# Instrument Procedure: Collecting Data with the Bomb Calorimeter

## Description

Higher heating value (HHV) is used to measure the total amount of chemical energy stored in a biomass. In other words, HHV shows the potential how much energy can be converted from a specific biomass.

## Procedure

The HHV of biomass fuel was detected through the Bomb Calorimeter. A standard operation procedure for testing fuel HHV with this calorimeter was developed as follows.

To complete this procedure, complete the steps under each of the following sections:

1. Turn on Equipment
2. Prepare Sample
3. Load Sample
4. Load Bomb
5. Set Order
6. Unload Bomb
7. Clean Bomb

Note: Due to the fact that different pieces of fuel samples have different moisture content, the testing results may vary. Therefore, test three samples of each fuel and the HHV of fuel. Then calculate the average the three testing results.

### Turn on Equipment

1. Turn on calorimeter.
2. Turn on oxygen supply.
3. Turn on heater and pump through the Calorimeter Operation menu.

### Prepare Sample

1. Grind small amount (about 1 gram) of biomass.
2. Condense and pelletize the fine samples to fit into the capsule and then put them into separate sample bags..
3. Weigh both sample pellets and record the data.
4. Put the sample pellets into the capsule.

## Load Sample

1. Attach a cotton thread to the fuse wire with the end touching the top of sample pellet as shown in Figure 1.

*Figure 1: Attach Cotton Thread*

2. Load the capsule into the bomb cylinder and screw the cap as shown in Figure 2.

*Figure 2: Load the Capsule*

3. Connect the oxygen fill connection to the bomb as shown in Figure 3.

*Figure 3: Oxygen Filling*

4. Press $O_2$ fill button on Calorimeter Operation menu to fill oxygen into the bomb.

### Load Bomb

1. Carefully put the bomb into the pail. Refer to Figure 4.

*Figure 4: Bomb Loading*

2. Put the pail in the calorimeter.
3. Connect the ignition wires to the terminals on the bomb head.
4. Fill 2 liters of 25~27$^{o}$C water into the pail.
5. Check the leakage of the bomb. Verify if there are any bubbles coming from the bomb.
6. Close the calorimeter lid.

### Set Order

1. Select the Operation Mode as *Determination* as shown in Figure 5.


*Figure 5: Setting the Order*

2. Sequentially input the sample ID, bomb ID, and the sample weight
3. Press *Start.*
4. Wait for the calorimeter to process.
5. Print the result when test is completed.

### Unload Bomb

1. Open the lid of the calorimeter.
2. Remove the pail from the calorimeter.
3. Remove the bomb from the pail.

### Clean Bomb

1. Slowly loosen the valve knob on the bomb to release the pressure.
2. Rinse the bomb head and cylinder.
3. Dry and clean the bomb head and cylinder for the next test.