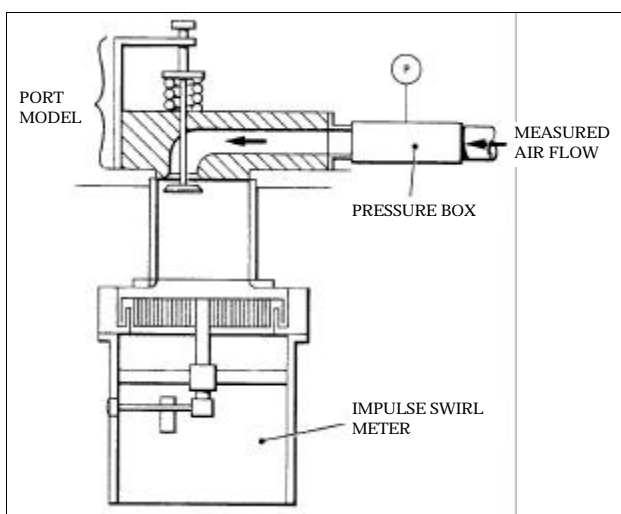




P7300 IMPULSE SWIRL METER INCORPORATING P7302 DISPLAY UNIT

INTRODUCTION

Cussons P7300 Impulse Swirl Meter's are designed to measure swirl in the air flow drawn into an engine cylinder generated by the engine inlet port. Earlier methods of measuring swirl such as swirl vane meters, were dependent on the velocity profile of the air stream, whereas the impulse type of meter overcomes this limitation by responding to the total angular momentum flux in the swirling air flow. The impulse swirl meter uses a swinging honeycomb type matrix which is restrained from rotation by a strain-gauged load cell to totally arrest the angular swirl component thereby measuring the resultant angular impulse as a torque.



DESCRIPTION

The Aeroweb honeycomb matrix is suspended within a cylindrical, aluminium housing with the skirt of the matrix immersed in an annular oil reservoir in the base which serves both as an air seal and a viscous damper. The matrix is mounted on an axle in the frame and supported by precision ball bearings while the torque arm connected to the axle acts on a Wheatstone Bridge strain gauge transducer.

The unit is designed for blow or suction induced flow and can be assembled for operation in either the upward or downward mode, whichever is most convenient. A set of weights is provided with the instrument to facilitate static calibration of the strain gauge with an accuracy of $\pm 2\%$.

Cussons Display Unit P7302, used in conjunction with the swirl meter, is a mains operated instrument complete with power supplies, which converts the strain gauge measurement into a four element, LED digital readout.

APPLICATION

The illustration shows a typical test rig layout arranged for downward air flow, in which the client's manometer registers a constant pressure drop across the model which must always be high enough to ensure fully turbulent flow in order that the results can be applied to his own particular engine configuration. In automotive and truck size engines for instance, a pressure drop of 254 mm water gauge is normally used.

The swirl meter is supplied complete with an adaptor plate having a 50 mm diameter pilot bore hole which should be machined to suit the test cylinder bore and recessed to the cylinder outside diameter. By using appropriate adaptor plates the meter can readily be made to perform tests over a range of bore sizes from 75 to 150 mm. Flow and swirl measurements are then made for a series of incremental valve lifts enabling non-dimensional parameters of lift, swirl and flow coefficient to be evaluated.

FLOW AND SWIRL CHARACTERISTICS

Typical inlet port characteristics are shown in the accompanying graph. Non-dimensional terms are used so that direct comparisons may be made with ports from other engines.

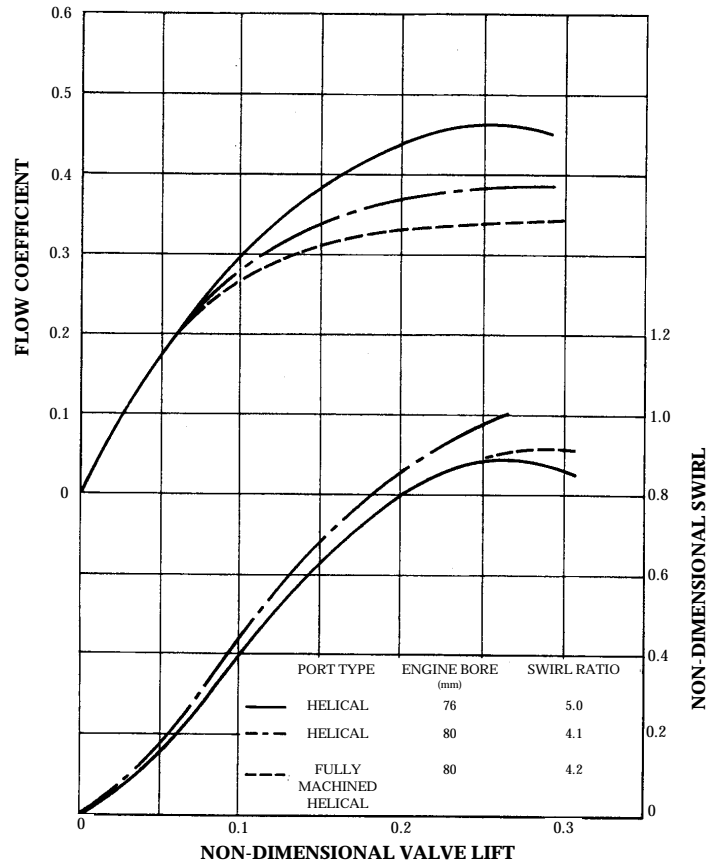
TENDER SPECIFICATION

The P7300 comprises a honeycomb matrix mounted within a cylindrical housing, the dimensions of the individual cells of the matrix being suitable for arresting the swirl of the incoming air. The matrix is connected via a torque arm to a strain gauge transducer which is calibrated by suspending weights over pulleys either side of the torque arm.

The strain gauge transducer is rated at 220g, measured as a positive or negative force; the length of the torque arm is such as to enable torque values up to 1×10^{-1} Nm to be measured. The unit can be arranged for flow in an upward or downward direction and is supplied complete with adaptor plate having a pilot bore of diameter 50 mm.

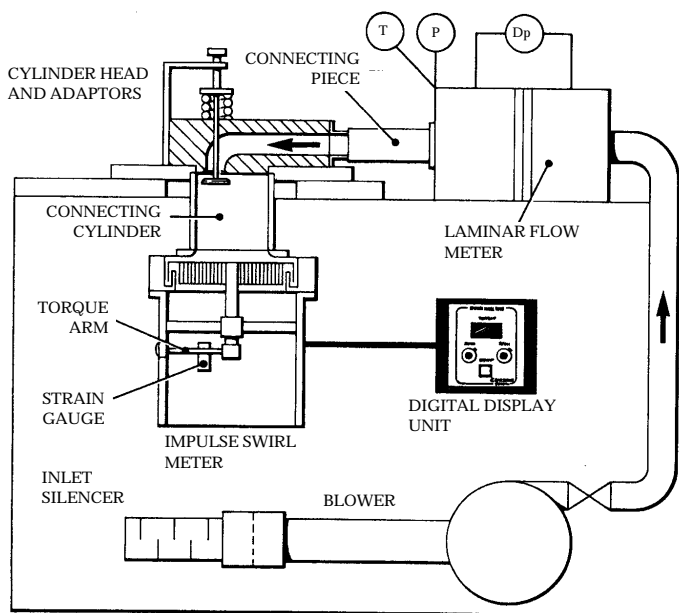
The P7302 display unit together with all the signal conditioning boards is contained in a steel case complete with carrying handle. If removed it can be mounted in a 1/2 rack case.

The front panel carries the 4 digit phosphorescent display, a mains on/off switch and zero and span potentiometers.



IMPULSE SWIRL RIGS

Cussons can design and manufacture impulse swirl rigs to suit customers specific research and development requirements.



Typically a Cussons Impulse Swirl Rig comprises a bench to position the test model, a single speed fan unit for blowing or drawing air through the model and a Cussons Laminar Flow Meter. The latter contains a contoured inlet to minimise the entrance loss to the model, serving both as an air smoothing box and as a means of flow measurement. The client's test model is connected between the laminar flow meter and the impulse swirl meter by an inlet connecting piece and a connecting cylinder.

Instrumentation includes two sloping manometers for the determination of pressure difference across the laminar flow meter, and for the measurement of pressure drop over the test model. An additional manometer is supplied to enable the pressure of the air leaving the flow meter to be measured; a resistance thermometer is supplied to measure the temperature of the air stream.

An advanced version of the rig includes a Cussons P7028 Mass Flow Computer to replace the manometers and thermometer, to give digital readout of pressure and temperature along with the value of the mass flow rate. This advanced version of the rig can also include a variable speed motor for the fan.

The unit is sized to give a flowrate of up to 100 litres/sec of air and a pressure drop over the test model of up to 300 mm of water.

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