

ASTM D240-02

Warning

Please note that certain fuels will spontaneously combust at room temperature and with increased pressure. When pressurizing a vessel, check that the sample did not combust, by feeling the temperature of the vessel after filling.

Introduction

This application note focuses on burning a fuel oil that does not evaporate at room temperature, and does not spontaneously combust at room temperature and a pressure of 3 MPa. Please see CAL2k – Application Note C1.2 : Fuel Oils – Part 2 for information relating to fuel oils that evaporate or spontaneously ignites under pressure. This is done in accordance with the above International Standards (ASTM).

Background

The calorific value (CV) of most liquid oils can be determined in exactly the same way as solids e.g. coal, i.e. by placing the sample in a pressurized vessel, igniting the sample and measuring the released heat in a controlled environment.

Equipment Required

The following list of equipment will be required to conduct this application:

- CAL2k System
- Crucibles
- Firing Cotton
- Syringe



Overview

The sample is placed in the crucible; the firing cotton is then placed in contact with the sample and the vessel pressurised with oxygen. The firing cotton is then ignited which in turn ignites the sample. The burning of the sample causes the vessel temperature to increase, this increase in temperature is very accurately measured and this is proportional to the calorific value of the sample.

This is the method generally used for fuel oils. If the oil is viscous then an eyedropper or syringe can be used to place the oil into the crucible. If the oil is not viscous then a spatula should be used – ensuring that the entire sample content is inside the crucible and hasn't fallen outside the crucible.



Procedure

1. Calibrate the vessel using 0.5g benzoic acid tablets.
2. Verify calibration using 0.5g benzoic acid tablets.
3. Place the clean crucible on the balance and tare.
4. Using a syringe add the sample oil to the crucible.
5. From the CAL2k keyboard, read the mass and enter.
6. Insert the crucible into the vessel crucible holder of the outer electrode.
7. Position the firing cotton so that it touches the sample
8. Insert the lid into the vessel, close the lid and pressurize with oxygen.
9. Continue with the analysis in the normal method.
10. When the analysis is complete, the result will be displayed.
11. Corrections for sulphur can be entered into the CAL2k unit.

Results

Using the CAL2k Calorimeter, these typical results were attained:

Fuel oil – Used in oil fired burners in the Brick-Making industry

Weight	Result (MJ/kg)
0.3110	45.633
0.3043	45.569
0.3115	45.611
0.3213	45.607
0.3117	45.578
0.3190	45.565
0.3127	45.597
0.3084	45.601
0.3145	45.585
0.3174	45.573

Average	:	45.592
Standard Deviation	:	0.21
Max – Min variation	:	0.068

Conclusion

Determining the calorific value of a fuel oil is very valuable in various industries. However, extreme caution must be exercised at all times when dealing with any oils. Protective wear is highly recommended and all safety rules must be adhered to.