



WHITE PAPER

Did you know natural gas is not the only option for appliance fuel?

▶ For those in the HVACR industry, it is common knowledge that natural gas is an appliance fuel type. However, those working in the sector may be slightly less familiar with the alternative fuel types out there, such as biofuels and oils. This will be of particular interest to those working in more remote or agricultural areas, where the usage of alternative fuel types will be more common due to the lack of access to gas grids.

This white paper will explore the alternative fuel choices which you may come in contact with, and explain the ways you can ensure accurate measurement with a Flue Gas Analyser (FGA).

Biofuel refers to a range of chemical fuels that are derived from non-fossil sources, as opposed to from

the slow geological process involved in the creation of fossil fuels. Biofuels are formed immediately from living matter.

Ensuring you have a thorough understanding of the fuel types utilised within different environments is important, as it allows for the prevention of inaccurate readings. Depending on the fuel type being measured, the way you use your equipment will vary.

This paper is a guide to raise awareness about the different fuel types used within different applications, and to safeguard against equipment malfunction within the HVACR sector.

Different Types of Biofuels

Firstly, let's take a look at the variety of biofuels.

One type of biofuel is bagasse. This is sourced from sugarcanes or sorghum stalks, and is the dry, mushy material that is left once the stalks have been crushed. It's chemical composition includes 45.5 wt% C, 5.6 wt% H, 45.2 wt% O and 0.3 wt% N. Bagasse can also be utilised to produce heat, energy, and electricity, and in the manufacture of pulp and building materials.

Another alternative source of fuel are wood pellets and wood chips. Composed of the ash-forming elements Ca, K, Al, Mg, and Fe chips and pellets are relatively well known environmentally friendly fuel types. Often used in biomass boilers to create hot water in domestic settings, chips and pellets can also be used in a range industrial settings including biomass dedicated energy plants, co-firing, combined heat and power plants, and industrial scale public and private heating.

Biogas chemical properties consist of methane (50–75%), carbon dioxide (25–50%), and smaller amounts of nitrogen (2–8%). This fuel is formed during the breakdown of organic matter, like food or animal waste. It stems from the bacteria produced in the biodegrading process of these materials and is often used as vehicle fuel, for water and room heating, electricity generation, as a replacement for compressed natural gas in vehicles, and can displace carbon dioxide in on-site CHP plants.

Biomethane is a near-pure source of methane that is created by removal of the CO₂ and other contaminants found in biogas, or by gasification of biomass followed by methanation. The removal of contaminants in biogas to create biomethane, is also known as 'upgrading biomass' and is the most common way of creating this type of biofuel.

Biomethane (also known as "renewable natural gas") is a near-pure source of methane produced either by "upgrading" biogas (a process that removes any CO₂ and other contaminants present in the biogas) or through the gasification of solid biomass followed by methanation. The other process of its creation sees woody biomass broken down at high temperature and high pressure in a low-oxygen environment. Under these conditions, the biomass is then converted into a mixture of

gases, mainly carbon monoxide, hydrogen and methane (sometimes collectively called syngas). This syngas is then cleaned to remove acidic and corrosive components, before a catalyst to promote a reaction between the hydrogen and carbon monoxide or CO₂ is introduced to produce methane. Finally any remaining CO₂ or water is removed at the end of this process.

As biomethane has an LHV of around 36 MJ/m³ it is identical to natural gas and therefore can be used without changes in transmission and distribution infrastructure or end-user equipment being required. It is also able to be used in natural gas vehicles.

All of these fuel types may be utilised for power, heating and industrial purposes.



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Different Types of Oils

Alternative fuel types used in more remote and agricultural areas cover light and heavy oils. Light oils, such as Kerosene, are oils with low viscosity which flow freely at room temperature. These types of oil also have a low specific gravity and high API gravity because of the presence of a high proportion of light hydrocarbon fractions. Usually light oils contain less wax content and are comparably expensive to heavy oil. Light oils include jet fuel, gasoline, kerosene, petroleum ether, petroleum spirit, and petroleum naphtha.

Kerosene is a clear liquid oil with low viscosity, which is sourced through the fractional distillation of petrol at a heat of 150 and 275 °C. The result contains between 10 to 16 carbon atoms and creates a lower density oil than that of diesel.

Often referred to as coal oil, in spite of this being inaccurate. Kerosene is used within kerosene lamps and domestic heaters or furnaces. It is also commonly used as a fuel or fuel component for jet engines, and can be harnessed as a solvent for greases and insecticides.

Heavy oils have high viscosity and therefore cannot flow as freely as their light counterpart at room temperature. These viscous oils comprise dense oil with a higher density and specific gravity than light oils. Heavy oils, which include coal tar creosote and diesel, have an API gravity of less than 20 degrees. It has a high density and viscosity because of the presence of high molecular weight hydrocarbon compounds.



Using an FGA with Alternate Fuel Appliances

Now that we have explored the alternative fuel sources that those in the HVACR may encounter, it is time to understand the ways in which to ensure emissions are appropriately measured within the gas detection process.

The first step when measuring alternate fuel types within a flue gas analyser is to ensure you select the correct fuel type in the FGA's menu. There are specific efficiency equations tailored to each fuel type within FGA's which are based upon the differing exhaust outputs of the different fuels. Ensuring the correct fuel type is chosen is very important or the readings will be inaccurate.

Using alternative fuel types will emit significant quantities of high micron particulates 1-15 microns when combusted. These can block filters which are designed primarily for gas usage, as gas gives off very few of these large particles. As a result smaller 1 micron filters are used when utilising natural gas as a fuel type, within Crowcon's FGA's, to provide better protection against water ingress.

The main purpose of the filters on FGA's is to prevent water ingress. In terms of achieving this the following breakdown applies:

- 1 micron - best
- 3 micron - good
- 5 micron - average
- 10 micron - not good

Essentially, the smaller the filter in terms of microns the more likely it is to become blocked from particulates released when combusting biofuels or oils. Crowcon recommends a 1 micron filter for protecting against water when using gas as the fuel type, and a 3 micron filter for protecting against water when using biofuels or oil as the fuel type.



“When mixtures of toxic gases are encountered the effects on health are often additive”

Choosing Reliable Equipment - Crowcon's Offerings

Crowcon's oil filter kit comes with a 3 micron filter and water trap and is designed for use with oil fuelled boilers. The kit also comes with a dust filter and connector hose with a positive click connector for ease of use.

For engineers measuring oil, they will require OFTEC certification and those working with wood, biomass, solid fuel and wood will need HETAS certification. For engineers regularly working with alternate fuel types, investing in the appropriate filters is a must to ensure the functionality of the FGA, as well as the continued safety of the environment you are working within.

As the filtration is on the probe tubing, and therefore not built into the device itself, it is easy to change to different probes or filter kits for different fuel types whilst still using the same sprint pro device.

For more information about alternative fuel types, FGA's and Crowcon's Sprint Pro 3 micron oil boiler kit get in touch today.

