094	1.083	1.075	1.071	1.070	1.070	1.070	1.072	1.080	1.090	1.098	1.105	1.118	1.127	1.133	1.138	1.141	9.13
9.14	1.139	1.122	1.108	1.095	1.084	1.076	1.072	1.070	1.070	1.070	1.073	1.080	1.090	1.099	1.106	1.119	1.128	1.133	1.138	1.141	9.14
9.15	1.140	1.123	1.109	1.096	1.085	1.077	1.073	1.071	1.071	1.071	1.074	1.081	1.091	1.099	1.106	1.119	1.128	1.133	1.138	1.141	9.15
9.16	1.141	1.124	1.110	1.097	1.086	1.078	1.074	1.072	1.072	1.072	1.075	1.082	1.092	1.100	1.106	1.120	1.128	1.133	1.138	1.141	9.16
9.17	1.142	1.125	1.111	1.098	1.087	1.079	1.075	1.073	1.072	1.072	1.076	1.082	1.092	1.100	1.107	1.120	1.129	1.134	1.139	1.142	9.17
9.18	1.144	1.126	1.112	1.099	1.088	1.080	1.076	1.073	1.073	1.073	1.076	1.083	1.093	1.101	1.107	1.121	1.129	1.134	1.139	1.142	9.18
9.19	1.145	1.127	1.113	1.100	1.089	1.081	1.077	1.074	1.073	1.073	1.077	1.083	1.093	1.101	1.108	1.121	1.130	1.135	1.140	1.143	9.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
9.20	1.146	1.128	1.114	1.101	1.090	1.082	1.078	1.075	1.074	1.074	1.078	1.084	1.094	1.102	1.108	1.122	1.130	1.135	1.140	1.143	9.20
9.21	1.147	1.129	1.115	1.102	1.091	1.083	1.079	1.076	1.075	1.075	1.079	1.084	1.094	1.102	1.108	1.122	1.130	1.135	1.140	1.143	9.21
9.22	1.148	1.130	1.116	1.103	1.092	1.084	1.080	1.077	1.076	1.075	1.079	1.085	1.095	1.103	1.109	1.123	1.131	1.135	1.140	1.144	9.22
9.23	1.149	1.131	1.117	1.103	1.092	1.084	1.080	1.077	1.076	1.076	1.080	1.085	1.095	1.103	1.109	1.123	1.131	1.136	1.141	1.144	9.23
9.24	1.150	1.132	1.118	1.104	1.093	1.085	1.081	1.078	1.077	1.076	1.080	1.086	1.096	1.104	1.110	1.124	1.132	1.136	1.141	1.145	9.24
9.25	1.151	1.133	1.119	1.105	1.094	1.086	1.082	1.079	1.078	1.077	1.081	1.086	1.096	1.104	1.110	1.124	1.132	1.136	1.141	1.145	9.25
9.26	1.152	1.134	1.120	1.106	1.095	1.087	1.083	1.080	1.079	1.078	1.082	1.087	1.097	1.104	1.110	1.124	1.132	1.136	1.141	1.145	9.26
9.27	1.153	1.135	1.121	1.107	1.096	1.088	1.084	1.081	1.080	1.078	1.082	1.087	1.097	1.105	1.111	1.125	1.133	1.137	1.142	1.146	9.27
9.28	1.155	1.136	1.122	1.108	1.097	1.089	1.084	1.081	1.080	1.079	1.083	1.088	1.098	1.105	1.111	1.125	1.133	1.137	1.142	1.146	9.28
9.29	1.156	1.137	1.123	1.109	1.098	1.090	1.085	1.082	1.081	1.079	1.083	1.088	1.098	1.106	1.112	1.126	1.134	1.138	1.143	1.147	9.29
9.30	1.157	1.138	1.124	1.110	1.099	1.091	1.086	1.083	1.082	1.081	1.084	1.089	1.099	1.106	1.112	1.126	1.134	1.138	1.143	1.147	9.30
9.31	1.158	1.139	1.125	1.111	1.100	1.092	1.087	1.084	1.083	1.082	1.085	1.090	1.099	1.106	1.112	1.126	1.134	1.138	1.143	1.147	9.31
9.32	1.159	1.140	1.126	1.112	1.101	1.093	1.088	1.085	1.084	1.082	1.085	1.090	1.100	1.107	1.113	1.127	1.135	1.139	1.144	1.147	9.32
9.33	1.160	1.141	1.127	1.113	1.102	1.093	1.088	1.085	1.084	1.083	1.086	1.091	1.100	1.107	1.113	1.127	1.135	1.139	1.144	1.148	9.33
9.34	1.161	1.142	1.128	1.114	1.103	1.094	1.089	1.086	1.085	1.083	1.086	1.091	1.101	1.108	1.114	1.128	1.136	1.140	1.145	1.148	9.34
9.35	1.162	1.143	1.129	1.115	1.104	1.095	1.090	1.087	1.086	1.084	1.087	1.092	1.101	1.108	1.114	1.128	1.136	1.140	1.145	1.148	9.35
9.36	1.163	1.144	1.130	1.116	1.105	1.096	1.091	1.088	1.087	1.085	1.088	1.093	1.102	1.109	1.115	1.128	1.136	1.140	1.145	1.148	9.36
9.37	1.164	1.145	1.131	1.117	1.106	1.097	1.092	1.089	1.088	1.086	1.088	1.093	1.102	1.109	1.115	1.129	1.137	1.141	1.146	1.148	9.37
9.38	1.165	1.146	1.132	1.118	1.107	1.098	1.093	1.090	1.088	1.086	1.089	1.094	1.103	1.110	1.116	1.129	1.137	1.141	1.146	1.149	9.38
9.39	1.166	1.147	1.133	1.119	1.108	1.099	1.094	1.091	1.089	1.087	1.089	1.094	1.103	1.110	1.116	1.130	1.138	1.142	1.147	1.149	9.39
9.40	1.167	1.148	1.134	1.120	1.109	1.100	1.095	1.092	1.090	1.088	1.090	1.095	1.104	1.111	1.117	1.130	1.138	1.142	1.147	1.149	9.40
9.41	1.168	1.149	1.135	1.121	1.110	1.101	1.096	1.093	1.091	1.089	1.091	1.096	1.104	1.111	1.117	1.130	1.138	1.142	1.147	1.149	9.41
9.42	1.169	1.150	1.136	1.122	1.111	1.102	1.097	1.094	1.092	1.090	1.091	1.096	1.105	1.112	1.118	1.131	1.139	1.142	1.147	1.149	9.42
9.43	1.170	1.151	1.137	1.122	1.111	1.102	1.097	1.094	1.092	1.090	1.092	1.097	1.105	1.112	1.118	1.131	1.139	1.143	1.148	1.150	9.43
9.44	1.171	1.152	1.138	1.123	1.112	1.103	1.098	1.095	1.093	1.091	1.092	1.097	1.106	1.113	1.119	1.132	1.140	1.143	1.148	1.150	9.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
9.45	1.172	1.153	1.139	1.124	1.113	1.104	1.099	1.096	1.094	1.092	1.093	1.098	1.106	1.113	1.119	1.132	1.140	1.143	1.148	1.150	9.45
9.46	1.172	1.154	1.140	1.125	1.114	1.105	1.100	1.097	1.095	1.093	1.094	1.099	1.107	1.114	1.120	1.132	1.140	1.143	1.148	1.150	9.46
9.47	1.173	1.155	1.141	1.126	1.115	1.106	1.101	1.098	1.096	1.094	1.095	1.100	1.107	1.114	1.120	1.133	1.141	1.144	1.149	1.151	9.47
9.48	1.175	1.157	1.142	1.127	1.116	1.107	1.101	1.098	1.096	1.094	1.095	1.100	1.108	1.115	1.121	1.133	1.141	1.144	1.149	1.151	9.48
9.49	1.176	1.158	1.143	1.128	1.117	1.108	1.102	1.099	1.097	1.095	1.096	1.101	1.108	1.115	1.121	1.134	1.142	1.145	1.150	1.152	9.49
9.50	1.178	1.159	1.144	1.129	1.118	1.109	1.103	1.100	1.098	1.096	1.097	1.102	1.109	1.116	1.122	1.134	1.142	1.145	1.150	1.152	9.50
9.51	1.179	1.160	1.145	1.130	1.119	1.110	1.104	1.101	1.099	1.097	1.098	1.102	1.109	1.116	1.122	1.134	1.142	1.145	1.150	1.152	9.51
9.52	1.180	1.161	1.146	1.131	1.120	1.111	1.105	1.102	1.099	1.097	1.098	1.103	1.110	1.117	1.123	1.135	1.142	1.146	1.150	1.152	9.52
9.53	1.180	1.162	1.147	1.132	1.120	1.111	1.105	1.102	1.100	1.098	1.099	1.103	1.110	1.117	1.123	1.135	1.143	1.146	1.151	1.153	9.53
9.54	1.181	1.163	1.148	1.133	1.121	1.112	1.106	1.103	1.100	1.098	1.099	1.104	1.111	1.118	1.124	1.136	1.143	1.147	1.151	1.153	9.54
9.55	1.182	1.164	1.149	1.134	1.122	1.113	1.107	1.104	1.101	1.099	1.100	1.104	1.111	1.118	1.124	1.136	1.143	1.147	1.151	1.153	9.55
9.56	1.183	1.165	1.150	1.135	1.123	1.114	1.108	1.105	1.102	1.100	1.101	1.105	1.112	1.119	1.124	1.137	1.143	1.147	1.151	1.153	9.56
9.57	1.185	1.166	1.151	1.136	1.124	1.115	1.109	1.106	1.102	1.100	1.101	1.105	1.112	1.119	1.125	1.137	1.144	1.148	1.152	1.154	9.57
9.58	1.186	1.167	1.152	1.137	1.125	1.116	1.109	1.106	1.103	1.101	1.102	1.106	1.113	1.120	1.125	1.138	1.144	1.148	1.152	1.154	9.58
9.59	1.188	1.168	1.153	1.138	1.126	1.117	1.110	1.107	1.103	1.101	1.102	1.106	1.113	1.120	1.126	1.138	1.145	1.149	1.153	1.155	9.59
9.60	1.189	1.169	1.154	1.139	1.127	1.118	1.111	1.108	1.104	1.102	1.103	1.107	1.114	1.121	1.126	1.139	1.145	1.149	1.153	1.155	9.60
9.61	1.190	1.170	1.155	1.140	1.128	1.119	1.112	1.109	1.105	1.103	1.104	1.108	1.115	1.121	1.126	1.139	1.145	1.149	1.153	1.155	9.61
9.62	1.191	1.171	1.156	1.141	1.129	1.120	1.113	1.110	1.106	1.103	1.104	1.108	1.115	1.122	1.127	1.140	1.146	1.149	1.153	1.155	9.62
9.63	1.192	1.172	1.156	1.141	1.130	1.120	1.113	1.110	1.106	1.104	1.105	1.109	1.116	1.122	1.127	1.140	1.146	1.150	1.154	1.156	9.63
9.64	1.193	1.173	1.157	1.142	1.131	1.121	1.114	1.111	1.107	1.104	1.105	1.109	1.116	1.123	1.128	1.141	1.147	1.150	1.154	1.156	9.64
9.65	1.194	1.174	1.158	1.143	1.132	1.122	1.115	1.112	1.108	1.105	1.106	1.110	1.117	1.123	1.128	1.141	1.147	1.150	1.154	1.156	9.65
9.66	1.195	1.175	1.159	1.144	1.133	1.123	1.116	1.113	1.109	1.106	1.107	1.111	1.118	1.124	1.129	1.141	1.147	1.150	1.154	1.156	9.66
9.67	1.196	1.176	1.160	1.145	1.134	1.124	1.117	1.114	1.110	1.107	1.107	1.111	1.118	1.124	1.129	1.142	1.148	1.151	1.155	1.157	9.67
9.68	1.198	1.177	1.161	1.146	1.135	1.125	1.118	1.114	1.110	1.107	1.108	1.112	1.119	1.125	1.130	1.142	1.148	1.151	1.155	1.157	9.68
9.69	1.199	1.178	1.162	1.147	1.136	1.126	1.119	1.115	1.111	1.108	1.108	1.112	1.119	1.125	1.130	1.143	1.149	1.152	1.156	1.158	9.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
9.70	1.200	1.179	1.163	1.148	1.137	1.127	1.120	1.116	1.112	1.109	1.109	1.113	1.120	1.126	1.131	1.143	1.149	1.152	1.156	1.158	9.70
9.71	1.201	1.180	1.164	1.149	1.138	1.128	1.121	1.117	1.113	1.110	1.110	1.114	1.120	1.126	1.131	1.143	1.149	1.152	1.156	1.158	9.71
9.72	1.202	1.181	1.165	1.150	1.139	1.129	1.122	1.118	1.113	1.111	1.111	1.114	1.121	1.127	1.132	1.144	1.149	1.153	1.156	1.158	9.72
9.73	1.203	1.182	1.166	1.151	1.139	1.129	1.122	1.118	1.114	1.111	1.111	1.115	1.121	1.127	1.132	1.144	1.150	1.153	1.157	1.159	9.73
9.74	1.204	1.183	1.167	1.152	1.140	1.130	1.123	1.119	1.114	1.112	1.112	1.115	1.122	1.128	1.133	1.145	1.150	1.154	1.157	1.159	9.74
9.75	1.205	1.184	1.168	1.153	1.141	1.131	1.124	1.120	1.115	1.113	1.113	1.116	1.122	1.128	1.133	1.145	1.150	1.154	1.157	1.159	9.75
9.76	1.206	1.185	1.169	1.154	1.142	1.132	1.125	1.121	1.116	1.114	1.114	1.117	1.123	1.129	1.134	1.146	1.150	1.154	1.157	1.159	9.76
9.77	1.207	1.186	1.170	1.155	1.143	1.133	1.126	1.122	1.117	1.115	1.115	1.117	1.123	1.129	1.134	1.146	1.151	1.155	1.158	1.160	9.77
9.78	1.208	1.187	1.171	1.156	1.144	1.133	1.126	1.122	1.117	1.115	1.115	1.118	1.124	1.130	1.135	1.147	1.151	1.155	1.158	1.160	9.78
9.79	1.209	1.188	1.172	1.157	1.145	1.134	1.127	1.123	1.118	1.116	1.116	1.118	1.124	1.130	1.135	1.147	1.152	1.156	1.159	1.161	9.79
9.80	1.210	1.189	1.173	1.158	1.146	1.135	1.128	1.124	1.119	1.117	1.117	1.119	1.125	1.131	1.136	1.148	1.152	1.156	1.159	1.161	9.80
9.81	1.211	1.190	1.174	1.159	1.147	1.136	1.129	1.125	1.120	1.118	1.118	1.120	1.125	1.131	1.136	1.148	1.152	1.156	1.159	1.161	9.81
9.82	1.212	1.191	1.175	1.160	1.148	1.137	1.130	1.126	1.121	1.118	1.118	1.120	1.126	1.132	1.137	1.149	1.153	1.156	1.159	1.161	9.82
9.83	1.213	1.192	1.176	1.160	1.148	1.137	1.130	1.126	1.121	1.119	1.119	1.121	1.126	1.132	1.137	1.149	1.153	1.157	1.160	1.162	9.83
9.84	1.214	1.193	1.177	1.161	1.149	1.138	1.131	1.127	1.122	1.119	1.119	1.121	1.127	1.133	1.138	1.150	1.154	1.157	1.160	1.162	9.84
9.85	1.215	1.194	1.178	1.162	1.150	1.139	1.132	1.128	1.123	1.120	1.120	1.122	1.127	1.133	1.138	1.150	1.154	1.157	1.160	1.162	9.85
9.86	1.216	1.195	1.179	1.163	1.151	1.140	1.133	1.129	1.124	1.121	1.121	1.123	1.128	1.133	1.138	1.150	1.154	1.157	1.160	1.162	9.86
9.87	1.217	1.196	1.180	1.164	1.152	1.141	1.134	1.130	1.125	1.122	1.121	1.124	1.128	1.134	1.139	1.151	1.155	1.158	1.161	1.163	9.87
9.88	1.219	1.198	1.181	1.165	1.153	1.141	1.135	1.130	1.125	1.123	1.122	1.124	1.129	1.134	1.139	1.151	1.155	1.158	1.161	1.163	9.88
9.89	1.220	1.199	1.182	1.166	1.154	1.142	1.136	1.131	1.126	1.123	1.122	1.125	1.129	1.135	1.140	1.152	1.156	1.159	1.162	1.164	9.89
9.90	1.221	1.200	1.183	1.167	1.155	1.143	1.137	1.132	1.127	1.123	1.123	1.126	1.130	1.135	1.140	1.152	1.156	1.159	1.162	1.164	9.90
9.91	1.222	1.201	1.184	1.168	1.156	1.144	1.138	1.133	1.128	1.124	1.124	1.127	1.131	1.136	1.140	1.152	1.156	1.159	1.162	1.164	9.91
9.92	1.223	1.202	1.185	1.169	1.157	1.145	1.139	1.134	1.128	1.124	1.124	1.127	1.131	1.136	1.141	1.153	1.157	1.160	1.162	1.164	9.92
9.93	1.224	1.203	1.185	1.169	1.157	1.145	1.139	1.134	1.129	1.125	1.125	1.128	1.132	1.137	1.141	1.153	1.157	1.160	1.163	1.165	9.93
9.94	1.225	1.204	1.186	1.170	1.158	1.146	1.140	1.135	1.129	1.125	1.125	1.128	1.132	1.137	1.142	1.154	1.158	1.161	1.163	1.165	9.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
9.95	1.226	1.205	1.187	1.171	1.159	1.147	1.141	1.136	1.130	1.126	1.126	1.129	1.133	1.138	1.142	1.154	1.158	1.161	1.163	1.165	9.95
9.96	1.227	1.206	1.188	1.172	1.160	1.148	1.142	1.137	1.131	1.127	1.127	1.130	1.134	1.139	1.142	1.154	1.158	1.161	1.163	1.165	9.96
9.97	1.228	1.207	1.189	1.173	1.161	1.149	1.143	1.138	1.132	1.128	1.128	1.130	1.134	1.139	1.143	1.155	1.159	1.162	1.164	1.166	9.97
9.98	1.229	1.208	1.190	1.174	1.162	1.150	1.143	1.138	1.132	1.128	1.128	1.131	1.135	1.140	1.143	1.155	1.159	1.162	1.164	1.166	9.98
9.99	1.230	1.209	1.191	1.175	1.163	1.151	1.144	1.139	1.133	1.129	1.129	1.131	1.135	1.140	1.144	1.156	1.160	1.163	1.165	1.167	9.99
10.00	1.231	1.210	1.192	1.176	1.164	1.152	1.145	1.140	1.134	1.130	1.130	1.132	1.136	1.141	1.144	1.156	1.160	1.163	1.165	1.167	10.00
10.01	1.232	1.211	1.193	1.177	1.165	1.153	1.146	1.141	1.135	1.131	1.131	1.133	1.137	1.141	1.144	1.156	1.160	1.163	1.165	1.167	10.01
10.02	1.233	1.212	1.194	1.178	1.166	1.154	1.147	1.142	1.136	1.132	1.131	1.133	1.137	1.142	1.145	1.157	1.161	1.163	1.165	1.167	10.02
10.03	1.234	1.213	1.195	1.178	1.166	1.154	1.147	1.142	1.136	1.132	1.132	1.134	1.138	1.142	1.145	1.157	1.161	1.164	1.166	1.168	10.03
10.04	1.235	1.214	1.196	1.179	1.167	1.155	1.148	1.143	1.137	1.133	1.132	1.134	1.138	1.143	1.146	1.158	1.162	1.164	1.166	1.168	10.04
10.05	1.236	1.215	1.197	1.180	1.168	1.156	1.149	1.144	1.138	1.134	1.133	1.135	1.139	1.143	1.146	1.158	1.162	1.164	1.166	1.168	10.05
10.06	1.237	1.216	1.198	1.181	1.169	1.157	1.150	1.145	1.139	1.135	1.134	1.136	1.139	1.143	1.147	1.158	1.162	1.164	1.166	1.168	10.06
10.07	1.238	1.217	1.199	1.182	1.170	1.158	1.151	1.146	1.140	1.136	1.135	1.136	1.140	1.144	1.147	1.159	1.163	1.165	1.167	1.169	10.07
10.08	1.240	1.218	1.200	1.183	1.171	1.158	1.151	1.146	1.140	1.136	1.135	1.137	1.140	1.144	1.148	1.159	1.163	1.165	1.167	1.169	10.08
10.09	1.241	1.219	1.201	1.184	1.172	1.159	1.152	1.147	1.141	1.137	1.136	1.137	1.141	1.145	1.148	1.160	1.164	1.166	1.168	1.170	10.09
10.10	1.242	1.220	1.202	1.185	1.173	1.160	1.153	1.148	1.142	1.138	1.137	1.138	1.141	1.145	1.149	1.160	1.164	1.166	1.168	1.170	10.10
10.11	1.243	1.221	1.203	1.186	1.174	1.161	1.154	1.149	1.143	1.139	1.138	1.139	1.142	1.145	1.149	1.160	1.164	1.166	1.168	1.170	10.11
10.12	1.244	1.222	1.204	1.187	1.175	1.162	1.155	1.150	1.143	1.139	1.138	1.139	1.142	1.146	1.150	1.161	1.164	1.166	1.168	1.170	10.12
10.13	1.245	1.223	1.204	1.188	1.175	1.162	1.155	1.150	1.144	1.140	1.139	1.140	1.143	1.146	1.150	1.161	1.165	1.167	1.169	1.171	10.13
10.14	1.246	1.224	1.205	1.189	1.176	1.163	1.156	1.151	1.144	1.140	1.139	1.140	1.143	1.147	1.151	1.162	1.165	1.167	1.169	1.171	10.14
10.15	1.247	1.225	1.206	1.190	1.177	1.164	1.157	1.152	1.145	1.141	1.140	1.141	1.144	1.147	1.151	1.162	1.165	1.167	1.169	1.171	10.15
10.16	1.248	1.226	1.207	1.191	1.178	1.165	1.158	1.153	1.146	1.142	1.141	1.142	1.145	1.148	1.152	1.162	1.165	1.167	1.169	1.171	10.16
10.17	1.249	1.227	1.208	1.192	1.179	1.166	1.159	1.153	1.147	1.143	1.141	1.142	1.145	1.148	1.152	1.163	1.166	1.168	1.170	1.172	10.17
10.18	1.250	1.228	1.209	1.193	1.179	1.167	1.160	1.154	1.148	1.143	1.142	1.143	1.146	1.149	1.153	1.163	1.166	1.168	1.170	1.172	10.18
10.19	1.251	1.229	1.210	1.194	1.180	1.168	1.161	1.154	1.149	1.144	1.142	1.143	1.146	1.149	1.153	1.164	1.167	1.169	1.171	1.173	10.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
10.20	1.252	1.230	1.211	1.195	1.181	1.169	1.162	1.155	1.149	1.145	1.143	1.144	1.147	1.150	1.154	1.164	1.167	1.169	1.171	1.173	10.20
10.21	1.253	1.231	1.212	1.196	1.182	1.170	1.163	1.156	1.150	1.146	1.144	1.145	1.147	1.150	1.154	1.164	1.167	1.169	1.171	1.173	10.21
10.22	1.254	1.232	1.213	1.197	1.183	1.171	1.164	1.157	1.151	1.146	1.144	1.145	1.148	1.151	1.155	1.165	1.168	1.170	1.172	1.174	10.22
10.23	1.255	1.233	1.214	1.197	1.183	1.172	1.164	1.157	1.151	1.147	1.145	1.146	1.148	1.151	1.155	1.165	1.168	1.170	1.172	1.174	10.23
10.24	1.256	1.234	1.215	1.198	1.184	1.173	1.165	1.158	1.152	1.147	1.145	1.146	1.149	1.152	1.156	1.166	1.169	1.171	1.173	1.175	10.24
10.25	1.257	1.235	1.216	1.199	1.185	1.174	1.166	1.159	1.153	1.148	1.146	1.147	1.149	1.152	1.156	1.166	1.169	1.171	1.173	1.175	10.25
10.26	1.258	1.236	1.217	1.200	1.186	1.175	1.167	1.160	1.154	1.149	1.147	1.148	1.150	1.153	1.157	1.166	1.169	1.171	1.173	1.175	10.26
10.27	1.259	1.237	1.218	1.201	1.187	1.176	1.168	1.161	1.155	1.150	1.147	1.148	1.150	1.153	1.157	1.167	1.170	1.172	1.174	1.176	10.27
10.28	1.261	1.238	1.219	1.202	1.188	1.177	1.168	1.161	1.155	1.150	1.148	1.149	1.151	1.154	1.158	1.167	1.170	1.172	1.174	1.176	10.28
10.29	1.262	1.239	1.220	1.203	1.189	1.178	1.169	1.162	1.156	1.151	1.148	1.149	1.151	1.154	1.158	1.168	1.171	1.173	1.175	1.177	10.29
10.30	1.263	1.240	1.221	1.204	1.190	1.179	1.170	1.163	1.157	1.152	1.149	1.150	1.152	1.155	1.159	1.168	1.171	1.173	1.175	1.177	10.30
10.31	1.264	1.241	1.222	1.205	1.191	1.180	1.171	1.164	1.158	1.153	1.150	1.151	1.153	1.155	1.159	1.168	1.171	1.173	1.175	1.177	10.31
10.32	1.265	1.242	1.223	1.206	1.192	1.181	1.172	1.165	1.158	1.154	1.150	1.151	1.153	1.156	1.160	1.169	1.172	1.173	1.175	1.177	10.32
10.33	1.266	1.243	1.224	1.206	1.192	1.181	1.172	1.165	1.159	1.154	1.151	1.152	1.154	1.156	1.160	1.169	1.172	1.174	1.176	1.178	10.33
10.34	1.267	1.244	1.225	1.207	1.193	1.182	1.173	1.166	1.159	1.155	1.151	1.152	1.154	1.157	1.161	1.170	1.173	1.174	1.176	1.178	10.34
10.35	1.268	1.245	1.226	1.208	1.194	1.183	1.174	1.167	1.160	1.156	1.152	1.153	1.155	1.157	1.161	1.170	1.173	1.174	1.176	1.178	10.35
10.36	1.269	1.246	1.227	1.209	1.195	1.184	1.175	1.168	1.161	1.157	1.153	1.154	1.156	1.158	1.162	1.170	1.173	1.174	1.176	1.178	10.36
10.37	1.270	1.247	1.228	1.210	1.196	1.185	1.176	1.169	1.162	1.158	1.154	1.154	1.156	1.158	1.162	1.171	1.174	1.175	1.177	1.179	10.37
10.38	1.272	1.248	1.229	1.211	1.197	1.186	1.176	1.169	1.162	1.158	1.154	1.155	1.157	1.159	1.163	1.171	1.174	1.175	1.177	1.179	10.38
10.39	1.273	1.249	1.230	1.212	1.198	1.187	1.177	1.170	1.163	1.159	1.155	1.155	1.157	1.159	1.163	1.172	1.175	1.176	1.178	1.180	10.39
10.40	1.274	1.250	1.231	1.213	1.199	1.188	1.178	1.171	1.164	1.160	1.156	1.156	1.158	1.160	1.164	1.172	1.175	1.176	1.178	1.180	10.40
10.41	1.275	1.251	1.232	1.214	1.200	1.189	1.179	1.172	1.165	1.161	1.157	1.157	1.158	1.160	1.164	1.172	1.175	1.176	1.178	1.180	10.41
10.42	1.276	1.252	1.233	1.215	1.201	1.190	1.180	1.173	1.166	1.162	1.157	1.157	1.159	1.161	1.165	1.173	1.176	1.176	1.178	1.180	10.42
10.43	1.277	1.253	1.234	1.216	1.201	1.190	1.180	1.173	1.166	1.162	1.158	1.158	1.159	1.161	1.165	1.173	1.176	1.177	1.179	1.181	10.43
10.44	1.278	1.254	1.235	1.217	1.202	1.191	1.181	1.174	1.167	1.163	1.158	1.158	1.160	1.162	1.166	1.174	1.177	1.177	1.179	1.181	10.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
10.45	1.279	1.255	1.236	1.218	1.203	1.192	1.182	1.175	1.168	1.164	1.159	1.159	1.160	1.162	1.166	1.174	1.177	1.177	1.179	1.181	10.45
10.46	1.280	1.256	1.237	1.219	1.204	1.193	1.183	1.176	1.169	1.165	1.160	1.160	1.160	1.163	1.167	1.174	1.177	1.177	1.179	1.181	10.46
10.47	1.281	1.257	1.238	1.220	1.205	1.194	1.184	1.177	1.170	1.166	1.160	1.160	1.161	1.163	1.167	1.175	1.178	1.178	1.180	1.182	10.47
10.48	1.283	1.258	1.239	1.221	1.206	1.194	1.184	1.177	1.170	1.166	1.161	1.161	1.161	1.164	1.168	1.175	1.178	1.178	1.180	1.182	10.48
10.49	1.284	1.259	1.240	1.222	1.207	1.195	1.185	1.178	1.171	1.167	1.161	1.161	1.162	1.164	1.168	1.176	1.179	1.179	1.181	1.183	10.49
10.50	1.285	1.260	1.241	1.223	1.208	1.196	1.186	1.179	1.172	1.168	1.162	1.162	1.162	1.165	1.169	1.176	1.179	1.179	1.181	1.183	10.50
10.51	1.286	1.261	1.242	1.224	1.209	1.197	1.187	1.180	1.173	1.169	1.163	1.163	1.163	1.166	1.169	1.176	1.179	1.179	1.181	1.183	10.51
10.52	1.287	1.262	1.243	1.225	1.210	1.198	1.188	1.181	1.174	1.169	1.163	1.163	1.163	1.166	1.170	1.177	1.180	1.180	1.181	1.183	10.52
10.53	1.288	1.263	1.244	1.225	1.210	1.198	1.188	1.181	1.174	1.170	1.164	1.164	1.164	1.167	1.170	1.177	1.180	1.180	1.182	1.184	10.53
10.54	1.289	1.264	1.245	1.226	1.211	1.199	1.189	1.182	1.175	1.170	1.164	1.164	1.164	1.167	1.171	1.178	1.181	1.181	1.182	1.184	10.54
10.55	1.290	1.265	1.246	1.227	1.212	1.200	1.190	1.183	1.176	1.171	1.165	1.165	1.165	1.168	1.171	1.178	1.181	1.181	1.182	1.184	10.55
10.56	1.291	1.266	1.247	1.228	1.213	1.201	1.191	1.184	1.177	1.172	1.166	1.166	1.166	1.169	1.172	1.179	1.181	1.181	1.182	1.184	10.56
10.57	1.292	1.267	1.248	1.229	1.214	1.202	1.192	1.185	1.178	1.172	1.167	1.166	1.166	1.169	1.172	1.179	1.182	1.182	1.183	1.185	10.57
10.58	1.294	1.268	1.249	1.230	1.215	1.202	1.193	1.185	1.178	1.173	1.167	1.167	1.167	1.170	1.173	1.180	1.182	1.182	1.183	1.185	10.58
10.59	1.295	1.269	1.250	1.231	1.216	1.203	1.194	1.186	1.179	1.173	1.168	1.167	1.167	1.170	1.173	1.180	1.183	1.183	1.184	1.186	10.59
10.60	1.296	1.270	1.251	1.232	1.217	1.204	1.195	1.187	1.180	1.174	1.169	1.168	1.168	1.171	1.174	1.181	1.183	1.183	1.184	1.186	10.60
10.61	1.297	1.271	1.252	1.233	1.218	1.205	1.196	1.188	1.181	1.175	1.170	1.168	1.169	1.172	1.174	1.181	1.183	1.183	1.184	1.186	10.61
10.62	1.298	1.272	1.253	1.234	1.219	1.206	1.197	1.189	1.181	1.175	1.170	1.169	1.169	1.172	1.175	1.182	1.183	1.183	1.184	1.186	10.62
10.63	1.299	1.273	1.254	1.234	1.219	1.206	1.197	1.189	1.182	1.176	1.171	1.169	1.170	1.173	1.175	1.182	1.184	1.184	1.185	1.187	10.63
10.64	1.300	1.274	1.255	1.235	1.220	1.207	1.198	1.190	1.182	1.176	1.171	1.170	1.170	1.173	1.176	1.183	1.184	1.184	1.185	1.187	10.64
10.65	1.301	1.275	1.256	1.236	1.221	1.208	1.199	1.191	1.183	1.177	1.172	1.170	1.171	1.174	1.176	1.183	1.184	1.184	1.185	1.187	10.65
10.66	1.302	1.276	1.257	1.237	1.222	1.209	1.200	1.192	1.184	1.178	1.173	1.171	1.172	1.175	1.177	1.183	1.184	1.184	1.185	1.187	10.66
10.67	1.303	1.277	1.258	1.238	1.223	1.210	1.201	1.193	1.185	1.179	1.174	1.171	1.172	1.175	1.177	1.184	1.185	1.185	1.186	1.188	10.67
10.68	1.305	1.278	1.259	1.239	1.224	1.211	1.201	1.193	1.185	1.179	1.174	1.172	1.173	1.176	1.178	1.184	1.185	1.185	1.186	1.188	10.68
10.69	1.306	1.279	1.260	1.240	1.225	1.212	1.202	1.194	1.186	1.180	1.175	1.172	1.173	1.176	1.178	1.185	1.186	1.186	1.187	1.189	10.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
10.70	1.307	1.280	1.261	1.241	1.226	1.213	1.203	1.195	1.187	1.181	1.176	1.173	1.174	1.177	1.179	1.185	1.186	1.186	1.187	1.189	10.70
10.71	1.308	1.281	1.262	1.242	1.227	1.214	1.204	1.196	1.188	1.182	1.177	1.174	1.174	1.177	1.180	1.185	1.186	1.186	1.187	1.189	10.71
10.72	1.309	1.282	1.263	1.243	1.228	1.215	1.205	1.196	1.189	1.183	1.177	1.174	1.175	1.178	1.180	1.186	1.186	1.187	1.188	1.189	10.72
10.73	1.310	1.283	1.263	1.244	1.229	1.215	1.205	1.197	1.189	1.183	1.178	1.175	1.175	1.178	1.181	1.186	1.187	1.187	1.188	1.190	10.73
10.74	1.311	1.284	1.264	1.245	1.230	1.216	1.206	1.197	1.190	1.184	1.178	1.175	1.176	1.179	1.181	1.187	1.187	1.188	1.189	1.190	10.74
10.75	1.312	1.285	1.265	1.246	1.231	1.217	1.207	1.198	1.191	1.185	1.179	1.176	1.176	1.179	1.182	1.187	1.187	1.188	1.189	1.190	10.75
10.76	1.313	1.286	1.266	1.247	1.232	1.218	1.208	1.199	1.192	1.186	1.180	1.177	1.177	1.180	1.183	1.187	1.187	1.188	1.189	1.190	10.76
10.77	1.314	1.287	1.267	1.248	1.233	1.219	1.209	1.200	1.193	1.187	1.180	1.177	1.177	1.180	1.183	1.188	1.188	1.189	1.190	1.191	10.77
10.78	1.316	1.289	1.268	1.249	1.234	1.220	1.209	1.200	1.193	1.187	1.181	1.178	1.178	1.181	1.184	1.188	1.188	1.189	1.190	1.191	10.78
10.79	1.317	1.290	1.269	1.250	1.235	1.221	1.210	1.201	1.194	1.188	1.181	1.178	1.178	1.181	1.184	1.189	1.189	1.190	1.191	1.192	10.79
10.80	1.318	1.291	1.270	1.251	1.236	1.222	1.211	1.202	1.195	1.189	1.182	1.179	1.179	1.182	1.185	1.189	1.189	1.190	1.191	1.192	10.80
10.81	1.319	1.292	1.271	1.252	1.237	1.223	1.212	1.203	1.196	1.190	1.183	1.180	1.180	1.183	1.185	1.189	1.189	1.190	1.191	1.192	10.81
10.82	1.320	1.293	1.272	1.253	1.238	1.224	1.213	1.204	1.196	1.191	1.184	1.180	1.180	1.183	1.186	1.190	1.190	1.191	1.191	1.192	10.82
10.83	1.321	1.294	1.273	1.253	1.238	1.224	1.213	1.204	1.197	1.191	1.184	1.181	1.181	1.184	1.186	1.190	1.190	1.191	1.192	1.193	10.83
10.84	1.322	1.295	1.274	1.254	1.239	1.225	1.214	1.205	1.197	1.192	1.185	1.181	1.181	1.184	1.187	1.191	1.191	1.192	1.192	1.193	10.84
10.85	1.323	1.296	1.275	1.255	1.240	1.226	1.215	1.206	1.198	1.193	1.186	1.182	1.182	1.185	1.187	1.191	1.191	1.192	1.192	1.193	10.85
10.86	1.324	1.297	1.276	1.256	1.241	1.227	1.216	1.207	1.199	1.194	1.187	1.183	1.183	1.186	1.188	1.191	1.191	1.192	1.192	1.193	10.86
10.87	1.325	1.298	1.277	1.257	1.242	1.228	1.217	1.208	1.200	1.195	1.188	1.184	1.184	1.186	1.188	1.192	1.192	1.193	1.193	1.194	10.87
10.88	1.327	1.299	1.278	1.258	1.243	1.228	1.217	1.208	1.200	1.195	1.188	1.184	1.184	1.187	1.189	1.192	1.192	1.193	1.193	1.194	10.88
10.89	1.328	1.300	1.279	1.259	1.244	1.229	1.218	1.209	1.201	1.196	1.189	1.185	1.185	1.187	1.189	1.193	1.193	1.194	1.194	1.195	10.89
10.90	1.329	1.301	1.280	1.260	1.245	1.230	1.219	1.210	1.202	1.197	1.190	1.186	1.186	1.188	1.190	1.193	1.193	1.194	1.194	1.195	10.90
10.91	1.330	1.302	1.281	1.261	1.246	1.231	1.220	1.211	1.203	1.198	1.191	1.187	1.187	1.189	1.190	1.193	1.193	1.194	1.194	1.195	10.91
10.92	1.331	1.303	1.282	1.262	1.247	1.232	1.221	1.212	1.204	1.198	1.191	1.187	1.187	1.189	1.191	1.194	1.194	1.195	1.195	1.196	10.92
10.93	1.332	1.304	1.282	1.263	1.247	1.233	1.221	1.212	1.204	1.199	1.192	1.188	1.188	1.190	1.191	1.194	1.194	1.195	1.195	1.196	10.93
10.94	1.333	1.305	1.283	1.264	1.248	1.234	1.222	1.213	1.205	1.199	1.192	1.188	1.188	1.190	1.192	1.195	1.195	1.196	1.196	1.197	10.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
10.95	1.334	1.306	1.284	1.265	1.249	1.235	1.223	1.214	1.206	1.200	1.193	1.189	1.189	1.191	1.192	1.195	1.195	1.196	1.196	1.197	10.95
10.96	1.335	1.307	1.285	1.266	1.250	1.236	1.224	1.215	1.207	1.201	1.194	1.190	1.190	1.192	1.193	1.195	1.195	1.196	1.196	1.197	10.96
10.97	1.336	1.308	1.286	1.267	1.251	1.237	1.225	1.216	1.208	1.202	1.194	1.191	1.191	1.192	1.193	1.196	1.196	1.197	1.197	1.198	10.97
10.98	1.337	1.309	1.287	1.268	1.252	1.238	1.226	1.216	1.208	1.202	1.195	1.191	1.191	1.193	1.194	1.196	1.196	1.197	1.197	1.198	10.98
10.99	1.338	1.310	1.288	1.269	1.253	1.239	1.227	1.217	1.209	1.203	1.195	1.192	1.191	1.193	1.194	1.197	1.197	1.198	1.198	1.199	10.99
11.00	1.339	1.311	1.289	1.270	1.254	1.240	1.228	1.218	1.210	1.204	1.196	1.193	1.192	1.194	1.195	1.197	1.197	1.198	1.198	1.199	11.00
11.01	1.340	1.312	1.290	1.271	1.255	1.241	1.229	1.219	1.211	1.205	1.197	1.194	1.192	1.194	1.195	1.197	1.197	1.198	1.198	1.199	11.01
11.02	1.341	1.313	1.291	1.272	1.256	1.242	1.230	1.219	1.211	1.206	1.197	1.194	1.193	1.195	1.196	1.198	1.198	1.198	1.198	1.199	11.02
11.03	1.342	1.314	1.292	1.273	1.256	1.242	1.230	1.220	1.212	1.206	1.198	1.195	1.193	1.195	1.196	1.198	1.198	1.199	1.199	1.200	11.03
11.04	1.343	1.315	1.293	1.274	1.257	1.243	1.231	1.220	1.212	1.207	1.198	1.195	1.194	1.196	1.197	1.199	1.199	1.199	1.199	1.200	11.04
11.05	1.344	1.316	1.294	1.275	1.258	1.244	1.232	1.221	1.213	1.208	1.199	1.196	1.194	1.196	1.197	1.199	1.199	1.199	1.199	1.200	11.05
11.06	1.345	1.317	1.295	1.276	1.259	1.245	1.233	1.222	1.214	1.209	1.200	1.197	1.194	1.197	1.198	1.199	1.199	1.199	1.199	1.200	11.06
11.07	1.346	1.318	1.296	1.277	1.260	1.246	1.234	1.223	1.215	1.209	1.200	1.197	1.195	1.197	1.198	1.200	1.200	1.200	1.200	1.201	11.07
11.08	1.348	1.319	1.297	1.278	1.261	1.247	1.234	1.223	1.215	1.210	1.201	1.198	1.194	1.198	1.199	1.200	1.200	1.200	1.200	1.201	11.08
11.09	1.349	1.320	1.298	1.279	1.262	1.248	1.235	1.224	1.216	1.210	1.201	1.198	1.196	1.198	1.199	1.201	1.201	1.201	1.201	1.202	11.09
11.10	1.350	1.321	1.299	1.280	1.263	1.249	1.236	1.225	1.217	1.211	1.202	1.199	1.196	1.199	1.200	1.201	1.201	1.201	1.201	1.202	11.10
11.11	1.351	1.322	1.300	1.281	1.264	1.250	1.237	1.226	1.218	1.212	1.203	1.200	1.197	1.199	1.200	1.201	1.201	1.201	1.201	1.202	11.11
11.12	1.352	1.323	1.301	1.282	1.265	1.251	1.238	1.227	1.219	1.212	1.204	1.200	1.197	1.200	1.201	1.202	1.202	1.202	1.202	1.202	11.12
11.13	1.353	1.324	1.301	1.282	1.266	1.251	1.238	1.227	1.219	1.213	1.204	1.201	1.198	1.200	1.201	1.202	1.202	1.202	1.202	1.202	11.13
11.14	1.354	1.325	1.302	1.283	1.267	1.252	1.239	1.228	1.220	1.213	1.205	1.201	1.198	1.201	1.202	1.203	1.203	1.203	1.203	1.203	11.14
11.15	1.355	1.326	1.303	1.284	1.268	1.253	1.240	1.229	1.221	1.214	1.206	1.202	1.199	1.201	1.202	1.203	1.203	1.203	1.203	1.203	11.15
11.16	1.356	1.327	1.304	1.285	1.269	1.254	1.241	1.230	1.222	1.215	1.207	1.203	1.200	1.202	1.202	1.204	1.203	1.203	1.203	1.203	11.16
11.17	1.357	1.328	1.305	1.286	1.270	1.255	1.242	1.231	1.223	1.216	1.208	1.203	1.200	1.202	1.203	1.204	1.204	1.204	1.204	1.204	11.17
11.18	1.358	1.329	1.306	1.287	1.271	1.255	1.243	1.231	1.223	1.216	1.208	1.204	1.201	1.203	1.203	1.205	1.204	1.204	1.204	1.204	11.18
11.19	1.359	1.330	1.307	1.288	1.272	1.256	1.244	1.232	1.224	1.217	1.209	1.204	1.201	1.203	1.204	1.205	1.205	1.205	1.205	1.205	11.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
11.20	1.360	1.331	1.308	1.289	1.273	1.257	1.245	1.233	1.225	1.218	1.210	1.205	1.202	1.204	1.204	1.205	1.205	1.205	1.205	1.205	11.20
11.21	1.361	1.332	1.309	1.290	1.274	1.258	1.246	1.234	1.226	1.219	1.211	1.206	1.203	1.204	1.204	1.205	1.205	1.205	1.205	1.205	11.21
11.22	1.362	1.333	1.310	1.291	1.275	1.259	1.247	1.235	1.226	1.219	1.211	1.206	1.203	1.205	1.205	1.206	1.206	1.206	1.206	1.206	11.22
11.23	1.363	1.334	1.311	1.292	1.275	1.259	1.247	1.235	1.227	1.220	1.212	1.207	1.204	1.205	1.205	1.206	1.206	1.206	1.206	1.206	11.23
11.24	1.364	1.335	1.312	1.293	1.276	1.260	1.248	1.236	1.227	1.220	1.212	1.207	1.204	1.206	1.206	1.207	1.207	1.207	1.207	1.207	11.24
11.25	1.365	1.336	1.313	1.294	1.277	1.261	1.249	1.237	1.228	1.221	1.213	1.208	1.205	1.206	1.206	1.207	1.207	1.207	1.207	1.207	11.25
11.26	1.366	1.337	1.314	1.295	1.278	1.262	1.250	1.238	1.229	1.222	1.214	1.209	1.206	1.207	1.207	1.207	1.207	1.207	1.207	1.207	11.26
11.27	1.367	1.338	1.315	1.296	1.279	1.263	1.251	1.239	1.230	1.223	1.215	1.209	1.206	1.207	1.207	1.208	1.208	1.208	1.208	1.208	11.27
11.28	1.368	1.339	1.316	1.297	1.280	1.263	1.251	1.239	1.230	1.223	1.215	1.210	1.207	1.208	1.208	1.208	1.208	1.208	1.208	1.208	11.28
11.29	1.369	1.340	1.317	1.298	1.281	1.264	1.252	1.240	1.231	1.224	1.216	1.210	1.207	1.208	1.208	1.209	1.209	1.209	1.209	1.209	11.29
11.30	1.370	1.341	1.318	1.299	1.282	1.265	1.253	1.241	1.232	1.225	1.217	1.211	1.208	1.209	1.209	1.209	1.209	1.209	1.209	1.209	11.30
11.31	1.371	1.342	1.319	1.300	1.283	1.266	1.254	1.242	1.233	1.226	1.218	1.212	1.209	1.209	1.209	1.209	1.209	1.209	1.209	1.209	11.31
11.32	1.372	1.343	1.320	1.301	1.284	1.267	1.255	1.243	1.234	1.226	1.218	1.212	1.209	1.210	1.210	1.210	1.210	1.210	1.209	1.209	11.32
11.33	1.373	1.344	1.321	1.301	1.284	1.267	1.255	1.243	1.234	1.227	1.219	1.213	1.210	1.210	1.210	1.210	1.210	1.210	1.210	1.210	11.33
11.34	1.374	1.345	1.322	1.302	1.285	1.268	1.256	1.244	1.235	1.227	1.219	1.213	1.210	1.211	1.211	1.211	1.211	1.211	1.210	1.210	11.34
11.35	1.375	1.346	1.323	1.303	1.286	1.269	1.257	1.245	1.236	1.228	1.220	1.214	1.211	1.211	1.211	1.211	1.211	1.211	1.210	1.210	11.35
11.36	1.376	1.347	1.324	1.304	1.287	1.270	1.258	1.246	1.237	1.229	1.221	1.215	1.212	1.212	1.212	1.212	1.212	1.211	1.210	1.210	11.36
11.37	1.377	1.348	1.325	1.305	1.288	1.271	1.259	1.247	1.238	1.230	1.222	1.215	1.212	1.212	1.212	1.212	1.212	1.212	1.211	1.211	11.37
11.38	1.379	1.349	1.326	1.306	1.289	1.271	1.259	1.247	1.238	1.230	1.222	1.216	1.213	1.213	1.213	1.213	1.213	1.212	1.211	1.211	11.38
11.39	1.380	1.350	1.327	1.307	1.290	1.272	1.260	1.248	1.239	1.231	1.223	1.216	1.213	1.213	1.213	1.213	1.213	1.213	1.212	1.212	11.39
11.40	1.381	1.351	1.328	1.308	1.291	1.273	1.261	1.249	1.240	1.232	1.224	1.217	1.214	1.214	1.214	1.214	1.214	1.213	1.212	1.212	11.40
11.41	1.382	1.352	1.329	1.309	1.292	1.274	1.262	1.250	1.241	1.233	1.225	1.218	1.214	1.214	1.214	1.214	1.214	1.213	1.212	1.212	11.41
11.42	1.383	1.353	1.330	1.310	1.293	1.275	1.263	1.251	1.241	1.234	1.225	1.218	1.215	1.215	1.215	1.215	1.215	1.214	1.213	1.212	11.42
11.43	1.384	1.354	1.331	1.311	1.293	1.275	1.263	1.251	1.242	1.234	1.226	1.219	1.216	1.215	1.215	1.215	1.215	1.214	1.213	1.213	11.43
11.44	1.385	1.355	1.332	1.312	1.294	1.276	1.264	1.252	1.242	1.235	1.226	1.219	1.216	1.216	1.216	1.216	1.216	1.215	1.214	1.213	11.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
11.45	1.386	1.356	1.333	1.313	1.295	1.277	1.265	1.253	1.243	1.236	1.227	1.220	1.217	1.216	1.216	1.216	1.216	1.215	1.214	1.213	11.45
11.46	1.387	1.357	1.334	1.314	1.296	1.278	1.266	1.253	1.244	1.237	1.228	1.221	1.218	1.217	1.217	1.217	1.216	1.215	1.214	1.213	11.46
11.47	1.388	1.358	1.335	1.315	1.297	1.279	1.267	1.254	1.245	1.238	1.229	1.222	1.218	1.217	1.217	1.217	1.217	1.216	1.215	1.214	11.47
11.48	1.389	1.360	1.336	1.316	1.298	1.280	1.267	1.254	1.245	1.238	1.229	1.222	1.219	1.218	1.218	1.218	1.217	1.216	1.215	1.214	11.48
11.49	1.390	1.361	1.337	1.317	1.299	1.281	1.268	1.255	1.246	1.239	1.230	1.223	1.219	1.218	1.218	1.218	1.218	1.217	1.216	1.215	11.49
11.50	1.391	1.362	1.338	1.318	1.300	1.282	1.269	1.257	1.247	1.240	1.231	1.224	1.220	1.219	1.219	1.219	1.218	1.217	1.216	1.215	11.50
11.51	1.392	1.363	1.339	1.319	1.301	1.283	1.270	1.258	1.248	1.241	1.232	1.225	1.221	1.220	1.219	1.219	1.218	1.217	1.216	1.215	11.51
11.52	1.393	1.364	1.340	1.320	1.302	1.284	1.271	1.258	1.249	1.242	1.232	1.225	1.221	1.220	1.220	1.220	1.219	1.218	1.217	1.216	11.52
11.53	1.394	1.365	1.341	1.320	1.302	1.284	1.271	1.259	1.249	1.242	1.233	1.226	1.222	1.221	1.220	1.220	1.219	1.218	1.217	1.216	11.53
11.54	1.395	1.366	1.342	1.321	1.303	1.285	1.272	1.259	1.250	1.243	1.233	1.226	1.222	1.221	1.221	1.221	1.220	1.219	1.218	1.217	11.54
11.55	1.396	1.367	1.343	1.322	1.304	1.286	1.273	1.260	1.251	1.244	1.234	1.227	1.223	1.222	1.221	1.221	1.220	1.219	1.218	1.217	11.55
11.56	1.397	1.368	1.344	1.323	1.305	1.287	1.274	1.261	1.252	1.245	1.235	1.228	1.224	1.223	1.222	1.221	1.220	1.219	1.218	1.217	11.56
11.57	1.398	1.369	1.345	1.324	1.306	1.288	1.275	1.262	1.253	1.246	1.236	1.228	1.224	1.223	1.222	1.222	1.221	1.220	1.219	1.218	11.57
11.58	1.400	1.370	1.346	1.325	1.307	1.289	1.275	1.262	1.253	1.246	1.236	1.229	1.225	1.224	1.223	1.222	1.221	1.220	1.219	1.218	11.58
11.59	1.401	1.371	1.347	1.326	1.308	1.290	1.276	1.263	1.254	1.247	1.237	1.229	1.225	1.224	1.223	1.223	1.222	1.221	1.220	1.219	11.59
11.60	1.402	1.372	1.348	1.327	1.309	1.291	1.277	1.264	1.255	1.248	1.238	1.230	1.226	1.225	1.224	1.223	1.222	1.221	1.220	1.219	11.60
11.61	1.403	1.373	1.349	1.328	1.310	1.292	1.278	1.265	1.256	1.249	1.239	1.231	1.227	1.225	1.224	1.223	1.222	1.221	1.220	1.219	11.61
11.62	1.404	1.374	1.350	1.329	1.311	1.293	1.279	1.266	1.256	1.249	1.239	1.231	1.227	1.226	1.225	1.224	1.222	1.221	1.220	1.219	11.62
11.63	1.405	1.375	1.351	1.329	1.311	1.293	1.279	1.267	1.257	1.250	1.240	1.232	1.228	1.226	1.225	1.224	1.223	1.222	1.221	1.220	11.63
11.64	1.406	1.376	1.352	1.330	1.312	1.294	1.280	1.267	1.257	1.250	1.240	1.232	1.228	1.227	1.226	1.225	1.223	1.222	1.221	1.220	11.64
11.65	1.407	1.377	1.353	1.331	1.313	1.295	1.281	1.268	1.258	1.251	1.241	1.233	1.229	1.227	1.226	1.225	1.223	1.222	1.221	1.220	11.65
11.66	1.408	1.378	1.354	1.332	1.314	1.296	1.282	1.269	1.259	1.252	1.242	1.234	1.230	1.228	1.227	1.225	1.223	1.222	1.221	1.220	11.66
11.67	1.409	1.379	1.355	1.333	1.315	1.297	1.283	1.270	1.260	1.253	1.243	1.234	1.230	1.228	1.227	1.226	1.224	1.223	1.222	1.221	11.67
11.68	1.410	1.380	1.356	1.334	1.315	1.298	1.284	1.270	1.260	1.253	1.243	1.235	1.231	1.229	1.228	1.226	1.224	1.223	1.222	1.221	11.68
11.69	1.411	1.381	1.357	1.335	1.316	1.299	1.285	1.271	1.261	1.254	1.244	1.235	1.231	1.229	1.228	1.227	1.225	1.224	1.223	1.222	11.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
11.70	1.412	1.382	1.358	1.336	1.317	1.300	1.286	1.272	1.262	1.255	1.245	1.236	1.232	1.230	1.229	1.227	1.225	1.224	1.223	1.222	11.70
11.71	1.413	1.383	1.359	1.337	1.318	1.301	1.287	1.273	1.263	1.256	1.246	1.237	1.233	1.231	1.230	1.227	1.225	1.224	1.223	1.222	11.71
11.72	1.414	1.384	1.360	1.338	1.319	1.302	1.288	1.274	1.263	1.257	1.246	1.237	1.233	1.231	1.230	1.228	1.226	1.225	1.223	1.223	11.72
11.73	1.415	1.385	1.361	1.338	1.319	1.303	1.288	1.274	1.264	1.257	1.247	1.238	1.234	1.232	1.231	1.228	1.226	1.224	1.224	1.223	11.73
11.74	1.416	1.386	1.362	1.339	1.320	1.304	1.289	1.275	1.264	1.258	1.247	1.238	1.234	1.232	1.231	1.229	1.227	1.226	1.225	1.224	11.74
11.75	1.417	1.387	1.363	1.340	1.321	1.305	1.290	1.276	1.265	1.259	1.248	1.239	1.235	1.233	1.232	1.229	1.227	1.226	1.225	1.224	11.75
11.76	1.418	1.388	1.364	1.341	1.322	1.306	1.291	1.277	1.266	1.260	1.249	1.240	1.236	1.234	1.232	1.229	1.227	1.226	1.225	1.224	11.76
11.77	1.419	1.389	1.365	1.342	1.323	1.307	1.292	1.278	1.267	1.260	1.250	1.241	1.236	1.234	1.233	1.230	1.228	1.227	1.226	1.225	11.77
11.78	1.421	1.390	1.366	1.343	1.324	1.307	1.292	1.278	1.267	1.261	1.250	1.241	1.237	1.235	1.233	1.230	1.228	1.227	1.226	1.225	11.78
11.79	1.422	1.391	1.367	1.344	1.325	1.308	1.293	1.279	1.268	1.261	1.251	1.242	1.237	1.235	1.234	1.231	1.229	1.228	1.227	1.226	11.79
11.80	1.423	1.392	1.368	1.345	1.326	1.309	1.294	1.280	1.269	1.262	1.252	1.243	1.238	1.236	1.234	1.231	1.229	1.228	1.227	1.226	11.80
11.81	1.424	1.393	1.369	1.346	1.327	1.310	1.295	1.281	1.270	1.263	1.253	1.244	1.238	1.236	1.234	1.231	1.229	1.228	1.227	1.226	11.81
11.82	1.425	1.394	1.370	1.347	1.328	1.311	1.296	1.282	1.271	1.264	1.253	1.244	1.239	1.237	1.235	1.232	1.230	1.228	1.227	1.226	11.82
11.83	1.426	1.395	1.371	1.348	1.328	1.311	1.296	1.282	1.271	1.264	1.254	1.245	1.239	1.237	1.235	1.232	1.230	1.229	1.227	1.226	11.83
11.84	1.427	1.396	1.372	1.349	1.329	1.312	1.297	1.283	1.272	1.265	1.254	1.245	1.240	1.238	1.236	1.233	1.231	1.229	1.228	1.227	11.84
11.85	1.428	1.397	1.373	1.350	1.330	1.313	1.298	1.284	1.273	1.266	1.255	1.246	1.240	1.238	1.236	1.233	1.231	1.229	1.228	1.227	11.85
11.86	1.429	1.398	1.374	1.351	1.331	1.314	1.299	1.285	1.274	1.267	1.256	1.247	1.241	1.239	1.237	1.234	1.231	1.229	1.228	1.227	11.86
11.87	1.430	1.399	1.375	1.352	1.332	1.315	1.300	1.286	1.274	1.268	1.257	1.248	1.241	1.239	1.237	1.234	1.232	1.230	1.229	1.228	11.87
11.88	1.431	1.400	1.376	1.353	1.333	1.316	1.300	1.286	1.275	1.268	1.257	1.248	1.242	1.240	1.238	1.235	1.232	1.230	1.229	1.228	11.88
11.89	1.432	1.401	1.377	1.354	1.334	1.317	1.301	1.287	1.276	1.269	1.258	1.249	1.242	1.240	1.238	1.235	1.233	1.231	1.230	1.229	11.89
11.90	1.433	1.402	1.378	1.355	1.335	1.318	1.302	1.288	1.277	1.270	1.259	1.250	1.243	1.241	1.239	1.236	1.233	1.231	1.230	1.229	11.90
11.91	1.434	1.403	1.379	1.356	1.336	1.319	1.303	1.289	1.278	1.271	1.260	1.251	1.244	1.242	1.239	1.236	1.233	1.231	1.230	1.229	11.91
11.92	1.435	1.404	1.380	1.357	1.337	1.320	1.304	1.290	1.278	1.272	1.260	1.251	1.244	1.242	1.240	1.237	1.234	1.232	1.230	1.229	11.92
11.93	1.436	1.405	1.381	1.357	1.337	1.320	1.304	1.290	1.279	1.272	1.261	1.252	1.245	1.243	1.240	1.237	1.234	1.232	1.231	1.230	11.93
11.94	1.437	1.406	1.382	1.358	1.338	1.321	1.305	1.291	1.279	1.273	1.261	1.252	1.245	1.243	1.241	1.238	1.235	1.233	1.231	1.230	11.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
11.95	1.438	1.407	1.383	1.359	1.339	1.322	1.306	1.292	1.280	1.274	1.262	1.253	1.246	1.244	1.241	1.238	1.235	1.233	1.231	1.230	11.95
11.96	1.439	1.408	1.384	1.360	1.340	1.323	1.307	1.293	1.281	1.275	1.263	1.254	1.247	1.245	1.242	1.238	1.235	1.233	1.231	1.230	11.96
11.97	1.440	1.409	1.385	1.361	1.341	1.324	1.308	1.294	1.282	1.276	1.264	1.254	1.247	1.245	1.242	1.239	1.236	1.234	1.232	1.231	11.97
11.98	1.442	1.411	1.386	1.362	1.342	1.325	1.308	1.294	1.282	1.276	1.264	1.255	1.248	1.246	1.243	1.239	1.236	1.234	1.232	1.231	11.98
11.99	1.443	1.412	1.387	1.363	1.343	1.326	1.309	1.295	1.283	1.277	1.265	1.255	1.248	1.246	1.243	1.240	1.237	1.235	1.233	1.232	11.99
12.00	1.444	1.413	1.388	1.364	1.344	1.327	1.310	1.296	1.284	1.278	1.266	1.256	1.249	1.247	1.244	1.240	1.237	1.235	1.233	1.232	12.00
12.01	1.445	1.414	1.389	1.365	1.345	1.328	1.311	1.297	1.285	1.279	1.267	1.257	1.250	1.247	1.244	1.240	1.237	1.235	1.233	1.232	12.01
12.02	1.446	1.415	1.390	1.366	1.346	1.329	1.312	1.297	1.286	1.279	1.267	1.257	1.250	1.248	1.245	1.241	1.237	1.235	1.234	1.233	12.02
12.03	1.447	1.416	1.391	1.366	1.346	1.329	1.312	1.298	1.286	1.280	1.268	1.258	1.251	1.248	1.245	1.241	1.238	1.236	1.234	1.233	12.03
12.04	1.448	1.417	1.392	1.367	1.347	1.330	1.313	1.298	1.287	1.280	1.268	1.258	1.251	1.249	1.246	1.242	1.238	1.236	1.235	1.234	12.04
12.05	1.449	1.418	1.393	1.368	1.348	1.331	1.314	1.299	1.288	1.281	1.269	1.259	1.252	1.249	1.246	1.242	1.238	1.236	1.235	1.234	12.05
12.06	1.450	1.419	1.394	1.369	1.349	1.332	1.315	1.300	1.289	1.282	1.270	1.260	1.253	1.249	1.247	1.242	1.238	1.236	1.235	1.234	12.06
12.07	1.451	1.420	1.395	1.370	1.350	1.333	1.316	1.301	1.290	1.283	1.270	1.260	1.253	1.250	1.247	1.243	1.239	1.237	1.236	1.235	12.07
12.08	1.452	1.421	1.396	1.371	1.351	1.333	1.316	1.301	1.290	1.283	1.271	1.261	1.254	1.250	1.248	1.243	1.239	1.237	1.236	1.235	12.08
12.09	1.453	1.422	1.397	1.372	1.352	1.334	1.317	1.302	1.291	1.284	1.271	1.262	1.254	1.251	1.248	1.244	1.240	1.238	1.237	1.236	12.09
12.10	1.454	1.423	1.398	1.373	1.353	1.335	1.318	1.303	1.292	1.285	1.272	1.262	1.255	1.251	1.249	1.244	1.240	1.238	1.237	1.236	12.10
12.11	1.455	1.424	1.399	1.374	1.354	1.336	1.319	1.304	1.293	1.286	1.273	1.263	1.256	1.252	1.249	1.244	1.240	1.238	1.237	1.236	12.11
12.12	1.456	1.425	1.400	1.375	1.355	1.337	1.320	1.305	1.294	1.286	1.273	1.263	1.256	1.252	1.250	1.245	1.241	1.239	1.237	1.236	12.12
12.13	1.457	1.426	1.401	1.376	1.355	1.337	1.320	1.305	1.294	1.287	1.274	1.264	1.257	1.253	1.250	1.245	1.241	1.239	1.238	1.237	12.13
12.14	1.458	1.427	1.402	1.377	1.356	1.338	1.321	1.306	1.295	1.287	1.274	1.264	1.257	1.253	1.251	1.246	1.242	1.240	1.238	1.237	12.14
12.15	1.459	1.428	1.403	1.378	1.357	1.339	1.322	1.307	1.296	1.288	1.275	1.265	1.258	1.254	1.251	1.246	1.242	1.240	1.238	1.237	12.15
12.16	1.460	1.429	1.404	1.379	1.358	1.340	1.323	1.308	1.297	1.289	1.276	1.266	1.259	1.255	1.252	1.246	1.242	1.240	1.238	1.237	12.16
12.17	1.461	1.430	1.405	1.380	1.359	1.341	1.324	1.309	1.298	1.290	1.277	1.266	1.259	1.255	1.252	1.247	1.243	1.241	1.239	1.238	12.17
12.18	1.463	1.431	1.406	1.381	1.360	1.342	1.324	1.309	1.298	1.290	1.277	1.267	1.260	1.256	1.253	1.247	1.243	1.241	1.239	1.238	12.18
12.19	1.464	1.432	1.407	1.382	1.361	1.343	1.325	1.310	1.299	1.291	1.278	1.267	1.260	1.256	1.253	1.248	1.244	1.242	1.240	1.239	12.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
12.20	1.465	1.433	1.408	1.383	1.362	1.344	1.326	1.311	1.300	1.292	1.279	1.268	1.261	1.257	1.254	1.248	1.244	1.242	1.240	1.239	12.20
12.21	1.466	1.434	1.409	1.384	1.363	1.345	1.327	1.312	1.301	1.293	1.280	1.269	1.262	1.257	1.254	1.248	1.244	1.242	1.240	1.239	12.21
12.22	1.467	1.435	1.410	1.385	1.364	1.346	1.328	1.313	1.302	1.293	1.281	1.269	1.262	1.258	1.255	1.249	1.245	1.243	1.241	1.240	12.22
12.23	1.468	1.436	1.411	1.386	1.364	1.346	1.328	1.313	1.302	1.294	1.281	1.270	1.263	1.258	1.255	1.249	1.245	1.243	1.241	1.240	12.23
12.24	1.469	1.437	1.412	1.387	1.365	1.347	1.329	1.314	1.303	1.294	1.282	1.270	1.263	1.259	1.256	1.250	1.246	1.244	1.242	1.241	12.24
12.25	1.470	1.438	1.413	1.388	1.366	1.348	1.330	1.315	1.304	1.295	1.283	1.271	1.264	1.259	1.256	1.250	1.246	1.244	1.242	1.241	12.25
12.26	1.471	1.439	1.414	1.389	1.367	1.349	1.331	1.316	1.305	1.296	1.284	1.272	1.265	1.260	1.257	1.250	1.246	1.244	1.242	1.241	12.26
12.27	1.472	1.440	1.415	1.390	1.368	1.350	1.332	1.317	1.305	1.297	1.285	1.272	1.265	1.260	1.257	1.251	1.247	1.245	1.243	1.242	12.27
12.28	1.473	1.441	1.416	1.390	1.369	1.351	1.332	1.317	1.306	1.297	1.285	1.273	1.266	1.261	1.258	1.251	1.247	1.245	1.243	1.242	12.28
12.29	1.474	1.442	1.417	1.391	1.370	1.352	1.333	1.318	1.306	1.298	1.286	1.273	1.266	1.261	1.258	1.252	1.248	1.246	1.244	1.243	12.29
12.30	1.475	1.443	1.418	1.392	1.371	1.353	1.334	1.319	1.307	1.299	1.287	1.274	1.267	1.262	1.259	1.252	1.248	1.246	1.244	1.243	12.30
12.31	1.476	1.444	1.419	1.393	1.372	1.354	1.335	1.320	1.308	1.300	1.288	1.275	1.268	1.263	1.259	1.252	1.248	1.246	1.244	1.243	12.31
12.32	1.477	1.445	1.420	1.394	1.373	1.355	1.336	1.321	1.309	1.301	1.288	1.275	1.268	1.263	1.260	1.253	1.249	1.246	1.245	1.244	12.32
12.33	1.478	1.446	1.421	1.395	1.373	1.355	1.336	1.321	1.309	1.301	1.289	1.276	1.269	1.264	1.260	1.253	1.249	1.247	1.245	1.244	12.33
12.34	1.479	1.447	1.422	1.396	1.374	1.356	1.337	1.322	1.310	1.302	1.289	1.276	1.269	1.264	1.261	1.254	1.250	1.247	1.246	1.245	12.34
12.35	1.480	1.448	1.423	1.397	1.375	1.357	1.338	1.323	1.311	1.303	1.290	1.277	1.270	1.265	1.261	1.254	1.250	1.247	1.246	1.245	12.35
12.36	1.481	1.449	1.424	1.398	1.376	1.358	1.339	1.324	1.312	1.304	1.291	1.278	1.271	1.266	1.262	1.254	1.250	1.247	1.246	1.245	12.36
12.37	1.482	1.450	1.425	1.399	1.377	1.359	1.340	1.325	1.313	1.305	1.291	1.279	1.271	1.266	1.262	1.255	1.251	1.248	1.247	1.246	12.37
12.38	1.484	1.451	1.426	1.400	1.378	1.360	1.340	1.325	1.313	1.305	1.292	1.279	1.272	1.267	1.263	1.255	1.251	1.248	1.247	1.246	12.38
12.39	1.485	1.452	1.427	1.401	1.379	1.361	1.341	1.326	1.314	1.306	1.292	1.280	1.272	1.267	1.263	1.256	1.252	1.249	1.248	1.247	12.39
12.40	1.486	1.453	1.428	1.402	1.380	1.362	1.342	1.327	1.315	1.307	1.293	1.281	1.273	1.268	1.264	1.256	1.252	1.249	1.248	1.247	12.40
12.41	1.487	1.454	1.429	1.403	1.381	1.363	1.343	1.328	1.316	1.308	1.294	1.282	1.274	1.268	1.264	1.256	1.252	1.249	1.248	1.247	12.41
12.42	1.488	1.455	1.430	1.404	1.382	1.364	1.344	1.328	1.317	1.308	1.294	1.282	1.274	1.269	1.265	1.257	1.253	1.249	1.248	1.247	12.42
12.43	1.489	1.456	1.431	1.405	1.382	1.364	1.344	1.329	1.317	1.309	1.295	1.283	1.275	1.269	1.265	1.257	1.253	1.250	1.249	1.248	12.43
12.44	1.490	1.457	1.432	1.406	1.383	1.365	1.345	1.329	1.318	1.309	1.295	1.283	1.275	1.270	1.266	1.258	1.254	1.250	1.249	1.248	12.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
12.45	1.491	1.458	1.433	1.407	1.384	1.366	1.346	1.330	1.319	1.310	1.296	1.284	1.276	1.270	1.266	1.258	1.254	1.250	1.249	1.248	12.45
12.46	1.492	1.459	1.434	1.408	1.385	1.367	1.347	1.331	1.320	1.311	1.297	1.285	1.277	1.271	1.267	1.259	1.254	1.250	1.249	1.248	12.46
12.47	1.493	1.460	1.435	1.409	1.386	1.368	1.348	1.332	1.321	1.311	1.298	1.286	1.277	1.271	1.267	1.259	1.255	1.251	1.250	1.249	12.47
12.48	1.494	1.462	1.436	1.409	1.387	1.368	1.348	1.332	1.321	1.312	1.298	1.286	1.278	1.272	1.268	1.260	1.255	1.251	1.250	1.249	12.48
12.49	1.495	1.463	1.437	1.410	1.388	1.369	1.349	1.333	1.322	1.312	1.299	1.287	1.278	1.272	1.268	1.260	1.256	1.252	1.251	1.250	12.49
12.50	1.496	1.464	1.438	1.411	1.389	1.370	1.350	1.334	1.323	1.313	1.300	1.288	1.279	1.273	1.269	1.261	1.256	1.252	1.251	1.250	12.50
12.51	1.497	1.465	1.439	1.412	1.390	1.371	1.351	1.335	1.324	1.314	1.301	1.288	1.280	1.273	1.269	1.261	1.256	1.252	1.251	1.250	12.51
12.52	1.498	1.466	1.440	1.413	1.391	1.372	1.352	1.336	1.324	1.315	1.301	1.289	1.280	1.274	1.270	1.262	1.257	1.253	1.251	1.250	12.52
12.53	1.499	1.467	1.441	1.414	1.392	1.372	1.352	1.336	1.325	1.315	1.302	1.289	1.281	1.274	1.270	1.262	1.257	1.253	1.252	1.251	12.53
12.54	1.500	1.468	1.442	1.415	1.393	1.373	1.353	1.337	1.325	1.316	1.302	1.290	1.281	1.275	1.271	1.263	1.258	1.254	1.252	1.251	12.54
12.55	1.501	1.469	1.443	1.416	1.394	1.374	1.354	1.338	1.326	1.317	1.303	1.290	1.282	1.275	1.271	1.263	1.258	1.254	1.252	1.251	12.55
12.56	1.502	1.470	1.444	1.417	1.395	1.375	1.355	1.339	1.327	1.318	1.304	1.291	1.283	1.276	1.271	1.263	1.258	1.254	1.252	1.251	12.56
12.57	1.503	1.471	1.445	1.418	1.396	1.376	1.356	1.340	1.328	1.319	1.305	1.291	1.283	1.276	1.272	1.264	1.259	1.255	1.253	1.252	12.57
12.58	1.505	1.472	1.446	1.418	1.397	1.377	1.356	1.340	1.328	1.319	1.305	1.292	1.284	1.277	1.272	1.264	1.259	1.255	1.253	1.252	12.58
12.59	1.506	1.473	1.447	1.419	1.398	1.378	1.357	1.341	1.329	1.320	1.306	1.292	1.284	1.277	1.273	1.265	1.260	1.256	1.254	1.253	12.59
12.60	1.507	1.474	1.448	1.420	1.399	1.379	1.358	1.342	1.330	1.321	1.307	1.293	1.285	1.278	1.273	1.265	1.260	1.256	1.254	1.253	12.60
12.61	1.508	1.475	1.449	1.421	1.400	1.380	1.359	1.343	1.331	1.322	1.308	1.294	1.286	1.278	1.274	1.265	1.260	1.256	1.254	1.253	12.61
12.62	1.509	1.476	1.450	1.422	1.401	1.381	1.360	1.344	1.332	1.323	1.308	1.295	1.286	1.279	1.274	1.266	1.260	1.256	1.255	1.254	12.62
12.63	1.510	1.477	1.451	1.423	1.402	1.381	1.360	1.344	1.332	1.323	1.309	1.295	1.287	1.279	1.275	1.266	1.261	1.257	1.255	1.254	12.63
12.64	1.511	1.478	1.452	1.424	1.403	1.382	1.361	1.345	1.333	1.324	1.309	1.296	1.287	1.280	1.275	1.267	1.261	1.257	1.256	1.255	12.64
12.65	1.512	1.479	1.453	1.425	1.404	1.383	1.362	1.346	1.334	1.325	1.310	1.297	1.288	1.280	1.276	1.267	1.261	1.257	1.256	1.255	12.65
12.66	1.513	1.480	1.454	1.426	1.405	1.384	1.363	1.347	1.335	1.326	1.311	1.298	1.289	1.281	1.277	1.267	1.261	1.257	1.256	1.255	12.66
12.67	1.514	1.481	1.455	1.427	1.406	1.385	1.364	1.348	1.335	1.327	1.312	1.298	1.289	1.281	1.277	1.268	1.262	1.258	1.257	1.256	12.67
12.68	1.515	1.482	1.456	1.428	1.407	1.386	1.365	1.348	1.336	1.327	1.312	1.299	1.290	1.282	1.278	1.268	1.262	1.258	1.257	1.256	12.68
12.69	1.516	1.483	1.457	1.429	1.408	1.387	1.366	1.349	1.336	1.328	1.313	1.299	1.290	1.282	1.278	1.269	1.263	1.259	1.258	1.257	12.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
12.70	1.517	1.484	1.458	1.430	1.409	1.388	1.367	1.350	1.337	1.329	1.314	1.300	1.291	1.283	1.279	1.269	1.263	1.259	1.258	1.257	12.70
12.71	1.518	1.485	1.459	1.431	1.410	1.389	1.368	1.351	1.338	1.330	1.315	1.301	1.292	1.284	1.279	1.269	1.263	1.259	1.258	1.257	12.71
12.72	1.519	1.486	1.460	1.432	1.411	1.390	1.369	1.352	1.339	1.330	1.315	1.301	1.292	1.284	1.280	1.270	1.264	1.260	1.258	1.257	12.72
12.73	1.520	1.487	1.461	1.433	1.411	1.390	1.369	1.352	1.339	1.331	1.316	1.302	1.293	1.285	1.280	1.270	1.264	1.260	1.259	1.258	12.73
12.74	1.521	1.488	1.462	1.434	1.412	1.391	1.370	1.353	1.340	1.331	1.316	1.302	1.293	1.285	1.281	1.271	1.265	1.261	1.259	1.258	12.74
12.75	1.522	1.489	1.463	1.435	1.413	1.392	1.371	1.354	1.341	1.332	1.317	1.303	1.294	1.286	1.281	1.271	1.265	1.261	1.259	1.258	12.75
12.76	1.523	1.490	1.464	1.436	1.414	1.393	1.372	1.355	1.342	1.333	1.318	1.304	1.295	1.287	1.281	1.271	1.265	1.261	1.259	1.258	12.76
12.77	1.524	1.491	1.465	1.437	1.415	1.394	1.373	1.356	1.343	1.334	1.319	1.304	1.295	1.287	1.282	1.272	1.266	1.262	1.260	1.259	12.77
12.78	1.525	1.493	1.466	1.437	1.416	1.395	1.373	1.356	1.343	1.334	1.319	1.305	1.296	1.288	1.282	1.272	1.266	1.262	1.260	1.259	12.78
12.79	1.526	1.494	1.467	1.438	1.417	1.396	1.374	1.357	1.344	1.335	1.320	1.305	1.296	1.288	1.283	1.273	1.267	1.263	1.261	1.260	12.79
12.80	1.527	1.495	1.468	1.439	1.418	1.397	1.375	1.358	1.345	1.336	1.321	1.306	1.297	1.289	1.283	1.273	1.267	1.263	1.261	1.260	12.80
12.81	1.528	1.496	1.469	1.440	1.419	1.398	1.376	1.359	1.346	1.337	1.322	1.307	1.297	1.289	1.284	1.273	1.267	1.263	1.261	1.260	12.81
12.82	1.529	1.497	1.470	1.441	1.420	1.399	1.377	1.360	1.346	1.337	1.322	1.307	1.298	1.290	1.284	1.274	1.268	1.264	1.262	1.260	12.82
12.83	1.530	1.498	1.471	1.442	1.420	1.399	1.377	1.360	1.347	1.338	1.323	1.308	1.298	1.290	1.285	1.274	1.268	1.264	1.262	1.261	12.83
12.84	1.531	1.499	1.472	1.443	1.421	1.400	1.378	1.361	1.347	1.338	1.323	1.308	1.299	1.291	1.285	1.275	1.269	1.265	1.263	1.261	12.84
12.85	1.532	1.500	1.473	1.444	1.422	1.401	1.379	1.362	1.348	1.339	1.324	1.309	1.299	1.291	1.286	1.275	1.269	1.265	1.263	1.261	12.85
12.86	1.533	1.501	1.474	1.445	1.423	1.402	1.380	1.363	1.349	1.340	1.325	1.310	1.300	1.292	1.287	1.275	1.269	1.265	1.263	1.262	12.86
12.87	1.534	1.502	1.475	1.446	1.424	1.403	1.381	1.363	1.350	1.340	1.326	1.310	1.300	1.292	1.287	1.276	1.270	1.266	1.264	1.262	12.87
12.88	1.535	1.503	1.475	1.447	1.425	1.403	1.381	1.364	1.350	1.341	1.326	1.311	1.301	1.293	1.288	1.276	1.270	1.266	1.264	1.262	12.88
12.89	1.536	1.504	1.476	1.448	1.426	1.404	1.382	1.364	1.351	1.341	1.327	1.311	1.301	1.293	1.288	1.277	1.271	1.267	1.265	1.263	12.89
12.90	1.537	1.505	1.477	1.449	1.427	1.405	1.383	1.365	1.352	1.342	1.328	1.312	1.302	1.294	1.289	1.277	1.271	1.267	1.265	1.263	12.90
12.91	1.538	1.506	1.478	1.450	1.428	1.406	1.384	1.366	1.353	1.343	1.329	1.313	1.303	1.295	1.289	1.277	1.271	1.267	1.265	1.263	12.91
12.92	1.539	1.507	1.479	1.451	1.429	1.407	1.385	1.367	1.354	1.344	1.329	1.313	1.303	1.295	1.290	1.278	1.271	1.267	1.265	1.264	12.92
12.93	1.540	1.508	1.480	1.452	1.429	1.407	1.385	1.367	1.354	1.344	1.330	1.314	1.304	1.296	1.290	1.278	1.272	1.268	1.266	1.264	12.93
12.94	1.541	1.509	1.481	1.453	1.430	1.408	1.386	1.368	1.355	1.345	1.330	1.314	1.304	1.296	1.291	1.279	1.272	1.268	1.266	1.265	12.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
12.95	1.542	1.510	1.482	1.454	1.431	1.409	1.387	1.369	1.356	1.346	1.331	1.315	1.305	1.297	1.291	1.279	1.272	1.268	1.266	1.265	12.95
12.96	1.543	1.511	1.483	1.455	1.432	1.410	1.388	1.370	1.357	1.347	1.332	1.316	1.306	1.298	1.291	1.279	1.272	1.268	1.266	1.265	12.96
12.97	1.544	1.512	1.484	1.456	1.433	1.411	1.389	1.371	1.358	1.348	1.333	1.317	1.306	1.298	1.292	1.280	1.273	1.269	1.267	1.266	12.97
12.98	1.546	1.513	1.485	1.456	1.434	1.412	1.389	1.372	1.358	1.348	1.333	1.317	1.307	1.299	1.292	1.280	1.273	1.269	1.267	1.266	12.98
12.99	1.547	1.514	1.486	1.457	1.435	1.413	1.390	1.373	1.359	1.349	1.334	1.318	1.307	1.299	1.293	1.281	1.274	1.270	1.268	1.267	12.99
13.00	1.548	1.515	1.487	1.458	1.436	1.414	1.391	1.374	1.360	1.350	1.335	1.319	1.308	1.300	1.293	1.281	1.274	1.270	1.268	1.267	13.00
13.01	1.549	1.516	1.488	1.459	1.437	1.415	1.392	1.375	1.361	1.351	1.366	1.319	1.308	1.300	1.293	1.281	1.274	1.270	1.268	1.267	13.01
13.02	1.550	1.517	1.489	1.460	1.438	1.416	1.393	1.376	1.362	1.352	1.336	1.320	1.309	1.301	1.294	1.282	1.275	1.270	1.268	1.267	13.02
13.03	1.551	1.518	1.490	1.461	1.438	1.416	1.393	1.376	1.362	1.352	1.377	1.320	1.309	1.301	1.294	1.282	1.275	1.271	1.269	1.268	13.03
13.04	1.552	1.519	1.491	1.462	1.439	1.417	1.394	1.377	1.363	1.353	1.337	1.321	1.310	1.302	1.295	1.283	1.276	1.271	1.269	1.268	13.04
13.05	1.553	1.520	1.492	1.463	1.440	1.418	1.395	1.378	1.364	1.354	1.338	1.321	1.310	1.302	1.295	1.283	1.276	1.271	1.269	1.268	13.05
13.06	1.554	1.521	1.493	1.464	1.441	1.419	1.396	1.379	1.365	1.355	1.339	1.322	1.311	1.302	1.296	1.284	1.276	1.271	1.269	1.268	13.06
13.07	1.555	1.522	1.494	1.465	1.442	1.420	1.397	1.379	1.365	1.356	1.339	1.322	1.311	1.303	1.296	1.284	1.277	1.272	1.270	1.269	13.07
13.08	1.556	1.523	1.495	1.466	1.443	1.420	1.397	1.380	1.366	1.356	1.340	1.323	1.312	1.303	1.297	1.285	1.277	1.272	1.270	1.269	13.08
13.09	1.557	1.524	1.496	1.467	1.444	1.421	1.398	1.380	1.366	1.357	1.340	1.323	1.312	1.304	1.297	1.285	1.278	1.273	1.271	1.270	13.09
13.10	1.558	1.525	1.497	1.468	1.445	1.422	1.399	1.381	1.367	1.358	1.341	1.324	1.313	1.304	1.298	1.286	1.278	1.273	1.271	1.270	13.10
13.11	1.559	1.526	1.498	1.469	1.446	1.423	1.400	1.382	1.368	1.359	1.342	1.325	1.314	1.305	1.298	1.286	1.278	1.273	1.271	1.270	13.11
13.12	1.560	1.527	1.499	1.470	1.447	1.424	1.401	1.383	1.369	1.359	1.343	1.325	1.314	1.305	1.299	1.287	1.279	1.274	1.272	1.270	13.12
13.13	1.561	1.528	1.500	1.471	1.447	1.424	1.401	1.383	1.369	1.360	1.343	1.326	1.315	1.306	1.299	1.287	1.279	1.274	1.272	1.271	13.13
13.14	1.562	1.529	1.501	1.472	1.448	1.425	1.402	1.384	1.370	1.360	1.344	1.326	1.315	1.306	1.300	1.288	1.280	1.275	1.273	1.271	13.14
13.15	1.563	1.530	1.502	1.473	1.449	1.426	1.403	1.385	1.371	1.361	1.345	1.327	1.316	1.307	1.300	1.288	1.280	1.275	1.273	1.271	13.15
13.16	1.564	1.531	1.503	1.474	1.450	1.427	1.404	1.386	1.372	1.362	1.346	1.328	1.317	1.308	1.301	1.288	1.280	1.275	1.273	1.271	13.16
13.17	1.565	1.532	1.504	1.475	1.451	1.428	1.405	1.387	1.372	1.362	1.347	1.329	1.318	1.308	1.301	1.289	1.281	1.276	1.274	1.272	13.17
13.18	1.566	1.533	1.505	1.475	1.451	1.429	1.406	1.387	1.373	1.363	1.347	1.329	1.318	1.309	1.302	1.289	1.281	1.276	1.274	1.272	13.18
13.19	1.567	1.534	1.506	1.476	1.452	1.430	1.407	1.388	1.373	1.363	1.348	1.330	1.319	1.309	1.302	1.290	1.282	1.277	1.275	1.273	13.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
13.20	1.568	1.535	1.507	1.477	1.453	1.431	1.408	1.389	1.374	1.364	1.349	1.331	1.320	1.310	1.303	1.290	1.282	1.277	1.275	1.273	13.20
13.21	1.569	1.536	1.508	1.478	1.454	1.432	1.409	1.390	1.375	1.365	1.350	1.332	1.320	1.311	1.303	1.290	1.282	1.277	1.275	1.273	13.21
13.22	1.570	1.537	1.509	1.479	1.455	1.433	1.410	1.391	1.376	1.366	1.350	1.332	1.321	1.311	1.304	1.291	1.283	1.277	1.275	1.274	13.22
13.23	1.571	1.538	1.510	1.480	1.456	1.433	1.410	1.391	1.376	1.366	1.351	1.333	1.321	1.312	1.304	1.291	1.283	1.278	1.276	1.275	13.23
13.24	1.572	1.539	1.511	1.481	1.457	1.434	1.411	1.392	1.377	1.367	1.351	1.333	1.322	1.312	1.305	1.292	1.284	1.278	1.276	1.275	13.24
13.25	1.573	1.540	1.512	1.482	1.458	1.435	1.412	1.393	1.378	1.368	1.352	1.334	1.322	1.313	1.305	1.292	1.284	1.278	1.276	1.275	13.25
13.26	1.574	1.541	1.513	1.483	1.459	1.436	1.413	1.394	1.379	1.369	1.353	1.335	1.323	1.314	1.306	1.292	1.284	1.278	1.276	1.275	13.26
13.27	1.575	1.542	1.514	1.484	1.460	1.437	1.414	1.395	1.380	1.370	1.353	1.335	1.323	1.314	1.306	1.293	1.285	1.279	1.277	1.276	13.27
13.28	1.576	1.544	1.515	1.484	1.461	1.438	1.414	1.396	1.380	1.370	1.354	1.336	1.324	1.315	1.307	1.293	1.285	1.279	1.277	1.276	13.28
13.29	1.577	1.545	1.516	1.485	1.462	1.439	1.415	1.397	1.381	1.371	1.354	1.336	1.324	1.315	1.307	1.294	1.286	1.280	1.278	1.277	13.29
13.30	1.578	1.546	1.517	1.486	1.463	1.440	1.416	1.398	1.382	1.372	1.355	1.337	1.325	1.316	1.308	1.294	1.286	1.280	1.278	1.277	13.30
13.31	1.579	1.547	1.518	1.487	1.464	1.441	1.417	1.399	1.383	1.373	1.356	1.338	1.326	1.316	1.308	1.294	1.286	1.280	1.278	1.277	13.31
13.32	1.580	1.548	1.519	1.488	1.465	1.442	1.418	1.399	1.383	1.373	1.356	1.338	1.326	1.317	1.309	1.295	1.286	1.280	1.278	1.277	13.32
13.33	1.581	1.549	1.519	1.489	1.465	1.442	1.418	1.400	1.384	1.374	1.357	1.339	1.327	1.317	1.309	1.295	1.287	1.281	1.279	1.278	13.33
13.34	1.582	1.550	1.520	1.490	1.466	1.443	1.419	1.400	1.384	1.374	1.357	1.339	1.327	1.318	1.310	1.296	1.287	1.281	1.279	1.278	13.34
13.35	1.583	1.551	1.521	1.491	1.467	1.444	1.420	1.401	1.385	1.375	1.358	1.340	1.328	1.318	1.310	1.296	1.287	1.281	1.279	1.278	13.35
13.36	1.584	1.552	1.522	1.492	1.468	1.445	1.421	1.402	1.386	1.376	1.359	1.341	1.329	1.319	1.311	1.296	1.287	1.281	1.279	1.278	13.36
13.37	1.585	1.553	1.523	1.493	1.469	1.446	1.422	1.402	1.387	1.377	1.360	1.341	1.329	1.319	1.311	1.297	1.288	1.282	1.280	1.279	13.37
13.38	1.587	1.554	1.524	1.493	1.470	1.447	1.422	1.403	1.387	1.377	1.360	1.342	1.330	1.320	1.312	1.297	1.288	1.282	1.280	1.279	13.38
13.39	1.588	1.556	1.525	1.494	1.471	1.448	1.423	1.403	1.388	1.378	1.361	1.342	1.330	1.320	1.312	1.298	1.289	1.283	1.281	1.280	13.39
13.40	1.589	1.556	1.526	1.495	1.472	1.449	1.424	1.404	1.389	1.379	1.362	1.343	1.331	1.321	1.313	1.298	1.289	1.283	1.281	1.280	13.40
13.41	1.590	1.557	1.527	1.496	1.473	1.450	1.425	1.405	1.390	1.380	1.363	1.344	1.332	1.321	1.313	1.298	1.289	1.283	1.281	1.280	13.41
13.42	1.591	1.558	1.528	1.497	1.474	1.451	1.426	1.406	1.391	1.380	1.363	1.344	1.332	1.322	1.314	1.299	1.290	1.284	1.282	1.280	13.42
13.43	1.592	1.559	1.529	1.498	1.474	1.451	1.426	1.406	1.391	1.381	1.364	1.345	1.333	1.322	1.314	1.299	1.290	1.284	1.282	1.281	13.43
13.44	1.593	1.560	1.530	1.499	1.475	1.452	1.427	1.407	1.392	1.381	1.364	1.345	1.333	1.323	1.315	1.300	1.291	1.285	1.283	1.281	13.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
13.45	1.594	1.561	1.531	1.500	1.476	1.453	1.428	1.408	1.393	1.382	1.365	1.346	1.334	1.323	1.315	1.300	1.291	1.285	1.283	1.281	13.45
13.46	1.595	1.562	1.532	1.501	1.477	1.454	1.429	1.409	1.394	1.383	1.366	1.347	1.335	1.324	1.315	1.300	1.291	1.285	1.283	1.281	13.46
13.47	1.596	1.563	1.533	1.502	1.478	1.455	1.430	1.410	1.395	1.384	1.367	1.347	1.335	1.324	1.316	1.301	1.292	1.286	1.284	1.282	13.47
13.48	1.597	1.564	1.534	1.502	1.478	1.455	1.430	1.410	1.395	1.384	1.367	1.348	1.336	1.325	1.316	1.301	1.292	1.286	1.284	1.282	13.48
13.49	1.598	1.565	1.535	1.503	1.480	1.456	1.431	1.411	1.396	1.385	1.368	1.348	1.336	1.325	1.317	1.302	1.293	1.287	1.285	1.283	13.49
13.50	1.599	1.566	1.536	1.504	1.481	1.457	1.432	1.412	1.397	1.386	1.369	1.337	1.337	1.326	1.317	1.302	1.293	1.287	1.285	1.283	13.50
13.51	1.600	1.567	1.537	1.505	1.482	1.458	1.433	1.413	1.398	1.387	1.370	1.338	1.338	1.326	1.317	1.302	1.293	1.287	1.285	1.283	13.51
13.52	1.601	1.568	1.538	1.506	1.483	1.459	1.434	1.414	1.398	1.387	1.370	1.350	1.338	1.327	1.318	1.303	1.294	1.288	1.286	1.284	13.52
13.53	1.602	1.569	1.539	1.507	1.483	1.459	1.434	1.414	1.399	1.388	1.371	1.351	1.339	1.327	1.318	1.303	1.294	1.288	1.286	1.284	13.53
13.54	1.603	1.570	1.540	1.508	1.484	1.460	1.435	1.415	1.399	1.388	1.371	1.351	1.339	1.328	1.319	1.304	1.295	1.289	1.287	1.284	13.54
13.55	1.604	1.571	1.541	1.509	1.485	1.461	1.436	1.416	1.400	1.389	1.372	1.352	1.340	1.328	1.319	1.304	1.295	1.289	1.287	1.285	13.55
13.56	1.605	1.572	1.542	1.510	1.486	1.462	1.437	1.417	1.401	1.390	1.373	1.353	1.341	1.329	1.320	1.304	1.295	1.289	1.287	1.285	13.56
13.57	1.606	1.573	1.543	1.511	1.487	1.463	1.438	1.418	1.402	1.391	1.374	1.353	1.341	1.329	1.320	1.305	1.296	1.290	1.288	1.286	13.57
13.58	1.607	1.575	1.544	1.512	1.488	1.464	1.438	1.418	1.402	1.391	1.374	1.354	1.342	1.330	1.321	1.305	1.296	1.290	1.288	1.286	13.58
13.59	1.608	1.576	1.545	1.513	1.489	1.465	1.439	1.419	1.403	1.392	1.375	1.354	1.342	1.330	1.321	1.306	1.297	1.291	1.289	1.287	13.59
13.60	1.609	1.577	1.546	1.514	1.490	1.466	1.440	1.420	1.404	1.393	1.376	1.355	1.343	1.331	1.322	1.306	1.297	1.291	1.289	1.287	13.60
13.61	1.610	1.578	1.547	1.515	1.491	1.467	1.441	1.421	1.405	1.394	1.377	1.356	1.344	1.332	1.322	1.306	1.297	1.291	1.289	1.287	13.61
13.62	1.611	1.579	1.548	1.516	1.492	1.468	1.442	1.422	1.406	1.394	1.377	1.356	1.344	1.332	1.323	1.307	1.297	1.291	1.289	1.288	13.62
13.63	1.612	1.580	1.549	1.516	1.492	1.468	1.442	1.422	1.406	1.395	1.378	1.357	1.345	1.333	1.323	1.307	1.298	1.292	1.290	1.288	13.63
13.64	1.613	1.581	1.550	1.517	1.493	1.469	1.443	1.423	1.407	1.395	1.378	1.357	1.345	1.333	1.324	1.308	1.298	1.292	1.290	1.288	13.64
13.65	1.614	1.582	1.551	1.518	1.494	1.470	1.444	1.424	1.408	1.396	1.379	1.358	1.346	1.334	1.324	1.308	1.298	1.292	1.290	1.288	13.65
13.66	1.615	1.583	1.552	1.519	1.495	1.471	1.445	1.425	1.409	1.397	1.380	1.359	1.347	1.335	1.325	1.308	1.298	1.292	1.290	1.288	13.66
13.67	1.616	1.584	1.553	1.520	1.496	1.472	1.446	1.426	1.410	1.398	1.380	1.359	1.347	1.335	1.325	1.309	1.299	1.293	1.291	1.288	13.67
13.68	1.617	1.585	1.554	1.521	1.497	1.473	1.446	1.426	1.410	1.398	1.381	1.360	1.348	1.336	1.326	1.309	1.299	1.293	1.291	1.289	13.68
13.69	1.618	1.586	1.555	1.522	1.498	1.474	1.447	1.427	1.411	1.399	1.381	1.360	1.348	1.336	1.326	1.310	1.300	1.294	1.292	1.290	13.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
13.70	1.619	1.587	1.556	1.523	1.499	1.475	1.448	1.428	1.412	1.400	1.382	1.361	1.349	1.337	1.327	1.310	1.300	1.294	1.292	1.290	13.70
13.71	1.620	1.588	1.557	1.524	1.500	1.476	1.449	1.429	1.413	1.401	1.383	1.362	1.349	1.337	1.327	1.310	1.300	1.294	1.292	1.290	13.71
13.72	1.621	1.589	1.558	1.525	1.501	1.477	1.450	1.430	1.414	1.402	1.383	1.362	1.350	1.338	1.328	1.311	1.300	1.295	1.292	1.290	13.72
13.73	1.622	1.590	1.559	1.525	1.501	1.477	1.450	1.430	1.414	1.402	1.384	1.363	1.350	1.338	1.328	1.311	1.301	1.295	1.293	1.291	13.73
13.74	1.623	1.591	1.560	1.526	1.502	1.478	1.451	1.431	1.415	1.403	1.384	1.363	1.351	1.339	1.329	1.312	1.301	1.296	1.293	1.291	13.74
13.75	1.624	1.592	1.561	1.527	1.503	1.479	1.452	1.432	1.416	1.404	1.385	1.364	1.351	1.339	1.329	1.312	1.301	1.296	1.293	1.291	13.75
13.76	1.625	1.593	1.562	1.528	1.504	1.480	1.453	1.433	1.417	1.405	1.386	1.365	1.352	1.340	1.330	1.312	1.301	1.296	1.293	1.291	13.76
13.77	1.626	1.594	1.563	1.529	1.505	1.481	1.454	1.434	1.417	1.406	1.387	1.366	1.352	1.340	1.330	1.313	1.302	1.297	1.294	1.292	13.77
13.78	1.628	1.595	1.564	1.530	1.506	1.481	1.454	1.434	1.418	1.406	1.387	1.366	1.353	1.341	1.331	1.313	1.302	1.297	1.294	1.292	13.78
13.79	1.629	1.596	1.565	1.531	1.507	1.482	1.455	1.435	1.418	1.407	1.388	1.367	1.353	1.341	1.331	1.314	1.303	1.298	1.295	1.293	13.79
13.80	1.630	1.597	1.566	1.532	1.508	1.483	1.456	1.436	1.419	1.408	1.389	1.368	1.354	1.342	1.332	1.314	1.303	1.298	1.295	1.293	13.80
13.81	1.631	1.598	1.567	1.533	1.509	1.484	1.457	1.437	1.420	1.409	1.390	1.369	1.355	1.343	1.332	1.314	1.303	1.298	1.295	1.293	13.81
13.82	1.632	1.599	1.568	1.534	1.510	1.485	1.458	1.437	1.421	1.409	1.391	1.369	1.355	1.343	1.333	1.315	1.304	1.299	1.296	1.294	13.82
13.83	1.633	1.600	1.569	1.535	1.511	1.485	1.458	1.438	1.421	1.410	1.391	1.370	1.356	1.344	1.333	1.315	1.304	1.299	1.296	1.294	13.83
13.84	1.634	1.601	1.570	1.536	1.512	1.486	1.459	1.438	1.422	1.410	1.392	1.370	1.356	1.344	1.334	1.316	1.305	1.300	1.297	1.295	13.84
13.85	1.635	1.602	1.571	1.537	1.513	1.487	1.460	1.439	1.423	1.411	1.393	1.371	1.357	1.345	1.334	1.316	1.305	1.300	1.297	1.295	13.85
13.86	1.636	1.603	1.572	1.538	1.514	1.488	1.461	1.440	1.424	1.412	1.394	1.372	1.358	1.346	1.335	1.316	1.305	1.300	1.297	1.295	13.86
13.87	1.637	1.604	1.573	1.539	1.515	1.489	1.462	1.441	1.424	1.412	1.395	1.372	1.358	1.346	1.335	1.317	1.306	1.300	1.298	1.296	13.87
13.88	1.638	1.606	1.573	1.540	1.515	1.490	1.463	1.441	1.425	1.413	1.395	1.373	1.359	1.347	1.336	1.317	1.306	1.301	1.298	1.296	13.88
13.89	1.639	1.607	1.574	1.541	1.516	1.491	1.464	1.442	1.425	1.413	1.396	1.373	1.359	1.347	1.336	1.318	1.307	1.301	1.299	1.297	13.89
13.90	1.640	1.608	1.574	1.542	1.517	1.492	1.465	1.443	1.426	1.414	1.397	1.374	1.360	1.348	1.337	1.318	1.307	1.301	1.299	1.297	13.90
13.91	1.641	1.609	1.576	1.543	1.518	1.493	1.466	1.444	1.427	1.415	1.397	1.375	1.361	1.348	1.337	1.318	1.307	1.301	1.299	1.297	13.91
13.92	1.642	1.610	1.577	1.544	1.519	1.494	1.467	1.445	1.428	1.416	1.398	1.375	1.361	1.349	1.338	1.319	1.308	1.301	1.299	1.297	13.92
13.93	1.643	1.611	1.578	1.544	1.520	1.494	1.467	1.445	1.428	1.416	1.398	1.376	1.362	1.349	1.338	1.319	1.308	1.302	1.300	1.298	13.93
13.94	1.644	1.612	1.579	1.545	1.521	1.495	1.468	1.446	1.429	1.417	1.399	1.376	1.362	1.350	1.339	1.320	1.309	1.302	1.300	1.298	13.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
13.95	1.645	1.613	1.580	1.546	1.522	1.496	1.469	1.447	1.430	1.417	1.399	1.377	1.363	1.350	1.339	1.320	1.309	1.302	1.300	1.298	13.95
13.96	1.646	1.614	1.581	1.547	1.523	1.497	1.470	1.448	1.431	1.418	1.400	1.378	1.364	1.351	1.339	1.320	1.309	1.302	1.300	1.298	13.96
13.97	1.647	1.615	1.582	1.548	1.524	1.498	1.471	1.449	1.432	1.419	1.400	1.378	1.364	1.351	1.340	1.321	1.310	1.303	1.301	1.299	13.97
13.98	1.648	1.616	1.583	1.548	1.524	1.498	1.471	1.449	1.432	1.419	1.401	1.379	1.365	1.352	1.340	1.321	1.310	1.303	1.301	1.299	13.98
13.99	1.649	1.617	1.584	1.549	1.525	1.499	1.472	1.450	1.433	1.420	1.401	1.379	1.365	1.352	1.341	1.321	1.311	1.304	1.302	1.300	13.99
14.00	1.650	1.618	1.585	1.550	1.526	1.500	1.473	1.451	1.434	1.421	1.402	1.380	1.366	1.353	1.341	1.322	1.311	1.304	1.302	1.300	14.00
14.01	1.651	1.619	1.586	1.551	1.527	1.501	1.474	1.452	1.435	1.422	1.403	1.381	1.367	1.354	1.341	1.322	1.311	1.304	1.302	1.300	14.01
14.02	1.652	1.620	1.587	1.552	1.528	1.502	1.475	1.453	1.435	1.423	1.403	1.381	1.367	1.354	1.342	1.323	1.312	1.305	1.302	1.300	14.02
14.03	1.653	1.621	1.588	1.553	1.529	1.502	1.476	1.453	1.436	1.423	1.404	1.382	1.368	1.355	1.342	1.323	1.312	1.305	1.303	1.301	14.03
14.04	1.654	1.622	1.589	1.554	1.530	1.503	1.477	1.454	1.436	1.424	1.404	1.382	1.368	1.355	1.343	1.324	1.313	1.306	1.303	1.301	14.04
14.05	1.655	1.623	1.590	1.555	1.531	1.504	1.478	1.455	1.437	1.425	1.405	1.383	1.369	1.356	1.343	1.324	1.313	1.306	1.303	1.301	14.05
14.06	1.656	1.624	1.591	1.556	1.532	1.505	1.479	1.456	1.438	1.426	1.406	1.384	1.370	1.356	1.344	1.324	1.313	1.306	1.303	1.301	14.06
14.07	1.657	1.625	1.592	1.557	1.533	1.506	1.480	1.457	1.439	1.427	1.407	1.384	1.370	1.357	1.344	1.325	1.314	1.307	1.304	1.302	14.07
14.08	1.659	1.626	1.593	1.558	1.533	1.507	1.480	1.457	1.439	1.427	1.407	1.385	1.371	1.357	1.345	1.325	1.314	1.307	1.304	1.302	14.08
14.09	1.660	1.627	1.594	1.559	1.534	1.508	1.481	1.458	1.440	1.428	1.408	1.385	1.371	1.358	1.345	1.326	1.315	1.308	1.305	1.303	14.09
14.10	1.661	1.628	1.595	1.560	1.535	1.509	1.482	1.459	1.441	1.429	1.409	1.386	1.372	1.358	1.346	1.326	1.315	1.308	1.305	1.303	14.10
14.11	1.662	1.629	1.596	1.561	1.536	1.510	1.483	1.460	1.442	1.430	1.410	1.387	1.373	1.358	1.346	1.326	1.315	1.308	1.305	1.303	14.11
14.12	1.663	1.630	1.597	1.562	1.537	1.511	1.484	1.461	1.443	1.430	1.410	1.387	1.373	1.359	1.347	1.327	1.316	1.308	1.306	1.304	14.12
14.13	1.664	1.631	1.598	1.563	1.537	1.511	1.484	1.461	1.443	1.431	1.411	1.388	1.374	1.359	1.347	1.327	1.316	1.309	1.306	1.304	14.13
14.14	1.665	1.632	1.599	1.564	1.538	1.512	1.485	1.462	1.444	1.431	1.411	1.388	1.374	1.360	1.348	1.328	1.317	1.309	1.307	1.305	14.14
14.15	1.666	1.633	1.600	1.565	1.539	1.513	1.486	1.463	1.445	1.432	1.412	1.389	1.375	1.360	1.348	1.328	1.317	1.309	1.307	1.305	14.15
14.16	1.667	1.634	1.601	1.566	1.540	1.514	1.487	1.464	1.446	1.433	1.413	1.390	1.376	1.361	1.349	1.328	1.317	1.309	1.307	1.305	14.16
14.17	1.668	1.635	1.602	1.567	1.541	1.515	1.488	1.465	1.447	1.434	1.414	1.390	1.376	1.361	1.349	1.329	1.318	1.310	1.308	1.306	14.17
14.18	1.669	1.637	1.603	1.568	1.542	1.516	1.488	1.465	1.447	1.434	1.414	1.391	1.377	1.362	1.350	1.329	1.318	1.310	1.308	1.306	14.18
14.19	1.670	1.638	1.604	1.569	1.543	1.517	1.489	1.466	1.448	1.435	1.415	1.391	1.377	1.362	1.350	1.330	1.319	1.311	1.309	1.307	14.19

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
14.20	1.671	1.639	1.605	1.570	1.544	1.518	1.490	1.467	1.449	1.436	1.416	1.392	1.378	1.363	1.351	1.330	1.319	1.311	1.309	1.307	14.20
14.21	1.672	1.640	1.606	1.571	1.545	1.519	1.491	1.468	1.450	1.437	1.417	1.393	1.379	1.364	1.351	1.330	1.319	1.311	1.309	1.307	14.21
14.22	1.673	1.641	1.607	1.572	1.546	1.520	1.492	1.469	1.450	1.437	1.417	1.393	1.379	1.364	1.352	1.331	1.319	1.312	1.309	1.307	14.22
14.23	1.674	1.642	1.607	1.573	1.546	1.520	1.492	1.469	1.451	1.438	1.418	1.394	1.380	1.365	1.352	1.331	1.320	1.312	1.310	1.308	14.23
14.24	1.675	1.643	1.608	1.574	1.547	1.521	1.493	1.470	1.452	1.438	1.418	1.394	1.380	1.365	1.353	1.332	1.320	1.313	1.310	1.308	14.24
14.25	1.676	1.644	1.609	1.575	1.548	1.522	1.494	1.471	1.452	1.439	1.419	1.395	1.381	1.366	1.353	1.332	1.320	1.313	1.310	1.308	14.25
14.26	1.677	1.645	1.610	1.576	1.549	1.523	1.495	1.472	1.453	1.440	1.420	1.396	1.382	1.367	1.354	1.332	1.320	1.313	1.310	1.308	14.26
14.27	1.678	1.646	1.611	1.577	1.550	1.524	1.496	1.473	1.454	1.441	1.421	1.396	1.382	1.367	1.354	1.333	1.321	1.314	1.311	1.309	14.27
14.28	1.679	1.647	1.612	1.578	1.551	1.525	1.496	1.473	1.454	1.441	1.421	1.397	1.383	1.368	1.355	1.333	1.321	1.314	1.311	1.309	14.28
14.29	1.680	1.648	1.613	1.579	1.552	1.526	1.497	1.474	1.455	1.442	1.422	1.397	1.383	1.368	1.355	1.334	1.322	1.315	1.312	1.310	14.29
14.30	1.681	1.649	1.614	1.580	1.553	1.527	1.498	1.475	1.456	1.443	1.423	1.398	1.384	1.369	1.356	1.334	1.322	1.315	1.312	1.310	14.30
14.31	1.682	1.650	1.615	1.581	1.554	1.528	1.499	1.476	1.457	1.444	1.424	1.399	1.385	1.369	1.356	1.334	1.322	1.315	1.312	1.310	14.31
14.32	1.683	1.651	1.616	1.582	1.555	1.529	1.500	1.476	1.458	1.444	1.424	1.399	1.385	1.370	1.357	1.335	1.322	1.315	1.312	1.310	14.32
14.33	1.684	1.652	1.617	1.582	1.555	1.529	1.500	1.477	1.458	1.445	1.425	1.400	1.386	1.370	1.357	1.335	1.323	1.316	1.313	1.311	14.33
14.34	1.685	1.653	1.618	1.583	1.556	1.530	1.501	1.477	1.459	1.445	1.425	1.400	1.386	1.371	1.358	1.336	1.323	1.316	1.313	1.311	14.34
14.35	1.686	1.654	1.619	1.584	1.557	1.531	1.502	1.478	1.460	1.446	1.426	1.401	1.387	1.371	1.358	1.336	1.323	1.316	1.313	1.311	14.35
14.36	1.687	1.655	1.620	1.585	1.558	1.532	1.503	1.479	1.461	1.447	1.427	1.402	1.388	1.372	1.358	1.336	1.323	1.316	1.313	1.311	14.36
14.37	1.688	1.656	1.621	1.586	1.559	1.533	1.504	1.480	1.462	1.448	1.428	1.402	1.388	1.372	1.359	1.337	1.324	1.317	1.314	1.312	14.37
14.38	1.690	1.657	1.622	1.587	1.559	1.534	1.504	1.480	1.462	1.448	1.428	1.403	1.389	1.373	1.359	1.337	1.324	1.317	1.314	1.312	14.38
14.39	1.691	1.658	1.623	1.588	1.560	1.535	1.505	1.481	1.463	1.449	1.429	1.403	1.389	1.373	1.360	1.338	1.325	1.318	1.315	1.313	14.39
14.40	1.692	1.659	1.624	1.589	1.561	1.536	1.506	1.482	1.464	1.450	1.430	1.404	1.390	1.374	1.360	1.338	1.325	1.318	1.315	1.313	14.40
14.41	1.693	1.660	1.625	1.590	1.562	1.537	1.507	1.483	1.465	1.451	1.431	1.405	1.391	1.374	1.360	1.338	1.325	1.318	1.315	1.313	14.41
14.42	1.694	1.661	1.626	1.591	1.563	1.538	1.508	1.484	1.466	1.452	1.431	1.405	1.391	1.375	1.361	1.339	1.326	1.319	1.316	1.314	14.42
14.43	1.695	1.662	1.627	1.592	1.563	1.538	1.508	1.484	1.466	1.452	1.432	1.406	1.392	1.375	1.361	1.339	1.326	1.319	1.316	1.314	14.43
14.44	1.696	1.663	1.628	1.593	1.564	1.539	1.509	1.485	1.467	1.453	1.432	1.406	1.392	1.376	1.362	1.340	1.327	1.320	1.317	1.315	14.44

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
14.45	1.697	1.664	1.629	1.594	1.565	1.540	1.510	1.486	1.468	1.454	1.433	1.407	1.393	1.376	1.362	1.340	1.327	1.320	1.317	1.315	14.45
14.46	1.698	1.665	1.630	1.595	1.566	1.541	1.511	1.487	1.469	1.455	1.434	1.408	1.394	1.376	1.363	1.340	1.327	1.320	1.317	1.315	14.46
14.47	1.699	1.666	1.631	1.596	1.567	1.542	1.512	1.488	1.470	1.456	1.435	1.409	1.394	1.377	1.363	1.341	1.328	1.321	1.318	1.316	14.47
14.48	1.700	1.667	1.632	1.596	1.568	1.542	1.513	1.488	1.470	1.456	1.435	1.409	1.395	1.377	1.364	1.341	1.328	1.321	1.318	1.316	14.48
14.49	1.701	1.668	1.633	1.597	1.569	1.543	1.514	1.489	1.471	1.457	1.436	1.410	1.395	1.378	1.364	1.342	1.329	1.322	1.319	1.317	14.49
14.50	1.702	1.669	1.634	1.598	1.570	1.544	1.515	1.490	1.472	1.458	1.437	1.411	1.396	1.379	1.365	1.342	1.329	1.322	1.319	1.317	14.50
14.51	1.703	1.670	1.635	1.599	1.571	1.545	1.516	1.491	1.473	1.459	1.438	1.412	1.396	1.380	1.365	1.342	1.329	1.322	1.319	1.317	14.51
14.52	1.704	1.671	1.636	1.600	1.572	1.546	1.517	1.492	1.474	1.459	1.438	1.412	1.397	1.380	1.366	1.343	1.330	1.323	1.320	1.317	14.52
14.53	1.705	1.672	1.637	1.601	1.573	1.546	1.518	1.492	1.474	1.460	1.439	1.413	1.397	1.381	1.366	1.343	1.330	1.323	1.320	1.318	14.53
14.54	1.706	1.673	1.638	1.602	1.574	1.547	1.519	1.493	1.475	1.460	1.439	1.413	1.398	1.381	1.367	1.344	1.331	1.324	1.321	1.318	14.54
14.55	1.707	1.674	1.639	1.603	1.575	1.548	1.520	1.494	1.476	1.461	1.440	1.414	1.398	1.382	1.367	1.344	1.331	1.324	1.321	1.318	14.55
14.56	1.708	1.675	1.640	1.604	1.576	1.549	1.521	1.495	1.477	1.462	1.441	1.415	1.398	1.383	1.368	1.344	1.331	1.324	1.321	1.318	14.56
14.57	1.709	1.676	1.641	1.605	1.577	1.550	1.522	1.496	1.478	1.463	1.441	1.415	1.399	1.383	1.368	1.345	1.332	1.325	1.322	1.319	14.57
14.58	1.710	1.677	1.641	1.606	1.578	1.550	1.522	1.496	1.478	1.463	1.442	1.416	1.399	1.384	1.369	1.345	1.332	1.325	1.322	1.319	14.58
14.59	1.711	1.678	1.642	1.607	1.579	1.551	1.523	1.497	1.479	1.464	1.442	1.416	1.400	1.384	1.369	1.346	1.332	1.326	1.323	1.320	14.59
14.60	1.712	1.679	1.643	1.608	1.580	1.552	1.524	1.498	1.480	1.465	1.443	1.417	1.400	1.385	1.370	1.346	1.333	1.326	1.323	1.320	14.60
14.61	1.713	1.680	1.644	1.609	1.581	1.553	1.525	1.499	1.481	1.466	1.444	1.418	1.401	1.385	1.370	1.346	1.333	1.326	1.323	1.320	14.61
14.62	1.714	1.681	1.645	1.610	1.582	1.554	1.526	1.500	1.482	1.466	1.444	1.418	1.401	1.386	1.371	1.347	1.333	1.326	1.323	1.320	14.62
14.63	1.715	1.682	1.646	1.611	1.582	1.554	1.526	1.500	1.482	1.467	1.445	1.419	1.402	1.386	1.371	1.347	1.334	1.327	1.324	1.321	14.63
14.64	1.716	1.683	1.647	1.612	1.583	1.555	1.527	1.501	1.483	1.467	1.445	1.419	1.402	1.387	1.372	1.348	1.334	1.327	1.324	1.321	14.64
14.65	1.717	1.684	1.648	1.613	1.584	1.556	1.528	1.502	1.484	1.468	1.446	1.420	1.403	1.387	1.372	1.348	1.334	1.327	1.324	1.321	14.65
14.66	1.718	1.685	1.649	1.614	1.585	1.557	1.529	1.503	1.485	1.469	1.447	1.421	1.404	1.388	1.373	1.348	1.334	1.327	1.324	1.321	14.66
14.67	1.719	1.686	1.650	1.615	1.586	1.558	1.530	1.503	1.486	1.470	1.448	1.421	1.405	1.388	1.373	1.349	1.335	1.328	1.325	1.322	14.67
14.68	1.720	1.688	1.651	1.615	1.587	1.559	1.530	1.504	1.486	1.470	1.448	1.422	1.405	1.389	1.374	1.349	1.335	1.328	1.325	1.322	14.68
14.69	1.721	1.689	1.652	1.616	1.588	1.560	1.531	1.504	1.487	1.471	1.449	1.422	1.406	1.389	1.374	1.350	1.336	1.329	1.326	1.323	14.69

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
14.70	1.722	1.690	1.653	1.617	1.589	1.561	1.532	1.505	1.488	1.472	1.450	1.423	1.407	1.390	1.375	1.350	1.336	1.329	1.326	1.323	14.70
14.71	1.723	1.691	1.654	1.618	1.590	1.562	1.533	1.506	1.489	1.473	1.451	1.424	1.408	1.390	1.375	1.350	1.336	1.329	1.326	1.323	14.71
14.72	1.724	1.692	1.655	1.619	1.591	1.563	1.534	1.507	1.489	1.473	1.451	1.424	1.408	1.391	1.376	1.351	1.337	1.329	1.326	1.324	14.72
14.73	1.725	1.693	1.656	1.620	1.592	1.563	1.534	1.507	1.490	1.474	1.452	1.425	1.409	1.391	1.376	1.351	1.337	1.330	1.327	1.324	14.73
14.74	1.726	1.694	1.657	1.621	1.593	1.564	1.535	1.508	1.490	1.474	1.452	1.425	1.409	1.392	1.377	1.352	1.338	1.330	1.327	1.325	14.74
14.75	1.727	1.695	1.658	1.622	1.594	1.565	1.536	1.509	1.491	1.475	1.453	1.426	1.410	1.392	1.377	1.352	1.338	1.330	1.327	1.325	14.75
14.76	1.728	1.696	1.659	1.623	1.595	1.566	1.537	1.510	1.492	1.476	1.454	1.427	1.411	1.393	1.378	1.352	1.338	1.330	1.327	1.325	14.76
14.77	1.729	1.697	1.660	1.624	1.596	1.567	1.538	1.511	1.493	1.477	1.455	1.427	1.411	1.393	1.378	1.353	1.339	1.331	1.328	1.326	14.77
14.78	1.731	1.698	1.661	1.625	1.596	1.568	1.538	1.511	1.493	1.477	1.455	1.428	1.412	1.394	1.379	1.353	1.339	1.331	1.328	1.326	14.78
14.79	1.732	1.699	1.662	1.626	1.597	1.569	1.539	1.512	1.494	1.478	1.456	1.428	1.412	1.394	1.379	1.354	1.340	1.332	1.329	1.327	14.79
14.80	1.733	1.700	1.663	1.627	1.598	1.570	1.540	1.513	1.495	1.479	1.457	1.429	1.413	1.395	1.380	1.354	1.340	1.332	1.329	1.327	14.80
14.81	1.734	1.701	1.664	1.628	1.599	1.571	1.541	1.514	1.496	1.480	1.458	1.430	1.414	1.396	1.380	1.354	1.340	1.332	1.329	1.327	14.81
14.82	1.735	1.702	1.665	1.629	1.600	1.572	1.542	1.515	1.496	1.481	1.458	1.430	1.414	1.396	1.381	1.355	1.340	1.333	1.330	1.327	14.82
14.83	1.736	1.703	1.666	1.630	1.601	1.572	1.542	1.515	1.497	1.481	1.459	1.431	1.415	1.397	1.381	1.355	1.341	1.333	1.330	1.328	14.83
14.84	1.737	1.704	1.667	1.631	1.602	1.573	1.543	1.516	1.497	1.482	1.459	1.431	1.415	1.397	1.382	1.356	1.341	1.334	1.331	1.328	14.84
14.85	1.738	1.705	1.668	1.632	1.603	1.574	1.544	1.517	1.498	1.483	1.460	1.432	1.416	1.398	1.382	1.356	1.341	1.334	1.331	1.328	14.85
14.86	1.739	1.706	1.669	1.633	1.604	1.575	1.545	1.518	1.499	1.484	1.461	1.433	1.417	1.399	1.383	1.356	1.341	1.334	1.331	1.328	14.86
14.87	1.740	1.707	1.670	1.634	1.605	1.576	1.546	1.519	1.500	1.485	1.461	1.434	1.417	1.399	1.383	1.357	1.342	1.335	1.332	1.329	14.87
14.88	1.741	1.708	1.671	1.634	1.605	1.577	1.547	1.519	1.500	1.485	1.462	1.434	1.418	1.400	1.384	1.357	1.342	1.335	1.332	1.329	14.88
14.89	1.742	1.709	1.672	1.635	1.606	1.578	1.548	1.520	1.501	1.486	1.462	1.435	1.418	1.400	1.384	1.358	1.343	1.336	1.333	1.330	14.89
14.90	1.743	1.710	1.673	1.636	1.607	1.579	1.549	1.521	1.502	1.487	1.463	1.436	1.419	1.401	1.385	1.358	1.343	1.336	1.333	1.330	14.90
14.91	1.744	1.711	1.674	1.637	1.608	1.580	1.550	1.522	1.503	1.488	1.464	1.437	1.419	1.401	1.385	1.358	1.343	1.336	1.333	1.330	14.91
14.92	1.745	1.712	1.675	1.638	1.609	1.581	1.551	1.523	1.503	1.488	1.464	1.437	1.420	1.402	1.386	1.359	1.344	1.337	1.333	1.330	14.92
14.93	1.746	1.713	1.676	1.639	1.610	1.581	1.551	1.523	1.504	1.489	1.465	1.438	1.420	1.402	1.386	1.359	1.344	1.337	1.334	1.331	14.93
14.94	1.747	1.714	1.677	1.640	1.611	1.582	1.552	1.524	1.504	1.489	1.465	1.438	1.421	1.403	1.387	1.360	1.345	1.338	1.334	1.331	14.94

Table 11 – Compressibility Factors of Natural Gas

Interpolation Between T_r Values

P_r	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.60	1.70	1.80	1.90	2.00	2.20	2.40	2.60	2.80	3.00	P_r
14.95	1.748	1.715	1.678	1.641	1.612	1.583	1.553	1.525	1.505	1.490	1.466	1.439	1.421	1.403	1.387	1.360	1.345	1.338	1.334	1.331	14.95
14.96	1.749	1.716	1.679	1.642	1.613	1.584	1.554	1.526	1.506	1.491	1.467	1.440	1.422	1.404	1.388	1.360	1.345	1.338	1.334	1.331	14.96
14.97	1.750	1.717	1.680	1.643	1.614	1.585	1.555	1.527	1.506	1.491	1.468	1.440	1.422	1.404	1.388	1.361	1.346	1.339	1.335	1.332	14.97
14.98	1.751	1.718	1.680	1.643	1.614	1.586	1.556	1.527	1.507	1.492	1.468	1.441	1.423	1.405	1.389	1.361	1.346	1.339	1.335	1.332	14.98
14.99	1.752	1.719	1.681	1.644	1.615	1.587	1.557	1.528	1.507	1.492	1.469	1.441	1.423	1.406	1.389	1.362	1.347	1.340	1.336	1.333	14.99
15.00	1.753	1.720	1.682	1.645	1.616	1.588	1.558	1.529	1.508	1.493	1.470	1.442	1.424	1.406	1.390	1.362	1.347	1.340	1.336	1.333	15.00

Table 12
Conversion Factors from Compressibility (Z) to Supercompressibility (F_{pv})

$$F_{pv} = \sqrt{\frac{1}{Z}}$$

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Table 12 – Conversion Factors from Compressibility (Z) to Supercompressibility (F_{pv})

Z	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Z
0.250	2.000	1.996	1.992	1.988	1.984	1.980	1.976	1.973	1.969	1.965	0.250
0.260	1.961	1.957	1.954	1.950	1.946	1.943	1.939	1.935	1.932	1.928	0.260
0.270	1.925	1.921	1.917	1.914	1.910	1.907	1.903	1.900	1.897	1.893	0.270
0.280	1.890	1.886	1.883	1.880	1.876	1.873	1.870	1.867	1.863	1.860	0.280
0.290	1.857	1.854	1.851	1.847	1.844	1.841	1.838	1.835	1.832	1.829	0.290
0.300	1.826	1.823	1.820	1.817	1.814	1.811	1.808	1.805	1.802	1.799	0.300
0.310	1.796	1.793	1.790	1.787	1.785	1.782	1.779	1.776	1.773	1.771	0.310
0.320	1.768	1.765	1.762	1.760	1.757	1.754	1.751	1.749	1.746	1.743	0.320
0.330	1.741	1.738	1.736	1.733	1.730	1.728	1.725	1.723	1.720	1.718	0.330
0.340	1.715	1.712	1.710	1.707	1.705	1.703	1.700	1.698	1.695	1.693	0.340
0.350	1.690	1.688	1.685	1.683	1.681	1.678	1.676	1.674	1.671	1.669	0.350
0.360	1.667	1.664	1.662	1.660	1.657	1.655	1.653	1.651	1.648	1.646	0.360
0.370	1.664	1.642	1.640	1.637	1.635	1.633	1.631	1.629	1.627	1.624	0.370
0.380	1.622	1.620	1.618	1.616	1.614	1.612	1.610	1.607	1.605	1.603	0.380
0.390	1.601	1.599	1.597	1.595	1.593	1.591	1.589	1.587	1.585	1.583	0.390
0.400	1.581	1.579	1.577	1.575	1.573	1.571	1.569	1.567	1.566	1.564	0.400
0.410	1.562	1.560	1.558	1.556	1.554	1.552	1.550	1.549	1.547	1.545	0.410
0.420	1.543	1.541	1.539	1.538	1.536	1.534	1.532	1.530	1.529	1.527	0.420
0.430	1.525	1.523	1.521	1.520	1.518	1.516	1.514	1.513	1.511	1.509	0.430
0.440	1.508	1.506	1.504	1.502	1.501	1.499	1.497	1.496	1.494	1.492	0.440
0.450	1.491	1.489	1.487	1.486	1.484	1.482	1.481	1.479	1.478	1.476	0.450
0.460	1.474	1.473	1.471	1.470	1.468	1.466	1.465	1.463	1.462	1.460	0.460
0.470	1.459	1.457	1.456	1.454	1.452	1.451	0.449	1.448	1.446	1.445	0.470
0.480	1.443	1.442	1.440	1.439	1.437	1.436	1.434	1.433	1.431	1.430	0.480
0.490	1.429	1.427	1.426	1.424	1.423	1.421	1.420	1.418	1.417	1.416	0.490
0.500	1.414	1.413	1.411	1.410	1.409	1.407	1.406	1.404	1.403	1.402	0.500

Table 12 – Conversion Factors from Compressibility (Z) to Supercompressibility (F_{pv})

Z	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Z
0.510	1.400	1.399	1.398	1.396	1.395	1.393	1.392	1.391	1.389	1.388	0.510
0.520	1.387	1.385	1.384	1.383	1.381	1.380	1.379	1.378	1.376	1.375	0.520
0.530	1.374	1.372	1.371	1.370	1.368	1.367	1.366	1.365	1.363	1.362	0.530
0.540	1.361	1.360	1.358	1.357	1.356	1.355	1.353	1.352	1.351	1.350	0.540
0.550	1.348	1.347	1.346	1.345	1.344	1.342	1.341	1.340	1.339	1.338	0.550
0.560	1.336	1.335	1.334	1.333	1.332	1.330	1.329	1.328	1.327	1.326	0.560
0.570	1.325	1.323	1.322	1.321	1.320	1.319	1.318	1.316	1.315	1.314	0.570
0.580	1.313	1.312	1.311	1.310	1.309	1.307	1.306	1.305	1.304	1.303	0.580
0.590	1.302	1.301	1.300	1.299	1.297	1.296	1.295	1.294	1.293	1.292	0.590
0.600	1.291	1.290	1.289	1.288	1.287	1.286	1.285	1.284	1.282	1.281	0.600
0.610	1.280	1.279	1.278	1.277	1.276	1.275	1.274	1.273	1.272	1.271	0.610
0.620	1.270	1.269	1.268	1.267	1.266	1.265	1.264	1.263	1.262	1.261	0.620
0.630	1.260	1.259	1.258	1.257	1.256	1.255	1.254	1.253	1.252	1.251	0.630
0.640	1.250	1.249	1.248	1.247	1.246	1.245	1.244	1.243	1.242	1.241	0.640
0.650	1.240	1.239	1.238	1.237	1.237	1.236	1.235	1.234	1.233	1.232	0.650
0.660	1.231	1.230	1.229	1.228	1.227	1.226	1.225	1.224	1.224	1.223	0.660
0.670	1.222	1.221	1.220	1.219	1.218	1.217	1.216	1.215	1.214	1.214	0.670
0.680	1.213	1.212	1.211	1.210	1.209	1.208	1.207	1.206	1.206	1.205	0.680
0.690	1.204	1.203	1.202	1.201	1.200	1.200	1.199	1.198	1.197	1.196	0.690
0.700	1.195	1.194	1.194	1.193	1.192	1.191	1.190	1.189	1.188	1.188	0.700
0.710	1.187	1.186	1.185	1.184	1.183	1.183	1.182	1.181	1.180	1.179	0.710
0.720	1.179	1.178	1.177	1.176	1.175	1.174	1.174	1.173	1.172	1.171	0.720
0.730	1.170	1.170	1.169	1.168	1.167	1.166	1.166	1.165	1.164	1.163	0.730
0.740	1.162	1.162	1.161	1.160	1.159	1.159	1.158	1.157	1.156	1.155	0.740
0.750	1.155	1.154	1.153	1.152	1.152	1.151	1.150	1.149	1.149	1.148	0.750
0.760	1.147	1.146	1.146	1.145	1.144	1.143	1.143	1.142	1.141	1.140	0.760

Table 12 – Conversion Factors from Compressibility (Z) to Supercompressibility (F_{pv})

Z	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	Z
0.770	1.140	1.139	1.138	1.137	1.137	1.136	1.135	1.134	1.134	1.133	0.770
0.780	1.132	1.132	1.131	1.130	1.129	1.129	1.128	1.127	1.127	1.126	0.780
0.790	1.125	1.124	1.124	1.123	1.122	1.122	1.121	1.120	1.119	1.119	0.790
0.800	1.118	1.117	1.117	1.116	1.115	1.115	1.114	1.113	1.112	1.112	0.800
0.810	1.111	1.110	1.110	1.109	1.108	1.108	1.107	1.106	1.106	1.105	0.810
0.820	1.104	1.104	1.103	1.102	1.102	1.101	1.100	1.100	1.099	1.098	0.820
0.830	1.098	1.097	1.096	1.096	1.095	1.094	1.094	1.093	1.092	1.092	0.830
0.840	1.091	1.090	1.090	1.089	1.089	1.088	1.087	1.087	1.086	1.085	0.840
0.850	1.085	1.084	1.083	1.083	1.082	1.081	1.081	1.080	1.080	1.079	0.850
0.860	1.078	1.078	1.077	1.076	1.076	1.075	1.075	1.074	1.073	1.073	0.860
0.870	1.072	1.071	1.071	1.070	1.070	1.069	1.068	1.068	1.067	1.067	0.870
0.880	1.066	1.065	1.065	1.064	1.064	1.063	1.062	1.062	1.061	1.061	0.880
0.890	1.060	1.059	1.059	1.058	1.058	1.057	1.056	1.056	1.055	1.055	0.890
0.900	1.054	1.054	1.053	1.052	1.052	1.051	1.051	1.050	1.049	1.049	0.900
0.910	1.048	1.048	1.047	1.047	1.046	1.045	1.045	1.044	1.044	1.043	0.910
0.920	1.043	1.042	1.041	1.041	1.040	1.040	1.039	1.039	1.038	1.038	0.920
0.930	1.037	1.036	1.036	1.035	1.035	1.034	1.034	1.033	1.033	1.032	0.930
0.940	1.031	1.031	1.030	1.030	1.029	1.029	1.028	1.028	1.027	1.027	0.940
0.950	1.026	1.025	1.025	1.024	1.024	1.023	1.023	1.022	1.022	1.021	0.950
0.960	1.021	1.020	1.020	1.019	1.019	1.018	1.017	1.017	1.016	1.016	0.960
0.970	1.015	1.015	1.014	1.014	1.013	1.013	1.012	1.012	1.011	1.011	0.970
0.980	1.010	1.010	1.009	1.009	1.008	1.008	1.007	1.007	1.006	1.006	0.980
0.990	1.005	1.005	1.004	1.004	1.003	1.003	1.002	1.002	1.001	1.001	0.990

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Table 13
Conversion of API Gravity to Specific Gravity (G_l)

$$G_l = \frac{141.5}{131.5 + API}$$

For conversion from other temperatures to 60º F see Table 17 (page 201).

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Table 13 – Conversion of API Gravity to Specific Gravity (G_l)

API Gravity at 60º F	Specific Gravity	API Gravity at 60º F	Specific Gravity	API Gravity at 60º F	Specific Gravity
10	1.0000	35	0.8498	60	0.7389
11	0.9930	36	0.8448	61	0.7351
12	0.9861	37	0.8398	62	0.7313
13	0.9792	38	0.8348	63	0.7275
14	0.9725	39	0.8299	64	0.7238
15	0.9659	40	0.8251	65	0.7201
16	0.9593	41	0.8203	66	0.7165
17	0.9529	42	0.8155	67	0.7128
18	0.9465	43	0.8109	68	0.7093
19	0.9402	44	0.8063	69	0.7057
20	0.9340	45	0.8017	70	0.7022
21	0.9279	46	0.7972	71	0.6988
22	0.9218	47	0.7927	72	0.6953
23	0.9159	48	0.7883	73	0.6919
24	0.9100	49	0.7839	74	0.6886
25	0.9042	50	0.7796	75	0.6852
26	0.8984	51	0.7753	76	0.6819
27	0.8927	52	0.7711	77	0.6787
28	0.8871	53	0.7669	78	0.6754
29	0.8816	54	0.7628	79	0.6722
30	0.8762	55	0.7587	80	0.6690
31	0.8708	56	0.7547	81	0.6659
32	0.8654	57	0.7507	82	0.6628
33	0.8602	58	0.7467	83	0.6597
34	0.8550	59	0.7428	84	0.6566

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Table 14
Values of e^s and 1 - e^{-s} for
Various Values of GH/TZ

$$s = 0.0375 \frac{GH}{TZ}$$

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Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ		e^s	$1-e^{-s}$	GH/TZ		e^s	$1-e^{-s}$	GH/TZ		e^s	$1-e^{-s}$
From	To			From	To			From	To		
1.289	1.314	1.050	0.048	1.867	1.891	3	0.068	2.433	2.456	6	0.088
1.315	1.339	1	0.048	1.892	1.916	4	0.069	2.457	2.480	7	0.088
1.340	1.364	2	0.049	1.917	1.941	1.075	0.070	2.481	2.504	8	0.089
1.365	1.389	3	0.050	1.942	1.966	6	0.071	2.505	2.529	9	0.090
1.390	1.415	4	0.051	1.967	1.990	7	0.072	2.530	2.553	1.100	0.091
1.416	1.440	1.055	0.052	1.991	2.015	8	0.072	2.554	2.577	1	0.092
1.441	1.466	6	0.053	2.016	2.040	9	0.073	2.578	2.602	2	0.093
1.467	1.491	7	0.054	2.041	2.065	1.080	0.074	2.603	2.626	3	0.093
1.492	1.517	8	0.055	2.066	2.089	2	0.075	2.627	2.650	4	0.094
1.518	1.541	9	0.056	2.090	2.114	2	0.076	2.651	2.673	1.105	0.095
1.542	1.566	1.060	0.057	2.115	2.139	3	0.077	2.674	2.699	6	0.096
1.567	1.592	1	0.057	2.140	2.163	4	0.078	2.700	2.723	7	0.097
1.593	1.616	2	0.058	2.164	2.187	1.085	0.078	2.724	2.747	8	0.098
1.617	1.642	3	0.059	2.188	2.211	6	0.079	2.748	2.771	9	0.098
1.643	1.667	4	0.060	2.212	2.237	7	0.080	2.772	2.795	1.110	0.099
1.668	1.692	1.065	0.061	2.238	2.262	8	0.081	2.796	2.819	1	0.100
1.693	1.717	6	0.062	2.263	2.286	9	0.082	2.820	2.843	3	0.102
1.718	1.743	7	0.063	2.287	2.310	1.090	0.083	2.844	2.867	3	0.102
1.744	1.767	8	0.064	2.311	2.334	1	0.083	2.868	2.891	4	0.102
1.768	1.792	9	0.065	2.335	2.359	2	0.084	2.892	2.915	1.115	0.103
1.793	1.817	1.070	0.065	2.360	2.384	3	0.085	2.916	2.939	6	0.104
1.818	1.841	1	0.066	2.385	2.408	4	0.086	2.940	2.963	7	0.105
1.842	1.866	2	0.067	2.409	2.432	1.095	0.087	2.964	2.986	8	0.106

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
2.987	3.010	9	0.106	3.530	3.552	2	0.124	4.062	4.084	1.165	0.142
3.011	3.034	1.120	0.107	3.553	3.575	3	0.125	4.085	4.106	6	0.142
3.035	3.057	1	0.108	3.576	3.599	4	0.126	4.107	4.129	7	0.143
3.058	3.081	2	0.109	3.600	3.622	1.145	0.127	4.130	4.152	8	0.144
3.082	3.105	3	0.110	3.623	3.645	6	0.127	4.153	4.175	9	0.145
3.106	3.129	4	0.110	3.646	3.668	7	0.128	4.176	4.198	1.170	0.145
3.130	3.152	1.125	0.111	3.669	3.692	8	0.129	4.199	4.220	1	0.146
3.153	3.176	6	0.112	3.693	3.715	9	0.130	4.221	4.243	2	0.147
3.177	3.200	7	0.113	3.716	3.738	1.150	0.130	4.244	4.266	3	0.148
3.201	3.223	8	0.114	3.739	3.761	1	0.131	4.267	4.289	4	0.148
3.224	3.247	9	0.114	3.762	3.784	2	0.132	4.290	4.311	1.175	0.149
3.248	3.270	1.130	0.115	3.785	3.808	3	0.133	4.312	4.334	6	0.150
3.271	3.294	1	0.116	3.809	3.831	4	0.133	4.335	4.357	7	0.150
3.295	3.318	2	0.117	3.832	3.854	1.155	0.134	4.358	4.379	8	0.151
3.319	3.341	3	0.117	3.855	3.877	6	0.135	4.380	4.402	9	0.152
3.342	3.365	4	0.118	3.878	3.900	7	0.136	4.403	4.425	1.180	0.153
3.366	3.388	1.135	0.119	3.901	3.923	8	0.136	4.426	4.447	1	0.153
3.389	3.412	6	0.120	3.924	3.946	9	0.137	4.448	4.470	2	0.154
3.413	3.435	7	0.120	3.947	3.969	1.160	0.138	4.471	4.492	3	0.155
3.436	3.458	8	0.121	3.970	3.992	1	0.139	4.493	4.515	4	0.155
3.459	3.482	9	0.122	3.993	4.015	2	0.139	4.516	4.537	1.185	0.156
3.483	3.505	1.140	0.123	4.016	4.038	3	0.140	4.538	4.560	6	0.157
3.506	3.529	1	0.124	4.039	4.061	4	0.141	4.561	4.582	7	0.158

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
4.583	4.605	8	0.158	5.095	5.116	1	0.174	5.597	5.617	4	0.190
4.606	4.627	9	0.159	5.117	5.138	2	0.175	5.618	5.639	1.235	0.190
4.628	4.649	1.190	0.160	5.139	5.160	3	0.176	5.640	5.660	6	0.191
4.650	4.672	1	0.160	5.161	5.182	4	0.176	5.661	5.682	7	0.192
4.673	4.694	2	0.161	5.183	5.204	1.215	0.177	5.683	5.704	8	0.192
4.695	4.717	3	0.162	5.205	5.226	6	0.178	5.705	5.725	9	0.193
4.718	4.739	4	0.162	5.227	5.248	7	0.178	5.726	5.747	1.240	0.194
4.740	4.761	1.195	0.163	5.249	5.269	8	0.179	5.748	5.768	1	0.194
4.762	4.784	6	0.164	5.270	5.291	9	0.180	5.769	5.790	2	0.195
4.785	4.806	7	0.165	5.292	5.313	1.220	0.180	5.791	5.811	3	0.195
4.807	4.828	8	0.165	5.314	5.335	1	0.181	5.812	5.832	4	0.196
4.829	4.850	9	0.166	5.336	5.357	2	0.182	5.833	5.854	1.245	0.197
4.851	4.873	1.200	0.167	5.358	5.379	3	0.182	5.855	5.875	6	0.197
4.874	4.895	1	0.167	5.380	5.400	4	0.183	5.876	5.897	7	0.198
4.896	4.917	2	0.168	5.401	5.422	1.225	0.184	5.898	5.918	8	0.199
4.918	4.939	3	0.169	5.423	5.444	6	0.184	5.919	5.939	9	0.199
4.940	4.961	4	0.169	5.445	5.466	7	0.185	5.940	5.961	1.250	0.200
4.962	4.983	1.205	0.170	5.467	5.487	8	0.186	5.962	5.982	1	0.201
4.984	5.005	6	0.171	5.488	5.509	9	0.186	5.983	6.003	2	0.201
5.006	5.028	7	0.171	5.510	5.531	1.230	0.187	6.004	6.025	3	0.202
5.029	5.050	8	0.172	5.532	5.552	1	0.188	6.026	6.046	4	0.203
5.051	5.072	9	0.173	5.553	5.574	2	0.188	6.047	6.067	1.255	0.203
5.073	5.904	1.210	0.174	5.575	5.596	3	0.189	6.068	6.088	6	0.204

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
6.089	6.110	7	0.204	6.573	6.593	1.280	0.219	7.048	7.068	3	0.233
6.111	6.131	8	0.205	6.594	6.614	1	0.219	7.069	7.088	4	0.233
6.132	6.152	9	0.206	6.615	6.634	2	0.220	7.089	7.108	1.305	0.234
6.153	6.173	1.260	0.206	6.635	6.655	3	0.221	7.109	7.129	6	0.234
6.174	6.175	1	0.207	6.656	6.676	4	0.221	7.130	7.149	7	0.235
6.195	6.215	2	0.208	6.677	6.697	1.285	0.222	7.150	7.170	8	0.235
6.216	6.236	3	0.208	6.698	6.718	6	0.222	7.171	7.190	9	0.236
6.237	6.258	4	0.209	6.719	6.738	7	0.223	7.191	7.210	1.310	0.237
6.259	6.279	1.265	0.210	6.739	6.759	8	0.224	7.211	7.231	1	0.237
6.280	6.300	6	0.210	6.760	6.780	9	0.224	7.232	7.251	2	0.238
6.301	6.321	7	0.211	6.781	6.800	1.290	0.225	7.252	7.271	3	0.238
6.322	6.342	8	0.211	6.801	6.821	1	0.225	7.272	7.292	4	0.239
6.343	6.363	9	0.212	6.822	6.842	2	0.226	7.293	7.312	1.315	0.240
6.364	6.384	1.270	0.213	6.843	6.862	3	0.227	7.313	7.332	6	0.240
6.385	6.405	1	0.213	6.863	6.883	4	0.227	7.333	7.352	7	0.241
6.406	6.426	2	0.214	6.884	6.903	1.295	0.228	7.353	7.373	8	0.241
6.427	6.447	3	0.214	6.904	6.924	6	0.228	7.374	7.393	9	0.242
6.448	6.468	4	0.215	6.925	6.945	7	0.229	7.394	7.413	1.320	0.242
6.469	6.489	1.275	0.216	6.946	6.965	8	0.230	7.414	7.433	1	0.243
6.490	6.509	6	0.216	6.966	6.986	9	0.230	6.434	7.453	2	0.244
6.510	6.530	7	0.217	6.987	7.006	1.300	0.231	7.454	7.474	3	0.244
6.531	6.551	8	0.218	7.007	7.027	1	0.231	7.475	7.494	4	0.245
6.552	6.572	9	0.218	7.028	7.047	2	0.232	7.495	7.514	1.325	0.245

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
7.515	7.534	6	0.246	7.974	7.992	9	0.259	8.425	8.443	2	0.271
7.535	7.554	7	0.246	7.993	8.012	1.350	0.259	8.444	8.463	3	0.272
7.555	7.574	8	0.247	8.013	8.032	1	0.260	8.464	8.482	4	0.272
7.575	7.594	9	0.248	8.033	8.052	2	0.260	8.483	8.501	1.375	0.273
7.595	7.614	1.330	0.248	8.053	8.071	3	0.261	8.502	8.521	6	0.273
7.615	7.634	1	0.249	8.072	8.091	4	0.261	8.522	8.540	7	0.274
7.635	7.654	2	0.249	8.092	8.111	1.355	0.262	8.541	8.559	8	0.274
7.655	7.674	3	0.250	8.112	8.130	6	0.263	8.560	8.579	9	0.275
7.675	7.694	4	0.250	8.131	8.150	7	0.263	8.580	8.598	1.380	0.275
7.695	7.714	1.335	0.251	8.151	8.170	8	0.264	8.599	8.617	1	0.276
7.715	7.734	6	0.252	8.171	8.189	9	0.264	8.618	8.637	2	0.276
7.735	7.754	7	0.252	8.190	8.209	1.360	0.265	8.638	8.656	3	0.277
7.755	7.775	8	0.253	8.210	8.229	1	0.265	8.657	8.675	4	0.277
7.775	7.794	9	0.253	8.230	8.248	2	0.266	8.676	8.694	1.385	0.278
7.795	7.814	1.340	0.254	8.249	8.268	3	0.266	8.695	8.714	6	0.278
7.815	7.834	1	0.254	8.269	8.287	4	0.267	8.715	8.733	7	0.279
7.835	7.854	2	0.255	8.288	8.307	1.365	0.267	8.734	8.752	8	0.280
7.855	7.874	3	0.255	8.308	8.326	6	0.268	8.753	8.771	9	0.280
7.875	7.893	4	0.256	8.327	8.346	7	0.268	8.772	8.791	1.390	0.281
7.894	7.913	1.345	0.257	8.347	8.365	8	0.269	8.792	8.810	1	0.281
7.914	7.933	6	0.257	8.366	8.385	9	0.270	8.811	8.829	2	0.282
7.934	7.953	7	0.258	8.386	8.404	1.370	0.270	8.830	8.848	3	0.282
7.954	7.973	8	0.258	8.405	8.424	1	0.271	8.849	8.867	4	0.283

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
8.868	8.886	1.395	0.283	9.304	9.322	8	0.295	9.734	9.751	1	0.306
8.887	8.905	6	0.284	9.323	9.341	9	0.295	9.752	9.770	2	0.306
8.906	8.924	7	0.284	9.342	9.360	1.420	0.296	9.771	9.788	3	0.307
8.925	8.944	8	0.285	9.361	9.379	1	0.296	9.789	9.807	4	0.307
8.945	8.963	9	0.285	9.380	9.397	2	0.297	9.808	9.825	1.445	0.308
8.964	8.982	1.400	0.286	9.398	9.416	3	0.297	9.826	9.843	6	0.308
8.983	9.001	1	0.286	9.417	9.435	4	0.298	9.844	9.862	7	0.309
9.002	9.020	2	0.287	9.436	9.453	1.425	0.298	9.863	9.880	8	0.309
9.021	9.039	3	0.287	9.454	9.472	6	0.299	9.881	9.899	9	0.310
9.040	9.058	4	0.288	9.473	9.491	7	0.299	9.900	9.917	1.450	0.310
9.059	9.077	1.405	0.288	9.492	9.510	8	0.300	9.918	9.935	1	0.311
9.078	9.096	6	0.289	9.511	9.528	9	0.300	9.936	9.954	2	0.311
9.097	9.115	7	0.289	9.529	9.547	1.430	0.301	9.955	9.972	3	0.312
9.116	9.134	8	0.290	9.548	9.565	1	0.301	9.973	9.991	4	0.312
9.135	9.152	9	0.290	9.566	9.584	2	0.302	9.992	10.009	1.455	0.313
9.153	9.171	1.410	0.291	9.585	9.603	3	0.302	10.010	10.027	6	0.313
9.172	9.190	1	0.291	9.604	9.621	4	0.303	10.028	10.045	7	0.314
9.191	9.209	2	0.292	9.622	9.640	1.435	0.303	10.046	10.064	8	0.314
9.210	9.228	3	0.292	9.641	9.658	6	0.304	10.065	10.082	9	0.315
9.229	9.247	4	0.293	9.659	9.677	7	0.304	10.083	10.100	1.460	0.315
9.248	9.266	1.415	0.293	9.678	9.696	8	0.305	10.101	10.119	1	0.316
9.267	9.285	6	0.294	9.697	9.714	9	0.305	10.120	10.137	2	0.316
9.286	9.303	7	0.294	9.715	9.733	1.440	0.306	10.138	10.155	3	0.316

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
10.156	10.173	4	0.317	10.572	10.589	7	0.328	10.981	10.998	1.510	0.338
10.174	10.191	1.465	0.317	10.590	10.607	8	0.328	10.999	11.016	1	0.338
10.192	10.210	6	0.318	10.608	10.625	9	0.328	11.017	11.033	2	0.339
10.211	10.228	7	0.318	10.626	10.643	1.490	0.329	11.034	11.051	3	0.339
10.229	10.246	8	0.319	10.644	10.660	1	0.329	11.052	11.068	4	0.340
10.247	10.264	9	0.319	10.661	10.678	2	0.330	11.069	11.086	1.515	0.340
10.265	10.282	1.470	0.320	10.679	10.696	3	0.330	11.087	11.104	6	0.340
10.283	10.300	1	0.320	10.697	10.714	4	0.331	11.105	11.121	7	0.341
10.301	10.319	2	0.321	10.715	10.732	1.495	0.331	11.122	11.139	8	0.341
10.320	10.337	3	0.321	10.733	10.750	6	0.332	11.140	11.156	9	0.342
10.338	10.355	4	0.322	10.751	10.767	7	0.332	11.157	11.174	1.520	0.342
10.356	10.373	1.475	0.322	10.768	10.785	8	0.332	11.175	11.191	1	0.343
10.374	10.391	6	0.322	10.786	10.803	9	0.333	11.192	11.209	2	0.343
10.392	10.409	7	0.323	10.804	10.821	1.500	0.333	11.210	11.226	3	0.343
10.410	10.427	8	0.323	10.822	10.839	1	0.334	11.227	11.244	4	0.344
10.428	10.445	9	0.324	10.840	10.856	2	0.334	11.245	11.261	1.525	0.344
10.446	10.463	1.480	0.324	10.857	10.874	3	0.335	11.262	11.279	6	0.345
10.464	10.481	1	0.325	10.875	10.892	4	0.335	11.280	11.296	7	0.345
10.482	10.499	2	0.325	10.893	10.910	1.505	0.336	11.297	11.314	8	0.346
10.500	10.517	3	0.326	10.911	10.927	6	0.336	11.315	11.331	9	0.346
10.518	10.535	4	0.326	10.928	10.945	7	0.336	11.332	11.349	1.530	0.346
10.536	10.553	1.485	0.327	10.946	10.963	8	0.337	11.350	11.366	1	0.347
10.554	10.571	6	0.327	10.964	10.980	9	0.337	11.367	11.384	2	0.347

Table 14 – Values of e^s and $1 - e^{-s}$ for Various Values of GH/TZ

GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$	GH/TZ From	GH/TZ To	e^s	$1-e^{-s}$
11.385	11.401	3	0.348	11.782	11.798	6	0.357	12.173	12.189	9	0.367
11.402	11.418	4	0.348	11.799	11.815	7	0.358	12.190	12.206	1.580	0.367
11.419	11.436	1.535	0.349	11.816	11.832	8	0.358	12.207	12.223	1	0.368
11.437	11.453	6	0.349	11.833	11.849	9	0.359	12.224	12.240	2	0.368
11.454	11.470	7	0.349	11.850	11.866	1.560	0.359	12.241	12.257	3	0.368
11.471	11.488	8	0.350	11.867	11.883	1	0.359	12.258	12.273	4	0.369
11.489	11.505	9	0.350	11.884	11.901	2	0.360	12.274	12.290	1.585	0.369
11.506	11.522	1.540	0.351	11.902	11.918	3	0.360	12.291	12.307	6	0.369
11.523	11.540	1	0.351	11.919	11.935	4	0.361	12.308	12.324	7	0.370
11.541	11.557	2	0.352	11.936	11.952	1.565	0.361	12.325	12.341	8	0.370
11.558	11.574	3	0.352	11.953	11.969	6	0.361	12.342	12.357	9	0.371
11.575	11.592	4	0.352	11.970	11.986	7	0.362	12.358	12.374	1.590	0.371
11.593	11.609	1.545	0.353	11.987	12.003	8	0.362	12.375	12.391	1	0.371
11.610	11.626	6	0.353	12.004	12.020	9	0.363	12.392	12.408	2	0.372
11.627	11.643	7	0.354	12.021	12.037	1.570	0.363	12.409	12.424	3	0.372
11.644	11.661	8	0.354	12.038	12.054	1	0.363	12.425	12.441	4	0.373
11.662	11.678	9	0.354	12.055	12.071	2	0.364	12.442	12.458	1.595	0.373
11.679	11.695	1.550	0.355	12.072	12.088	3	0.364	12.459	12.475	6	0.373
11.696	11.712	1	0.355	12.089	12.105	4	0.365	12.476	12.491	7	0.374
11.713	11.729	2	0.356	12.106	12.121	1.575	0.365	12.492	12.508	8	0.374
11.730	11.746	3	0.356	12.122	12.138	6	0.365	12.509	12.526	9	0.375
11.747	11.764	4	0.356	12.139	12.155	7	0.366				
11.765	11.781	1.555	0.357	12.156	12.172	8	0.366				

Table 15
Friction Factors for
Various Flow Strings (F_r)

See Appendix A (page 41).

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Table 15 – Friction Factors for Various Flow Strings (F_r)

Nominal Size, in	d_o	lb/ft	d	F_r
1	1.315	1.80	1.049	0.09528800
1.25	1.660	2.40	1.380	0.04655200
1.5	1.900	2.75	1.610	0.03112200
2	2.375	4.70	1.995	0.01777700
2.5	2.875	6.50	2.441	0.01049500
3	3.500	9.30	2.992	0.00616720
3.5	4.000	11.00	3.476	0.00416870
4	4.500	12.70	3.958	0.00296960
4.5	4.750	16.25	4.082	0.00273970
	4.750	18.00	4.000	0.00288880
4.75	5.000	18.00	4.276	0.00242680
	5.000	21.00	4.154	0.00261740
	5.000	13.00	4.494	0.00213450
	5.000	15.00	4.408	0.00224370
5.1875	5.500	14.00	5.012	0.00161050
	5.500	15.00	4.976	0.00164080
	5.500	15.50	4.950	0.00166310
	5.500	17.00	4.892	0.00171450
	5.500	20.00	4.778	0.00182210
	5.500	23.00	4.670	0.00193290
	5.500	25.00	4.580	0.00203250

Table 15 – Friction Factors for Various Flow Strings (F_r)

Nominal Size, in	d_o	lb/ft	d	F_r
5.625	6.000	15.00	5.524	0.00125280
	6.000	17.00	5.450	0.00129720
	6.000	20.00	5.352	0.00135950
	6.000	23.00	5.240	0.00143580
	6.000	26.00	5.140	0.00150900
6.25	6.625	20.00	6.049	0.00099103
	6.625	22.00	5.989	0.00101690
	6.625	24.00	5.921	0.00104730
	6.625	26.00	5.855	0.00107810
	6.625	28.00	5.791	0.00110910
	6.625	31.80	5.675	0.00116860
	6.625	34.00	5.595	0.00121220
6.625	7.000	20.00	6.456	0.00083766
	7.000	22.00	6.398	0.00085741
	7.000	23.00	6.366	0.00086858
	7.000	24.00	6.336	0.00087924
	7.000	26.00	6.276	0.00090111
	7.000	28.00	6.214	0.00092451
	7.000	30.00	6.154	0.00094795
	7.000	40.00	5.836	0.00108710

Table 15 – Friction Factors for Various Flow Strings (F_r)

Nominal Size, in	d_o	lb/ft	d	F_r
7.25	7.625	26.40	6.969	0.00068759
	7.625	29.70	6.875	0.00071213
	7.625	33.70	6.765	0.00074241
	7.625	38.70	6.625	0.00078360
	7.625	45.00	6.445	0.00084136
	8.000	26.00	7.386	0.00059178
7.625	8.125	28.00	7.485	0.00057179
	8.125	32.00	7.385	0.00059199
	8.125	35.50	7.285	0.00061320
	8.125	39.50	7.185	0.00063548
8.25	8.625	17.50	8.249	0.00044488
	8.625	20.00	8.191	0.00045306
	8.625	24.00	8.097	0.00046677
	8.625	28.00	8.003	0.00048106
	8.625	32.00	7.907	0.00049623
	8.625	36.00	7.825	0.00050982
	8.625	38.00	7.775	0.00051833
	8.625	43.00	7.651	0.00054030

Table 15 – Friction Factors for Various Flow Strings (F_r)

Nominal Size, in	d_o	lb/ft	d	F_r
8.625	9.000	34.00	8.290	0.00043922
	9.000	38.00	8.196	0.00045235
	9.000	40.00	8.150	0.00045897
	9.000	45.00	8.032	0.00047658
9	9.625	36.00	8.921	0.00036342
	9.625	40.00	8.835	0.00037264
	9.625	43.50	8.755	0.00038149
	9.625	47.00	8.681	0.00038995
	9.625	53.50	8.535	0.00040741
	9.625	58.00	8.435	0.00042000
9.625	10.000	33.00	9.384	0.00031893
	10.000	55.50	8.908	0.00036481
	10.000	61.20	8.790	0.00037759
10	10.750	32.75	10.192	0.00025767
	10.750	35.75	10.136	0.00026136
	10.750	40.00	10.050	0.00026718
	10.750	45.50	9.950	0.00027417
	10.750	48.00	9.902	0.00027761
	10.750	54.00	9.784	0.00028634

Table 16
Friction Factors for
Various Annuli (F_r)

See Appendix A (page 41).

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Table 16 – Friction Factor for Various Annuli (F_r)

Casing	Add to observed API Reading							
I.D., d	1.900	2.375	2.875	3.500	4.000	4.500	4.750	5.000
				F_r				
4.154	0.00481170	0.00653390	0.01033100	-----	-----	-----	-----	-----
4.276	0.00433240	0.00576360	0.00876750	-----	-----	-----	-----	-----
4.408	0.00388770	0.00507180	0.00744560	-----	-----	-----	-----	-----
4.494	0.00363250	0.00468470	0.00673890	-----	-----	-----	-----	-----
4.580	0.00340080	0.00433940	0.00612800	0.0118040	-----	-----	-----	-----
4.670	0.00318020	0.00401640	0.00557300	0.0102600	-----	-----	-----	-----
4.778	0.00294170	0.00367320	0.00500050	0.0087831	-----	-----	-----	-----
4.892	0.00271680	0.00335520	0.00448600	0.0075490	-----	-----	-----	-----
4.950	0.00261170	0.00320870	0.00425390	0.0070197	-----	-----	-----	-----
4.976	0.00256650	0.00314590	0.00415550	0.0068006	-----	-----	-----	-----
5.012	0.00250560	0.00306200	0.00402480	0.0065138	0.0117530	-----	-----	-----
5.140	0.00228630	0.00278840	0.00360600	0.0056294	0.0095637	-----	-----	-----
5.240	0.00214850	0.00259870	0.00332200	0.0050586	0.0082610	-----	-----	-----
5.352	0.00200770	0.00238160	0.00304130	0.0045167	0.0071001	-----	-----	-----
5.450	0.00189520	0.00223430	0.28232000	0.0041110	0.0062769	-----	-----	-----
5.524	0.00181600	0.00213160	0.00267340	0.0038397	0.0057479	0.0103670	-----	-----
5.595	0.00174440	0.00203940	0.00254040	0.0036037	0.0053016	0.0092398	-----	-----
5.675	0.00166850	0.00194230	0.00237150	0.0033629	0.0048589	0.0081822	-----	-----
5.791	0.00156650	0.00181280	0.00219420	0.0030541	0.0043101	0.0069508	0.0096004	-----
5.836	0.00152930	0.00176600	0.00213060	0.0029455	0.0041221	0.0065486	0.0089292	-----

Table 16 – Friction Factor for Various Annuli (F_r)

Casing I.D., d	Add to observed API Reading 1.900	2.375	2.875	3.500	4.000	4.500	4.750	5.000
	F_r							
5.855	0.00151400	0.00174670	0.00210460	0.0029014	0.0040465	0.0063895	0.0086675	-----
5.921	0.00146240	0.00168210	0.00201770	0.0027555	0.0037993	0.0058805	0.0078448	-----
5.989	0.00141190	0.00161900	0.00193350	0.0026163	0.0035676	0.0054183	0.0071172	-----
6.049	0.00136930	0.00156610	0.00186330	0.0025019	0.0033804	0.0050551	0.0065582	0.0090467
6.154	0.00129900	0.00147940	0.00174930	0.0022860	0.0030866	0.0045031	0.0057301	0.0076842
6.214	0.00126120	0.00143290	0.00168860	0.0021929	0.0029355	0.0042279	0.0053270	0.0070434
6.276	0.00122370	0.00138700	0.00162900	0.0021025	0.0027907	0.0039696	0.0049545	0.0064642
6.336	0.00118890	0.00134460	0.00157420	0.0020202	0.0026606	0.0037417	0.0046306	0.0059709
6.366	0.00117200	0.00132410	0.00154780	0.0019808	0.0025988	0.0036352	0.0044807	0.0057458
6.398	0.00115440	0.00130270	0.00152040	0.0019400	0.0025353	0.0035265	0.0043288	0.0055197
6.445	0.00112910	0.00127220	0.00148130	0.0018823	0.0024462	0.0033756	0.0041196	0.0052117
6.456	0.00112340	0.00126520	0.00147240	0.0018692	0.0023861	0.0033417	0.0040729	0.0051434
6.625	0.00103940	0.00116420	0.00134450	0.0016832	0.0021135	0.0028794	0.0034457	0.0042463
6.765	0.00097647	0.00108910	0.00125030	0.0015491	0.0019214	0.0025657	0.0030307	0.0036725
6.875	0.00093072	0.00103480	0.00118290	0.0014544	0.0017881	0.0023128	0.0027555	0.0033006
6.969	0.00089399	0.00099146	0.00112930	0.0013800	0.0016848	0.0021573	0.0025492	0.0030264
7.185	0.00081698	0.00090112	0.00101870	0.0012289	0.0014786	0.0018543	0.0021190	0.0025135
7.285	0.00078449	0.00086323	0.00097275	0.0011670	0.0013955	0.0017352	0.0019718	0.0022765
7.385	0.00075376	0.00082756	0.00092969	0.0011096	0.0013192	0.0016272	0.0018394	0.0021101
7.386	0.00075347	0.00082722	0.00092928	0.0011090	0.0013184	0.0016262	0.0018382	0.0021086

Table 17
Corrections to Observed API Gravity Taken at Various Temperatures, to Obtain API Gravity at 60ºF

Based on data from U. S. Bureau of Standards Technical Paper 77.

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Table 17 – Corrections to Observed Gravity Taken at Various Temeratures, to Obtain API Gravity at 60º F

Observed Temperature ºF	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0
				Add to observed API Reading				
30	1.7	2.0	2.4	3.0	3.7	4.3	5.0	5.7
32	1.6	1.9	2.3	2.8	3.4	4.0	4.7	5.3
34	1.5	1.8	2.1	2.6	3.1	3.7	4.3	4.9
36	1.4	1.6	2.0	2.4	2.9	3.4	4.0	4.6
38	1.3	1.5	1.8	2.2	2.6	3.1	3.6	4.2
40	1.2	1.4	1.6	2.0	2.4	2.8	3.2	3.8
42	1.1	1.2	1.5	1.8	2.2	2.5	2.9	3.4
44	0.9	1.1	1.3	1.6	2.0	2.2	2.6	3.0
46	0.8	0.9	1.1	1.4	1.7	1.9	2.3	2.7
48	0.7	0.8	0.9	1.2	1.4	1.6	2.0	2.3
50	0.6	0.7	0.8	1.0	1.2	1.4	1.6	1.9
52	0.5	0.6	0.7	0.8	1.0	1.1	1.3	1.5
54	0.3	0.4	0.5	0.6	0.8	0.9	1.0	1.1
56	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7
58	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.4

Table 17 – Corrections to Observed Gravity Taken at Various Temeratures, to Obtain API Gravity at 60º F

Observed Temperature ºF	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0
	Subtract from observed API Reading							
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4
64	0.2	0.3	0.3	0.4	0.4	0.6	0.6	0.7
66	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
68	0.5	0.6	0.6	0.7	0.9	1.1	1.3	1.4
70	0.6	0.7	0.8	0.9	1.1	1.4	1.6	1.7
72	0.7	0.8	0.9	1.1	1.3	1.6	1.9	2.1
74	0.8	0.9	1.1	1.3	1.6	1.8	2.2	2.5
76	0.9	1.1	1.3	1.5	1.8	2.1	2.5	2.8
78	1.0	1.2	1.4	1.7	2.0	2.4	2.8	3.1
80	1.1	1.3	1.5	1.8	2.2	2.6	3.1	3.5
82	1.2	1.4	1.7	2.0	2.5	2.9	3.4	3.9
84	1.3	1.5	1.8	2.2	2.7	3.2	3.7	4.3
86	1.4	1.7	2.0	2.4	2.9	3.4	4.0	4.6
88	1.6	1.8	2.1	2.6	3.1	3.7	4.2	4.9
90	1.7	2.0	2.3	2.7	3.3	3.9	4.5	5.2

Table 17 – Corrections to Observed Gravity Taken at Various Temeratures, to Obtain API Gravity at 60º F

Observed Temperature ºF	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0
	Subtract from observed API Reading							
92	1.8	2.1	2.4	2.9	3.5	4.2	4.8	5.6
94	1.9	2.2	2.6	3.1	3.8	4.4	5.1	5.9
96	2.0	2.3	2.7	3.3	4.0	4.6	5.4	6.3
98	2.1	2.4	2.9	3.4	4.2	4.9	5.7	6.6
100	2.2	2.6	3.0	3.6	4.4	5.1	6.0	6.9
102	2.3	2.7	3.2	3.8	4.6	5.4	6.3	7.2
104	2.4	2.9	3.3	4.0	4.8	5.7	6.6	7.5
106	2.5	3.0	3.5	4.2	5.0	5.9	6.9	7.9
108	2.7	3.1	3.6	4.3	5.2	6.2	7.2	8.2
110	2.8	3.2	3.7	4.4	5.4	6.4	7.5	8.5
112	2.9	3.3	3.9	4.6	5.6	6.7	7.7	8.8
114	3.0	3.4	4.0	4.7	5.8	6.9	7.9	9.1
116	3.1	3.6	4.1	4.9	6.0	7.1	8.2	9.4
118	3.2	3.7	4.3	5.1	6.2	7.3	8.5	9.8
120	3.3	3.8	4.4	5.3	6.4	7.5	8.8	10.0

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