Diesel Fuel

"One of the top - 100 best inventions of 2001"

R&D Magazine Annual Awards

Ignition Quality Tester (IQT™)

Research and refinery laboratory ignition quality measurement

- Direct measurement alternative to the cetane engine, as per ASTM D 6890, IP 498 and EN15195 specification test methods; ASTM D975 (diesel), ASTM D6751 (biodiesel) and EN 590 (diesel) approved
- Accurately determines the ignition quality of diesel and alternative diesel fuels
- Sensitive to cetane improver additives; sensitive to small fuel quality variations
- Improved repeatability and reproducibility over the full DCN scale
- Automated test procedure and quiet operation
- Short test time (less than 20 minutes)
- Small sample size (less than 100 mL)
- High level of reliability, rugged system, low operating and maintenance costs
- Rapid response service

The automated Ignition Quality Tester (IQT™), with patented air assisted fuel injection system, is a combustion-based analytical instrument, which enables the determination of the ignition quality of diesel fuels in a rapid, quiet and cost-effective manner. The ignition delay and derived cetane number of diesel and alternative fuels (including cetane improved diesel fuels) can be efficiently and accurately measured, in a matter of minutes. Based on the Southwest Research Institute (SwRI) constant volume combustion apparatus (CVCA) technology, the IQT™ also has the potential for use in refinery on-line operations. The IQT™ is CE and Canadian Standards Association (CSA) approved (CSA Special Acceptance Program, electrical equipment).

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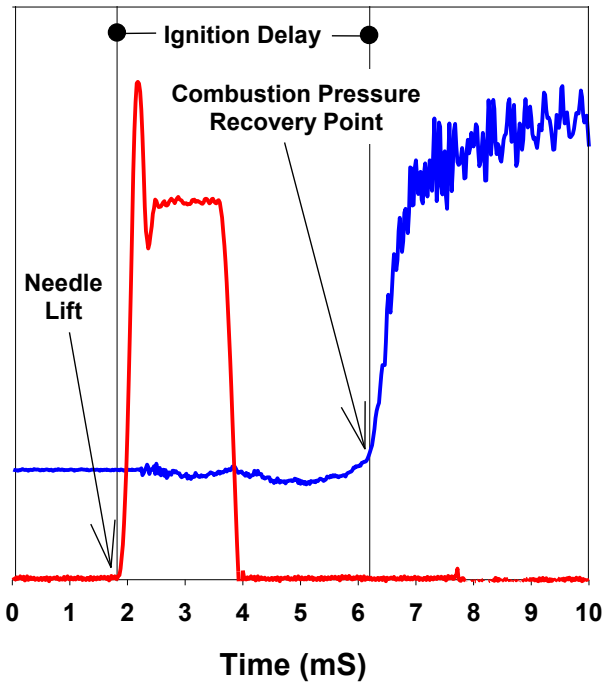
Correlation Development

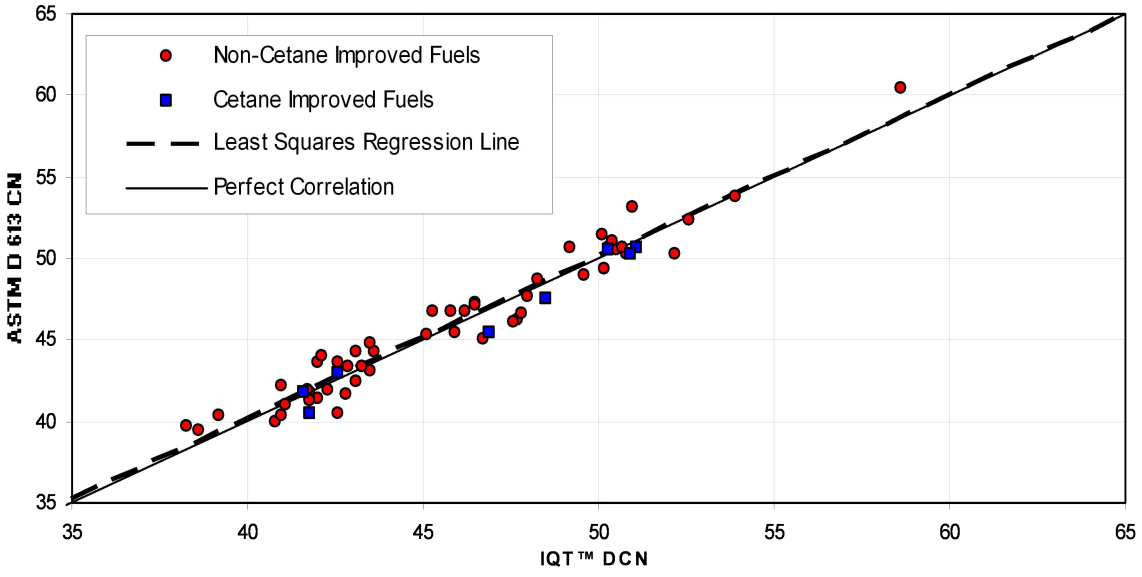


Test results have demonstrated that the IQT™ combustion pressure recovery ignition delay is highly correlated to the ASTM D 613 cetane number (CN). The Test Method can accurately measure the ignition delay of a wide range of middle distillate fuels over the entire cetane number scale including conventional diesel fuels, oil sands-based, biodiesel, refinery streams, specialty fuels, as well as fuels with nitrate-based and oxygenate-based cetane improver additives.

Based on a model developed from well characterized ASTM D 613 fuels (see reference 1), the IQT™ results are displayed in real time in ignition delay and derived cetane number (DCN) formats. The test sequence is completely automated and is performed in under 20 minutes (including sample and system preparation). Test results and statistical analysis are printed at the end of each test, permitting the operator to quickly evaluate test validity.

Validation

Initial validation of the IQT™ model was conducted using 63 samples (10 of which were cetane-improved) which have been part of the ASTM National Exchange Group (NEG) interlaboratory test program. Results indicate good agreement between the IQT™ DCN and the D 613 CN. The relationship between the IQT™ DCN and the D 613 CN is highly linear and very close to parity, with an R^2 of 0.96 and a slope of 0.99.



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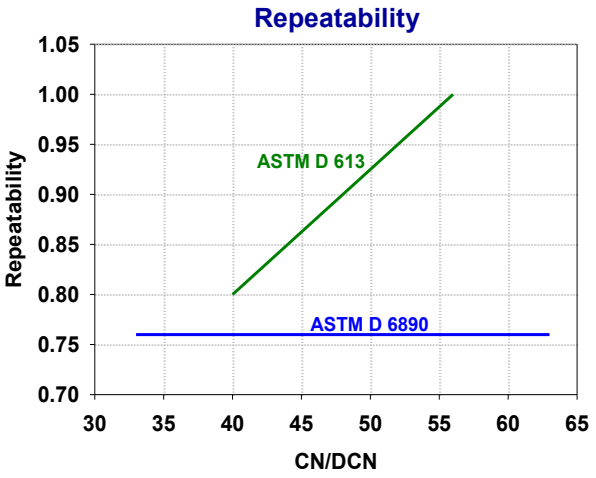
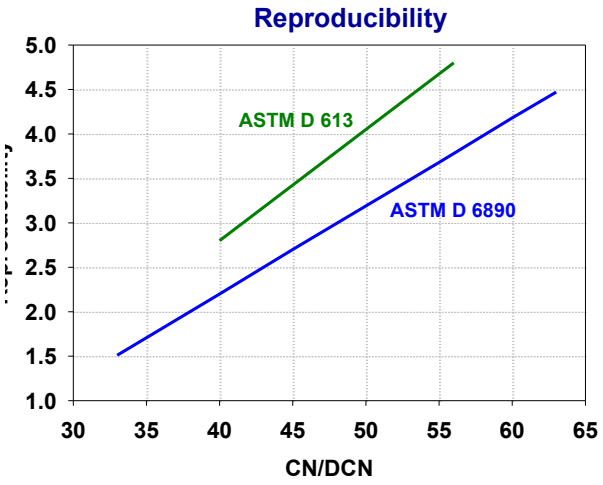
Test Method Precision

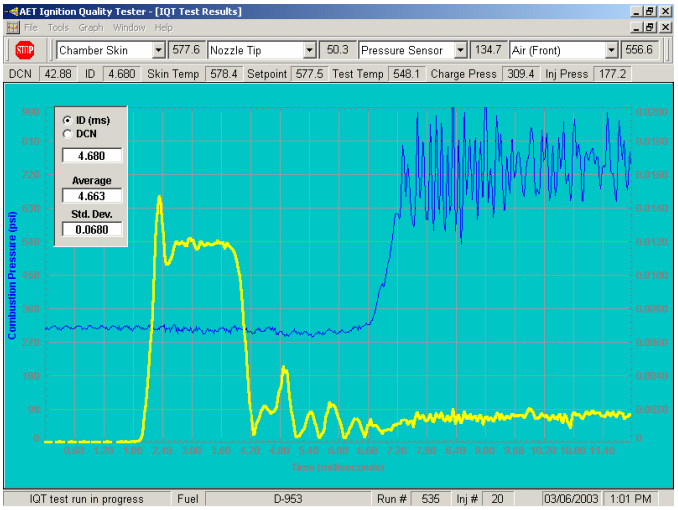
A joint ASTM/IP interlaboratory test program, which included the participation of 10 laboratories, was conducted in 2002 to determine the precision of the IQT™. Comparison between the IQT™ (ASTM D 6890) precision data and the ASTM D 613 precision data are provided in the following graphs.





Software

The Windows 2000®-based interface permits manual as well as automated operation through keyboard or mouse input. For specific research objectives, test conditions can be varied to simulate actual engine operation - from cold-starting to high speed conditions. Combined with its low fuel volumetric requirement (absolute minimum of 15 mL), the IQT™ is a capable, fully automated tool for use in laboratory, refinery and pilot plant applications, where candidate fuels can only be produced in small quantities.



Acknowledgements

AET wishes to acknowledge the valuable contributions made by the following organizations for IQT™ R&D: (i) the Southwest Research Institute, (ii) Natural Resources Canada, and (iii) the petroleum and additive industries.

References

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Technology Development
Award 2000

Ignition Quality Tester (IQT™)

Base Unit Dimensions:	**56 cm (22 in) H X 74 cm (29 in) W X 36 cm (14 in) D.**
Base Unit Weight:	**Approx. 68 kg (150 lbs)**
Power requirement:	**120/220 VAC, 60 Hz or 220 VAC, 50 Hz Protected by an Uninterruptible Power Supply (UPS)**
Air Supply:	**Compressed air, 20.9 % O_2 ±1.0 % Regulated minimum: 21.7 bar (310 psi) - Combustion process 12.1 bar (175 psi) - Injection process**
Nitrogen Supply:	**Compressed nitrogen, industrial grade Regulated minimum: 3.5 bar (50 psi) - Fuel feed process**
Cooling System:	**Closed-loop liquid to air cooling system**
Fuel Injection System: (Patented)	**Pintle-type, single hole nozzle with air-driven fuel injection pump**
Computer and Instrument Control:	**Pentium-based (or equivalent) system**

The IQT™ is based on the SwRI CVCA technology. As the SwRI worldwide licensee, Advanced Engine Technology Ltd. has undertaken further development and commercialization of this technology for research and refinery laboratories, as well as refinery on-line applications.

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