Combustion Research Unit - CRU

The CRU instrument from Fueltech Solutions is an advanced tool for research on ignition- and combustion properties. The instrument is based on well proven Constant Volume Combustion Chamber (CVCC) technology, and features an electronically controlled, high-pressure fuel injector together with a sophisticated computer system for automated operations and control

CRU is a valuable R&D tool for *Automotive Engine Manufacturers*, *Ship Engine Builders*, *Oil Companies*, *Universities* and *Commercial Research Laboratories* working in the field of engine- and fuels technology.

Fuels Research

The CRU concept is well suited for both qualitative as well as quantitative study of fuel properties:

- Keep physical conditions constant - isolate and study the effects of varying fuel characteristics
- Change process parameters (temperature, pressure, injected volume, injection pressure) and observe how this influences the combustion process

The instrument can be installed in a standard fuels lab with normal ventilation and connection to pressurized air.

CRU Main unit

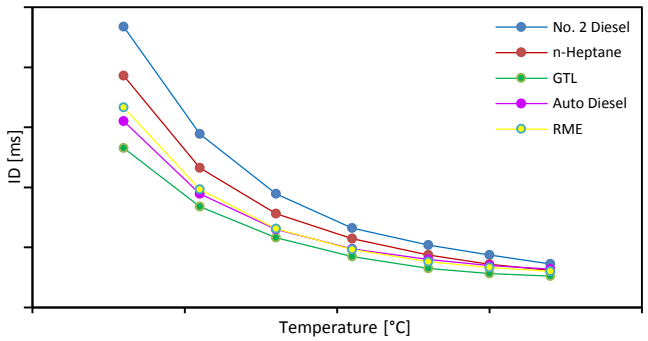
The system can be tailored to the user's needs and requirements, with respect injection system, chamber design and various optional add-on equipment and tools. The possibility of tailoring makes the CRU especially suitable both for evaluation of "difficult" fuel qualities, as well as to gain increased understanding of the basic ignition and combustion mechanisms in "normal" fuels.

Features

The operating principle is to simulate the conditions in a reciprocating engine, however with a simplified approach, where the effects of engine dynamics (e.g. piston movement) are eliminated. This makes it easier to isolate and study the effects of varying fuel properties and fuel compositions.

The technology is based on a Constant Volume Combustion Chamber (CVCC) and a modern common rail fuel injection system.

The CRU is a cost efficient tool for analysing fuel properties and the sensitivity of these properties to varying process conditions.



During the combustion phase, the pressure development is measured and transferred to the computer for further analysis and presentation.

Different types of engines and operating conditions can be simulated by varying the process conditions:

- Chamber pressure and Temperature
- Charge mixture (air + CO_2)
- Injection pressure, duration and timing

Solution

The Fueltech CRU has a modular design, and is built of components and sub-systems that can be adapted to the specific needs for each user and lab.

The instrument is applicable for various fuels and ignition methods:

- Diesel Fuels
- Heavy Fuel Oil
- Gasoline Fuels
- Gaseous Fuels

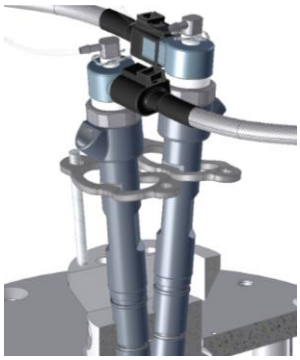
Diesel Fuel Auto Ignition | *Heavy Fuel with Diesel Pilot fuel Ignition* | *Gaseous Fuel Spark Ignition* | *Gasoline Injection Spark Ignition*

Injection system for Diesel Fuels

The injection system is based on industry-standard high-pressure common rail injector. The injection pressure can be varied from 300 bar to 1600 bar.

Twin Injectors

A double set of injectors can be fitted for replication of dual fuel combustion, i.e. where one of the injectors is used for pilot injection. This is especially applicable for examining ignition and combustion characteristics of "exotic" and challenging fuel qualities



Twin injectors
Main fuel & Pilot Injection

Gasoline Injector and Spark Ignition Module
For gasoline fuels the CRU can be configured with a spark plug module and Lambda sensor in the exhaust line. This makes the CRU a useful tool for studying flame propagation speed.

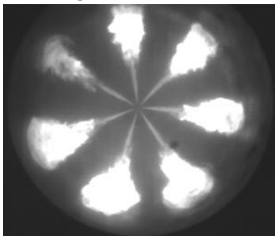
Various injector types

Simulation of Exhaust Gas Recirculation
By blending CO2 or other inert gas into the CRU combustion chamber, the effects of EGR can be simulated easily.

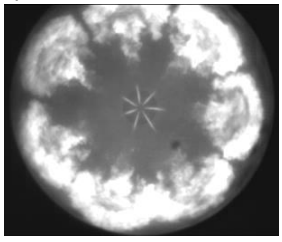
Combustion Chamber
The chamber is heated with multiple individually controlled heater elements with separate temperature sensor for uniform temperature distribution.

The design of the combustion chamber can be optimized according to the type of fuel and injection nozzle to be used (spray angle, longitudinal penetration etc.)

Optional feature – High Speed video camera
Bore-scope and high-speed video camera can be fitted to capture live images and video of the combustion process



Diesel Fuel Combustion



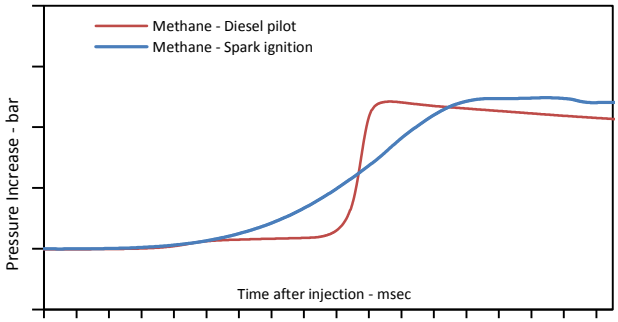
n-Heptane Combustion

Autosampler
The CRU can be equipped with an Autosampler enabling automatic and unmanned processing of up to 10 samples with varying process conditions.

CRU with Autosampler for 10 different samples

Test results and output

The most important output from the CRU system is the pressure trace generated during the combustion phase. From this set of data, a number of important parameters related to ignition and combustion can be derived.



Test results and output can be exported to MS-Excel for further analysis and evaluations.

Process Control and Data Acquisition
The CRU features a sophisticated software control system, and in combination with sensors and actuators this makes the instrument near fully automated. Set point values for process parameters like pressure, temperature, injection pressure, injection period etc. are controlled by the user.

Technical Specifications

The CRU can be installed in a standard fuels lab with access to normal lab utilities.

Chamber temperature:	*400 -590 °C*
Chamber pressure:	*10 - 75 bar initial pressure*
Power consumption:	*< 1800 W*
Instrument footprint:	*< 1 m²*
Required utilities:	*air vent, compressed air, cooling bath*

For further information and complete overview of technical specifications, contact:

Fueltech Solutions AS
Nedre Ila 39. N-7018 Trondheim
Norway
www.fueltechsolutions.com

All specifications and descriptions are subject to change without further notice