



P1810 MINI VARIABLE SPLIT PARTICULATE SAMPLER

INTRODUCTION

Legislative requirements for particulate sampling systems for engine exhaust utilise the constant volume sampling system handling the whole exhaust flow whilst the engine or vehicle is operated over the prescribed 'drive' cycle. Such particulate and constant volume sampling systems are expensive capital items, particularly for heavy duty engines.

For engine development studies measurement of particulate emissions are required at various individual engine conditions and it is therefore possible to conduct these measurements during steady state tests. Constant volume techniques are not necessary for such steady state testing and it also possible to make measurements based on a fraction of the total exhaust flow. Consequently Cussons have developed a mini variable split particulate sampling system which is being successfully used by a number of client companies.

PRINCIPLE OF OPERATION

Cussons Mini Variable Split Particulate System splits the exhaust flow into two streams and diverts one stream through a particulate formation tunnel, fitted with standard particulate probe, particulate filters and gas flow measurement system. The tunnel utilises an industrial centrifugal fan and a butterfly valve to throttle the tunnel flow rate rather than the more expensive positive displacement pump (PDP) or critical flow venturies (CVF) used in legislative sampling systems. To relate the mass of the particulate collected on the particulate filters back to the total particulates produced by the engine then it is also necessary to know the total exhaust flow rate, the dilution ratio and the exhaust split ratio. The exhaust flowrate can be determined from air and fuel flow measurements or from

one of these and an exhaust based air-fuel ration measurement. The exhaust split ratio and dilution ratio are then determined by calculation from either CO₂ or NO_x measurements taken in the raw exhaust and diluted exhaust gas flow.

DESCRIPTION

The system, which is shown diagrammatically below, consists of a dilution air filter, exhaust inlet mixer section, particulate formation tunnel, throttle valve and fan together with a twin mode particulate filter and a gas flow metering system. The system is housed in a cubicle with the particulate formation tunnel mounted horizontally.

Dilution air enters vertically downwards through an 18" square horizontal sandwich filter via a transition section into a 90° bend, which leads into the horizontal o.d. 135.7 mm diameter 1345 mm long flange to flange particulate formation tunnel. Exhaust gas enters through a horizontal 60 mm diameter exhaust pipe, which terminates at a mixing orifice trapped between the 90° bend and the tunnel.

A raw exhaust gas sampling probe is located in the 60 mm exhaust pipe. The tunnel terminates at its exit end in a 180° stainless steel bend, into which are fitted a particulates probe and a dilute exhaust gas sampling probe. From the 180° bend flexible plastic trunking connects to the manual butterfly valve at the entry to the centrifugal fan and from the fan to the discharge port.

The twin particulate filter bank is located in a 19" rack mounted recess at the opposite end to the exhaust entry. Above this recess are located the flow control module and the mode select and display module, both of which are 19" rack modules. The sample pump and the gas meter are located on the base of the cabinet.

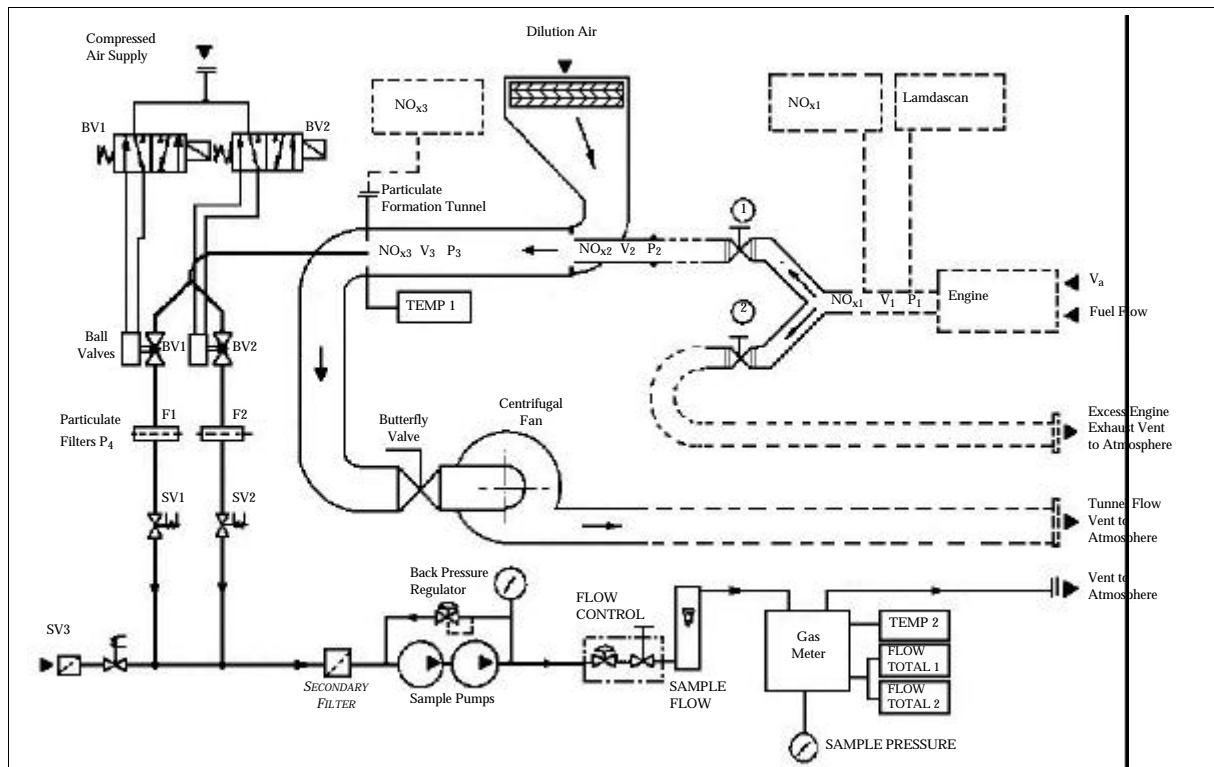


FIG. 2 SCHEMATIC ARRANGEMENT OF P1810 PARTICULATES SAMPLER

All main electrical circuitry is located in a 19" rack mounted electrical power distribution module, located centrally in the cabinet above the particulate formation tunnel. This module is secured by interlocked door isolators in the two access doors. The cabinet includes twin doors on both long sides for access. It is possible to easily remove the particulate formation tunnel for cleaning. The cabinet is mounted on lockable wheels and castors.

The exhaust splitter, P1820, is a separate assembly comprising a 'Y' piece and 2 high temperature valves mounted in a framework suitable for mounting close to an engine test bed or vehicle exhaust tail pipe.

TENDER SPECIFICATION

P1810 Mini Split Particulates Sampler self contained mobile unit comprising:

Particulate Tunnel: Stainless steel construction 113 mm bore with 10 x diameters between exhaust inlet and sample point and 100 mm mixing orifice at exhaust gas inlet. Reynolds number at 2860 l/m = 31,400.

Exhaust Inlet: 52 mm bore with 'V' flange connections to variable exhaust flow splitter.

Tunnel Particulate Probe: 14.0 mm bore stainless steel.

Tunnel Particulate Sampling:

Dual sampling lines each with Gelman 2220, 47 mm dia. filter with 35 mm dia. effective filtration area.

Sample Pump:

Metbel MB 602

Sample Flow:

By variable area flowmeter 0.05 -0.06 l/sec. Total sample flow by dry gas meter 3200 l/hr rating converted to provide digital display of total flow.

Tunnel Fan:

Centrifugal fan providing turbulent flow conditions may be throttled by manual butterfly valve at fan inlet.

Temperature Indications:

Two digital indicators providing continuous monitoring of tunnel at sampling point and gas meter temperatures.

SERVICES

Electrical Supplies:- 380V, 3 ph, 50 Hz and neutral, loading 1500 VA (alternative supplies to order).

Compressed Air:- 410 to 820 kP (60 to 120 psig)

DIMENSIONS

2100 mm long x 600 mm wide x 1470 mm high.

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