

Gross Calorific Value in Coal

LECO Corporation; Saint Joseph, Michigan USA

Instrument: AC600

Introduction

The gross calorific value of coal, a solid fossil hydrocarbon fuel material, is most often used when calculating the total calorific value for a quantity of coal for fuel value purposes, or when determining the classification rank of the coal material. The gross calorific value and sulfur value of the coal material can also be used to calculate whether or not the coal material meets regulatory requirements for industrial fuel use.

Sample Preparation

A representative, uniform sample is required (-60 Mesh).

Standard Method

ASTM D5865.

Accessories

774-204 Nickel Crucibles, 776-978 Glass Scoop, 502-461 Cotton Thread Fuse, Tweezers

Calibration Sample

LECO 774-208 Benzoic Acid Pellets, or Benzoic acid pellets made from NIST 39j.

Method Parameters

| | |
|---------------|------------|
| Method | TruSpeed® |
| Standard Mode | ASTM D5865 |

Thermochemical Corrections

| | |
|----------------------|------------------|
| Titrant Energy Value | 0.0039683 BTU/ml |
| Sulfur Correction | 23.861 BTU/lb |
| Calculation Mode | TruSpeed |
| Analysis Time | 5.0 Minutes |
| Equilibrate Time | 1.5 Minutes |
| Main Time | 2.8 Minutes |
| Stir Speed | 13.0 |

System Parameters – Database

| | |
|----------------------------|--------------------|
| Fuse Type | Cotton |
| Fuse Length | 10 cm |
| Fuse Combustion Heat | 0.006255562 BTU/cm |
| Significant Digits | 5 |
| Result Units | BTU/lb |
| Sleep Timeout | 300 minutes |
| Water Temperature | 25°C |
| Auto Increment Sample Name | Disable |
| Alarm | Yes |



Procedure

1. Prepare the instrument as outlined in the operator's instruction manual.
2. Choose TruSpeed Method for analysis.
3. Condition the system by analyzing LECO 774-208 Benzoic Acid Pellet.
4. Calibration
 - a. Weigh ~1.0 g Benzoic Acid Pellet into a 774-204 Crucible.
 - b. Enter mass and sample identification into the AC600 software.
 - c. Place the crucible containing the sample onto the crucible holder of the combustion vessel.
 - d. Tie a single cotton thread fuse to the electrode wire and place one end of the fuse under the sample.
 - e. Carefully close the combustion vessel and secure the closure ring.
 - f. Pressurize the vessel with oxygen.
 - g. Submerge the vessel in a container of distilled water to check for leaks.
 - h. Place the combustion vessel on the electrode connectors of the loading mechanism.
 - i. Press the green analyze button to initiate analysis.
 - j. When the analysis has completed, the loading mechanism will raise. Remove the vessel and depressurize.
 - k. After the vessel has depressurized, rinse the inside of the combustion vessel with distilled water and pour the washings into a clean beaker.
 - l. Add 1-2 drops of indicator.
 - m. Titrate with sodium carbonate until the endpoint is reached.
 - n. Enter the titrated amount in milliliters into the nitrogen correction column of the AC600 software.
 - o. Repeat steps 4a through 4n a minimum of five times and calibrate the instrument.

Note: For the recommended reagents and indicators, see the current version of ASTM D5865.

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Organic Application Note

5. Analyze Samples
 - a. Weigh ~0.80 g of a coal sample.
 - b. Enter mass and sample identification into the AC600 software.
 - c. Place the crucible containing the sample on to the crucible holder of the combustion vessel.
 - d. Tie a single cotton thread fuse to the electrode wire and place one end of the fuse on top of the sample.
 - e. Follow steps 4e through 4n for the sample analysis
 - f. Repeat steps 5a through 5e for all coal samples.
- Note: Coal samples must be corrected for sulfur and moisture content. Enter the as received sulfur value and the as determined moisture value into the respective columns in the AC600 software. The sulfur units for the correction can be found in the method screen.*

Typical Results

| Sample | Mass (g) | BTU/lb |
|--------------|----------------|--------------|
| Coal A | 0.8004 | 14048 |
| Low Volatile | 0.8017 | 14064 |
| Bituminous | 0.8031 | 14054 |
| | 0.8063 | 14056 |
| | 0.8003 | 14043 |
| | $\bar{\chi} =$ | 14053 |
| | s = | 8 |

| | | |
|-----------------|----------------|--------------|
| Coal C | 0.8012 | 12983 |
| High Volatile C | 0.8032 | 12969 |
| Bituminous | 0.8038 | 12976 |
| | 0.8040 | 12974 |
| | 0.8071 | 12974 |
| | $\bar{\chi} =$ | 12975 |
| | s = | 5 |

| | | |
|-----------------|----------------|--------------|
| Coal B | 0.8046 | 13769 |
| High Volatile A | 0.8091 | 13774 |
| Bituminous | 0.8047 | 13766 |
| | 0.8004 | 13754 |
| | 0.8007 | 13768 |
| | $\bar{\chi} =$ | 13766 |
| | s = | 7 |

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