



APPLICATION NOTE | DDS CALORIMETERS

C1.1 : 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
- Cellophane Tape
- Scalpel



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 cellophane tape are used as a spike value and this is automatically deducted from the result.

The firing cotton is placed on top of the cellophane.

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 cellophane tape, ensuring a firm seal around the edge.
5. Cut the excess tape from around the edge using a scalpel.



6. Make a small, bent flap on the top of the cellophane cover with a piece of cellophane tape. This will later cover the hole made by the syringe.
7. Place the crucible with the cellophane covered flap on the balance. Record the new weight (for spiking).
8. Enter this weight into "Spike Mass" and the calorific value of the cellophane tape (see Note 1, below) into "Spike Value".
9. Turn spiking "ON".
10. Now press "Tare" on the balance.
11. Use a syringe with a needle to insert the sample into the crucible. Insert the needle through the cellophane. Ensure the hole from the insertion will be covered by the flap.
12. Gently press down the flap so that the insertion hole is covered.
13. Place the crucible onto the holder of the outer electrode and ensure that the firing cotton lies on top of the cellophane and touches the cellophane flap.
14. 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).
15. Continue to run the determination as a normal sample.
16. When the result is displayed the spiking factor from the cellophane tape has already been deducted.

Note 1:

Determination of the Calorific Value (CV) of cellophane tape

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 cellophane tape.

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

RESULTS

Using a DDS 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

Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

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.