

ENGINEERING LABORATORY DESIGN INC.

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SPECIFICATIONS

30 CM FLOW VISUALIZATION WATER TUNNEL

General: The system is a recirculating design with the flow loop arranged in a vertical configuration.

System components include: flow sections, test section, circulating pump, variable speed drive assembly, and piping.

Overall dimensions of the unit are: length, 5.35m; height, 169.0cm; width, 183.0cm. Test section centerline height: 146.5.0cm above the floor. The gross weight of the system, filled with water, is approximately 3,700kg. The tunnel has a capacity of approximately 2,625 Liters of water.

Flow Sections: The sections containing the water are fabricated of a composite lamination of fiberglass reinforced plastic and a rigid, PVC, foam core material. The incorporation of the foam core material produces a strong, relatively light weight, structure that easily withstands the static and dynamic loads imposed upon it. The foam is also an excellent thermal insulator and significantly reduces condensation on the exterior of the ducts during periods of high relative humidity. Interior surfaces are glass smooth, white, gel-coat. Exterior surfaces are spray finished with polyester gel-coat enamel. A medium blue color is standard. Flanged joints are sealed using a high quality, polyurethane marine adhesive/sealant. Stainless steel fasteners secure the joints. Careful attention is paid to the fit and alignment of mating sections to insure that no discontinuities exist which could disturb the flow. The tunnel is shipped unassembled to permit installation in laboratories with smaller access doors.

A perforated cylinder distributes flow to the distribution chamber.

Stainless steel, perforated plates, act as head loss baffles in the distribution and settling chambers.

A turning vane system in the return plenum, divides and directs the flow leaving the test section. The top portion of the return plenum is constructed of plexiglass, permitting convenient observation and video recording of flow around models in the test section from directly downstream.

Test Section: The top, bottom, sides and flanges of the test section will be fabricated from 19.05mm, Super Abrasion Resistant[®], clear, acrylic. The interior dimensions of the standard test section are 30cm wide by 37.5cm high (freeboard) by 100.0cm long. The top of the test section will be fitted with a fully removable cover. The test section will operate "full". The integral 7.5cm high "freeboard" prevents overflow.

The actual test section is 115.0cm in length, however the downstream 15.0cm of this length is intended to be part of the entrance to the return plenum. This length may be used but the flow characteristics in this area are not guaranteed.

Flow velocity in the test section will be continuously variably from 1.0 m/s down to approximately 0.01 m/s. Turbulence level: approximately 3.0%. Velocity profile: $\pm 1\%$, exclusive of boundary layer. Note: The minimum speed, turbulence level and velocity profile characteristics are cited as goals, to which we will give our best effort to achieve, but are not guaranteed.

Flow Straighteners: An extended length plenum, upstream of the contraction, will be fitted with a precision, round cell, polycarbonate plastic, honeycomb sections. Three, stainless steel perforated plates and four, high porosity, stainless steel screens, mounted to stainless steel frames, using a proprietary technique, will be furnished. A removable cover will provide access to the flow straightener containment area.

Pump: Two commercially available, enclosed impeller, all stainless steel construction, centrifugal pumps will be used. Each of the pumps will deliver a maximum flow rate of 2,840 LPM at a maximum 3.5m of total dynamic head for a total combined flow rate of 5,680 LPM. The pump case, impeller, and shaft are fabricated of type 316 stainless steel.

Motor and Controller: Each pump will be belt driven by a 7.5 HP, ODP, 1800RPM, 208-230 VAC/3 ϕ /60Hz motor.

A 15 HP transistor inverter type, variable speed motor control will regulate pump shaft RPM. The controller is arranged for 208-230 VAC/3 ϕ /60Hz/60Amp input electric service. A remote control station, located adjacent to the test section, will regulate test section velocity.

A NEMA rated fusible disconnect is furnished to protect both the motor and controller. The disconnect is mounted in a NEMA Type 1 enclosure.

The buyer will be responsible for the installation of permanent wiring from the building electric service to the motor starter.

Supporting Frames: The flow sections are supported by a single frame fabricated of structural steel tubing joined by welding. The frame is etched, prime coated and spray finished with acrylic enamel. Each frame leg is fitted with an adjustable leveling pad.

Piping: Commercial PVC pipe will be used throughout. Mating flanges and pipe saddle floor supports will be fabricated of PVC. Flexible rubber couplings will join the piping to the flow sections and will serve to isolate the pump from the main components of the tunnel.

Miscellaneous: The water tunnel will be assembled and tested in our plant prior to shipment. Interested persons from the buyer's organization are invited to visit the plant and observe the final testing period.

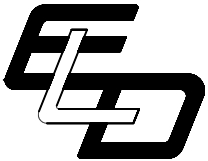
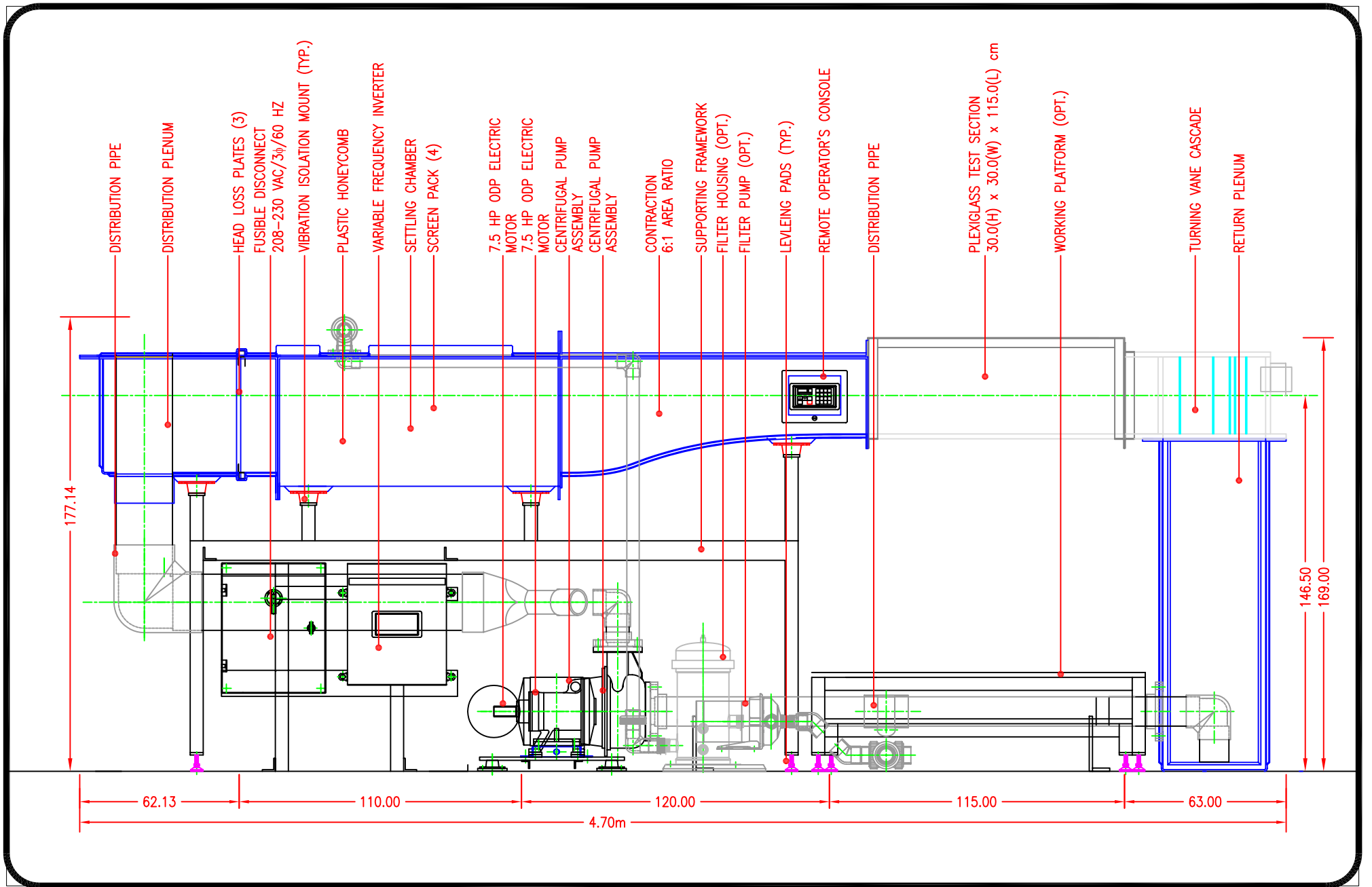
The water tunnel will be disassembled and shipped via specialized motor freight carrier to the installation site. Complete installation, operation, and maintenance instructions will be furnished with the equipment. Alternatively, an ELD representative can be contracted to meet the incoming shipment, assist and supervise in the installation of the equipment, and provide the necessary operation and maintenance training.

A one year limited warranty covers the equipment.

Optional Accessories:

Working Platform: The height of the test section centerline above the floor provides convenient viewing from the front, bottom and downstream areas. A 1.5m by 1.0m working platform with a height of 0.4m can be provided to allow for easier access through the test section ceiling. The platform will be fabricated from high quality plywood laminated with a non-skid working surface. The platform will be supported by structural steel tubing joined by welding. The frame is etched, prime coated and spray finished with acrylic enamel. Each frame leg is fitted with an adjustable leveling pad. The platform is provided with locking, swivel casters for easy mobility.

Filter Assembly: A commercial filter system will be furnished as a means of removing dye concentrations and other contaminants from the system water. The filter system includes a 3/4 HP circulating pump, replaceable particle filter cartridges and an activated carbon filter pack. Connecting piping and valves and will occupy 0.6 square meters of floor space adjacent to the inlet plenum chamber. The approximately 2,600 liter volume of the system can be cycled in a one hour period.



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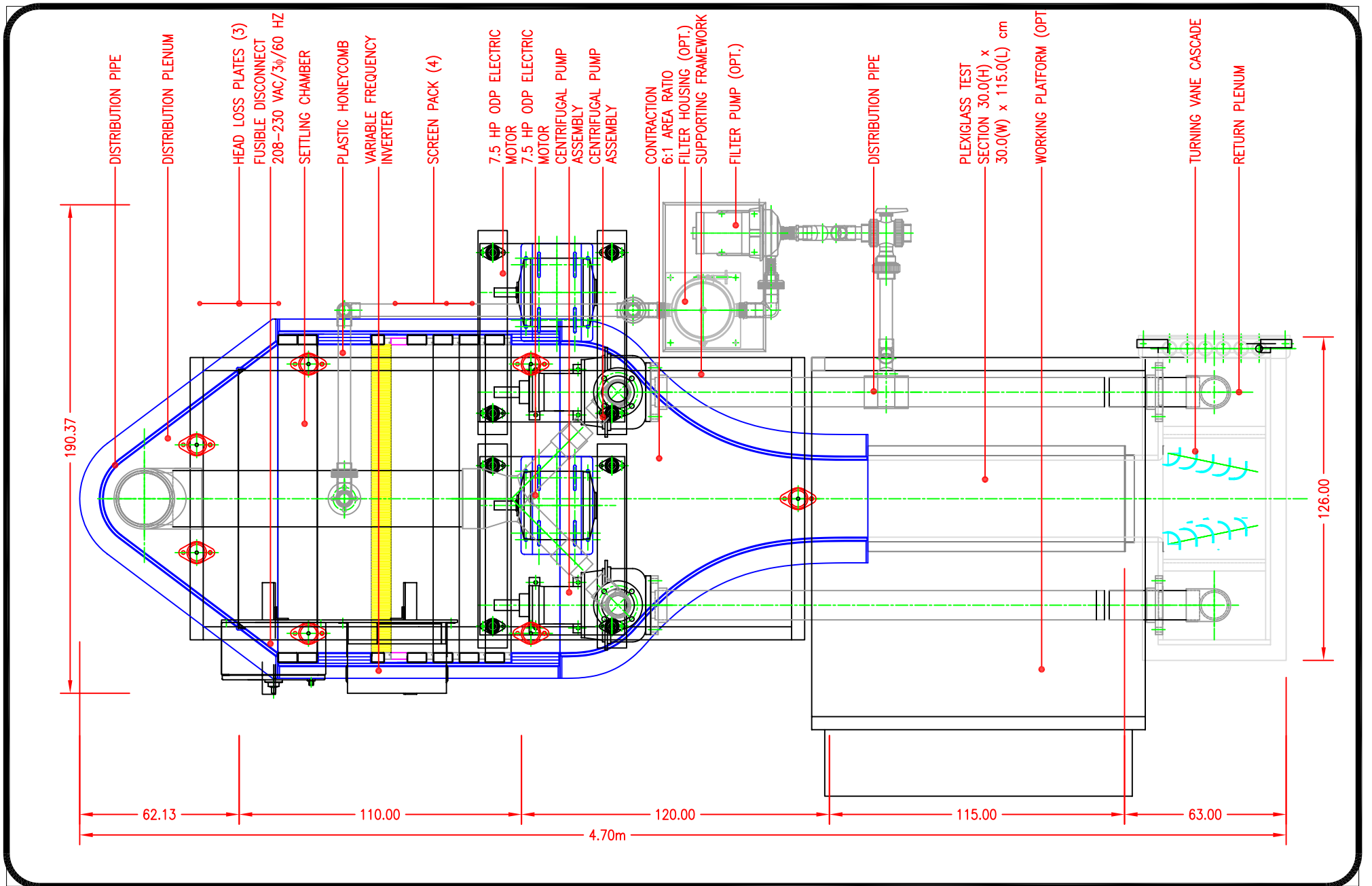
TITLE: OVERALL - PLAN VIEW

PROJECT: 30cm FLOW VISUALIZATION WATER TUNNEL

REFERENCE: MODEL NO. 503

DATE: 10/24/05

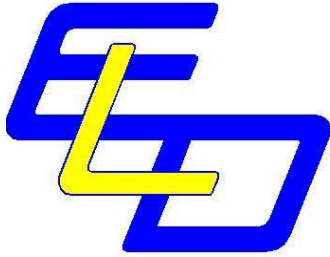
SCALE: 1cm = 20cm



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TITLE: OVERALL - ELEVATION VIEW		
PROJECT: 30cm FLOW VISUALIZATION WATER TUNNEL		
REFERENCE: MODEL NO. 503	DATE: 10/24/05	SCALE: 1cm = 20cm



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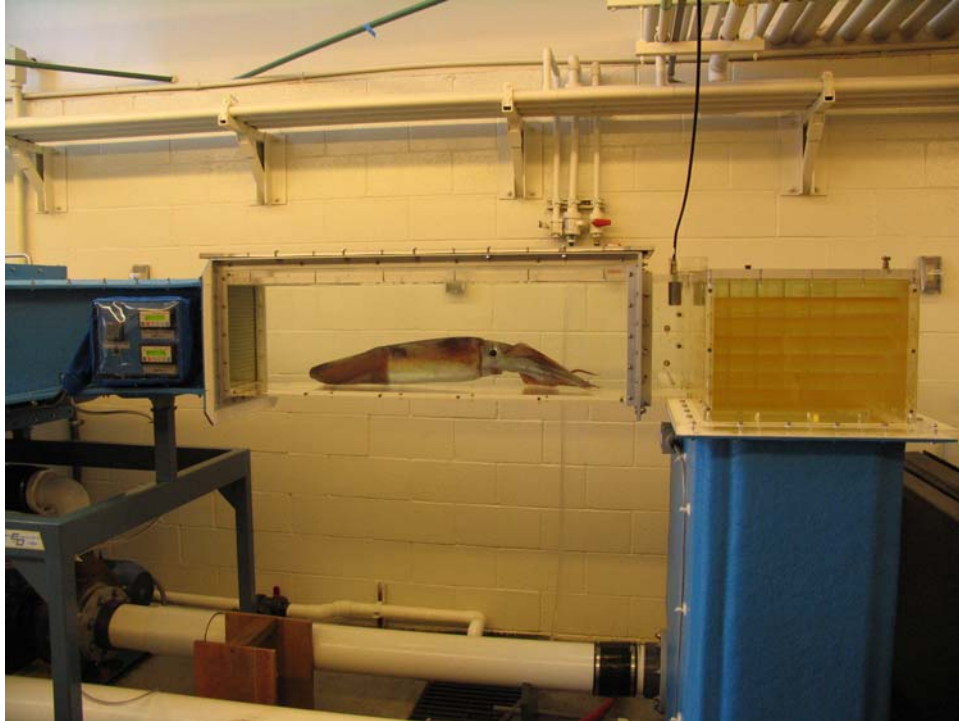


Figure 1: Squid being tested in 30cm Water Tunnel.



Figure 2: Close up of Squid near downstream end of test section.

30cm Flow Visualization Water Tunnel supplied to Moss Landing Marine Laboratory in December 2003.

Photos courtesy of Moss Landing Marine Laboratories (www.mlml.calstate.edu)

Photographer: W. Watson