Combustion Laboratory Unit Apparatus

(EDC-HT-036)

EXPERIMENTAL DATA:

- Familiarization of the adjustment and operation of a commercial oil or gas burner.
- Using either clean light boiler fuels, or natural gas or LPG.
- The effect of air/fuel ratio on:
  - Combustion efficiency as measured by flue gas constituents and temperature.
  - Heat transfer.
  - Energy balance.
- Comparison of Flue Gas Analysis with theoretical predictions.
- Comparison of Oil and Gas Burners (With optional extra Burner).
- Comparative performance of different fuels or fuel additives.
- Assessment of a burner, including:
  - Firing rate.
  - Turndown range.
  - Flame stability.
  - Flame shape.
  - Flame radiation.
  - Smoke emission.

DESCRIPTION:

The Combustion Laboratory Unit enables students to study many features of combustion and Burner operation. A Gas and oil burners are supplied with the unit for experimentation. The unit is mounted in a frame, with fully instrumented and requires three phase electrical supply for instrumentation.

Training unit is designed for student operation by including several safety features. A hand-held digital gas analyzer provided allows the O2 content of the flue gas to be resolute and this in turn allows calculation of the air /fuel ratio, excess air and combustion efficiency.

For **Research** purpose, an **optional** high specification gas analyzer is available that allows investigation of CO, NO and SO2 in addition to the typical examination.

Optional Software is available for Data Acquisition and Control Function.

SPECIFICATIONS AND TECHNICAL DATA:

- Combustion Chamber:
  - Metallic structure that guarantees a good stability and resistance.
  - Stainless steel combustion chamber (700 mm x 1100 mm) with 100 mm diameter for the observation points.
  - Dual burner of 150 kW to work both with natural gas (or other LPG) and fuel oil.
  - Cooling jacket with thermometer, manometer and pressure switch to avoid overpressure in the jacket.
- Natural Gas Line with:
  - Manual Valve
  - Gas filter.
  - Pressure sensor, range: 0 – 10 bar.
  - Pressure regulator, range: 0 - 3 bar.
  - Manometer, range: 0 - 500 mbar.
  - Electronic solenoid valve and safety pressure switch.
  - Flow sensor, range: 3 - 25 m3/h.
  - Needle valve to regulate the gas inlet flow.
- Fuel oil line with:
  - Manual valve.
  - Electronic solenoid valve.
  - Flow sensor, range: 4 - 40 kg/h.
  - Needle valve to regulate the liquid fuel inlet flow.
  - Two Storage and supply tanks for the fuel oil.
  - Suction pump of the fuel into the burner.
- Air ventilation, safety and drain valves.
- Five temperature sensors:
  - Combustion chamber,
  - Cooling water inlet,
  - Cooling water inlet outlet,
  - Combustion fumes outlet
  - Air inlet to the burner.
- Four Flow sensors:
  - Natural gas inlet,
  - Fuel oil inlet,
  - Cooling water flow inlet (range: 1.5 - 30 l/min)
  - Air inlet (by means of a differential pressure sensor, range: 0 - 1 psi).
- Combustion gases analysers: measurement of the content in O2, CO and CO2, efficiency of the combustion, air excess and CO/CO2 ratio.
- Two solenoid valves, one for each working flow: gas or fuel oil.
- Flame detection sensor and ignition controller.
- **Safety measures:** The feeding to the burner is cut off when: The outlet water temperature exceeds 80^{o}C. The pressure of the cooling jacket exceeds 1 bar. A water flow is not detected.
- Touch LCD with GUI Interface for better monitoring and accurate measurement.
- Calibration exercises, which are included, teach the user how to calibrate a sensor and the importance of checking the accuracy of the sensors before taking measurements.

NOTE (Optional):

- Software for DATA Acquisition and Control.
- High specifications Gas Analyzer for Research purpose.

DIMENSIONS AND WEIGHT:

- L x W x H (mm): 2100 X 900 X 1750 approx.
- Weight: 350 kg approx.

SCOPE OF DELIVERY:

- 1 x EDC-HT-036.
- 1 x Instructional Manual.
- 1 x Safety and Maintenance Manual.
- 1 x Hand Held Gas Analyzer for O2 gas analysis.