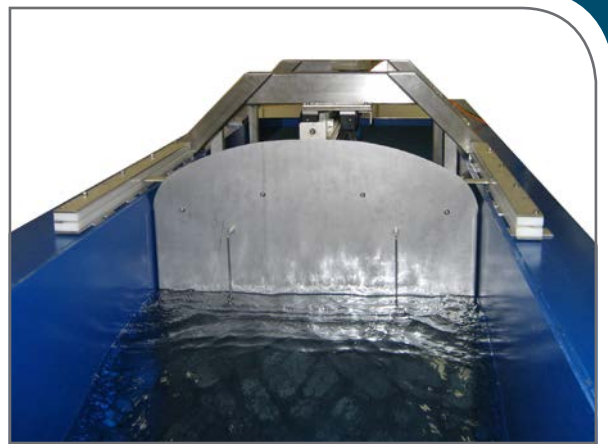


Laboratory instrumentation and software

Flume wavemakers



As one of the world's leading hydraulics laboratories, HR Wallingford has more than 50 years experience in all aspects of physical modelling and has supplied wavemakers to laboratories around the world.

Each wavemaker is custom-built to the client's requirements and is equipped with HR Wallingford's Active Wave Absorption System.

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

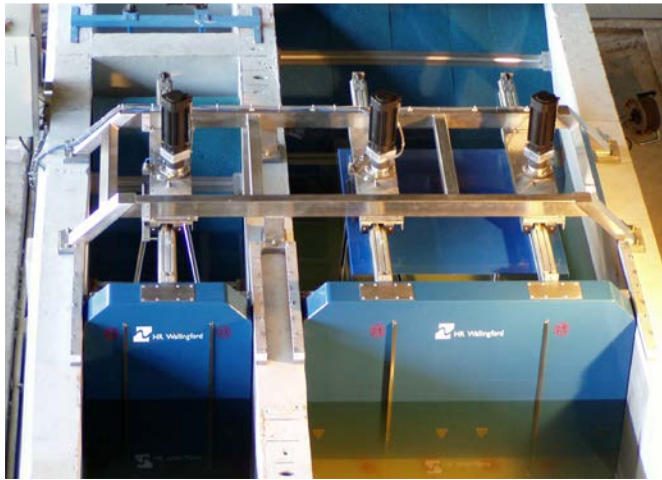
Flume wavemakers

When using physical models to test the design of coastal structures or to investigate wave processes, 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 many years.

Flume wavemakers are normally driven by AC electric servo motors. Very large wavemakers are hydraulically powered.

Flume wavemakers are based on a wet-back design for simplicity and ease of maintenance. All flume wavemakers have active wave absorption fitted as standard.



Electrically powered wavemakers

Piston type wavemakers

For water depths up to 1.5 m the wavemaker is typically a piston type design where the paddle moves backwards and forwards horizontally. The advantage of this type of design is that the stroke is not generally limited, making the piston wavemaker ideal for producing solitary waves, absorbing reflected waves and compensating for long period set down phenomena.

Depending upon the width of the flume, the paddle is mounted underneath either one or two electric drive actuators. These actuators are suspended from a structure that spans the flume walls. Alternatively the structure can be free-standing if required. With this arrangement all the bearings and precision components are situated well above the water level.

Each drive actuator comprises a specially designed extruded beam which runs between a series of linear bearings. This beam is driven backwards and forwards by digital AC servo motor that operates through a gearbox with rack and pinion. The motor has a low inertia which is necessary for high frequency operation and the rack and pinion allows the high velocity to be achieved which would not be possible with other types of drive.

The gearbox has an eccentric mounting to allow the rack and pinion to mesh without backlash. The rack and pinion method of driving the paddle is simple and does not require a sealed lubrication system. All that is required is an occasional wipe down and re-grease to maintain it in good condition. The result is a reliable wavemaker with low maintenance requirements.

Stainless steel is used for all the metal work of the wavemaker. The rack is also made of stainless steel and the bearings and bearing slides have a special corrosion resistant coating.

An absorbing beach is fitted behind the paddle to prevent splashing. The beach consists of an open cell foam material which is held in place within the framework of the wave maker.

The AC servo motor is controlled by an intelligent digital drive. The 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 drive can be interrogated and a variety of parameters can be monitored such as the motor speed, current and drive temperature.

Hinge flap type wavemakers

This type of wavemaker is best suited to deeper water applications and is often used for ship towing tanks.

The wavemaker comprises a paddle that is hinged either on the bottom of the flume or on a raised supporting structure. The movement of the paddle is limited to approximately ± 15 degrees to prevent wave distortion.

Again the design of this wavemaker ensures all of the drive actuation system is kept well above the water level with the use of a flexible belt and quadrant to drive the paddle. For wider flumes and towing tanks a dual actuator is used to achieve the required wave heights. The control system for the hinged flap wavemaker is the same as that for the piston type.



Control system

The motor drive and electronics for the paddle are housed in a Motor Drive Control Panel (MDCP) that is mounted beside the flume.

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.

Design life

The motor, drive and bearing assembly 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 also 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 an operational life well in excess of 20 years.

Active wave absorption

In many studies, there can be considerable reflection from the model being tested.

However active wave absorption overcomes this problem and provides precise control of wave conditions throughout the model.

Without active wave absorption, these reflected waves will be re-reflected from the paddle and build up in the flume. This results in the wave spectra becoming distorted and, in the extreme case, the waves becoming unstable

Dynamic 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 at the other end of the flume.

Hydraulically powered wavemakers

Hydraulically powered wavemakers are usually of the piston type. The largest wavemaker supplied by HR Wallingford to date was hydraulically powered and was for a flume 5m deep and 3m wide.

Key features

Generates long-crested random waves using HR Merlin signal generation software

Dynamic Wave Absorption guarantees precise control of wave conditions

Wet-backed piston paddle provides long stroke

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

Digital AC servo motor provides precise control and rapid response

Easy to maintain with all bearings and precision components above water

Hinged flap wavemakers are available for deep water and hydraulically powered wavemakers are available for very large flumes

