



## P7670 STEAM BOILER BENCH

### PRINCIPLE EXPERIMENTS

- ◆ To determine the boiler evaporation capacity and equivalent evaporation
- ◆ Boiler efficiency trial
- ◆ To assess the heat loss from a boiler at a given steam output pressure

### FEATURES

- ◆ Safe automatic boiler operation
- ◆ Low capital cost
- ◆ Compact modular design offering easy installation
- ◆ Comprehensive instrumentation
- ◆ Fully certified design

### INTRODUCTION

The expansive power of Steam and its ability to do work were known to antiquity. The "Thunderer" of Archimedes is supposed to have been a gun operated by high pressure steam instead of by powder. In 120 BC, Hero of Alexandria described a device used by the priests of ancient Egypt consisting of a hollow sphere into which steam was introduced under pressure through a hollow axle, the steam escaping through two diametrically opposite pipes curved in opposite directions, so that the reaction of the escaping steam caused the sphere to rotate.

Since that time nearly two thousand years elapsed before any thought was given to the actual utilisation of the power of steam. The Italian scientist, Giovanni de Branca, in 1629 was the first to propose using the rotating movement achieved by escaping steam to turn a roasting spit. His steam wheel was of course useless due to the undeveloped art of mechanical construction.

Now after a further three and a half centuries of experimentation and development, steam has been put to many uses in our modern world. The steam boiler bench described below provides the necessary steam supply to operate the various steam experiments available in the system.

### DESCRIPTION

Cussons P7670 Steam Boiler Bench consists of a sturdy framework and panels of all steel construction, fitted with a student work surface, interconnecting back panel and adjustable feet.

Adjacent and connected to the framework is an electric steam boiler of 36 kW rated output. The heat input to the boiler is provided by specially designed electrical resistance immersion elements run at a low power density in order to give a long operational life. The boiler, with its attendant mains water make up tank, feed pump, steam main, blowdown, drain and feedwater connections is housed in a self contained unit.

The student desk unit contains a control box with an electric power supply isolator and instrumentation to read steam and water temperatures and also to display the electrical energy consumed in kWh. All piping and wiring required to connect the boiler to the steam benches is supplied.

### BOILER

Fully automatic electric boiler, operated by a three probe electronic circuit system which controls the boiler feed pump and also provides integral fail safe 'low water' protection. The boiler heating is controlled by a pressure switch system. The boiler is fully insulated and housed in a mild steel jacket. Fitted with:

- boiler blowdown valve with discharge to bench blowdown line
- pressure relief valve and discharge line with condensate drain
- pressure control unit
- Bourdon type pressure gauge 0 to 20 bar
- steam output line with integral type K thermocouple and stop valve

## BOILER PERFORMANCE

Output rating	36 kW
Max. working pressure	10.34 bar
Evaporation rate	55 kg/h from and at 100°C
Water capacity	68 litres (boiler)

## CERTIFICATION

The boiler is subjected to an hydraulic test of 16 bar and is supplied complete with an independent insurance company test certificate. The pressure vessel is built to BS 2790, inspected throughout construction and fully certified upon completion by a member company of A.O.T.C.

## FEEDTANK

Constructed from stainless steel with a capacity of 90 litres. Fitted with:

- pump suction line with pre-pump isolating valve, strainer and type K thermocouple
- water supply line (untreated, unless used in conjunction with P7677 Water Treatment Studies Bench), complete with ballcock valve and stop valve
- overflow outlet

## BOILER FEED WATER SUPPLY

- centrifugal water feed pump automatically operated by boiler water level controller
- feed line fitted with one way check valve

## ADDITIONAL INSTRUMENTATION

- a solid state kilowatt hour meter with 8 digit alpha-numeric display
- a digital temperature indicator

## WATER SUPPLY

The boiler consumes 46 litres per hour and it is recommended that the water is treated to attain a minimum quality as follows

Total hardness in terms of Ca Co <sup>3</sup>	Max 2
Caustic alkalinity in terms of Ca Co <sup>3</sup>	300 ppm
Total Dissolved Solids	
– recommended level	500 ppm
– max. allowable level	2000 ppm
– pH value	8-10

- Free from corrosive gases such as oxygen and carbon dioxide.

If Cussons P7677 Water Treatment Studies Bench is installed this will provide the required supply of treated water for the boiler.

## TENDER SPECIFICATION

To comprise a fully automatic electric steam boiler of 36 kW rated output providing 55 Kg/hr of steam from and at 100°C, complete with a stainless steel mains water feed tank, centrifugal feed pump, steam main, blowdown, drain and feedwater connections, pressure relief valve, check valve and stop valve all housed in a self contained unit.

A sturdy framework and panels of all steel construction fitted with a student work surface is to be connected and adjacent to the boiler. Instrumentation is to include a boiler pressure controller and 0 to 20 bar pressure gauge, two point temperature measurement via type K thermocouples to a digital indicator and a solid state kWh meter. The bench should be complete with all service facilities relating to water supply, blowdown and drainage, to enable the interconnection to other steam bench units.

## SERVICES

*Electrical Supply:-*

3 phase plus neutral and earth 50Hz

Supply Voltage	Rating (kW)	Boiler Load Current (Amps)
415	36	55
380	36	60

The unit may also be supplied for operation on other voltages and frequencies upon request.

## DIMENSIONS

1375 mm wide, 800 mm deep, 1970 mm high

*Weight:-* 340 Kg. empty (i.e. excluding water in boiler and feedtank)

## SHIPPING DETAILS

Case Size:	145 x 90 x 210 cm
Gross Weight:	440 Kg