



## P7690

## 1 KW STEAM POWER PLANT

### FEATURES

- Self-contained complete teaching facility
- Low cost
- Easy installation
- Built to British Safety Standards
- Comprehensive instrumentation
- Demonstration of Rankine Cycle

### APPLICATIONS

- Operation of a complete power plant
- Thermal efficiencies
- Heat Balance and Energy utilisation
- Power generation
- Fuel consumption

### INTRODUCTION

Cussons Steam Laboratory Equipment has been designed to provide a comprehensive range of products for teaching the technology of steam plant in thermodynamics courses.

All items reflect modern practices and their design incorporates safety features to minimize any risk in operation.

The equipment has been designed to provide a comprehensive facility for the complete investigation of a steam power plant.

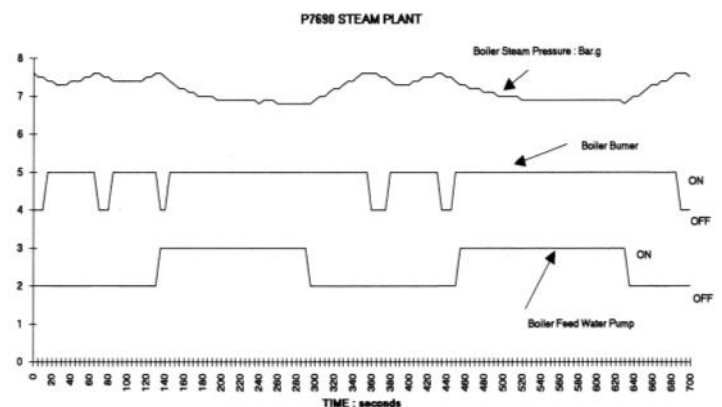
The features incorporated and power ratings chosen constitute an excellent representation of industrial practice within the limitations of an educational laboratory.



### DESCRIPTION

Cussons Mini Steam Power Plant has been specifically designed to allow institutes of education to study the principles and operations of an industrial steam power plant without the large capital investment normally required. The plant can operate as a steam boiler, turbo-generator or complete power plant. Available tests include: thermal and total efficiency consumption, boiler capacity, efficiency, heat balance, turbine power and specific steam consumption.

Cussons P7690 Mini Steam Power Plant is designed as a comprehensive self-contained unit with all relevant items of equipment factory mounted on a common steel bedplate. This modular construction and assembly greatly reduces space and installation requirements. The plant is designed to operate at pressures up to 7 bar g and is complete with all pipework, insulation, electric cabling and trunking. All services terminate on the base allowing easy installation.





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**TENDER SPECIFICATION**

- [1] Automatic oil fired steam boiler with a design pressure of 8.6 bar g and an output of 96 Kg/hr from and at 100°C.
- [2] Automatic electric superheater to provide dry saturated/superheated steam, maximum rating 6 kW, 8.6 bar, 200°C.
- [3] Fuel oil storage tank 100 litre capacity fitted with hand transfer pumps and contents gauge.
- [4] Water treatment system to soften the mains water supply. Boiler water storage tank 100 litre capacity fitted with makeup water inlet, condensate return pipe, boiler sample cooling coil, all mounted on common frame with the oil tank. Centrifugal boiler feed pump.
- [5] Pneumatically operated pressure reducing valve to control the steam turbine inlet pressure.
- [6] Steam Turbine set – single stage, single row, one nozzle type. Designed to operate up to 4000 rpm with a steam supply pressure of 7 bar g and producing a maximum power output of 1 kW. The Turbine is directly coupled to a 1.5 kW a.c. electric dynamometer connected to the main electrical supply.
- [7] Blowdown Tank to allow the safe discharge of pressurised water drains with atmospheric vent for the discharge of steam exhaust.
- [8] Control panel with PLC for plant control and safety shutdown, together with electronic controllers for superheat temperature and turbine inlet pressure, all instrumentation, 10 channel safety shut down system
- [9] Instrumentation to provide readings of:

- PRESSURES:
- Boiler steam
  - Steam orifice inlet
  - Steam orifice differential
  - Turbine steam inlet
  - Turbine steam exhaust.
- TEMPERATURES:
- Ambient air
  - Boiler feed water
  - Fuel oil
  - Boiler flue and Boiler steam outlet
  - Superheater outlet
  - Steam orifice inlet
  - Turbine nozzle inlet
  - Turbine exhaust
  - Condensate return
  - Condenser cooling water, in & out
- FLOWMETERS:
- Fuel oil
  - Condenser cooling water
- SPEED:
- Turbine
- TORQUE:
- Turbine

- [10] Demonstration of Rankine Cycle
- [11] All measured variables are available as independent 0-10V signals for data logging purposes
- [12] DATA ACQUISITION. Signal conditioning A/D and digital I/Interface boards suitable for use with IBM PC/AT/XT or compatible computer. Supplied with software to display and store all parameters for use in the clients' programs
- [13] Condenser Unit – atmospheric surface condenser sized to condense all the steam discharged from the steam turbine. Con-densate extraction pump with provision to return condensate to the feed tank or to drain. Cooling water circulation pump
- [14] All necessary interconnecting pipework, valves, fittings, lagging and flue, together with electrical cabling and trunking is included
- [15] All services terminate on the base, together with suitable connections to allow the easy installation of optional equipment
- [16] All the above equipment is secured to a common base and is painted, tested and inspected before dispatch
- [17] Portable instrumentation for the analysis of boiler feed water and of boiler drum water samples is provided
- [18] Operating and instruction manuals are available in English but can be translated into other languages as an optional extra
- [19] A standard set of Installation Materials based on a standard laboratory building and heights is included within the extent of supply. If extra lengths of flue are required then these are chargeable.







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### OPTIONAL EQUIPMENT

**P7692 COOLING TOWER.** Sized to suit Condenser, including cooling water supply and return pipework. Instrumentation enclosure with mimic diagram, temperature and relative humidity of ambient air and tower exit air, and air flow prediction from fan motor current.

**N.B.** This unit is designed to be located externally from the laboratory.

**P7693 INSTALLATION AND COMMISSIONING** by Cussons Engineers.

**P8385 FLUE GAS ANALYSIS UNIT** for CO, CO<sub>2</sub> and O<sub>2</sub>.



### DIMENSIONS AND WEIGHTS

#### P7690

Length: 285cm  
Width: 180cm  
Height: 236cm  
Gross weight: 2630kg  
Nett weight: 2200kg

#### P7692

Length: 282cm  
Width: 137cm  
Height: 137cm  
Gross weight: 460kg  
Nett weight: 165kg



### INSTALLATION REQUIREMENTS

**Electrical Supply:** 380/415 3ph 50Hz. 220/240 1ph 50Hz

**Fuel Oil:** 7 litres/hr 35 sec. gas oil

#### Water Supply & Drainage:

Boiler feed water 100 litres/h

Total dissolved solids 600 ppm

Total alkalinity 300 ppm. pH value 9-11

Condenser cooling water 7000 litres/hour if Cooling Tower not supplied, else 500 litres/hour cooling tower make up.

**Atmospheric:** 75 mm from blow down tank

**Vents:** 150 mm chimney from boiler

#### Head Office

Cussons Technology Limited  
102 Great Clowes Street,  
Manchester.  
M7 1RH England  
Tel: + (44)161 833 0036  
Fax: + (44)161 834 4688  
E-mail: sales@cussons.co.uk



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