



P6340 Wave Absorber Oscillating Air Column and P6341

INTRODUCTION

The oscillating air column uses the rise and fall of the wave to move a column of air. Cussons P6340 Oscillating Air Column Apparatus allows experiments to be carried out using such a wave absorber. Oscillating air columns can be created either on the shore, perhaps in a jetty wall or cliff face, or on a large floating structure that is stable enough not to react to waves. The Wells Turbine allows the energy of the air stream in both directions to be used to generate electricity. Cussons product P3110 The Wells Turbine, allows the performance of this device to be examined.

The scale of a student's laboratory experiment means that it is not possible to produce sufficient air flow to power a Wells turbine, so the P6340 air column uses the oscillating air to drive a pneumatic piston connected with a special pump that provides an easily variable load and measurable output.

EXPERIMENTAL CAPABILITY

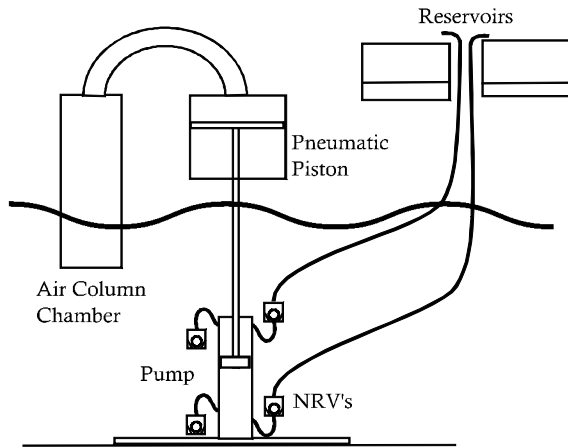
The P6340 Oscillating air column design allows experiments related to the following topics to be conducted

- ◆ The energy available from a wave
- ◆ Buoyancy and Archimedes principle
- ◆ Relationship between wave form and buoyancy

- ◆ Potential Energy in a fluid
- ◆ Float shape in determining energy extraction
- ◆ Compression of air
- ◆ Pneumatic / hydraulic pistons

DESCRIPTION

The P6340 Oscillating air column design comprises of three main sections; an open-ended, acrylic chamber to create the moving column of air, a pneumatic piston and a water pump. The acrylic chamber is supplied with adjustable legs and is weighted to stand on the floor of the wave channel. The chamber is mounted with its open-end submerged below the water level, in the path of the waves and creates a column of moving air. The upper edge of the chamber is attached to a pipe ducting the air to an acrylic cylinder, in which a lightweight piston is able to move. The energy in the wave is transferred to the air, which is in turn transferred to the piston. The piston is connected via a straight connecting rod to a double acting water pump. The double acting water pump comprises of a small piston running within a vertical cylinder. Special low resistance Non Return Valves (NRV's) allow water to be drawn into the upper side of the cylinder as the piston descends, whilst at the same time pumping water from the



P6340 Oscillating Air Column Wave Absorber

lower side of the cylinder up one outlet pipe. As the piston rises the NRV on the inlet to the upper side of the cylinder closes whilst the outlet NRV opens as water is pumped up the second outlet pipe. Similarly as the piston rises, the outlet NRV closes and the inlet NRV opens to admit water to the lower side of the cylinder.

The outlet pipes are routed to two reservoirs mounted on an integrated support stand. The height of the each reservoir can be adjusted so that a variable head, (and hence a variable load) is applied. The amount of water collected over a number of wave cycles can be measured. It should be noted that as a relatively low head of water is pumped the resistance of the NRV's must be very low, and hence some leak back is inevitable. Similarly there is some air leakage in the pneumatic cylinder. The efficiency of the absorber is therefore not accurate, but the engineering principles can still be studied and applied consistently.

TENDER SPECIFICATION

The P6340 Oscillating Air Column apparatus is to provide experiments on testing the performance of a small oscillating air column wave absorber, and is to comprise of clear open-ended chamber that can be set in a wave stream. The chamber is to be connected to a suitable pneumatic cylinder and piston driving a water pump. The chamber is to be able to accept a range of different wave concentration devices,

such as Cussons P6341 wave concentrator range. The pump is to lift water into two reservoirs to allow the energy from the upstroke of the wave to be recorded separately from the down stroke. The unit is to be suitable for use in waves up to 100mm wave height, and in water depths greater than 200mm.

PACKING DIMENSIONS

Length 1.0m Width 0.6m Height 0.4m

REQUIRED ACCESSORIES

A 300mm wave channel with wave generator is required such as Cussons P6275 Water Flow Channel and Cussons P6285 Regular Wave Maker, or access to suitable open water.

P6341 RANGE OF PITCH DEVICES

The use of an open-ended chamber allows experiments to be conducted on the natural rise and fall of the free water surface caused by the wave. However the energy of the wave can be focused onto the entrance of the air column by the use of a guide nozzle to concentrate the wave.

Cussons P6341 Wave Concentrators provide four wave nozzles made of clear acrylic, each of which can, in turn, be bolted to the leading edge of the P6340 Oscillating Air Column Experiment. One provides a short angled entrance, the width of the column, one a short angled entrance but 290mm wide, one a long shallow angled entrance and one a curved entrance.

P6341 Wave Concentrators for the Oscillating Air Column – Technical Specification

A set of four nozzle devices is to be supplied for use with Cussons P6340 Oscillating Air Column Experiment, to concentrate the waves into the column. The four concentrators are to be manufactured from clear acrylic.