# Mass Measurement of Natural Gas Liquids

## GPA Standard 8182–03

## API Manual of Petroleum Measurement Standards Chapter 14.7



THIRD EDITION, OCTOBER 2009

ADOPTED AS TENTATIVE STANDARD, 1982
REVISED 1984, 1995, 2003

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This standard was developed jointly by GPA Section H, Measurement and Product Handling, and the API Committee on Gas Fluids Measurement (COGFM). It is referenced by API as Chapter 14.7 of the API *Manual of Petroleum Measurement Standards* (*MPMS*). The participation of COGFM in developing this standard is gratefully appreciated and acknowledged.

Throughout this publication, the latest appropriate API and GPA standards are referenced.

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, D.C. 20005, standards@api.org.

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## Introduction

Measurement by mass is often preferred for chemical reactions and various processes where the mass ratios of components are of primary interest in effecting control of the operation.

Since the 1970s, the gas processing industry has recognized the importance of measuring mixed natural gas liquid (NGL) streams using mass measurement techniques. The volume at standard conditions of each component of an NGL mixture may be accurately derived from the mass measurement process because, unlike volumetric measurement, the mass measurement process is not sensitive to the effect pressure, temperature, intermolecular adhesion and solution mixing have on the measured stream.

Solution mixing and intermolecular adhesion occurs when smaller molecules fill in the spaces between the larger molecules in the solution. Temperature and pressure also affect the amount of shrinkage caused by solution mixing and intermolecular adhesion. Due to these behaviors, the sum of the volumes of individual components in their pure state is greater than the volume of the mixture.

Today, mass measurement systems are commonly used to measure NGL mixtures like raw make and ethane-propane mixes as well as specification ethane product. On the other hand, many propane, isobutane, normal butane and natural gasoline streams are measured using volumetric techniques. A number of industry-developed standards address the design, construction, operation and maintenance aspects of mass and volumetric measurement systems. Volumetric measurement depends on tables and correlations to correct the volume measured at flowing conditions to a volume at base conditions. The actual stream composition is important to both mass and volumetric techniques.

The Gas Processors Association (GPA) publishes specifications for some of the products resulting from natural gas processing and fractionation including commercial propane, HD-5 propane, commercial butane and others. Many companies also have specifications describing, among other things, the compositional requirements of a particular product. Mass measurement is the recommended method of measurement for these mixtures.

These specification products rarely, if ever, are comprised of a single component. Instead, specification products are themselves a mixture of several components, and the actual composition may vary somewhat over time as a function of plant operation. Solution mixing therefore occurs in specification products as well as in raw make. Industry developed tables and correlations address physical properties of certain specification products, within the limits of the research database. Volumetrically measured streams are then adjusted using these tables and correlations for temperature, pressure and density effects. Errors may result when performing these volumetric measurement adjustments if the composition of the stream does not match the compositions for which the volume correction tables and correlations were derived.