MPM CATHODIC PROTECTION (CP) RETROFIT

Cost Effective Impressed Current CP Systems
CP Data Evaluation and Design
Brownfield Topside and Subsea Interface
Project Management - Design through Commissioning

MPM, *THE* ADDED VALUE RETROFIT CONTRACTOR

PROJECTS DESIGNED WITH EXPERIENCE

MPM® MARINE PROJECT MANAGEMENT, INC.

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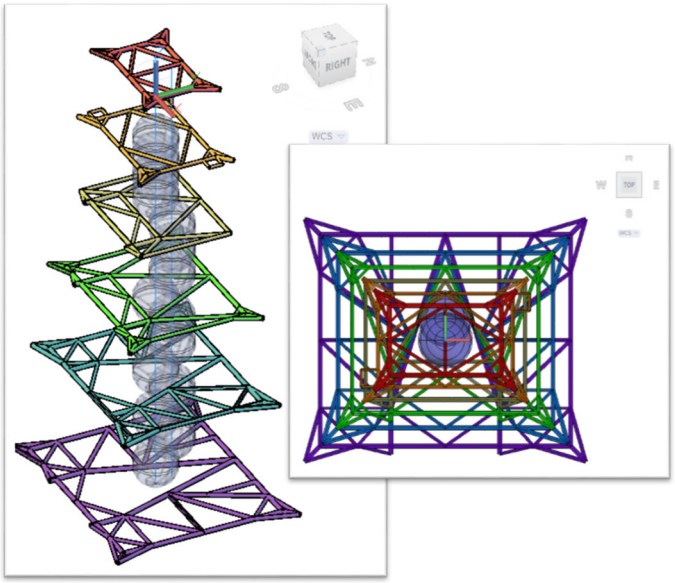
MPM Design / Build Advantages

Marine Project Management, Inc. is first a marine project management and engineering firm, and secondarily a cathodic protection specialist. Advantages in utilizing MPM:

- √ MPM provides a one stop shop for the system design, installation, commissioning, and maintenance of your system.
- √ MPM understands that a CP retrofit is primarily a facility interface and logistics project and that the cathodic protection design, while important, is a minor component of the project. With this understanding we work closely with I&E design, HSE, structural, operations, and topside and marine construction groups to complete the project in a cost effective and safe manner.
- √ MPM's design team generates 3-D models of the structure and appurtenances, defines cable routing and loading and identifies logistics and construction constraints.
- √ Anodes - MPM develops output calculations, structural design, soil analysis, remote distance calculations, anode position scoping, etc.
- √ I-tubes and I-tube Clamps — MPM works through location determination, structural design, installation appurtenance design, CP design, fabrication drawings, etc.
- √ Submarine Power Cable — MPM analyzes loads including electrical, structural, catenary, VIV, etc.
- √ Marine Construction Operations — MPM will subcontract and manage the marine construction work for installation of MPM cathodic protection systems. This provides the owner with one qualified contractor retaining care, custody, and control of the system throughout the project.
- √ System Commissioning — MPM trains owner facility personnel in system operation and maintenance concurrent with the start up and commissioning operations.



MPM Deep Anode String design modeling

CP Survey Services

MPM provides complete CP survey services, with the MPM Subsea Inspection Management System (SIMS). SIMS is a proprietary Windows-based software package integrated with specialized hardware for use in underwater pipeline, outfall, or platform CP surveys. The system is ideally suited for close interval underwater potential surveys and can be configured either as a towed fish, or interfaced with a remotely operated vehicle (ROV). SIMS is particularly well suited to perform interrupted and/or EFG surveys due to the system's high accuracy and sample rate.

MPM has surveyed over 5,000 miles (8,000 km) of underwater pipeline with SIMS in the towed fish configuration, and over of 3,000 miles (4,800 km) of pipeline in the ROV configuration.

www.mpmi.com/services/cathodic-protection/

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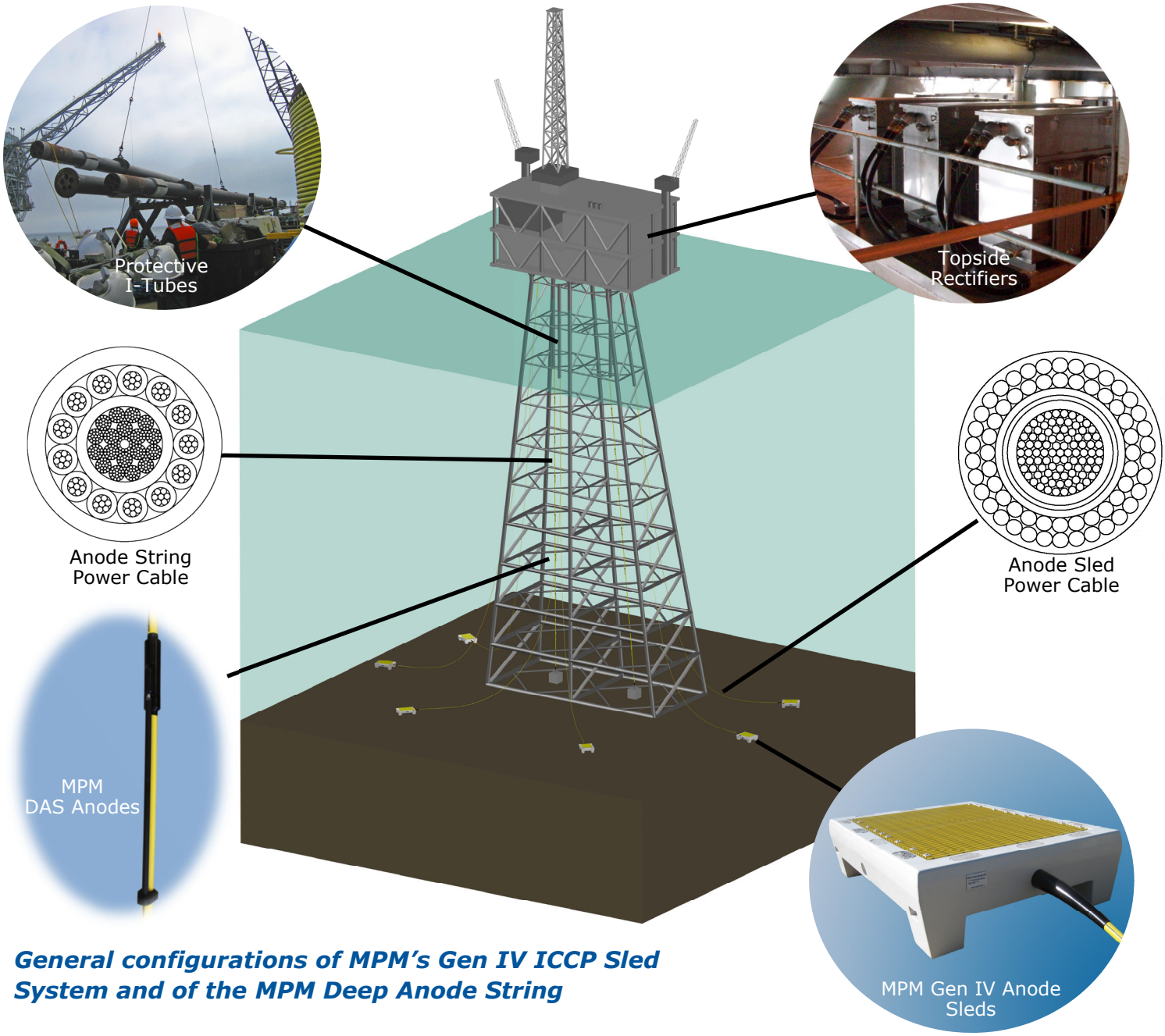
Impressed Current Cathodic Protection Systems

MPM-designed systems (anode strings and sleds) provide cost effective, long-term subsea corrosion protection for standard jacket configurations (shown below), FPSOs, floating TLP's, and pipelines. MPM provides added value with retrofit system design, system manufacture, installation, commissioning, and overall project management. This provides the benefit of having one qualified supplier manage the project from inception through commissioning.



General configurations of MPM's Gen IV ICCP Sled System and of the MPM Deep Anode String

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MPM Impressed Current Cathodic Protection System (ICCPS) Sleds

MPM Gen IV anode sleds are specifically designed to be low profile and trawl friendly and incorporates ROV-compatible installation and recovery rigging features. Our now-standard Gen IV-R sled uses a molded concrete housing comprised of our propriety concrete mix design that is seawater and chlorine compatible to protect our MMO anode rods. Durable grating is included above and below the anodes protecting them from damage during installation, dropped/ lost article impact, and ROV contact. Fiberglass components are non-corrosive and chlorine compatible, eliminating risks of deterioration.

The sled has been designed to withstand 2G dynamic loads, allowing offshore dynamic lifts during installation The sled structure is able to accept the full power cable installation and in-service loads.

MPM's Anode Sled Kits are a low cost, lower output system designed specifically for shallower depths and smaller marine structures. The system is ideally suited to protect shallow water platforms, seawalls, piling, or marine terminals, and has a service life of up to 30 years. The sled "kit" may be assembled at the client's job site or shipped fully completed.

Why MPM GEN IV Sleds?

Cost Effective

- √ Requires no subsea maintenance.
- √ Costs less than half of traditional CP retrofits.

Designed for Durability

- √ Anode and connection are protected within the structure, not exposed in the water column.
- √ Low-profile design helps protect from trawling, mooring operations, ROVs, or construction.
- √ All materials and components are the of highest quality, thoroughly tested, and designed and manufactured specifically by or for MPM.

Proven Electrical Connection

- √ No moving parts and nothing to fail due to fatigue.
- √ Single electrical connection for each anode has been proof tested to 850-psi/1,900 FSW (581m).
- √ No oil filled junction boxes which are prone to leakage.

Proven Reliability

- √ Design life up to 40 years.
- √ More than 50 sled systems installed and presently in service - some in areas with current velocities up to 6-knots.
- √ Previous generations in operation since 1996.
- √ Rectifier alarms and continuous monitoring available to identify rectifier failure or unintentional shut down.

Installation

- √ MPM Gen IV Sleds are designed specifically for ease of installation.

MPM Anode Sled Specifications

High Output Model (HO) Up to 1000A

Weight: Shipped = 970 lbs (440 kg)
Completed Dry Weight = up to 9,600 lbs (4,354 kg)
Dimensions: 120" x 96" x 29" (305 x 244 x 74 cm)

Standard Mesh Model (STD) Up to 800A

Weight: Shipped = 780 lbs (353.8 kg)
Dimensions: 96" x 72" x 29" (244 x 183 x 74 cm)

Standard Rod Model (STD-R) Up to 500A

Sled Weight: Shipped = 6,800 lbs (3,094 kg) + cable weight
Dimensions: 96" x 72" x 29" (244 x 183 x 74 cm)

Anode Sled Kit - 50 to 220A

Weights and Dimensions Vary

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MPM Deep Anode String Cathodic Protection System

The MPM Deep Anode String (MPM DAS) is *the* cost-effective, long-term retrofit solution for cathodic protection systems that must be installed inside a structure's perimeter under relatively benign environmental conditions. Its design avoids common issues in other systems that impact installation cost, long-term performance, and achievable depth.

Benefits of string anode systems include:

- √ **Proven Reliability** – String anodes have been used since the 1970s to retrofit shallow-water structures across diverse environments. Past failures typically result from inadequate splash-zone cable protection (lack of an I-tube), poor routing design, or improper anode string construction.

- √ **Lower Ground Bed Resistance** – Linear anode configurations minimize mutual anode interference, producing significantly lower ground bed resistance than clustered, parallel, or sled-based systems. This enables the use of lower-voltage rectifiers while still delivering the required amperage output.

- √ **Consistent Current Distribution** – Semi-remote tensioned string anodes provide excellent long-term current distribution.

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Why MPM Deep Anode String?

MPM's design incorporates decades of experience in cathodic protection system component design which includes advantages as follows:

Cost Effective

- √ Requires no subsea maintenance.
- √ Costs less than half of traditional CP retrofits.

Proven Design

- √ Cable incorporates MPM's proven submarine power cable design which meets or exceeds ICEA requirements for submarine power cable.

Handling

- √ The DAS can be spooled on standard cable reels, greatly reducing shipping, handling, and installation costs over conventional string anode systems that must be flaked out and boxed to prevent damage to the fixed anode.

Designed for Durability

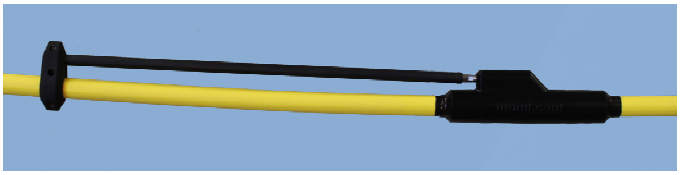
- √ MPM DAS electrical connections and associated insulation waterproofing have been proof tested to 850-psi/1,900 FSW (581m).

Installation

- √ MPM's procedures allow for the economical installation of DAS on shallow water platforms (-200 FSW/60m) without the use of divers or ROVs in some cases.

- √ No oil filled junction boxes, which are prone to leakage.

- √ MPM has the global depth record for ICCP retrofit of conventional jackets utilizing ICCP Sleds and DAS.



MPM Anode String Specifications

MPM Deep Anode String (DAS) Up to 60A per Anode—Up to 13 Anodes per String

Weight: Shipped = 4lbs/ft (6kg/m)
Anode Dimensions: 36" - 48" (91.5-122 cm) Cylindrical

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ICCP System Components

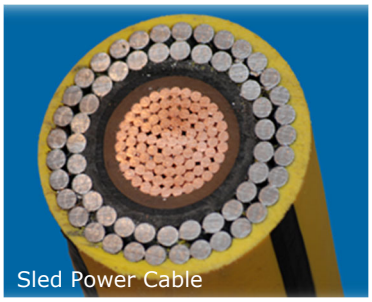
Anodes

MPM ICCP systems use dimensionally stable mixed metal oxide-coated anodes, with a design life of up to 40-years, sized to provide up to 1,000 amps output throughout the design life.

Subsea Power Cables

MPM's power cables are contra-helically wound double armored, with an HDPE outer jacket. MPM cables are available in various sizes from 2/0 AWG to 1,100 kcmil.

The power cables for the MPM Deep Anode String consist of a central strength member surrounded by multiple conductors with an HDPE outer jacket.


Sled Power Cable

DAS Power Cable

Power Cable Connections

MPM's proven power cable electrical connection has no moving parts, and does not use oil filled junction boxes (which are prone to leakage).

Proof Pressure Tested: MPM's connections have been hydrotested to 850 psi or 1,900 feet of seawater (581m) without failure. For deeper installations, modifications are available.

Mechanical: Torque and tension tested at a minimum of 3 times the cable's working load limit (WLL).

500A Oil Cooled Rectifiers

Rectifiers

MPM provides oil or air cooled transformer/ rectifiers, supplying up to 1,000 amps to the subsea anode sleds or MPM Deep Anode String. The rectifier cases are galvanized steel or 316L stainless steel, and are manufactured to allow SCADA interface to voltage and amperage input/ output.

Power Cable Conduits (I-Tubes)

MPM's existing multi-conduit power cable I-tube and I-tube clamp designs are based on either US West Coast or Gulf of Mexico environmental forces.

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MPM Cathodic Protection Services

CP Survey Services

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MPM has successfully surveyed over 5,000 miles of underwater pipeline in the towed fish configuration, and over of 3,000 miles of pipeline in the ROV configuration.

SIMS Brochure

Existing CP System Evaluation

MPM evaluates existing jacket and/or pipeline CP system life using surface area calculations and performing comparative analysis of historical potentials and survey data. If supplemental CP is needed, MPM can evaluate the requirements to extend the existing facility's operational life.

ICCP System Design

√ Anodes — Output calculations, structural design, soil analysis, remote distance calculations, anode position scoping, etc.

√ I-tubes and I-tube Clamps — Location determination, structural design, installation appurtenance design, CP design, fabrication drawings, etc.

√ Submarine Power Cable — Electrical, structural, catenary, VIV analysis, etc.

√ I&E Design — Interface with the owner's I&E staff to complete the I&E design utilizing MPM interface components.

√ Structural Evaluation — Local analysis and interface with the owner's structural support team for global analysis.

System Installation and Commissioning

√ Installation Planning/Facility Interface — MPM is ideally suited to plan installation of MPM cathodic protection systems. We are highly proficient in installation operations utilizing diving and ROV equipment, construction support vessels, rigging, and all associated equipment and personnel requirements. Further, we are familiar with drilling and production operations, allowing us to interface with the facility team during development of the execution plan, risk assessments, etc.

√ System Construction and QA — MPM utilizes its Inspection & Test Procedures (ITP's) for installation aids, rigging, and installed system components.

√ Topside Construction Operations — MPM can subcontract the topside work directly, or preferably, interface with the owner's topside construction team.

√ Marine Construction Operations — MPM will subcontract and manage the marine construction work for installation of MPM cathodic protection systems. This provides the owner with one qualified contractor retaining care, custody, and control of the system throughout the project.

√ System Commissioning — MPM trains owner facility personnel in system operation and maintenance concurrent with the start up and commissioning operations.

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MPM Safety

MPM has a **100% accident free** safety record, and has extensive experience in successfully planning and implementing projects in the environmentally sensitive waters of Alaska, California, and the Gulf of Mexico.

MPM Safety Statistics

MPM Founded: 1996
Years of Business: In excess of 25 years
Total Hours Worked: Over 2,200,000 hours of marine and underwater work
Accidents or Incidents: 0

MPM Recognition

MPM has received an audited "A" contractor rating from Chevron, and a "Project Excellence" Award from Plains Exploration and Production (PXP).

Method

MPM places the highest priority on completing all operations safely. To ensure that all operations are completed without accident or incident, we have developed and implemented an active behavioral based health, safety, and environmental (HSE) program.

Quality Policy

As a Project Management and Cathodic Protection Services Company, we are committed to satisfying our clients by providing quality products and services. Our quality objectives are met by continuous employment of internal and external system improvement. Activities are carefully planned, managed, executed and controlled to exceed minimum contractual requirements. We learn from our experiences and from each other. We document these lessons and use them to continuously improve our systems.

Quality Management

The Marine Project Management, Inc. Quality Management System was registered as compliant with the of International Standard Organization ISO 9001:2015. To meet this standard, we adopted a process approach to develop, implement, and improve the effectiveness of our Quality Management System to consistently provide services that meet our Mission Statement.

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