Manual of Petroleum Measurement Standards
Chapter 11—Physical Properties Data

Section 1—Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils

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Chapter 11 — Physical Properties Data

Section 1 — Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils

NOTE: This version of API *MPMS* Chapter 11.1 includes modifications published in May 2019 as Addendum 2. Added text is highlighted in yellow. Deleted text is indicated by strikethrough. Modifications published in September 2007 as Addendum 1 have already been incorporated and are not specifically indicated, although a summary of the changes is given in 11.1.1.5.

11.1.0 Implementation Guidelines

This Standard (Revised Standard) is effective upon the date of publication and supersedes the previous edition of the Standard(s) (Previous Standard(s)) referenced in Appendix A of this Revised Standard. ~~However, due to the nature of the changes in this Revised Standard, it is recognized that guidance concerning an implementation period may be needed in order to avoid disruptions within the industry and ensure proper application. As a result, it is recommended that this Revised Standard be utilized on all new applications no later than TWO YEARS after the publication date. An application for this purpose is defined as the point where the calculation is applied.~~

Once the Revised Standard is implemented in a particular application, the Previous Standard will no longer be used in that application.

If an existing application complies with the Previous Standard(s) then it shall be considered in compliance with this Revised Standard.

However, the use of API standards remains voluntary and the decision on when to utilize a standard is an issue that is subject to the negotiations between the parties involved in the transaction.

11.1.1 Introduction & History

The density and therefore the volume of hydrocarbons is sensitive to temperature and pressure. Volume Correction Factors (VCFs) are used to correct observed volumes to equivalent volumes at a standard temperature and pressure. These standard, or base, conditions serve as a way to use volumetric measures equitably in general commerce. This Standard establishes a procedure for crude oils, liquid refined products, and lubricating oils by which density measurements taken at any temperature and pressure can be corrected to an equivalent density at the base conditions. The Standard also provides a method for making a conversion to alternate base temperatures.

The volume correction factors, in their basic form, are the output of a set of equations derived from and based on empirical data relating to the volumetric change of hydrocarbons over a range of temperatures and pressures. Traditionally, the factors have been listed in a tabular format called the Petroleum Measurement Tables. In order to introduce this document and the work that serves as its foundation, a short history of these Tables is warranted.

11.1.1.1 Early Temperature and Pressure Correction Tables

Correction factors to account for the thermal expansion of liquid hydrocarbons were first formally developed in 1916 by the National Bureau of Standards (United States) under *Circular No. 57*. These data were based on density and temperature pairs documented in the National Bureau of Standards (NBS*) Technologic Paper No. 77*. *Circular No. 57* was superseded in 1924 by *Circular No. C154* which in turn was superseded by a more widely known *Circular C410*, in 1936. By 1945 The Institute of Petroleum (IP) was publishing the *Tables for Measurement of Oil* in British units.

The compressibility standard (API Standard 1101, Appendix B, Table II) for hydrocarbons in the 0 to 90° API gravity ranges was developed in 1945 by Jacobson, et al. It was based on limited data obtained mostly on pure compounds and lubricating oil type materials. Standard 1101 was developed without the aid of a mathematical model.

11.1.1.2 1952 Temperature Correction Tables

In 1952 the British and the American temperature correction factor tables were joined together and made available in three units of measure: US units, British (Imperial) units, and metric units. These tables were called The Petroleum Measurement Tables and were published jointly by the American Society for Testing and Materials (ASTM) and the IP. These tables are commonly referred to as the 1952 Tables, or “Blue Book Tables.”