

Celle, August 25th, 2014

Reliable Mixture Control helps to comply with current Regulations

Worldwide lean gas (biogas, mine gas, landfill gas or digester gas) is becoming more important for power and heat generation. Especially in North America the use of lean gas will drastically gain momentum due to the massive development. Besides variations in the gas quality which have to be adjusted constantly, stricter rules and regulations for emissions are factors which are permanently asking for increased performance of mixture controls for stationery gas engines.



Caterpillar G3516B equipped with VariFuel2 air/fuel ratio mixer

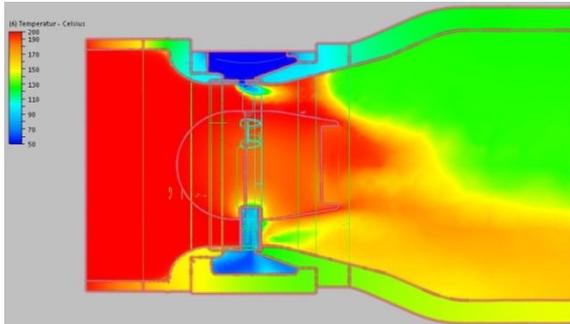
While using lean gas, a constant gas quality cannot be guaranteed. Lean gas is exposed to permanent variations in the production process, resulting in a constant change in the calorific value. Should the variations in fuel quality not be reliably balanced, this would be having an effect on the efficiency and emission. At the same time emission rules and regulations, which are constantly becoming stricter, create high requirements on the mixture control of the engine. So far only new or modified engines were concerned by the emission rules and

regulations, e.g. the „New Source Performance Standards“ (NSPS, Subpart JJJJ), but since the modification of the „National Emission Standards for Hazardous Air Pollutants“ (NESHAP, Subpart ZZZZ) this rule also applies to engines already in operation.

A modern mixture control must react fast, flexible and reliable to any changes in gas quality with constant adjustments reacting to any kind of fuel changes. Only this way can the engine operation be reached at maximized efficiency while concurrently complying to the emission limits.

The MOTORTECH Air/ Fuel Ratio Mixer VariFuel2

The MOTORTECH air/ fuel ratio mixer VariFuel2 is a flexible solution for applications with constant changes of the calorific value in the fuel. The two gas inlets do not only optimize the position of the gas connection conduit, but also enable the use of two different kinds of gas, e.g. natural gas and lean gas. The innovative mixture system of the VariFuel2 grants ideal fuel power due to the perfect option to switch from one gas to another within a very short time period, thus holding the previously defined Lambda value at any given time. The emission limits can be observed in each and every operating phase.



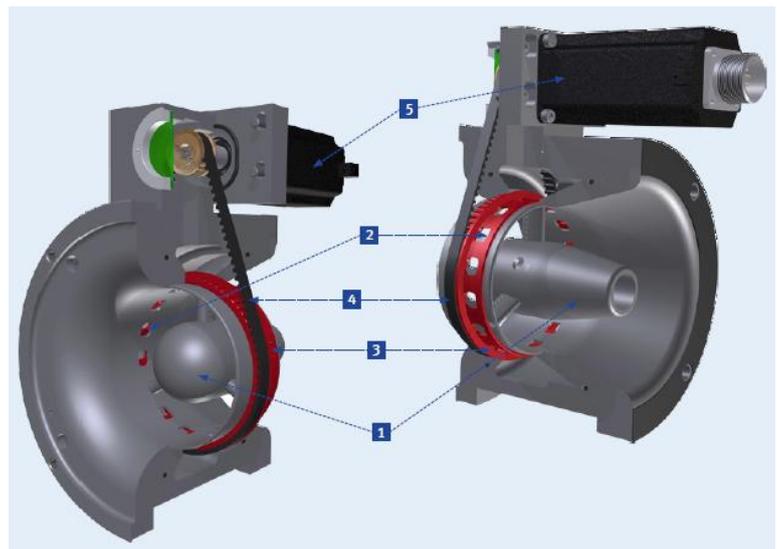
CFD simulation shows a VariFuel2 air/fuel ratio before the optimization.

MOTORTECH is developing their gas mixers by using modern 3D CAD-systems and CFD-simulations. The theoretical results are proven with experiments and measurements on an own test facility and in collaboration with selected customers and external laboratories.

Venturi Principle for an optimal combustion

In the VariFuel2, gas and air are mixed by the Venturi effect. Based on the suction vacuum of the engine, the air is sucked through the air inlet into the Venturi nozzle. This generates a vacuum at the narrowest point, which causes the gas to be pulled in through the gas inlet. This way gas and air are mixed and released at the Venturi outlet. In order to find the best shape for the individual components, numerous simulations and trials were undertaken, resulting in different design sizes and different flow bodies **1.** in the Venturi nozzle, in order to achieve various flow volumes.

The fuel (gas) is drawn into the nozzle via the adjustable openings **2.** in a fuel ring **3.** The openings of the ring are adjusted using a drive belt **4.** - either manually or normally via a stepper motor **5.**, depending on the VariFuel2 type. The stepper motor is controlled by a stepper motor card (VariStep) which processes the signals of a master control.



In addition, the VariFuel2 gas mixers are equipped with a port for an air pressure gauge as well as a connection for the pulse line of a zero pressure regulator.

VariFuel2 series 100, 140, 200 and 250 are available for engines with an air requirement from 100 up to max. 5.000 m³/h (176,500 ft³/h). By using two gas mixers in a parallel arrangement, air demands up to 10.000m³/h (353,000 ft³/h) can be achieved.

About MOTORTECH

MOTORTECH develops and manufactures ignition components, air/fuel ratio controllers, engine management systems and other accessories for stationary gas engines. With a focus on research and development, the company is demonstrating cutting edge when it comes to adjusting ignition systems with regard to efficiency and profitability. Products developed by MOTORTECH as well as products developed in cooperation with almost every well-known engine manufacturer have led to a strong and well established position in the industry. The favorable strategic position of the company is being continuously extended and improved by more than 200 employees at plants in Celle, Germany and Kolobrzeg, Poland and a subsidiary in the United States.

High voltage ignition with adjustable power, customized ignition coils, wiring rails and an innovative air/fuel ratio mixer ensure that gas engines powered by alternative kinds of gas such as biogas, mine gas, sewage gas or landfill gas can reach an availability of more than 95%. Highest efficiency, adherence to exhaust emission standards and high quality significantly raises the engine's profitability.