

9. Facilities and Instrumentations

The development and experience in use of specialized model testing facilities and instrumentation for ocean engineering will be an important concern of the Committee. Emphasis is placed on the study of wave generation systems for irregular and directional waves, current and wind generation systems, and on special instrumentation for the long-range monitoring of free-floating models with respect to position, motions, forces and data telemetry.

(Recommendation, O.E., Comm., 15th ITTC)

by

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Details of principal items of facilities and instrumentations which were presented from organizations in Japan are shown in the "Japan Towing Tank Conference (J.T.T.C.) Catalogue of Facilities and Instrumentations for Ocean Engineering" annexed in the end of this chapter.

In this catalogue, only the facilities of organizations belonging to J.T.T.C., namely the facilities related to towing tanks, are shown.

But of course, in Japan, there are many facilities which are connected with the Ocean Engineering in the field of what is called Civil Engineering such as Port and Harbor Engineering, Coastal Engineering and Fisheries Engineering.

In recent years, the expansion of the facilities in this Civil Engineering field is remarkable like those for Ocean Engineering Research in the Naval Architecture Field as shown in the already mentioned catalogue.

But we leave the introduction of the facilities of Civil Engineering Field to another chance and refer only to that of the field of Naval Architecture.

In order to respond to the increase of the need of making tank tests on Ocean Engineering Field, almost all Japanese Ship Model Testing Tanks adjusted and expanded facilities and measuring instruments to be able to make some what experiments on this field.

On the other hand, tanks which are aimed at making experiments on Ocean Engineering from the beginning of their construction plan are also completed.

First of all, we will describe these exclusive tanks. Offshore Structure Experimental Basin of Ship Research Institute is a typical exclusive large rectangular experimental tank with current generator. Rectangular experimental tank of Sumitomo Heavy Industries, Ltd. (in Hirakata) is the one which can be made experiments on ships, but it will be said that it is an Ocean stressed new type multi-purpose tank both for ships and ocean engineering equipped with large scale current generator and with simple wind generator. Rectangular tank of "Japan Foundation for Shipbuilding Advancement (in Tsukuba)" was made for the special purpose of studying oil spill prevention, but it is the largest rectangular tank as an exclusive experimental tank for Ocean Engineering in the field of ships.

As one of the latest facilities which have all functions as an Ocean Engineering Rectangular Tank, there is a Current Water Tank of Mitsui Engineering and Shipbuilding Co., Ltd. (in Akishima).

Above functions are such that, bottom character is variable by the sand pit, wave and current are generated by the regular instruments and shallow water experiments are easily conducted.

As similar facilities, the Offshore Structure Experimental Tank of Mitsubishi Heavy Industries (M.H.I.), Ltd. (in Hiroshima) had been already

constructed.

Above two are unique all-round experimental tanks which were born during the effort of those people of naval architecture for responding to the needs of making ocean engineering field experiments and so those facilities have contrasts comparing with those of the civil engineering field which possesses many experimental tanks of single function.

The wave flume of NIPPON KOKAN Co., Ltd. (in Tsu) is a large, glass fitted, wave flume with a pit for sand, but it is different from that of civil engineering field because this flume mainly aims at making experiment of offshore structure models in waves.

The Wave Current Wind Generating Tank of Hitachi Shipbuilding & Engineering Co., Ltd. has an outstanding characteristics of being able to generating waves from both ends of the tank, and the Internal Wave Tank of Research Institute For Applied Mechanics of Kyushu University is a wave flume with wind blower but current generation is also capable.

Above two will be said to be tanks of aiming at studying interaction between wave, wind and current.

As exclusive tanks for ocean engineering, other tanks such as the Hydraulic Channel of Ishikawajima-Harima Heavy Industries (I.H.I.) Co., Ltd. (in Yokohama) which has strong color of civil engineering, and that of Mitsui Ocean Development & Engineering Co., Ltd. (in Tamano) will be listed up.

Tsuyazaki Sea Safety Research Laboratory of Research Institute For Applied Mechanics in Kyushu University have facilities such as various kinds of experimental tanks and wind tunnels, and play an important role as a special research organization for ocean engineering.

In that Laboratory, they grapple with works for the actual machine development and studies about actual ocean surfaces, for example, the trial construction of the Ocean Observation Station and ocean wave measurement by the wave buoy.

Above tanks are those for exclusive use for ocean engineering, but, as facilities related to this ocean engineering field in Japan, those which are in combined use with ships and ocean engineering must not be overlooked.

Namely, large rectangular tanks of Tokyo University (in Chiba), Ship Research Institute of Ministry of Transport (in Tokyo), I.H.I. (in Yokohama) and M.H.I. (in Nagasaki) for seakeeping experiments, which are the pride of Japan to the world, are often used for ocean engineering, and those can be said the most important facilities in this field in Japan.

Any one of those tanks are equipped with long spanned wave generator on two sides of tank wall and this is characteristics that other foreign tanks of this kind do not possess.

Recently constructed Japanese towing tank, without exception, have

superior wave makers capable of generating random waves and have measuring instruments for offshore models.

So, it will be said that, in Japan, there are many superior and very long experimental tank for floating offshore structures or for structures in deep sea.

In Japan, abilities for generating irregular waves and for disposing and analyzing irregular wave data are superior from the averaged point of view.

And so, the generation of irregular waves with given design spectra and the generation of transiently concentrated waves which correspond to extreme waves, they are discussed recently, are capable in most of tanks, and then the technical level in this field is very high.

And further, the fact that the abilities of collecting, disposing and analyzing irregular phenomena are in high level, is a characteristics of Japanese experiental tank.

It is regretted that, in Japan, although there are tanks which are capable of generating two directional short crested waves by the two sided wave generator or short crested waves by the multi-divided wave generator, we have not wave maker yet which can generate short crested irregular waves especially with desired two dimensional spectrum.

Evaluation of current and wind generator in Japan is not fixed because those instruments have not much actual operation results.

As mentioned above, it will be recognized that the Japanese facilities of experimental tanks relating to Ocean Engineering have been coming full, even if we confine the description within the field of shipbuilding.

But the completion of these leading experimental tanks are only in quite recently, and it will be said that they are not yet used effectively.

So, it is also said that experimental results and published papers are not so many comparing to the numbers of facilities existing now.

From now, according to the effective use of these facilities, small facilities and instruments will become fully equipped, and experimental methods will also becoming established.

Further, there is a tendency to make joint research with organizations possessing experimental tank equipped latest instruments in the field of Civil Engineering.

So, it can be said that Japanese facilities for Ocean Engineering have an integrated ability which covers wide field and we can proud of it in the world.

Then, it will be very clear that in the near future, they can contribute to the development of this Ocean Engineering field in the world.

LIST
OF
JAPAN TOWING TANK CONFERENCE CATALOGUE OF FACILITIES & INSTRUMENTATIONS
FOR
OCEAN ENGINEERING

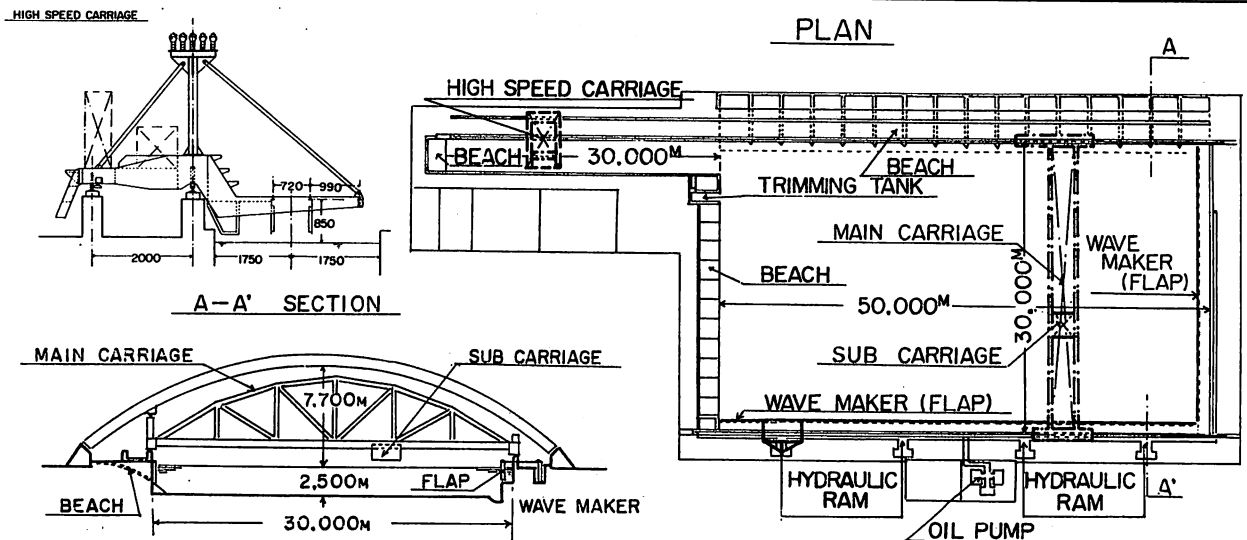
1	THE UNIVERSITY OF TOKYO FACULTY OF ENGINEERING YAYOI-CHO, CHIBA 280	Phone (0472)51-3516
1-1	SEAKEEPING AND MANOEUVRING TANK (1969)	
2	INSTITUTE OF INDUSTRIAL SCIENCE UNIVERSITY OF TOKYO 7-22-1 ROPPONGI, MINATOKU, TOKYO 106	Phone (03) 402-6231
2-1	SEAKEEPING BASIN (1965)	
3	DEPARTMENT OF NAVIGATION TOKYO UNIVERSITY OF MERCANTILE MARINE 2-1-6 ETCHUJIMA, KOTO-KU, TOKYO 135	Phone (03) 641-1171
3-1	SEAKEEPING TANK WITH WIND TUNNEL (1959, REMOVAL OF THE TANK ESTABLISHED IN 1955)	
4	DEPARTMENT OF NAVAL ARCHITECTURE AND OCEAN ENGINEERING FACULTY OF ENGINEERING, YOKOHAMA NATIONAL UNIVERSITY TOKIWA-DAI, HODOGAYA-KU, YOKOHAMA 240	Phone (045) 335-1451
4-1	TOWING AND SEAKEEPING TANK (1977, RENEWAL OF THE OLD TANK ESTABLISHED IN 1934)	
5	DEPARTMENT OF MECHANICAL ENGINEERING NATIONAL DEFENSE ACADEMY 10-20 HASHIRIMIZU 1-CHOME, YOKOSUKA, 239	Phone (0468)41-3810
5-1	CIRCULATING WATER CHANNEL (1956)	
6	OSAKA UNIVERSITY DEPARTMENT OF NAVAL ARCHITECTURE YAMADA-OKA-2-1, SUITA, OSAKA 565	Phone (06)877-5111
6-1	TOWING AND SEAKEEPING TANK (1970)	
7	DEPARTMENT OF NAVAL ARCHITECTURE COLLEGE OF ENGINEERING UNIVERSITY OF OSAKA PREFECTURE 4-804 MOZU-UMEMACHI, SAKAI, OSAKA 591	Phone (0722)52-1161
7	TOWING TANK (1949)	
8	DEPARTMENT OF NAUTICAL STUDIES KOBE UNIVERSITY OF MERCANTILE MARINE 1-1, 5-CHOME, FUKAE-MINAMI-MACHI, HIGASHINADA-KU KOBE, 658, JAPAN	Phone (078)453-2332
8-1	SHALLOW WATER TOWING TANK (1973)	
8-2	CIRCULATING WATER TANK	

9	DEPARTMENT OF NAVAL ARCHITECTURE FACULTY OF ENGINEERING, HIROSHIMA UNIVERSITY 3-8-2, SENDA-MACHI, HIROSHIMA 730	Phone (0822)41-1161
9-1	TOWING TANK (1967)	
10	DEPARTMENT OF NAVAL ARCHITECTURE FACULTY OF ENGINEERING, KYUSHU UNIVERSITY HAKOZAKI, HIGASHI-KU, FUKUOKA 812	Phone (092)641-1101
10-1	SEAKEEPING AND MANOEUVRING BASIN (1961)	
11	TSUYAZAKI SEA SAFETY RESEARCH LABORATORY, RESEARCH INSTITUTE FOR APPLIED MECHANICS, KYUSHU UNIVERSITY HAKOZAKI, HIGASHI-KU, FUKUOKA 812	Phone (092)641-1101
11-1	TOWING AND SEAKEEPING TANK (1963)	
11-2	INTERNAL WAVE TANK WITH WIND-BLOWER (MULTIPURPOSE WATER TANK)	
12	INSTITUTE OF OCEAN ENVIRONMENTAL TECHNOLOGY JAPAN FOUNDATION FOR SHIPBUILDING ADVANCEMENT 2 MINAMIHARA, OHO-MACHI, THUKUBA-GUN, IBARAGI-PREFECTURE 305	Phone (0298)64-2125
12-1	RECTANGULAR TANK (1978)	
12-2	CIRCULATING WATER CHANNEL (1978)	
13	SHIP RESEARCH INSTITUTE MINISTRY OF TRANSPORT SHINKAWA 6-38-1, MITAKA-SHI, TOKYO 108	Phone (0422)45-5171
13-1	MITAKA NO. 2 SHIP MODEL EXPERIMENT TANK (1965)	
13-2	MITAKA NO. 3 SHIP MODEL EXPERIMENT TANK (1972)	
13-3	OFFSHORE STRUCTURE EXPERIMENTAL BASIN (1978) ... (Rectangular Tank)	
14	AKISHIMA LABORATORY, MITSUI ENGINEERING & SHIPBUILDING CO., LTD. TSUTSUJIGAOKA 1-1-50, AKISHIMA-SHI, TOKYO 196	Phone (0425)45-3111
14-1	LARGE TOWING TANK (1978)	
14-2	SMALL TOWING TANK (1978)	
14-3	CIRCULATING WATER CHANNEL (1970)	
14-4	CURRENT WATER TANK (1978)	

15	RESEARCH INSTITUTE ISHIKAWAJIMA-HARIMA HEAVY INDUSTRIES CO., LTD. 1, SHIN-NAKAHARA-CHO, ISOGO-KU, YOKOHAMA 235 Phone (045)751-1231 Telex IHICO J47758
15-1	HYDRAULIC CHANNEL NO. 1 (1971)
15-2	HYDRAULIC CHANNEL NO. 2 (1971)
15-3	TOWING TANK (1966)
15-4	SEAKEEPING AND MANOEUVRING BASIN (1975)
16	HYDRODYNAMICS SECTION, HIRATSUKA RESEARCH LABORATORY SUMITOMO HEAVY INDUSTRIES, LTD. YUHIGAOKA 63-30, HIRATSUKA-SHI, KANAGAWA-KEN Phone (0463)23-1811
16-1	SEAKEEPING AND MANOEUVRING BASIN (1979)
17	TSU RESEARCH LABORATORIES, TECHNICAL RESEARCH CENTER, NIPPON KOKAN K.K. 1-KUMOZU KOKAN-CHO, TSU-CITY, MIE-PREF Phone (0592)34-3111
17-1	SHIP MODEL BASINS (1977)
17-2	WAVE FLUME (1977)
18	AKASHI SHIP MODEL BASIN CO., LTD. 3-1, KAWASAKI-CHO, AKASHI Phone (078)922-1200 Telex 5628815
18-1	TOWING TANK (1971)
19	TAMANO COASTAL LABORATORY MITSUI OCEAN DEVELOPMENT & ENGINEERING CO., LTD. GOKAN 2032, TAMANO-SHI, OKAYAMA-KEN 706-03 Phone (0863)41-1525
19-1	SMALL TOWING TANK (1974)
20	HIROSHIMA EXPERIMENTAL TANK HIROSHIMA TECHNICAL INSTITUTE MITSUBISHI HEAVY INDUSTRIES, LTD. 4-6-22, KAN-ON-SHIN-MACHI, HIROSHIMA 733 Phone (0822)91-2111
20-1	OFFSHORE-STRUCTURE EXPERIMENTAL TANK (1969) (SEA-BED SOIL SIMULATION BASIN)
21	NAGASAKI EXPERIMENTAL TANK, NAGASAKI TECHNICAL INSTITUTE, MITSUBISHI HEAVY INDUSTRIES, LTD. 1-1 AKUNOURA-MACHI, NAGASAKI 850-91 Phone (0958)61-2111
21-1	SEAKEEPING AND MANOEUVRING BASIN (1972)

1-1 FACILITIES

SEAKEEPING AND MANOEUVRING TANK (1969)



DESCRIPTION OF CARRIAGE: Main and sub-carriage (x-y carriage) over the main part of basin (50 m x 30 m) and a high speed carriage of a cantilever type along 80 m wall of the basin.

TYPE OF DRIVE SYSTEM AND TOTAL POWER : SCR, main : 36 kW
 Sub : 2.2 kW
 High speed: 7.4 kW

MAXIMUM CARRIAGE SPEED : Main : 1.6 m/s
 Sub : 1.8 m/s
 High speed: 5 m/s

OTHER CAPABILITIES : Rotating arm with the maximum turning radius of 12 m can be fitted on the main carriage. x-y carriage has an automatic control system based on a mini-computer which is capable of controlling the sub-carriage to move through any predetermined loci such as a circle, a sinusoid, etc.

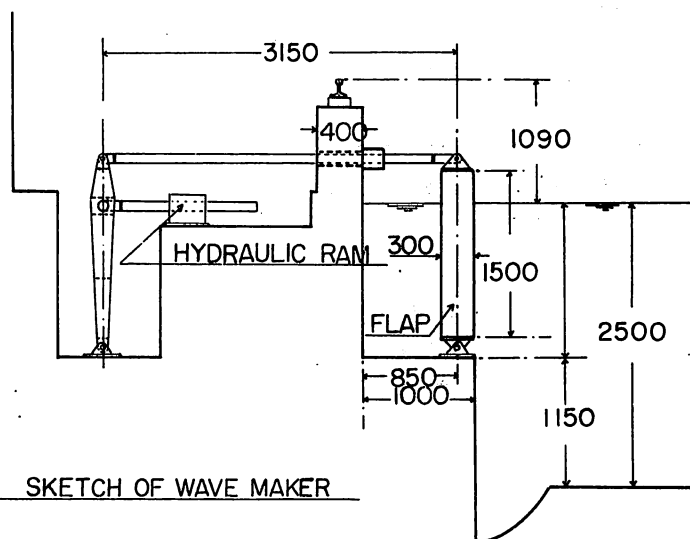
WAVE MAKER

Type : Flap type, 50 m in a body and 30 m consisting of two sections

Drive system : Hydraulic pump

Wave generation capability : Regular and irregular, wave length: 0.8 ~ 10 m, maximum wave slope 6°, short crested wave as the sum of two long crested waves with different different direction of travelling can be created.

Sketch of Wave Maker:



WAVE ABSORBER

Type : Beach with a parabolic arc
 Length : 6 m

INSTRUMENTATION

TEST PERFORMED : Motions in waves of floating or moored bodies, forces in waves of fixed bodies, forced oscillation of floating bodies
 WATER DEPTH : Normal depth of water is 2.5 m, shallow water experiments are carried out by using false bottom

MEASURING APPARATUS

Wave measurement: Resistance wire and capacitance type probe
 Motion in waves : Six-components motion guide with potentiometers, gyroscope
 Force and moment: Three-components block gauge

DATA RECORDING

Data recorder : Analogue data recorder with six channels
 Data processing : Stored in mini-computer after A-D transformation

METHODS OF TESTING

MODELS

Size : 5 m x 5 m for floating bodies
 Material : Wood, plastics, metal

USED WAVES

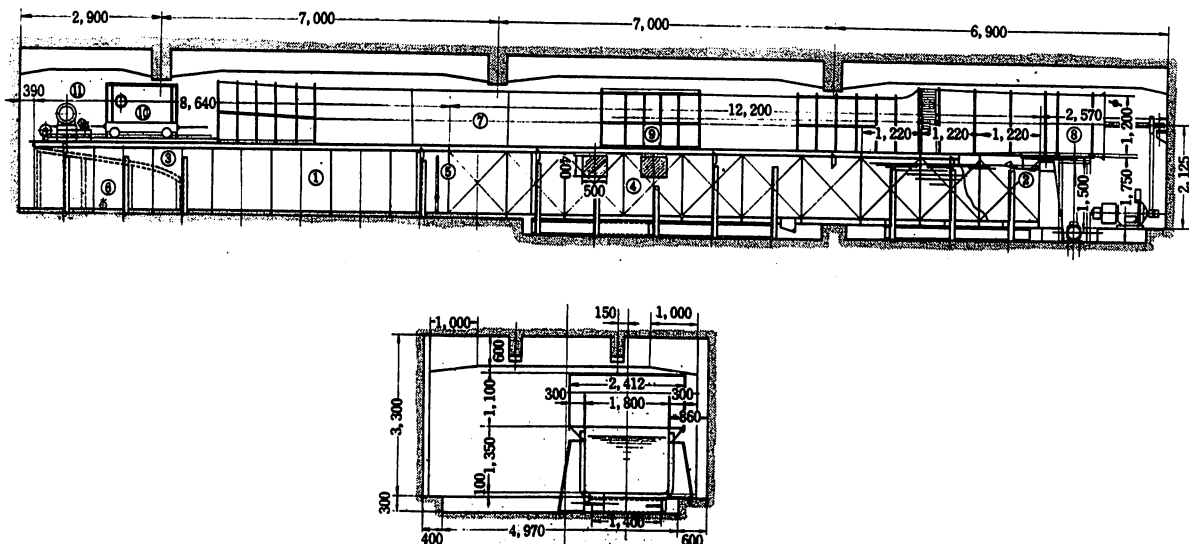
Irregular wave : ITTC and ISSC wave spectra
 Extreme wave : Transient water wave is used for extremely high wave

PUBLISHED DESCRIPTION

1. Proceeding of 12th ITTC
2. Jour. Soc. Nav. Arch. Japan, Vol. 128, 1970
3. Jour. Soc. Nav. Arch. Japan, Vol. 129, 1971

2-1 FACILITIES

SEAKEEPING BASIN (1965)



General Arrangement

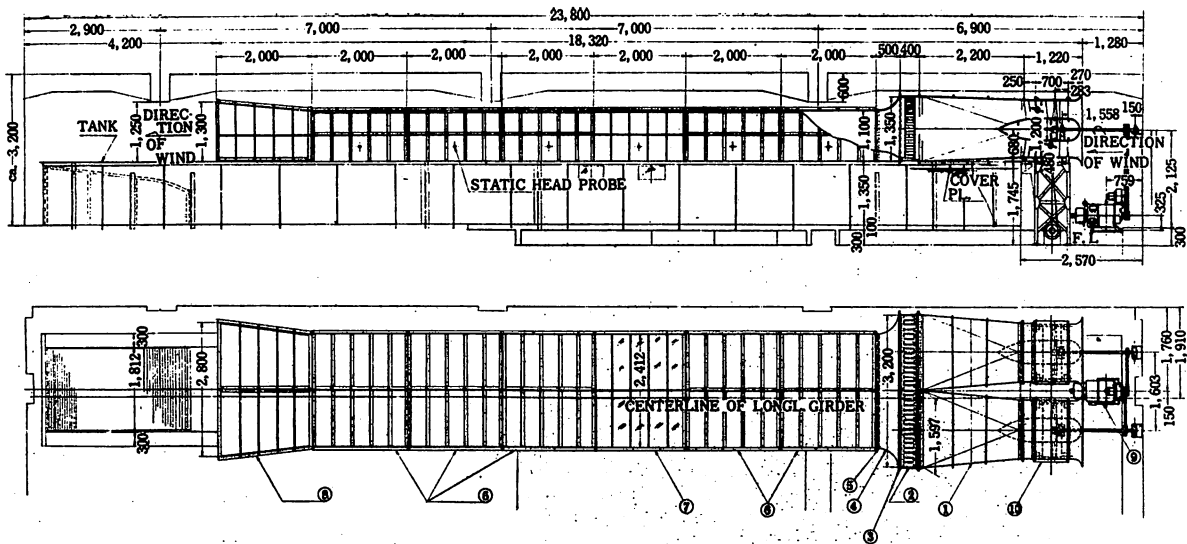
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|----------------------|-------------------|---------------------|
| 1 Tank | 5 Supply pipe | 9 Transparent panel |
| 2 Wave maker | 6 Discharge valve | 10 Carriage |
| 3 Wave absorber | 7 Wind tunnel | 11 Driving gear |
| 4 Observation window | 8 Fan | |

WAVE MAKER

Type : Oscillatory flap type
 Drive system : Hydraulic actuator with servo control
 Regular waves : Wave length (m) 6 3 1 0.5 0.3
 Max. height (m) 0.06 0.08 0.08 0.05 0.03
 Max. steepness 1/100 1/37.5 1/12.5 1/10 1/10
 Irregular waves : Waves having specified wave spectra

WIND GENERATOR

Type : Fixed type
 Wind direction : Follow to waves
 Area : 2.0 m wide x 1.1 m high
 Speed : 10 m/s max.
 Wind gust : Unavailable
 Generator : 11 kW axial blower
 Sketch of wind generator:



General arrangement of wind blowing facilities

- | | | | | | |
|---|-------------------|---|----------------------------|----|--------------------|
| 1 | Decelerator | 5 | Fine screen | 9 | 11kW driving motor |
| 2 | Current regulator | 6 | Portable wind panels | 10 | Propeller fan |
| 3 | Coarse screen | 7 | Plastic transparent panels | | |
| 4 | Accelerator | 8 | Diverging outlet | | |

INSTRUMENTATION

TEST PERFORMED

- Motions of ships and off-shore structures in waves and in wind/waves.
- Forced oscillation of ships and off-shore structures in calm water.
- Performance of floating break water

MEASURING APPARATUS AND TRANSDUCER

Wave : Capacity type wave height meter
 Motion in waves : Double carriages type motion detector
 Total force and moment: Strain gauge type dynamometer
 Others : Local force, pressure

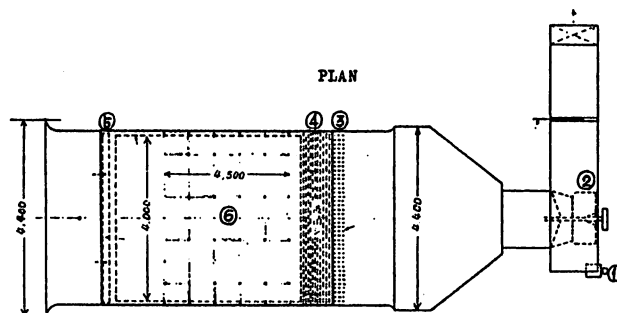
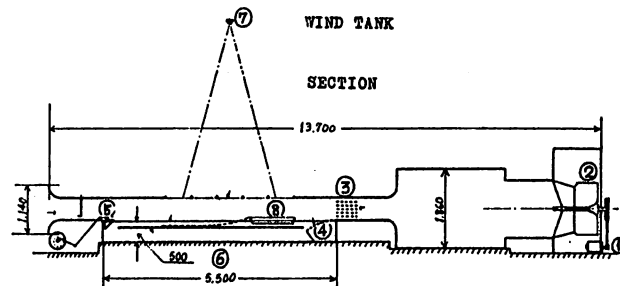
METHOD OF TESTING

MODELS

Size : 0.5 - 1.5 m for ship model
 0.3 - 0.6 m breadth for off-shore structure
 Material : Wooden, FRP, Vinyl chloride

3-1 FACILITIES

SEAKEEPING TANK WITH WIND TUNNEL (1959, removal of the tank established in 1955)

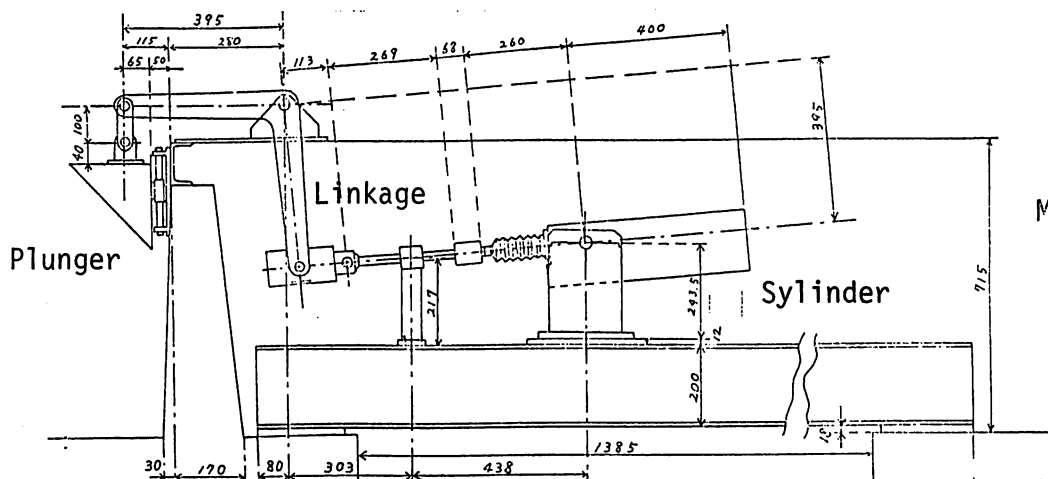


- | | |
|----------|------------|
| 1. Motor | 5. Plunger |
| 2. Fan | 6. Basin |
| 3. Vane | 7. Camera |
| 4. Beach | 8. Model |

WAVE MAKER

Type : Plunger type, variable stroke in driving
 Drive system : electro-hydraulic
 Regular waves : Wave length (m) 1.4 1.0 0.6 0.2
 Max. height (m) 0.047 0.050 0.060 0.022
 Max. steepness 1/30 1/20 1/10 1/10
 Range of water : 0 - 0.45 m (false bottom is installed)
 depth

Sketch of wave maker



Max. Stroke
 ± 50mm

WIND GENERATION

Type : Suction type, fixed
Wind direction : 1
Area : 3.73 m x 8.32 m
Range of speed : 0 - 6 m/sec

INSTRUMENTATION**TEST PERFORMED**

Motions in waves, winds } Floating, moored, fixed
Forces in waves, winds }
Ship colliding force with ocean structures

MEASURING APPARATUS & TRANSDUCER

Wave : Electric capacitance types
Motions in waves: Measurement apparatuses with potentiometers,
photograph
Dynamic total : Dynamometer utilized wertheim effect on magnetism
force and moment

DATA RECORDING & ANALYSIS

Data recorder : Multi channel analogue data recorder of cassette
magnetic tape

METHODS OF TESTING**MODEL**

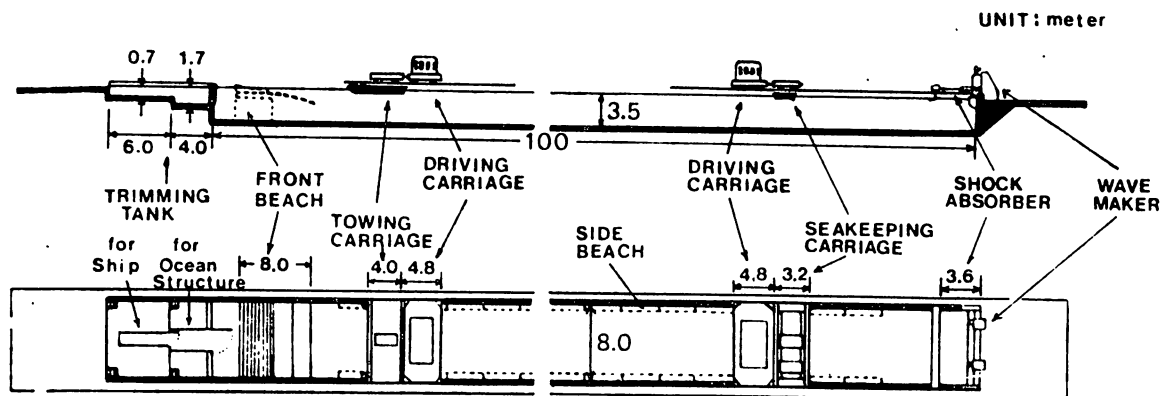
Ship & ocean : Length : 1 - 2 m
structure : Material : Wood

SIMILITUDE

Froude's law

4-1 FACILITIES

TOWING AND SEAKEEPING TANK (1977, renewal of the old tank established in 1934)



DESCRIPTION OF CARRIAGE : Three rigid carriages with connector, towing tests are carried out by the towing carriage with driving carriage, dynamic tests are performed by the seakeeping carriage with driving carriage:

TYPE OF DRIVE SYSTEM AND TOTAL POWER : Automatic sequence drive system.
 Thyrista-Leonard controle. 7.5 KW x 4

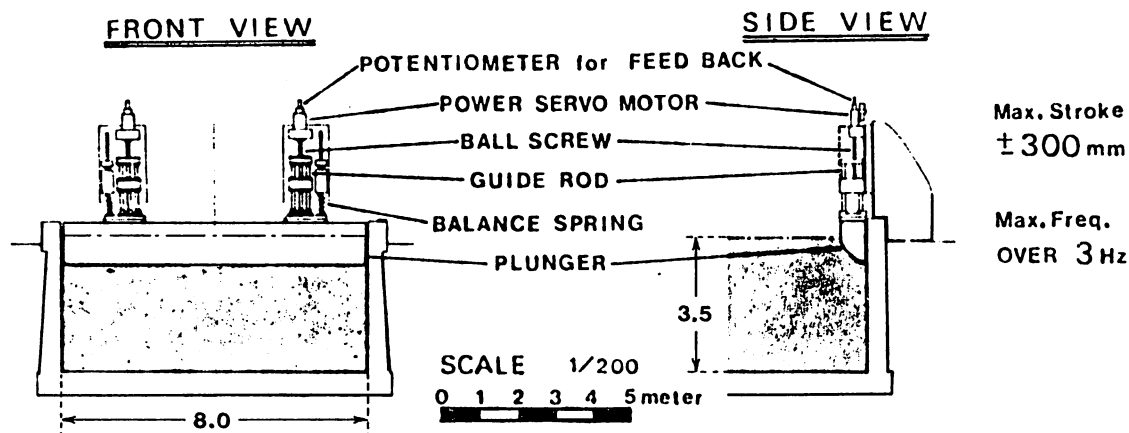
CARRIAGE SPEED : Maximum speed 4.0 m/sec. speed setting accuracy ± 0.01 m/sec., speed fluctuation within 1.5 mm/sec (RMS).

OTHER CAPABILITIES : Longitudinal or lateral forced oscillator can be fitted on the seakeeping carriage. Large amplitude PMM on the seakeeping carriage.

WAVE MAKER

Type : Plunger type, variable stroke in driving
 Drive system : Pure electric motor drive servo system
 Regular waves : Wave length (m) 30 10 6 4 2 0.4
 Max. height (m) 0.1 0.2 0.3 0.4 0.2 0.04
 Max. steepness 1/300 1/50 1/20 1/10 1/10 1/10
 Irregular waves : Waves having specified wave spectra are used in routine tests. Extreme waves having specified spectra can be generated.
 Short crested waves : Generation of short crested irregular waves having specified two dimensional spectra is planned.
 Others : Transient water waves are used instead of regular waves on the frequency response experiments in waves. Specified wave profile at specified position can be created.
 Range of water depth : 0 ~ 3.5 m (on plan to fix the buoyancy balanced false bottom in experimental zone)

Sketch of wave maker



INSTRUMENTATION

TEST PERFORMED

Motions in waves	} Floating, moored, fixed	} Deep, Shallow (Planned)
Forces in waves		
Forced oscillation, planar motion		
Resistance		

MEASURING APPARATUS & TRANSDUCER

Wave probe : Electric resistance and capacitance types

Motions in waves: Mechanical six degrees or four degrees motion measurement apparatuses with six or four potentiometers in ordinary experiments. Small vertical gyro and mini triaxial accelerometers in special cases.

Dynamic total forces and moment : Assembly block transducer of strain gauge force pick-up

Dynamic local forces : Strain gauge

Dynamic local pressures : Micro pressure gauge of semi conductive strain gauge type

Dynamic Acceleration : Mini accelerometers of strain gauge type

DATA RECORDING & ANALYSIS

Data recorder : Multi channel analogue data recorder of open reel and cassette magnetic tape

Data processor : Multi channel data processor with multiplexer, A/D converter, tape puncher, printer and real time D/A converter

Computer : Large off-line computer with TSS terminal for regular analysis. Micro computer with X-Y plotter for data processing and first stage analysis.

Real time analyser : Real time wave analyser with A/D converter, graphic display and hard copyer for auto, cross power spectrum, frequency transfer function and statistical computation (mean, maximum value, histogram of amplitude and period etc.)

METHODS OF TESTING

MODEL

Floating Platform : Length: : 1.5 ~ 2.5 m
Scale : 1/50 ~ 1/100
Material : Wood, aluminum

SIMILITUDE

Tests in waves: Froude's law only

USEING WAVE FOR TESTS

Frequency response : Regular waves and transient waves for search of tests in waves frequency transfer functions. Irregular waves for check of linear superposition.

Severe seastate tests: High irregular waves having "design wave spectra". No use regular waves corresponding to "design wave".

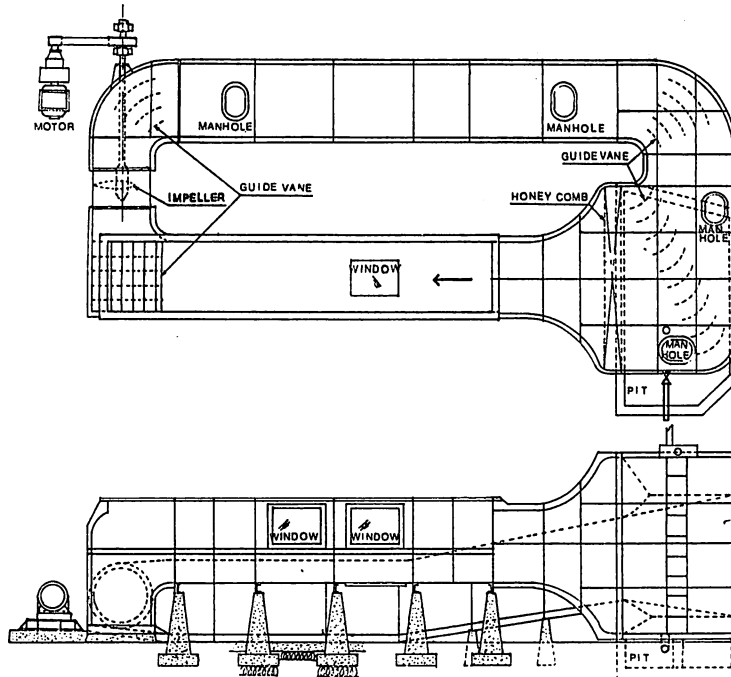
Extreme waves : Concentrating transient waves at chosen point in tank having Fourier spectra corresponding to the "design wave spectra".

DEPARTMENT OF MECHANICAL ENGINEERING
 NATIONAL DEFENSE ACADEMY
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5-1 FACILITIES

CIRCULATING WATER CHANNEL (1956)



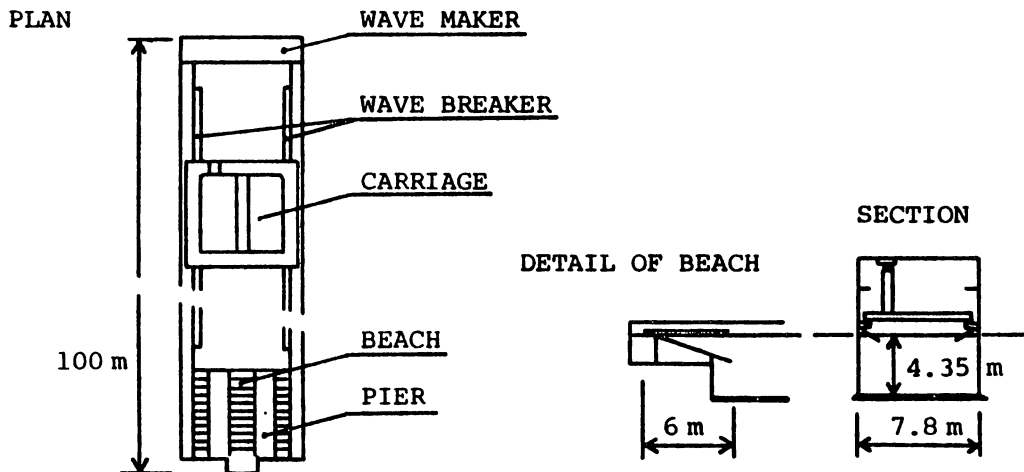
DESCRIPTION OF FACILITY : Semi-vertical
 TYPE OF DRIVE SYSTEM : 3-bladed axial flow impeller
 TOTAL MOTER POWER : 30 KW
 WORKING SECTION MAX. VELOCITY : 1.5 m/s

INSTRUMENTATION : Properller dynamometer, resistance dynamometer, 6-component balances
 MODEL SIZE : Ship ~ 2 m length
 Propeller ~.3 m diameter
 TEST PERFORMED : (1) Resistance and self-propulsion test
 (2) Open water propeller tests and wake surveys
 (3) Flow visualizations

PUBLISHED DESCRIPTION : None

6-1 FACILITIES

TOWING AND SEAKEEPING TANK (1970)



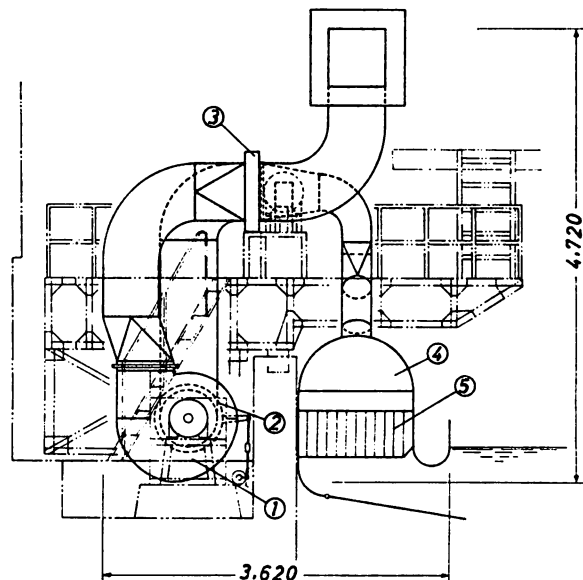
DESCRIPTION OF CARRIGE : 1 manned, motor driven
 TYPE OF DRIVE SYSTEM AND : Static Leonard system with analog-digital hibrid control. DC 15 KW x 4
 TOTAL POWER
 CARRIAGE SPEED : Maximum speed 3.5 m/sec, speed setting accuracy ± 1 mm/sec, speed fluctuation ± 1 mm/sec r.m.s.
 OTHER CAPABILITIES : Vertical and horizontal PMM can be fitted.

WAVE MAKER

Type : Pneumatic
 Drive system : Pure electric motor drive servo system
 Regular waves : Length 1.5 ~ 12 m
 Height 0 ~ 0.3 m
 Irregular waves : Waves having specified wave spectra are used.
 Others : Transient water waves can be generated.
 Range of water depth : Constant

Sketch of wave maker

- ① blower
- ② inlet vanes controlling wave heights
- ③ slide valve controlling wave periods
- ④ wave generating dome
- ⑤ grating



INSTRUMENTATION

TEST PERFORMED

Resistance, self-propulsion test and wave analysis in calm water and waves,
Open water propeller tests and 3-D wake surveys,
Hydrodynamic forces on ships and submerged bodies, wave induced motions
and loads on ships or floating and moored structures,
Upright and heeled sailing yacht tests,
Stopping and manoeuvring tests of ships.

MEASURING APPARATUS & TRANSDUCER

Wave, current,
Speed,
Motions in waves,
Total forces and moment,
Local forces and pressures,
Others

DATA RECORDING & ANALYSIS

Data recorder,
A-D & D-A converter,
Mini-computer,
Others

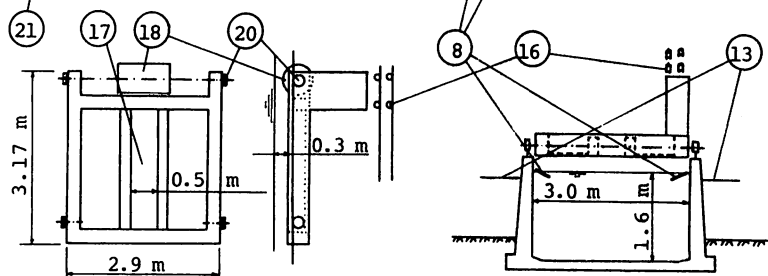
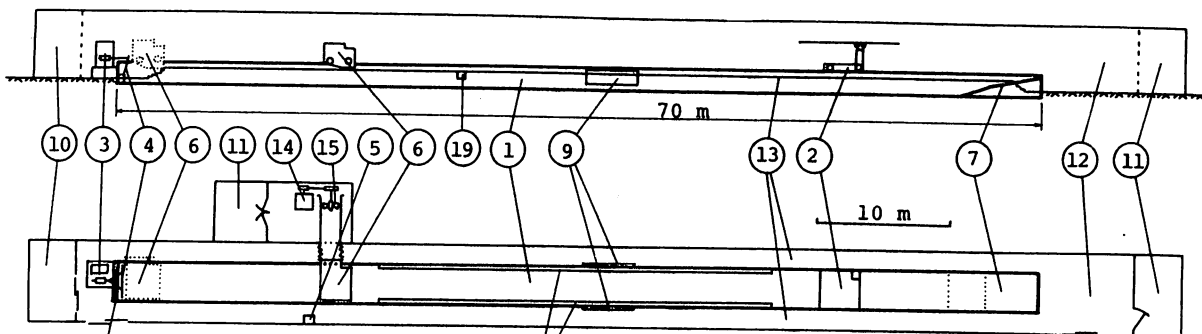
METHODS OF TESTING

MODELS

Size : 2 ~ 4.5 m
Material : Wooden or F.R.P.
Others

7-1 FACILITIES

TOWING TANK (1949)



DETAILS OF CARRIAGE AND TANK SECTION

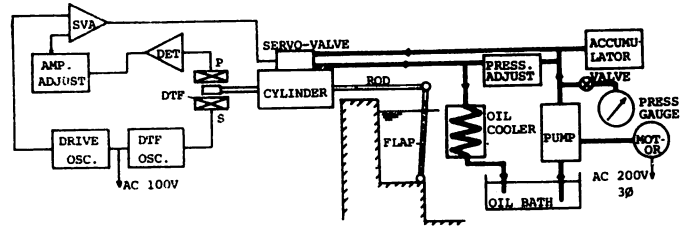
- | | | |
|----------------------|--------------------------|----------------------|
| 1 towing tank | 5 wave generator control | 9 observation window |
| 2 towing carriage | 6 wind tunnel | 10 laboratory |
| 3 hydraulic actuator | 7 beach | 11 store |
| 4 flap | 8 movable side beach | 12 workshop |
| | | 13 passage |
| | | 14 motor |
| | | 15 fan |
| | | 16 trolley |
| | | 17 measuring section |
| | | 18 motor |
| | | 19 overflow hole |
| | | 20 wheel |
| | | 21 wave suppressor |

DESCRIPTION OF TOWING CARRIAGE : Box-girder type, motor driven
 SUB CARRIAGE : 2 wooden
 TYPE OF DRIVE SYSTEM AND TOTAL POWER: Automatic speed control with SCR, 7.5KW
 MAXIMUM CARRIAGE SPEED : 2.5 m/S
 OTHER CAPABILITIES : (1) Arbitrary mode drive is available
 (2) Vertical and horizontal forced oscillation mechanisms can be fitted

WAVE MAKER

Type : Oscillatory flap type
 Drive system : Hydraulic actuator with servo control
 Regular waves : Wave length (m) 10 5 2 1 0.5 0.3
 Max. height (m) 0.1 0.15 0.1 0.1 0.05 0.03
 Max. steepness 1/100 3/100 1/20 1/10 1/10 1/10
 Irregular waves : Waves having specified wave spectra
 Transient waves : Transient waves which coalesce at any specified position of the tank is available
 Others : Tele-control system on the carriage is available for generating waves

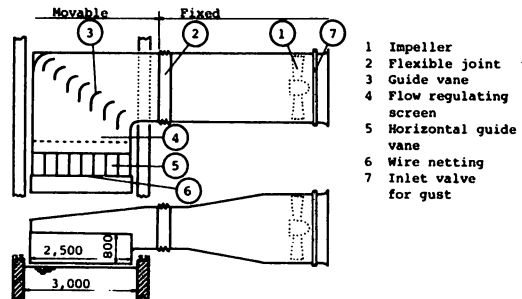
Sketch of wave maker



WIND GENERATOR

Type : Movable gust wind tunnel; Operates at a fixed position and is at rest in front of the wave maker

Wind direction : Follow to waves
 Area : 3.0 m wide x 0.6 m high
 Speed : 20 m/s max.
 Wind gust : Available
 Generator : 55 KW axial blower
 Sketch of wind generator



INSTRUMENTATION

TEST PERFORMED

- Motions of ships and off-shore structures in waves and in wind/waves in moving, floating, moored and fixed conditions.
- Forces and pressures acting on ships and off-shore structures in waves and in wind/waves in moving, floating, moored and fixed conditions.
- Forced oscillation of ships in calm water.
- Resistance and self-propulsion tests in waves.
- Measurements of diffracted waves around ship model.

MEASURING APPARATUS AND TRANSDUCER

Wave : Resistance, conductance and servo type wave probe
 Wind : Hot-wire and hot-film anemometers
 Speed : Tacho-meter fitted on the carriage
 Motions in waves : Touched roller and low-friction precise potentiometer
 Total forces and moments : Block-gauge with linear-transformer
 Local forces : Canti-level pick-up with strain-gauge on it
 Pressure on the structure : Piezo-electronic pressure transducer

DATA ACQUISITION

- (1) A micro-computer is available for preparation of test signals, data acquisition and data analysis on the carriage
- (2) 7 and 4 channel analogue data recorders and 8 channel digital data recorder (1024 words each) are available for data acquisition on the carriage

DATA PROCESSOR

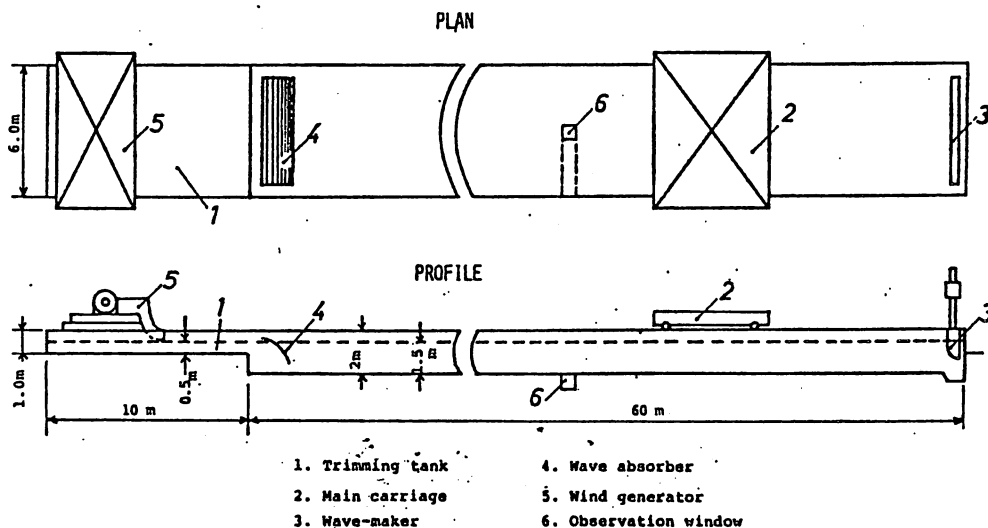
- (1) Data can be processed at the data process center of the university (ACOS 77 Model 600)
- (2) A mini-computer with 32 KW mos memory, cartridge and floppy disc, 8 channel A-D and 2 channel D-A converters is available for data processing

METHOD OF TESTING	
MODELS	
Size	: 1.0 - 3.0 m for ship model 1.5 m x 1.5 m for off-shore structure
Material	: Wooden, FRP, polyurethane
SIMILITUDE	
Wave	: According to Froude law
Wind	: According to equivalent speed
USED WAVES	
<ul style="list-style-type: none"> - Regular waves, irregular waves & transient waves: for estimating linear frequency response functions of motion characteristics - Regular waves & irregular waves: for estimating quadratic frequency response function of slowly varying drifting force - Extreme wave: transient waves having a specified design spectra are used for estimating extreme response of ships and off-shore structures 	
PUBLISHED DESCRIPTION: Directory of hydraulic research institutes and laboratories in Japan, COMMITTEE ON HYDRAULICS, THE SCIENCE COUNCIL OF JAPAN, 1973.	

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8-1 FACILITIES

SHALLOW WATER TOWING TANK (1973)



DESCRIPTION OF CARRIAGE : Box-girder type
 SUB CARRIAGE : With up-down movable platform

TYPE OF DRIVE SYSTEM AND CONTROL POWER
 Main carriage : Automatic speed control (Analog-thyrister type)
 : DC 7.5 KW x 4
 Sub carriage : DC 1.5 KW x 1

CARRIAGE SPEED : Max. 3.0 m/sec, speed setting accuracy 0.1%

OTHER CAPABILITIES : The platform can be adjusted the position to variable depth of water

WAVE MAKER

Type : Plunger type, variable stroke
 Drive system : Hydraulic
 Regular wave : Wave length (m) 0.5 ~ 6.0
 : Max. height (m) 0.15
 : Max. steepness 1/25

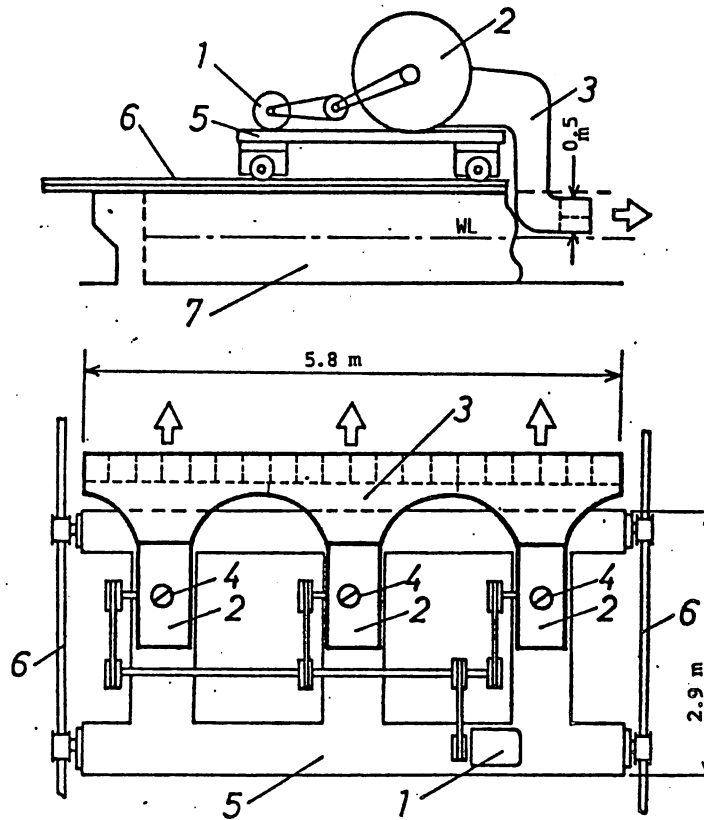
Irregular wave : Input signal for irregular waves are given from data recorder

Others : Plunger body can be adjusted the height in range of water depth from 0.2 m to 1.5 m.

WIND GENERATOR

- Type : Turbo fan type, 3 fans are arranged in parallel on the carriage.
- Wind direction : Parallel on the water level
- Portable or fixed: Movable with the carriage
- Area : 6 m breadth and about 10 m length area
- Speed : Max. 8 m/sec at about 3 m from fan exit
- Wind gust : Not to be planned
- Generator : 3 fans are driven by 30 KW motor

Sketch of wind generator



- | | |
|------------------------|------------------|
| 1. Motor | 5. Carriage |
| 2. Fan | 6. Rail |
| 3. Fan duct | 7. Trimming tank |
| 4. Fan handle adjuster | |

INSTRUMENTATION

TEST PERFORMED

Resistance & self-propulsion in calm and waves. Forces in waves, wind on floated, moored and fixed condition of ships and floating structures, Manoeuvring of ship in deep water and in shallow water. Bodily running squat.

MEASURING APPARATUS & TRANSDUCER

Wave : Capacity type wave height meter
Wind : 6 point Anemomaster
Track : TV system
Motion in wave : Motion detector with 6 potentiometer
Total forces : DTF type X-Y force detector.
and moments
Others :

DATA RECORDING & ANALYSIS

Cassette type data recorder
6 pen recorder
X-Y recorder
18 chs oscilo-graph
VTR

METHODS OF TESTING

MODELS

Ship : 2 ~ 3 m, wooden material
Ocean structures: 1 ~ 2 m

SIMILITUDE

Wave : Model scale
Wind : Froude's number

USED WAVE

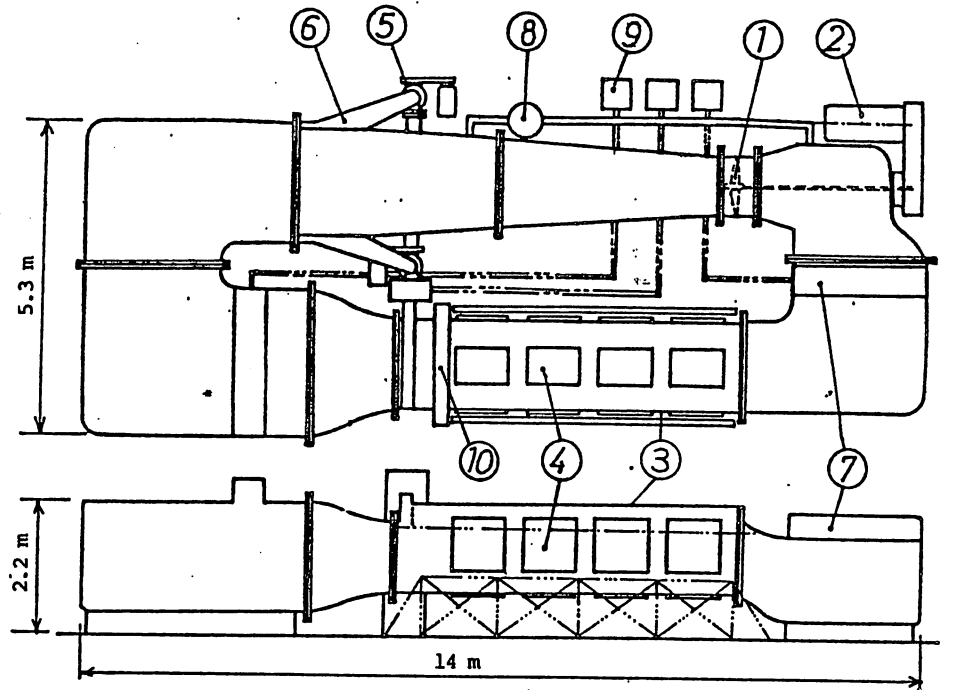
Design wave : Regular, Irregular.

PUBLISHED DESCRIPTION : None

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8-2 FACILITIES

CIRCULATING WATER TANK



- | | |
|--|---|
| 1. Impeller | 6. Discharge duct of divided circulation system |
| 2. Main motor | 7. Air reserve tank |
| 3. Observation section | 8. Filter apparatus |
| 4. Observation window | 9. Vacuum pump |
| 5. Pump of divided circulation section | 10. Vertical shaking system |

DESCRIPTION OF FACILITIES : Circular water channel
 TYPE OF DRIVE SYSTEM FOR CIRCULAR WATER : Axial flow type, pump motor 30 KW
 Thyristor leonard control
 WATER DEPTH : Max. 1.1 m
 FLOW SPEED : 0.2 m/sec ~ 2.0 m/sec

INSTRUMENTATIONS

TEST PERFORMED

Mooring forces of fixed, mooring, floated ship and ocean structure.
 Propeller thrust in pitching motion.
 Observation on waves around the running ship, on stream line around ship's bodies, and on motion of buoy & structures in current.

MEASURING APPARATUS & TRANSDUCER

Current : Propeller type current meter
Total forces & : 3 element dynamometer
moment
Local forces & : Strain guage pressure transducers
pressure
Others :

DATA RECORDING & ANALYSIS

Data recorder : 6 prn recorder
18 chs oscillo-graph
Cassette data recorder
Analysor or : Mini-computer
computer

METHODS OF TESTING

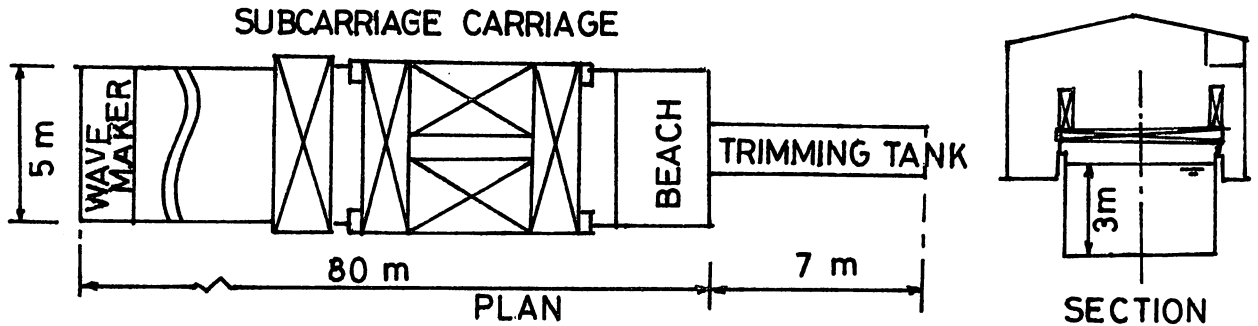
MODELS

Size : 1.0 m ~ 2.0 m length
Material : Wooden or metal

PUBLISHED DESCRIPTION: None

9-1 FACILITIES

TOWING TANK (1967)

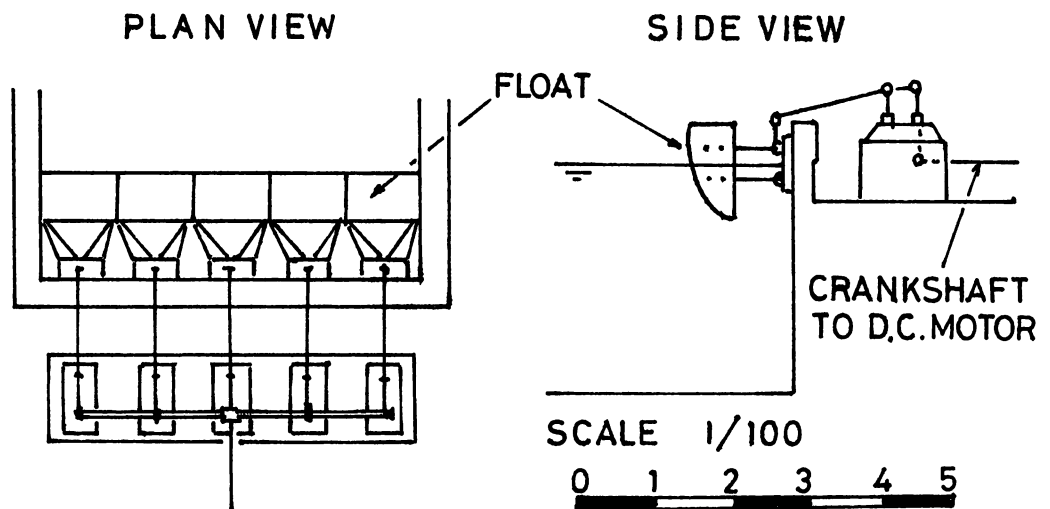


DESCRIPTION OF CARRIAGE : 1 manned, motor driven
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor-Leonard control, 32 KW
 MAXIMUM CARRIAGE SPEED : 6 m/sec
 OTHER CAPABILITIES : PMM & vertical PMM can be fitted

WAVE MAKER

Type : Plunger type
 Drive system : Electric motor drive, Electronic servo system
 Regular waves : Wave length (m) 6 4 3 2 1
 Max height (m) 0.3 0.3 0.3 0.2 0.1
 Max steepness 1/20 1/13 1/10 1/10 1/10
 Irregular waves: Scheduled program generates variable-period waves at every cycle.

Sketch of wave maker



INSTRUMENTATION

TESTS PERFORMED

Wave induced motions and load on ships
Forced oscillation, Planer motion, Manoeuvring
Resistance, Self-propulsion
Others : Capsizing tests of fisher-boat, Dynamic response of deep sea
towing rope.

MEASURING APPARATUS & TRANSDUCER

Wave : Resistance-type probe on carriage and tank wall.
Motions in waves: Ship 6-motion recorder
Total forces and: Dynamometer
moments
Local forces and: Pressure gauge
pressures
Others : Resistance dynamometer, Self-propulsion dynamometer,
Propeller open test dynamometer

DATA RECORDING & ANALYSIS

Data recorder
Microcomputer for data acquisition: 16 digital channels, up to 1,000
samples per second per channel.

METHODS OF TESTING

MODELS

Size : Ship length from 1.2 to 5 m
Material : Wood, glassfiber

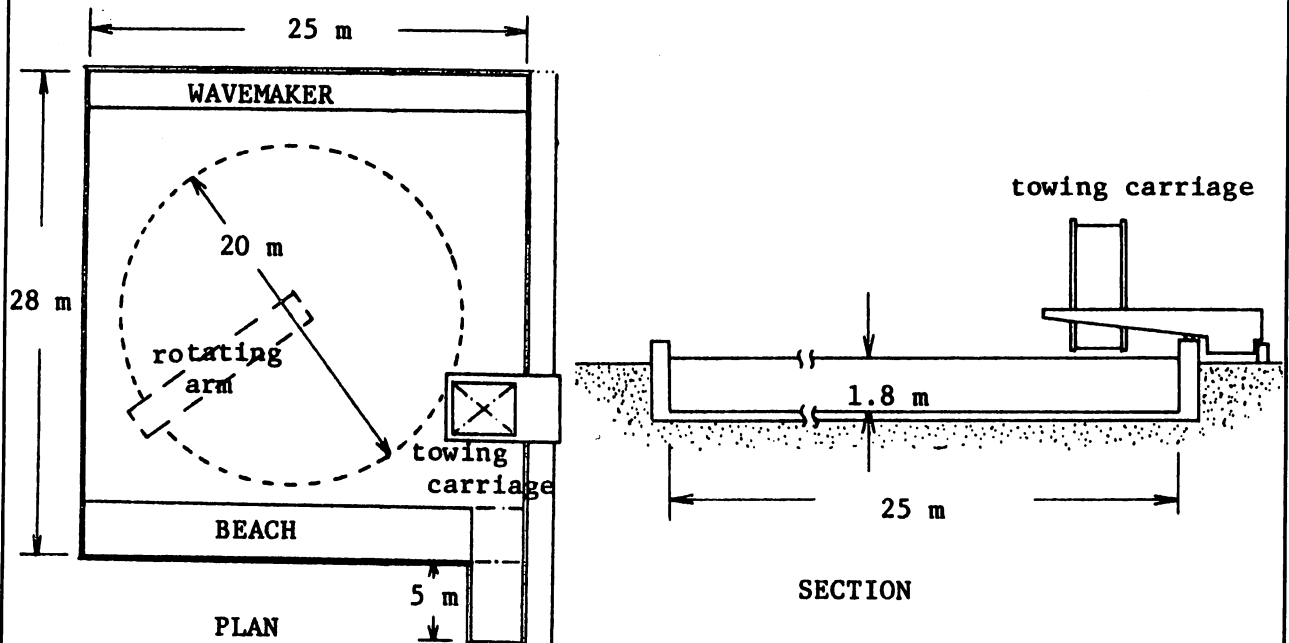
SIMILITUDE

Wave : Time domain parameters are $H_{z,1/3}$ and \tilde{T}_z . In frequency domain,
function is power spectral density, and parameters are F_p
(peak frequency), $T_p (= 1/F_p)$, σ , and $T_{m0,2}$.

USED WAVES

10-1 FACILITIES

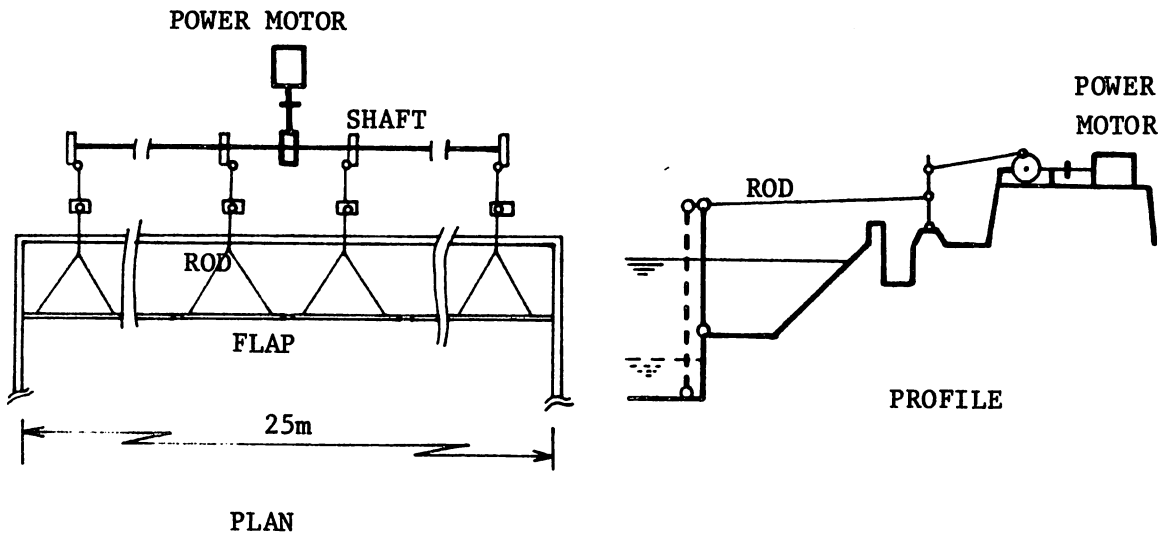
SEAKEEPING AND MANOEUVRING BASIN (1961)



DESCRIPTION OF CARRIAGE : Cantilever type towing carriage
 rotating arm (movable)
 TYPE OF DRIVE SYSTEM AND : Motor drive system
 TOTAL POWER : Towing carriage: Ward-Leonard control, 4.4 KW
 Rotating arm : Ward-Leonard control, 3.7 KW
 CARRIAGE SPEED : Maximum speed for towing carriage 1.2 m/s and
 for rotating arm 0.2 rad/s

WAVE MAKER
 Type : Flap type, variable stroke in driving
 Drive system : Motor drive
 Regular wave : Wave length (m) 0.7 ~ 5.0
 Max. height (m) 0.3
 Max. steepness 1/16
 Range of water depth : 0.15 ~ 1.8 m
 Others : Two kinds of flaps for deep and shallow waters
 are used.

Sketch of wave maker



INSTRUMENTATIONS

TEST PERFORMED

Manoeuvring tests of ships in deep, shallow and narrow waters, free running tests in waves, hydrodynamic forces on ships or submerged bodies by oblique and rotary tests.

MEASURING APPARATUS & TRANSDUCER

Wave measurement : Resistance type probe on carriage and tank walls
 Speed & track : Model positions and drift angles are measured by photography and yaw gyro
 Total or local force: Various strain gage dynamometers and moment

METHODS OF TESTING

MODEL SIZE

Ship model lengths for seakeeping and manoeuvring tests 1 ~ 3.5 m

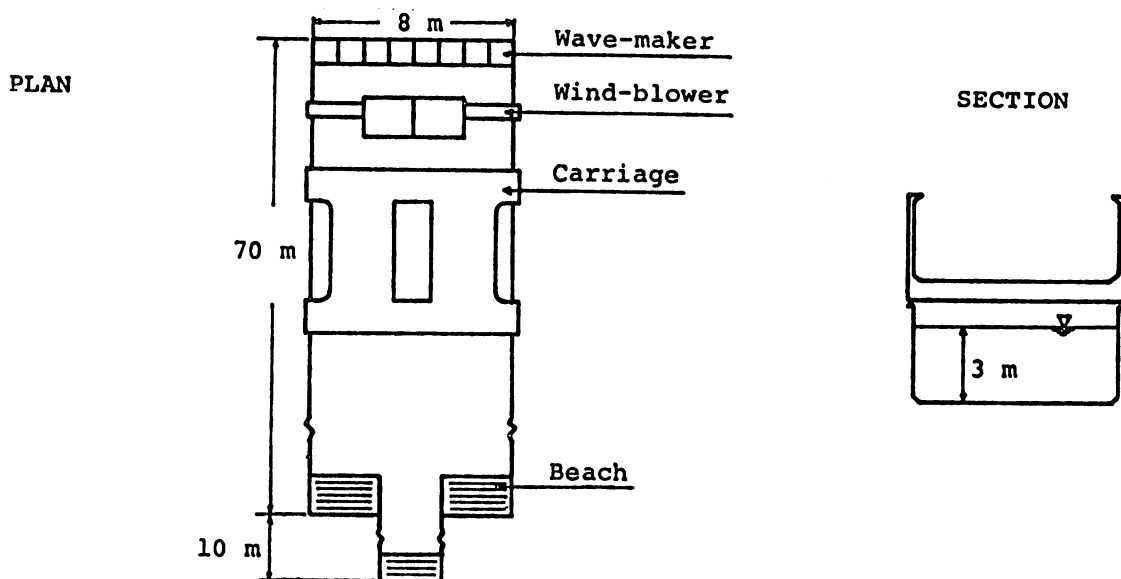
PUBLISHED DESCRIPTION: 13th ITTC

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11-1 FACILITIES

TOWING AND SEAKEEPING TANK (1963)

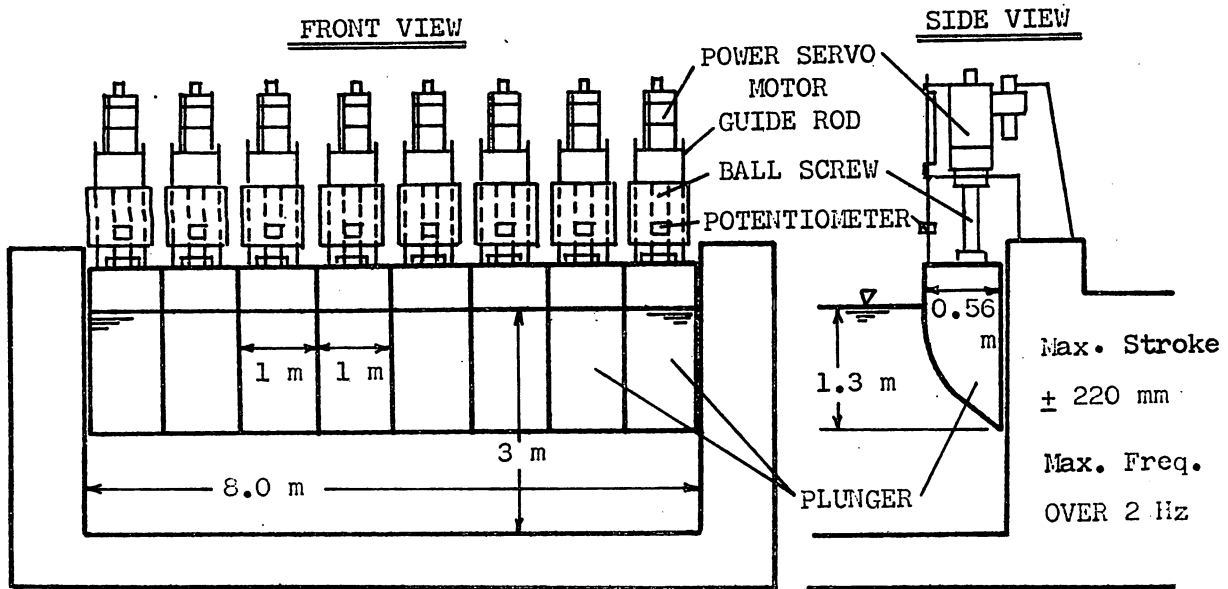


DESCRIPTION OF CARRIAGES : 1 manned, motor driven
 TYPE OF DRIVE SYSTEM AND TOTAL POWER: Thyristor Stationary-Leonard, 60 KW
 CARRIAGE SPEED : Maximum speed 5.0 m/sec

WAVE MAKER

Type : Plunger divided into eight independently movable blocks, variable stroke of each block in driving
 Drive system : Electric motor driven
 Regular waves : Wave Length (m) 15 10 6 4 2 0.4
 Max. Height (m) 0.18 0.25 0.30 0.40 0.18 0.01
 Max. Steepness 1/80 1/40 1/20 1/10 1/11 1/40
 Irregular waves : Waves with the spectra specified are generated.
 Short crested waves : Short crested regular and irregular waves are generated.
 Range of water depth : 3.5 m to 0 m with another wave maker and the false bottom

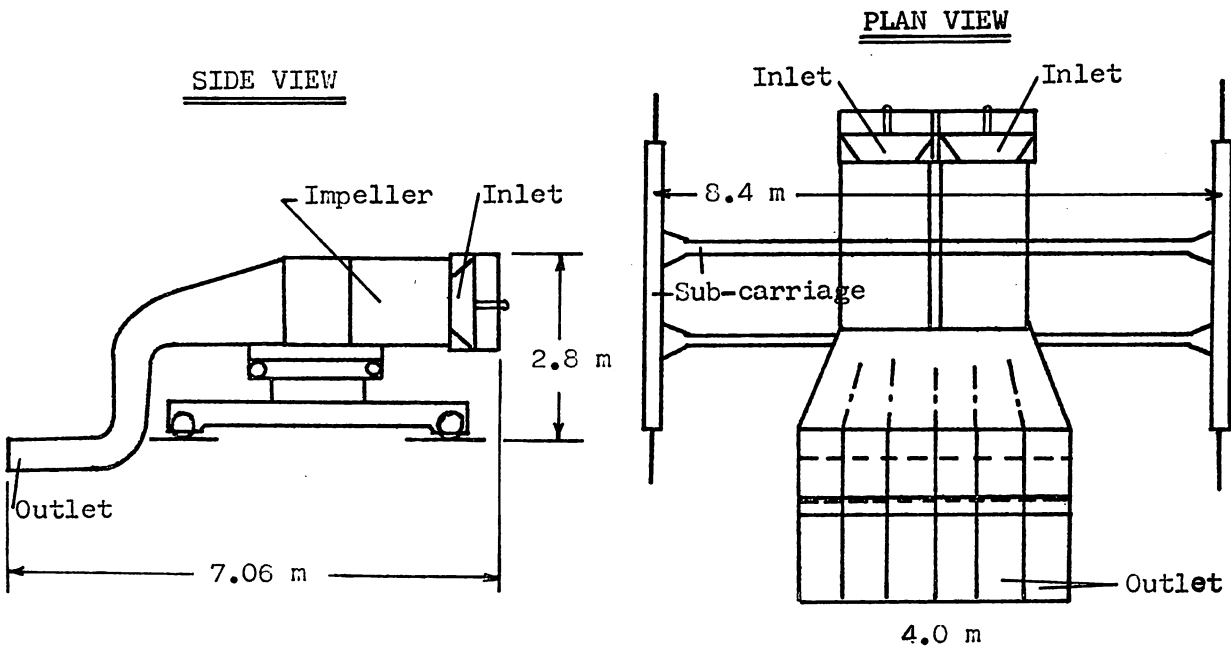
Sketch of wave maker



WIND GENERATION

- Type : 2 axial blowers movable with the carriage
- Wind direction : Variable within $\pm 40^\circ$
- Area : Width 4 m, height 0.4 m at the blower outlet
- Maximum speed : 20 m/sec
- Generator : 10 bladed impellers

Sketch of wind blower



INSTRUMENTATION

TEST PERFORMED

Motions in waves, Currents, Winds }
Forces in waves, Currents, Winds } Floating, Moored, Fixed
Forced oscillation, Manoeuvring, }
Resistance, Self-propulsion }
Others: Deep, Shallow

MEASURING APPARATUS & TRANSDUCER

Wave : Ultrasonic, Capacitance, Resistance and Servo control types
Motion in waves : 6 degrees of freedom and 3 degrees of freedom motions measurement apparatuses with potentiometers
Total forces and moments : 6 components and 3 components transducers with block gauge pick up
Local forces and pressures : Pressure gauges of semi-conductor type
Others : Forced oscillation apparatuses

DATA RECORDING & ANALYSIS

Data recorder,
On-line computer and graphic display

METHODS OF TESTING

MODELS

Size : 0.5 to 6 m in length
Material : Wood

SIMILITUDE

Wave : Froude's law
Wind : Unspecified
Wave and current forces on cylinders: Froude's law or K-C number
Experimental work on flexible system: Unspecified

USED WAVES

Design wave and design spectra

REFERENCES

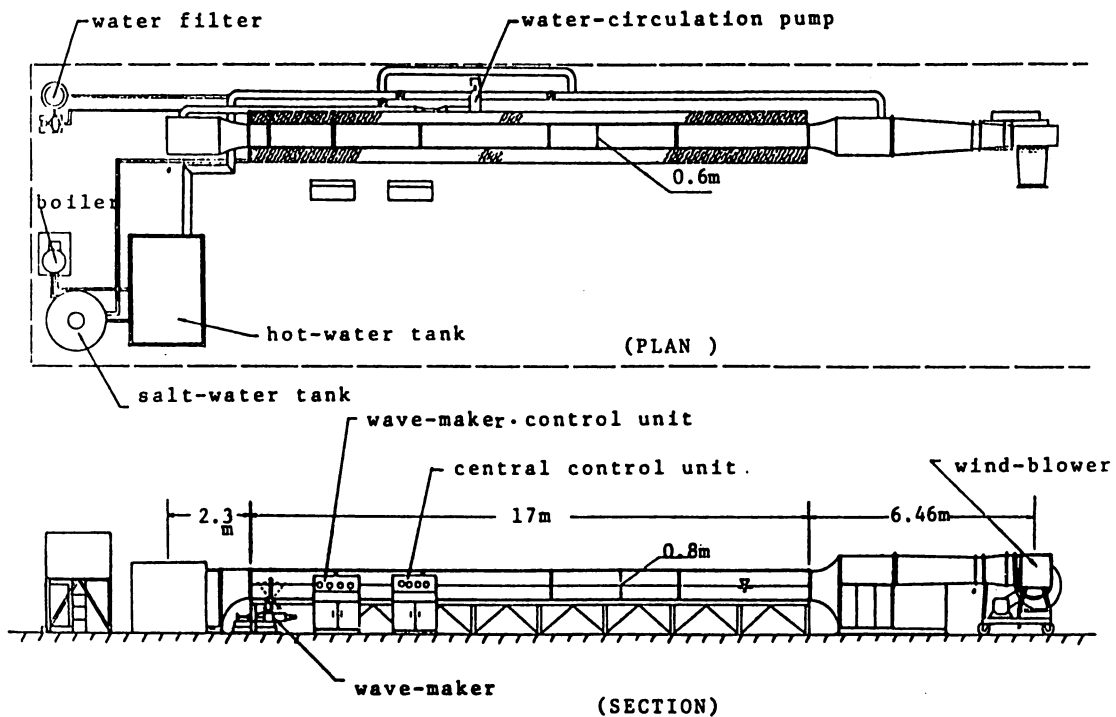
On the Experimental Tank for Sea Disasters, JOURNAL OF SEIBU ZOKEN KAI, No. 32, July, 1966.
Equipment for Measuring Six Motions of a Ship Model, Rep. Res. Inst. Appl. Mech., Vol. XIII, No. 45, 1965.

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11-2 FACILITIES

INTERNAL WAVE TANK WITH WIND-BLOWER (MULTIPURPOSE WATER TANK)



WAVE MAKER

Type : Flapper type
 Drive system : Variable-speed electric motor (3 kW) and ball screw
 (max stroke 0.5 m)
 Usual wave period: 0.2 sec ~ 2 sec
 Max wave height : 10 cm
 Irregular waves : Waves with the spectra specified are generated

WIND-BLOWER

Type : Sirocco fan (Q_{max} : 525 m³/min, P_s : 100 mmAq)
 Drive system : Variable-speed electric motor (22 kW)
 Max wind speed : 30 m/sec

WATER CIRCULATION

Pump : Centrifugal pump (Q_{\max} : 5 m³/min, P_s : 8 m)
Drive system : Electric motor (11 KW)
Flow control : Electric control valve (ϕ 200 mm)
Electro-magnetic flow meter (ϕ 100 mm)
Max current velocity in the tank: 0.3 m/sec
Current direction : Opposite direction is possible

INSTRUMENTATION

MEASURING APPARATUS

Wind : Pitot-static tube, hot-wire anemometer
Wave : Resistance-type wave gauge
Current : Pitot-static tube, hot-film current meter
ultra-sonic current meter
Pressure : Pressure gauge of semi-conductor type
Temperature : Thermister-type thermometer

DATA RECORDING & ANALYSIS

Data recorder (F.M. type, 14 channel)
Mini-computer system

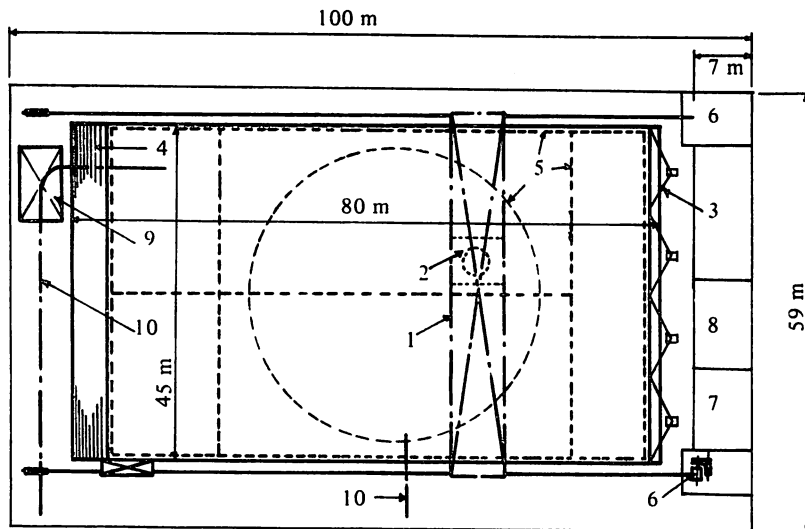
INSTITUTE OF OCEAN ENVIRONMENTAL TECHNOLOGY
 JAPAN FOUNDATION FOR SHIPBUILDING ADVANCEMENT
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12-1 FACILITIES

RECTANGULAR TANK (1978)

- 1: Main carriage
- 2: Sub-carriage
- 3: Wave maker
- 4: Wave absorber
- 5: Air bubble generating pipe
- 6: Winch room
- 7: Control room
- 8: Hydraulic unit room
- 9: Cleaning pit
- 10: Monorail hoist



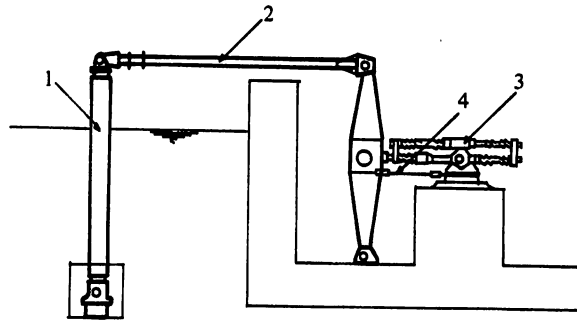
DESCRIPTION OF CARRIAGES : Winch driven, analog control
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor analog, 180 kW
 MAXIMUM CARRIAGE SPEED : 2 m/s
 OTHER CAPABILITIES : Remote control in the control room on shore

WAVE GENERATION CAPABILITY : Regular/irregular, wave length 1 ~ 10 m
 max. wave height 0.3 m
 WAVE MAKER TYPE AND WIDTH : Multiple flap, 45 m
 WAVE ABSORBER AND LENGTH : Beach type, 5 m
 WAVE MEASUREMENT : Capacitance probe and acoustic probe on the carriage or at fixed points on tank wall
 under water acoustic probe at an arbitrary point in the tank

INSTRUMENTATION : Analog data recorder, 8 channels
 TEST PERFORMED : Performance test of oil booms and skimmers
 spread and drift of spilled oil
 Hydrodynamic forces on marine structures and ships
 Wave induced motions and loads marine structures and ships

PUBLISHED DESCRIPTION: TEST AND RESEARCH FACILITIES OF THE OIL SPILL PREVENTION INSTITUTE 1978
 Bulletin of SNAJ, No. 590, August 1978

- 1: Flap
- 2: Arm
- 3: Hydraulic cylinder



DRIVE SYSTEM : Electro-hydraulic system
 MAX. STROKE : ± 480 mm
 MAX. FREQ : 1.25 Hz

REGULAR WAVES : Internally generated sinusoidal signal

Wave length (m)	10	6	4.5	3	1
Max. height (m)	0.3	0.3	0.3	0.2	0.07
Max. steepness	1/33	1/20	1/15	1/15	1/15

IRREGULAR WAVES : Specified wave spectra

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

Motion in waves: Potentiometer type motion recorder

DATA RECORDING & ANALYSIS

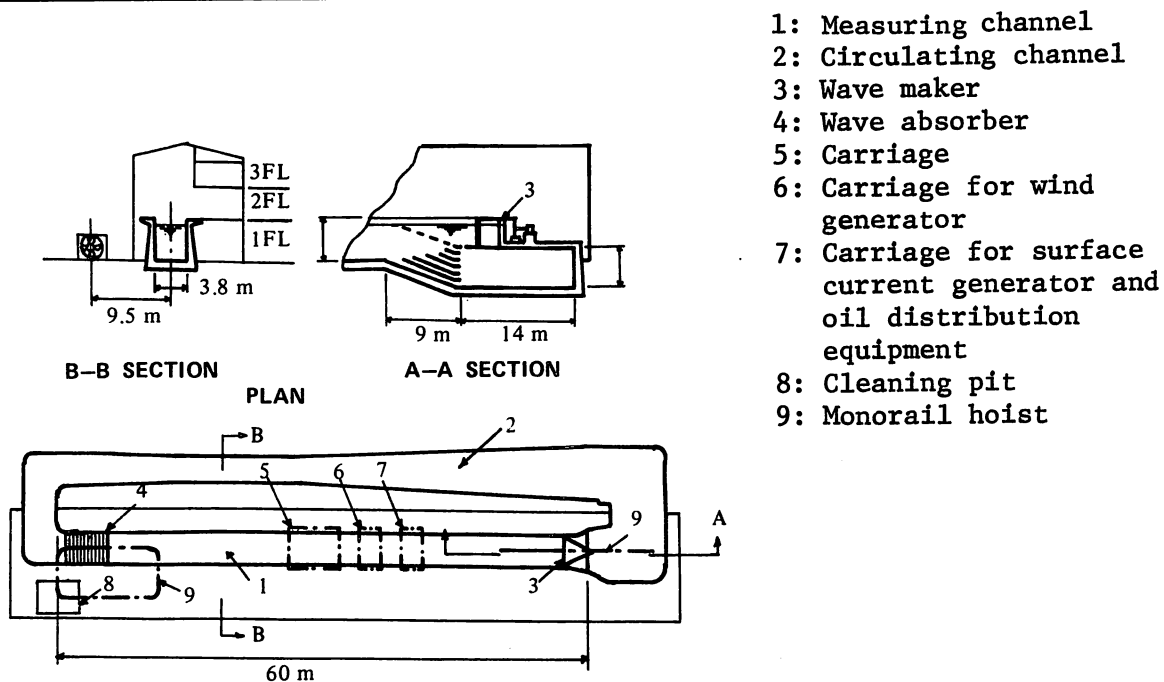
Data recorder : Analog data recorder electromagnetic oscillograph

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12-2 FACILITIES

CIRCULATING WATER CHANNEL (1978)



DESCRIPTION OF FACILITY : Circulating water channel
 TYPE OF DRIVE SYSTEM FOR CIRCULATING WATER : Axial flow pump with controlable pitch impeller, direction of rotation is reversible, 200 KW
 WATER DEPTH : 4.3 m
 MAXIMUM FLOW SPEED : ± 1.5 m/s

DESCRIPTION OF CARRIAGE : Moved and fixed by man power

WAVE GENERATION CAPABILITY : Regular/irregular, wave length 0.5 ~ 10 m
 max. wave height 0.6 m

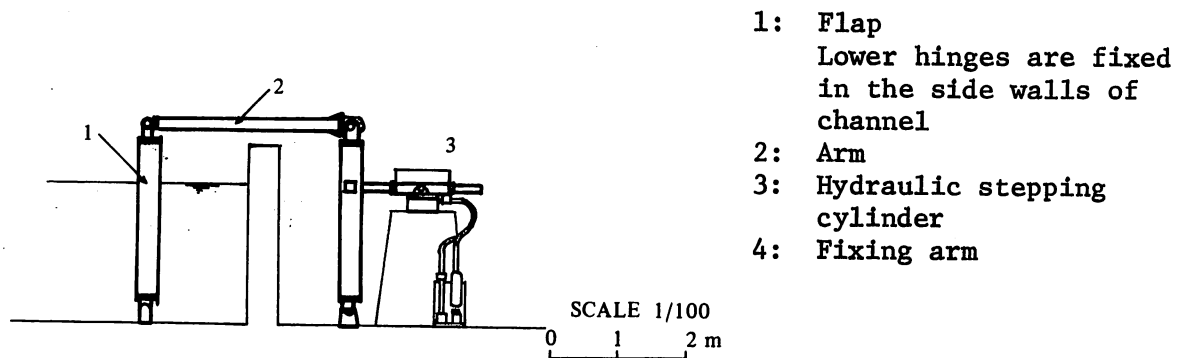
WAVE MAKER TYPE AND WINDTH : Single flap, 3.8 m

WAVE ABSORBER AND LENGTH : Beach type, 5 m

INSTRUMENTATION : Analog data recorder, 8 channels

TEST PERFORMED : Performance test of oil booms and skimmers
 spread and drift of spilled oil
 Hydrodynamic forces on marine structure and ships
 Wave induced motions and loads on marine structure and ships

PUBLISHED DESCRIPTION : TEST AND RESEARCH FACILITIES OF THE OIL SPILL PREVENTION INSTITUTE 1978 Bulletin of SNAJ, NO. 590, August 1978



- 1: Flap
Lower hinges are fixed in the side walls of channel
- 2: Arm
- 3: Hydraulic stepping cylinder
- 4: Fixing arm

DRIVE SYSTEM : Electro-hydraulic system
 MAX. STROKE : ± 570 mm
 MAX. FREQ. : 1.8 Hz

TYPE : Single flap
 REGULAR WAVES : Internally generated sinusoidal signal

Wave length (m)	10	8	6	4	2	0.5
Max. height (m)	0.6	0.6	0.6	0.4	0.2	0.05
Max. steepness	1/17	1/13	1/10	1/10	1/10	1/10

IRREGULAR WAVES : Specified wave spectra

CURRENT GENERATION

Type : Open
 Current direction: The same or the opposite direction of the waves
 Portable or fixed: Fixed
 Area of current : All area in the channel
 Current speed : $0 \sim \pm 1.5$ m/s
 Generator : Axial flow pump with controlable pitch impeller, 200 KW
 Range of water : 4.3 m const depth
 Sketch : See general layout drawing on preceding page

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

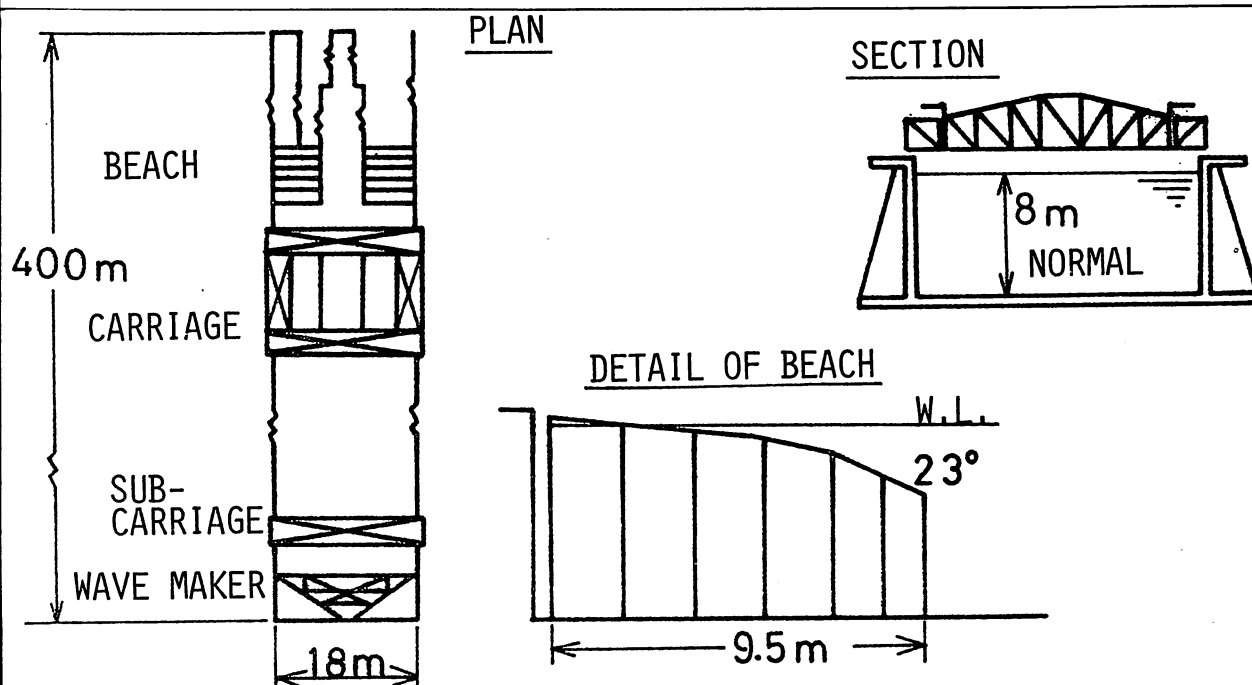
Wave : Capacitance and acoustic type wave meter
 Current : Propeller type current meter
 Motions in waves: Potentiometer type motion recorder

DATA RECORDING & ANALYSIS

Data recorder : Analog data recorder
 electromagnetic oscillograph

13-1 FACILITIES

MITAKA NO. 2 SHIP MODEL EXPERIMENT TANK (1965)



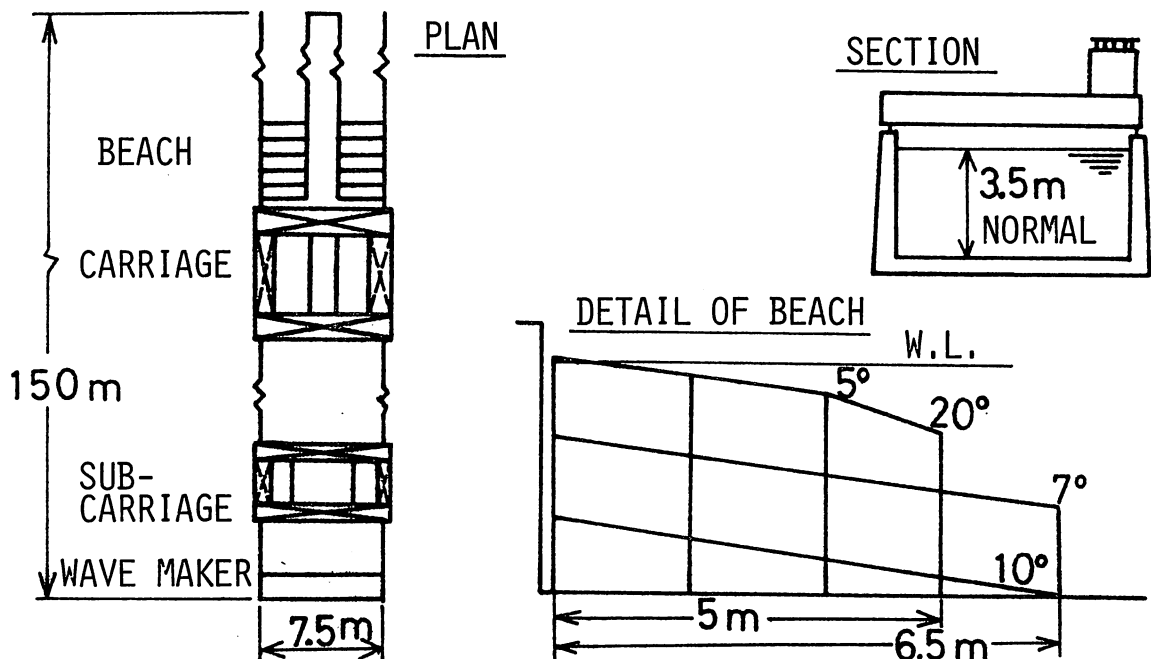
DESCRIPTION OF CARRIAGE	: 1 manned, motor driven
TYPE OF DRIVE SYSTEM AND TOTAL POWER	: Thyristor-Leonard, 840 KW
MAXIMUM CARRIAGE SPEED	: 15 m/s
OTHER CAPABILITY	: Sub-carriage can be fitted
WAVE GENERATION CAPABILITY	: Regular & irregular, length 3 ~ 30 m max. height 0.45 m
WAVE MAKER TYPE AND EXTENT	: Flap type, 18 m wide
BEACH TYPE AND LENGTH	: Impermeable single layered beach, 9.5 m
WAVE MEASUREMENT	: Ultrasonic & capacitance type probes on carriage and tank wall

INSTRUMENTATION	: Measuring instruments of digital type with remote control system
MODEL SIZE RANGE	: Maximum ship length 15 m, normal 7 ~ 10 m
MODEL TRACKING TECHNIQUES	: Propeller rpm adjusted manually
TEST PERFORMED	: Resistance and self propulsion in calm water and waves. Open water propeller tests and 3-D wake survey. Hydrodynamic forces on submerged bodies, etc. Wave induced motions and loads on ships. Vibratory forces induced by propeller

PUBLISHED DESCRIPTION	: Jour. Soc. Naval Archi. Japan, Vol. 124, 1968; Report of SRI, Vol. 6, No. 4, 1969
-----------------------	--

13-2 FACILITIES

MITAKA NO. 3 SHIP MODEL EXPERIMENT TANK (1972)



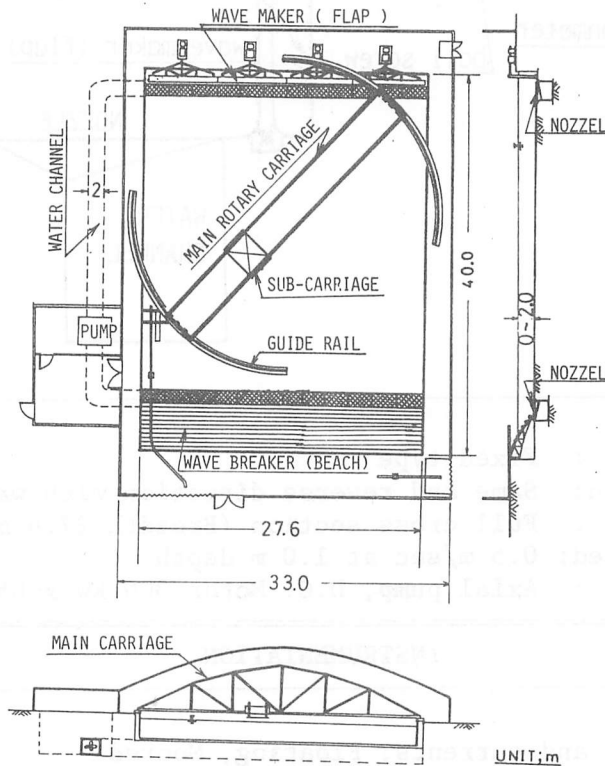
DESCRIPTION OF CARRIAGE	: 1 manned, motor driven
TYPE OF DRIVE SYSTEM AND TOTAL POWER	: Thyristor-Leonard, 120 KW
MAXIMUM CARRIAGE SPEED	: 6 m/s
OTHER CAPABILITY	: Sub-carriage carrying a wind blower to perform the tests in waves with wind.
WAVE GENERATION CAPABILITY:	Regular & irregular, length 0.3 ~ 12 m max. height 0.20 m
WAVE MAKER TYPE AND EXTENT:	Plunger type, 7.5 m wide
BEACH TYPE AND LENGTH	: Impermeable multi-layers beach, 5 m & 6.5 m
WAVE MEASUREMENT	: Ultrasonic & capacitant type probes on carriage and tank wall
INSTRUMENTATION	: Measuring instruments of digital type with remote control system
MODEL SIZE RANGE	: Maximum ship length 6 m
MODEL TRACKING TECHNIQUES	: Propeller rpm adjusted manually
TEST PERFORMED	: Resistance & self propulsion in calm water and waves. Open water propeller tests and 3-D wake surveys. Hydrodynamic forces on submerged bodies, etc. Wave induced motions and loads on ships. Tests in shallow water. Horizontal PMM

PUBLISHED DESCRIPTION: Jour. Soc. Naval Archi. Japan, Vol. 132, 1972;
Report of SRI, Vol. 10, No. 6, 1973

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13-3 FACILITIES

OFFSHORE STRUCTURE EXPERIMENTAL BASIN (1978)



DESCRIPTION OF CARRIAGES : Rotary carriage with sub-carriage
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : VS control, 2.2 KW (sub-carriage)
 MAXIMUM CARRIAGE SPEED : 0.45 m/sec (sub-carriage)
 OTHER CAPABILITIES : Sub-carriage can move up and down.

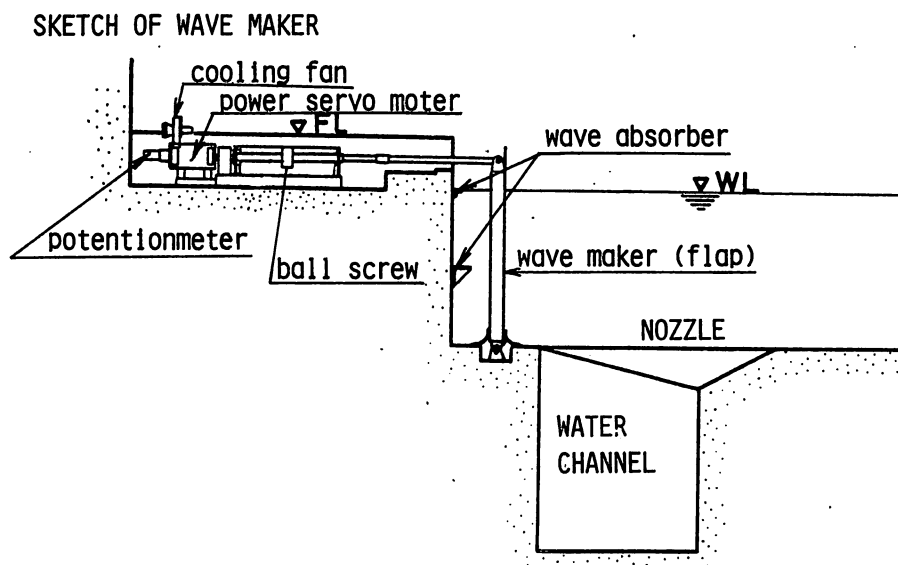
WAVE MAKER

Type : Flap type, variable stroke in driving
 Drive system : Pure electric motor drive servo system
 Regular waves :

Wave length (m)	20	10	6	4	2	0.4
Max. height (m)	0.1	0.2	0.3	0.3	0.2	0.04
Max. steepness	1/200	1/50	1/20	1/13.3	1/10	1/10

 Irregular waves : Waves having specified wave spectra are used in routine tests.
 Range of water depth : 0.6 ~ 2.0 m

Sketch of wave maker



CURRENT GENERATION

Type : Fixed type
 Current direction: Same and reverse direction with wave propagation
 Area of current : Full cross section (Breadth 27.6 m Depth 2.0 m)
 Max. current speed: 0.5 m/sec at 1.0 m depth
 Generator : Axial pump, D.C. Motor 300 KW x 650 rpm

INSTRUMENTATION

TEST PERFORMED

Motions in waves and currents; Floating, Moored
 Forces in waves and current; Floating, Moored, Fixed
 Forced oscillation
 Resistance in waves and currents
 All these tests can be performed in deep and shallow waters

MEASURING APPARATUS & TRANSDUCER

Wave probe : Electric capacitance and electric servo types
 Motions in waves : Mechanical six degrees motion measurement apparatuses with six potentiometers in ordinary experiments. Small vertical gyro and directional gyro in special cases.
 Dynamic total : Assembly block transducer of strain gauge force forces and moment pickup
 Dynamic local : Strain gauge forces
 Dynamic local : Micro pressure gauge of semi conductive strain pressures gauge type
 Dynamic acceler- : Mini accelerometers of strain gauge type ation

DATA RECORDING & ANALYSIS

Data recording : Magnetic analogue data recorder of open reel and cassette tape, oscillograph and pen recorder
 Data processor : Multi channel data processor with multiplexer, A/D converter, tape puncher, printer for spectrum and Fourier analysis by FFT

METHODS OF TESTING

MODEL

Floating platform : Length: 1.5 ~ 4.0 m,
Scale : 1/30 ~ 1/100
Material: Wood, aluminum

SIMILITUDE

Tests in waves and : Froude'- law only
currents

USEING WAVE FOR TESTS

Frequency response : Regular waves for search of frequency transfer
tests in waves functions.

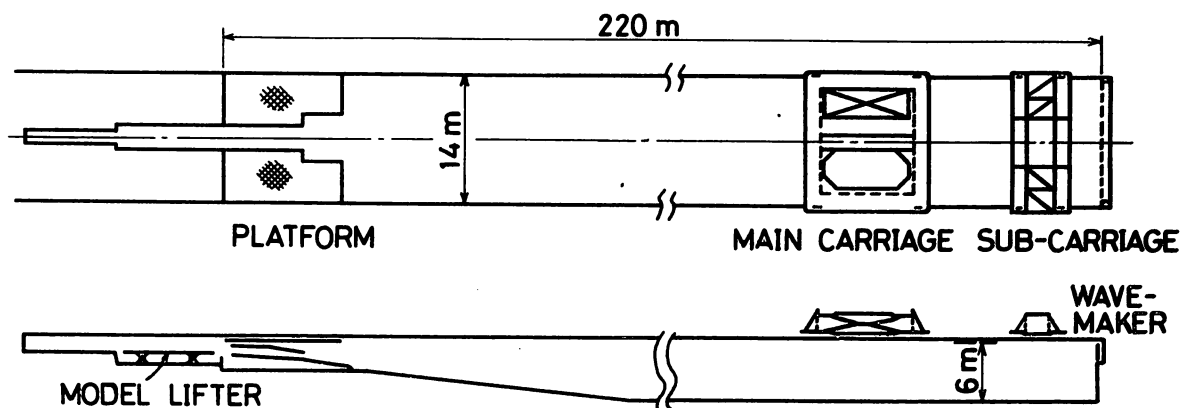
Severe seastate tests: High irregular waves having "design wave spectra".
Regular waves corresponding to "design wave" in
special cases.

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14-1 FACILITIES

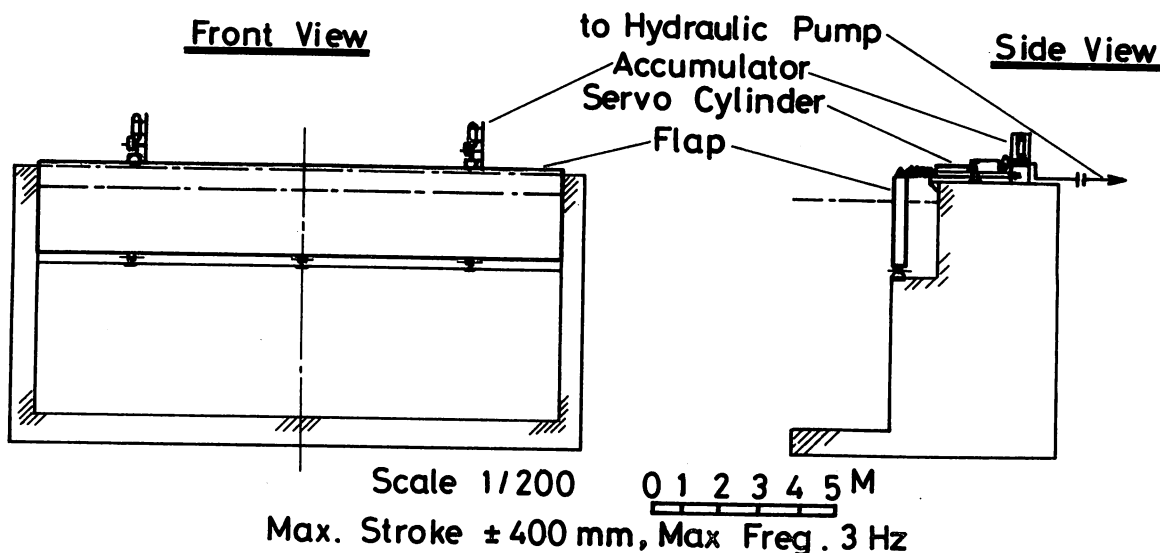
LARGE TOWING TANK (1978)



DISCRIPTION OF CARRIAGES : Motor driven
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor Leonard with digital differential analyzer, 220 KW
 MAXIMUM CARRIAGE SPEED : 7 m/s
 OTHER CAPABILITIES : PMM test can be performed, connecting sub-carriage

WAVE MAKER

Type : Flap type, variable stroke in driving
 Drive system : Hydraulic drive servo system
 Regular waves : Wave length (m) 30 10 6 4 2 0.4
 Max. height (m) 0.10 0.33 0.40 0.40 0.20 0.04
 Max. steepness 1/300 1/30 1/15 1/10 1/10 1/10
 Irregular waves : Waves having specified wave spectra are used in routine test. Extreme waves having specified spectra can be generated.
 Range of water depth : 6.5 m \pm 0.5 m



INSTRUMENTATION

TEST PERFORMED: Resistance & self-propulsion in calm water & waves, open water propeller tests, 3-D wake surveys manoeuvring & seakeeping performance tests of ships and offshore structures.

MEASURING APPARATUS & TRANSDUCER

Wave probe : Electric resistance, capacity and electric servo types

Motions in waves : Mechanical six degrees or four degrees motion measurement apparatuses with six or four potentiometers in ordinary experiments.
Small vertical gyro and mini triaxial accelerometers in special cases.

Dynamic total forces and moment : Assembly block transducer of stain gauge force pickup

Dynamic local forces : Strain gauge

Dynamic local pressures : Micro pressure gauge of semi conductive strain gauge type

Dynamic acceleration : Mini accelerometers of strain gauge type

DATA RECORDING & ANALYSIS

Data recording : Magnetic data recorder, oscillograph and pen recorder

Analysis : Fourier analysis, Spectrum analysis, Correlation analysis and non-linear time series analysis (auto regressive & moving average type model fitting and system identification)

METHODS OF TESTING

MODEL

Floating platform : Length : 1.5 ~ 3.0 m
Scale : 1/30 ~ 1/100
Material : Wood, aluminium
Ships type structures : Length : 10.0 m
Scale :
Material : Wood

SIMILITUDE

Tests in waves : Froude's law only
Current of wind forces : Acting the force corresponding to current or wind force on structure

WAVES USED FOR TESTS

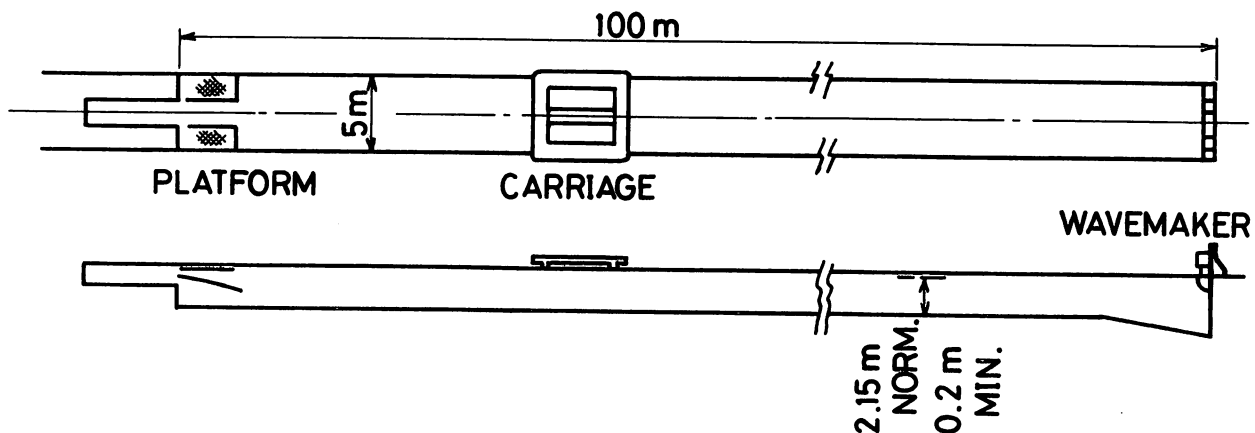
Frequency response tests in waves : Regular waves for search of frequency transfer functions.
Irregular waves for check of linear superposition.
Severe seastate tests : High irregular waves having "design wave spectra". Regular waves corresponding to "design wave".

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14-2 FACILITIES

SMALL TOWING TANK (1978)

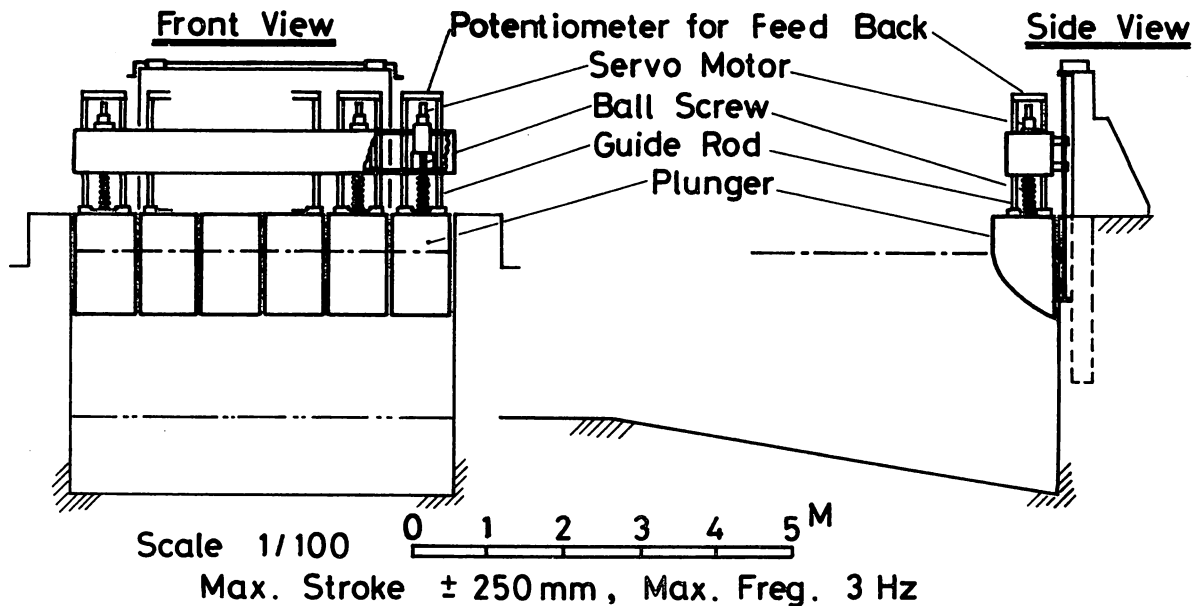


DESCRIPTION OF CARRIAGE : Motor driven
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor leonard with digital differential analyzer, 44 KW
 MAXIMUM CARRIAGE SPEED : 4 m/s
 OTHER CAPABILITIES :

WAVE MAKER

Type : 6-block plunger independently driven by 6 electric motors
 Drive system : Pure electric motor drive servo system
 Regular waves : Wave length (m) 10 6 4 2 0.4
 Max. height (m) 0.25 0.30 0.40 0.20 0.04
 Max. steepness 1/300 1/40 1/20 1/10 1/10
 Irregular waves : Waves having specified wave spectra are used in routine tests. Extreme waves having specified spectra can be generated.
 Short crested waves : Generation of short crested regular and irregular waves.
 Range of water depth : 0.2 m ~ 2.15 m

Sketch of wave maker



INSTRUMENTATION

TEST PERFORMED: Resistance in calm water & waves, propeller related tests manoeuvring & seakeeping performance tests of ships and offshore structures

MEASURING APPARATUS & TRANSDUCER

Wave probe : Electric resistance and capacitance and electric servo types

Motions in waves : Mechanical six degrees or four degrees motion measurement apparatuses with six or four potentiometers in ordinary experiments. Small vertical gyro and mini triaxial accelerometers in special cases.

Dynamic total forces and moment : Assembly block transducer of strain gauge force pickup

Dynamic local forces : Strain gauge

Dynamic local pressures: Micro pressure gauge of semi conductive strain gauge type

Dyanmic acceleration : Mini accelerometers of strain gauge type

DATA RECORDING & ANALYSIS

Data recording : Magnetic data recorder, oscillograph and pen recorder

Analysis : Fourier analysis, Spectrum analysis, Correlation analysis and non-linear time series analysis (auto regressive & moving average type model fitting and system identification)

METHODS OF TESTING

MODEL

Floating platform : Length : 1.5 ~ 2.5 m
 Scale : 1/50 ~ 1/100
 Material : Wood, aluminum

SIMILITUDE

Tests in waves : Froude's law only
Current or wind force : Acting the force corresponding to current or wind force on structure

WAVES USED FOR TESTS

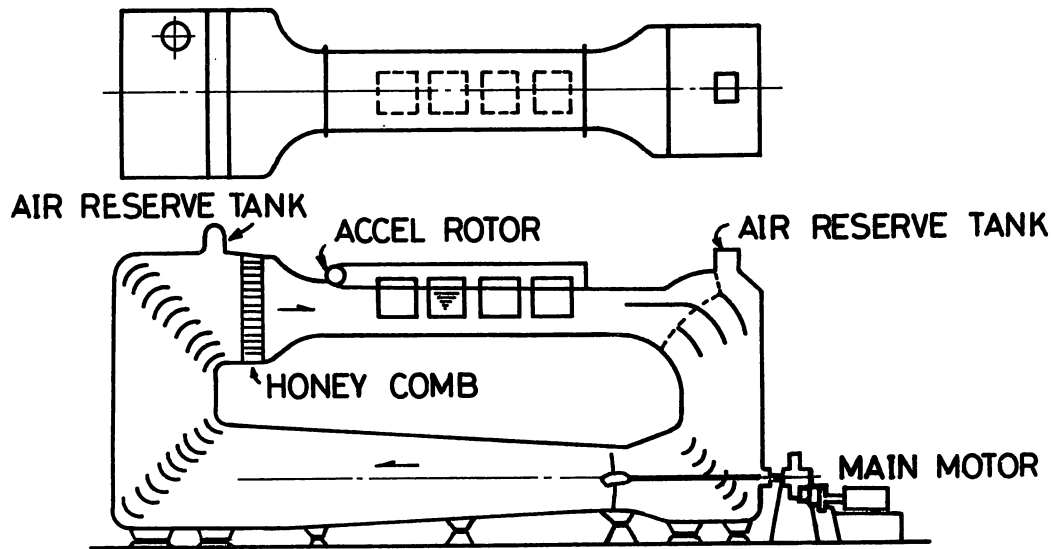
Frequency response tests : Regular waves for search of frequency transfer functions. Irregular waves for check of linear superposition.
in waves
Severe seastate tests : High irregular waves having "design wave spectra". Regular waves corresponding to "design wave".

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14-3 FACILITIES

CIRCULATING WATER CHANNEL (1970)



DESCRIPTION OF FACILITY : Vert. plane, open recirc.

CURRENT GENERATION

Type of drive system : 4-bladed axial flow impeller with Thyristor Leonard control
 Total motor power : 75 KW, 1,750 rpm
 Working section max. velocity : 2 m/s
 Other remarks : Accelerating rotor at the upstream of the measuring part

WIND GENERATION

Type, wind direction, portable or fixed, Area, Speed Wind gust, Generator, Sketch

INSTRUMENTATION

TEST PERFORMED: Towing performance and underwater behaviour of ships, propulsion systems and offshore structures flow patterns observation

MEASURING APPARATUS & TRANSDUCER

Resistance dynamometer, flow observation apparatus traverse device forced oscillation apparatus in 6- degree of freedom.

METHODS OF TESTING

MODELS

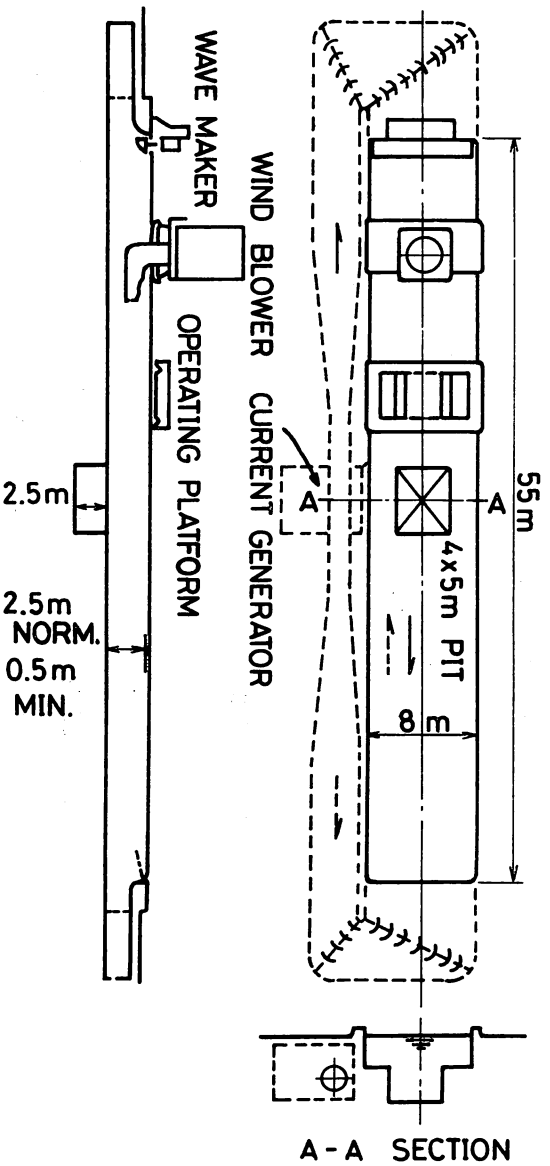
Floating platform: Length: 0.5 ~ 1.0 m, Scale 1/100 ~ 1/200
 Material: Wood, aluminium

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14-4 FACILITIES

CURRENT WATER TANK (1978)

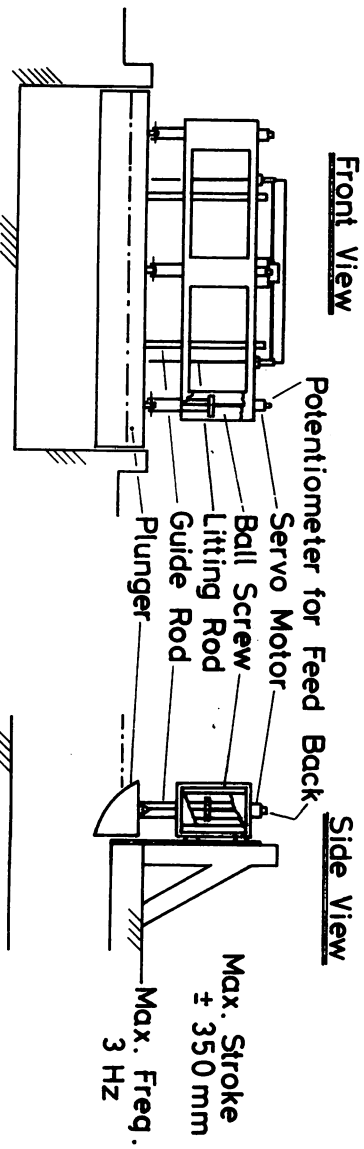


DESCRIPTION OF CARRIAGE: Motor driven operation platform

WAVE MAKER

- Type : Plunger type, variable stroke in driving
- Drive system : Pure electric motor drive servo system
- Regular waves : Wave length (m) 10 6 4 2 0.4
 Max. height (m) 0.40 0.40 0.40 0.20 0.04
 Max. steepness 1/40 1/15 1/10 1/10 1/10
- Irregular waves : Waves having specified wave spectra are used in routine tests. Extreme waves having specified spectra can be generated.
- Range of water depth : 0.5 ~ 2.5 m

Sketch of wave maker



Scale 1/150 0 1 2 3 4 5 M

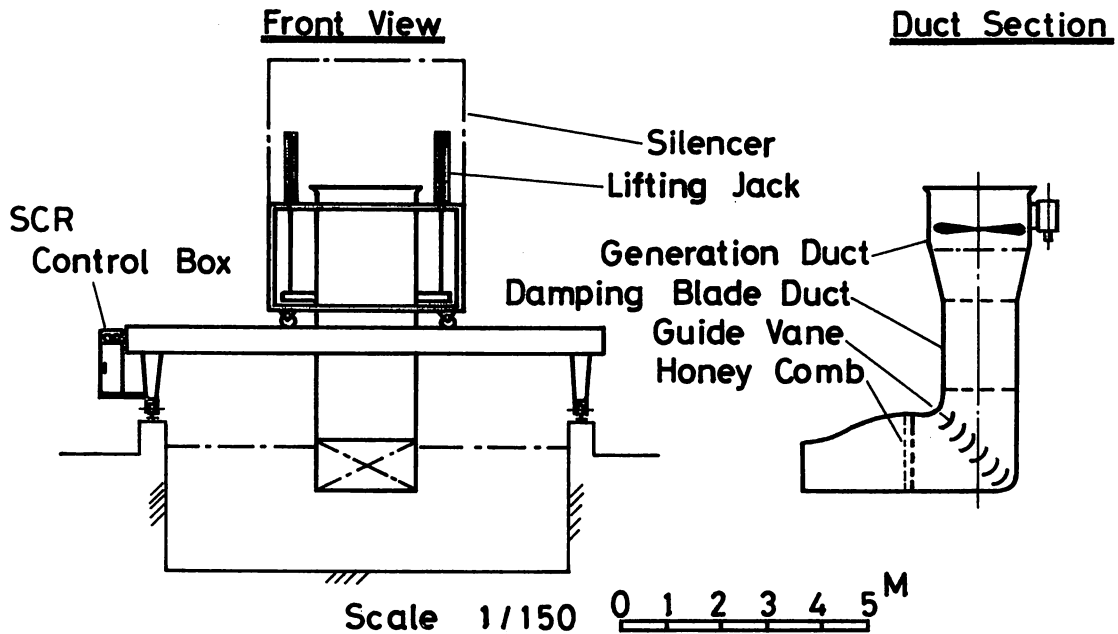
CURRENT GENERATION

- Type : Fixed type
- Current direction : Same and reverse direction with wave propagation
- Area of current : Breadth 8 m x depth 2.5 m
- Speed : 0.1 m/sec ~ 0.5 m/sec (depth 2.5 m)
- Unsteady current : By arranging the mesh screen
- Range of water depth : 0.5 m ~ 2.5 m
- Generator : Axial pump

WIND GENERATION

- Type : Portable on carriage
- Wind direction : $+45^\circ \sim -45^\circ$ (for wave propagation)
- Area : 2.0 m x 1.0 m
- Speed : 0.1 m/sec ~ 20 m/sec
- Wind gusts : Can be simulated by damping blades
- Generator : Axial flow type

Sketch of Wind Blower



INSTRUMENTATION

TEST PERFORMED

- Motions in waves, currents, winds } Floating, moored, fixed
- Forces in waves, currents, winds }
- Forced oscillation
- All these test can be performed in deep & shallow waters
- Scouring of bottom sand around structures

MEASURING APPARATUS & TRANSDUCER

- Wave probe : Electric resistance, capacitance and electric servo types
- Motions in waves : Mechanical six degrees or four degrees motion measurement apparatuses with six or four potentiometers in ordinary experiments. Small vertical gyro and mini triaxial accelerometers in special cases.
- Dynamic total forces and moment : Assembly block transducer of strain gauge force pickup
- Dynamic local forces : Strain gauge
- Dynamic local pressures : Micro pressure gauge of semi conductive strain gauge type
- Dynamic acceleration : Mini accelerometers of strain gauge type

DATA RECORDING & ANALYSIS

- Data recording : Magnetic data recorder, oscillograph and pen recorder
- Analysis : Fourier analysis, spectrum analysis, correlation analysis and non-linear time series analysis (auto regressive & moving average type model fitting and system identification)

METHODS OF TESTING**MODE**

- Floating platform : Length : 1.5 ~ 3.0 m
Scale : 1/30 ~ 1/100
Material : Wood, aluminium

SIMILITUDE

- Tests in waves : Froude's law only

WAVES USED FOR TESTS

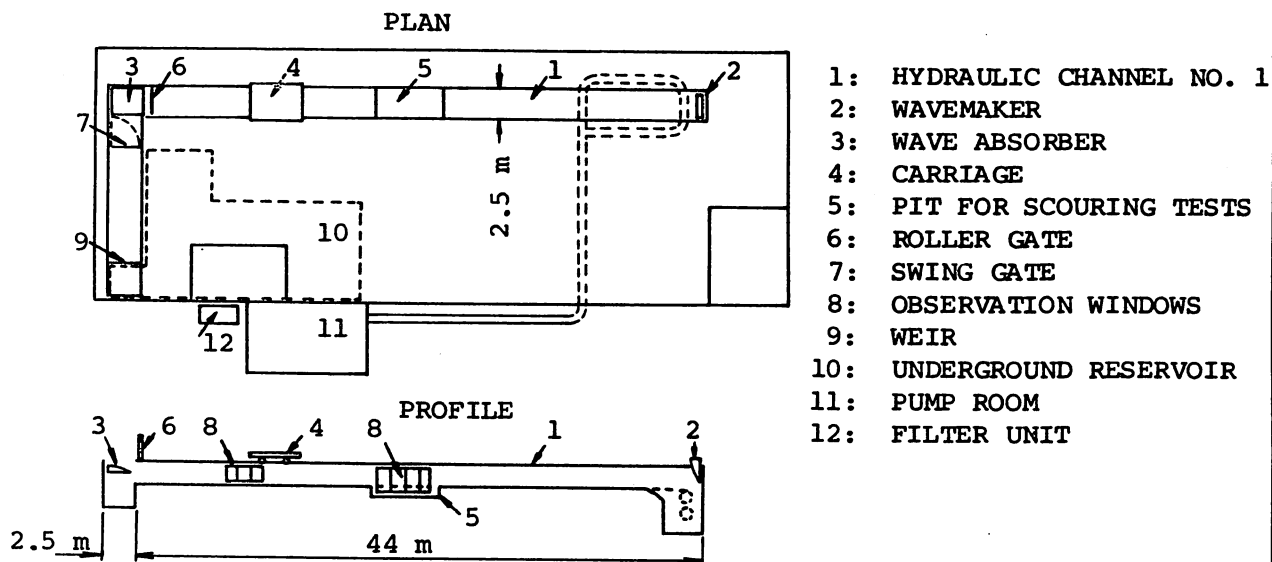
- Frequency response tests in waves : Regular waves and for search of frequency transfer functions.
Irregular waves for check of linear superposition.
- Severe seastate tests: High irregular waves having "design wave spectra".
Regular waves corresponding to "design waves".

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15-1 FACILITIES

HYDRAULIC CHANNEL NO. 1 (1971)



DESCRIPTION OF FACILITY : Hydraulic/circulating water channel
 TYPE OF DRIVE SYSTEM FOR CIRCULATING WATER : Mixed-flow pump, 55 kW double-suction centrifugal pump, 110 kW
 WATER DEPTH : 1.5 ~ 0.2 m
 MAXIMUM FLOW SPEED : 0.33 m/s at 1.5 m depth

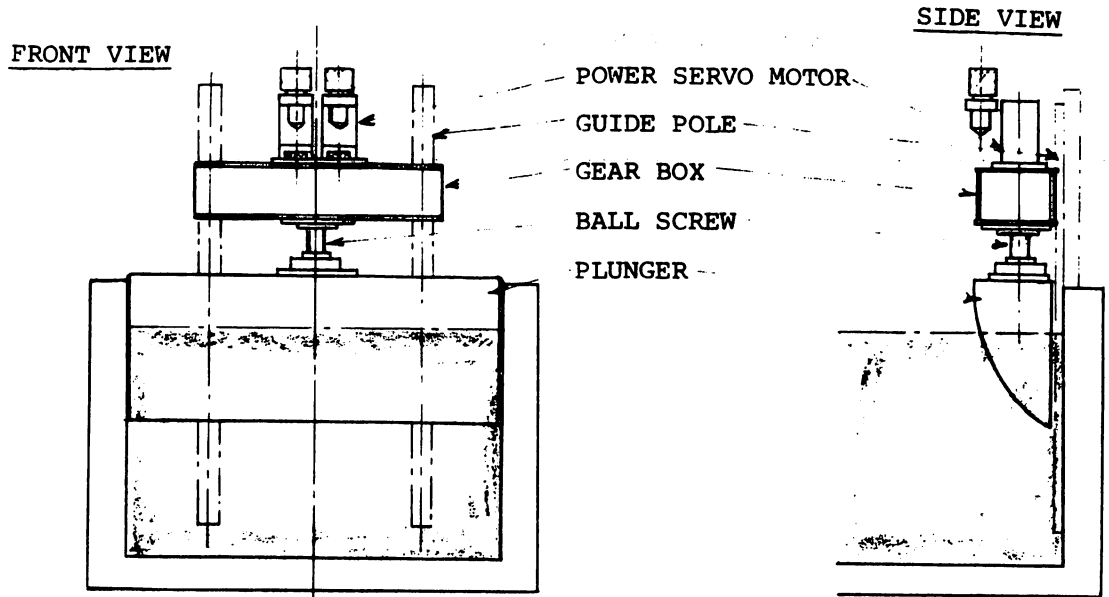
DESCRIPTION OF CARRIAGES : Motor driven
 TYPE OF DRIVE SYSTEM AND TOTAL PWER : Thyristor leonard, 5 kW
 MAXIMUM CARRIAGE SPEED : 2 m/s
 OTHER CAPABILITIES : Motion measuring equipment/vertical PMM can be fitted

WAVE GENERATION CAPABILITY : Regular/irregular, wave length 0.5 ~ 10 m max. wave height 0.2 m at 1.5 m depth
 WAVE MAKER TYPE AND WIDTH : Single plunger, 2.5 m
 WAVE ABSORBER AND LENGTH : Beach type, 2.5 m
 OTHER CAPABILITIES : Vertical positions of wave maker/wave absorber are adjustable

INSTRUMENTATION : Digital data recorder, 32 channels
 TEST PERFORMED : Hydrodynamic forces on marine structures and ships
 Wave induced motions and loads on marine structures and ships
 Offshore-structures mooring
 Scouring phenomens
 Hydraulic flow and vibration on dam gates

PUBLISHED DESCRIPTION: None

SKETCH OF WAVE MAKER



MAX. STROKE : ±200mm
 MAX. FREQ : 1.8 Hz

SCALE 1/50

0 1 meter

Type	:	Single plunger
Drive system	:	Electric motor drive servo system
Regular waves	:	Wave length (m) 10 8 6 4 2 0.5
	:	Max. height (m) 0.125 0.16 0.2 0.2 0.2 0.05
	:	Max. steepness 1/80 1/50 1/30 1/20 1/10 1/10
Irregular waves	:	Specified wave spectra
Others	:	Transient water waves

CURRENT GENERATION

Type	:	Open
Current direction	:	The same as the direction of the waves
Portable or fixed	:	Fixed
Area of current	:	All area in the channel
Current speed	:	0 ~ 0.33 m/s at 1.5 m depth
Generator	:	Mixed - flow pump 55 kW, double - suction centrifugal pump 110 kW
Range of water depth	:	1.5 ~ 0.2 m
Sketch	:	See general layout drawing on preceding page

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

Wave	:	Capacitance type wave meter
Current	:	Propeller type current meter
Motions in waves	:	Potentiometer type motion recorder
	:	Noncontact multi-point measuring system by infrared rays
Total forces and moments	:	3 or 6 component dynamometer, VPMM, HPMM
Local forces and pressures	:	Strain gage, pressure transducer
Others	:	Flow rate: Weir

DATA RECORDING & ANALYSIS

Data recorder : Digital data recorder, analog data recorder,
electromagnetic oscillograph

Analysers of computer : IBM 1130

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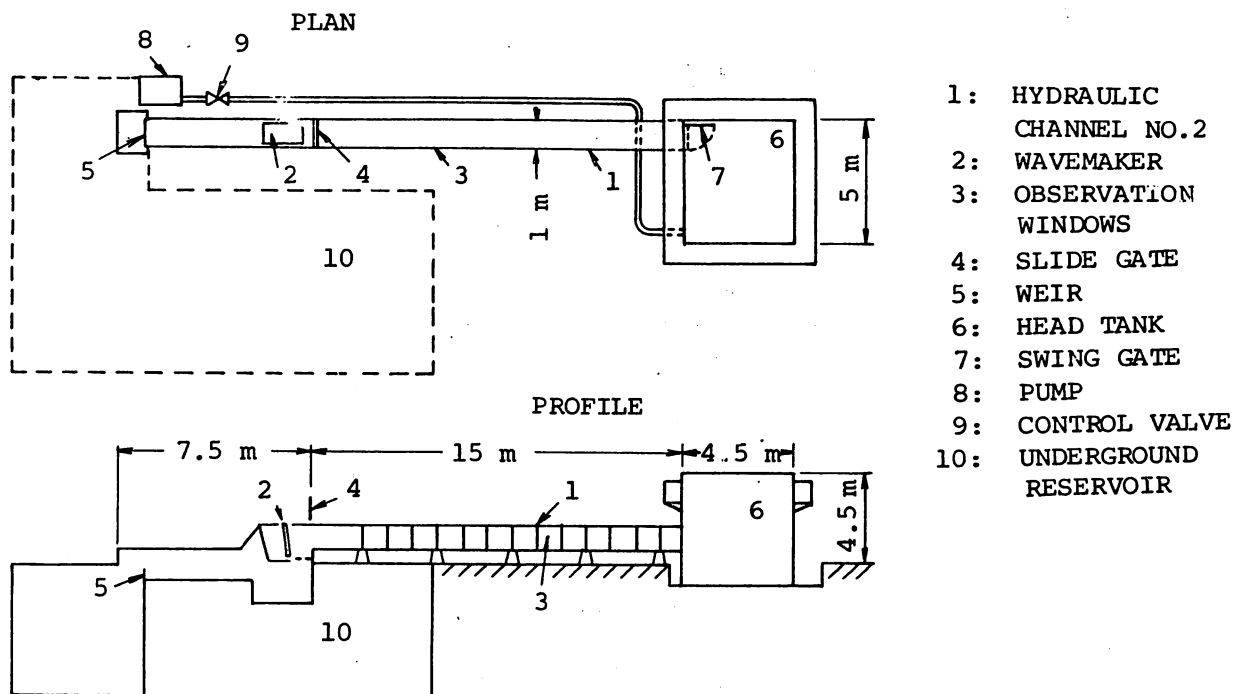
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15-2 FACILITIES

HYDRAULIC CHANNEL NO. 2 (1971)



DESCRIPTION OF FACILITY : Hydraulic/circulating water channel

TYPE OF DRIVE SYSTEM FOR CIRCULATING WATER : Mixed-flow pump, 11 kW

WATER DEPTH : 0.6 ~ 0.2 m

MAXIMUM FLOW SPEED : 0.19 m/s at 0.6 m depth

WAVE GENERATION CAPABILITY : Regular, wave length 0.4 - 3 m
 Max. wave height 0.12 m at 0.6 m depth

WAVE MAKER TYPE AND WIDTH : Single flap, 1 m

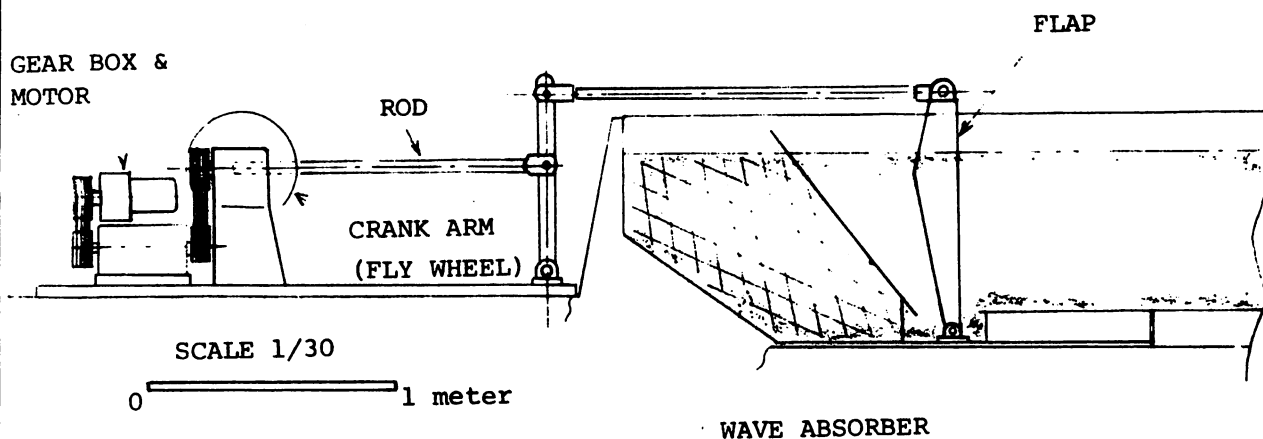
WAVE ABSORBER : Beach type, temporary

INSTRUMENTATION : Digital data recorder, 32 channels

TEST PERFORMED : Hydrodynamic forces on marine structures and ships wave induced motions and loads on marine structures and ships offshore-structures mooring
 Hydraulic flow and vibration on dam gates

PUBLISHED DESCRIPTION : None

SKETCH OF WAVE MAKER



Type	:	Single flap
Drive system	:	Electric motor drive servo system
Regular waves	:	Wave length (m) 3 2 1 0.4
	:	Max. height (m) 0.1 0.1 0.1 0.04
	:	Max. steepness 1/30 1/20 1/10 1/10
Range of water depth	:	0.6 ~ 0.2 m

CURRENT GENERATION

Type	:	Open
Current direction	:	Opposite direction to the waves
Portable or fixed	:	Fixed
Area of current	:	All area in the channel
Current speed	:	0 ~ 0.19 m/s at 0.6 m depth
Generator	:	Mixed - flow pump 11 kW
Range of water depth	:	0.6 ~ 0.2 m
Sketch	:	See general layout drawing on preceding page

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

Wave	:	Capacitance type wave meter
Current	:	Blade wheel type current meter
Motions in waves	:	Potentiometer type motion recorder
	:	Noncontact multi - points measuring system by infrared rays
Total forces and moments	:	3 or 6 component dynamometer, VPMM, HPMM
Local forces and pressures	:	Strain gage, pressure transducer
Others	:	Flow rate: Weir

RESEARCH INSTITUTE

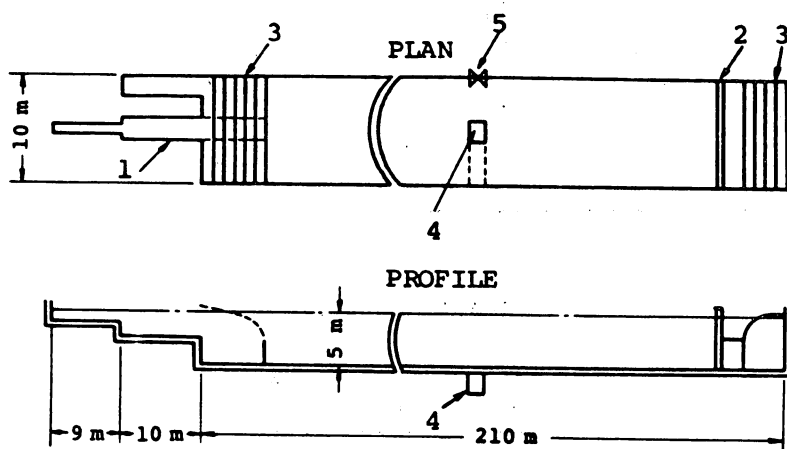
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15-3 FACILITIES

TOWING TANK (1966)



- 1: TRIMMING TANK
- 2: WAVEMAKER
- 3: WAVE ABSORBER
- 4: OBSERVATION ROOM
- 5: OBSERVATION WINDOW

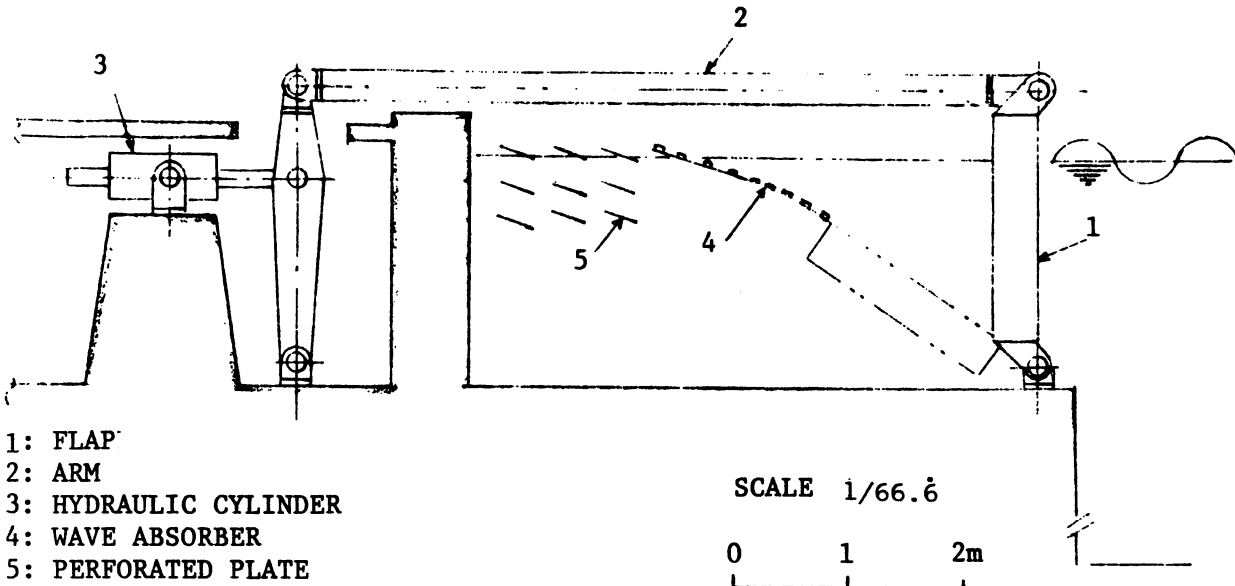
DESCRIPTION OF CARRIAGES : 1 manned, motor driven, digital control
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor leonard, 100 kW
 MAXIMUM CARRIAGE SPEED : 5 m/s
 OTHER CAPABILITIES : Vertical/horizontal PMM can be fitted

WAVE GENERATION CAPABILITY : Regular/irregular, wave length 0.5 ~ 15 m
 max. wave height 0.5 m
 WAVE MAKER TYPE AND WIDTH : Single flap, 10 m
 WAVE ABSORBER AND LENGTH : Beach type, 5 m
 WAVE MEASUREMENT : Capacitance probe on the carriage

INSTRUMENTATION : Minicomputer on carriage for data acquisition and on-line analysis
 32 analog and 5 digital channels
 Up to 100 samples per second per channel
 MODEL SIZE : Ship length 5 ~ 7 m
 MODEL TRACKING TECHNIQUES : Propeller rpm determined formerly using minicomputer (IHI-method)
 TEST PERFORMED : Resistance & self-propulsion in calm water and waves
 Open water propeller tests, 3-D wake surveys and wave analysis hydrodynamic forces on floating bodies
 Wave induced motions and loads on ship and marine structures

PUBLISHED DESCRIPTION: IHI Engineering Review (J), Special Issue No. 4,
 Oct. 1970
 IHI engineering Review (J), Vol. 17, No. 6, Nov. 1977

SECTION OF WAVEMAKER



Drive system	: Electro-hydraulic system							
Max. stroke	: ±320 mm							
Max. freq.	: 1.77 Hz							
Regular waves	: Internally generated sinusoidal signal							
Wave length (m)	15	12	10	8	5	4	2	0.5
Max. height (m)	0.23	0.28	0.33	0.4	0.5	0.4	0.2	0.05
Max. steepness	1/66	1/42	1/30	1/20	1/10	1/10	1/10	1/10
Irregular waves	: Specified wave spectra							

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

Motions in waves: Servo driven mechanical motion recorder
 Total forces and moments: 3 or 6 component dynamometer, VPMM, HPMM
 Local forces and pressures: Pressure gage

DATA RECORDING & ANALYSIS

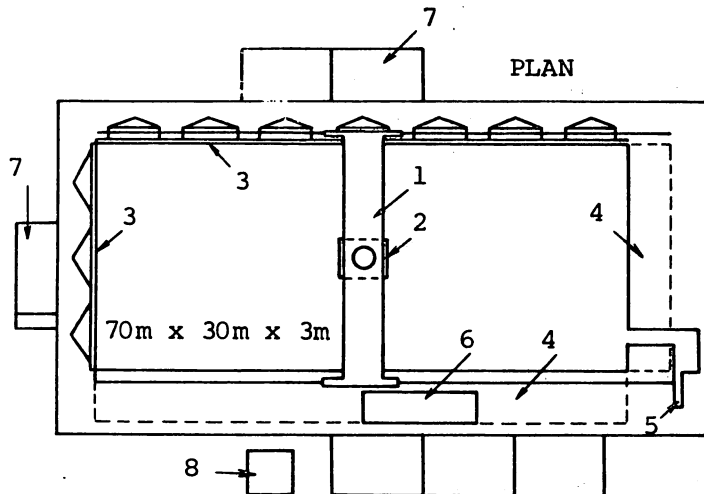
Data recorder (Off line): Magnetic tape in digital/analog signal
 Analysis: Digital computer IBM1130

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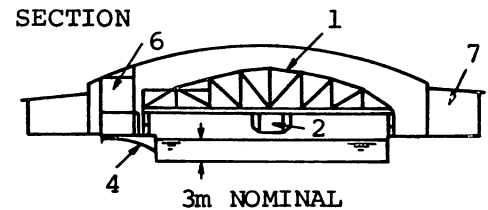
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15-4 FACILITIES

SEAKEEPING AND MANOEUVRING BASIN (1975)



- 1: MAIN CARRIAGE
- 2: SUB-CARRIAGE
- 3: WAVEMAKER
- 4: WAVE ABSORBER
- 5: TRIMMING TANK
- 6: CONTROL ROOM
- 7: HYDRAULIC UNIT ROOM
- 8: FILTER UNIT



DESCRIPTION OF CARRIAGES : Motor driven, digital control
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor leonard, 102 kW
 MAXIMUM CURRIAGE SPEED : 2 m/s
 OTHER CAPABILITIES : Remote control in the control room on shore

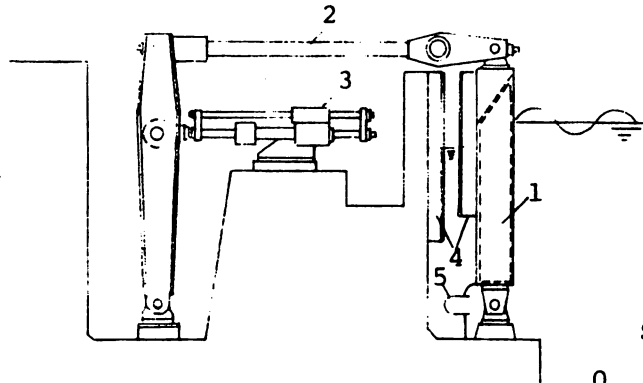
WAVE GENERATION CAPABILITY : Regular/irregular, wave length 0.5 ~ 12 m, max. wave height 0.4 m
 WAVE MAKER TYPE AND WIDTH : Multiple flap, 30 m and 70 m
 WAVE ABSORBER AND LENGTH : Beach type, 6 m
 WAVE MEASUREMENT : Servocontrolled probes at fixed points in the tank capacitance probes on the carriage

INSTRUMENTATION : Minicomputer on shore for data acquisition and on-line analysis 1-32 analog channels up to 32 kHz sampling rate
 MODEL SIZE RANGE : 4 m in length for captive model tests, 2.5-3 m for other tests
 MODEL TRACKING TECHNIQUES : Propeller rpm adjusted manually, relative model position detected by mechanical contact with the model
 TEST PERFORMED : Resistance and self-propulsion tests in waves
 Hydrodynamic forces on ships and marine structures
 Wave induced motions and loads on ships and marine structures
 Captive model tests tracing programmed loci with the carriages free running model tests of ships

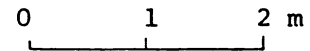
PUBLISHED DESCRIPTION: Proceedings, 14th ITTC, Vol. 4, 1975
 Journal of SNAJ, Vol. 137, June 1975
 IHI Engineering Review (J), Vol. 15, No. 4, July 1975
 IHI Engineering Review (J), Vol. 15, No. 5, Sep. 1975

SECTION OF WAVEMAKER

- 1: FLAP
- 2: ARM
- 3: STEPPING CYLINDER
- 4: FINS
- 5: SEAL



SCALE 1/65



Drive system : Electro-hydraulic system
 Max. stroke : ±285 mm
 Max. freq. : 1.77 Hz

Regular waves : Internally generated sinusoidal signal

Wave length (m)	12	10	6	5	4	2	0.5
Max. height (m)	0.15	0.2	0.4	0.4	0.3	0.17	0.04
Max. steepness	1/80	1/20	1/15	1/12.5	1/12	1/12	1/12

Irregular waves : Specified wave spectra
 Others : Bi-directional waves

Wind generation : Fetch 10 m, width 6 m, max. 2 m/s capability

Generator : Sirocco type fan, portable
 Similitude : Equivalent speed

INSTRUMENTATION

MEASURING APPARATUS & TRANSDUCER

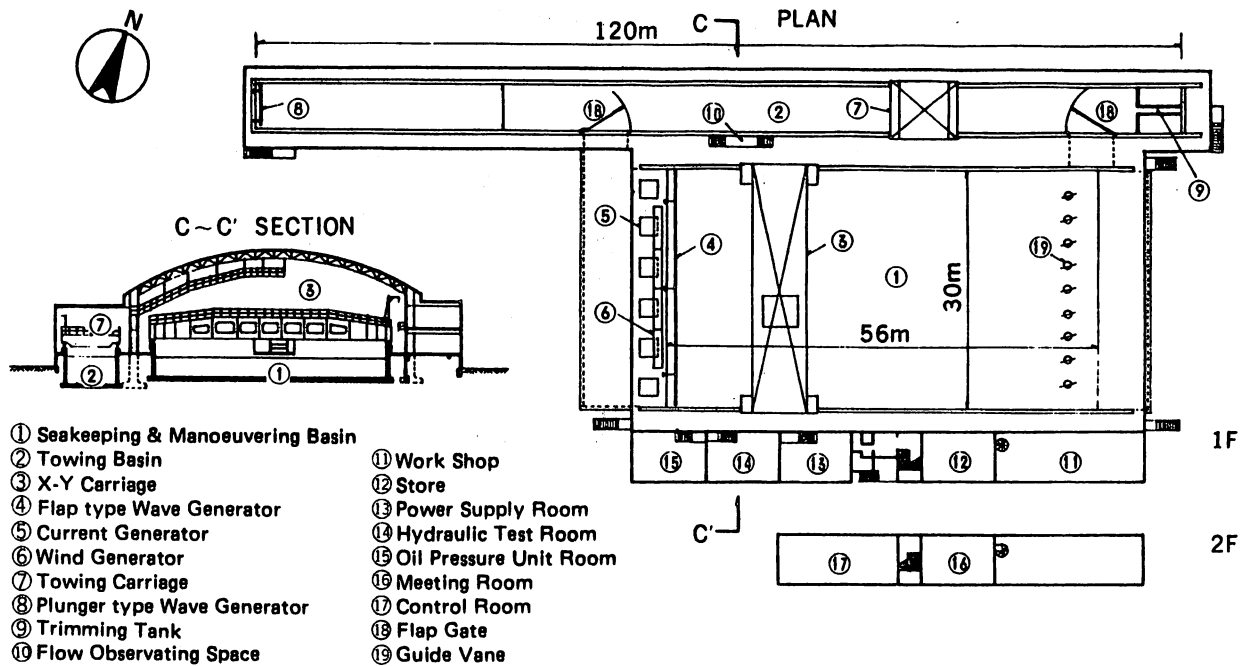
Motion in waves : Servo driven mechanical motion recorder
 Total forces and moments : 3 or 6 component dynamometer, VPMM, HPMM
 Local forces and pressures: Pressure gage

DATA RECORDING & ANALYSIS

Data recorder (Off line) : Magnetic tape in digital/analog signal
 Data recorder (On line) : Bulk core memory connected to the mini-computer
 Minicomputer : YHP1000 system with a graphic display and a plotter

16-1 FACILITIES

SEAKEEPING AND MANOEUVRING BASIN (1979)



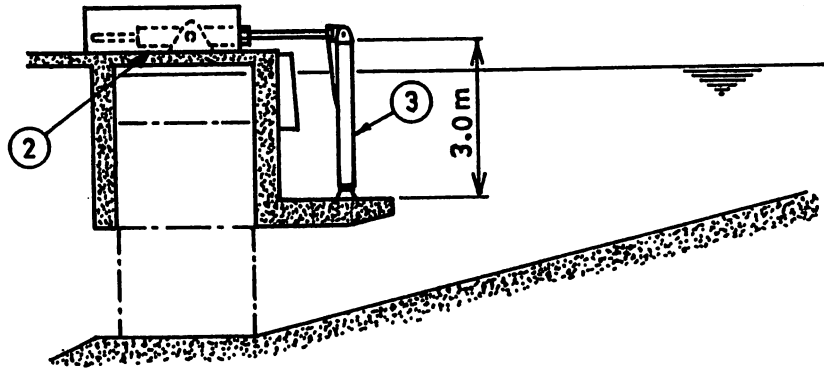
DESCRIPTION OF CARRIAGE	: Plate girder type, motor driven, digital controlled by micro-computer
TYPE OF DRIVE SYSTEM AND TOTAL POWER	: Thyristor Leonard system, double carriage (X-Y) type, X-carriage (30 kW x 4), Y-carriage (11 kW x 2)
CARRIAGE SPEED	: Maximum speed 2.0 m/sec, speed setting accuracy 1 mm/sec, speed fluctuation within 1 mm/sec
OTHER CAPABILITIES	: Programmed CMT (Circular Motion Test), PMM test and automatic tracking by two carriages

WAVE MAKER

Type	: Flap type, controllable stroke in driving, digital controlled by micro-computer
Drive system	: Electro-Hydraulic drive system
Regular waves	: Wave length (m) 20 10 5 1 0.5 Max. height (m) 0.3 0.4 0.4 0.1 0.05 Max. steepness 1/66.7 1/25 1/12.5 1/10 1/10
Irregular waves	: I.S.S.C. wave spectra are used and input-signal for irregular waves are given from data recorder
Others	: Transient waves are also used on the frequency response experiments in waves and input-signal specified waves are given from data recorder.
Range of water depth	: Designed depth is 2.5 m but possible to make shallow to about 0.75 m.

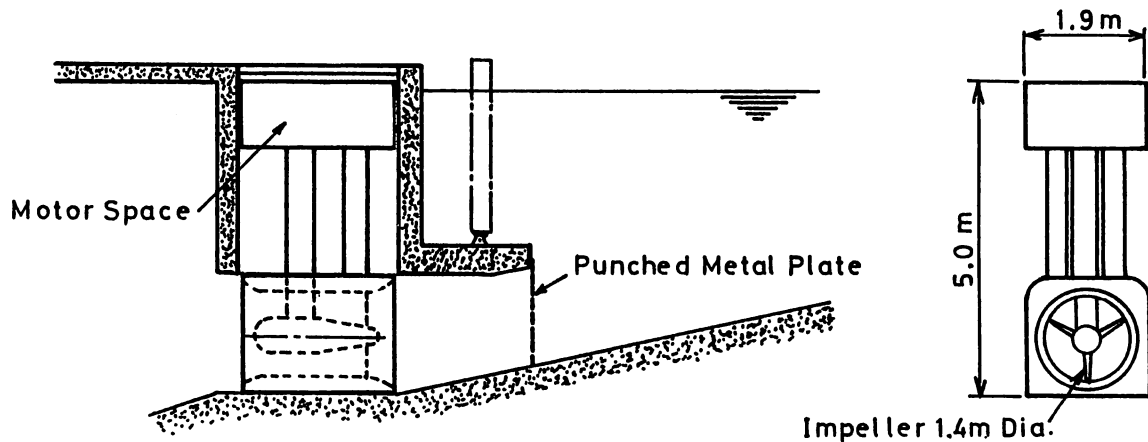
Sketch of wave maker

- ② actuator x 3
- ③ flap, 30 m breadth



CURRENT GENERATION

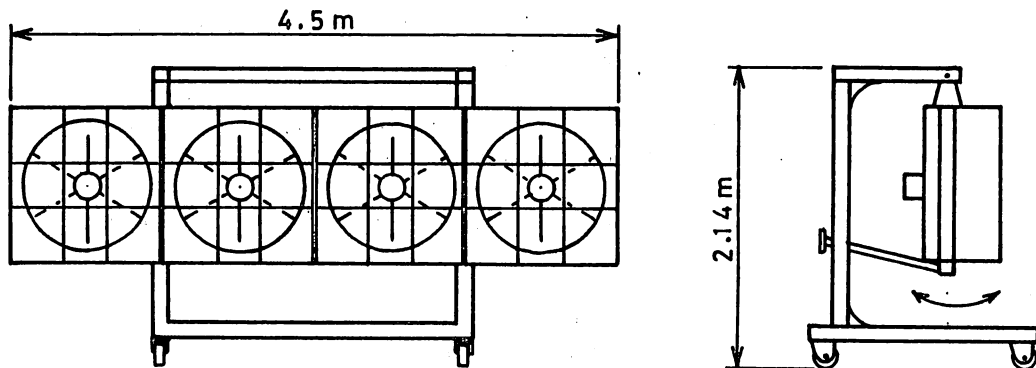
- Type : Impeller type, 6 sets are fixedly arranged in parallel with the wave maker
- Current direction: With and/or against the wave direction
- Portable or fixed: Fixed type but assembled in each one unit which is hoistable for maintenance
- Area of current : Full breadth of the tank and about 30 m length area
- Speed : Max. 0.5 m/sec
- Current profile : Incapable to control
- Unsteady current : Only by manual operation
- Range of water : Designed depth is 2.5 m but possible to make shallow depth to about 0.75 m
- Sketch of current: One unit generator



WIND GENERATION

- Type : Axial fan type, 4 sets are arranged in parallel with the wave maker
- Wind direction : With the wave direction
- Portable or fixed: Movable
- Area : 20 m breadth and about 30 m length area
- Speed : 6 m/sec at about 10 m from the fans
- Wind gust : Not to be planned
- Generator : 4 fans for each one set and each fan has 0.7 kW motor

Sketch of the Fans (one unit)



INSTRUMENTATION

TEST PERFORMED:

Motions in waves, current and wind on floated, moored and fixed conditions
 Forces in waves, current and wind on floated, moored and fixed conditions
 Forced oscillation, planner motion, Manoeuvring in deep water and in shallow water (planning false bottom)

MEASURING APPARATUS & TRANSDUCER

Wave : Servo type, Resistance type, Capacitance type
 Current : Propeller type, Electro-magnetic type
 Wind : Propeller type
 Track : Measuring TV system
 Motions in waves : Motion detector (6 and 4 degrees of freedom),
 Vertical gyro
 Total forces and moments : Load cell (3 components)
 Local forces and pressures : Ring type load cell and pressure gage

DATA RECORDING & ANALYSIS

Cassette type data recorder
 6 pens recorder
 X-Y recorder
 8 pens oscilo-graph
 18 chs oscilo-graph
 VTR
 Real time data analyser
 Graphic display

METHODS OF TESTING

MODELS

Size : 2.5 m ~ 3.0 m
 Material : Wooden

SIMULITUDE

Wave : Model scale
 Wind : Froude number
 Current : Froude number

USED WAVES

Design wave : Regular, Irregular
Design spectra : I.S.S.C.

REFERENCES

This basin is connected with the Towing Basin, which is arranged as shown in the sketch (page 1), for the circulating flow of current.

The towing basin is mainly used for resistance & propulsion tests.

SIZE OF TOWING BASIN : 120 m (L)
6 m (B)
3.5 m Water depth

TOWING CARRIAGE : Box girder type, motor driven, digital controlled
by micro-computer
Drive system and power: Thyristor Leonard system, 11 KW x 4
Carriage speed : Max. 4.0 m/sec

WAVE MAKER : Plunger type, motor driven

CURRENT SPEED IN TOWING : Max. 1.5 m/sec
BASIN

PUBLISHED DESCRIPTION

Bulletin of the Society of Naval Architects of Japan, No. 604, Oct. 1979.
Sumitomo Heavy Industries, Ltd. TECHNICAL REVIEW, Vol. 28, No. 82, Apr. 1980

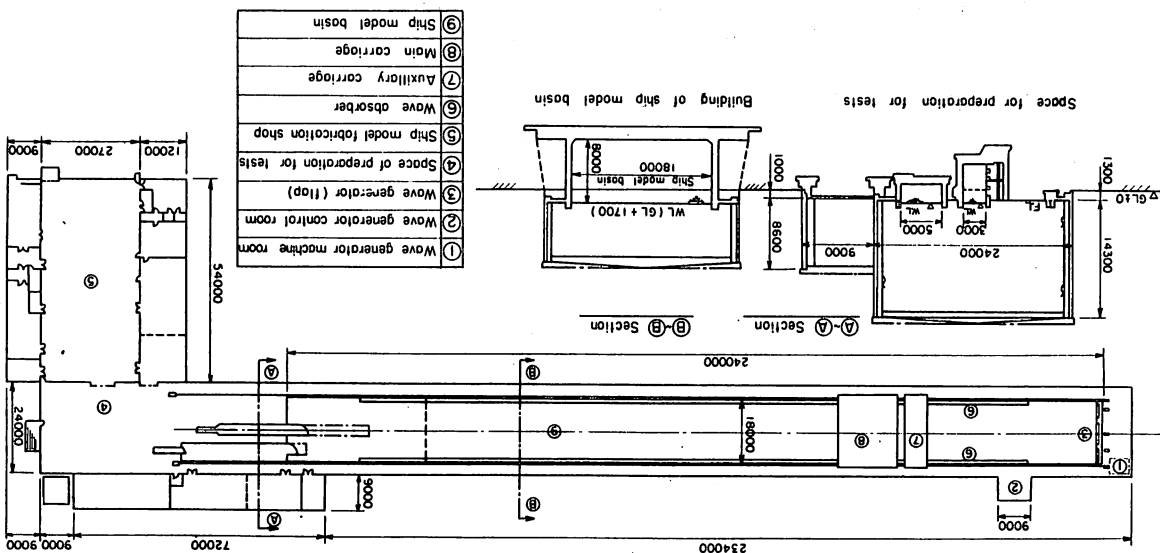
TSU RESEARCH LABORATORIES, TECHNICAL RESEARCH CENTER, NIPPON KOKAN K.K.
 1-KUMOZU KOKAN-CHO, TSU-CITY, MIE-PREF.

Phone (0592) 34-3111

Telex 4922-134

17-1 FACILITIES

SHIP MODEL BASINS (1977)



DESCRIPTION OF CARRIAGES : Set-point controlled with mini-computer, motor driven, separated two carriages

TYPE OF DRIVE SYSTEM AND TOTAL POWER : Inversed-parallel connection reversing thyristor converter with circulating current control 132 KW x 1,150 rpm x 4 sets

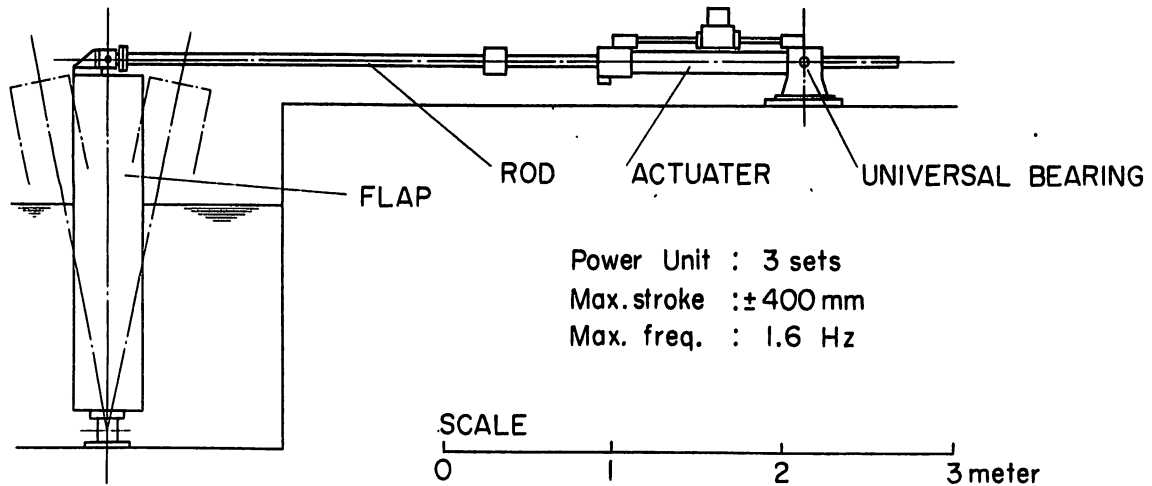
MAXIMUM CARRIAGE SPEED : X-direction 7 m/sec, Y-direction 1.5 m/sec, around-2 15 deg/sec

OTHER CAPABILITIES : Circular towing and oblique towing are possible with two carriages

WAVE MAKER
 Type : Flap type
 Drive system : Hydraulic
 Regular waves :
 Wave length (m) : 18 10 6 4 2 0.6
 Max. height (m) : 0.2 0.4 0.4 0.4 0.2 0.06
 Max. steepness : 1/90 1/25 1/15 1/10 1/10 1/10
 Irregular waves : Waves having specified wave spectra are used in routine tests
 Range of water depth : 8 m fixed

Sketch of wave maker

SIDE VIEW



INSTRUMENTATION

TESTS PERFORMED : Resistance & self propulsion in calm water and in waves,
 Open water propeller tests, 3-D wake survey and wave analysis,
 Hydrodynamic force on ship and floating structures under circular towing and oblique towing,
 Wave induced motion and loads on ship and floating moored structures,
 Manoeuvring trajectory of ships and floating structures.

MEASURING APARATUS & TRANSDUCER

Wave : Servo motor type and capacity type wave height meter
 Motion in wave : Six components of motion are measured with double carriages type motion detector
 Total force and moment: Strain gauge type dynamometer
 Track : Relative model position from towing carriage are measured by potential difference and carriage chases model automatically
 Others : Speed, local force, pressure

DATA RECORDING & ANALYSIS

Computer : Minicomputer on towing carriage is used for data record, data process and analysis NOVA 02, 32kW
 Graphic display : 19 inches cathode-ray-tube with keyboard

METHODS OF TESTING

MODELS

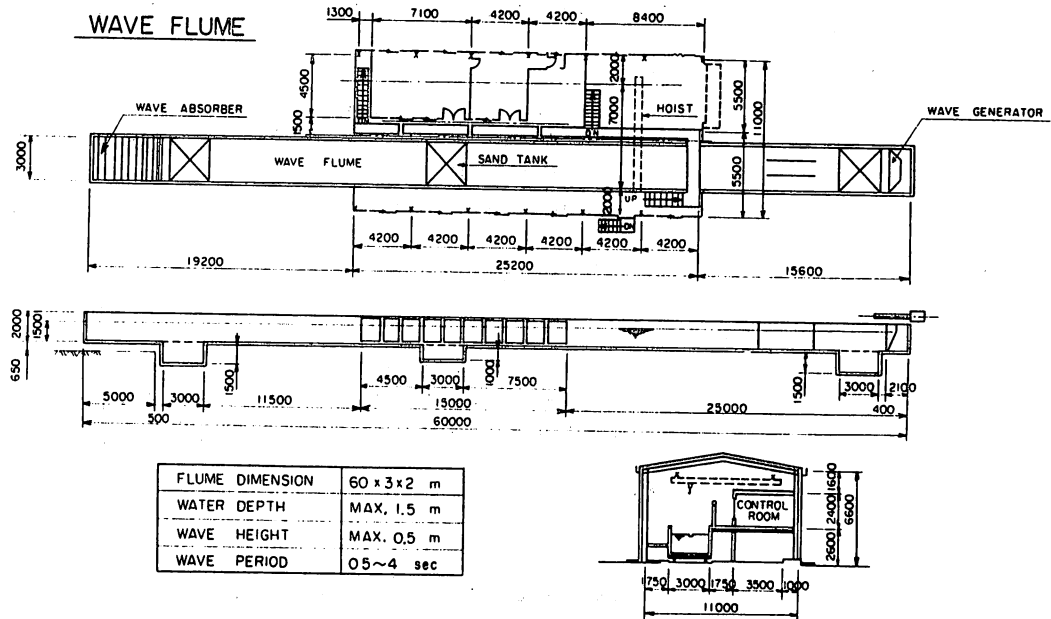
Size : Ship type (for seakeeping and manoeuvring) 3 ~ 8 m length
 Others 2 tons weight
 Scale : 1/20 ~ 1/100
 Material: Wood and metal

PUBLISHED DESCRIPTION: NIPPON KOKAN TECHNICAL REPORT-OVERSEAS,
 September 1978 & March 1979

TSU RESEARCH LABORATORIES, TECHNICAL RESEARCH CENTER, NIPPON KOKAN K.K.
 1-KUMOSU KOKAN-CHO, TSU-CITY, MIE-PREF., Phone (0592) 34-3111
 Telex 4922-134

17-2 FACILITIES

WAVE FLUME (1977)

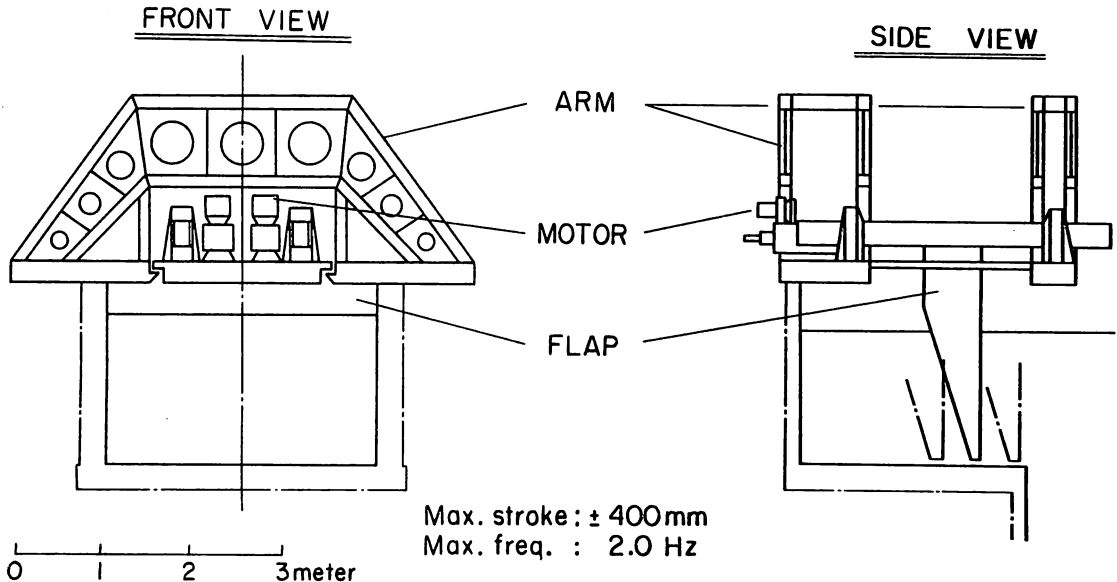


DESCRIPTION OF CARRIAGES: None

WAVE MAKER

Type : Piston type
 Drive system : Electric
 Regular waves : Wave length (m) 15 10 6 4 2 0.4
 Max. height (m) 0.45 0.45 0.45 0.43 0.22 0.032
 Max. steepness 1/33 1/22 1/13 1/9 1/9 1/13
 Irregular waves : Waves having specified wave spectra are used in routine tests
 Range of water : 0.2 ~ 1.5 m depth

Sketch of wave maker



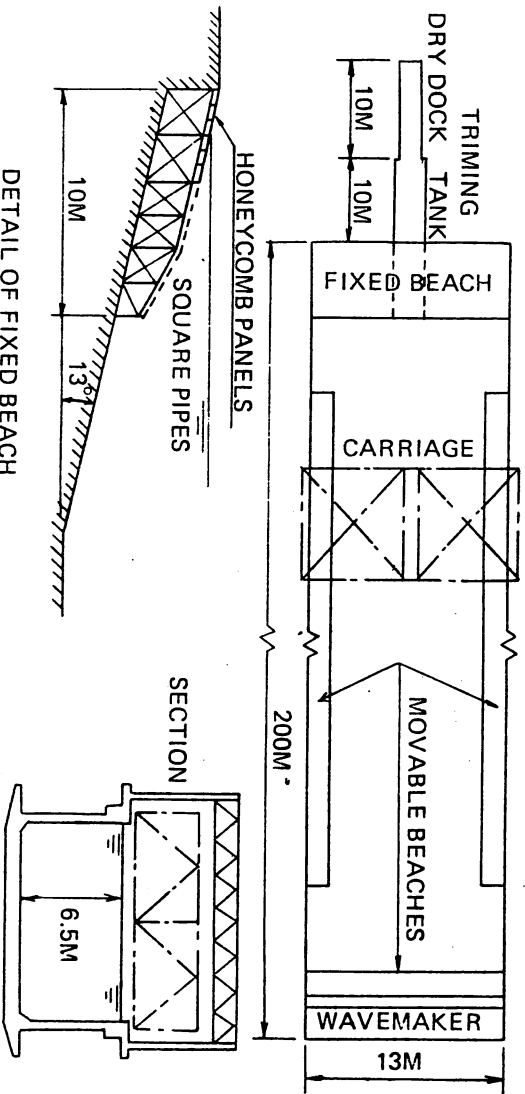
INSTRUMENTATION	
<p>TESTS PERFORMED :</p> <p>Wave forces on pile group, Pressure distribution on the tower against breaking wave, Performance of floating break water, Performance of timber stock floaters, Motions and loads of semi-submersible barge.</p>	
MEASURING APPARATUS & TRANSDUCER	
<p>Wave : Capacity type wave height meter</p> <p>Motion in wave : Six components of motion are measured with double carriages type motion detector</p> <p>Total force and moment : Strain gauge type dynamometer</p> <p>Others : Local force, pressure</p>	
DATA RECORDING & ANALYSIS	
<p>Data recorder : Analogue data recorder</p> <p>Analysis : A/D conversion by NOVA 02, storing digital magnetic tape, analyzing by IBM 370/158.</p>	
METHODS OF TESTING	
MODELS	
<p>Size : Max. diameters 1 m, 2-dimensional 3 m x 2.5 m x 1.5 m</p> <p>Scale : 1/10 ~ 1/50</p> <p>Material : Wood, metal, acrylic resin</p>	
PUBLISHED DESCRIPTION : None	

AKASHI SHIP MODEL BASIN CO., LTD.
3-1, KAWASAKI-CHO, AKASHI

Phone (078) 922-1200
Telex 5628815

18-1 FACILITIES

TOWING TANK (1971)



DESCRIPTION ON CARRIAGE : Truss structure, motor driver

TYPE OF DRIVE SYSTEM AND : Thyristor Leonard (digital speed control),
37 KW 4

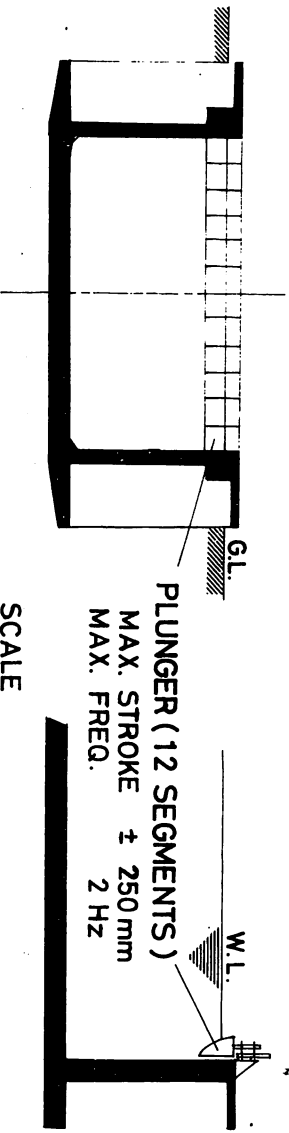
MAXIMUM CARRIAGE SPEED : 5 m/s

WAVE MAKER

- Type : Plunger type, 12 segments, variable stroke
 - Drive system : Hydraulic
 - Regular waves : Wave length (m) 0.5 1 15
Max. height (m) 0.4
Max steepness 1/25
 - Irregular waves : Waves having specified wave spectra are used in routine tests.
 - Short crested waves : Generation of short crested regular waves merging specified two regular waves.
 - Others : Transient waves can be utilized instead of regular waves for frequency response tests in waves.
 - Range of water depth : 6.5 m constant
- Sketch of wave maker

FRONT VIEW

SIDE VIEW



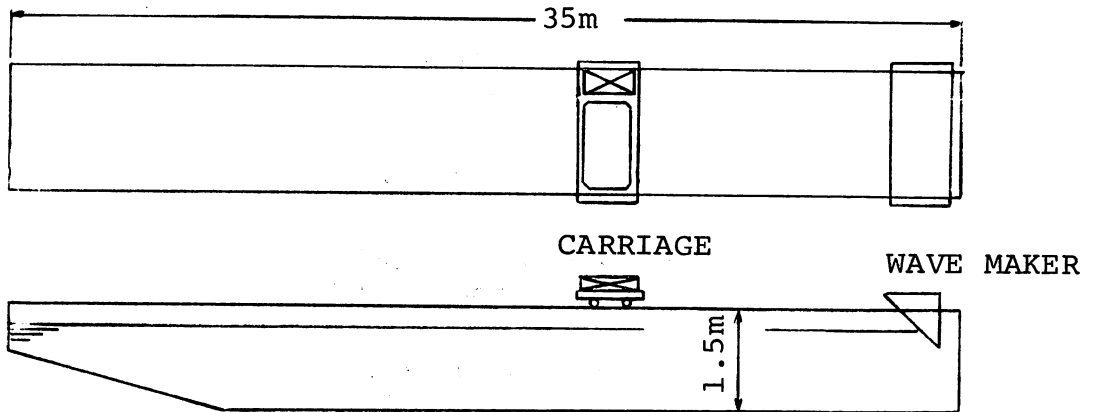
SCALE
0 2 4 6 8 10 12 14 METER

CURRENT GENERATION	: None
WIND GENERATION	: None
INSTRUMENTATION	
TEST PERFORMED	
Motions in waves] Floating, or fixed
Forces in waves	
Forced oscillation, Planer motion	
Resistance, Self-propulsion	
Others: Deep only	
MEASURING APPARATUS & TRANSDUCER	
Wave:	capacity type, ultrasonic type
Speed	
Motions in waves:	Poentiometer type
Total Forces and moment	
Local forces and pressures	
DATA RECORDING & ANALYSIS	
Data recorder	
Data processor	
Analyser or computer	
METHODS OF TESTING	
MODELS	
4 meters wooden model as standard	
SIMILITUDE	
Wave	
Wave and current forces on cylinders	
USED WAVES	
Design wave	
Design spectra	
PUBLISHED DESCRIPTION: 1) 14th ITTC (1975)	
2) S. Watanabe & others: On the Specific Features of the Ship	
Model Experimental Tank of Akashi Ship Model Basin,	
Jour. Soc. Nav. Arch. of Japan, Vol. 136 Dec. 1974	

TAMANO COASTAL LABORATORY
 MITSUI OCEAN DEVELOPMENT & ENGINEERING CO., LTD.
 GOKAN 2032, TAMANO-SHI, OKAYAMA-KEN 706-03 Phone (0863) 41-1525

19-1 FACILITIES

SMALL TOWING TANK (1974)

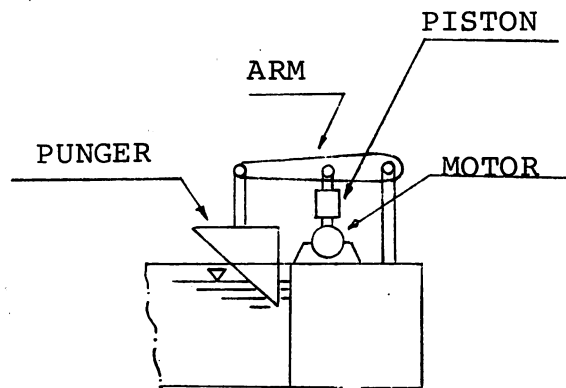


DESCRIPTION OF CARRIAGES : Motor driven (2.2 kW)
 MAXIMUM CARRIAGE SPEED : 2 m/sec.

WAVE MAKER

Type : Plunger type
 Regular wave : Wave length (max) 10 m
 : Wave height (max) 0.3 m
 Range of water depth : 1 m \pm 0.2 m

Sketch of wave maker:



INSTRUMENTATION

TEST PERFORMED : Oilskimming efficiency test
 : (Towing test in waves)
 MEASURING APPARATUS & TRANS- : None
 DUSER
 DATA RECORDING & ANALYSIS : None

HIROSHIMA EXPERIMENTAL TANK
 HIROSHIMA TECHNICAL INSTITUTE
 MITSUBISHI HEAVY INDUSTRIES, LTD.
 4-6-22, KAN-ON-SHIN-MACHI, HIROSHIMA 733

Phone (0822) 91-2111

20-1 FACILITIES

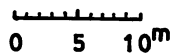
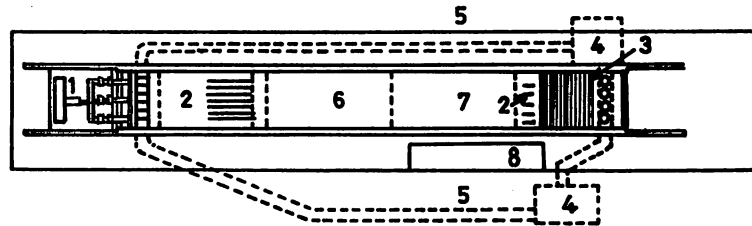
OFFSHORE-STRUCTURE EXPERIMENTAL TANK (1969)
 (SEA-BED SOIL SIMULATION BASIN)

OFFSHORE STRUCTURE EXPERIMENTAL TANK
 (SEABED SOIL SIMULATION TANK)

LONGITUDINAL SECTION



PLAN OF GROUND FLOOR



NO.	NAME	NO.	NAME
1	WAVE GENERATOR	5	PIPE LINE
2	STREAM REGURATOR	6	COHESIVE SOIL
3	WAVE ABSORBER	7	SANDY SOIL
4	PUMP ROOM	8	MEASURING ROOM

DIMENSIONS OF BASIN

Length : 40.0 m
 Width : 4.5 m
 Depth of water : 2.5 m max.

DIMENSIONS OF MEASURING SECTION

a) Cohesive Soil Floor	b) Sandy Soil Floor
Length : 10.0 m	Length : 10.0 m
Width : 4.5 m	Width : 4.5 m
Depth of soil : 1.5 m	Depth of soil : 1.5 m
Depth of water: 1.0 m max.	Depth of water: 1.0 m max.

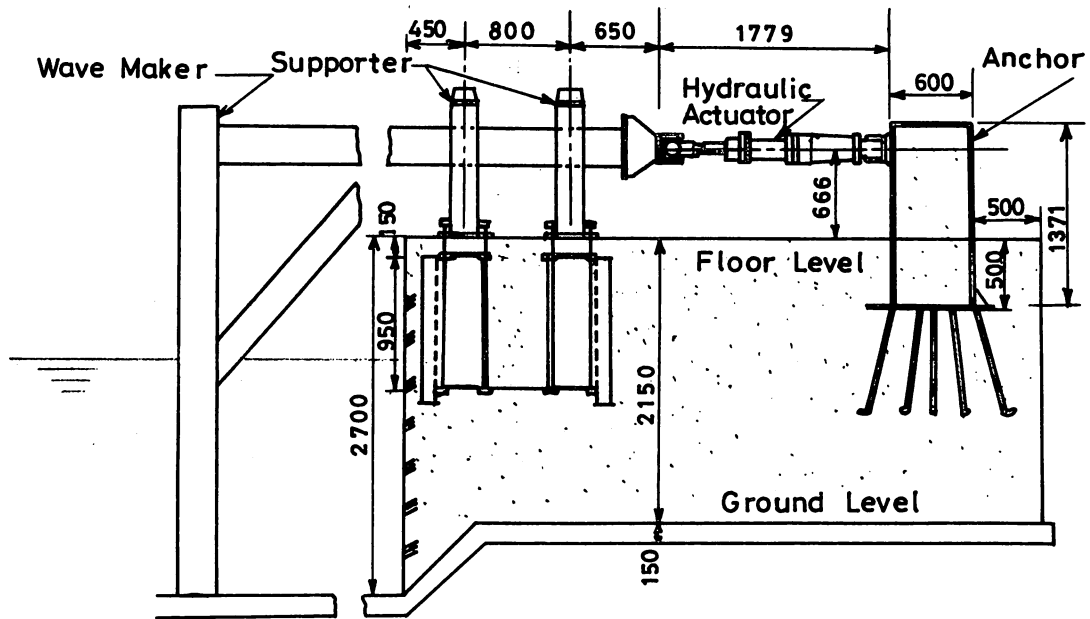
DESCRIPTION OF CARRIAGE : 1-manned, motor-driven, analog control
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor static Leonard system single carriage type: 5.5 kW x 1
 MAXIMUM CARRIAGE SPEED : 3 m/sec
 OTHER CAPACITIES : None

WAVE MAKER

Type : Piston type
Drive system : Hydraulic system
Regular waves : Maximum wave height : 0.15 m
Corresponding frequency : 0.7 Hz
Irregular waves : Waves having specified wave spectra are used in routine tests.
Range of water depth: 0.2 m ~ 1.0 m

WAVE ABSORBERS : Beach type wave absorber

Sketch of wave maker



CURRENT GENERATION:

Type : Vertical
Current direction : Same direction to wave
Current profile : Uniform only
Pump capacity : 1.5 m³/sec

INSTRUMENTATION

TEST PERFORMED:

Motion tests in waves (shallow)
Restrained model tests in waves and currents (shallow)
Mooring tests (shallow)
Soil-structure interaction in currents and waves
(Scouring, bearing capacity, suction force mechanism, dredging mechanism)

MEASURING APPARATUS & TRANSDUCER

Waves : Capacitance-type wave height probes
Motions in waves : A double-carriage-and-potentiometer-type six-component ship motion detector
A double-carriage-and-potentiometer-type three-component longspanned ship drift detector
Total forces and moment : Block dynamometer by use of strain gauge
Local forces : Strain gauge dynamometry

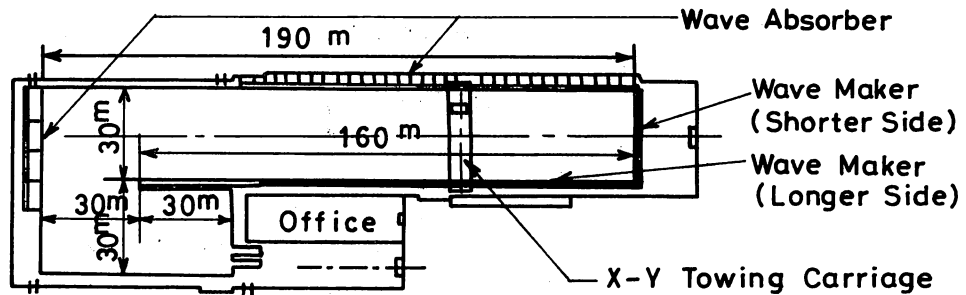
Local pressures	:	Strain-gauge-type high sensitivity pressure transducers
Accelerations	:	Strain-gauge-type accelerometers
Scouring depth	:	Ultra-sonic type depth sounder
DATA RECORDING & ANALYSIS		
Data recorder in measuring room for off-line data acquisition		
Mini-computer	:	MELCOM 70 system
Analysis	:	Fourier analysis: Spectrum analysis
METHOD OF TESTING		
MODELS		
Model size range	:	Length : 1 ~ 4 m Scale ratio: 1/20 ~ 1/80
Material	:	Vinyl chloride
SIMILITUDE		
Test in waves	:	Froude's law
WAVES USED FOR TESTS		
Regular waves for frequency response functions.		
Irregular waves for floating body response characteristics based on linear superposition principle.		
LITERATURE		
1) "Directory of Ship Hydrodynamic Research Laboratories in Japan" Japan Towing Tank Committee, The Society of Naval Architects of Japan (Sept., 1978)		

NAGASAKI EXPERIMENTAL TANK
 NAGASAKI TECHNICAL INSTITUTE,
 MITSUBISHI HEAVY INDUSTRIES, LTD.
 1-1 AKUNOURA-MACHI, NAGASAKI 850-91

Phone (0958)61-2111

21-1 FACILITIES

SEAKEEPING AND MANOEUVRING BASIN (1972)



DESCRIPTION OF CARRIAGE : 1-manned, motor-driven, digital control.
 TYPE OF DRIVE SYSTEM AND TOTAL POWER : Thyristor static Leonard system, double carriage (X-Y) type; X-carriage (22 KW x 4), Y-carriage (2 KW x 2).
 MAXIMUM CARRIAGE SPEED : 3 m/sec (X-carriage), 2 m/sec (Y-carriage).
 OTHER CAPABILITIES : Horizontal PMM tests, or CMT (Circular Motion Tester) Tests.

WAVE MAKER

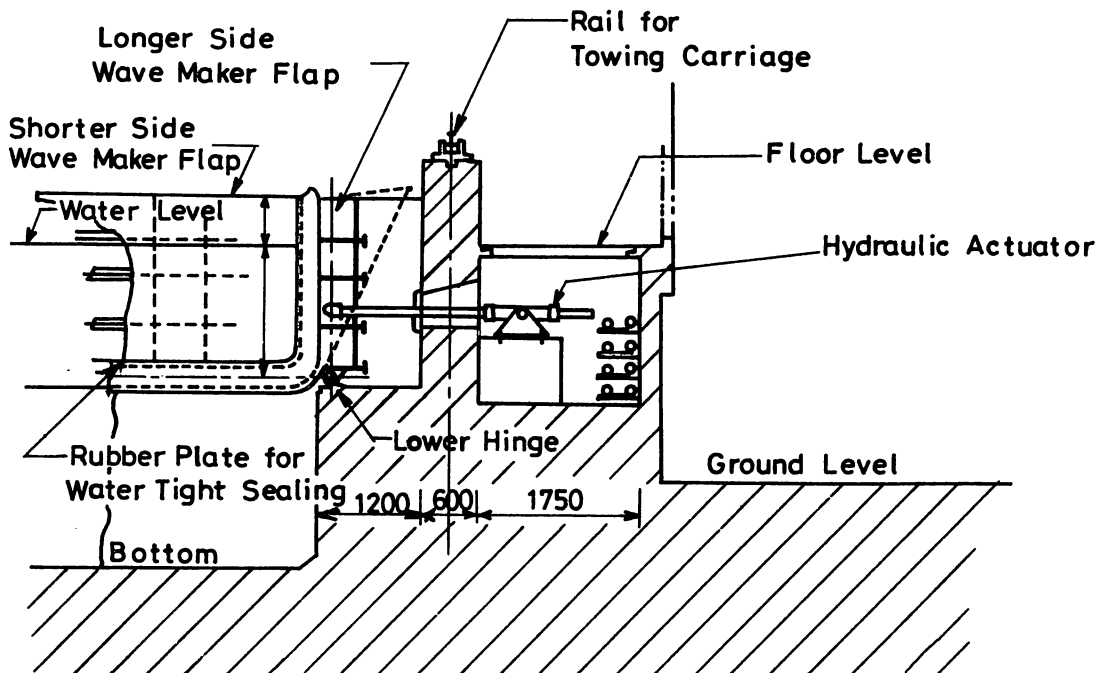
Type : Flap type (without water on back side)
 Drive system : Electro-hydraulic system

Regular waves	Wave maker	Shorter side	Longer side
Maximum wave height		0.4 m	0.3 m
Corresponding frequency		0.55 Hz	0.62 Hz

Irregular waves : Waves having specified wave spectra are used in routine tests.
 Range of water depth : Designed for constant water depth (3.5 m) for deep water waves. In case shallow water test is needed, false bottom is installed.
 Others : Transient water waves of various kinds.

WAVE ABSORBERS : Beach type wave absorber

Sketch of wave maker



WIND GENERATION

None for permanent wind generating facility. When necessary, however, portable blower system is installed. Max. 20 m/sec wind speed, all direction (adjusted); incapable of gust generation.

INSTRUMENTATION

TEST PERFORMED

Forced oscillation tests
 Restrained model tests in waves
 Resistance and self-propulsion tests in waves (incl. oblique waves)
 Mooring tests
 PMM, and CMT tests
 Free-running model tests

MEASURING APPARATUS & TRANSDUCER

Waves : Electric resistance-, capacitance-, and/or electric-servo-type wave height probes.
 Motions in waves: A double-carriage-and-potentiometer-type six-component ship motion detector
 Total forces and moment: Block dynamometer by use of strain gauge
 Local forces : Strain gauge dynamometry
 Local pressures : Semi-conductor-type high sensitivity pressure transducers.
 Accelerations : Strain-gauge-type accelerometers.

DATA RECORDING & ANALYSIS

Data recording and processing : Data recorder on model (free-running tests) or on Y-carriage (under-carriage tests) for off-line data acquisition; analog telemetry system and sonar tracking system link to data acquisition system with 12 channel A/D converter and digital plotter for on-line data processing; data processing system with mini-computer.

Model tracking technique : Ultra-sonic type model tracking system with digital plotter.

Mini-computer : HP2100A system

Analysis : Fourier analysis (FFT occasionally applied); Spectrum analysis; time series analysis (for non-linear response).

METHODS OF TESTING

MODELS

Model size range : Length 2 ~ 5 m; scale ratio: 1/10 ~ 1/70
(Ship model : 3 ~ 7 m; scale; 1/20 ~ 1/80)

Material : Wood or FRP

SIMILITUDE

Tests in waves : Froude's law

Tests in winds : Force (scaled down)

WAVES USED FOR TESTS

Regular waves for frequency response functions.

Irregular waves for floating body response characteristics based on linear superposition principle.

High irregular waves for design evaluations under extreme seastate.

LITERATURES

- 1) Taniguchi, K. and Fujii, H.: "On the new Seakeeping and Manoeuvring Basin of Nagasaki Technical Institute, MHI"
Trans. Soc. Naval Arch. of West Japan, No. 45 (Feb., 1973)
- 2) Taniguchi, K. and Kasai, H.: "A new flap-type wave maker without water on back side."
Journal of Soc. Naval Arch. of Japan, Vol. 132 (Dec., 1972)