

INTERNATIONAL TOWING TANK CONFERENCE CATALOGUE OF FACILITIES  
CIRCULATING WATER CHANNELS AND CAVITATION TUNNELS

<b>DAVID TAYLOR MODEL BASIN</b> , Carderock Division, NSWC BETHESDA, MD 20084-5000, Phone: (301) 227-1578, FAX: (301) 227-3679	<b>UNITED STATES</b>															
<b>24-INCH VARIABLE-PRESSURE CAVITATION TUNNEL (1940)</b>																
<p><b>DESCRIPTION OF FACILITY:</b> Vertical plane, closed recirculating, variable-speed, variable-pressure, open jet test section, closed jet test section, and semi-rectangular test section.</p> <p><b>TYPE OF DRIVE SYSTEM:</b> 1.22 m (48 in.) diameter three-bladed axial flow impeller with direct drive 6-pulse solid state variable speed DC drive system with digital closed loop control.</p> <p><b>TOTAL IMPELLER MOTOR POWER:</b> 559 kW (750 hp), 340 rpm</p> <p><b>WORKING SECTION MAX. VELOCITY:</b> 17 m/s (55.8 ft/s, 33 knots)</p> <p><b>MAX. &amp; MIN. ABS. PRESSURES:</b> 241 kPa (35 psia), 14 kPa (2 psia)</p> <p><b>MIN. CAVITATION NUMBER:</b> Sigma = 0.08 (at 2 psia &amp; 33 knots)</p>																
<p><b>INSTRUMENTATION:</b> Dynamometers for measuring steady &amp; unsteady propeller forces on up and downstream shafts, 2-component force balance, hydrophones, pressure sensors, strobe lights, high speed photographic system.</p> <p><b>TYPE &amp; LOCATION OF TORQUE &amp; THRUST DYNAMOMETERS:</b></p> <ol style="list-style-type: none"> <li>(1) Electric-cradle dynamometer located downstream outside the tunnel                         <ul style="list-style-type: none"> <li>• Drive motor rating = 112 kW (150 hp) at 3600 rpm max.</li> <li>• Thrust range = <math>\pm 13,344</math> N (<math>\pm 3000</math> lbs)</li> <li>• Torque range = <math>\pm 415</math> Nm (<math>\pm 306</math> lb-ft) at 3600 rpm and <math>\pm 1424</math> Nm (<math>\pm 1050</math> lb-ft) at 1050 rpm</li> </ul> </li> <li>(2) Electric-cradle dynamometers located upstream &amp; downstream outside the tunnel                         <ul style="list-style-type: none"> <li>• Drive motor rating = 7.5 kW (10 hp) at 3600 rpm max.</li> <li>• Thrust range = <math>\pm 1334</math> N (<math>\pm 300</math> lbs)</li> <li>• Torque range = <math>\pm 24</math> N m (<math>\pm 18</math> lb-ft) at 3600 rpm</li> </ul> </li> <li>(3) Unsteady propeller force transmission dynamometer, 6-component waterproof strain gaged sting-balance located either upstream or downstream in the tail shaft housing approx. 76 mm (3.0 in.) from the propeller hub.                         <ul style="list-style-type: none"> <li>• Drive motor rating = 7.5 kW (10 hp), 1800 rpm max. with this dynamometer</li> </ul> </li> </ol>																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 35%;">Steady Load Range</th> <th style="width: 35%;">Unsteady Load Range* (double amplitude)</th> </tr> </thead> <tbody> <tr> <td>• Thrust</td> <td>0-1334 N (0-300 lbs)</td> <td>133 N (30 lbs)</td> </tr> <tr> <td>• Torque</td> <td>0-47 Nm (0-35 lb-ft)</td> <td>4.7 Nm (3.5 lb-ft)</td> </tr> <tr> <td>• Side Forces (vert. &amp; horz.)</td> <td>0-67 N (0-15 lbs)</td> <td>13 N (3 lbs)</td> </tr> <tr> <td>• Moments (vert. &amp; horz.)</td> <td>0-17 Nm (0-12.5 lb-ft)</td> <td>1.7 Nm (1.25 lb-ft)</td> </tr> </tbody> </table> <p>*Blade frequency limitation of the sting-balance: 12 hz min., 200 hz max.                  Optimum propeller size range: Diameter = 250-300 mm (10-12 in.); Weight = 9-44 N (2-10 lbs)</p>			Steady Load Range	Unsteady Load Range* (double amplitude)	• Thrust	0-1334 N (0-300 lbs)	133 N (30 lbs)	• Torque	0-47 Nm (0-35 lb-ft)	4.7 Nm (3.5 lb-ft)	• Side Forces (vert. & horz.)	0-67 N (0-15 lbs)	13 N (3 lbs)	• Moments (vert. & horz.)	0-17 Nm (0-12.5 lb-ft)	1.7 Nm (1.25 lb-ft)
	Steady Load Range	Unsteady Load Range* (double amplitude)														
• Thrust	0-1334 N (0-300 lbs)	133 N (30 lbs)														
• Torque	0-47 Nm (0-35 lb-ft)	4.7 Nm (3.5 lb-ft)														
• Side Forces (vert. & horz.)	0-67 N (0-15 lbs)	13 N (3 lbs)														
• Moments (vert. & horz.)	0-17 Nm (0-12.5 lb-ft)	1.7 Nm (1.25 lb-ft)														
<p><b>PROPELLER SIZE RANGE:</b> Diameter = 450 mm (18 in.) max.</p>																
<p><b>TESTS PERFORMED:</b></p> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;">                     (1) cavitation characterizations on propellers, appendages, headforms, foils, etc.                      (2) 6-component unsteady propeller force measurements in simulated wakes                      (3) acoustic measurements on cavitating propellers, bodies, etc.                 </td> <td style="width: 50%; vertical-align: top;">                     (4) flow field measurements                      (5) contrarotating propeller performance tests with synchronized shafts &amp; indexed rotation                      (6) unsteady force measurements with modulated speeds                 </td> </tr> </table>		(1) cavitation characterizations on propellers, appendages, headforms, foils, etc. (2) 6-component unsteady propeller force measurements in simulated wakes (3) acoustic measurements on cavitating propellers, bodies, etc.	(4) flow field measurements (5) contrarotating propeller performance tests with synchronized shafts & indexed rotation (6) unsteady force measurements with modulated speeds													
(1) cavitation characterizations on propellers, appendages, headforms, foils, etc. (2) 6-component unsteady propeller force measurements in simulated wakes (3) acoustic measurements on cavitating propellers, bodies, etc.	(4) flow field measurements (5) contrarotating propeller performance tests with synchronized shafts & indexed rotation (6) unsteady force measurements with modulated speeds															
<p><b>PUBLISHED DESCRIPTION:</b></p> <ul style="list-style-type: none"> <li>• Mumma, A. G. "The Variable-Pressure Water Tunnels at the David W. Taylor Model Basin," SNAME Transactions Vol. 49 (1941)</li> </ul>																

