

AGA Report No. 5

Natural Gas Energy Measurement

Prepared by Transmission Measurement Committee

March 2009



American Gas Association

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**Prepared by
Transmission Measurement Committee**



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FOREWORD

This report is published to foster consensus among parties conducting energy-based measurement of natural gas.

The report addresses methods, assumptions and criteria relevant to the determination of heating value and heat energy.

Gas property measurement has a history of continual refinement. A goal of this report is to provide stabilizing influence through the stewardship of the Transmission Measurement Committee of the American Gas Association.

This revision was triggered by technology advancement and heightened industry attention to gas quality issues.

This version of AGA Report No. 5 supersedes all prior versions of this document. Users of previous editions are advised to upgrade to this edition.

Programs in Excel Spreadsheet for AGA 5 related calculations including heating values both in Imperial and SI units are provided with this report.

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1. Scope of Application

1.1 General

This report applies specifically to energy-based custody transfer measurement of natural gas. It may or may not be suitable to other applications, as determined by the user.

Heating value measurement is used in tandem with volume flow or mass flow measurement, the use of which is guided by other reports and industry standards. This report is not intended to supersede, extend or duplicate the content of flow measurement documents.

For ease of use, this report supports two approaches to estimating heating value from composition: simplified 'table look-up' or full calculation. The approaches are functionally equivalent because the look-up tables were produced with the calculation methods.

The tables A.1.1 and A.1.2 provide pre-calculated heating values of common gas constituents for a range of common reference conditions. The detailed methods and data elsewhere in this report are primarily for traceability.

Report No. 5 differs in scope from other documents concerning energy measurement. In addition to technical data and formulas, this report recommends performance criteria.

The physical property data reproduced in this report were drawn from widely-accepted industry sources, including NIST[1] and CODATA[12]. Results obtained using this report will agree closely with results from methods sharing its lineage.

In keeping with gas industry practice, this report supports both SI and Imperial units of measure.

1.2 Range Of Application

This report is focussed on methods for predicting the heat energy resulting from complete combustion of commercially acceptable natural gas.

1.2.1 Inclusion Criteria for Fuel Gas Mixtures

This report is valid only for fuel gas mixtures meeting the following criteria:

- the fuel must be in the gas phase at the specified reference conditions.
- air/fuel mixtures must be capable of ignition followed by self-sustaining, exothermic combustion reactions.
- hydrocarbon combustion reactions must reach stoichiometric completion, resulting in product water and carbon dioxide.
- trace products of combustion, such as NO_x and CO, are negligible in the context of heat production

Not in the scope of this report are:

- combustion characteristics such as flame geometry and air/fuel ratio
- determination of emissions or the products of incomplete combustion
- natural Gas Interchangeability indices, other than Wobbe Number, Methane Number (MN) and Motor Octane Number (MON)