

Fuel Consumption Measurement for Turbines

Accurate, reliable and leakage-free fuel consumption measurement, is now possible.



Typical operating parameters for the KRAL fuel consumption measurement system

- Fuel: Turbine Diesel and marine fuel
- Flow rate: up to 2000 l/min
- Pipe size: up to 4", DN 100
- Length: max. 500 mm (no flow conditioning required)
- Temperature: up to 150 °C

Consult factory for specific operating data or further information on the individual components of our fuel consumption measurement system.

Fuel Cost Reduction

Power plant operators monitor any measurements that reduce the operating costs. They would also like to prove the turbine specifications are being met. High fuel costs make this an economic necessity. Measurement with tank level gauges or billing from the fuel supplier are influenced by temperature and fuel type variations. A practical direct measurement of fuel consumption is required.

The extremely accurate KRAL Volumeters are installed directly in the fuel supply system. In multi-turbine installations, a difference measurement of the supply and return flow can provide individual turbine data.

Claim Cost Reduction

The planned down-time of a turbine is typically 5%. Unplanned shut downs can be very expensive, especially for IPP's, because a shut down can close an entire factory. For this reason, turbine manufacturers are seeing more penalty clauses that reduce the price or increase the warranty period.

The reliable and leakage-free KRAL Volumeter prevents claims like these. A unique technical aspect is the sensor's "dry sleeve", which keeps the flowmeter sealed if the sensor is taken out. When changing the sensor, there is no reason to open the meter, which would require depressurizing.

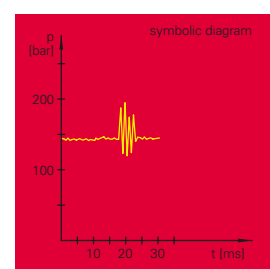
Compact Design



Space is limited in power plant modules. Valves and pipe elbows are normally very close to a flowmeter. A flowmeter in a turbine module must be compact and not require additional room or flow conditioners.

The Volumeter has a compact design compared with other high-pressure flowmeters. With a KRAL Volumeter there is never a need for flow conditioners.

Robust Design



If dual fuel turbines switch over from natural gas to diesel oil, a valve is opened rapidly. This causes a strong pressure surge in the piping system. The flowmeter needs to have a robust design to handle such pressure pulses mechanically.

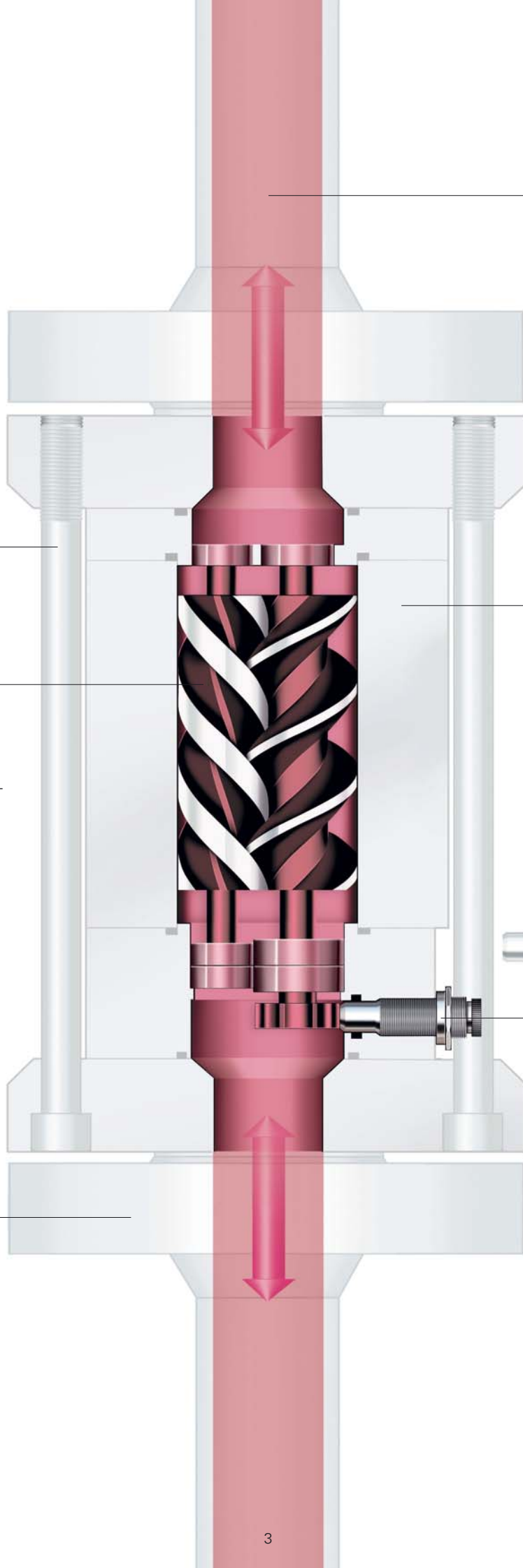
KRAL Volumeters have a special spindle and casing design that protects the spindles from mechanical harm.

The Fuel Solution

Through bolts for high-pressure safety.

Precision measuring chamber for high measurement accuracy.

Various connections are available for easy integration into existing piping, including: Pipe thread, ANSI, SAE, JIS and DIN flange.



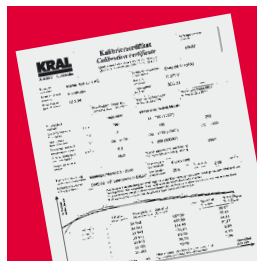
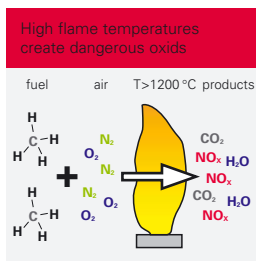
No flow conditioning or straight piping is necessary upstream or downstream of the meter.

Rigid casing to handle pressure pulses without losing performance.

A second sensor can be installed for bi-directional flow measurement.

Sensor can be removed from dry sleeve even under full system pressure.

Stable measurement and easy installation for water injection measurement



Typical operating parameters for the KRAL water injection measurement system

- Fuel: Demineralized water
- Flow rate: up to 700 l/min
- Pipe size: up to 2", DN 50
- Length: max. 355 mm (no flow conditioning required)
- Temperature: up to 80 °C

Consult factory for operating data confirmation or further information for the individual components of our water consumption measurement system.

Reduction of Exhaust for Environmental Reasons

Turbine improvement is a continuous task. Reduction of exhaust is a main target of these improvements. At temperatures above 1200 °C the nitrogen of air burns into dangerous oxides (NO_x). In order to reduce the NO_x emissions, the temperature must be decreased. Water is injected to reduce temperature. The amount of water is controlled but not regulated. More and more turbine manufacturers want to regulate their water injection. For this kind of regulation, a suitable flow measurement is required.

KRAL Volumeters are precise flowmeters that can measure water injection.

Minimization of Water for Cost Reduction

Only demineralized water can be injected in the turbine. Demineralized water is very expensive. In some places it is more expensive than fuel. Because of this, water consumption should be optimized. Water consumption can be very high but it should not be any higher than necessary. A precise water measurement is required for optimization.

The KRAL Volumeter is compatible with demineralized water and can measure this flow precisely. Every KRAL Volumeter is calibrated on the company's own test stand. This calibration is traceable to national standards.

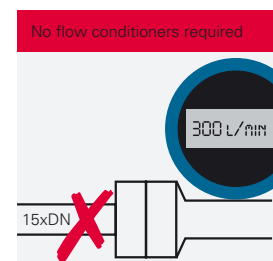
Operating Principle Advantages



Electromagnetic and Vortex flowmeters are frequently used for water measurement. For this application, magnetic meters do not work with demineralized water since the liquid is non-conductive. Vortex meters need flow conditioning before the meter or they will not have the required accuracy.

With the spindle design, KRAL Volumeters can function in water with high accuracy.

Easy Installation



Other meters used for water measurement depend on the flow profile. They depend on flow conditioners which needs space for integration. If the flow conditioners is shortened to accommodate limited space, then it is not as effective.

KRAL Volumeters do not depend on flow profile and need no flow conditioners for accurate measurement.

The Water Solution

Precision measuring chamber provide accurate measurement of injection water.

Spindle design can measure demineralized water and requires no flow conditioning.

Various connections are available for easy integration into existing piping, including: Pipe thread, ANSI, SAE, JIS and DIN flange.

Flow profile does not affect meter accuracy.

Stainless steel casing.

Industry standard outputs for easy integration.



KRAL Volumeter® - Components of a Fuel Consumption and Water Injection Measurement System



Application	OMG* or OMH*	OMS	BEM 4U*	BEM 2U*	BGG	EET
Description	Standard or High Pressure Flowmeter	Stainless Steel Flowmeter	Flow & Energy Computer	Local Display	Dry Sleeve	Temp. Sensor
Fuel consumption measurement	•		•	• or •		
Water injection measurement		•	•	• or •		
SFOC** measurement in [g/kWh]	•		•			•
Sealed flowmeter for claim cost reduction	•	• or •			•	


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

** Specific fuel oil consumption

Sound Applications to Choose KRAL

Fuel Consumption Measurement on Turbines



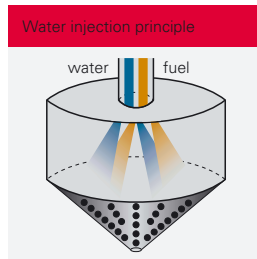
Liquid: Diesel Oil
 Flow rate: 28 to 1770 l/min
 Pressure: 142 bar
 Temperature: 15 to 80 °C
 Viscosity: 1,6 to 6 mm²/s
 Measuring instrument:
 OMH 100 with -sensor

A turbine manufacturer needed to measure the consumption of diesel oil in an explosion-proof area. The special requirements for this application included:

- high flowrate at high pressure in minimum space
- accurate and reliable measurements
- explosion-proof electronics
- long service life
- world-wide service

The KRAL Volumeter OMH 100 was selected to measure the oil consumption of this turbine.

Water Injection Measurement on Turbines



Liquid: Demineralized Water
 Flow rate: 25 to 380 l/min
 Temperature: 5 to 40 °C
 Pressure: 140 bar
 Measuring instrument:
 OMS 52

To reduce NOx exhaust our customer needed a turbine water injection regulation. For a regulation a turbine manufacturer required accurate measurement. He could not use magnetic or Vortex flowmeters because they don't work with demineralized water or need flow conditioners.

The KRAL OMS 52 was selected, because this high accurate PD flowmeter measures demineralized water with high system pressure. There is never a need of flow conditioners.

Diesel Engine FC Measurement



Liquid: Heavy Fuel Oil
 Flow rate: up to 170 l/min
 Temperature: 135 °C
 Pressure: 8 bar
 Measuring instrument:
 OMG 52

KRAL is very experienced in fuel consumption (FC) measurement for Diesel engines. With multiple engine installations operators need an engine related measurement. This requires a measurement of the supply and return flow close to the injection pumps. The injection pumps cause pressure pulses which may be responsible for surge impact on the flowmeter. There are also fuel temperature differences.

OMG with pressure-pulse and temperature compensation was selected.

Joint projects

Our customers particularly value their co-operative collaboration with KRAL. Excellent business relationships arise again and again out of the best possible project implementation. We offer our customers inter-active dialogue and close technical co-operation to achieve a successful project conclusion. In partnership with KRAL, project goals are achieved.

Please visit us at
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