

VAF

INSTRUMENTS



ViscoSense[®] 3D

Viscosity & Density Measurement
Enabling Mass Flow Measurement

774

Product Bulletin

WWW.VAF.NL

**TO BE
REALLY
SURE**

Introduction

Most of the operating costs of a ship are fuel related. Therefore it is very important to use fuel in the most efficient way. Calculated Carbon Aromaticity Index (CCAI) is the index for the ignition quality of residual fuel oil and is calculated from density and viscosity of the fuel. The measurement and control of the viscosity and density ensures an improved combustion efficiency preventing engine damage and reduction of fuel and maintenance costs.

Viscosity, Density and temperature measurement

ViscoSense®3D is a highly accurate sensor with a superior measuring principle based on the proven ViscoSense® technology. The sensor offers density, viscosity and temperature measurements. Furthermore, in combination with VAF Instruments PD Flowmeters, this measurement system is a cost effective solution for mass flow measurement, for fuel consumption and bunkering applications.

Viscosity control

A large variation in the quality and composition of fuel oil makes the behavior of the fuel oil at higher temperatures difficult to predict. An optimal viscosity is needed for the best possible atomization of HFO in the engine and thus the fuel will be burned completely without remaining deposits.

Mass flow measurement

In general fuel is bought in metric tonnes. Therefore, to be consistent, fuel consumption is more and more monitored in kilograms. Smart usage of existing components of the fuel system in combination with ViscoSense®3D enables mass flow measurement.

Bunkering applications

The highly accurate measurement principle of ViscoSense®3D in combination with VAF Instruments PD Flowmeter enables to monitor the exact kilograms or tonnes of fuel supplied or received. Furthermore, measurement of viscosity and density by ViscoSense®3D enables to detect possible cappuccino effect.

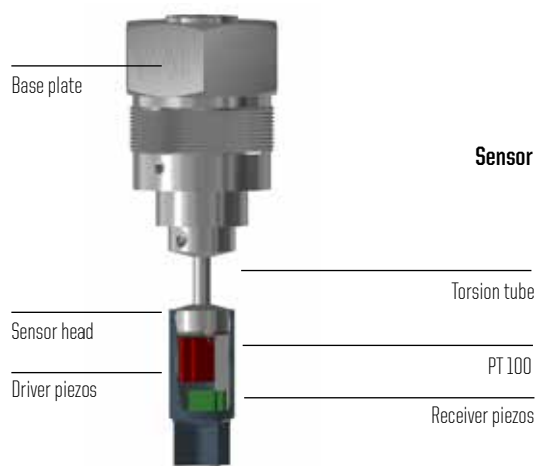
For the maritime industry

After many years of research ViscoSense®3D is based on proven and patented ViscoSense® technology and especially designed for the maritime industry. VAF Instruments has decades of experience in viscosity measurement, is the worldwide market leader in measurement and control systems and specialist for the maritime and process industry.

To maximize efficiency, improve operational excellence and reduce the environmental impact of shipping, VAF Instruments develops innovative and highly accurate measurement and control systems. With agents around the globe, VAF Instruments has a worldwide network. Over 70 representatives are specialised in VAF Instruments' products and solutions. Please feel free to contact us or one of our representatives, any time, any place.

Principle of operation

ViscoSense®3D is able to measure inline the actual dynamic viscosity and density of a large range of liquids. The unique measuring principle of ViscoSense®3D is based on a torsional vibration of a pendulum in liquid. The measured damping of this piezo-driven vibration is directly related to the viscosity. A built-in temperature sensor is used to measure the temperature at the same location where the viscosity is measured. The sensor head is equipped with a cross vane through which a small amount of fluid is increasing the mass moment of inertia. The frequency of the pendulum, which is dependent on the mass moment of inertia, is now directly related to the density of the fluid.



Reliability

Due to the operating principle based on a torsional vibration, the measurement is insensitive to unwanted external influences. Flow velocity, flow direction and pulsations have no effect on the sensor operation. The robust sensor is designed to operate under the most difficult conditions in which a faultless and stable viscosity and density measurement is required.

Cost-effective operation

The ViscoSense®3D sensor is developed to measure viscosity and density without interruptions and with low operating costs. Since the sensor does not actually move, it is not subject to wear and therefore it ensures a long lifetime and a maintenance free operation. The non-stick surface of the pendulum in combination with a smooth edged design makes the sensor highly insensitive to fouling and easy to clean. The sensor is calibrated for life and the high accuracy will be kept without the necessity of re-calibration. Due to its compact design the sensor is suitable for easy installation in any new or retrofit system.

Cost-effective solution

To enable mass flow measurement, only a small upgrade of your current system is required.



One ViscoSense®3D can be combined with one or multiple Flowmeters in the same fuel system, independent of configuration. Fuel consumption measurement by VAF Instruments' Positive Displacement Flowmeters in combination with density measurement by the ViscoSense®3D is a cost-effective solution that enables mass flow measurements with highest accuracy, reliability and repeatability.

Features and benefits

As a result of the torsional vibration technique, the flow velocity has no effect on the measurement. External vibrations have no influence on the ViscoSense®3D. In practice the smooth edged design of the sensor makes the system highly insensitive to fouling and easy to clean. In addition the closed-loop controlled torsional vibration principle is independent of ageing of piezo material, ensuring a long term stable and accurate measurement.

Features

Benefits

Stable and accurate in-line measurement	Optimal burning efficiency and fuel consumption Engine damage prevention and reduced maintenance
Torsional vibration measuring principle	Reliable under all circumstances Not influenced by vibrations, flow velocity or dirt particles
No moving parts	No preventive maintenance required Low operating costs
Minimal load on components	No ageing and wear effects
Stainless steel 316L pendulum	No wear due to corrosion Durable
Smooth edged pendulum	Insensitive to adherence
Compact light-weight construction	Easy to install
Calibrated for life	Long and trouble-free operation
Type approval from all major classification authorities	To be implemented directly on any ship without additional costs

Technical specification

Sensor

Viscosity range	0-25/50 mPa.s (other ranges on request, max. 1000 mPa.s)
Density range	750-1100 g/l (other ranges on request)
Temperature range	0-200°C
Maximum operating temperature	180°C
Temperature transmitter	PT100 element
Viscosity accuracy	± 2% instantaneous or 0.5 mPa.s
Density accuracy	± 0.1% instantaneous or 1 g/l
Temperature accuracy	± 1°C
Sensor material	Stainless steel 316L / Ni-alloy
Coating material	Diamond Like Carbon (DLC)
Protection class	IP65
Cable length	5 m integrated
Weight	1 kg

Interface box

Viscosity, density and temperature output	Isolated active output 4-20 mA, current loop, max. load 400Ω
Bus	Modbus over TCP/IP: all measuring data
Power supply	100-230 VAC, 50-60 Hz (fluctuations should not exceed 10% of the nominal voltage)
Power consumption	6 Watt
Response time	Depending on application
Resolution	0,1 mPa.s and 1 g/l
Ambient temperature	-20-55 °C
Humidity range	0-95% RH
Protection class	IP66
Mounting	Wall mounting
Installation category	I acc. IEC 1010-10
Pollution degree	I acc. IEC 664
Weight	2 kg



Interface box

Sensor housing

Material	Ductile iron
Flange connections	Standard DN50 (2"), DIN, ANSI or JIS; other sizes on request
Pressure rating	PN40
Weight	10 kg
<hr/>	
Diameter	<i>max. flow m³/h</i>
DN 50	20
DN 65	34
DN 80	51
DN 100	80

Custom made solutions are available for higher flow rates and / or larger piping diameters.



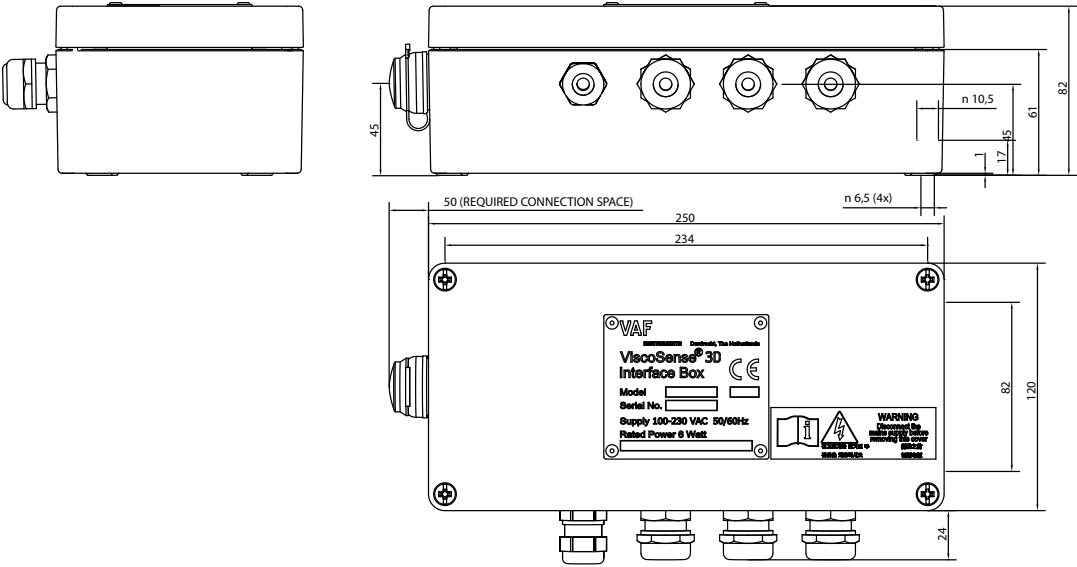
ViscoSense® housing



For Viscotherm replacement a retrofit housing is available.
Please refer to Information Bulletin 732.

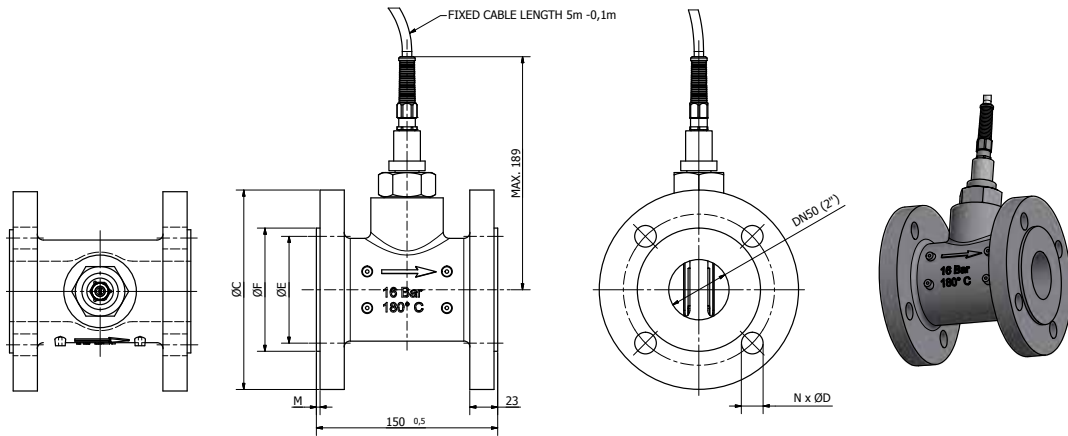
Dimensions

Interface box

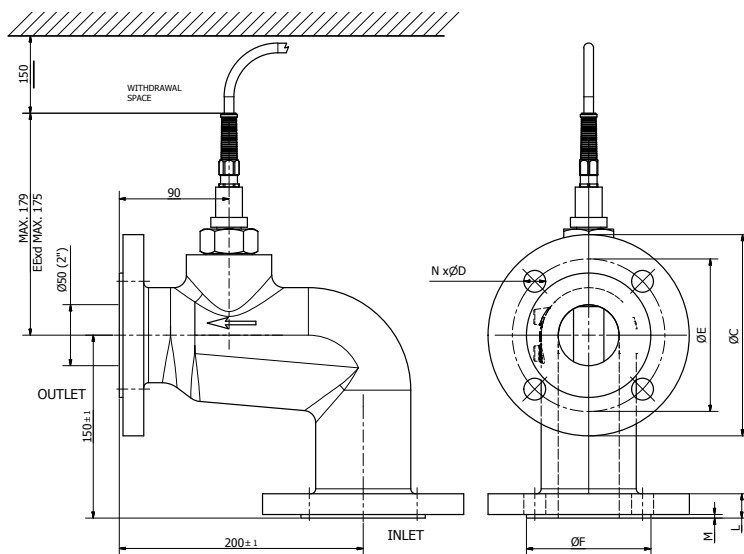


Interface box

Sensor housing



ViscoSense® housing



Sensor housing for Viscotherm replacement

Quotation and ordering information

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1.	Basic system designation: ViscoSense®3D			
2.	Application:	<input type="radio"/> fuel viscosity and density measurement	<input type="radio"/> fuel viscosity control	
		<input type="radio"/> Viscotherm retrofit	<input type="radio"/> ViscoSense® retrofit	
		<input type="radio"/> mass flow measurement (please consult factory)	<input type="radio"/> bunker receipt / supply (please consult factory)	
3.	Viscosity range:	<input type="radio"/> 0 - 25	<input type="radio"/> 0 - 50	
			<input type="radio"/> special:	
4.	Viscosity reading [unit]:	<input type="radio"/> mPa.s	<input type="radio"/> cSt	
5.	Density range:	750-1100 g/l		
6.	Temperature range:	<input type="radio"/> 0 - 100	<input type="radio"/> 0 - 200	
7.	Fluid type:	<input type="radio"/> HFO	<input type="radio"/> MDO	
		<input type="radio"/> MGO	<input type="radio"/> Other...	
8.	Flow rate* [m³/h]: * For fuel consumption, please specify flow rate of circulation pump			
9.	Nominal diameter of piping:			
10.	Flange type:	<input type="radio"/> DIN PN 10 bar	<input type="radio"/> ANSI RF 150 lbs	
		<input type="radio"/> DIN PN 16 bar	<input type="radio"/> ANSI RF 300 lbs	
		<input type="radio"/> DIN PN 25 bar	<input type="radio"/> JIS 10 K	
		<input type="radio"/> DIN PN 40 bar	<input type="radio"/> JIS 16 K	
			<input type="radio"/> JIS 20 K	
		<input type="radio"/> JIS 30 K	<input type="radio"/> JIS 40 K	
11.	Optional extras:	<input type="radio"/> viscosity controller		
		<input type="radio"/> control valve		
		<input type="radio"/> flow computer / read-out for mass flow (please consult factory)		
		<input type="radio"/> inspection by classification bureau bureau name:		
Below information is only required when 'control valve' is selected in question 11.				
12.	Control valve:	actuation		
		<input type="radio"/> electric (relay)	<input type="radio"/> electric (analog)	
		medium		
		<input type="radio"/> steam	<input type="radio"/> thermal oil	
		body material:		
<input type="radio"/> ductile iron	<input type="radio"/> steel			
flange connections:		<input type="radio"/> DIN PN [bar]	<input type="radio"/> ANSI RF [lbs]	<input type="radio"/> JIS [K]
13.	Nominal diameter of piping:			
14.	Inlet pressure [bar]:			
15.	Nominal flow rate [for steam in kg/h, liquids in m³/h]:			
16.	Allowable pressure drop across valve [max. 1 bar]:			
17.	Specific gravity of medium [water = 1,0]:			

Name:

Place and date:

For further information see relevant Product Bulletins or www.vaf.nl

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Specifications subject to change without notice.
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