

Laboratory instrumentation and software

Multi-element wavemakers



The multi-element wavemaker is used to create long and short crested waves for either deep or shallow water. Each wavemaker is custom-built to meet the client's requirements and is equipped with HR Wallingford's Active Wave Absorption System.

Installation is straightforward with HR Wallingford providing commissioning, training and on-going support.

Multi-element wavemakers

When using physical models to test the design of ports and harbours, coastal protection schemes or off-shore structures, engineers must be able to work with a wide range of realistic wave conditions.

HR Wallingford has extensive experience in designing and building wave generating systems that realistically simulate sea conditions. We have supplied wavemakers to many laboratories around the world and they have been in use on our own models at Wallingford for over 50 years.



Piston type wavemakers

HR Wallingford's piston-type multi-element wavemakers are made up from a number of self contained eight-paddle modules. This enables them to be easily installed, moved to different positions within the basin and to be extended as required.

These wavemakers are predominantly used in shallow water applications of up to 1m depth. The main advantage of this type of design is that the stroke is not limited which makes a piston wavemaker ideal for producing solitary and focused waves, absorbing reflected waves and compensating for long period set down phenomena.

Hinge type wavemakers

HR Wallingford also supplies wavemakers for deep water basins and towing tanks. These hinge type paddles are again supplied in modular frames, each with four paddles that are fixed to the inside of the basin.

The design of the hinge wavemaker support frame is such that it can be incorporated into basins and towing tanks with a two point fixing system that allows the modules to be removed for periodic maintenance.

Paddle drive system

Paddle width varies from 0.5-0.75m depending upon the client's requirements. All paddles are of a wet-back design which means that there are no complicated seals between paddles or the basin walls and the floor. The paddles are mounted on linear slide assemblies that are supported from a common framework for the piston paddles. This leaves all motors, bearings and precision components well above the water level. All mounting parts below water level in the hinge paddle are rated for operation in this environment.

Each paddle is driven by an electric servo motor operating through a gearbox and either a rack and pinion for the piston, or toothed belt for the hinge paddles. The gearbox has an eccentric mounting to allow the rack and pinion to mesh with negligible backlash. The paddles are designed in such a way that the possibility of side movement is minimised and interference by overlapping is prevented.

All components are made from corrosion resistant steel that ensures reliable and low maintenance operation. The design of both drive systems ensures that they do not require a sealed lubrication system. All that is needed is an occasional clean and re-grease to maintain them in good operational condition. The framework of each module is made from stainless steel, the paddles from either glass reinforced plastic, or folded stainless steel sheet.

In order to reduce space behind the wavemaker, a beach is incorporated into the framework of each module to absorb any splashing or back waves. This beach is made from a reticulated plastic foam.



The servo motors are controlled by intelligent digital drives. Each drive provides all the gain and damping for the motor to ensure that the paddle accurately follows the position demand signal. While the wavemaker is running, the drives can be interrogated and a variety of parameters can be monitored such as the motor speed, current and drive temperature.

Control System

Due to the mobility of the piston wavemaker modules, a motor drive cabinet is mounted on the framework. This houses all the motor drives and associated controls. For deep water hinge wavemakers the Motor Drive Control Panels (MDCP) are located outside the tank, to the rear of the modules. Allowance for the routing of cables should be considered during the design stages.

HR Wallingford's multi-element wavemakers run with HR Merlin signal generation software – see brochure 'Wave generation software' (EQ-010).

The output from the signal generation computer is transferred to an embedded PLC, which is located in the MDCP. For installations where the control room is some distance from the wavemaker we provide a remote control unit to provide an emergency stop button for the operator. There is a second emergency stop button mounted on to the MDCP.

Active Wave Absorption

In some studies, there can be considerable reflection from the model being tested. Active wave absorption, however, overcomes this problem and provides precise control of wave conditions throughout the model. Without Active Wave Absorption, these reflected waves would be re-reflected from the paddle and build up in the basin. This will result in the wave spectra becoming distorted and, in the extreme case, the waves becoming unstable. Active wave absorption prevents waves being reflected back from the paddle by measuring the wave height at the paddle. It then modifies the demand signal in real time to take account of the additional waves that have been reflected from the model in the basin.

Design life

The motors, drives and bearing assemblies of the wavemaker are standard components in a wide range of industries where they often run continuously. In comparison, wavemakers tend to be used for only a few hours a day and there are often long periods between studies while models are built and bathymetry constructed.

Studies usually use random waves which impose less wear on the components than the peak demands of the regular waves that they have been designed for. For these reasons, a wavemaker can be expected to have a life well in excess of 20 years.

Key features

Generates short and long-crested random waves at normal and oblique angles using HR Merlin signal generation software

Dynamic Wave Absorption guarantees precise control of wave conditions

Wet-backed piston paddles ensure that performance is not limited by stroke for shallow water applications

Stainless steel and GRP construction delivers a design life in excess of 20 years

Digital AC servo motors provide precise control and rapid response

Wavemakers supplied in either 4 or 8 paddle modules for ease of installation

Easy to maintain with all precision components above water

Hinge flap wavemakers are available for deep water basins, designed for easy removal of modules for maintenance tasks.

HR Wavemakers use HR Merlin wave generation software
(refer to brochure EQ-010 for the sea states available)

