

Manual of Petroleum Measurement Standards Chapter 11—Physical Properties Data

Section 2, Part 4—Temperature Correction for the Volume
of NGL and LPG
Tables 23E, 24E, 53E, 54E, 59E, and 60E

ASTM Technical Publication [Stock No. PETROLTBL-TP27]
GPA Technical Publication TP-27

FIRST EDITION, SEPTEMBER 2007



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Foreword

For custody transfer purposes, natural gas liquid (NGL) and liquefied petroleum gas (LPG) volumes are generally stated at a fixed base temperature and saturation pressure. As most volume transfers occur at temperatures and pressures other than standard conditions, these volumes are adjusted to standard conditions through the use of correction factors.

This document presents a new method to calculate temperature correction factors. With the publication of this document, previous API, ASTM and GPA documents containing NGL and LPG temperature correction factors should no longer be used. The document is specifically titled as being suitable for NGL and LPG liquids. Light hydrocarbon mixtures containing significant quantities of methane, carbon dioxide and nitrogen which have density ranges which overlap those contained in these tables can be encountered. However, the two-fluid correlation which is the basis of these tables was not calibrated for such mixtures.

The actual Standard represented by this report consists of the explicit implementation procedures. Sample tables and other examples created from a computerized version of these implementation procedures are presented within. However, these are for examples only and do not represent the Standard.

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Nomenclature

A, B, C	parameters in Section 5.1.2 quadratic equation
C_{TL}	temperature correction factor
h_2	scaling factor
k_1, k_2, k_3, k_4	parameters in saturation density equation
T_B	base temperature (60°F, 15°C, or 20°C)
T_{BK}	base temperature (288.15 K, or 293.15 K)
T_c	fluid critical temperature (K)
$T_{c,ref}$	reference fluid critical temperature (K)
T_F	observed measurement temperature (°F or °C)
$T_{r,x}$	reduced observed temperature
T_x	observed temperature (K)
V_{60}/V_{T_x}	ratio of volume at 60°F to volume at temperature T_x . Is the basic definition of C_{TL}
X	interpolating factor
Z_c	critical compressibility factor
α, β, ϕ	parameters in Section 5.1.2 quadratic equation
δ	interpolation variable
τ	parameter in saturation density equation
γ_x	relative density at observed temperature
$\gamma_{x,high}$	relative density at the observed temperature corresponding to the upper bound for the 60° relative density
$\gamma_{x,low}$	relative density at the observed temperature corresponding to the lower bound for the 60° relative density
$\gamma_{x,mid}$	relative density at the observed temperature corresponding to the intermediate 60° relative density used in Section 5.1.2 iteration procedure
$\gamma_{x,trial}$	trial relative density at the observed temperature used in Section 5.1.2 iteration procedure
γ_{TB}	relative density at the base temperature, T_B
γ_{60}	relative density at a base temperature of 60°F
γ_{T_x}	relative density at the observed temperature, T_x
$\gamma_{60,high}$	upper bound for the observed fluid's 60° relative density
$\gamma_{60,low}$	lower bound for the observed fluid's 60° relative density
$\gamma_{60,mid}$	intermediate 60°F relative density value used in Section 5.1.2 iteration procedure
$\gamma_{60,trial}$	trial 60°F relative density value used in Section 5.1.2 iteration procedure
ρ_c	critical molar density (gram-mole/L)
ρ_{60}	density at a base temperature of 60°F (kg/m ³)
ρ_{15}	density at a base temperature of 15°C (kg/m ³)
ρ_{20}	density at a base temperature of 20°C (kg/m ³)
ρ^{sat}	saturation molar density (gram-mole/L)
ρ_{60}^{sat}	saturation molar density at 60°F (gram-mole/L)
ρ_T^{sat}	saturation molar density at observed temperature (gram-mole/L)



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