

VAF

INSTRUMENTS



ViscoSense[®] 3

Viscosity Measurement & Control Systems

753

Product Bulletin

WWW.VAF.NL

**TO BE
REALLY
SURE**

Introduction

With decades of experience VAF Instruments is the worldwide market leader for in-line viscosity measurement and control systems. ViscoSense®3 is the latest innovative development in a long history of outstanding viscosity sensors for fuel oil applications. In this most demanding environment of diesel engines on board ships and in land based power plants, VAF Instruments has proven itself with high quality products and a comprehensive and professional customer support.

Necessity of 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, so the fuel will be burnt completely without remaining deposits. The measurement and control of the viscosity ensures an improved combustion efficiency, preventing engine damage and reducing cost of maintenance.

Accuracy

ViscoSense®3 is a highly accurate viscosity sensor with a superior measuring principle. This patented measuring principle 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 viscosity is measured.

Reliability

ViscoSense®3 is able to measure the actual dynamic viscosity in-line of a large range of liquids. 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 measurement is required.

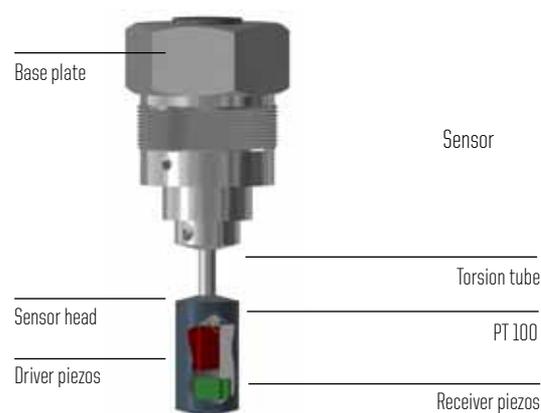
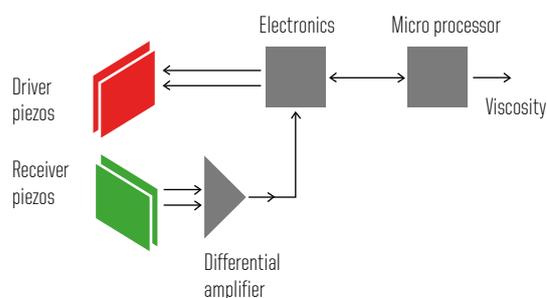
Cost-effective operation

The ViscoSense®3 sensor is developed to measure viscosity 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 surface of the pendulum (which has undergone special surface treatment to improve its non-stick performances) 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 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.

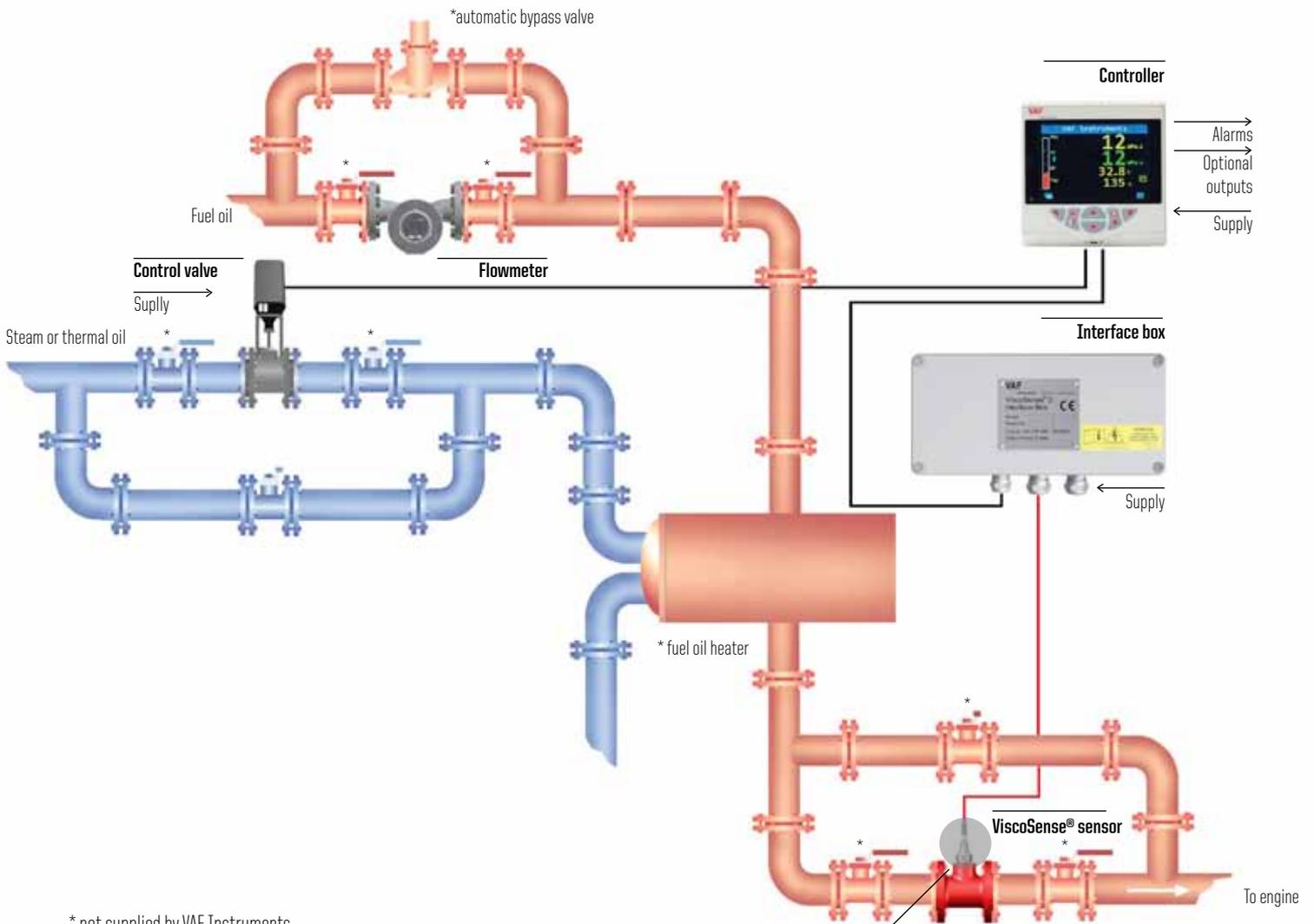
ViscoSense®3 is a registered trade mark of VAF Instruments.

Principle of operation

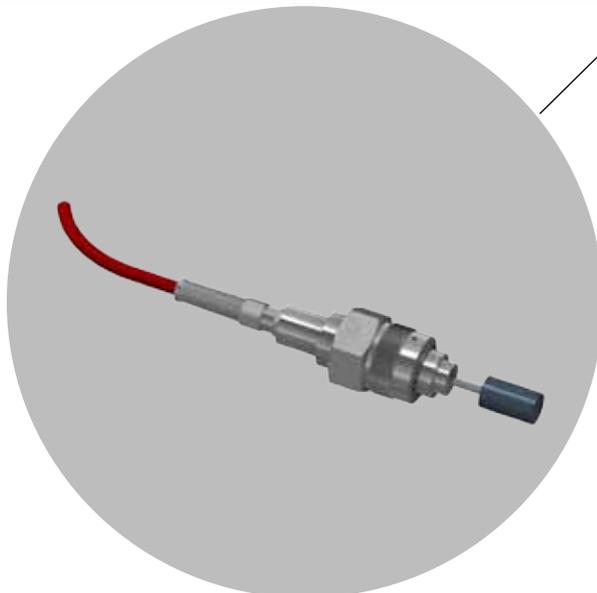
The operating principle of the sensor is that of a torsion pendulum. The sensor consists of a stainless steel sensor head, attached to the base plate by means of a tubular torsion spring. In the head, one pair of piezo elements (driver piezos) actuates the pendulum at its torsional resonance frequency, while another pair of piezos detects the actual movement of the head. In a low viscosity medium, like air, the resonance frequency is in the range of 1600 Hz. In a high viscosity medium the movement of the head is damped by the liquid. Consequently, the resonance frequency slightly shifts towards lower frequencies, whilst the width of the resonance peak increases, which is a measure for the viscosity.



Typical system arrangement



* not supplied by VAF Instruments
Scope of supply is customized



Features and benefits

As a result of the torsional vibration technique, the flow velocity has no effect on the measurement. In addition, external vibrations have no influence on the accuracy of the ViscoSense®3. In practice the smooth edged design of the stainless steel sensor makes the system highly insensitive to fouling and easy to clean. On top of that the closed-loop controlled torsional vibration principle, is independent of ageing of piezo material, ensuring 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 or 0-50 mPa.s for fuel oil applications; other ranges on request (up to 1000 mPa.s) |
| Temperature range | 0-200 °C |
| Maximum operating temperature | max. 180°C |
| Temperature transmitter | PT 100 element |
| Viscosity accuracy | ± 2% instantaneous with a minimum of 0,5 mPa.s |
| Temperature accuracy | ± 1°C |
| Sensor material | stainless steel 316L |
| Coating material | Diamond Like Carbon (DLC) |
| Protection class | IP65 |
| Cable length | 5 m integrated |
| Weight | 1 kg |
| Note | for Ex d version consult factory |

Interface box

| | |
|---|--|
| Viscosity and temperature output | Isolated active output 4-20 mA, current loop, max. load 400Ω |
| 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 |
| 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

Controller

| | |
|-----------------------------------|--|
| General | PI control function |
| Power supply | 100-240 VAC, 48-62 Hz (fluctuations should not exceed ±10% of the nominal voltage) |
| Power consumption | 10 W |
| Ambient temperature | 0-55°C |
| Operating humidity range | 5-95% RH (non-condensing) |
| Protection class | IP66/NEMA 4X (front only) |
| Housing for panel mounting | 96 x 96 mm |
| Operator controls | up/down push buttons, menu button, auto/manual button, access level button |
| Electronic connections | screw terminals, accept wire size 0,5-1,5 mm (16 to 22 Awg) |
| Weight | 0,5 kg |

Controls

| | |
|--------------------------------|---|
| Control strategy | single channel or dual channel |
| Input viscosity | 4-20 mA |
| Input temperature | 4-20 mA |
| Output control contacts | 2 relays, 5A/240 VAC (standard) |
| Output control action | if measured value is higher than setpoint value, the "open" output relay is activated to open control valve (viscosity control) |
| Output current | galvanically isolated 4-20 mA for retransmission |
| Alarm feature | non-latching band alarm, adjustable 1 potential-free SPDT contact, 5A/240 VAC rating (NC fail safe) |

Read-out

| | |
|--------------------------------|---|
| Display | fully graphic display ¼" VGA TFT with backlight |
| Scale range viscosity | 0-25 mPa.s / 0-50 mPa.s (or as ordered) |
| Scale range temperature | 0-200° C (optional) |
| Alarm indication | by means of one dedicated alarm bar in display |
| Output indication | by means of "open/close" messages |



Electronic controller

Technical specification

Housing

| | |
|---------------------------|---|
| Material | ductile iron |
| Flange connections | standard DN50 (2"), DIN, ANSI or JIS; other sizes on request |
| Pressure rating | PN40 |
| Weight | 10kg |
| Diameter | max. flow m ³ /h |
| DN 50 | 20 |
| DN 65 | 34 |
| DN 80 | 51 |
| DN 100 | 80 |



ViscoSense® housing



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

Options and accessories

Electric heater control cabinet

The EHC cabinet has been designed for automatic control of the injection viscosity of heavy fuel oil in combination with electric heaters. The control action is realized by heating the fuel oil step by step to an appropriate temperature. The built-in viscosity/temperature controller with its programmed setpoint values activates more or less heater relays. Up to six heater stages are controlled by means of relays. The first stage is controlled by means of time proportional control, which enables a linear control of power from zero to a maximum value. The power required at a certain load is adjusted by switching "ON" or "OFF" a number of stages, while the remaining fraction is added by the time proportional control. Consult factory for more details.



Electric heater control cabinet

Applications

ViscoSense®3 systems are used in a variety of applications such as:

Marine applications

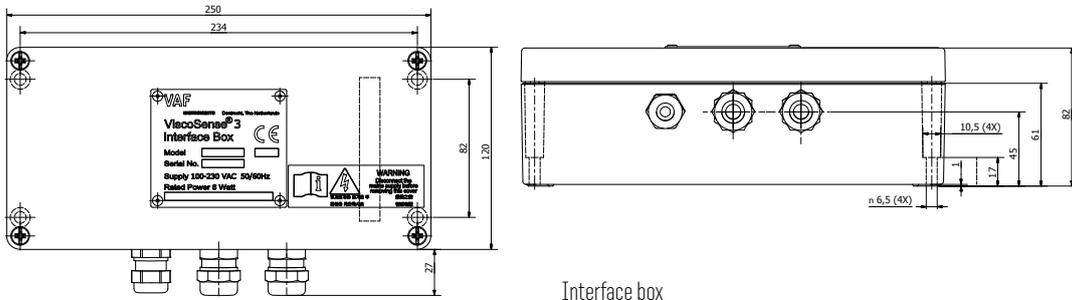
In-line viscosity control is required when (ships) diesel engines or - burners are operated on (heavy) fuel oil, since there is a large variety in quality of this fuel. A correct viscosity ensures an optimal burning efficiency of the fuel, and therefore reduces operating and maintenance costs.

Industrial applications

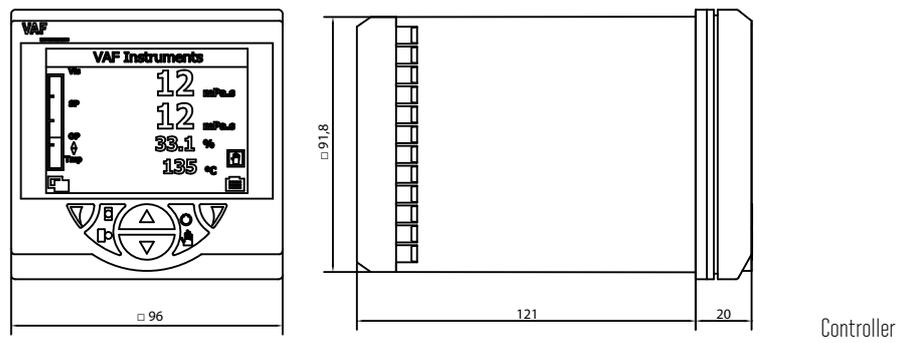
The ViscoSense®3 sensor is also suitable for the in-line measurement of viscosity of many liquids in industrial applications. Because individual applications need special attention please contact VAF Instruments for a tailor made solution.

Dimensions

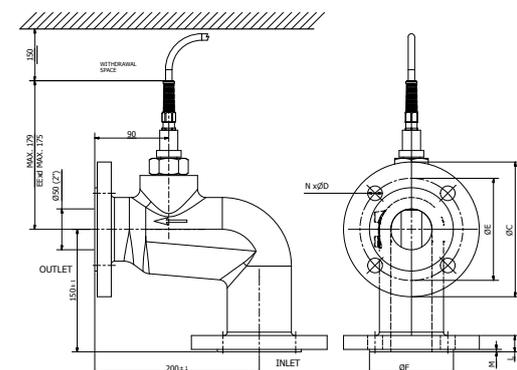
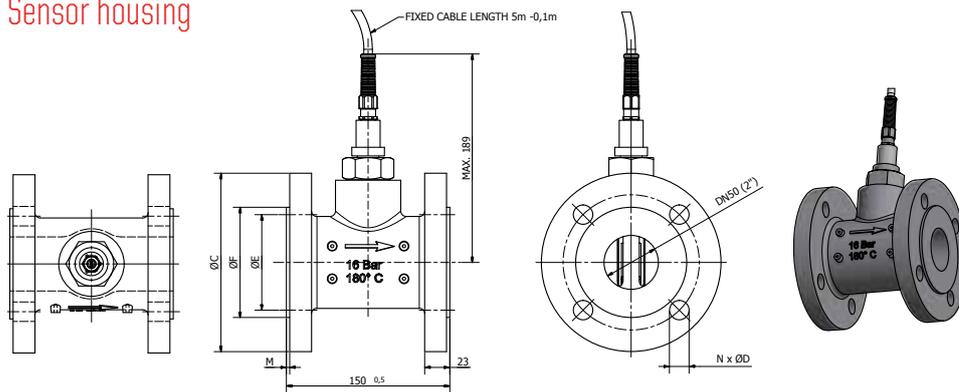
Interface box



Controller



Sensor housing



Quotation and ordering information

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| | | | |
|-----|--|---|---|
| 1. | Basic system designation: ViscoSense®3 | | |
| 2. | Application: | <input type="radio"/> fuel viscosity control | <input type="radio"/> Viscotherm retrofit |
| | | <input type="radio"/> other fluid (please indicate specifications): | |
| 3. | Viscosity range: | <input type="radio"/> 0 - 25 mPa.s | <input type="radio"/> 0 - 50 mPa.s |
| | | <input type="radio"/> special: | |
| 4. | Flow rate [m³/h]: | | |
| 5. | Nominal diameter of piping: | | |
| 6. | Controller type: | | |
| | <input type="radio"/> electronic with viscosity control + temperature indication | <input type="radio"/> electronic with viscosity control + temperature control | |
| 7. | Viscosity reading on electronic controller: | <input type="radio"/> mPa.s | <input type="radio"/> cSt |
| 8. | Flange type: | <input type="radio"/> DIN PN [bar] | <input type="radio"/> ANSI RF [lbs] |
| | | <input type="radio"/> JIS [K] | |
| 9. | Optional extras: | | |
| | <input type="radio"/> remote viscosity indicator | | |
| | <input type="radio"/> remote viscosity indicator with alarm contacts | | |
| | <input type="radio"/> remote temperature indicator | | |
| | <input type="radio"/> remote temperature indicator with alarm contacts | | |
| | <input type="radio"/> inspection by classification bureau | | |
| | bureau name: | | |
| | Tagging of all system components: | | |
| | <input type="radio"/> paper tags | <input type="radio"/> stainless steel tags | |
| 10. | Control valve: | | |
| | actuation | <input type="radio"/> electric | <input type="radio"/> pneumatic |
| | 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] | |
| 11. | Nominal diameter of piping: | | |
| 12. | Inlet pressure [bar]: | | |
| 13. | Nominal flow rate [for steam in kg/h, liquids in m³/h]: | | |
| 14. | Allowable pressure drop across valve [max. 1 bar]: | | |
| 15. | 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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