

Diesel Fuel

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Ignition Quality Tester (IQT™)

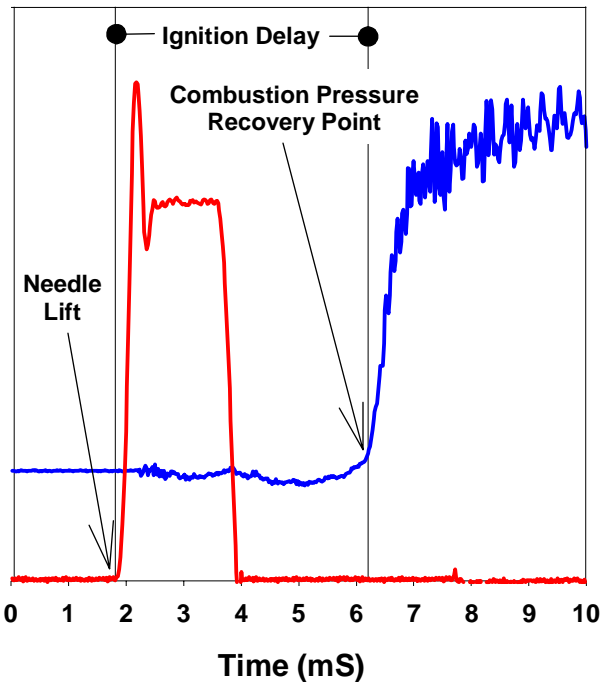
Research and refinery laboratory ignition quality measurement

- Direct measurement alternative to the cetane engine, as per ASTM D 6890 and IP 498 standard test methods
- 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



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).

Correlation Development

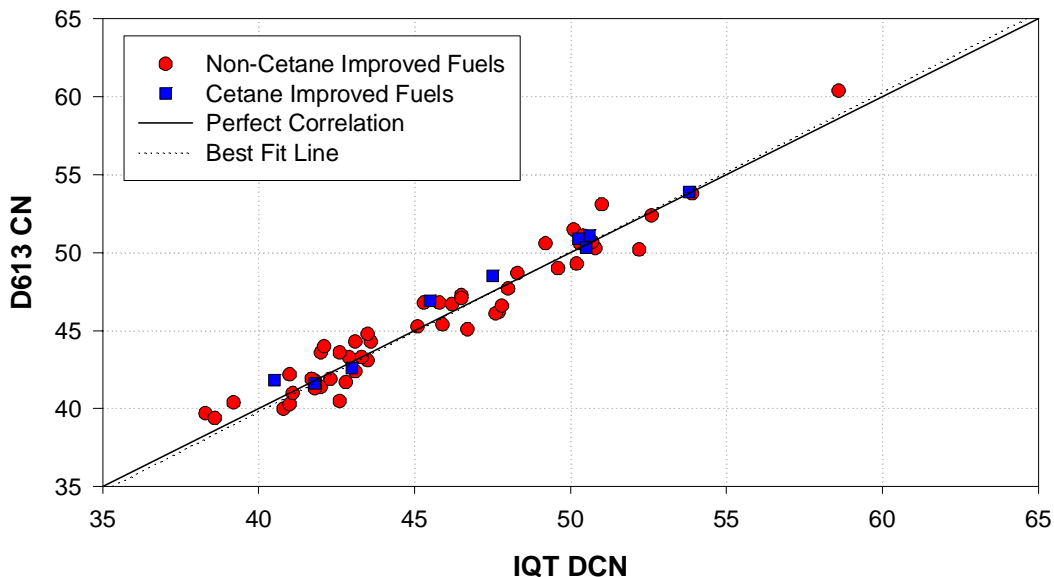


Test results have demonstrated that the IQT™ combustion pressure recovery ignition delay is highly correlated to the ASTM D 613 cetane number (CN). The Test Method can accurately measure the ignition delay of a wide range of middle distillate fuels over the entire cetane number scale including conventional 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.

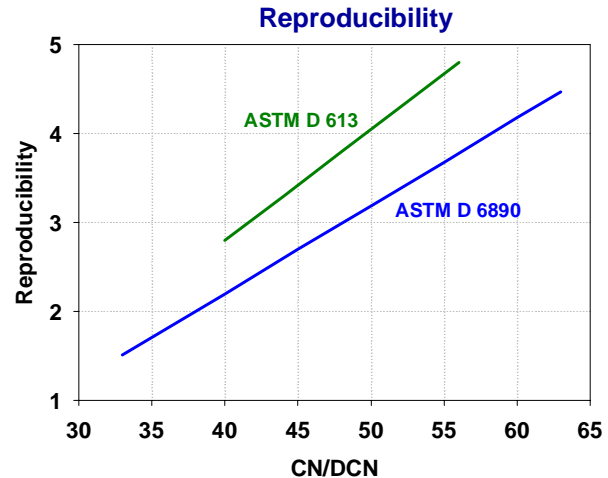
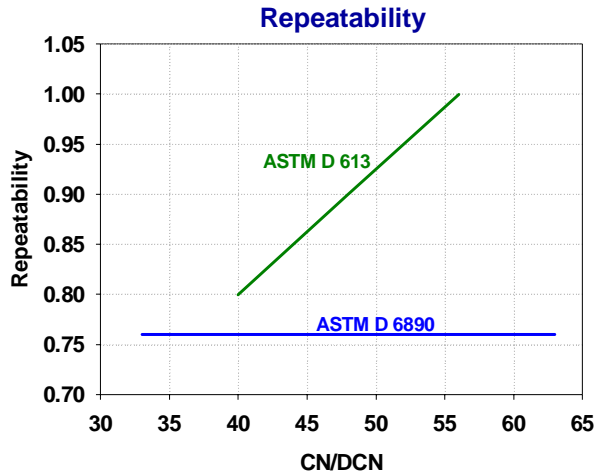
Validation

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.



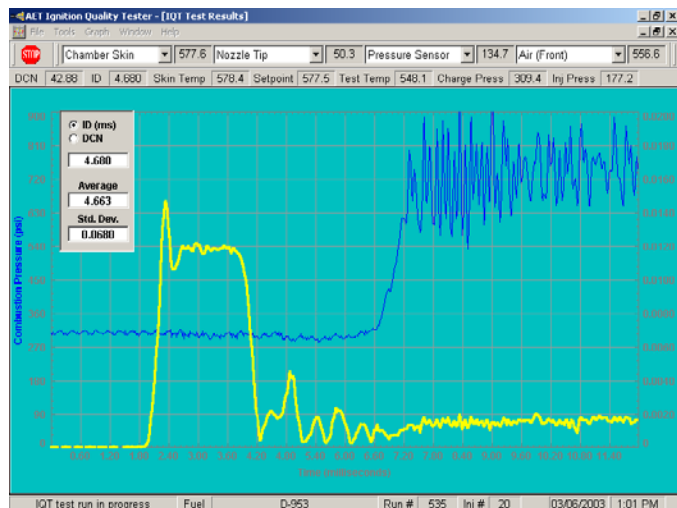
Test Method Precision

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

1. ASTM Research Report D02-1531, Diesel Fuel Ignition Quality Tester (IQT™) - Development of the IQT™ model to calculate the Derived Cetane Number (DCN)
2. ASTM Research Report D02-1532, Ignition Quality Tester (IQT™) - Collection of Recent Data
3. ASTM Research Report D02-1533, Ignition Quality Tester (IQT™) - Summer 2001 Interlaboratory Study
4. ASTM Research Report D02-1534, Diesel Fuel Ignition Quality Tester (IQT™) - Spring 2000 Round Robin
5. Diesel Fuel Ignition Quality as Determined in the Ignition Quality Tester (IQT™) - Part IV, SAE Paper No. 2001-01-3527
6. Analysis of the Ignition Behaviour of the ASTM D-613 Primary Reference Fuels and Full Boiling Range Diesel Fuels in the Ignition Quality Tester (IQT™) - Part III, SAE Paper No. 1999-01-3591.
7. Diesel Fuel Ignition Quality as Determined in the Ignition Quality Tester (IQT™) - Part II, SAE Paper No. 971636.
8. Diesel Fuel Ignition Quality as Determined in the Ignition Quality Tester (IQT™) - Part I, SAE Paper No. 961182.

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.