



F5 Cetane EFI Rating System with XCP[®] TECHNOLOGY

CFR Engines Inc.

Providing Value and Confidence in Global Fuel Quality

CFR® F5 Cetane EFI Rating System with XCP® TECHNOLOGY

Most Accurate Method to Measure the Cetane Number

The CFR F5 Cetane EFI (*Electronic Fuel Injection*) Rating System is the globally recognized standard for determining and certifying the ignition quality of diesel fuels.

First introduced in 1938, the CFR F5 continues to provide a stable, accurate testing platform for defining the ignition quality of diesel fuels.

At CFR, we are continuously applying advanced designs and innovative approaches to give our customers an enhanced product offering.

The CFR F5 Cetane EFI 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 Cetane EFI also helps to ensure the integrity of the fuel supply chain from refinery to the pump.

The CFR F5 Cetane EFI is capable of testing Middle Distillate fuel types: Diesel Fuel, Biodiesel, FAME, Renewables, HVO, GTL, and Kerosene. Additional testing capabilities include Jet Fuel, Green Jet Fuel, SAF, and SATF for research purposes.

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



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

Cetane Number	r (CN) Repeatability	R (CN) Reproducibility
30	0.81	2.51
40	0.90	2.80
50	0.98	3.05
60	1.05	3.28
70	1.12	3.47
80	1.17	3.66



Features & Benefits

Providing value and confidence in global fuel quality

Whether working with a complete unit, an upgrade/conversion kit, or a CFR genuine part; the product has been designed, manufactured, and fully tested by the CFR team to work as an integrated solution for your operation.



Reliability of Proven Design

The F5 Cetane EFI brings improved fuel atomization and air / fuel mixing, a cleaner combustion chamber, and longer maintenance intervals. The EFI system is more tolerant of biodiesels and high Cetane Number (CN) alternative diesel fuels.

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.



Cost Savings with One System Flexibility

With standard product offerings, a CFR F5 Cetane EFI Rating System provides the user unmatched flexibility and cost savings. With computer touch screen control and guided testing prompts, users can easily conduct the test procedure in ASTM Methods D613. Cost savings are realized in greater utilization of resources, quicker tests, and reduced reliance on operator expertise.



Precision

Tightly controlled start of injection and injection duration is provided by the F5 Cetane EFI, resulting in stable and consistent combustion. High pressure atomized fuel spray results in improved air fuel mixing compared to the existing F5. Together these enhancements result in improved D613 precision.

	Mechanical Injection	EFI
Start of Injection (SOI)	Fuel dependent, manually adjusted, varies with fuel	Constant
Injection Duration	Fuel dependent, manually adjusted, varies with fuel	Constant
Injection Quantity	Fuel dependent, manually adjusted, varies with fuel	Constant
Start of Combustion (SOC)	Very inconsistent due to injection timing and duration	Very stable due to consistent injection
Injector Spray Quality	Wet spray = soot and constantly degrading spray	Atomized spray places focus on chemical aspects of ignition delay
Engine Position Tracking	Two fixed proximity sensors = approximation only	Optical encoder, very precise tracking of SOI and SOC
SOI & SOC Tolerance	+/- 0.2 Crank Angle Degrees	+/- 0.1 Crank Angle Degrees



XCP[®] TECHNOLOGY for the CFR F5 Cetane EFI

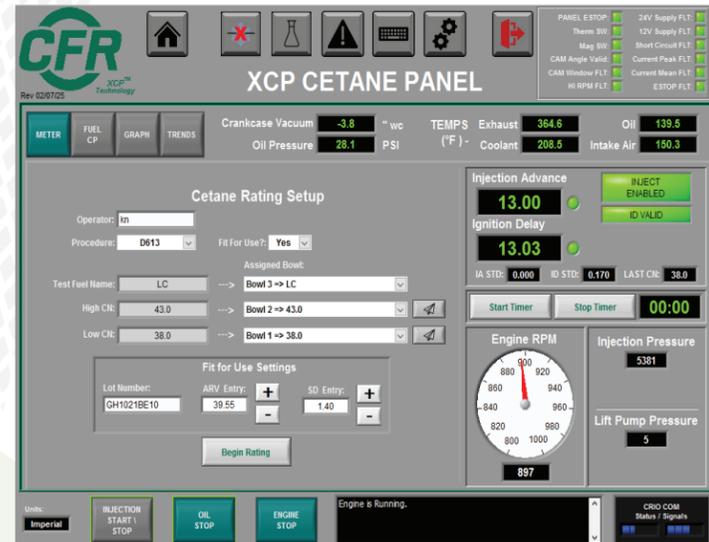
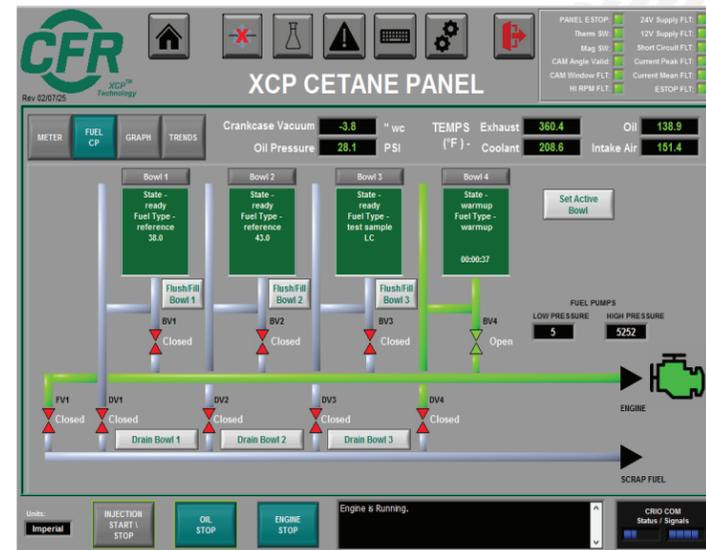
XCP TECHNOLOGY remains the modern instrumentation of choice for cetane testing. CFR continues to apply advances in design, measurement, and control to its XCP TECHNOLOGY platform.

Safety Monitoring of Critical Systems:

- Three Phase Power
- EFI System Sync to Engine
- Fuel Injector Driver Fault
- Injector and / or Injector Wiring Fault
- Fuel Pressure (Low & High Pressure Systems)
- Oil Pressure
- Crankcase Vacuum
- Coolant Temperature

Fuel Control Panel:

- Assign Fuel Type to each Bowl
- Flush / Fill Sequence via Prompts
- Graphical Indication of Active Bowl & Valve Status
- Proceed to Rating when a Sample Fuel & Two Reference Fuel Bowls are in "Ready" State



Cetane Rating Setup:

- Assign Fuel Bowls for Test Fuel & Reference Fuels
- Fit for Use Evaluation Utilizes Check Fuel ARV & Standard Deviation to Determine Allowable Limits Begin Rating

Handwheel:

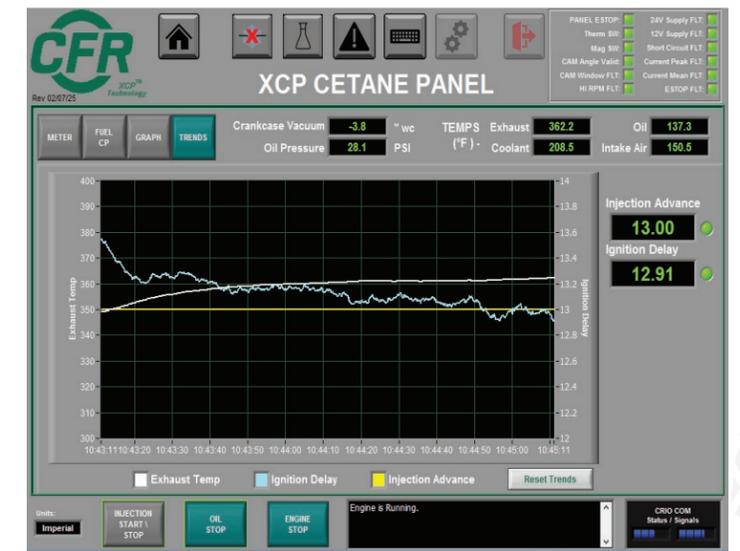
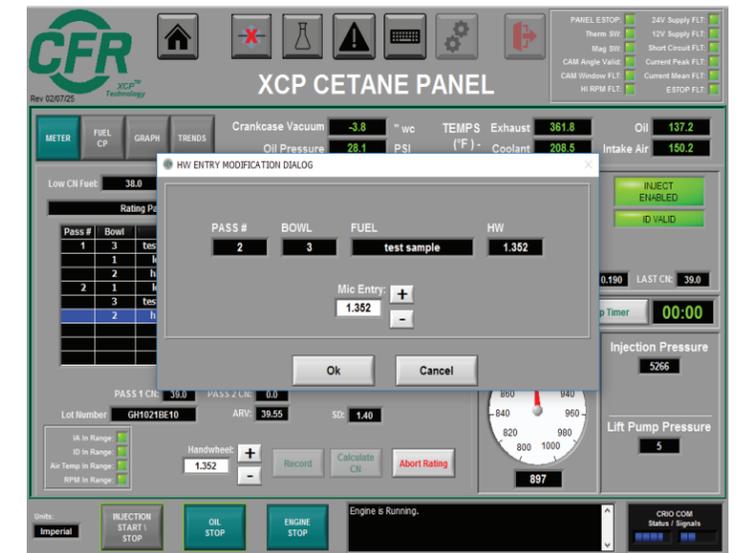
- Entry can be Modified within the Current Pass
- Entry is Locked After Clicking "Calculate CN" Button

CETANE REPORT

Date	Time	Method	Operator	CN 39.2	Sample ID	LC	Avg Handwheel
2025-02-18	10:29:52	D613	KN	CN 39.2	LC	YES	1.349

Pass	CN Result	Pass to Pass Difference (shall be <1.4 CN)	Avg Inlet Air Temp (deg F)	Avg Engine RPM
Pass 1	39.0		150.8	896.7
Pass 2	39.3	Pass 1-2: 0.245		
Pass 3	0.0	Pass 2-3: n/a		

Fit For Use Status	passed	Lot Number	GH1021BE10	ARV	39.55	SD	1.40
Pass 1							
Fuel ID	Handwheel	Engine RPM	Injection Adv (deg)	Injection Adv Std Dev (deg)	Ignition Delay (deg)	Ignition Delay Std Dev (deg)	Pass 1 CN
LC	1.345	897	13.00	0.00	13.04	0.17	39.0
38.0	1.325	897	13.00	0.00	12.98	0.18	
43.0	1.421	897	13.00	0.00	13.01	0.24	
Pass 2							
Fuel ID	Handwheel	Engine RPM	Injection Adv (deg)	Injection Adv Std Dev (deg)	Ignition Delay (deg)	Ignition Delay Std Dev (deg)	Pass 2 CN
LC	1.326	897	13.00	0.00	13.05	0.21	39.3
LC	1.352	897	13.00	0.00	12.96	0.22	
43.0	1.427	897	13.00	0.00	13.00	0.24	
Pass 3							
Fuel ID	Handwheel	Engine RPM	Injection Adv (deg)	Injection Adv Std Dev (deg)	Ignition Delay (deg)	Ignition Delay Std Dev (deg)	Pass 3 CN
LC	28.0	137.5	206.5	121.2	150.7	-3.8	
38.0	28.0	138.4	206.5	121.0	151.0	-3.8	
43.0	28.1	137.9	206.4	121.4	150.3	-3.8	



Continuous Trend Graphs:

- Verify Steady State Conditions
- Injection Advance
- Ignition Delay
- Exhaust Temperature



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 Cetane EFI continues to be the gold standard for determining the cetane number of compression-ignition diesel engine fuels.



High-Pressure EFI System

The system features a modern solenoid-style automotive fuel injector with a modified nozzle, paired with an electrically driven injection pump that maintains a constant flow of 11 mL/min at a maximum pressure of 500 bar. This high-pressure fuel injection system eliminates sensitivity to fuel physical properties, ensuring consistent performance across various fuel types. Additionally, the injector and handwheel benefit from significantly extended maintenance intervals due to cleaner combustion, reducing downtime and improving overall efficiency.

Variable Compression Cylinder Head

At the heart of the CFR engine lies the variable volume cylinder and head assembly. Varying the compression chamber volume by adjusting the handwheel makes it possible to compare unknown fuels to reference fuels with known cetane values.



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. Removeable 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

Fully integrated control, data capture, and reporting via XCP TECHNOLOGY directly supports the accountability and traceability needs of today's testing environments.



Configurations and Specifications

Available as a CFR Kit or with New Units:

- p/n G-802-70: Cetane EFI Upgrade Kit, Legacy
- p/n G-802-71: Cetane EFI Upgrade Kit, XCP*
*Requires latest cRIO and Windows Versions

Standard CFR F5 System Inclusions:

- Engine unit mounted to rigid base
- Synchronous motor mounted to slide base (220/380/440 V; 3 Ph; 50/60 Hz)
- Variable compression ratio cylinder head with handwheel
- XCP panel with touchscreen PC (120V, 1 Ph, 50/60 Hz)
- Intake air heater
- Exhaust surge tank system
- Solenoid style electronic fuel injector
- High-pressure injection pump (electrically driven)
- Fuel control panel

Dimensions & Weight:

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



Operation Conditions	
	Cetane Method (ASTM D613)
RPM	900 +/- 1%
Injection Timing	13 BTDC
Water Jacket Temperature	100 °C +/- 5 °C (212 °F +/- 3 °F)
Oil Temperature	57 °C +/- 8 °C (135 +/- 15 °F)
Oil Pressure	172 kPa-207 kPa (25 psi-30 psi)
Crankcase Vacuum	25-150 mm H ₂ O (1-6 in H ₂ O)
Intake Air Temperature	66 °C +/- 0.5 °C (150 °F +/- 1 °F)





Scan to learn
more about the
F5 Cetane EFI
Rating System



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Form C520, Revision C