

DIN EN ISO 20765-2:2018-12 (E)

Natural gas - Calculation of thermodynamic properties - Part 2: Single-phase properties (gas, liquid, and dense fluid) for extended ranges of application (ISO 20765-2:2015)

Contents		Page
	European foreword	4
1	Scope	6
2	Normative references	7
3	Terms and definitions	7
4	Thermodynamic basis of the method	9
4.1	Principle	9
4.2	The fundamental equation based on the Helmholtz free energy	9
4.2.1	Background	9
4.2.2	The Helmholtz free energy	10
4.2.3	The reduced Helmholtz free energy	10
4.2.4	The reduced Helmholtz free energy of the ideal gas	11
4.2.5	The pure substance contribution to the residual part of the reduced Helmholtz free energy	11
4.2.6	The departure function contribution to the residual part of the reduced Helmholtz free energy	12
4.2.7	Reducing functions	13
4.3	Thermodynamic properties derived from the Helmholtz free energy	13
4.3.1	Background	13
4.3.2	Relations for the calculation of thermodynamic properties in the homogeneous region ...	14
5	Method of calculation	16
5.1	Input variables	16
5.2	Conversion from pressure to reduced density	16
5.3	Implementation	17
6	Ranges of application	18
6.1	Pure gases	18
6.2	Binary mixtures	19
6.3	Natural gases	22
7	Uncertainty of the equation of state	23
7.1	Background	23
7.2	Uncertainty for pure gases	23
7.2.1	Natural gas main components	23
7.2.2	Secondary alkanes	24
7.2.3	Other secondary components	26
7.3	Uncertainty for binary mixtures	26
7.4	Uncertainty for natural gases	28
7.4.1	Uncertainty in the normal and intermediate ranges of applicability of natural gas	29
7.4.2	Uncertainty in the full range of applicability, and calculation of properties beyond this range	30
7.5	Uncertainties in other properties	30
7.6	Impact of uncertainties of input variables	30
8	Reporting of results	30

Annex A (normative) Symbols and units	32
Annex B (normative) The reduced Helmholtz free energy of the ideal gas	34
Annex C (normative) Values of critical parameters and molar masses of the pure components	40
Annex D (normative) The residual part of the reduced Helmholtz free energy	41
Foreword	5
Annex G (informative) Examples	63
Bibliography	65
Annex E (normative) The reducing functions for density and temperature	53
Annex F (informative) Assignment of trace components	60