

Diesel Consumption Measurement for Vehicles and Rolling Stock

Minimise-Optimise-Realise-Maximise



Diesel consumption measurement is essential for the following reasons

- Oil prices are exploding and soon reaching over 100 US\$ / barrel of crude oil: savings is a MUST
- Minimise Diesel consumption
- Optimise performance in Diesel motors and generators
- Detect fuel loss or leakage within a fuel system
- Maximise savings and lifetime of vehicles and rolling stock
- Bonus for drivers (agreement with owner) by optimizing consumption

CONTOIL® - family : fuel and diesel consumption measuring systems

Fuel metering systems are available for various applications, process conditions and flowrates:

VZO 4/8 OEM

- Applications : Trucks, buses, tractors and construction machines
- Description: VZO 4 OEM and VZO 8 OEM are fuel meters with Reed pulsers to display measured values on totalisers.
- Nominal flowrates: up to 50 l/h for VZO 4 OEM and 135 l/h for VZO 8 OEM
- Maximum flowrates up to 80 l/h (VZO 4) and 200 l/h (VZO 8)
- Accuracy: ± 1 % between minimum and maximum flowrate
- Repeatability : $\pm 0,2$ %
- Ambient temperature : -10 °C ... $+60$ °C
- For direct (VZO 4, VZO 8) or differential measurement applications (VZO 8)
- Easy connection to external display or GPS, GPRS systems or GSM
- Compact diesel meter for remote reading of consumption

DFM 8

- Applications : Trucks, buses, tractors and construction machines
- Description: DFM8 is a fuel meter with 2 measuring chambers, 1 pulsers
- Nominal flowrate : 135 l/h
- Maximum flowrate: 200 l/h
- Accuracy of measurement: ± 1 % between minimum and maximum flowrate
- Repeatability : $\pm 0,2$ %
- Ambient temperature : -40 °C ... $+125$ °C
- External power supply: 16 VDC
- Most accurate solution for differential measurement
- Open solution thanks to integrated components such as display, pulsers and other electronic devices like GPS, GSM.

VZO 4/8

- Applications : Trucks, buses, tractors and construction machines
- Description Fuel meter with mechanical roller counter
- Reed pulser as option
- Nominal flowrates: up to 50 l/h (VZO 4) OEM and 135 l/h (VZO 8)
- Maximum flowrates up to 80 l/h (VZO 4) and 200 l/h (VZO 8)
- Repeatability: $\pm 0,2$ %
- Accuracy of measurement: ± 1 % between minimum and maximum flowrate
- Ambient temperature : -10 °C ... $+60$ °C
- For direct (VZO 4, VZO 8) or differential measurement applications (VZO 8)
- Rough metering solution for certain tractors and agricultural machines
- Mounting is possible for every position



s for diverse applications of diesel engines

VZO 8 EKS

- Applications : Trucks, buses, tractors and construction machines
- Description: VZO 8 EKS is a fuel meter with 1 measuring chamber, 1 pulser of inductive type
- Nominal flowrate : 135 l/h
- Maximum flowrate: 200 l/h
- Accuracy of measurement: ± 1 % between minimum and maximum flowrate
- Repeatability : $\pm 0,2$ %
- Ambient temperature : -40 °C ... $+125$ °C
- External power supply: 16 VDC
- Very accurate solution for differential and direct measurements
- Open solution thanks to integrated components such as display, and other electronic devices like GPS, GSM.

VZO(A) 15 - 50

- Applications : Diesel-electric and Diesel-hydraulic locomotives, large tractors and construction machines (medium and large size engines)
- Description: Fuel meters with mechanical roller counters
- Reed or inductive pulser: optional
- Nominal flowrates: up to 400 l/h (DN 15) and 20,000 l/h (DN 50)
- Maximum flowrates: up to 600 l/h (DN 15) and 30,000 l/h (DN 50)
- Accuracy of ± 0.5 % (VZOA) and ± 1 % (VZO) between minimum and maximum flowrates
- Repeatability: $\pm 0,2$ %
- Ambient temperature : -25 to $+70$ °C
- Easy mounting and connection when output signal is required

VZF(A) 15 - 50

- Applications : Diesel-electric and Diesel-hydraulic locomotives, large tractors and construction machines (medium and large size engines)
- Fuel meters with mechanical roller counters
- Reed or inductive pulser: optional
- Nominal flowrates: up to 400 l/h (DN 15) and 20,000 l/h (DN 50)
- Maximum flowrates: up to 600 l/h (DN 15) and 30,000 l/h (DN 50)
- Accuracy of ± 0.5 % (VZFA) and ± 1 % (VFO) between minimum and maximum flowrates
- Repeatability: $\pm 0,2$ %
- Ambient temperature : -10 °C ... $+60$ °C
- Ambient temperature : -25 to $+70$ °C
- Fuel temperature: up to 180 °C
- Easy mounting and connection when output signal is required

Selection guide

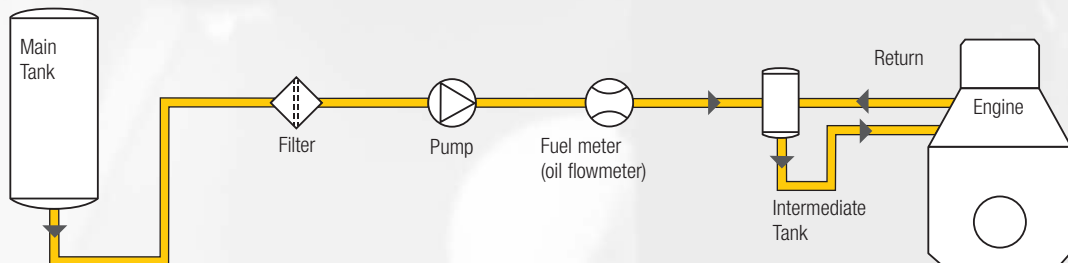
Please see latest technical brochure CONTOIL® or visit our website: www.aquametro.com.



Measuring principles

There are basically two consumption measurement methods:

Direct consumption measurement



The direct consumption measurement is the most accurate method.

According to the above figure, generally an intermediate tank which is equipped with a heat exchanger is installed on the supply side of the system, thereby preventing the unconsumed fuel to flow back to the main tank. The fuel meter is therefore placed in the supply pipe prior to the intermediate tank. The load on the flowmeter and the measuring result corresponds to the consumption.

Additional components often used:

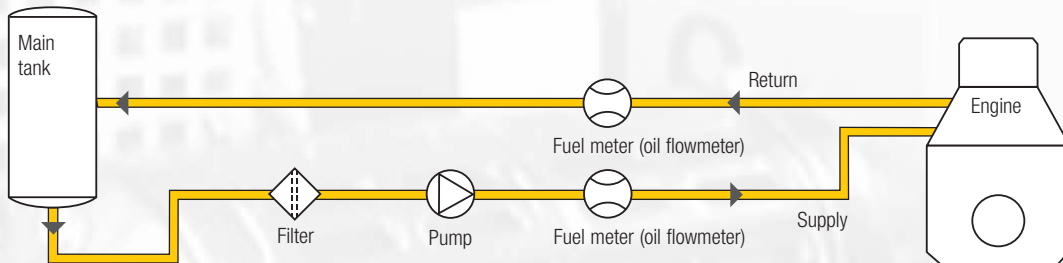
According to diesel engine experts, in a direct measurement system, the following additional components are often used:

- Intermediate tank to separate the air.
- A heat exchanger on the return line in order to reduce the fuel temperature coming from the engine (optional).

Types of flowmeters that can be used:

- VZO 4, VZO 8
- VZO 4 OEM, VZO 8 OEM
- VZO(A) 15...50
- VZF(A) 15...50

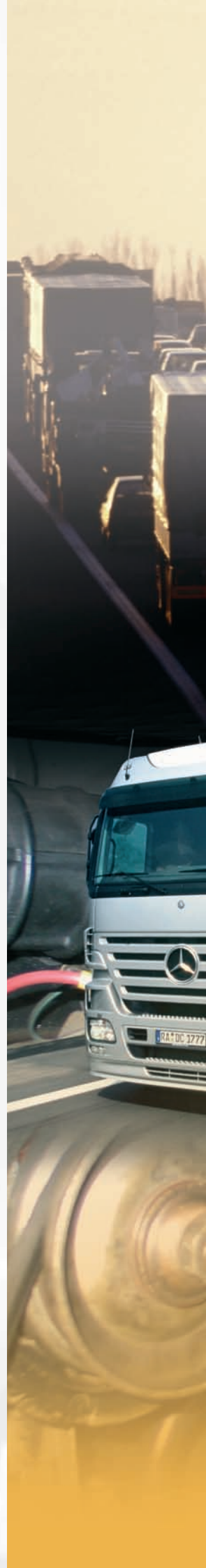
Differential measurement



The differential consumption measurement is another way of measuring diesel fuel in engines. It is a very accurate method and does not require many additional components or high knowledge. With the differential measurement method, the piping remains unchanged, thereby the return flow from the engine goes back to the main tank. There are two flowmeters installed (see figure above): one on the supply side and the other on the return side. The consumption is determined by the difference between the supply flow and the return flow.

Types de débitmètres :

- VZO 8 and DFM 8
- VZO 8 OEM and VZUO 8 EKS
- VZO(A) 15...50
- VZF(A) 15...50



Installation requirements

In order to achieve highest accuracy measurement, several points must be considered:

Vibrations and mechanical shocks

High vibrations must be avoided on the measuring system. High vibrations resulting from the Diesel engine or high pressure pump can damage the mechanical flowmeter. Vibrations can also cause additional pulse output thereby leading to an error in measurement for flowmeters equipped with mechanical pulsers such as VZO with Reed pulser.

Solution

Install the flowmeter within the engine room / body at a distance such that the meter is subject to minimum vibrations i.e. the meter must be away enough from the engine. The use of rubber shock absorbers and hoses is strongly recommended by experts in order to minimize the effect of vibrations and mechanical shocks.

Air in diesel fuel

Air in fuel leads to inaccuracy in measurement because its volume is counted by the flowmeter in addition to the diesel fuel flowrate. Air in fuel system must be therefore avoided.

Solution

Air can be avoided by periodical deaeration (air separation) of the fuel system. De-Aerators can be used. Whenever possible, install the flowmeter at the lowest part of the fuel system.

Ambient and fuel temperatures

The different types of diesel fuel cover a wide range of temperatures from cold to hot (ambient and medium). Nevertheless these temperatures must never exceed the specified temperatures in order to avoid the damage of the meter and error in measurement.

Solution

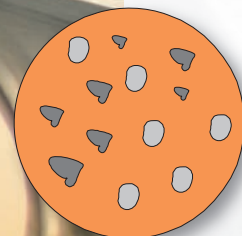
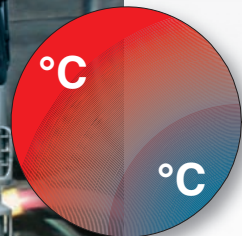
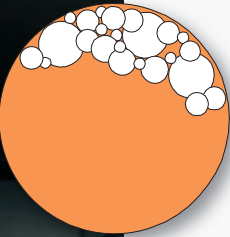
For very low temperatures, the use of an auxiliary heater is strongly recommended according to diesel engine experts. This is used in order to heat up the diesel fuel prior to engine start up. The use of an insulated metal box can also be another solution.

Bad quality of diesel fuel

In some countries, diesel fuel often contains large amount of dirt, paraffine, water and other particles. These can damage the meter and the engine if they are not properly removed.

Solution

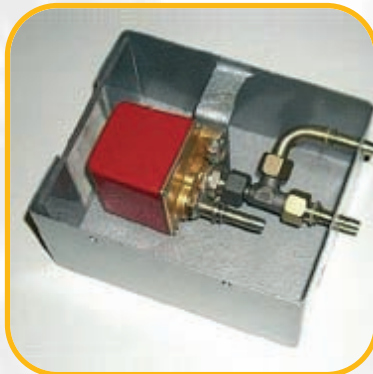
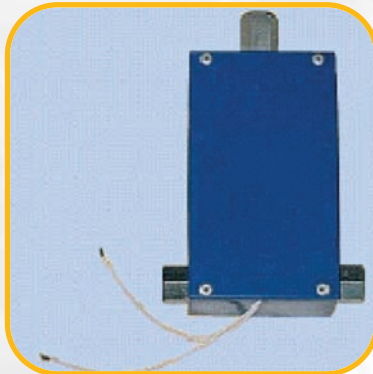
The installation of a diesel filter prior to the measuring devices to remove any strange particles that can get stuck in the fuel system.



Protection against vandalism

Protection of the measuring devices is an essential part of a proper, accurate and reliable diesel consumption measurement. It is important to make sure that meters, hoses and calculation devices (display) are properly secured to avoid opening and destruction of the measuring system. Such events can have a very negative influence on the measured results. To protect the measuring system from the influence of people with bad intentions, some of the following ideas can be used:

Lock



Examples of locking diesel meters in metal boxes.

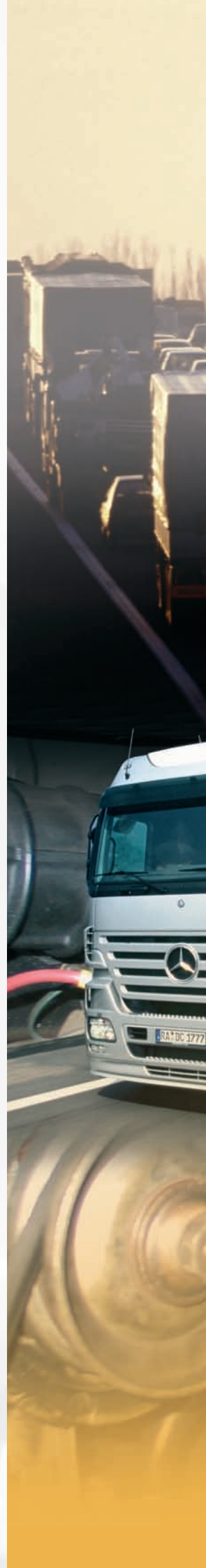
Seal

Use of liquid, plastic or wire seals to secure hose connections, screws and other removable parts of the measuring system.

Checking

It is strongly recommended to periodically check the metering system. A periodic check of the measuring system e.g. every week by trusted employees, will give you a maximum security.

If all above methods are used together, your measuring system is well guaranteed against destruction and vandalism thereby resulting with a maximum security and reliability.



Applications and installations examples

Diesel fuel consumption measurement is used in a wide range of vehicle applications running on diesel engines such as:

- Trucks
- Buses
- Tractors
- Agriculture and construction machines.
- Rolling Stock: Diesel-Electric and Diesel-Hydraulic locomotives

Aquametro's fuel meters are also used in other applications such as:

- Ships
- Diesel generators
- Industrial and domestic Burners

Examples of installation



Caterpillar Excavator



Carrier Diesel Generator



Tractor



MAN Truck



Small Passenger Truck



Tractor



Locomotive diesel



Large Truck



Large Truck

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