



Combustion Laboratory Unit C492

Figure 1: C492 Unit



- *Purpose built Combustion Chamber, with Instrumentation.***
- *Designed for Supervised Student Operation.***
- *Oil or Gas Burners Available.***
- *Changes to Burner Settings Quickly and Easily Observed.***
- *Options Available include High Specification Flue Gas Analysis Package, Flue Assembly and Gas or Oil Burner.***
- *Two year Warranty.***



Figure 2: C492 Console



Introduction

In spite of the contributions made by nuclear, hydraulic, solar, wind and other renewable energy sources, the vast majority of energy is derived from combustion of hydrocarbon fuels.

These fuels, in general, are finite in quantity, and it is vital that they are used efficiently and economically to conserve resources and reduce pollution. A sound knowledge of the factors which affect the efficient combustion of fuels is essential for everyone involved with energy use.

The Hilton Combustion Laboratory Unit enables students to study many aspects of combustion and burner operation using burners typical of those used commercially. Light oils or gas can be burned using the appropriate burner. The unit is frame mounted, is fully instrumented and requires only a conventional single phase electrical supply, cooling water and the chosen fuel. As a purpose built training unit it is designed for supervised student operation by including several safety features. A hand held digital gas analyser supplied allows the O_2 content of the flue gas to be determined and this in turn allows calculation of the air /fuel ratio, excess air and combustion efficiency.

For advanced students or research, an optional high specification gas analyser is available that allows investigation of CO , NO and SO_2 in addition to the standard analysis.

The unit will be of wide interest to all those concerned with the combustion of fuels and energy conservation, from the burner maintenance technician, to research and test engineers.



Experimental Capabilities

*Familiarisation of the adjustment and operation of a commercial oil or gas burner.

* Assessment of a burner, including:

- Firing rate
- Turndown range
- Flame stability
- Flame shape
- Flame radiation
- Smoke emission

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.

Description

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, 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.

A water cooled gas sampling probe and thermocouple probe allow conditions within the flame to be investigated

The unit allows similar locally supplied automatic package burners of up to 150kW to be operated and analysed.



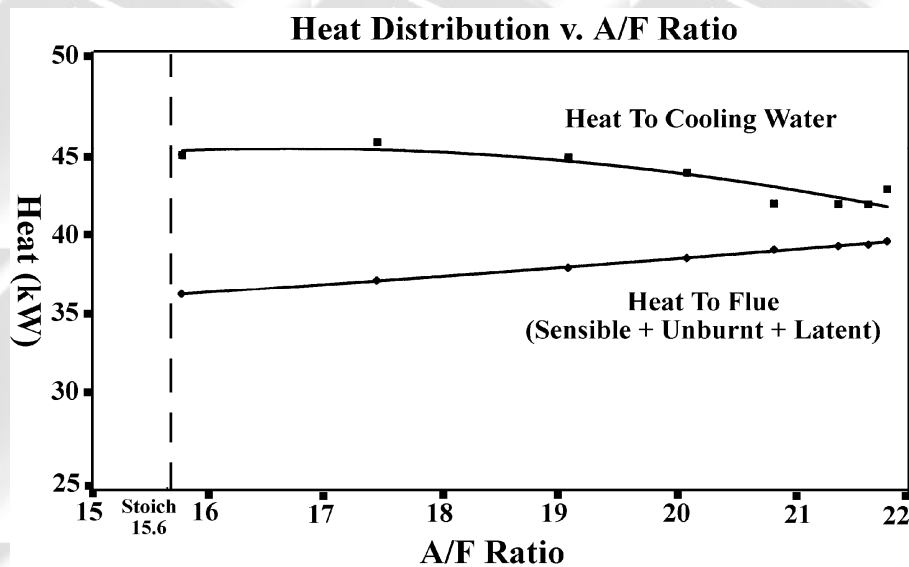
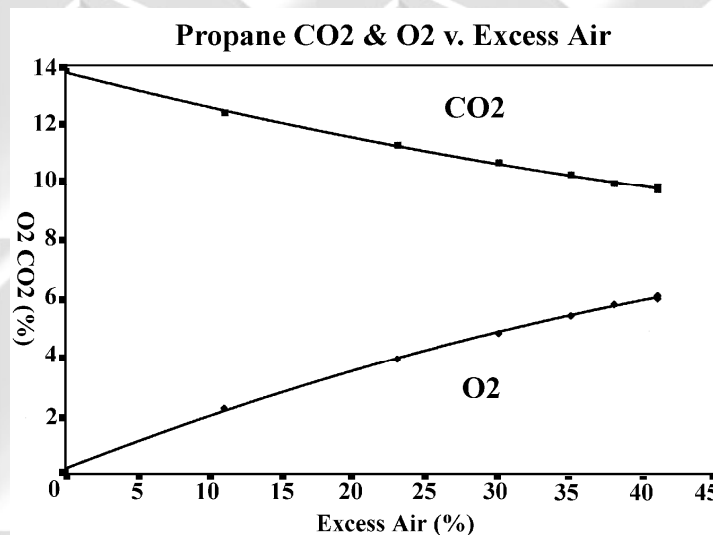
Experimental Results

The combustion products leave the combustion chamber through a duct in the end remote from the burner, and are turned to discharge vertically upward. Due to high flue temperatures, an air break transition piece is supplied between the chamber duct and the main flue, to entrain cool air and so reduce flue temperature. A flue system is available as an optional extra.

The unit must be installed in a well ventilated area, with access to the burner end and at least one of the two sides.

Electrical safety is provided by overload and earth leakage circuit breakers. The cooling water system has a flow switch and high temperature cutout.

The standard instrumentation provides measurement of flue temperature, O₂ content, excess air, combustion efficiency, cooling water inlet and outlet temperatures, water and fuel flow, thereby allowing energy balances to be determined.





Specification

General

A fully instrumented water-cooled combustion chamber with oil and/or gas burner(s) for studying burner operation and the combustion process.

Detailed

A frame mounted burner training unit comprising a 450 dia x 1000mm cylindrical water-cooled stainless steel chamber in which either an oil or gas burner can be fired, and the flame observed through four 100mm dia windows.

Internal electric and mechanical safety devices allow for supervised operation by students. Instrumentation to measure the water, air and exhaust temperatures, and flow rates of the cooling water, air and fuel. A hand held gas analyser supplied measures flue gas O₂ content and also displays combustion efficiency, excess air, and CO₂ content.

Smoke Number can be determined for the oil burner with the Smoke Tester supplied.

Further flue gas analysis including CO, NO and SO₂ can be performed on either burner by using the additional optional high specification Gas Analyser.

Oil or Gas Burners up to 150kW can be used in the chamber.

Supplied with a detailed experimental operating and maintenance manual giving example experimental results and sample calculations.

Accessories and spares for two years normal operation together with a full two year warranty.

Dimensions

Height: 1700mm **Depth:** 2000mm

Width: 800mm **Weight:** 175kg

Services Required

Electrical: A: 220-240 Volts, Single Phase, 50Hz(With earth/ground).

Line current up to 3A at 230v

B: 110-120 Volts, Single Phase, 60Hz(With earth/ground).

Line current up to 6A at 110v

Water: Up to 25 litres m⁻¹ at a minimum of 10m head. Open drain for this flow rate.

Gas: LPG at maximum 2bar or mains natural gas at maximum 50mbar. Flow rate 1 to 3 g/s.

Oil: Kerosene, gas oil or other clean light fuels (density 790 - 835 kg/m³, viscosity 0.011 - 0.055 cm²/s@ 40 C). Flow rate 2 to 5 g/s.

Ordering Information

Order as:

Combustion Laboratory Unit C492

Electrical Specification

Either: **A:** 220-240 Volts, Single Phase, 50Hz(With earth/ground).

B: 110-120 Volts, Single Phase, 60Hz(With earth/ground). (Supplied with transformer)

Language

Either: English, Spanish or French.

Optional Items, Order as:

Gas Burner C492A

Oil Burner C492B

Flue Assembly C492C

Flue Gas Analyser C492D

Shipping Specifications

(Estimated)

Net Weight: 175kg.

Approximate Gross Weight: 225 kg.

Packing Case Dimensions: 1.0 x 1.8 x 2.2m

Packing Case Volume: 3.96m³

Accessories and Spares

Unit supplied with:

- One experimental operating and maintenance manual in English, Spanish or French.
- Accessories and spares for 2 years normal operation. List available on request.

Also Available On Request

- Further detailed specification.
- Additional copies of instruction manual.
- Recommended list of spares for 5 years operation.

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