



## Combustion Laboratory Unit (SMT-HT-32)

The Combustion Laboratory Unit is mounted on a frame, allowing easy access to the burner, controls and combustion chamber. The package burner starts with an air purge, ignites its appropriate fuel (oil or gas) and automatically sets to a safe firing condition. Combustion air is provided by the integral fan with a regulating lever for the air flow, and a sensor monitors the flame, shutting the fuel valve in the event of flame failure. Air/fuel ratio and fuel firing rate can then be varied by the user.

Gas from either an LPG cylinder stored outside the building, or from local mains supply, is fed through pipes to the connections on the frame. Oil is supplied from portable tanks provisioned with the oil burner. The flame burns within a stainless-steel combustion chamber which is water cooled and of sufficient size to prevent flame impingement under normal conditions. Observation windows on the side of the chamber allow the flame to be observed.

The unit also includes a manual digital analyzer for the combustion fumes. It allows to determine the composition of such gases, the air excess, content in O<sub>2</sub>, CO, CO<sub>2</sub> and CO/CO<sub>2</sub> ratio.



The unit has Touch LCD display for visualization of process and the measurements. The Unit is also connected to Software for computer connectivity and data analysis. The Touch screen and computer software is included in the package.

## TECHNICAL SPECIFICATIONS

### Specifications:

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- Touch LCD with GUI Interface for better monitoring and accurate measurement of Plant variables.
- Anodized aluminum frame and panels made of painted steel.
- The unit includes wheels to facilitate its mobility.
- Diagram in the front panel with distribution of the elements similar to the real one.
- Cooling jacket with thermometer, manometer and pressure switch to avoid overpressure in the jacket.
- Sensors record all relevant data visualised on displays in the process schematic.
- ESOLS DAQ Software for monitoring and control.

### Technical Data:

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- **Combustion Chamber:**
  - Metallic structure that guarantees a good stability and resistance.
  - Stainless steel combustion chamber (700 mm x 1100 mm) with five pieces of 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 m<sup>3</sup>/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 and outlet, combustion fumes outlet and air inlet to the burner.
- Four Flow sensors: natural gas inlet, fuel oil inlet, cooling water flow inlet (range: 1.5 - 30 l/min) and air inlet (by means of a differential pressure sensor, range: 0 - 1 PSI).
- Combustion gases analyzer: measurement of the content in O<sub>2</sub>, CO and CO<sub>2</sub>, efficiency of the combustion, air excess and CO/CO<sub>2</sub> 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 80oC.

The pressure of the cooling jacket exceeds 1 bar.

A water flow higher than 5 l/min is not detected.

- Touch LCD with GUI Interface for better monitoring and accurate measurement of Plant variables. 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.

- ESOLS DAQ Software for monitoring and control.
  - Graphical visualization.
  - Security mechanism for login.
  - USB Connected
  - Compatible with Windows 7,8.1,10.
- Digital Instrumentation
- Capability to modify according to end user.
- Can be used in Research Purposes.
- Dimensions and weight:
  - LxWxH: 2000x950x1800mm.
  - Weight: approx. 350kg.

## Experiments:

- Study of the combustion process and the burner operation.
- Familiarisation of the adjustment and operation of a fuel oil or gas burner.
- Effect of the air/fuel ratio both in the efficiency of the combustion and in the measuring of the combustion gases components and in the temperature.
- Effect of the air/fuel ratio on energy balance.
- Effect of the air/fuel ratio on heat transfer.
- Effect of the flame radiation on heat transfer and observed temperature.
- Comparison of flue gas analysis with theoretical predictions.
- Comparison of the performance of different fuels.
- Assessment of a burner, including:
  - Flame stability. Flame shape. Flame radiation. Firing rate. Turndown range. Smoke emission.
- Comparison between a gas burner and a fuel oil burner.