

## **Fabrication of Multipurpose Open Channel Flume with Accessories**

**Make : ETHER**

**Model No : (EE-1555)**

**RECTANGULAR TILTING FLUME**

### **DESCRIPTION**

The open channel experimental flume with approximately 15m long with working length not less than 12.5m and has a cross-section of 1200mm x 800mm (W x H). The flow bed of the flume is of stainless steel and of 10mm thickness. The side walls of the experimental section are made of tempered glass of minimum 19mm thickness, which allows excellent observation of the experiments and is scratch proof. The side walls of the experimental section are made of toughened glass, which allows excellent observation of the experiments and is scratch proof. All material that comes in contact with water are made of Stainless Steel (304 grade). The inlet transition is designed so that the flow enters experimental section with very little turbulence. The water enters from below through a flow straightener. A damping plate calms the water further. The damping plate floats on the water and is mounted on a guide. The outlet element of flume contains a plate weir, so that damming heights can be adjusted as per requirement. The arrangement of free discharge without a weir is also provided. To protect against overflowing of the experimental section level switch is provided that turn off the pump when the maximum level in the inlet or outlet element is exceeded. The design offered should be of a modular form. The flume should be supplied in 2.5m long modules. This modular design would allow for relocation at some future point and/or extension/reduction, all with relative ease.

In order to utilize the laboratory space efficiently, an arrangement of water tanks shall be such that it can form a gallery to walk and stand on. Staircase shall be provided at both ends of the platform. This will help user to comfortably reach to any part of the experimental section for taking readings or keeping table on it for the desktop PC, which requires during the measurement of velocity. The drain valve shall also be provided at the bottom of water tanks to remove water. Tanks shall be made of stainless steel (grade 304) and shall have 2mm thickness. There shall be 6 tanks with capacity of each tank between 3500-3700 liters. Each tank should be connected to other tank by the means of two parallelly connected stainless steel 304 grade pipes of 8-inch diameter with 3mm thickness and bolted together with the flanges of 10mm thickness. The stiffeners used for tanks should also be of Stainless-Steel. Staircase are provided at the both ends of the platform. The user can thus comfortably reach any part of the experimental section.

Toughened glass side panels should be provided over the full length, to the full depth, on both sides of the working section. Toughened Glass should be screwed or bolted with frame of stainless steel and bed to make glass easily replaceable in case of breakage. The modular design of the flume must allow for easy replacement of side panels either caused by damage or should it be a requirement to replace a glass panel with an alternative material, such as marine ply, in order to mount structures or other objects from a side.

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The experimental flume has a motorized inclination adjustment to allow adjustment of slope and to create a uniform flow at a constant discharge depth.

A 'V' shaped sediment trap must be mounted on the flume before tailgate for bed load study. The sediment trapping system shall not create any upstream disturbance of the flow. The sediment trap is provided at the end of flume. The flume is suitable for bed load sediment transport. Two set of nested buckets are required for continuous data collection in the trap box. Also, the strainer of fine mesh (1mm aperture) should be provided after free fall so that the sediment particles should not entered in the tank.

There should also be provision for seepage throughout the working length of the flume and all the accessories required for it should be included with the flume like perforated bed and extra electromagnetic flow meter. Bidder have to include all the relative design and drawing of the same.

Two pumps of rated flowrate 125lps to 150lps each to be provided. The flow of pumps can be easily controlled with frequency drive. The pumps should be capable of recirculating sediment laden flow.

**UTILITIES DETAILS**

- Water Supply (Initial fill)
- Floor Drain Required
- Electric Supply: Three Phase, 440V AC, 50 Hz
- Floor Area Required: 19 m x 1.5 m.

**STRUCTURE**

- a) Two MS rectangular pipes of minimum 240 x 120 x 8mm thickness arranged parallelly and welded with 16 mm thick plate.
- b) Flume Structure Stand- Square pipe of 100 x 100 x 5mm thick on 16 mm thick MS plate
- c) All the nut bolts and fasteners used should be of stainless steel.

All the materials used for joints/sealing should be of reputed brand. The equipment must ensure the leakage-proof flow of water through the flume and the recirculation system.

**Accessories:**

1. Sediment trap
2. Digital level gauge (4No.)
3. Pitot static tube
4. Instrument Carrier with moving wheels and scale (for carrying ADV, digital point gauge etc)
5. Set of 2 Piers (each of size 75mm, 80mm, 90mm, 100mm dia with 30cm height)

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6. Model of Dam (To be placed in the flume width)
7. Wave generator
  - a. Motor with reduction gear
    - power output: 1kW
    - speed: 300 min<sup>-1</sup>
  - b. Crank mechanism
    - stroke:70...230mm
8. Instrument rails with length markings at every 1mm
9. Scraper for leveling the sediment bed
10. Data acquisition system (DAQ) with inbuilt sensors:

The system must provision for a versatile and independent multi-sensor tool compilation, that is completely programmable with a minimum of 16 different identified sensors that are completely programmable and AI & machine learning enabled with independent real-time data visualization options.

The sensor compilation should have the following sensors: sounds, Acceleration, CO<sub>2</sub>, Gyroscope, Air Pressure, External Temperature probe, altitude, Magnetism, Humidity, Ambient light, Color, Gesture, and short and long range proximity sensors with rechargeable battery and programmable RGB LEDs and a tone generator for physical computing.

### **Technical Details**

Dimensions of Flume	Length of the Flume: 12.5 m long excluding inlet and outlet section. (15m total length) Width of the Flume: 1.2 m Depth of the Flume: 0.8 m
Flume Bed	Flume bed material is made up of 10 mm thick or above SS304 grade sheet. Maximum deflection of the bed should be within the range of 1 mm at the maximum load (flume filled with 50% sediment (sand, gravel) and 50% water) and tilt.
Side walls	Flume should have transparent 19 mm thick toughened glass as side walls on either side with intermediate stiffeners supporting the glass. Side wall deflection should be maximum 1 mm.
Inlet section	Inlet section made from 2 mm thick SS 304 grade sheet. The inlet section to be well designed so that the flow enters the flume with little turbulence. Flow straightener to be provided at the inlet section and the water enters below it.

Storage tanks	All the storage tanks should be made from 2mm thick SS 304 grade sheet with Stainless Steel stiffener support
Tilting Mechanism	Motorized inclination with synchronized spindle lifting gears should be provided. The inclination adjustment should be between -0.75% to 2.5 %, 3 jacking stations each consisting 2 jacks + 1 pivot.
Pumps and flow measurement	<p>Pumps (2Nos.) of reputed make along with suitable electric motor of reputed make.</p> <ul style="list-style-type: none"> <li>a) Rated flow rate (for each pump): between 125 l/s to 150 l/s</li> <li>b) Impeller: AISI 316 Stainless Steel (precision cast) (EN 1.4401)</li> <li>c) Stub shaft: AISI 316 Stainless Steel (EN 1.4404)</li> <li>d) Rotation speed (for each pump): Below 1600 rpm</li> <li>e) Head of the pump should be sufficient to recirculate the water from attached tank to channel.</li> <li>f) Pumps should be provided with suction and delivery valves.</li> </ul>

**VFD is required to control the flow of each pump.**

Flow measurement to be done by Electromagnetic flow meter, attached to delivery pipe, degree of accuracy  $\pm 0.2\%$ . in delivery Output signal- 4-20Ma, electrode material- stainless steel 316L, digital communication – RS-485, support standard Modbus Protocol with digital display.

Tail Gate	Tail gate made of SS 304 with thickness 8mm at the outlet end of the flume to achieve desired level of water in experiment section.
Sediment trap	The sediment trap should be mounted at the end of the test section and before tail gate
Flume Platform	Tanks should be arranged in such a way that it forms a gallery and should be used as a platform. Side railings should be provided for safety.
Railing	There should be a grade rail throughout the top of the flume. One carriage should be provided which can move throughout length of the flume from inlet to tail gate. The instrument carrier which is capable of holding ADV, point gauge should be provided and it should move transverse direction on the carriage.
Stair case	A stair case is provided on either side of the flume.
Nut, bolts and fasteners	All the nut bolts and fasteners should be of Stainless steel
	All material that comes in contact with water are made of corrosion-resistant materials GRP/stainless steel as specified.