



APPLICATION NOTE | DDS CALORIMETERS

FUEL OILS – PART 1 (ASTM D240-02)

SAMPLE - FUEL OIL – USED IN OIL FIRED BURNERS IN THE BRICK-MAKING INDUSTRY

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 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:

- DDS Calorimeter 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 pressurized 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 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 calorimeter unit.

RESULTS

Using a DDS Calorimeter system, 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.





APPLICATION NOTE | DDS CALORIMETERS

FUEL OILS – PART 2 (ASTM D240-02)

SAMPLE - FUEL OIL – USED IN OIL FIRED BURNERS IN THE BRICK-MAKING INDUSTRY

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 evaporates or spontaneously ignites with increased 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:

- DDS Calorimeter System
- Crucibles
- Firing Cotton
- Syringe
- Crucible Cover Disc

OVERVIEW

The procedure is similar to that for ordinary fuel oils (see Application Note – C1.1). However, the sample must be covered to prevent evaporation of the sample and to prevent oxygen from reaching the sample.

The mass and Calorific Value (CV) of the cover disc are used as a spike value and this is automatically deducted from the result.

The firing cotton is placed on top of the cover disc.

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. Remove the crucible and cover it with the crucible cover disc, ensuring a firm seal around the edge.





5. Make a small, bent flap on the top of the crucible cover disc. This will later cover the hole made by the syringe.
6. Place the crucible with the cover disc covered flap on the balance. Record the new weight (for spiking).
7. Enter this weight into "Spike Mass" and the calorific value of the crucible cover disc (see Note 1, below) into "Spike Value".
8. Turn spiking "ON".
9. Now press "Tare" on the balance.
10. Use a syringe with a needle to insert the sample into the crucible. Insert the needle through the cover disc. Ensure the hole from the insertion will be covered by the flap.
11. Gently press down the flap so that the insertion hole is covered.
12. Place the crucible onto the holder of the outer electrode and ensure that the firing cotton lies on top of the crucible cover disc and touches the cover disc flap.
13. When pressurizing the vessel check that the sample has not spontaneously combusted by checking that the temperature of the vessel has not increased (do this by feeling the temperature with your fingers around the exterior of the vessel wall).
14. Continue to run the determination as a normal sample.
15. When the result is displayed the spiking factor from the cover disc has already been deducted.

Note 1:

Determination of the Calorific Value (CV) of Crucible Cover disc

1. Roll up approximately 0.5g of tape and place in a crucible. Weigh this accurately, and run as a normal sample, ensuring the firing cotton touches the tape.
2. Repeat 5 (five) times.
3. Use the average of the 5 (five) readings as the Calorific Value of the cover disc.

For example:

Weight	Result (MJ/Kg)
0.6824	39.027
0.5199	38.763
0.5234	38.776
0.5318	38.801
0.5257	38.854
	38.844 Average

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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.

