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American Gas Association

GAS MEASUREMENT MANUAL

MEASUREMENT OF GAS PROPERTIES

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GAS MEASUREMENT MANUAL
(REVISED)

PART ELEVEN
MEASUREMENT OF GAS PROPERTIES

SECTION 11.1—SPECIFIC GRAVITY DETERMINATION
SECTION 11.2—HEATING VALUE OF GAS DETERMINATION
SECTION 11.3—GAS SAMPLING
SECTION 11.4—SULFUR DETERMINATION
SECTION 11.5—TEMPERATURE AND PRESSURE DETERMINATION
SECTION 11.6—SUPERCOMPRESSIBILITY DETERMINATION
SECTION 11.7—DENSITY DETERMINATION
SECTION 11.8—GAS ANALYSIS
SECTION 11.9—GAS ODORIZATION
SECTION 11.10—WATER VAPOR DETERMINATION

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Section 11.1
SPECIFIC GRAVITY DETERMINATION

INTRODUCTION

Definition

Specific gravity is a term used to express the ratio of the molecular weight of a gas (or a mixture of gases) to the molecular weight of air. Air is a compound of varying composition. Its molecular weight has been established as 28.9625, as reported in the Table of Physical Properties, A.G.A. Report #3, revised 5/16/85. Where precise specific gravity determinations are made by analytical means, the prevailing composition of air is of no consequence if consistently related to the number 28.9625. Yet, considering technical inability to determine the molecular weight of gas short of analytical fractionation, the ratio of gas density to the density of air under common pressure and temperature conditions is often taken to represent specific gravity. The difference between relative density and relative molecular weight is small, provided, however, that densities are determined at relatively low pressures. Any difference between the two ratios may be attributed to the difference in Ideal Gas Laws deviation at any given common pressure and temperature, if we can assume the composition of reference air at a particular locale approximates a molecular weight of 28.9625. Relative densities may be converted to relative molecular weight (specific gravity) by accounting for the Ideal Gas Laws.

Specific Gravity Relationship to Gas Measurements

Specific gravity is a fundamental aspect of a gas in several gas measuring sectors. In flow metering, the pressure drop across an orifice, flow nozzle, venturi tube, or similar restriction is affected by the molecular weight of the flowing fluid. Also, the relationships that have been found between specific gravity of a gas and its deviation from Ideal Gas Laws account for the preparation of A.G.A.'s *Manual for the Determination of Supercompressibility Factors for Natural Gas* PAR Research Project NX-19*. Similar relationships have also been found between specific gravity and the calorific value of fuel gases and are covered by A.G.A.'s publication Report No. 5, *Fuel Gas Energy Metering.*

Effect of Specific Gravity Errors

Any error in specific gravity determination is very significant, if examined in the light of any one of the several factors affected—F_{gr}, F_{pv}, F_{hgm}, and the heating value of a gas. Yet the overall effect of specific gravity error will be found less than the sum of individual errors, considering the error attributed to a single factor is often offset by compensating errors in other factors tied to a specific gravity index. The effect of specific gravity error on individual factors and combined factors used in orifice meter measurements is illustrated in the following example for a hydrocarbon gas mixture flowing at 1000 psia, at 60°F, under standard gravitational forces of 980.665 cm/sec./sec. (32.174 ft/sec²) at sea level and 45° latitude.

EXAMPLE

	Specific Gravity	Factor F_{gr} (Report #3)	Factor F_{pv} (NX-19)	Factor F_{hgm} (Report #3)	Btu/cf (Report #5)	Combined Factors
Correct	.600	1.2910	1.0834	.9978	1086.9	1516.9
Erroneous	.610	1.2804	1.0872	.9977	1102.6	1531.3
% Error	+1.67	−0.82	+0.35	−0.01	+1.44	+0.95

*This manual has been superseded by A.G.A. Transmission Measurement Committee Report #8. A.G.A. 8 extends the range of contaminants, pressures, and temperatures allowed when it is used to calculated F_{pv}.