Waukesha® CFR® Combination Research & Motor Method Octane Rating Unit

* Trademark of General Electric Company
More than 80 years ago, GE’s Waukesha gas engines pioneered a system for fuel rating that today remains the standard for defining the anti-knock qualities of motor fuel gasoline, fuel constituents and alternative fuels. By providing a stable test platform for accurately defining fuel anti-knock quality, the Waukesha CFR Octane Rating Unit has given the automotive and petroleum industries the ability to tailor their respective products to perform together more effectively. Accurate anti-knock fuel quality testing has led to development of better fuels and better automotive technology solution. In the years since it was first introduced, the CFR Octane Rating Unit has been updated regularly with features that enhance test documentation, productivity and throughput while continuing to deliver reliable and accurate fuel ratings.

The Waukesha CFR F1/F2 Combination Octane Rating Unit is supported by ASTM test methods D2699 (Research), D2700 (Motor), IP237 and IP236 and is globally accepted as the standard for the determining and certifying the anti-knock characteristics of motor fuels. The standard F1/F2 Combination Unit may be configured to perform both Research Method (RON) and Motor Method (MON) tests with minor equipment modifications. With either method, testing capabilities cover the 40 -120 octane number range.

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The CFR Octane Rating Unit with XCP Digital Control Panel

Designed for Today’s Fuel Testing Facilities

The latest generation of Waukesha CFR octane rating units combines the easy-to-use features of a digital control panel with the robust engine design that users expect from GE’s Waukesha gas engines. The CFR F1/F2 Combination Octane Rating Unit with XCP Digital Control Panel is widely accepted in today’s fuel testing laboratories. It is in ASTM Methods D2699-10 (RON) and D2700-10 (MON), and conforms to IP237 and IP236.

The XCP Panel

The fuel rating process takes a big step forward with the XCP™ Digital Octane Panel’s automated functions and enhanced documentation capabilities. The XCP Digital Octane Panel is intuitive and user-friendly, and operators require less training to achieve proficiency. The CFR F1/F2 Combination Octane Rating unit with XCP Panel delivers consistent and reliable test results, accurate data recording, comprehensive report generation, and improved productivity for operators at all skill levels.

The XCP Panel Features & Benefits

- Easy-to-use touch-screen panel interface
- Built-in prompts guide the operator through the test procedures for all of the ASTM methods. User-friendly software and interface produce consistent and reliable test results from operator-to-operator
- Critical information for each rating is captured and displayed on screen with bold graphics and easy-to-read charts
- Automated calculations and data logging for ease of use and greater accuracy
- A digital knock meter displays actual knock intensity value, eliminating the need of visual interpretation of an analog meter by the operator
- Non-contact laser sensor accurately measures cylinder height and displays results on-screen, providing more accurate test results
- Electronic on-board barometer automatically corrects cylinder height for barometric pressure.
- Environmentally friendly RTDs for improved accuracy and management of critical temperature variables
- Electronic maintenance log
- On-screen reports, operations and maintenance manuals
Model F1/F2 Combination Octane Rating Unit Standard Equipment

Model F1/F2 Combination Octane Rating Unit for performing ASTM test methods D2699 “Research Method” (RON) and D2700 “Motor Method” (MON)

- XCP Digital Octane Panel/touch screen PC
- CF4R crankcase
- Electronic barometer
- Either 50 or 60 HZ three-phase reluctance-type synchronous motor
- 120 Volt 60 HZ single phase heater and instrumentation
- Four-bowl “falling level” carburetor with one bowl and carburetor body water cooled
- CFR installation, operations and maintenance, and parts manuals
- Non-cooled exhaust manifold
- Exhaust surge tank
- Laser cylinder height sensor
- Compression ratio change motor and switch for power compression ratio changer
- Ice tower assembly or intake air refrigeration unit (50 or 60 HZ)
- Desk
- Digital ignition timing indicator / tachometer

The Digital Octane Analyzer Option

The Digital Octane Analyzer option integrates with the XCP panel for an automated fuel rating process that significantly reduces operator involvement and provides more consistent rating results. Using a bracketing procedure, the Digital Octane Analyzer automatically sequences through the fuel sample and two primaries to determine octane numbers per ASTM methods. This process allows rapid selection and measurement of the fuel/air ratio for maximum knock value and significantly reduces the time required to complete octane number determinations. The Octane Analyzer can run fuel samples in a bracketing mode in approximately 20 minutes for a full octane number determination.
Key Design Features

Variable Compression Ratio Cylinder and Sleeve Assembly
At the heart of the CFR system is the variable compression cylinder and sleeve assembly by which the knock characteristics of unknown fuels can be determined. Varying the compression ratio by manipulating the cylinder height during engine operation produces various levels of knock intensity, making it possible to compare unknown fuels to reference fuels with known octane values. Cylinder height is correlated to a compression ratio which then can be directly correlated to a specific octane value through ASTM method specifications. A laser height sensor mounted on the cylinder / sleeve exterior assists the operator in determining the cylinder position as it is raised or lowered. The available compression range is 4:1 to 18:1 which allows for testing a wide range of fuels.

Four Bowl Falling Level Carburetor
The CFR Octane Rating Unit is equipped with a four-bowl variable-level carburetor that includes a falling level mode. Key operating features include finer and more sensitive fuel flow adjustments that result in more accurate fuel ratings. The XCP control panel’s falling level program delivers an efficient and accurate falling level test in which the operator can determine maximum knock intensity without manual adjustment of the carburetor bowl. With the falling level program, a single operator can run very accurate tests with multiple carburetors without the need to manipulate each bowl’s levels to determine maximum knock. The CFR’s falling level carburetor gives the operator the flexibility to utilize any of the four test procedures in ASTM Methods D2699 and D2700.

CFR Crankcase
The CFR crankcase is a heavy-duty cast box-type design that provides both strength and rigidity for the loads produced by various types of fuels. Heavy-duty 3-inch main crankshaft journals and bearings and stout crankcase construction are designed for long service (50,000-70,000 hours or 10 years) 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 CFR octane rating unit 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 provides consistent and accurate octane ratings.

Intake Air Humidity Equipment

A humidity control system – either an ice tower and related equipment, or an intake air refrigeration unit – manages the moisture content of the combustion air going into the CFR octane rating unit. Maintaining humidity levels at a constant 25-50 grains of moisture /lb. of dry air, is prescribed by the ASTM method for producing consistent octane ratings.

Genuine GE Waukesha Parts and Service to Support your Investment

Your purchase of a CFR Octane Unit is a major long-term investment. GE’s Waukesha gas engines and its distributor network offer genuine Waukesha CFR parts and factory-trained service technicians to help you maximize your unit’s life and maintain its rating integrity in conformance with ASTM specifications. Your unit and genuine Waukesha repair parts are backed by a one-year guarantee to be free from manufacturing defects. For more information, on genuine Waukesha parts and service, consult your local CFR distributor.

CFR Octane Rating Operating Conditions

<table>
<thead>
<tr>
<th>Motor Method (D2700)</th>
<th>Research Method (D2699)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM: 900 RPM +/- 1%</td>
<td>RPM: 600 +/- 1%</td>
</tr>
<tr>
<td>Timing: Variable Based on Cylinder Height</td>
<td>Timing: 13˚ BTDC</td>
</tr>
<tr>
<td>Water Jacket Temp: 212˚F +/-3</td>
<td>Water Jacket Temp: 212˚F/-3</td>
</tr>
<tr>
<td>Oil Temp: 135˚F</td>
<td>Oil Temp: 135˚F</td>
</tr>
<tr>
<td>Oil Pressure:25-30 PSI</td>
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</tr>
<tr>
<td>Vacuum: 1-6” H2O</td>
<td>Vacuum: 1-6” H2O</td>
</tr>
<tr>
<td>Intake Temp: 100˚F +/-5˚F</td>
<td>Intake Temp: 100˚F +/-5˚F</td>
</tr>
<tr>
<td>Mixture Temp: 300˚F +25˚F / -15˚F</td>
<td>—</td>
</tr>
<tr>
<td>Intake Humidity: 25-50 grains H2O/lb. dry air</td>
<td>Intake Humidity: 25-50 grains H2O/lb. dry air</td>
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Synchronous Motors with Slide Base are available in the following configurations:

- 220 volt, 50 hz, 3 phase power
- 380 volt, 50 hz, 3 phase power
- 280 volt, 60hz, 3 phase power