

# Scanner Flow Computer Calculations

Fluids	Industry Standards	Scope	Limitations	Series 3000	Series 2000	Series 1100
<b>Natural gas, detailed composition</b>						
Mole fractions of 21 components	AGA-8 (1994); ISO 12213 (1997)	Natural gas	Gas phase only; limits on mol%	•	•	•
	Groupe Européen de Recherche sur les Normativités (GERG) 2008 (2012)	Natural gas	Gas, liquid, dense phases	•		
Mole fractions of 18 components	GERG-2004 (2007)	Hydrocarbon fuel gas, natural gas	Gas, liquid, dense phases; no mol% limits			•
Chromatograph support		Manual or automated updates of gas compositions (Series 2000 computers can be linked via a Series 3100 computer)		•		•
<b>Natural gas, gross characterization</b>			<b>Pressure, psi</b>	<b>Temperature, degF [degC]</b>		
Gravity, carbon dioxide (CO <sub>2</sub> ), and nitrogen (N <sub>2</sub> ), graphic carbon nitride (GCN)	Standard GERG (SGERG) 88 (1988)	Natural gas	Up to 2,500	17 to 143 [-8 to 62]	•	•
	AGA-8 (1994); ISO 12213 (1997)		CO <sub>2</sub> : 28.8% max.; nitrogen: 53.6% max.; gravity 0.554 to 0.587	CO <sub>2</sub> : 28.8% max.; nitrogen: 53.6% max.; gravity 0.554 to 0.587	•	•
<b>Steam</b>			<b>Pressure, psi [MPa]</b>	<b>Temperature, degF [degC]</b>		
Saturated steam	International Association for the Properties of Water and Steam (IAPWS) IF-97 (1997)	Steam (Regions 2 and 4); only a pressure input is required; temperature is calculated	Up to 14,500 [100]	32 to 662 [0 to 350]		•
<b>Hydrocarbon liquids</b>			<b>Density, kg/m<sup>2</sup></b>	<b>Temperature, degF [degC]</b>		
Crude oil and refined products	API Manual of Petroleum Measurement Standards (MPMS) Chapter 11.1 (2004)	Pressure and temperature correction	610 to 1,163	-58 to 302 [-50 to 150]	•	•
	API 2540	Pressure and temperature correction	See API tables 33, 34, 53A, 53B, 54A, 54B; MPMS 11.2.1 and MPMS 11.2.2			•
<b>Meters</b>						
<b>Concentric sharp-edged orifice</b>						
American Gas Association (AGA) standard orifice	AGA-3 Part 1 (1991)	Liquid, gas	Nominal 2-in pipe and larger	•	•	•
	AGA-3 Part 1 (2012); API MPMS Ch 14.3.1 (2012)	Liquid, gas	Nominal 2-in pipe and larger	•	•	•
ISO and American Society of Mechanical Engineers (ASME) standard orifice	ISO-5167 (2003) Part 2	Liquid, gas	Nominal 2-in pipe and larger	•	•	•
<b>Concentric small-bore orifice</b>						
ASME precision small-bore orifice	ASME Measurement of Fluid Flow in Closed Conduits (MFC) 14M (2003)	Liquid, gas	½- to 1½-in pipe	•	•	
<b>Averaging pitot tubes</b>						
Annubar <sup>®</sup> pitot tube	None; see Miller 3rd Ed.	Liquid, gas	High velocity required		•	
Generic pitot tube	None; see Miller 3rd Ed.	Liquid, gas	High velocity required		•	
<b>Cone meters</b>						
Wafer and spoolpiece	None, see Miller 3rd Ed.	Liquid, gas Steam		•	•	•
<b>Venturi meters</b>						
Classic venturi	ISO-5167 (2003) Part 4; ASME MFC-3M (2004)	Liquid, gas Steam		•		•

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Meters	Industry Standards	Scope	Limitations	Series 3000	Series 2000	Series 1100
<b>Linear meters</b>						
Gas volume accumulation	AGA-7 (2006)	Gas turbine, vortex shedder, or ultrasonic	Any gas	•	•	•
Liquid volume accumulation	None	Liquid turbine, vortex shedder, or ultrasonic	Low viscosity liquid	•	•	•
Mass accumulation	None	Gas or liquid Coriolis mass meter	Single phase	•		•
<b>Multiphase correction</b>						
Oil shrinkage factor correction	None	Hydrocarbon liquids	User-entered value	•		
BS&W correction	None	Hydrocarbon liquids	Analog input	•		•
Water or liquid hydrocarbon in natural gas	Chisholm-Steven	User-entered liquid content	Lockhart-Martinelli <0.3, (~8 % max. liquid); see sizing program		•	
Water in steam vapor	Chisholm-Steven	User-entered value: steam quality	Lockhart-Martinelli <0.3, (~8 % max. liquid); see sizing program		•	
<b>Energy flow calculation</b>						
Natural gas energy measurement	AGA-5 (2009)	Hydrocarbon fuel gas, natural gas	29 components including trace gases	•		
	ISO-6976 (1995); AGA-8(1994) Appendix C4; GPA 2172 (1996)	Hydrocarbon fuel gas, natural gas	21 components	•		•
	AGA-3 (1992) Part 3 Appendix F; AGA-5 (1963)	Hydrocarbon fuel gas, natural gas	21 components		•	
<b>Natural gas properties (Mr, Pc, Tc, W, Mu, k, hc, HN<sub>2</sub>)</b>						
Natural gas, detailed characterization	GPA-2145 (2008)	Hydrocarbon fuel gas, natural gas; coefficients frequently amended		•	•	•
<b>Miscellaneous</b>						
Meter factor correction	None	All fluids		•		•
Proportional-integral-derivative (PID) control	None				• <sup>†</sup>	PI only

<sup>†</sup> Wireless devices excluded.

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