Software Applications

Flow Measurement Calculation Details

This document lists the flow measurement calculations available for use in KELTON™ FLOCALC™, UNCERTAINTYPLUS™, MeterManager™ and Smart Asset Management

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1.0 Revision Control

Rev	Issue date	Description	Prep.	App.
1	12/10/2016	Issued	JON	MH
1.1	20/11/2017	Reformatted	KW	JON
1.2	20/04/2018	Updated	KW	JS
1.3	10/09/2018	Updated in accordance with Brand Guidelines	KW	JON
1.4	30/10/2019	Updated to include new Modules	PK	JON
1.5	23/09/2020	Updated to include new Module	PK	KW
1.6	28/04/2021	Updated to include new calculation	PK	JON
2.3.1	20/05/2025	Reformatted and updated as per release.	AP	PK

2.0 Calculations by Associated Standards

Standard	Title	FLOCALC Reference(s)	Year(s) Published
AGA Report No. 3	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids	F034, F074, F098	1992, 2012
AGA Report No. 5	Natural Gas Energy Measurement	F087	2009
AGA Report No. 7	Measurement of Natural Gas by Turbine Meters	F088	2006
AGA Report No. 8	Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases	F013, F014, F035, F063, F318	1985, 1994, 2017
AGA Report No. 9	Measurement of Gas by Multipath Ultrasonic Meters	F089	2007
AGA Report No. 10	Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases	F093	2003
API MPMS – Chapter 11.1	Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils	F060, F092	2004
API MPMS – Chapter 11.1	Volume correction factors - Volume X - Background, Development and Program Documentation	F023	1980
API MPMS – Chapter 11.2.1	Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range	F023, F028, F091	1984
API MPMS - Chapter 11.2.2	Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature	F023, F028, F091, F092	1986
API MPMS – Chapter 11.2.4	Temperature Correction for the Volume of LPG and NGL	F090, F091, F092	1998, 2007
API MPMS – Chapter 11.2.5	A Simplified Vapor Pressure Correlation for Commercial NGLs	F058	2007
API MPMS – Chapter 14.3	Concentric, Square-Edged Orifice Meters	F034, F074	1992
ASTM D1250	Petroleum Measurement Tables	F023, F028, F029, F060, F062, F073, F083, F084, F085, F086	1952, 1980, 2004
ASTM D1555	Standard Test Method for Calculation of Volume and Weight of Industrial Aromatic Hydrocarbons and Cyclohexane	F101	2009
ASTM D3588	Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels	F067	1998
BS 1904	Specification for industrial platinum resistance thermometer sensors	F042	1984
BS EN ISO 3171	Petroleum liquids - Automatic pipeline sampling	F095	1999

Standard	Title	FLOCALC Reference(s)	Year(s) Published
BS 7577	Calculation procedures for static measurement of refrigerated light hydrocarbon fluids	F054	1992
BS 8609	Natural Gas – Calculation of carbon dioxide emission factors from composition	F400	2014
BS EN 60751	Industrial platinum resistance thermometer sensors	F042	1996
GPA 2145	Table of Physical Constants for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry	F036, F049, F067	2000, 2003, 2009
GPA TP-15	A Simplified Vapor Pressure Correlation for Commercial NGLs	F058	2007
GPA TP-17	Table of Physical Properties of Hydrocarbons for Extended Analysis of Natural Gases	F047	1998
GPA TP-25	Temperature Correction for the Volume of Light Hydrocarbons - Tables 24E and 23E	F091	1998
GPA TP-27	Temperature Correction for the Volume of NGL and LPG - Tables 23E, 24E, 53E, 54E, 59E, and 60E	F090, F092	2007
IP 200	Petroleum Measurement Tables	F023, F028, F029, F060, F062, F073, F083, F084, F085, F086	1952, 1980, 2004
IP Paper No.2	Guidelines for Users of the Petroleum Measurement Tables	F022, F029	1984
IP Petroleum Measurement Manual - Part X	Meter Proving	F066	1989
IP Petroleum Measurement Manual - Part XII	Static and Dynamic Measurement of Light Hydrocarbon Liquids	F059, F105, F106	1998
ISO 3171	Petroleum liquids - Automatic pipeline sampling	F095	1988
ISO 5167	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full	F026, F032, F033, F037, F068, F069, F070, F075, F076, F079, F080, F099	1991, 1998, 2003, 2016
ISO 6578	Calculation procedures for static measurement of refrigerated light hydrocarbon fluids	F054	1991
ISO 6976	Natural Gas - Calculation of calorific values, density, relative density and Wobbe indices from composition	F001, F002, F003, F036, F049, F110	1983, 1995, 2016

Standard	Title	FLOCALC Reference(s)	Year(s) Published
ISO 8222	Petroleum measurement systems - Calibration - Temperature corrections for use when calibrating volumetric proving tanks	F097	2002
ISO 12213	Natural gas – Calculation of compressor factor	F014	2006
ISO TR 9464	Guidelines for use of the ISO 5167	F037, F068, F069, F070, F075, F076, F080	1998, 2008
ISO TR 12748	Natural gas – Wet gas flow measurement in natural gas	F072	2015

3.0 Calculation by Reference Number(s)

Reference(s)	Title and Description
F001 (C001)	ISO 6976:1983 Calorific Value and Relative Density Volumetric calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case.
ISO 6976:1983 - Natural Gas - Calculation of calorific value, density and relative density	
F002 (C002)	ISO 6976:1989 Calorific Value and Relative Density Calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case.
ISO 6976:1989 draft - Natural Gas - Calculation of calorific value, density and relative density	
F003 (C003)	ISO 6976:1995 - Calorific Value and Relative Density Calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case.
ISO 6976:1995 - Natural Gas - Calculation of calorific values, density, relative density and Wobbe index from composition	
F013 (C013)	AGA 8:1985 - Gas Density and Compressibility The compressibility and density of a gas are calculated from its composition, temperature and pressure in accordance with the 'Detail Characterisation' method outlined in this standard. Results are displayed for both standard (user configurable) temperature and pressure and operating temperature and pressure.
AGA Report No.8 - Compressibility and Supercompressibility for Natural Gas and Other Hydrocarbon Gases (1985)	
F014 (C014)	AGA 8:1994 - Gas Density and Compressibility (Detail Characterisation) The compressibility and density of a gas are calculated from its composition, temperature and pressure in accordance with the 'Detail Characterisation' method outlined in this standard. Results are displayed for both standard (user configurable) temperature and pressure and operating temperature and pressure. This 1994 printing of the Second Edition 1992 achieves computational consistency with GPA 2172-94 and AGA 3 1992.
AGA Report No.8 - Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases (1994) *ISO 12213-2:2006 - Natural gas - Calculation of compression factor - Part 2: Calculation using molar-composition analysis*	

Reference(s)	Title and Description
F015 (C015)	Orifice Plate Buckling An orifice plate, when exposed to differential pressure, will always experience a degree of elastic deformation, in certain cases the elastic deformation can be augmented by plastic (permanent) deformation. The calculation calculates the differential pressure that would cause the plastic distortion of a simply supported orifice plate. In addition to this, flow measurement errors caused by the deformation of the orifice plate are estimated.
Effect of Plate Buckling on Orifice Meter Accuracy, P Jepson and R Chipchase, Journal Mechanical Engineering Science Vol. 17 No. 6 (1975) *Buckling and Eccentricity Effects on Orifice Metering Accuracy, R Norman, M S Rawat and P Jepson (1983)*	
F017 (C230)	Solartron Appendix A Calculation The 'Solartron Appendix A calibration considerations' calculated using this form reduce the effect of systematic errors associated with the density sensor, and also the non-ideal behaviour of gasses.
Solartron 3098 Specific Gravity Transducer Technical Manual	
F022 (C022)	IP Paper 2 - Density Referral To 'convert' density values between standard conditions and operating conditions by applying a correction for the change in temperature (Ctl) and pressure (Cpl). Cpl is calculated using the methods outlined in IP Paper 2 and Ctl using the API equations from which the appropriate product group can be selected. The option is given to either perform the calculation following the rounding/truncation algorithms outlined in the standard or to use full precision.
IP Petroleum Measurement Paper No.2 / IP 200 / ASTM D1250 - Guidelines for Users of the Petroleum Measurement Tables	
F023 (C023)	API Density Referral 1980-86 To 'convert' density values between standard conditions and operating conditions by applying a correction for the change in temperature (Ctl) and pressure (Cpl). Cpl is calculated using the methods outlined in the petroleum measurement standards and Ctl using the API equations from which the appropriate product group can be selected. The option is given to either perform the calculation following the rounding/truncation algorithms outlined in the standard or to use full precision.
ASTM D1250-80 / IP 200/80 / API Manual of Petroleum Measurement Standards, Chapter 11.1 - Volume correction factors, Volume X - Background, Development and Program Documentation (1980) *API Manual of Petroleum Measurement Standards, Chapter 11.2.1 - Compressibility Factors for Hydrocarbons: 0-90° API Gravity Range (1984)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.1M - Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range (1984)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2 - Compressibility Factors for Hydrocarbons: 0.35-0.637 Relative Density (60°F/60°F) and -50°F to 140°F Metering Temperature (1986)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2M - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature (1986)*	

Reference(s)	Title and Description
F025 (C025)	Local Gravity Calculation The local value of gravitation acceleration for a geographical location can be estimated from the latitude and height above sea level. The calculation provides a choice of three accepted formulae for determining this value. In addition to this the option is given to calculate for an offshore or an onshore location which takes applies an additional correction for the density of the rock base.
The Geodetic Reference System 1967 *The new gravity system - changes in international gravity base values and anomaly values, Woollard G.P. (1979)* *WGS84 - IAG Developed Geodetic Reference System 1980, leading to World Geodetic Reference System (1984)*	
F026 (C189)	Pressure Calculation - Absolute and Gauge Determine the pressure generated by deadweight testers, pressure indicators and gauges. Pressure can either be calculated from first principals using mass and piston area or simply applying corrections to the nominal applied pressure. The calculation can also be reversed to calculate the mass required to generate a required pressure. Absolute pressure can be calculated for either using a deadweight tester in absolute mode or combining gauge pressure with barometric pressure.
F028 (C012)	API/Table 54:1952 - Density Referral The calculation 'converts' density values between standard conditions and operating conditions by applying a correction for the change in temperature (Ctl) and pressure (Cpl). Cpl is calculated using the methods outlined in the petroleum measurement standards and Ctl using the petroleum measurement tabled for light hydrocarbons (Table 53/54). The option is given to either perform the calculation following the rounding/truncation algorithms outlined in the standard or to use full precision.
ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960) *API Manual of Petroleum Measurement Standards, Chapter 11.2.1 - Compressibility Factors for Hydrocarbons: 0-90° API Gravity Range (1984)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.1M - Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range (1984)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2 - Compressibility Factors for Hydrocarbons: 0.35-0.637 Relative Density (60°F/60°F) and -50°F to 140°F Metering Temperature (1986)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2M - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature (1986)*	
F029 (C019)	IP Paper 2/Table 54:1952 - Density Referral The calculation 'converts' density values between standard conditions and operating conditions by applying a correction for the change in temperature (Ctl) and pressure (Cpl). Cpl is calculated using the methods outlined in IP Paper 2 and Ctl using the petroleum measurement tabled for light hydrocarbons (Table 53/54). The option is given to either perform the calculation following the rounding/truncation algorithms outlined in the standard or to use full precision.
IP Petroleum Measurement Paper No.2 / IP 200 / ASTM D1250 - Guidelines for Users of the Petroleum Measurement Tables *ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - Metric Edition (1952)* *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F032 (C024)	ISO 5167 - Wet Gas Venturi (Murdock) The calculation is based on the ISO 5167 standard to calculate mass flow rate through a Venturi tube or nozzle extended to include the Dickenson/Jamieson variant of the Murdock correction. The wet gas (saturated) flow rate is calculated along with the flow rate for each phase of the fluid.

Reference(s)	Title and Description
ISO 5167-1:1991 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	
F033 (C026)	ISO 5167: Wet Gas Venturi (Chisholm/De Leeuw) The calculation is based on the ISO 5167 standard to calculate mass flow rate through a Venturi tube or nozzle extended to include the Chisholm De Leeuw wet gas correction. The wet gas (saturated) flow rate is calculated along with the flow rate for each phase of the fluid.
ISO 5167-1:1991 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	
F034 (C104)	API MPMS Ch.14:1992 - Gas Volume Flowrate (Factors Approach Method) The calculation calculates the volumetric flow rate of natural gas at standard conditions using the 'Factors Approach' method outlined in the Manual of Petroleum Measurement Standards Chapter 14, Section 3, Appendix 3-B.
AGA Report No. 3 - Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids, Part 3: Natural Gas Applications (1992) *API Manual of Petroleum Measurement Standards, Chapter 14 - Natural Gas Fluids Measurement, Section 3 - Concentric, Square-Edged Orifice Meters, Part 3 - Natural Gas Applications (1992)*	
F035 (C105)	AGA 8:2017 - Gas Density and Compressibility (Detail Characterisation) The compressibility and density of a gas are calculated from its composition, temperature and pressure in accordance with the 'Detail Characterisation' method outlined in this standard. Results are displayed for both standard (user configurable) temperature and pressure and operating temperature and pressure.
AGA Report No.8 – Thermodynamic Properties of Natural Gas and Related Gases (2017)	
F036 (C046)	ISO 6976/GPA 2145:2000 - Calorific Value and Relative Density The calculation calculates calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case. This version of the standard uses the gas properties given in the GPA 2145:2000 tables.
ISO 6976:1995 - Natural Gas - Calculation of calorific values, density, relative density and Wobbe index from composition *GPA 2145:2000 - Table of Physical Constants for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry*	
F037 (C150)	ISO 5167:2003 - Upstream Density Calculation The calculation corrects density from downstream to upstream conditions for an orifice meter. Options include calculating the density exponent from the isentropic exponent or using the isenthalpic method outlined in 'Implementation of ISO 5167:2003 at Gas Terminals for Sales Gas Metering Systems using Densitometers in the 'bypass' mode.' DTI March 2007.
ISO 5167-1:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements *ISO/TR 9464:2008 - Guidelines for the use of ISO 5167:2003*	
F039 (C170)	Instromet - Ultrasonic Meter Flowrate The calculation calculates the volume flow rate, applying corrections for the elastic distortion of the ultrasonic meter spool due pressure and thermal expansion. Options are also given to apply a linearity correction to include data obtained by calibration and convert the calculated volume flow rate to mass and standard volume.
Instromet International - Temperature and pressure correction for ultrasonic gas flow meters	

Reference(s)	Title and Description
F040 (C135)	Peek (Sarasota) Densitometer Computation Sarasota/Peek densitometers work on the principle that the natural frequency of the transducers vibrating element is affected by the density of the fluid in which it is submerged. The calculation calculates the density from the measured frequency and densitometer constants obtained from calibration. Options are given to apply corrections for temperature and pressure. An option to calculate the corrected time period for use during an air-check is also included.
Sarasota FD910, FD950 & FD960 Liquid Density Meters - User Guide	
F041 (C192)	Pressure Calculation - High-Line DP The calculation determines the pressure generated by differential deadweight testers, pressure indicators and gauges. Differential pressure can either be calculated from first principals using mass and piston area (or Kn) or correcting the nominal applied pressure. The calculation can also be reversed to calculate the mass required to generate a required differential pressure.
NPL Report CMAM41 - Development of high-line differential pressure standards, M Hay and D Simpson (1999)	
F042 (C193)	BS EN 60751:1996/BS 1904 - PRT Calculation The calculation calculates the temperature from a resistance value or vice versa. The option is given to select either BS EN 60751 or the BS 1904 which it superseded.
BS EN 60751:1996 - Industrial platinum resistance thermometer sensors	
F043 (C033)	CIPM:2007 - Density of Moist Air The calculation calculates the density of moist air from density pressure and relative humidity using the process outlined by R. S. Davis in metrologia 1992.
CIPM-2007 - Revised formula for the density of moist air - A Picard, R S Davis, M Glaser and K Fujii (2007)	
F047 (C034)	Hydrocarbon Dew Point Calculation The calculation calculates the dew point temperature from a composition at a given pressure or the cricondentherm from a composition. The calculation can be run using a simple composition or a more complex extended composition which includes aromatics, cycloalkanes and sulphur compounds. The calculations can be performed using either the Peng-Robinson or the Redlich-KwongSoave equation of state.
ASTM DS 4B – Physical Constants of Hydrocarbon and Non-Hydrocarbon Compounds – 2nd Edition (1991) *GPA TP-17 – Table of Physical Properties of Hydrocarbons for Extended Analysis of Natural Gases (1998)* *The Properties of Liquids and Gases - Poling, Prausnitz, O'Connell – 5th Edition (2001)*	
F048 (C125)	Daniel Ultrasonic Meter - Flowrate The calculation calculates the volume flow rate, applying corrections for the elastic distortion of the ultrasonic meter spool due pressure and thermal expansion. Options are also given to apply a linearity correction to include data obtained by calibration and convert the calculated volume flow rate to mass and standard volume. In addition to this the flow velocity can be calculated from the transit times and geometry of the meter.
Daniel Ultrasonic Gas Flow Meters with Mark III Electronics - Reference, Installation, and Operations Manual	

Reference(s)	Title and Description
F049 (C035)	ISO 6976/GPA 2145:2003 - Calorific Value and Relative Density The calculation calculates calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case. This version of the standard uses the gas properties given in the GPA 2145:2003 tables.
ISO 6976:1995 - Natural Gas - Calculation of calorific value, density and relative density *GPA 2145:2003 - Table of Physical Constants for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry*	
F051 (C178)	NX-19 Gas Supercompressibility The calculation calculates supercompressibility following the methods outlined PAR Research Project NX-19 published in December 1962 by Pipeline Research Council International. All four calculation methods are included; Specific gravity, analysis, methane and heating value method. The calculation will also calculate the volume correction factor and the line density.
PRCI - NX-19 - Manual for the Determination of Supercompressibility Factors for Natural Gas (1962)	
F052 (C195)	AP09-600 Flow Rate Calculation (Compensation Method) The calculation calculates the flow rate using a choice of algorithms commonly used by distributed control systems (DCS). The algorithms often referred to as 'simple square route extraction' differ from standard methods such as ISO 5167 in that they do not contain iterative routines.
Honeywell - Advanced Process Manager Control Functions and Algorithms - AP09-600	
F054 (C183)	ISO 6578:1991 - Klosek-McKinley LNG Density The calculation calculates the saturated liquid density of LNG mixtures from composition. The equation is valid at temperatures between -180°C and -140°C.
BS 7577:1992 / ISO 6578:1991 - Calculation procedures for static measurement of refrigerated light hydrocarbon fluids	
F056 (C036)	Wagenbreth and Blanke - Water Density Calculation The calculation calculates the density of water at a given temperature according to the formula published by Wagenbreth and Blanke.
Der Dichte des Wassers im Internationalen Einheitensystem und im der Internationalen Praktischen Temperaturkala von 1968 - H. Wagenbreth, W. Blanke	
F057 (C160)	IAPWS-IF97:2007 - Steam Tables The calculation calculates specific properties of water at temperature and pressure according to the IAPWS Industrial Formulation 1997 including specific volume, enthalpy, entropy, both isochoric and isobaric heat capacity, and speed of sound.
International Association for the Properties of Water and Steam - Revised Release on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties for Water and Steam (2007)	
F058 (C243)	TP-15:2007 Vapour Pressure Calculation for NGLs The calculation uses the GPA Technical Publication TP-15 to calculate vapour pressure.
GPA TP-15 / API Manual of Petroleum Measurement Standards, Chapter 11 - Physical Properties Data, Section 2, Part 5 - A Simplified Vapor Pressure Correlation for Commercial NGLs (2007)	

Reference(s)	Title and Description
F059 (C180)	COSTALD-Tait Density Calculation The calculation calculates the density of LNG and LPGs. This calculation comprises four distinct density calculation options. The "standard" COSTALD equation is used to calculate the saturated liquid density of light hydrocarbon mixtures (LPGs) from composition. The "enhanced" COSTALD equation is used to calculate the saturated liquid density of LNG mixtures (i.e. predominantly CH4). The Tait extension to the COSTALD equation (known as COSTALD-Tait) calculates the compressed liquid density of light hydrocarbon mixtures (i.e. density at pressures above the saturation pressure). The Tait extension applies to both the "standard" and "enhanced" COSTALD equations giving four options in total.
IP Petroleum Measurement Manual Part XII - Static and Dynamic Measurement of Light Hydrocarbon Liquids - Section 1: Calculation Procedures (1998)	
F060 (C251)	API Density Referral 2004 (incl Amnd 2007) The calculation 'converts' density values between standard conditions and operating conditions by applying a correction for the change in temperature (Ctl) and pressure (Cpl). In this standard both are calculated simultaneously and iteratively since the effects of temperature and pressure are coupled. This calculation uses the API product groups to determine the density of the liquid.
ASTM D1250-04 / IP 200/04 / API 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 (2004, Addendum 2007)	
F061 (C258)	Gas Relative Density Calculation - Solartron The calculation calculates the relative density from the Solartron RD transducer constants and the measured time period. The transducer constants can be calculated by entering the known relative densities of two calibration gases along with their corresponding measured time periods.
Solartron NT3096 Specific Gravity Transducer Technical Manual	
F062 (C255)	ASTM IP Table 53:1952 The calculations determine the density at 15°C from an observed density at an observed temperature according to Table 53 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - Metric Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F063 (C253)	AGA 8 - Gross Characterisation Methods The calculation calculates density and compressibility using the SGERG model as detailed in AGA Report No. 8. The calculation gives a choice between the 2 gross characterisation methods and of different reference conditions.
AGA Report No.8 - Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases (1994)	
F065 (C256)	Gas Density Computation PTZ The calculation determines the density of a non-ideal gas at a given temperature and pressure from known values of pressure temperature and compressibility or molecular weight. Options include solving for either line density, standard density or relative density.

Reference(s)	Title and Description
F066 (C108)	Meter K-Factor Computation The calculation calculates the K-Factor for a meter which has been 'proved' using either a pipe prover, compact prover or a master meter. Corrections are applied to compensate for changes in the geometry of the 'prover' and changes in the volume of the liquid caused by temperature and pressure. Where applicable these corrections may be calculated using a choice of industry and international standards.
IP Petroleum Measurement Manual Part X - Meter Proving (1989) IP Petroleum Measurement Paper No.2 / IP 200 / ASTM D1250 - Guidelines for Users of the Petroleum Measurement Tables API Manual of Petroleum Measurement Standards, Chapter 11.2.1M - Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range (1984) API Manual of Petroleum Measurement Standards, Chapter 11.2.2M - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature (1986) ASTM D1250-80 / IP 200/80 / API Manual of Petroleum Measurement Standards, Chapter 11.1 - Volume correction factors, Volume X - Background, Development and Program Documentation (1980) ASTM D1250-04 / IP 200/04 / API 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 (2004) GPA TP-27 / API 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 (2007)	
F067 (C263)	ASTM D3588/GPA 2145 - Calorific Value and Relative Density The calculation calculates calorific values, density and relative density from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, net and gross calorific value are displayed in each case. The option is also included to perform a correction for wet gas either by entering the mole fraction of water or by assuming a saturated gas and approximating water content using Raoult's law.
ASTM D3588 - Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels (1998)	
F068 (C068)	ISO 5167:1991 Orifice Flow Calculation The calculation follows the process outlined in the standard to calculate flow rate through an orifice meter. Density and temperature can be entered at up or downstream conditions to mimic the calculations performed by a flow computer and the calculation can iterate to solve for flow, differential pressure or orifice bore size. This version of the standard uses the Stoltz equation to calculate the discharge coefficient.
ISO 5167-1:1991 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	
F069 (C069)	ISO 5167: 1998 Amd 1 - Orifice Flow Calculation The calculation follows the process outlined in the standard to calculate mass flow rate through an orifice meter. Density and temperature can be entered at up or downstream conditions to mimic the calculations performed by a flow computer and the calculation can iterate to solve for flow, differential pressure or orifice bore size. This version of the standard uses the Reader-Harris/Gallagher equation to calculate the discharge coefficient.
ISO 5167-1:1991/Amd 1:1998 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	

Reference(s)	Title and Description
F070 (C070)	ISO 5167: 2003 - Orifice Flow Calculation The calculation follows the process outlined in the standard to calculate flow rate through an orifice meter. The calculation can iterate to solve for flow, differential pressure or orifice bore size. This version of the calculation includes the option to calculate the upstream density using the isenthalpic method for densitometers in 'bypass' mode outlined in the 2007 DTI Paper on the implementation of ISO 5167.
ISO 5167-2:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice Plates	
FO71 (C029)	ISO 1567 - Orifice Plate Validation The calculation checks the condition and geometry of an orifice plate meets the criteria laid out in the standard. The user can either enter measurements taken directly from an Orifice Plate or independently validate an orifice plate certificate produced and issued by a calibration laboratory.
ISO 5167-1:1991 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full *ISO 5167-2:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice Plates*	
F072 (C311)	ISO 5167/TR 12748 - Wet Gas Orifice Flow Calculation This follows the process outlined in the standard to calculate the corrected mass flow rate through an orifice meter encountering wet gas. Uncorrected gas mass flow rate is calculated according to ISO 5167-2:2003.
ISO 5167-2:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 2: Orifice Plates *ISO/TR 12748:2015 - Natural Gas - Wet gas flow measurement in natural gas operations*	
F073 (C219)	ASTM-IP Table 54:1952 The calculation is used to determine the temperature correction factor for a crude oil from a standard density at 15°C to an observed temperature according to Table 54 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - American Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F074 (C266)	AGA 3:1992 - Orifice Flow Calculation The calculation uses the processes outlined in the American Gas Association standard to solve flow rate, differential pressure or orifice size through an orifice plate metering system.
AGA Report No. 3 - Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids (1992) *API Manual of Petroleum Measurement Standards, Chapter 14 - Natural Gas Fluids Measurement, Section 3 - Concentric, Square-Edged Orifice Meters (1992)*	
F075 (C075)	ISO 5167:1991 - Venturi Flow Calculation The calculation follows the process outlined in the standard to calculate flow rate through a Venturi tube or nozzle. The calculation can iterate to solve for flow, differential pressure or Venturi throat size.
ISO 5167-1:1991 - Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full	

Reference(s)	Title and Description
F076 (C076)	ISO 5167:2003 - Venturi Flow Calculation The calculation follows the process outlined in the standard to calculate flow rate through a Venturi tube or nozzle. The calculation can iterate to solve for flow, differential pressure or venturi throat size. This version of the calculation includes the option to calculate the upstream density using the isenthalpic method for densitometers in ‘bypass’ mode outlined in the 2007 DTI Paper on the implementation of ISO 5167.
ISO 5167-3:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 3: Nozzles and Venturi nozzles *ISO 5167-4:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 4: Venturi tubes*	
F079 (C288)	ISO 5167-5:2016 - Cone Calculations The calculation can be set to solve for flow rate, differential pressure or cone diameter using the equations set out in the standard. To utilise calibration data the option is included to enter a characterisation curve showing the change in discharge coefficient with Reynolds number. The calculation can be set to solve for flow rate, differential pressure or cone diameter.
ISO 5167-5:2016 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 5: Cone meters	
F080 (C282)	ISO 5167/McCrometer Cone Calculations The calculation is an ISO 5167 flow rate calculation modified by McCrometer for the geometry and characteristics of their VCone meters. The calculation has options to use either the 2000 or 2005 version on the McCrometer calculation the latter of which contains a revised method of determining expansibility. To utilise calibration data the option is included to enter a characterisation curve showing the change in discharge coefficient with Reynolds number. The calculation can be set to solve for flow rate, differential pressure or cone diameter.
ISO 5167-1:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements *McCrometer 24509-5: Flow Calculations for the V-Cone and Wafer-Cone Flow meters* *McCrometer 24517-16: V-Cone Flow Meter Technical Brief*	
F081 (C134)	Gas Densitometer Calculation – Micro Motion Micro Motion densitometers work on the principle that the natural frequency of the transducers vibrating element is affected by the density of the fluid surrounding it. The calculation calculates the density from the measured frequency and densitometer constants obtained from calibration. Options are given to apply corrections for temperature and the velocity of sound, a further option is included to correct density from down to upstream conditions.
Micro Motion 7812 Gas Density Meter Technical Manual	

Reference(s)	Title and Description
F082 (C137)	Liquid Densitometer Calculation – Micro Motion Micro Motion densitometers work on the principle that the natural frequency of the transducers vibrating element is affected by the density of the fluid in which it is submerged. The calculation calculates the density from the measured frequency and densitometer constants obtained from calibration. Options are given to apply corrections to compensate for the temperature and pressure of the fluid. This calculation also has the option to use revised pressure constants K20C and K21C and the temperature pressure coupling correction.
Micro Motion 7835/45/46/47 Liquid Density Meter Technical Manual	
F083 (C197)	ASTM-IP - Table 5:1952 The calculation determines the API gravity at 60°F from API gravity at an observed temperature according to Table 5 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - American Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F084 (C198)	ASTM-IP - Table 6:1952 The calculation determines the temperature correction factor for a crude oil from an API gravity at 60°F to an observed temperature according to Table 6 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - American Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F085 (C199)	ASTM-IP - Table 23:1952 The calculation determines the specific gravity at 60°F from a specific gravity at an observed temperature according to Table 23 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - American Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F086 (C200)	ASTM-IP - Table 24: 1952 The calculation determines the temperature correction factor for a crude oil from a specific gravity at 60°F to an observed temperature according to Table 24 from the ATSM-IP Petroleum Measurement Tables.
ASTM D1250, IP 200 - ASTM-IP Petroleum Measurements Tables - American Edition (1952) *ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960)*	
F087 (C127)	AGA 5:2009 - Natural Gas Energy Measurement The calculation calculates calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas. Net and gross volumetric, molar and mass based calorific values are displayed in along with gas and air compressibility factors and Wobbe index. There is the option of calculating the calorific value from volumetric or molar based heating value data.
AGA Report No. 5 - Natural Gas Energy Measurement (2009)	

Reference(s)	Title and Description
F088 (C268)	AGA 7 - Turbine Meter Gas Flow Rate Calculation The calculation uses Appendix B of AGA Report No. 7 to calculate volumetric and mass flow rates for gas flow through a turbine meter.
AGA Report No. 7 - Measurement of Natural Gas by Turbine Meters (2006)	
F089 (C269)	AGA 9 - Ultrasonic Meter Gas Flow Rate Calculation The calculation calculates volumetric and mass flow rates for gas flow through an ultrasonic meter according to AGA Report No. 9.
AGA Report No. 9 - Measurement of Gas by Multipath Ultrasonic Meters (2007)	
F090 (C293)	GPA-TP-27:2007 - Temperature Correction for NGL and LPG The calculation calculates the temperature correction factor for NGL and LPG's. This can then be used to obtain a density at standard or line conditions.
GPA TP-27 / API 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 (2007)	
F091 (C295)	GPA TP-25 - NGL and LPG Density Referral Calculation The calculation 'converts' the density values between standard and operating conditions. The calculation uses the GPA TP-25 for the temperature correction. One of API 11.2.1 or API 11.2.2 is used for the pressure correction depending on the standard density of the mixture. There is also the option to calculate vapour pressure according to GPA TP-15. The temperature and pressure correction going from observed density to standard density is performed as an iterative calculation using a direct substitution method.
GPA TP-15 / API Manual of Petroleum Measurement Standards, Chapter 11 - Physical Properties Data, Section 2, Part 5 - A Simplified Vapor Pressure Correlation for Commercial NGLs (2007) *GPA TP-25 / API Manual of Petroleum Measurement Standards, Chapter 11 - Physical Properties Data, Section 2, Part 4 - Temperature Correction for the Volume Of Light Hydrocarbons, Tables 24E and 23E (1998)* *API Manual of Petroleum Measurement Standards - Chapter 11.2.1 - Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range (1984)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.1M - Compressibility Factors for Hydrocarbons: 638-1074 Kilograms per Cubic Meter Range (1984)* *API Manual of Petroleum Measurement Standards - Chapter 11.2.2 - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°) and -46°C to 60°C Metering Temperature (1986)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2M - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature (1986)*	
F092 (C296)	GPA TP-27 - NGL and LPG Density Referral Calculation The calculation 'converts' the density values between standard and operating conditions. The calculation uses the GPA TP-27 for the temperature correction. One of API 11.1 or API 11.2.2 is used for the pressure correction depending on the standard density of the mixture. There is also the option to calculate vapour pressure according to GPA TP-15. The temperature and pressure correction going from observed density to standard density is performed as an iterative calculation using a direct substitution method.
GPA TP-15 / API Manual of Petroleum Measurement Standards, Chapter 11 - Physical Properties Data, Section 2, Part 5 - A Simplified Vapor Pressure Correlation for Commercial NGLs (2007) *GPA TP-27 / API 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 (2007)* *API Manual of Petroleum Measurement Standards, Chapter 11.2.2M - Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature (1986)* *ASTM D1250-04 / IP 200/04 / API 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 (2004, Addendum 2007)*	

Reference(s)	Title and Description
F093 (C265)	AGA 10 - Velocity of Sound / Isentropic Exponent The calculation evaluates the velocity of sound and isentropic exponent of a natural gas along with various other gas related properties such as specific heat capacity (at constant pressure and volume), enthalpy and compressibility at line conditions based on the composition, pressure and temperature using the formulae presented in the American Gas Association Report No. 10.
AGA Report No. 10 - Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases (2003)	
F094 (C297)	API - Natural Gas Viscosity Calculation The calculation calculates the viscosity from the gas composition temperature and pressure following methods outlined in the American Petroleum Institute Technical Data Book.
API Technical Data Book	
F095 (C099)	ISO 3171 - 1999 Annex A - Estimating Water-in-Oil Dispersion The calculation indicates whether the dispersion of water in oil is likely to be adequate for sampling.
BS EN ISO 3171:1999 / ISO 3171:1988 - Petroleum liquids - Automatic pipeline sampling	
F096 (C298)	Product Type 7 - Cpl and Compressibility Calculation The calculation calculates Cpl and compressibility of a crude oil using what is generally referred to as the Aramco equation for Product Type 7. Details for this equation were taken from the reference below and are consistent with other flow computers.
FMC Energy Systems - Smith Meter GeoProv - Bidirectional Prover Computer Manual. - Bulletin MN09019L	
F097 (C299)	ISO 8222 Annex A – Density of Water The calculation calculates the density of water at a given temperature according to the formulae presented in Annex A of ISO 8222.
ISO 8222 - Petroleum measurement systems - Calibration - Temperature corrections for use when calibrating volumetric proving tanks	
F098 (C285)	AGA 3:2012 - Orifice Flow Calculation The calculation uses the processes outlined in the American Gas Association standard to solve flow rate, differential pressure or orifice size through an orifice plate metering system. This version of the calculation uses a new equation to calculate the gas expansion factor.
AGA Report No. 3 - Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids, Part 1: General Equations and Uncertainty Guidelines (2012) *API Manual of Petroleum Measurement Standards - Chapter 14 - Natural Gas Fluids Measurement - Section 3 Concentric, Square-Edged Orifice Meters - Part 1: General Equations and Uncertainty Guidelines (2012)*	
F099 (C283)	ISO 5167/McCrometer Wet Gas V-Cone Flow Calculation (Steven) The calculation is an ISO 5167 flow rate calculation modified by McCrometer for the geometry and characteristics of their VCone meters. The calculation has options to use either the 2000 or 2005 version on the McCrometer calculation the latter of which contains a revised method of determining expansibility. To utilise calibration data the option is included to enter a characterisation curve showing the change in discharge coefficient with Reynolds number. The calculation is set to correct for wet gas using the Steven correction.
ISO 5167-1:2003 - Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements *McCrometer 24509-5: Flow Calculations for the V-Cone and Wafer-Cone Flow meters* *McCrometer 24517-16: V-Cone Flow Meter Technical Brief* *Wet Gas Metering with V-Cone Meters - R Steven, RJW Peters, D Hodges, D Stewart*	

Reference(s)	Title and Description
F100 (C300)	Water Content in Natural Gas – Bukacek Method The calculation calculates the water content in natural gas. The calculation has the option to correct for the presence of methanol.
Equilibrium Moisture Content of Natural Gases – Institute of Gas Technology - R.F Bukacek	
F101 (C301)	ASTM D1555 - Volume and Weight of Industrial Aromatics and Cyclohexane The calculation calculates the volume at a selected reference temperature and the weight (in vacuo and in air) of a specified aromatic or cyclohexane.
ASTM D1555-09 - Standard Test Method for Calculation of Volume and Weight of Industrial of Aromatic Hydrocarbons and Cyclohexane (2009) *ASTM D1555-08ε1 - Standard Test Method for Calculation of Volume and Weight of Industrial of Aromatic Hydrocarbons and Cyclohexane [Metric] (2009)*	
F103 (C303)	API/Table 24: 1952 Density Referral This calculation is used to 'convert' density values between standard conditions and operating conditions by applying a correction for the change in temperature (C_{tl}) and pressure (C_{pl}). C_{pl} is calculated using the methods outlined API 11.2.1 and C_{tl} using the petroleum measurement table (Table 24). The option is given to either perform the calculation following the rounding/truncation algorithms outlined in the standard or to use full precision.
ASTM D1250, IP 200 - Report on the Development, Construction, Calculation, and Preparation of the ASTM-IP Petroleum Measurement Tables (1960) *API Manual of Petroleum Measurement Standards, Chapter 11.2.1 - Compressibility Factors for Hydrocarbons: 0-90° API Gravity Range (1984)*	
F105 (C050)	Liquid Flow Rate - Pulse Output Meter This calculation is used to calculate the flow rate through a flow meter that supplies a pulsed output. Option is available to specify for flow meters which directly measure mass or volume and to correct for temperature and pressure. Options are also given to apply a linearity correction to include data obtained by calibration and convert the calculated flow rate to other types e.g. volume to mass etc
IP Petroleum Measurement Manual Part XII - Static and Dynamic Measurement of Light Hydrocarbon Liquids - Section 1: Calculation Procedures (1998)	
F106 (C051)	Gas Flow Rate - Pulse Output Meter This calculation is used to calculate the flow rate through a flow meter that supplies a pulsed output. Option is available to specify for flow meters which directly measure mass or volume and to correct for temperature and pressure. Options are also given to apply a linearity correction to include data obtained by calibration and convert the calculated flow rate to other types e.g. volume to mass etc
IP Petroleum Measurement Manual Part XII - Static and Dynamic Measurement of Light Hydrocarbon Liquids - Section 1: Calculation Procedures (1998)	
F108 (C306)	GPA 2172 – Compressibility (with AGA 8 option), Gross Heating Value and SG of Natural Gas from Composition This calculates real and ideal relative density, Compressibility and real and ideal Gross heating value of natural gas from composition. Various versions of the GPA 2145 tables are available as a user option. There is the option to use the AGA8 calculated compressibility as an intermediate value in the GPA 2172 calculations.
AGA Report No.8 - Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases (1994) *GPA Standard 2172-09 / API Manual of Petroleum Measurement Standards, Chapter 14.5 - Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer*	

Reference(s)	Title and Description
F109 (C307)	GPA 2172 - Gross Heating Value, SG and Compressibility of Natural Gas from Composition This calculates real and ideal relative density, Compressibility and real and ideal Gross heating value of natural gas from composition. Various versions of the GPA 2145 tables are available as a user option.
GPA Standard 2172-09 / API Manual of Petroleum Measurement Standards, Chapter 14.5 - Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer	
F110 (C308)	ISO 6976:2016 Calorific Value and Relative Density This calculates calorific values, standard density, relative density and Wobbe index from a gas composition. Results are calculated for the composition treated as both a real and an ideal gas, inferior (net) and superior (gross) calorific value and Wobbe index are displayed in each case.
ISO 6976:2016 - Natural Gas - Calculation of calorific values, density and relative density and Wobbe indices from composition	
F111 (C313)	ISO TR11583 - Wet Gas Venturi This calculates a corrected gas flowrate using an ISO 5167 flowrate calculation and a calculated over-reading correction factor. This correction factor is calculated using the gas density, liquid density, Lockhart-Martinelli parameter and the gas densiometric Froude number.
ISO/TR 11583:2012 - Measurement of wet gas flow by means of pressure differential devices inserted in circular cross-section conduits	
F312 (C312)	Reynolds Number Calculation This calculates the Reynolds number of a fluid. Inputs can be in mass flowrate, volume flowrate or velocity. Viscosity input can be kinematic or dynamic.
F315 (C315)	NORSOK – Annex D - Water in oil Calculations This calculates net oil mass and standard volume using the methods described in Annex D of Norsok I-105. Cto and Cpo are determined using API Chapter 11.1 and 11.2 methods. Cpw is determined using ISO 12916 1995 equation. Ctw is determined using method described in API Chapter 20, section 1, appendix A.2
Norsok Standard I-105 Fiscal measurement systems for hydrocarbon liquid	
F318 (C318)	AGA 8:2017 - Gas Density and Compressibility (part 2/GERG) AGA Report No. 8 Part 2 provides technical information necessary to compute thermodynamic properties including compressibility factors, densities, speeds of sound, and dew and bubble points for natural gas and related gases. This standard uses the GERG – 2008 equations of state
AGA Report No. 8 Part 2: Thermodynamic Properties of Natural Gas and Related Gases – GERG-2008 Equation of State (2017)	
F319 (C319)	ISO 17089-1:2019 Speed of Sound Bias (USM) This calculates the % error (Bias) between a theoretical and measured speed of sound value.
ISO 17089-1: 2019 Measurement of fluid flow in closed conduits – Ultrasonic meters for gas	

Reference(s)	Title and Description
F322 (C322)	ISO 20765:5 – Natural Gas Calculation for Thermodynamic Properties This calculates dynamic viscosity, Joule-Thomson coefficient, isentropic exponent and speed of sound for natural gas.
ISO 20765-5:2022 – Natural Gas – Calculation of thermodynamic properties – Part 5: Calculation of viscosity, Joule-Thomson coefficient, and isentropic exponent	
F400 (C300)	BS 8609:2014 – CO2 Emission Factors From Composition This calculates the carbon dioxide emission factor on a molar, mass, volume, gross combustion energy and net combustion energy basis. The input to the calculation is gas composition.
BS 8609:2014 Natural Gas – Calculation of carbon dioxide emission factors from composition	