



Standard Method for ANALYSIS OF NATURAL GASES AND RELATED TYPES OF GASEOUS MIXTURES BY THE MASS SPECTROMETER¹

This Standard is issued under the fixed designation D 1137; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method covers the determination of the complete chemical composition of natural gases and like gaseous mixtures through the C₄ hydrocarbons (Note 1), including information concerning vapors of heavier hydrocarbons that may be present. Determinations for the following components of such gaseous mixtures may be made (Notes 2 and 3):

Helium	Ethene
Neon	Propane
Argon	Propene
Oxygen	Isobutane
Nitrogen	Butane
Carbon dioxide	Butenes
Hydrogen sulfide	Pentanes
Sulfur dioxide	Pentenes
Methane	Hexanes
Ethane	

NOTE 1—A volumetric-chemical method for the analysis of natural gases, where the complete composition is not required, is given in ASTM Method D 1136, for Analysis of Natural Gases by the Volumetric-Chemical Method.²

NOTE 2—Hydrogen may occur to an extent great enough to be detected, as the result of decomposition of iron or of compressor oil. As a natural component it may be expected only in trace amounts. It can be determined, if necessary, in amounts of 0.1 percent or greater. Hydrocarbons heavier than C₆ may be indicated on the spectrogram if present in sufficient amount, but their estimation should be made in a concentrate, not in the original sample.

NOTE 3—Hydrogen sulfide and sulfur dioxide do not coexist in large amounts. Other sulfur gases may also be determined.

2. Summary of Method

2.1 The molecular species making up a gaseous mixture are ionized and dissociated by electron bombardment, the resulting positive ions of different masses are accelerated in an electric field and are separated magnetically, and the abundance of each mass present is recorded. The mixture spectrogram thus obtained is solved against the mass spectra of each of the pure molecular species constituting the mixture.

3. Apparatus

3.1 A suitable mass spectrometer for the analysis of natural gas is the Consolidated mass spectrometer, Models 21-101 and 21-102,³ or equivalent.

NOTE 3—The two models of the Consolidated mass spectrometer differ in that Model 21-102 uses an MS filament power supply instead of storage batteries, automatic ionization - emission control, ionization chamber temperature control, and a Type III ionization chamber. The details of the method as written are applicable to both models of the spectrometer. The Research Model of the Westinghouse mass spectrometer has also been used satisfactorily for the analysis of this type of gas mixture. Other spectrometers may be found satisfactory from time to time and, if so, will be listed in future editions of this method.

4. Reference Standards

4.1 The mass spectrometer must be cali-

¹ This method is under the jurisdiction of ASTM Committee D-3 on Gaseous Fuels.

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² *Annual Book of ASTM Standards*, Part 26.

³ Available from the Consolidated Engineering Corp., Pasadena, Calif.