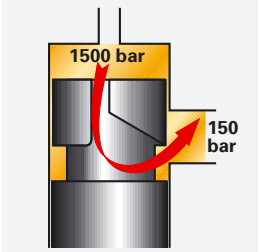
LITREMETER
Specialist flow measurement engineering

KRAL Volumeter® - Fuel Consumption Measurement for Diesel Engines

KRAL

Engine related fuel consumption measurement, influenced by pressure pulses of the injection pumps, is now possible.



Typical operating parameters for the KRAL fuel consumption measurement system

Fuel:	Diesel fuel (LFO) Heavy fuel oil (HFO) Marine fuel oil (MFO)
Temperature:	up to 150 °C
Filtration:	up to 0,3 mm
Pulsation pressure:	up to 20 bar, consult factory

For further information, please request product brochures for the individual components of our diesel consumption measurement system.

Exact Measurement of Fuel Usage

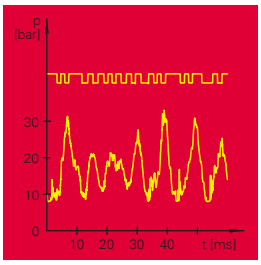
About 80 % of diesel engine operating costs are fuel costs. Diesel engines can power such equipment as:

- ☐ power generators
- ☐ ships
- ☐ locomotives

All of these demanding applications require accurate flow measurement.

Efficient operation is important, especially with systems using multiple engines. Therefore fuel usage is a decision criteria in the purchase of a diesel engine and is carefully monitored during:

- ☐ engine development
- ☐ commissioning
- ☐ the warranty period



Reliable Flow Measurement with Pulsating Flow

The pistons of the fuel injection pump cause fluid pulsation in the fuel supply system. These pulsations may be responsible for:

- ☐ surge impact on the system components
- ☐ high-frequency flow fluctuations
- ☐ in rare cases, a brief reversal of the flow direction.

Insensitive to System Vibrations

Slow- and medium-speed diesel engines can cause severe vibrations, which also induce oscillations at the flowmeter.

Vibration and fluid pulsation must not affect the accurate and reliable performance of the flowmeter.

Dual Fuel Engines and Changing Conditions

Dual fuel engines combust both light and heavy fuel oils.

Fuel properties may vary between local markets.

Additionally, temperatures may affect your fuel oil temperature.

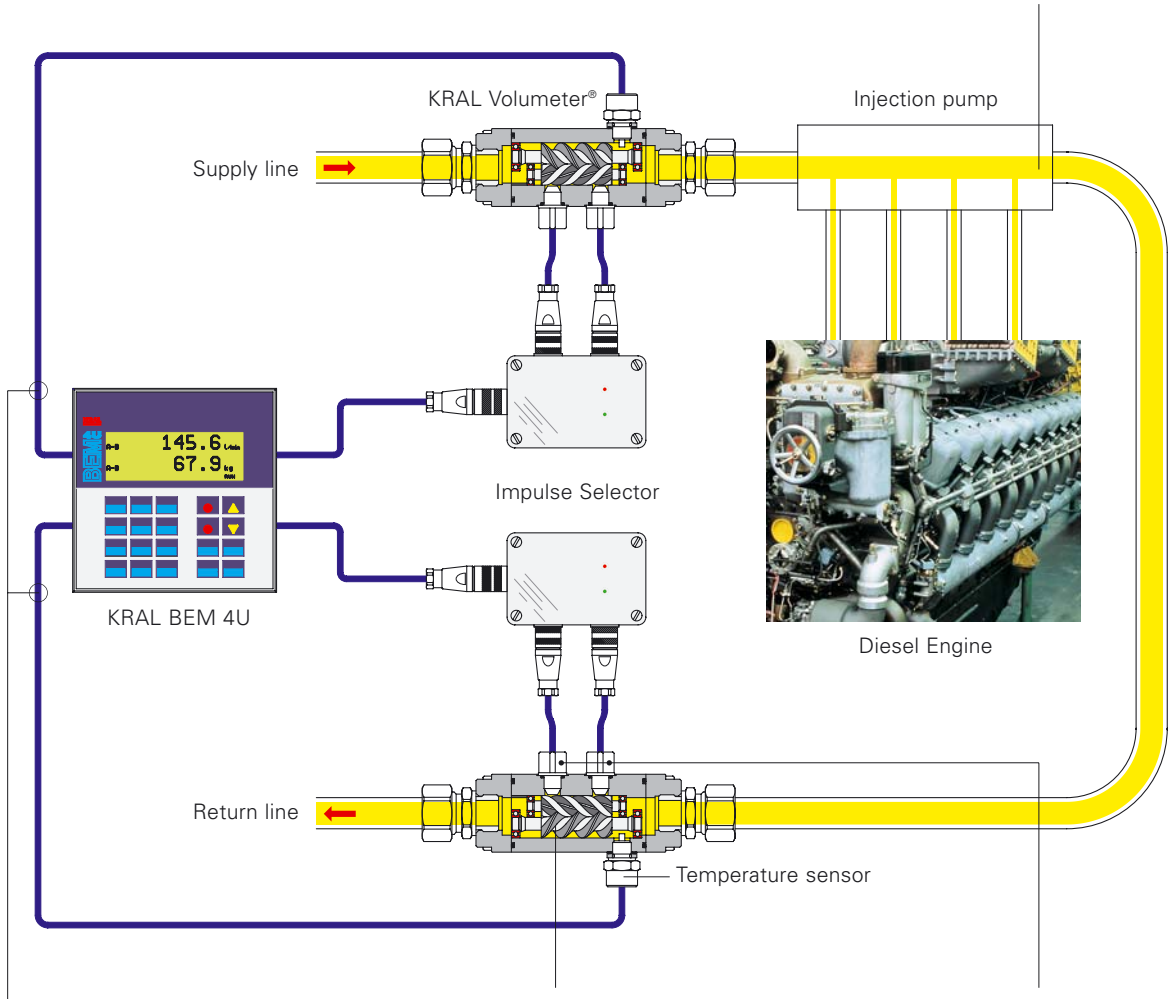
All of these influence the oil viscosity. Therefore, the flowmeter must be able to measure accurately in wide-ranging conditions.

The Solution

Two KRAL Volumeters for differential measurement provide real-time fuel consumption for individual engines in multi-engine systems.

The KRAL Volumeter is designed to handle the rough operating conditions near the injection pump.

As a positive-displacement meter, the KRAL Volumeter follows the changing velocities of pulsating flow.



Using temperature sensors, the BEM 4U displays fuel consumption in mass units.

The BEM 4U can read the energy output from a generator and calculate the specific fuel oil consumption (SFOC) in [g/kWh].

Our principle of operation using spindles is insensitive to mechanical vibrations, without loss of accuracy.

With two sensors, bi-directional measurement is possible. Pressure pulses can cause brief reversal of the flow direction. The impulse selectors detect reverse flow and correct the total.

Sound Reasons to Choose KRAL

Precise and Reproducible Flow Measurement

The accuracy of the KRAL Volumeter is unmatched. Our meters are accurate to within ±0,1% of rate over a wide range of flow and viscosity. The reproducibility is better than ±0,01% (consult factory). With excellent service life and long-term stability, this clearly shows that sturdiness and precision are not mutually exclusive.

Nine European standards laboratories used a KRAL Volumeter for a calibration intercomparison. With results beyond expectations, the report suggests using our device as the default transfer standard between kerosene laboratories.

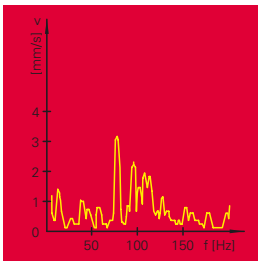
High Accuracy over a Wide Viscosity and Flow Range

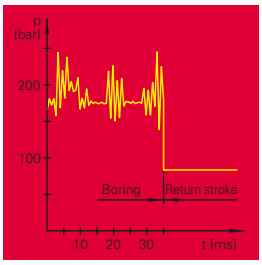
Being a positive-displacement meter, the KRAL Volumeter is naturally insensitive to wide changes in:

- ☐ viscosity
- ☐ temperature
- ☐ flow rate

The **Measuring Range** diagram shows the extent in which:

- ☐ high accuracy is achieved
- ☐ continuous operation is possible
- ☐ measuring independent of viscosity is possible





Measurement under Difficult Operating Conditions

The photo above shows a real-world installation.

Obviously, KRAL Volumeters are extremely sturdy devices.

KRAL is also experienced in flow measurement under other difficult operating conditions.

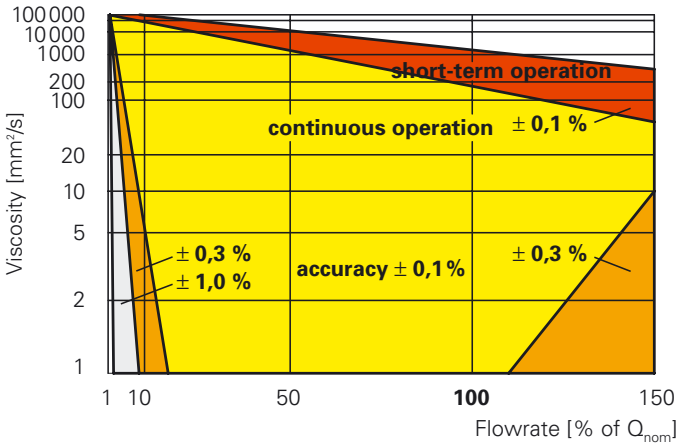
Example: Hydraulics of Tunnel Boring Machines

Liquid: Hydraulic oil
Flow rate: 0,3-45l/min bi-directional
Pressure: Pulsating up to 250 bar
Temperature: 40-80 °C
Viscosity: 60-3000 mm²/s

The flow to the hydraulic cylinder is measured in order to determine the exact position of the boring bit.

These KRAL Volumeters are characterized by reliable measurement in both flow directions despite extreme vibrations and surge impact during boring.

Measuring Range



The measuring range diagram is internationally patented.

KRAL Volumeter® - Components of a Fuel Oil Consumption Measurement System

Application	OMG*	OME*	BEM 4U*	BEM 4U*	BEA 42	EET
Description	Universal Flowmeter	or Economy Flowmeter	Flow Computer	Energy Computer	Impulse Selector	Temp. Sensor
Consumption measurement	•	•	•			
Consumption measurement with reverse flow	•	•	•		•	
Mass consumption measurement	•	•	•			•
Mass consumption measurement with reverse flow	•	•	•		•	•
SFOC** measurement in [g/kWh]	•	•		•		•
SFOC measurement in [g/kWh] with reverse flow	•	•		•	•	•

Flowmeter selection will vary depending on process conditions. Consult factory for assistance.

* For detailed product information, please request our product series brochures.

** Specific fuel oil consumption

KRAL

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Specialist flow measurement engineering

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