

NORTHWEST NATURAL GAS COMPANY
 WN U-6 Third Revision of Sheet 11.1
 Cancels Second Revision of Sheet 11.1

GENERAL RULES AND REGULATIONS
 (continued)

Rule 11. Determination of Thermal Units.

The quality of Natural Gas procured and delivered by Company, or by Customers under **SCHEDULE T**, shall conform to standard purity requirements of the Commission; shall have an energy content of 1050 Btu per standard cubic foot ± 10 percent (945 to 1155); and shall permit satisfactory operation of appliances.

Customers will be billed based on energy units, normally in therms. Determination of thermal units shall take into account metered volume, metering pressure, metering temperature, compressibility ratio and energy content of the gas. Therms will be computed to a standard base pressure of 14.73 PSIA and a standard temperature of 60 degrees Fahrenheit. Equipment and methods used for billing factor calculations may vary.

Total Energy = Metered Volume x Billing Factor, where Billing Factor = Pressure Factor (PF) X Temperature Factor (TF) X Compressibility Ratio (CR) X BTU Factor (C)
 (C)

Metered volume is measured by the meter at the customer premises. The meter index is the output device that provides the index volume readings, typically in hundreds of cubic feet (ccf). An index multiplier of 1 is used for most residential and commercial customers. Larger volume customers may have index multipliers of 10, 100, or 1000.

$$\text{Metered Volume} = \text{Index Volume} \times \text{Index Multiplier}$$

The pressure factor times compressibility ratio (PF x CR) for residential and small commercial customer billings will be approximately 1.0091 when metering pressure is 6.5 inches water column, and approximately 1.1293 for 2.0 psig metering pressure. For metering pressures above 2.0 psig, the pressure factor will be calculated on a customer-specific basis. Some meters may incorporate a pressure compensating device for automatic calculation of the pressure factor at the meter site.

$$\text{Pressure Factor (PF)} = \frac{\text{Metering Pressure (PSIG)} + \text{Atmospheric Pressure (PSIA)}}{14.73 \text{ PSIA}}$$

Atmospheric Pressure (PSIA) is determined from plat map average elevation and an average determined from the daily barometric pressure during the billing period.

$$\begin{aligned} \text{Atmospheric Pressure (PSIA)} &= 14.73 \times \text{Barometric Factor} \times \text{Elevation Factor} && \text{(T)} \\ \text{Barometric Factor} &= \frac{\text{PDX Barometer Reading (inHg)} + 0.025}{29.99} \\ \text{Elevation Factor} &= 0.9871 \times \frac{(55457 - \text{Elevation})}{(54735 + \text{Elevation})} \end{aligned}$$

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GENERAL RULES AND REGULATIONS
(continued)

Rule 11. Determination of Thermal Units. (continued)

Temperature Factor (TF) is an average determined from representative samples of metering temperatures for the billing period. Temperature information for most accounts will be obtained from daily temperature data for the weather stations specified in this **RULE 11**, as published daily by third party sources. The temperature factor might alternatively be applied through on-site temperature compensating devices or other temperature recording equipment.

$$\text{Temperature Factor} = \frac{520}{(\text{Metering Temperature } ^\circ\text{F} + 460)}$$

Temperature data will be based on the daily temperatures reported for the following weather stations. Each weather station corresponds to three weather zone assignments within the Company's Washington service territory. Each account is assigned a weather zone based upon where the Customer's premise is located on the plat map. Plat map data is electronically downloaded into the Company's Customer Information System (CIS) from data received from the respective County Assessors Office. In most cases, the weather zone will correspond with the assigned service district.

Weather Station	NWN Weather Zone
Vancouver (458773)	Clark County & Western Skamania County
Hood River Oregon AgriMet Weather Station (HOXO)	Eastern Skamania County and Klickitat County

If at any time the temperature data is not available for any of the listed weather stations, the Company will use a substitute station and associated basis temperature differentials, where applicable, in accordance with Company policy. For billing purposes, the Company will use the daily temperatures that are reported by the third party each day. The Company will not be required to issue corrected bills to customers when any of the reported data is later changed by the reporting party.

Compressibility Ratio (CR) will be calculated in accordance with American Gas Association (AGA) recommendations. The CR is dependent on pressure, temperature and gas composition. At very high metering pressures, the value becomes significant (about 1.100 at 500 PSIG). For larger volume Customers, the CR may be applied through on-site equipment. At low metering pressures it has a value close to about 1.000, and an approximation is used.

$$\text{Compressibility Ratio (CR)} = 1 + \text{Metering Pressure} / 6000$$

The Btu Multiplier, Btu per standard cubic foot (Btu/Scf) is Gross Heating Value, measured at 60 degrees, at 14.73 PSIA and without water vapor, in accordance with AGA methods. Energy content of natural gas supplied to the customer shall be measured, typically at the Company's receipt and storage points. The Btu multiplier for a billing period will be computed based on the appropriate gas source during the billing period.

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