



Designation: **D 1903–031903 – 08**

Standard Test Method Practice for Determining the Coefficient of Thermal Expansion of Electrical Insulating Liquids of Petroleum Origin, and Askarels¹

This standard is issued under the fixed designation D 1903; 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. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This ~~test method practice~~ covers the determination of the coefficient of thermal expansion of electrical insulating liquids of petroleum origin, and askarels, containing PCBs (polychlorinated biphenyls), when used as an insulating or cooling medium, or both, in cables, transformers, oil circuit breakers, capacitors, or similar apparatus.

1.2 The values given stated in acceptable metric-SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

D 941 [Test Method for Density and Relative Density \(Specific Gravity\) of Liquids by Lipkin Bicapillary PycnometerPycnometer³](#)

D 1250 [Guide for Petroleum Measurement Tables²–Guide for Use of the Petroleum Measurement Tables](#)

D 1298 [Practice–Test Method for Density, Relative Density \(Specific Gravity\), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method²Method](#)

D 1810 [Test Method for Specific Gravity of Askarels–Test Method for Specific Gravity of Askarels \(Discontinued 2001\)](#)

3. Terminology

3.1 *Definition of Term Specific to This Standard:*

3.1.1 *coefficient of thermal expansion of a liquid, n* —the change in volume per unit volume per degree change in temperature. It is commonly stated as the average coefficient over a given temperature range.

4. Significance and Use

4.1 Knowledge of the coefficient of thermal expansion of a liquid is essential to compute the required size of a container to accommodate a volume of liquid over the full temperature range to which it will be subjected. It is also used to compute the volume of void space that would exist in an inelastic device filled with the liquid after the liquid has cooled to a lower temperature.

5. Procedure for Liquids of Petroleum Origin

5.1 The coefficient of thermal expansion used in Guide D 1250, is 0.00040/°F for the temperature range from – 17.7 to 65.5°C (0 to 150°F), and petroleum oils ranging from 15.0 to 34.9° API gravity or 0.9659 to 0.8504 relative density (specific gravity). In the preparation of these tables for relative density (specific gravity) values above 0.600, it has been assumed for purposes of standardization that all crude petroleum and petroleum products have uniform coefficients of expansion in the same temperature ranges. When the required accuracy of results falls within these assumptions, this value for coefficient of expansion may be used.

5.2 If closer approximation than that indicated in 5.1 is required, the coefficient of thermal expansion may be calculated by determining observed relative densities (specific gravities). Determine the relative densities at any two temperatures below 90°C

¹ This ~~test method practice~~ is under the jurisdiction of ASTM Committee D27 on Electrical Insulating Liquids and Gases and is the direct responsibility of Subcommittee D27.07 on Physical Tests-Test.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.