



Standard Practice for Interconversion of Analysis of C₅ and Lighter Hydrocarbons to Gas-Volume, Liquid-Volume, or Weight Basis¹

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1. Scope

1.1 This practice describes the procedure for the interconversion of the analysis of C₅ and lighter hydrocarbon mixtures to gas-volume (mole), liquid-volume, or weight in vacuum basis.

1.2 The computation procedures described assume that gas-volume percentages have already been corrected for non-ideality of the components as a part of the analytical process by which they have been obtained. These are numerically the same as mole percentages.

1.3 The procedure assumes the absence of nonadditivity corrections for mixtures of the pure liquid compounds. This is approximately true only for mixtures of hydrocarbons of the same number of carbon atoms, and in the absence of diolefins and acetylenic compounds.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Source of Data

2.1 The basic values for the relative density 15.6/15.6°C (60/60°F) of the pure compounds have been obtained from the Thermodynamics Research Center, Texas A & M University, except where otherwise noted. The values for methane, ethylene, and acetylene are not those of pure materials but are assumed to apply as a component of a liquid mixture.

2.2 The conversion factors for 1 mL of ideal gas at 15.6°C (60°F) and 760 mm Hg to millilitres of liquid at 15.6°C (60°F) have been calculated as follows: 1 mL gas at 15.6°C (60°F), 760 mm Hg

$$L = (273.16/288.72) \times (M/22414) \times [1/(\text{relative density})(0.99904)] \\ 4.2251 \times 10^{-5} \times (M/\text{relative density}) \quad (1)$$

¹ This practice is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.01 on Liquefied Petroleum Gas.

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= millilitres liquid at 15.6°C (60°F)

where:

M = molecular weight of the pure compound, and

Relative density = relative density, 15.6/15.6°C (60/60°F) (vacuum), of the pure compound.

2.3 Where ideal gas volumes have been measured at temperatures and pressures different from 15.6°C (60°F) at 760 mm Hg, they must be corrected to these conditions.

3. Significance and Use

3.1 For custody transfer and other purposes, it is frequently necessary to convert a component analysis of light hydrocarbon mixture from one basis (either gas-volume, liquid volume, or weight) to another.

3.2 The component distribution data of light hydrocarbon mixtures can be used to calculate physical properties such as relative density, vapor-pressure, and calorific value. Consistent and accurate conversion data are extremely important when calculating vapor, liquid, or mass equivalence.

4. Procedure

4.1 To convert from the original to the desired basis, multiply or divide the percent of each compound in the original basis according to the schedule shown in Table 1. Perform the calculation, using the corresponding factor indicated in Table 2. Carry at least one more significant figure in all of the calculations than the number of significant figures in the original analysis.

NOTE 1—The factors or percentages can be multiplied by any constant number for convenience (such as moving the decimal) without changing the end result.

4.2 Add the products or quotients obtained in accordance with 4.1.

4.3 Multiply the products or quotients obtained in accordance with 4.1 by 100 divided by the sum of the products or quotients. Round off the results so that the same number of significant figures is obtained in the final answer as was used in the original analysis.

4.4 Add the percentages of the desired basis from 4.3 and distribute the round-off error (difference between the sum and 100 %) proportionately. Usually only the largest percentage will be changed in the final digit.

TABLE 1 Conversion Factors Scheduled

Original Basis	Desired Basis	Operation	Factor Column in Table 2
Gas-volume	weight	multiply by	1
Gas-volume	liquid-volume	multiply by	2
Weight	gas-volume	divide by	1
Weight	liquid-volume	divide by	3
Liquid-volume	gas-volume	divide by	2
Liquid-volume	weight	multiply by	3

5. Keywords

5.1 analysis; liquefied petroleum gases; natural gas liquids

TABLE 2 Weight-Volume Data for Liquefied Petroleum Gases and Low Boiling Hydrocarbons

Compound	Column 1	Column 2	Column 3	Source
	Molecular Weight	Liquid Volume in millilitre of 1 mL of ideal gas at 15.6°C (60°F) and 760 mm Hg	Relative Density 15.6/15.6°C (60/60°F) (Vacuum)	
Methane ^A	16.04	0.00226	0.30	2145-94
Ethane ^B	30.07	0.003548	0.3581	2145-94
Acetylene ^A	26.04	0.00263	0.418	GPSA
Ethylene ^A	28.05	0.0032	0.37	est.
Propane ^B	44.10	0.003675	0.5070	2145-94
Propylene ^B	42.08	0.003413	0.5210	GPSA
Propadiene (Allene) ^B	40.06	0.00282	0.600	API-88
Methylacetylene ^B	40.06	0.00273	0.621	API-88
<i>n</i> -Butane ^B	58.12	0.004205	0.5840	2145-94
Isobutane ^B	58.12	0.004362	0.5629	2145-94
1-Butene ^B	56.11	0.003944	0.6011	GPSA
<i>trans</i> -2-Butene ^B	56.11	0.003887	0.6100	GPSA
<i>cis</i> -2-Butene ^B	56.11	0.003780	0.6272	GPSA
Isobutylene ^B	56.11	0.003949	0.6004	GPSA
1,2-Butadiene ^B	54.09	0.00347	0.658	GPSA
1,3-Butadiene ^B	54.09	0.003643	0.6272	GPSA
Ethylacetylene ^B	54.09	0.00328	0.696	API-88
<i>n</i> -Pentane	72.15	0.004830	0.6311	2145-94
Isopentane	72.15	0.004882	0.6244	2145-94
Neopentane ^B	72.15	0.005108	0.5967	GPSA
1-Pentene	70.13	0.004589	0.6457	GPSA
<i>trans</i> -2-Pentene	70.13	0.004537	0.6530	TRC
<i>cis</i> -2-Pentene	70.13	0.004482	0.6611	TRC
2-Methyl-1-butene	70.13	0.004519	0.6557	TRC
3-Methyl-1-butene	70.13	0.004684	0.6325	TRC
2-Methyl-2-butene	70.13	0.00447	0.663	TRC
Cyclopentane	70.13	0.003948	0.7505	GPSA
Isoprene	68.12	0.004195	0.6861	GPSA
1- <i>trans</i> -3-Pentadiene	68.12	0.004224	0.6815	API
1- <i>cis</i> -Pentadiene	68.12	0.004133	0.6964	API
1,2-Pentadiene	68.12	0.004125	0.6976	API

^AApparent values for dissolved gas at 15.6°C (60°F).^BProperty of liquid phase measured at its saturation pressure at 15.6°C (60°F).

Sources: GPA 2145-94: "Physical Constants of Paraffin Hydrocarbons and Other Components of Natural Gas," Gas Processors Association,

GPSA: "Engineering Data Book, 10th Edition," Gas Processors Suppliers Association,

API: Technical Data Book, American Petroleum Institute, and

TRC: Thermodynamic Research Center, Texas A&M University.

NOTE 2—For sample calculations, see the Appendix.