



# EN ISO 1716:2018

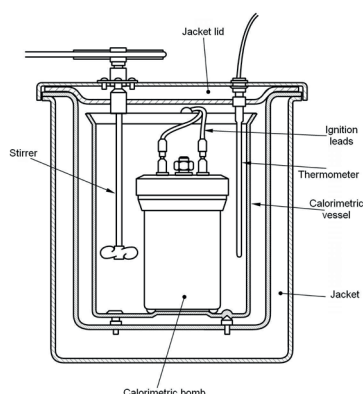
## Heat of combustion (Caloric Bomb)

### Role of test in the Euroclass system

Determination of the heat of combustion of a material (substantial and non-substantial components of a product) is required for classification A1 and A2 and A2, and floorings to classes A1fl and A2fl.

### Test principle

In this test, a test specimen of specified mass is combusted completely under standardised conditions, at constant volume, in an oxygen atmosphere, in a high-pressure calorimetric bomb. The calorific value determined under these conditions is calculated on the basis of the observed temperature rise, taking account of heat losses and the latent heat of vaporisation of water. This test determines an absolute combustion value of the product. 3 parallel tests are performed.



### Test apparatus

This apparatus is commonly known as the Oxygen bomb. The equipment consists of three main parts, the bomb body, the bomb head and the bomb sealing cap. The bomb head contains the crucible support and the electrodes used for the initiation of the reaction. The volume of the bomb is  $\pm 300$  ml. The bomb is immersed in water in a calorimetric vessel, and then both are placed in a thermally insulated water jacket. The specimen is situated in the bomb head in a crucible either in the form of a powder or moulded into a so-called 'cigarette' (i.e. wrapped in a paper of a known calorific value).

### Test procedure

Prior to conducting a test, the bomb calorimeter is calibrated by determining the water equivalence of the apparatus using a standard organic compound

(benzoic acid) of known calorific value. A specified mass of 0.5 gram of the powdered or chopped specimen is mixed with an equal amount of a combustion aid (benzoic acid) and placed in the crucible directly in the form of a pellet. If complete combustion cannot be achieved using the crucible method, the test specimen can be made by wrapping cigarette paper around the specimen and benzoic acid mixture, which is then placed within the crucible. A firing wire is positioned to just contact the powder or through the cigarette and connected to the electrodes. The bomb is filled with pure oxygen and pressurized and then exploded. The calorific value is determined by measuring the temperature change resulting from the reaction within the bomb.

### Test report

The report contains information about:

#### Water equivalent

The water equivalent  $E$  (MJ/K) of the calorimeter, the bomb and their accessories is determined by making at least five determinations of the gross heat of combustion of pellets of 0.4 g to 1.0 g of certified benzoic acid. Correction of the temperature: is necessitated by the exchange of heat with the exterior.

Calculation of the gross heat of combustion of the specimen:

$$PCS = (E * (T_m - T_i + C) - b) / m$$

**PCS** = gross heat of combustion [MJ/kg]  
**E** = water equivalent [MJ/K]  
**T<sub>m</sub>** = maximum temperature [K]  
**T<sub>i</sub>** = initial temperature [K]  
**C** = temperature correction [K]  
**b** = correction [MJ] (fuels only)  
**m** = mass of test specimen [kg]

### Criteria for evaluation according to EN 13501-1

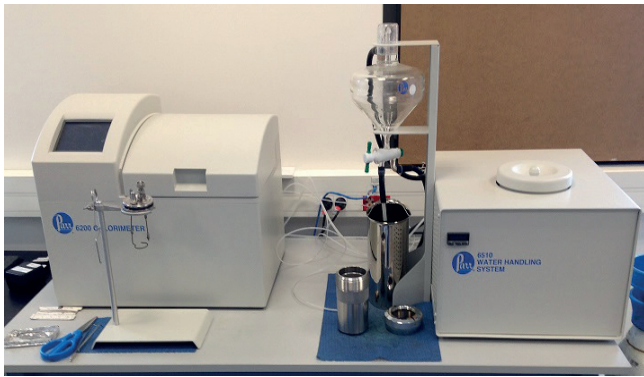
The criteria below apply to the average test results from the three parallel tests. A product needs to meet the following criteria for a classification A1.

1.  $PCS \leq 2.0$  MJ/kg <sup>a</sup> and
2.  $PCS \leq 2.0$  MJ/kg <sup>b,c</sup> and
3.  $PCS \leq 1.4$  MJ/m<sup>2</sup> <sup>d</sup> and
4.  $PCS \leq 2.0$  MJ/kg

For a classification A2, the following criteria need to be met:

1.  $PCS \leq 3.0 \text{ MJ/kg}$  <sup>a</sup> and
2.  $PCS \leq 4.0 \text{ MJ/m}^2$  <sup>b</sup> and
3.  $PCS \leq 4.0 \text{ MJ/m}^2$  <sup>d</sup> and
4.  $PCS \leq 3.0 \text{ MJ/kg}$  <sup>e</sup>

- <sup>a</sup> For homogeneous products and substantial components of non-homogeneous products.
- <sup>b</sup> For any external non-substantial component of non-homogeneous products.
- <sup>c</sup> Alternatively, any external non-substantial component having a  $PCS \leq 2.0 \text{ MJ/m}^2$ , provided that the product satisfies the following criteria of EN 13823:  $FIGRA \leq 20 \text{ W/s}$ , and  $LFS < \text{edge of specimen}$ , and  $THR_{600s} \leq 4.0 \text{ MJ}$ , and  $s1$ , and  $d0$ .
- <sup>d</sup> For any internal non-substantial component of non-homogeneous products.
- <sup>e</sup> For the product as a whole.



## Test specimens

A product shall be evaluated through each of its components, taking into account the rules for non-substantial components. If a non-homogeneous product cannot be delaminated, its components shall be provided separately.



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A sample of a minimum mass of 50 g shall be taken at random from the homogeneous product or component of a non-homogeneous product or loose-fill product. For liquid applied products a sample of a minimum mass of 10 g of dried material shall be prepared.

Three test specimens of 10 g each shall be prepared from the samples taken by grinding and using the preparation methods 'crucible' or 'cigarette'.

## Testing

Testing can be started when order is confirmed in writing, and the test specimens have been conditioned according to the standard.

Normally it will take about 4-5 weeks from when we have received the test specimens until the test report is finished.

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