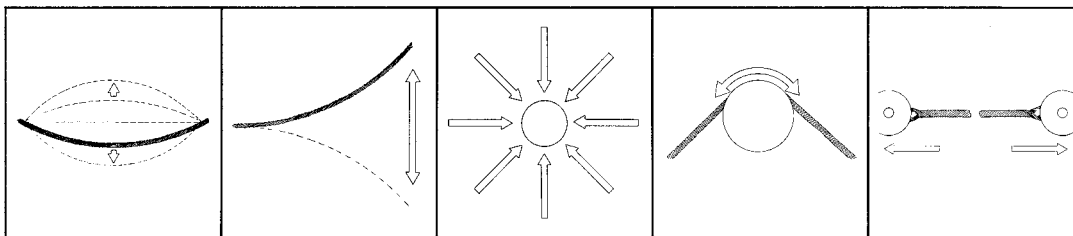


TESTING

Capabilities & Services

- *For Underwater Cable, Systems & Hardware*
- *Confidential*
- *Evaluation, Qualification & Acceptance*
- *Experienced*



COMPLETE TESTING SERVICES

Since 1969, PMI Industries, Inc. has maintained and continually expanded testing facilities and developmental programs concerned with improving the SURVIVABILITY of cables, cable systems, ropes. Our unique capabilities and services are relied upon by all segments of the Offshore and Underwater Cable, Wire and Synthetic Rope, Flexible Risers, Towed Array, and Cable System markets- the same group since 1969!

TESTING FOR SURVIVABILITY

Many tests require special or unique fixtures and set-ups but all testing gives one or more of the following: Improved Products ▪ Failure Analysis ▪ Develop Customer Confidence ▪ Improve System Reliability ▪ Qualify Suppliers and Hardware ▪ Promote Products ▪ Performance ▪ Evaluation of a Competitors Products ▪ Simulate Conditions of Use Show Competitive Advantages – and the Protection of Your Reputation.

CONFIDENTIALITY – YOU & PMI

You paid for the effort and the results belong to you for as long as you choose! The reasons for testing are implicit to your reputation and the product you are developing. PMI's testing laboratory is dedicated to protecting *your* investment because we want to support your *next* program.

PMI'S UNIQUE CAPABILITY

Our laboratory capabilities have been shaped by the wide variety of specialized tests performed at PMI. It started with the development of our own product line, which involved the Helical Gripping Principle and evolved into a testing facility. Our unique capability in dynamic testing involves: Cyclic Tension, Hydrostatic Pressure, Vibration, Flexing, Bending, Temperature, Torque, Static and Snap Loading, and general cable handling. This has been applied to cable and cable-related products for confirmation of those products' performance to some general or unique application. New machines, jigs, fixtures, and today's evolving technologies continue to expand our laboratory services.

SPECIALISTS IN TESTING

Testing is a professional process applied by our experienced staff to the planning and performance of COST EFFECTIVE programs to produce usable results. PMI has prepared thousands of informative, thoroughly documented contract test reports, factory acceptance test reports, failure analysis reports, and other certifying and qualifying test data to government, commercial, institutional, and international standards.

BE INVOLVED – YOUR CHOICE

PMI welcomes you to both witness and work alongside our staff during the test set-up and in observation of your testing. You can quickly evaluate raw data, verify the suitability of test set-ups and procedures, and observe processed data in real time on our PC-based Data Acquisition System (DAS). PMI can provide you with complete office and conference room facilities for you and your vendors, customers, and sponsors when you become our customer.



TESTING Capabilities & Services

The following test conditions can be generated by the many specialized testing machines utilized often and developed by the PMI staff. These include: various sized Pressure Chambers with overhead loading crane, Flexure/Fatigue Tension Machines, Impact/Snap-Load Machines, Cyclic Tension Test Machines, Vibration Test Spans, Long Span Proof-Load Test Beds, Induced Torque Machine, Cyclic Bend-Over-Sheave Machine, Static Test Stands, and Environmental Chambers.

| Test Capability | Typical Use | Test Capability | Typical Use |
|---|---|--|---|
| Tension Specimen length up to 100 feet, tension up to 450,000 lbs., piston stroke up to 8 feet. | <ul style="list-style-type: none"> Break Strength Test Load vs. Elongation Data Proof Load Certification | Repeated Snap Load Specimen length up to 12 feet. Peak tension up to 50,000 lbs. Rate to 15 cycles/minute. | <ul style="list-style-type: none"> Simulate Pulsating Shock Loads Simulate Ship Heave/Tow Body Dynamics Measure Longitudinal Cable Damping |
| Cyclic Tension Specimen length up to 100 feet, tension up to 400,000 lbs. | <ul style="list-style-type: none"> Dynamic Load Simulation Fatigue Studies | Hydrostatic Pressure 1,000-psi (15 inches ID x 240 inches long); 1,500-psi (60 inches ID x 120 inches long); 2,500-psi (2.5 inches ID x 230 inches long); 10,000-psi (9.4 inches ID x 21 inches long); | <ul style="list-style-type: none"> Simulate At-Depth Pressure Loading Feed-thru's allow real time monitoring of cable or equipment performance At-Depth Qualification of Cable and Assemblies Verify Seal and Electro/Optical Performance Certification for Third-Party-Underwriters |
| Servo-Controlled Tension Programmable rate of load or displacement using ramp, swine, saw tooth, or recorded waveforms. Specimen up to 65 feet in length, 5 foot stroke, & tension up to 100,000 lbs. at a rate of 120 inches/minute (max). | <ul style="list-style-type: none"> Break Strength Tests to Federal, MIL, ASTM, & Cordage Institute Methods Dynamic Load Simulation Fatigue & Retirement Criteria Tests Design Verification/Qualification Quality Assurance | Flexure Sample length up to 5 meters. Tension up to 150,000 lbs. Flexure up to $\pm 25^\circ$. Moments to 300,000 ft-lbs. Hydraulic Operating System with variable rate. | <ul style="list-style-type: none"> Deflection and Fatigue Testing of Cable & Riser Systems Acceptance Testing of Bend Stiffeners (BSR's) Qualification of Flexible Pipe & Umbilicals |
| Elongation Multiple displacement transducers for gage length or overall length data. | <ul style="list-style-type: none"> Tension vs. Elongation Failure Mode Analysis | Temperature -40° F to +140° F, (7 feet x 8 feet x 7 feet with walk-in capability). -100° F to +400° F, (4 feet x 3 feet x 3 feet, bench top, some humidity control). | <ul style="list-style-type: none"> Qualification of Cable & Equipment Thermal Shock Testing Life Testing |
| Torque In-line torque cells for Torque vs. Tension data. Ranges from 100 inch-lbs to 750 foot-lbs. | <ul style="list-style-type: none"> Tension vs. Torque tests Torque Balance Verification Cable Qualification | Salt Fog Size: 30 inches x 36 inches x 48 inches Per ASTM B-117 | <ul style="list-style-type: none"> Corrosion & Coatings Testing |
| Induced Torque/Rotation Controlled rotation of tensioned specimen while measuring in-line torque & twist. Torque up to 750 foot-lbs, twist to $\pm 1080^\circ$, tension up to 100,000 lbs. | <ul style="list-style-type: none"> Tension vs. Rotation Tests Verify "Non-Rotating" Cable Qualification Test for Twist Resistance Torque Restraint Testing | Ultraviolet/Moisture Simulated sun/rain/temperature cycles. Specimens to 9 inches x 28 inches x $\frac{3}{4}$ inches. | <ul style="list-style-type: none"> Environmental Testing of Non-metallic Cable & Hardware Materials |
| Bend Over Sheave Multi-sheave test frame, tension up to 60,000 lbs, stroke to 30 feet, & line speed up to 60 feet per minute. Sheaves available up to 96 inch diameter. Curved abrasion plates available. | <ul style="list-style-type: none"> Static & Dynamic Cable Qualification Simulate Handling System Problems Qualify Cable Fairing & Hardware Verify Wet/Dry Fatigue Performance Cable Jacket Abrasion Tests | Radiographic X-ray inspection on 6 inch x 16 inch film. | <ul style="list-style-type: none"> Failure Analysis & NDT |
| Cyclic Flexure Repeated bends to $\pm 27^\circ$, tension up to 20,000 lbs, test specimens up to 22 feet in length. | <ul style="list-style-type: none"> Simulate Tow Point Dynamics Bend Stiffener Fatigue Testing Ball Joint & Flex Joint Testing | Acoustic Emission Single-channel crack detector with specimen-mounted transducer, 300-700kHz. Preset trigger, event counter, & alarms. | <ul style="list-style-type: none"> Failure Mode Analysis Fatigue Tests of Synthetic or Center-Strength Member Cable & Assemblies |
| Strumming Laterally induced vibrations of tensioned cables via mechanical shakers. Length up to 180 feet, tension up to 60,000 lbs. | <ul style="list-style-type: none"> Simulate Tow & Current Induced Vibration Qualification of Cable & Termination | Electrical High-voltage breakdown, Corona, insulation resistance, impedance, DC resistance, capacitance, attenuation, cross-talk, TDR, current capacity, etc. | <ul style="list-style-type: none"> Verification of Specified Performance of Cable Assemblies Monitoring & Measurement of Conductor Performance during Mechanical Tests |
| Long Span Proof Load Up to 2,000 feet of cable over multiple sheaves. Tension up to 10,000 lbs. | <ul style="list-style-type: none"> Certification of Cable Assemblies requiring full-length tensioning upon completion Repair Evaluation of Damaged Cables | Optical Loss measurements of fiber-optic cable elements using power-meters, laser, OTDR, splicers & field-installable connectors. | <ul style="list-style-type: none"> Monitoring & Measurement of Attenuation during Mechanical Tests Verification of Cable & Assemblies |
| Sustained Tension Test st&s of 12 feet, 25 feet, & 50 foot lengths. Tension up to 25,000 lbs. | <ul style="list-style-type: none"> Long-term Creep Tests of Synthetics Long-term Evaluation of Cable Hardware | Data Acquisition PC-based high-speed DAS providing real time graphics displays, hard disk storage of data, & quality hardcopy. Data loggers, strip charts, X-Y recorders are also available. | <ul style="list-style-type: none"> Supports accurate collection & reporting of critical test data Standard data format allows detailed analysis/reduction later by customer Flexible graphical presentation of results |
| Free Fall Impact Specimen length up to 10 feet. Peak tension up to 50,000 lbs. Impact up to 10,000 feet/lbs | <ul style="list-style-type: none"> Simulate Single Pulse Shock Load Qualification of Cable & Hardware | | |

If your testing requirements exceed those listed above, please call us as our testing capacity is constantly expanding.