



# F5 Cetane Rating System with XCP Technology



# Providing value and confidence in global fuel quality.

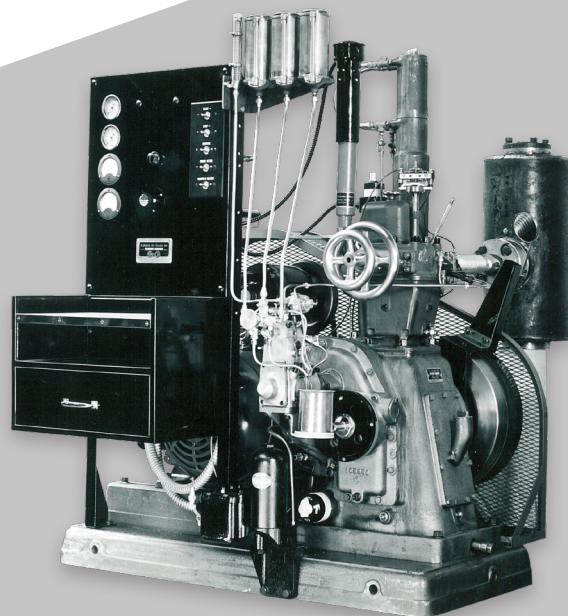
The CFR<sup>®</sup> F5 Cetane Rating Unit is the globally accepted standard for determining and certifying the ignition quality of diesel fuels. First introduced in 1938, the CFR F5 today continues to provide a stable, accurate testing platform for defining the ignition quality of diesel fuels. The CFR F5 enables the automotive and petroleum industries to develop new engines and fuels that perform together more effectively. As the most accurate method to measure the cetane number of diesel fuels, the CFR F5 also helps to ensure the integrity of the fuel supply chain from refinery to the pump.

**The CFR F5 is the specified equipment for testing fuels according to:**

**ASTM D613:** Standard Test Method for Cetane Number of Diesel Fuel Oil

**IP 41:** Petroleum Products - Determination of the ignition quality of diesel fuels - Cetane engine method

**EN ISO 5165:** Petroleum Products - Determination of the ignition quality of diesel fuels - Cetane engine method



# Features & Benefits



## Confidence in a Fully Integrated Fuel Testing System

A complete CFR Engines Inc. cetane fuel testing system includes three main elements, each designed to seamlessly integrate and deliver trusted results. With the F5 engine unit, XCP™ Technology, and a CFR® exhaust surge tank, each critical parameter of a successful cetane test is controlled. Whether working with a complete unit, an upgrade/conversion kit, or a genuine CFR service part, you can trust that the product has been designed, manufactured, and fully tested to work in an integrated solution for your operation. Confidence in the CFR system to do its job, allows users to focus less on making the system work and focus more on what else they need to do.



## Data Integrity with XCP Technology

With the XCP Digital Control Panel, critical information for each rating is automatically captured and presented in a ready-to-use Excel-based report, minimizing manual data recording and calculating errors. XCP's standard report provides handwheel positions, fuel flow rate micrometer settings, environmental data (temperatures and pressures), and ignition advance and delay values. The XCP is also capable of being integrated into a Laboratory Information Management System (LIMS). Clear graphics, color-coded indicators, and built-in prompts simplify the fuel rating.



## Reliability of Proven Design

Since 1929, thousands of users have relied on the proven service of CFR Engines Inc. products. This reliability has been consistently maintained through a long series of well-designed system upgrades and product enhancements. CFR systems and components, such as the robust engine crankcase and cylinder/head, are built to deliver unsurpassed operating life. With basic maintenance and upkeep, a user can expect CFR products to consistently withstand the demands of today's fuel testing environment with a true engine-based Cetane Number.



## Precision through Modern Instrument Control

The CFR F5 with XCP Technology uses digital instrumentation to record and process critical aspects of system operation and performance. On-board handwheel position recording, automatic cetane number calculation, and multi-pass data recording are some of the many advantages of CFR's digital instrument control system. More accurate measurements and reduced operator interpretations lead to better overall precision.



## Cost Savings with One System Flexibility

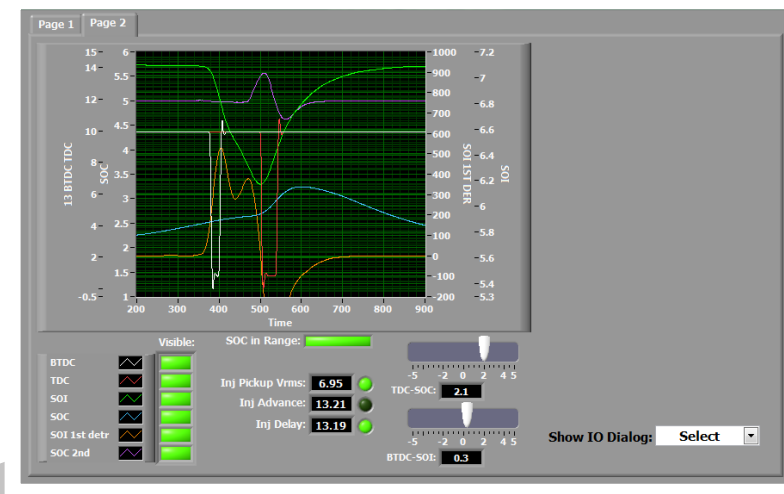
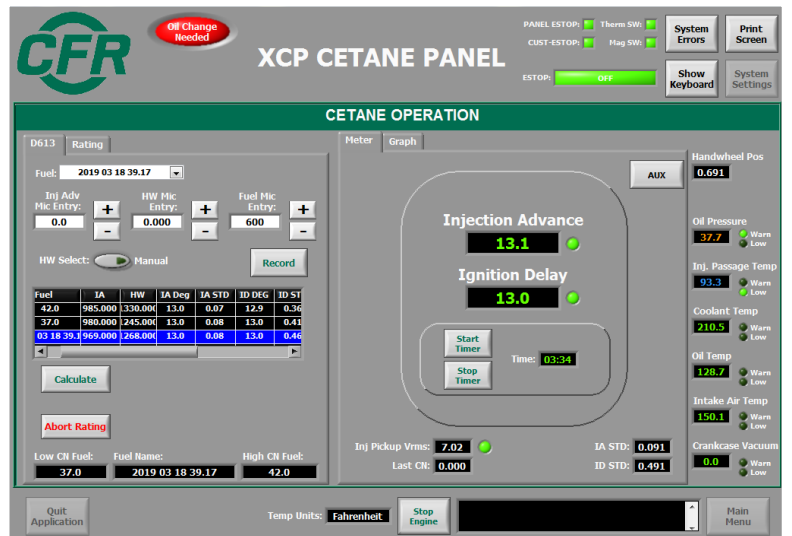
With standard product offerings, a CFR F5 Cetane Rating System provides the user unmatched flexibility and cost savings. With push button control and machine guided testing prompts, Users can easily conduct the test procedure of ASTM Method D613. Cost savings are realized in greater utilization of resources, quicker tests, and reduced operator training.



# XCP Technology for the CFR F5

XCP™ Technology remains the modern instrumentation of choice for cetane testing. CFR continues to apply advances in design, measurement, and control to its XCP Technology platform.

The main operating screen clearly displays the injection advance and the ignition delay, using red/green color codes as well as illuminated buttons to indicate to the user when the injection advance and ignition delay are in or out of spec. In addition, green/ orange/blue color coding is used to indicate when temperatures and pressures are in or out of spec. Standard deviation readings for both injection advance and ignition delay ensure quality ratings.



Auxiliary screens allow the user to set and view basic parameters, calibrate sensors, monitor real-time conditions, and perform diagnostics. The screen depicted here contains a graph that is generated in real time during a test, enabling the user to troubleshoot various problems, such as evaluating whether an injector nozzle needs maintenance, determining whether a sensor or cable is malfunctioning, and ensuring appropriate combustion. The user can choose which sensor signals are displayed.



## XCP D613 Cetane Report 43.63

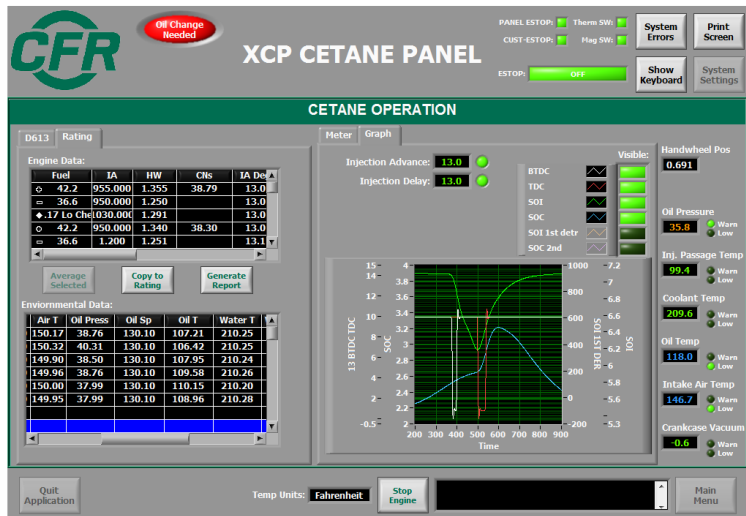
Date: 1/15/2018  
Time: 10:58:01

Sample ID: Test 1407.5 3.536  
Low Reference CN: 42.8 1394 5.657  
High Reference CN: 48.1 1480 0.000

Operator: dave  
Detailed Report Information:

Reference	Fuel	IA	Hw	CNs	IA Deg	IA Std	ID DEG	ID STD	Fuel Mic	Avg Hw	Avg CNs	Time	HW	Vacuum PS	Air Sp	Air T	Oil PS	Oil Setpoint	Oil T	Water T	Water Vapor	NI pass	Sp	NI pass T
High CN	48.1	1071	1480	43.98	13.1	0.08	13	0.41	578	1480	43.63	0.450845	1.49	-0.52	150	150.1	27.7	130.1	130.1	209.62	115.73	0	85.98	
Low CN	42.8	1069	1390	0	13	0.07	13	0.38	578	1394	0	0.447708	1.41	-0.45	150	150.06	28.09	130.1	129.88	209.53	115.62	0	86.01	
Unknown	Test	1068	1410	0	13	0.09	13.1	0.33	578	1407.5	0	0.444282	1.41	-0.48	150	150.19	27.96	130.1	129.54	209.64	115.53	0	85.98	
High CN	48.1	1074	1480	43.25	13	0.08	13.1	0.72	578	0	0	0.456956	1.49	-0.41	150	150.06	28.09	130.1	130.62	209.52	115.78	0	86.27	
Low CN	42.8	1075	1398	0	13	0.07	13	0.46	578	0	0	0.452928	1.4	-0.52	150	150.07	27.58	130.1	130.21	209.58	115.7	0	85.88	
Unknown	Test	1074	1405	0	12.9	0.1	13	0.31	578	0	0	0.454977	1.4	-0.45	150	149.84	28.21	130.1	130.33	209.53	115.76	0	85.98	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

A standard cetane rating report captures the environmental test parameters, timestamps, injection advance degree setting, ignition delay degree setting, injection advance micrometer setting, fuel flow micrometer setting, and handwheel micrometer setting.



### Additional User Conveniences

- Run fuel sequence in any order (not restricted to the sequence of the ASTM Method)
- Run as many passes as you choose without restarting the rating
- Quickly view data from previous pass
- View all data from the current rating
- Calculate CN from two consecutive passes on demand - no need to end the test and generate the report in order to see the CN result



# Trusted Design, Reliable Results

The core design around which the CFR engine is built has been tested and proven through rigorous and continued usage by customers around the world over many decades. Even as vehicle designs have changed and fuel performance has improved, the CFR F5 continues to be the gold standard for determining the cetane number of compression-ignition diesel engine fuels.

## Variable Volume Cylinder Head

At the heart of the CFR® engine lies the variable volume cylinder and head assembly. Varying the combustion chamber volume by adjusting the handwheel makes it possible to compare unknown fuels to reference fuels with known cetane values. Cylinder volume is correlated to ignition advance and delay which can then be directly correlated to a specific cetane value as per ASTM Method specifications.



## Fuel System

The CFR F5 Cetane Rating Unit is equipped with three fuel bowls, fuel selector valve, heavy duty fuel pump, and a robust fuel injector. These components work together to precisely manage fuel delivery and bracketing per the test procedure of ASTM Method D613.



## CFR Crankcase

The CFR crankcase is a heavy-duty cast design that provides both strength and rigidity for the loads produced by various types of fuels, and will provide long service life when operated and maintained properly. Removable side doors allow for easy access to critical internal components for inspection, maintenance, and repair.



## Exhaust Surge Tank System

The F5 is equipped with a surge or expansion tank that eliminates the resonant pulsations and back pressure that occur in the CFR rating unit's exhaust lines during operation. Eliminating these variables in the testing process ensures consistent and accurate cetane ratings.



## XCP Technology

The fully integrated control, data capture, and reporting of XCP™ Technology directly supports the accountability and traceability needs of today's testing environments.



# Specifications

Model: CFR F5 Cetane Rating System

Test methods: ASTM D613, IP 41 , EN ISO 5165

Cetane number range: 15-100

## Standard CFR F5 System Inclusions:

- Engine unit mounted to rigid base
- Synchronous motor mounted to slide base (220/380/440V; 3 Ph; 50/60Hz)
- Variable volume cylinder head with handwheel
- Handwheel position sensor
- XCP panel with touchscreen PC (120V; 1 Ph; 50/60Hz)
- Fuel shut-off solenoid
- Three bowl fuel delivery system
- Intake air heater
- Exhaust surge tank system
- Water cooled exhaust manifold
- Desk with keyboard and mouse

## Dimensions & Weight:

- Approximately 1.77 x 1.33 x 1.04m (H x W x D), 844kg; (69 ¾ x 52 ¼ x 41in, 1860lbs)
- Including concrete base: approximate height 2.15m (84 ¾ in), weight 1754kg (3860lbs)
- With exhaust surge tank: approximate depth 1.57m (62in)

## Operating Conditions:

	Motor Method (ASTM D613)
RPM	900 +/- 1%
Injection timing	13 BTDC
Water jacket temperature	100 C +/- 2 °C (212 °F +/- 3 °F)
Oil temperature	57 °C +/- 8 °C (135 °F +/- 15 °F)
Oil pressure	172 kPa-207 kPa (25 psi-30 psi)
Crankcase vacuum	25mm-150mm H <sub>2</sub> O (1-6 in H <sub>2</sub> O)
Intake air temperature	66 °C +/- .5 °C (150 °F +/- 1 °F)
Nozzle passage temperature	38 °C +/- 2.8 °C (100 °F +/- 5 °F)





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