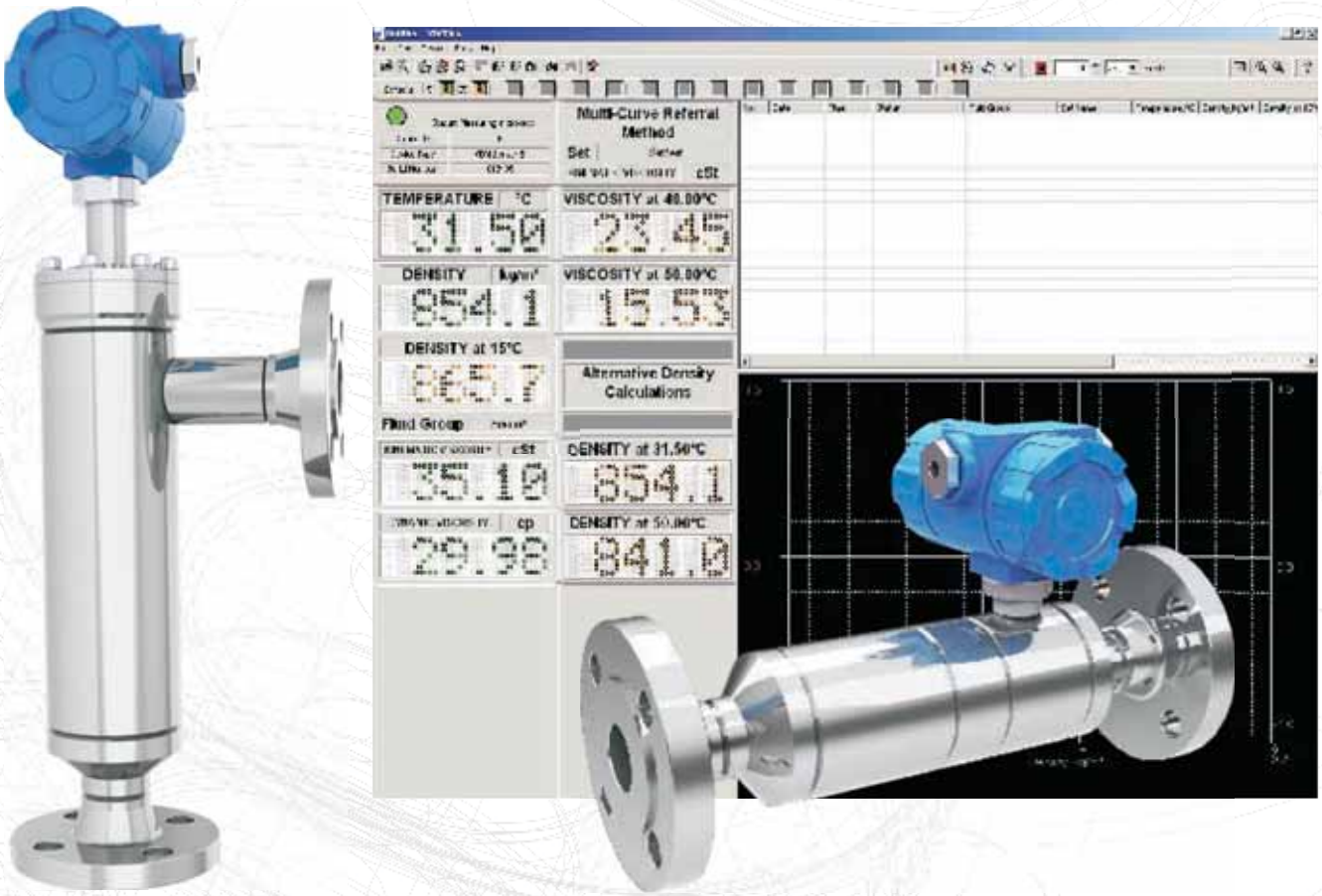
LEMIS® process

DC-50 SERIES



ViscoAnalytic

DC-52

Kinematic Viscosity

Dynamic Viscosity

Observed Density

Base Density

Specific Gravity

Alternative Density

Advantages

- No pressure effect
- Insensitive to plant vibration
- Continuous real time measurement
- No remote electronics
- Self-cleaning
- Low/no maintenance
- Fast response
- Hazardous area installation

Applications

- Fuel oil/crude oil blending
- Pipeline interface detection
- Quench oil control
- Fuel oil heater control
- Oil and petrochemical
- Marine industry & Military
- General industries

Correlation to ASTM D445, ISO 3104, IP71

Calculated: ASTM D341

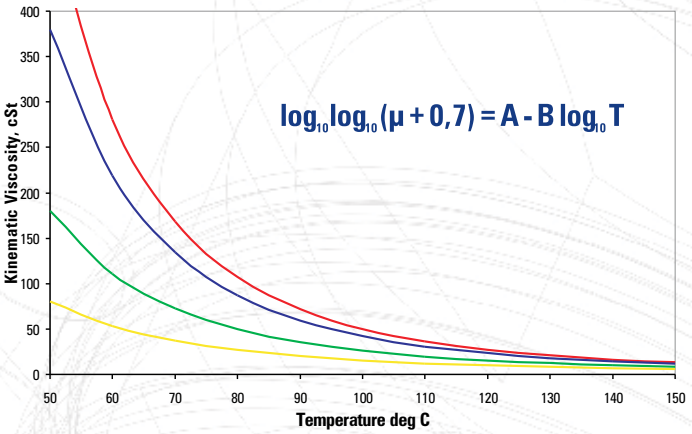
Multi-Curve Method

According to ASTM D1250 Tables

IN PROCESS TO EXCELLENCE

Viscosity temperature referral methods based on the ASTM D341 equation

Dual Viscometer Method



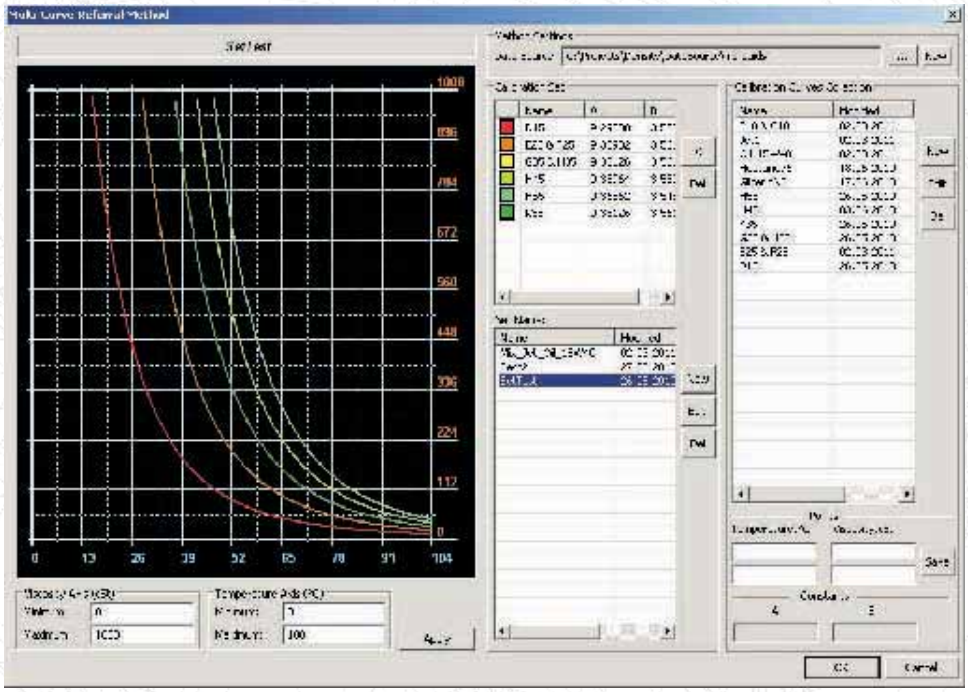
T: Temperature in °K

μ: Kinematic Viscosity in cSt

A & B: Coefficients specific to the fluid

Two viscometers are arranged in a series, separated by a heat exchanger in such way that they measure Viscosity at different temperatures compared to each other. These two measurements are used to calculate the values of A and B in the ASTM D341 equation. Using these values the Viscosity at any other temperature can be calculated.

Multi-Curve Method



Typical applications include:

- blending of heavy fuel oils in terminals,
- blending of heavy fuel oils on barges,
- fuel oil quality checking on barges and on board receiving ships,
- product interface detection e.g. in multi-product pipelines or in packaging plant.

Multi-Curve Method is the simplest indirect method for Viscosity calculation at base/reference temperature.
This method uses a single viscometer.
The sensor is programmed with a number of representative curves of Temperature vs Viscosity.
A ratio method is used to compare the measured Viscosity to the reference curve data at the observed temperature and from this ratio, to determine the Viscosity at the reference temperature.

Terminal Box

DM-Interface in the Terminal Box allows the sensors to act as standalone transmitters. Built-in ASTM Tables converse observed values to base/relative density, etc.

Alternative Density

LEMIS process software allows ViscoAnalytic to find density at any user defined temperature. This is an alternative density.
Alternative density values are correlated according to the standard ASTM D1250 for petroleum products.

Principle of operation

A precision calibrated vibrating element process density and viscosity transmitter with an integral temperature sensor. The sensor is a tubular element fully immersed in the flow stream. It vibrates in hoop mode at the resonant frequency.

The sensor electronics employ sophisticated signal processing and computational algorithms to deliver high accuracy measurements. The sensor has a rugged design and is fully suited to the process environment with little or no need for service, maintenance or cleaning. The measurement is robust: the calibration is very stable over a long period of time and does not require re-calibration, under normal circumstances. Taken together these features result in a sensor with a long service life, a high on-stream factor and very low cost of ownership.

$$f = 1 / T$$

f - frequency
T - oscillation period

$$\rho = A + B \cdot T_R^2$$

ρ - density
A, B - calibration coefficients
T_R - resonator oscillation period

$$\mu = \eta / \rho$$

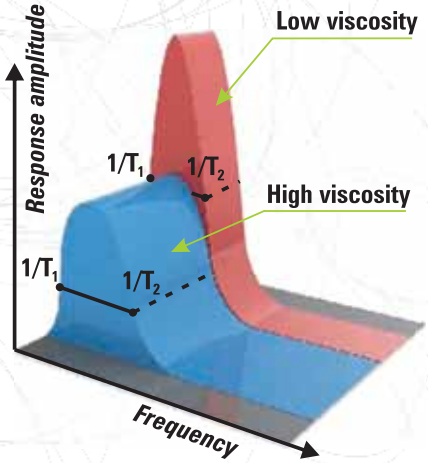
μ - kinematic viscosity
η - dynamic viscosity
ρ - density

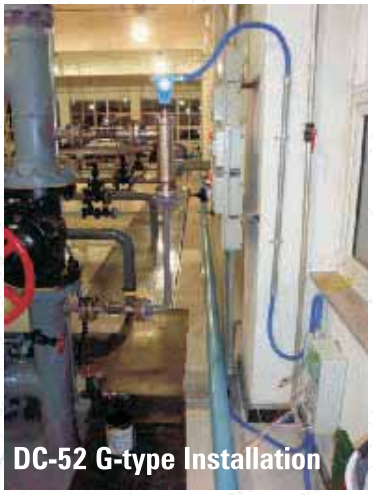
$$\Delta T = T_2 - T_1$$

1/ΔT - bandwidth
T_1 - oscillation period at a point A
T_2 - oscillation period at a point B

$$\eta = C + D(\Delta T/T_R)^2 + E(\Delta T/T_R)^4$$

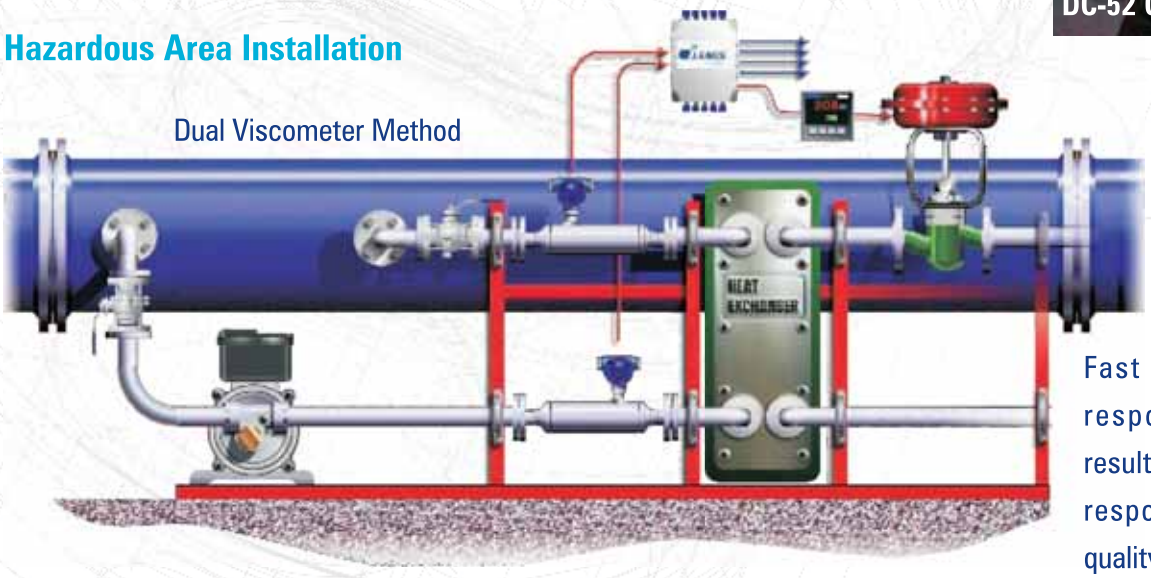
η - dynamic viscosity
C, D, E - calibration coefficients
1/ΔT - bandwidth
T_R - resonator oscillation period



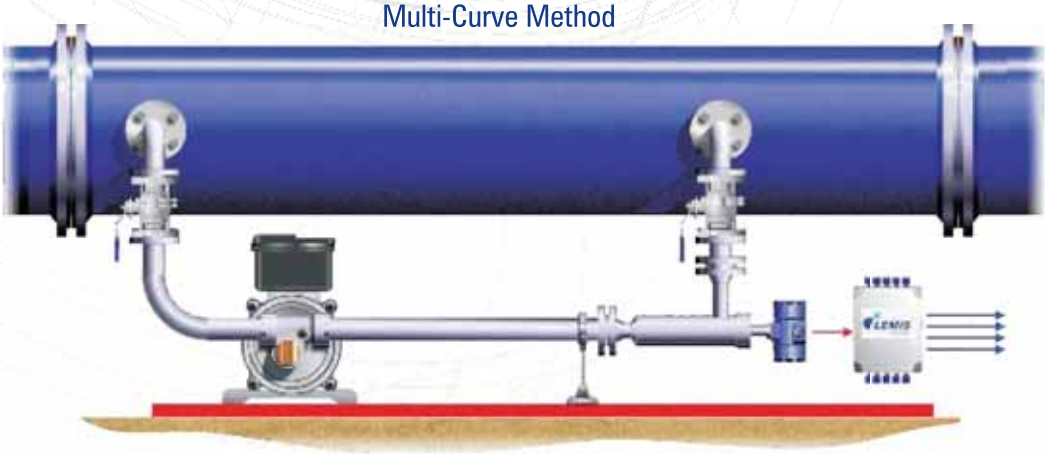

DC-52 G-type Installation

Hazardous Area Installation

Dual Viscometer Method



Multi-Curve Method



Measure at the point of optimum process control

Fast loop flow & fast response measurement results in a fast control response allowing tight quality control

Low installation costs - no long heated sample loops to analyser houses

Flexible and multi-functional - multiple reference temperature calculations of density and kinematic viscosity

Specifications

Measuring range:	
Density	0… 3 g/cm³ (0… 3000 kg/m³)
Density Standard	0.6… 1.2 g/cm³ (600… 1200 kg/m³)
Dynamic Viscosity	Up to 2000 mPa·s (up to 2000 cP)
Temperature	-200… +200°C (-328... +392°F)
Accuracy:	
Density	Up to ±0.00025 g/cm³ (up to ±0.25 kg/m³)
Dynamic Viscosity	±1% of span
Temperature	±0.2°C (±0.4°F)
Repeatability:	
Density	Up to ±0.000125 g/cm³ (up to ±0.125 kg/m³)
Dynamic Viscosity	±0.5% of span
Temperature	±0.1°C (±0.2°F)
Resolution:	
Density	0.0001 g/cm³ (0.1 kg/m³)
Dynamic Viscosity	0.1 mPa·s (0.1 cP)
Temperature	0.01°C (0.02°F)
Process Connection	NPT 3/8", 1/2", 3/4", 1" ANSI 1/2", 1", 2", 3", 4" DN 10, 15, 25, 50, 80, 100
Operating Pressure	Up to 100 Bar (up to 1450 psi)
Supported Measuring Units	Real Density: g/cm³, kg/m³, lb/gal, lb/ft³; API; SG Dynamic Viscosity: mPa·s, cP Kinematic Viscosity: mm²/s, cSt Referred Density: at 15°C, 20°C, 60°F; API60; SG60 Tables ASTM D1250 Alcohol Tables Temperature in °C or °F
Ambient Temperature	-40… +85°C (-40... +185°F)
Weather Rating	IP68 for sensor and IP65 for other parts
Power voltage:	
Device	110-230V AC (50-60 Hz) or 24V DC (16-28V DC)
Sensor	6-14V DC (30 mA)
Implosion Protection Marking	**ATEX** II 1/2G Ex ia IIB T4; **IECEx** Ex ia IIB T4 Ga /Gb; CCE
Digital Output	Standard: RS485, Modbus; user choice of signals and protocols
Analog Output	4-20 mA, up to 3 channels
Pressure Effect	No pressure effect
Temperature Compensation	Automatic
Viscosity Compensation	Automatic
Factory Calibration	Calibration certificates supplied as standard

DC-50 S-type

DC-50 G-type

For more information please visit www.lemis-process.com

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