cussons
TECHNOLOGY

P7676

STEAM ENGINE

FEATURES

- Compact modular design
- Low capital cost
- Easy installation
- Comprehensive instrumentation
- Pressure test certificates supplied for major components
- Single cylinder, double acting reciprocating vertical engine

PRINCIPLE EXPERIMENTS

- To determine the mean effective pressure, brake power, indicated power, steam consumption and mechanical efficiency of a single cylinder steam engine under varying loads and constant speed.

INTRODUCTION

Steam engines utilise the energy contained in steam under pressure. The energy released when steam expands in the cylinder of an engine enables rotary motion to be achieved, which can be used to pump, lift and move.

DESCRIPTION

Cussons P7676 Steam Engine Steam Bench consists of a sturdy framework and panels of all steel construction, fitted with a student work surface, interconnecting hack panel and adjustable feet.

The steam bench comprises a robust single cylinder, double acting reciprocating steam engine driving a dynamometer which enables a calculable, variable resistive load to be easily imposed on the engine. The steam engine is supplied with steam from a steam header at a reduced pressure via an overspeed trip solenoid valve and a displacement lubricator from which oil is displaced by droplets of condensed steam into the steam supply to lubricate the engine. Exhaust steam is cooled by a water cooled, coiled tube type condenser. Engine inlet and outlet steam pressures are indicated on 0-16 bar and -1 to 3 bar Bourdon tube pressure gauges respectively.

A control cubicle surmounted by resistive load elements within a separate ventilated enclosure, contains electrical control circuits and is fitted with the control switches and the indicating instruments for engine speed, dynamometer output current and voltage and analogue temperatures which can be selected by an associated multi-position switch.

STEAM HEADER ASSEMBLY

Mild steel steam header in accordance with BS2633 (1973) with a branch, including a Vee-reg control valve, a 10.3 to 5.5 bar pressure reducing valve, a pressure relief valve set to vent to atmosphere at 6.9 bar and a solenoid valve closing on engine overspeed, providing steam to the engine. Fitted in the steam supply line is a pressure measuring point connected to a 0-16 bar Bourdon tube pressure gauge. The steam header is enclosed within a header box and fully insulated with mineral wool.

ENGINE

A single cylinder, double-acting reciprocating engine, vertically mounted on four vibration isolators. A clear perspex protective cover is fitted in front of the engine. The engine has a bore of 57.15 mm, a stroke of 50.8 mm and a swept volume of 0.130 litres. The power output is 500 watts with the engine running at 800 rpm and supplied with steam at 5.5 bar running with a fixed cut-off ratio of 1/5. Steam consumption at these conditions is 36 kg/hr.

DYNAMOMETER

A fan cooled alternator with a 12 pole wound rotor, providing a 3 phase star connected output, internally rectified to provide a dc supply which can be resistively loaded. Mounted on an adjustable pivoted support block to tension the drive belt.

CONDENSER

A horizontally mounted water cooled, coiled type heat exchanger fitted with:

- pressure measuring point at the steam inlet, connected to a -1 to 3 bar Bourdon tube pressure gauge.
- an isolating valve and a flap type flow indicator in the cooling water supply line.
- two temperature measuring points each complete with a type K thermocouple, fitted in the cooling water outlet and condensate lines.
- condensate collecting/measuring vessel.

CONTROL CUBICLE

A mild steel fabrication containing fused electrical control circuits for operation from clients supply voltage, and surmounted by a bank of resistive load elements inside a ventilated cover. On the front door of the unit are mounted a Power On/Off switch, three buttons for engine Start, Stop and Warm Up, an engine load control, an engine speed indicator scaled 0-20 RPS (engine) and 0-141.2 RPS (dynamometer). a 0-250ºC analogue temperature indicator connected through a multi-position switch, a 0-60V dc voltmeter and a 0-50A dc ammeter.

CERTIFICATION

The steam header is pressure tested at 21 bar and supplied with a test certificate.

SERVICE SYSTEMS

The Bench is equipped with independent service lines relating to water supply (untreated), blowdown and drainage. These lines interconnect with similar facilities on the other steam benches to provide common service facilities.

SERVICE REQUIRED

Steam supply at maximum working pressure of 10.34 bar and maximum temperature of 235ºC, which may be supplied by Cussons P7670 Steam Boiler Bench, a Cussons Steam Plant or clients own steam line.

INTER-CONNECTION OF STEAM BENCHES

To enable steam benches to be linked to form a system utilising a common steam supply and service system, the steam bench is supplied complete with:

- An interconnecting back panel and student work surface.
- A set of 4 stainless steel flexible hoses for the steam and service connections.
- A selection of aluminium clad lagging for the flexible steam hose.

PIPE CLOSURE KIT

If this steam bench is to be installed on a stand alone basis **or** is the last unit in a run of steam benches a P7682 Pipe Closure Kit will be required.

TENDER SPECIFICATION

Steam bench to demonstrate the method of testing a steam engine and to determine various performance characteristics of a simple steam engine. The bench comprises: a single cylinder, double acting steam engine, fitted with two cylinder drain valves, inlet and outlet temperature measuring points complete with type K thermocouples; flexible steel braided inlet and outlet hoses; lubrication from a displacement lubricator; engine vertically mounted on vibration isolators; a belt driven dynamometer mounted on an adjustable pivoted support bracket and a water cooled, coiled tube exhaust steam condenser fitted with an inlet pressure measuring point connected to a -1 to 3 bar Bourdon tube pressure gauge. The condenser cooling water is to be supplied from the water mains line via an isolating valve and flap type flow indicator, and temperature measuring points complete with type K thermocouples, are to be fitted in the cooling water outlet and condensate lines. The steam engine is to be supplied with steam from a fully insulated steam header line via a Vee-reg steam control valve, 10.3 to 5.5 bar pressure reducing valve, a pressure relief valve set to vent to atmosphere at 6.9 bar, an overspeed trip solenoid valve and a pressure measuring point connected to a 0-16 bar Bourdon tube pressure gauge. Electrical control circuits will be connected to the clients supply voltage and housed in a mild steel cubicle which will be surmounted by resistive load elements in a ventilated enclosure, and fitted with a power on/off switch, three engine control push buttons, a rotary control for varying the load, a meter (0-20 RPS) for engine speed and 0-141.2 RPS (for dynamometer speed), a 0-250ºC analogue temperature indicator to be used in conjunction with a multi-position switch, a 0-60V d.c. voltmeter and a 0-50A d.c. ammeter. A protective guard is to be fitted over the belt drive and a clear perspex protective cover is to be fitted in front of the engine, the foregoing will be installed on a sturdy frame and panels of all steel construction complete with service facilities relating to water supply, blowdown and drainage. The unit to be supplied with an inter-connecting back panel, student work surface and a set of 4 stainless steel flexible inter-connecting hoses to be integrated into a steam bench system.

P7682 Pipe Closure Kit

A complete assembly of pipework, comprising connections, valves and steam trap to enable the steam header to be discharged of condensate into the blowdown line.

SERVICES

Steam supply:-
Maximum working pressure of 10.34 bar and maximum temperature of 235ºC, which can be supplied by Cussons P7670 Steam Boiler Bench, a Cussons Steam Plant or clients own steam line.

Water supply:-
From bench water service line.

SHIPPING DETAILS

Case size:	2.32 m³
Gross weight:	300 Kg
Nett weight:	190 Kg

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