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Guidance on Practice for Procurement of Cathodic Protection Goods and Services

GIS 06-311

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GIS 06-311. This Guidance on Industry Standard (GIS) replaces heritage documents from the merged BP companies as follows:

British Petroleum

PTA CP-CP-ANOD-P	Corrosion Protection—Cathodic Protection—Sacrificial High-Potential Magnesium Anode—Procurement Specification.
PTA CP-CP-00-A	Corrosion Protection—Cathodic Protection—Acceptable Vendors Specification.

Amoco

A CP-CP-00-A	Corrosion Protection—Cathodic Protection—Acceptable Vendors Specification.
A CP-CP-ANOD-P	Corrosion Protection—Cathodic Protection—Sacrificial High-Potential Magnesium Anode—Procurement Specification.
A CP-CP-AOP-P	Corrosion Protection—Cathodic Protection—Anodes for Offshore Pipelines—Procurement Specification.
A CP-CP-AOS-P	Corrosion Protection—Cathodic Protection—Anodes for Offshore Structures—Procurement Specification.
A CP-CP-GAOP-E	Corrosion Protection—Cathodic Protection—Design of Galvanic Anodes for Offshore Platforms—Engineering Specification.

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1. Scope

This GIS provides guidance on procurement of materials and services for cathodic protection applicable to buried and immersed metallic structures including, but not limited to, pipelines, offshore structures, storage tanks, well casings, firewater and sea water pump caissons, fixed and floating production facilities, and internal submerged compartments.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

American Society for Testing and Materials (ASTM)

ASTM A694	Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service.
ASTM A518	Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.

Det Norske Veritas (DNV)

DNV RP-B401	Recommended Practice Cathodic Protection Design.
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International Electrotechnical Commission (IEC)

IEC 60143	Series Capacitors for Power Systems.
IEC 60228	Conductors of insulated cables.
IEC 60502	Power cables with extruded insulation and their accessories for rated voltages from 1kV ($U_m=1,2kV$) up to 30kV ($U_m=36kV$).
IEC 60529	Degrees of protection provided by enclosures (IP Code).

International Organization for Standardization (ISO)

ISO 9000	Quality management systems - Fundamentals and vocabulary.
ISO 9001	Quality management systems – Requirements.
ISO 10005	Quality management. Guidelines for quality plans.
ISO 13879	Petroleum and natural gas industries. Content and drafting of functional specifications.
ISO 13880	Petroleum and natural gas industries – Content and drafting of a technical specification.
ISO/TS 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems - Requirements for product and service supply organizations.

NACE International (NACE)

NACE RP0387	Metallurgical and Inspection Requirements for Cast Sacrificial Anodes for Offshore Applications.
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NACE TM0190

Impressed Current Test Method for Laboratory Testing of Aluminium Anodes.

3. Terms and definitions

For the purposes of this GIS, the following terms and definitions apply:

Concession request

A written application by the Vendor requesting BP (or designated agent) to accept at least one action or item that deviates from agreed specifications as a consequence of non-conformance.

Functional specification

Document that describes the features, characteristics, process conditions, boundaries and exclusions defining the performance and use requirements of the product, process or service [ISO 13879].

Goods

Equipment or materials used for cathodic protection purposes.

Invitation to bid

A solicitation from BP (or designated agent) for a Contractor to bid. Bid shall mean a tender, proposal or quotation submitted by the Contractor. Note that Invitation to Tender (ITT), Request for Proposal (RFP) and Request for Quotation (RFQ) all have different meanings; for the purposes of this document, Invitation to Bid encompasses all these terms.

Non-conformance

A non-fulfilment of a requirement within an agreed specification for design, manufacture, construction, intervention, test, or commissioning.

Quality

Assurance: Part of quality management focused on providing confidence that quality requirements will be fulfilled. [ISO 9000].

Quality plan

Document specifying which procedures and associated resources shall be applied by whom and when specific to a project, product, process or contract. [ISO 9000].

Note: Guidance for the production of Quality Plans is given in ISO 10005.

Specifying engineer

The Cathodic Protection Engineer or Corrosion Discipline Engineer responsible for identifying functional and technical requirements for cathodic protection Goods and services.

Technical authority

An engineer with specific discipline expertise appointed by the Engineering Authority. The primary role of a Technical Authority is to manage technical integrity within their designated engineering discipline or activity by ensuring the safe and consistent application of Company and regulatory codes and standards and good engineering practices.

Technical specification

Document that defines technical requirements to be fulfilled by the product, process, or service in order to comply with the functional specification. [ISO 13880].



Vendor

Manufacturer or supplier contracted to supply cathodic protection Goods or services on behalf of BP.

Throughout this document, the words *will*, *may*, *should*, *shall* and *must*, when used in the context of actions by BP (or designated agent) or others, have specific meanings as follows:

Will

Normally used in connection with an action by BP (or designated agent) rather than by a Vendor.

May

Used if alternatives are equally acceptable.

Should

Used if a provision is preferred or recommended.

Shall

Used if a provision is considered mandatory to follow recommendations of this document.

Must

Only used if a provision is a statutory requirement.

4. Symbols and abbreviations

For the purpose of this GIS, the following symbols and abbreviations apply:

a.c.	Alternating current
AgCl	Silver chloride
CCVT	Closed cycle vapour turbo generator
CIPS	Close interval potential survey
CuSO ₄	Copper sulphate
d.c.	Direct current
DCVG	Direct current voltage gradient
HMWPE	High molecular weight polyethylene
PCR	Polarisation cell replacement
PSCM	Procurement and supply chain management
PVC	Polyvinyl chloride
TEG	Thermo electric generator
TR	Transformer rectifier
XLPE	Cross-linked polyethylene



5. Basic selection criteria

5.1. General

Refer to GP 06-31.

Two distinct types of cathodic protection systems exist; these being:

- *Galvanic (sacrificial) anode systems.*
- *Impressed current systems.*

Galvanic systems provide cathodic protection current by the preferential corrosion of the anode alloy, which is more electronegative in the galvanic series with respect to the carbon-steel (C-steel) structure to be protected (the cathode). Anodes are usually directly attached to the C-steel structure with an electrically continuous mechanical connection, such as a bolt or weld.

Impressed current systems use inert, non-corroding anodes. As the anodes are inert and do not provide their own protection current through corrosion of the alloy, an external d.c. power source is required. As anodes are not directly connected to the structure, external cabling is required to complete the electrical circuit between anode, cathode and external power source.

5.2. Galvanic (sacrificial) systems

5.2.1. General

- a. There are basically three main options that shall be considered for use in galvanic cathodic protection systems. These being:
 1. Aluminium.
 2. Magnesium.
 3. Zinc (secondary alternative to aluminium and magnesium).
- b. Galvanic systems should be provided for systems in which life spans of 5 – 10 years are required for onshore structures, and between 20 – 30 years for offshore structures.

5.2.2. Aluminium

- a. Aluminium anodes should be primarily considered for aqueous and offshore applications.
- b. Aluminium anodes shall not be used for potable water storage applications due to the toxic nature of the corrosion products.
- c. Aluminium anodes may be considered for use in onshore buried and freshwater applications if water resistivity does not exceed 10 Ω -m (33 Ω -ft), as passivation is likely to occur beyond this value.

5.2.3. Magnesium

- a. Magnesium anodes should predominately be considered for buried onshore applications and also for non-saline aqueous applications in which resistivity is between 5 – 150 Ω -m (16 – 490 Ω -ft).

Note Due to the self-corrosive nature of magnesium, a practical anode life of between 10 – 12 years is likely regardless of theoretical anode mass calculation.

- b. For resistivity below 5 Ω -m (16 Ω -ft), alternative alloys such as aluminium and zinc should be considered.



Magnesium anode alloys are available in two grades which give two distinct output potentials.

- c. Anodes should be pre-packaged in cotton bags containing moisture retentive, low resistivity back fill, containing hydrated gypsum, bentonite, and sodium sulphate.

5.2.4. Zinc

- a. Zinc anodes may be considered as a secondary alternative to Aluminium and Magnesium if their individual limitations for use may preclude them for selection. Zinc anodes may be used for aqueous and offshore applications, although they may be used in buried applications if conditions are suitable subject to their limitations.
- b. Zinc anodes should not be used if water resistivity exceeds 30 Ω -m (100 Ω -ft), and shall not be used in environments in which operating temperature will exceed 50°C (122°F).

Zinc anodes are not subject to a minimum resistivity value restriction.

5.3. Impressed current systems

5.3.1. General

- a. The following anode materials shall be considered for use in impressed current cathodic protection systems:
 1. Mixed metal oxide (MMO) on titanium substrate.
 2. Silicon iron with chrome addition.
 3. Other alternatives to MMO and silicon iron anodes (rarely used).
- b. Unlike galvanic anodes, external power is provided to the impressed current anode, and hence they may operate in much higher electrolyte resistivity (approx. 500 – 1 000 Ω -m (1 640 – 3 280 Ω -ft)), the limiting factor being the driving voltage of the external power supply and the overall circuit resistance.
- c. For buried applications, the anodes should be surrounded with a low resistivity carbonaceous backfill either contained within a C-steel canister or loose filled around the anode within its excavated hole.
- d. Relevant specifications are given in clause A.2.1 – A.2.2 for MMO and silicon iron anodes.

5.3.2. Mixed metal oxide (MMO) on titanium substrate

- a. MMO anodes should be chosen, as they are technically superior and cheaper to install than the other commonly used impressed current anodes in most applications.

MMO anodes are predominately used in onshore applications, in both aqueous and buried environments; however, MMO anodes are commonly found on ship's cathodic protection systems.

MMO anodes have proven performance with over twenty years experience operating at very high current densities and in extreme conditions.

In comparison with silicon iron, MMO anodes are:

- *Lighter (a typical 5 Amps MMO anode weighs less than 1 kg (2,2 lb) compared with up to 50 kg (110 lb) for an equivalent solid silicon iron anode).*
- *Cheaper and easier to transport and install (due to weight saving).*
- *Not prone to long term cable breakage (due to lower weight).*
- *Not easily broken (Silicon iron anodes are brittle and prone to breakage).*
- *Not prone to “end effect” wastage.*



- *Not subject to high consumption rates. Typical anode consumption rates are as follows:*
 - *MMO – 0,000 5 kg/amp-year (0,001 lb/amp-year).*
 - *Silicon iron with chrome – 0,45 kg/amp-year (1 lb/amp-year).*

These figures must be taken into account when calculating minimum anode mass required for the project assigned design life, particularly with respect to silicon iron anodes. It is however common practice to include an additional contingency of 25% to overall current demand over the minimum theoretical value.

- b. MMO anodes shall not be used in environments containing the halides of bromine, fluorine, or iodine as these are detrimental to the operation of the anode and may lead to premature failure.

5.3.3. Silicon iron with chrome addition

Silicon iron anodes should be considered as a secondary alternative choice to MMO but limitations to the points raised above.

Silicon iron anodes have been the traditional choice since the inception of the impressed current system in the 1940s.

5.3.4. Alternatives to MMO and silicon iron anodes

Guidance should be sought from EPTG whenever projects/operations consider utilising these anodes.

Other impressed current anode types such as graphite, magnetite, and platinised titanium may also be encountered, but are rarely used. MMO and silicon iron anodes are most common to the industry and have a more diverse application range.

Platinised titanium is basically used for aqueous applications.

Magnetite and graphite anodes are used for buried onshore applications only, and suffer many of the disadvantages of silicon iron due to their similar brittle nature.

6. Initial market review

Specifying engineers are responsible for ensuring market reviews are undertaken for goods or services in their specific areas of responsibility.

- a. PSCM should be consulted before undertaking market reviews and under most circumstances the expectation is that the specifying engineers will work closely with PSCM for the conduct of market reviews.

Once the main functional and technical requirements are known for critical equipment it is necessary to determine whether suitable equipment provision already exists and whether it can be supplied or supported locally. There is no process associated with the initial market review, which simply involves informal contact with potential vendors.

- b. In addition to the information available from vendors, similar projects should be reviewed, BP (or designated agent) should be consulted, and external databases on equipment performance should be reviewed.
- c. As well as identifying potential vendors, the market review should determine whether the functional and technical requirements could be met with:
 1. Standard-design – this is equipment that is already in use and has an established performance record.



2. Modified-design – this is standard design equipment with a limited number of project specific modifications.
3. New-design – this is required if standard equipment cannot be modified or upgraded and new equipment/service is required specifically for the project.

For standard-design and modified-design equipment, the expected output at this stage is an outline design or description of potentially suitable equipment that has already been supplied to, or proposed for, other projects. If a new-design is required, the expected output is a conceptual design that could be developed and supplied within the time frame available.

Based on findings during the market review, the bidders or sole source (as applicable) will be identified.

7. Identification of requirements

7.1. General

- a. The specifying engineer shall liaise closely with the procurement representative to ensure relevant technical, quality, quantity, schedule, and delivery requirements are properly addressed.
- b. If cathodic protection goods and/or services are procured directly by BP, procurement shall comply with applicable BP policies and procedures and be conducted through the Business Unit's PSCM Team or other BU approved process.

7.2. Invitations to bid

- a. The specifying engineer shall identify functional requirements and known technical requirements for the cathodic protection system. Guidance for producing functional specifications is given in ISO 13879.
- b. Known technical requirements should be given by using the relevant Material Data Sheet, see Annex A.
- c. For the purpose of an Invitation to Bid, the specifying engineer shall ensure that the purchasing representative receives the following:
 1. Scope of work.
 2. Functional specification and technical requirements including sparing philosophy.
 3. Quality assurance including technical documentation requirements.
 4. Delivery requirements, e.g. timing and location.
- d. The non-technical information for an Invitation to Bid, such as Instructions to Tenderers, Form of Tender, Terms & Conditions, Tax Information Guidelines, Warranties, etc., will be provided by the procurement representative.
- e. The following statements, or statements identifying the same requirements, should be included in the Invitation to Bid and subsequent contract/order:
 1. The vendor shall not deviate from contractual requirements unless authorisation for a change or deviation has been agreed in writing with BP (or designated agent).
 2. The vendor shall collaborate jointly with BP (or designated agent) to identify and agree technical and commercial communication routes and methods/formats to be used.
- f. The contract will identify the type(s) of document required, e.g., Quality Plan, material certificates, etc. The onus is on the vendor to contact BP (or designated agent) if guidance is required for document content.



- g. A pre-production meeting shall be arranged when requested by BP (or designated agent). In any event, the vendor shall contact BP (or designated agent) well in advance of the proposed production schedule to determine pre-production meeting requirements.
- h. BP (or designated agent) reserves the right to perform inspections, appraisals or audits of the vendor's facilities, systems, procedures or working practices; this shall also extend to subcontractors if applicable. Access to the works shall be afforded by the vendor and subcontractors for such activities.

7.3. Contract/orders

- a. The final commitment documents (Purchase Orders, Service Orders, Contracts, etc.) need to identify the technical specifications or technical requirements that are to apply in order to comply with the stated functional requirements.

Note: Technical specifications are normally produced by a bidder in response to the Invitation to Bid or following a subsequent evaluation and clarification process.

- b. Technical requirements shall be agreed between the specifying engineer and vendor before manufacture/supply or service provision. The specifying engineer should endeavour to determine and agree technical requirements pre-contract/ order.

7.4. Deviations and alternatives

- a. The vendor may be permitted to offer a technically superior item for consideration, providing that it provides an improvement over the minimum standard laid out in the specification or data sheet.
- b. Accepted deviations and alternatives shall be signed off by the responsible specifying engineer or appointed technical authority.

7.5. Lead times

Due consideration must be made for long lead time items, such as transformer rectifiers and other power supply systems, which are custom built devices, with an approximate lead time of 8 to 14 weeks. More standard items such as sacrificial anodes and cable may be available ex-stock or are usually available within 4 weeks from order.

7.6. Spare parts

Due consideration should be made for necessary spare parts. If no specific requirements exist, these would normally include the following:

- a. Start-up and commissioning spares.
- b. 2-years operating spares.
- c. Insurance spares.

8. Accountabilities and roles

8.1. Specifying engineers

- a. Specifying engineers shall be accountable for developing functional specifications, for acceptance of the final equipment design (including material selection) and for the final acceptance of the goods and/or service.
- b. Major steps to fulfil this accountability shall include, but are not limited to, the following:



1. Performing a market review (see clause 6), liaising with other projects, EPT, and vendors to identify possible equipment, materials and designs.
2. Establishing, reviewing and approving functional and technical requirements with vendors prior to finalizing the design. Obtaining schedules for all goods and services.
3. Establishing vendor bid lists, coordinating with procurement representatives to manage bid solicitation package, evaluating bids and recommending vendors.
4. Reviewing and approving vendors' quality plans, exceptions and concession requests, as appropriate including participation in pre-manufacturing and/or pre-inspection meetings to ensure that vendors deliver quality expectations/ requirements.
5. Conducting periodic audits, reviewing non-conformance records of vendors and maintaining a sufficient level of BP (or designated agent) presence during manufacturing, installation and testing as well as ensuring the final documentation package is compiled and forwarded in line with requirements identified by contract/order.

8.2. Procurement personnel

Personnel used for procuring cathodic protection materials or services shall be accountable for administering all aspects of the tender and purchasing process to deliver Goods that meet technical, quality, and schedule requirements. Major steps to fulfil this accountability shall include, but are not limited to, the following:

- a. Assisting the specifying engineer with the initial market review and coordinating the pre-qualification process in liaison with the responsible specifying engineer.
- b. The preparation, compilation, and issue of Invitations to Bid and commitment documents liaising with PSCM to ensure compliance with all BP procurement policies and procedures and the specifying engineer to ensure all technical, quality assurance and schedule requirements are included.
- c. Non-technical evaluation of the tenders/quotations.
- d. Establishing or amending existing Contract, as necessary, to satisfy the level of technical/quality requirements for the goods and services.
- e. Managing the shipping process to ensure delivery of correct goods to the correct location on the required dates.

8.3. Vendors

- a. BP (or designated agent) shall ensure that vendors are accountable for delivering goods and services in compliance with agreed specifications and contract/order terms, using the vendor's systems (including quality plans), which are reviewed, revised as necessary, and approved by BP to ensure compliance with BP policies, guidelines and requirements.
- b. The key steps to fulfil this accountability shall include, but are not limited to, the following:
 1. Ensuring appropriate resources, personnel, systems, processes, procedures and quality plans are in place to deliver goods in accordance with contract/order requirements; this includes compliance with requirements and expectations for HSE and quality.
 2. Providing a point of contact for contact with BP (or nominated agent) and subcontractors ensuring that quality plans are reviewed/approved and audited by BP (or nominated agent) in accordance with the agreement.
 3. Ensuring that their staff are aware of, and adhere to, contract/order requirements, including HSE and quality expectations and ensuring BP-approved quality plans are fully executed.



4. Performing and documenting inspection and testing activities in accordance with the BP (or designated agent) approved quality plans including identification, documentation and reporting of non-conformances.
5. Ensuring goods and services are delivered to the agreed specifications and other requirements of the contract/order. Deviations should be directed through the relevant BP personnel.

8.4. Electrical personnel

- a. The vendor shall employ, directly or indirectly, competent electrical personnel who shall be suitably certificated for the electrical testing operations that they will undertake on power supply systems such as TRs or similar.
- b. Electrical personnel shall hold the appropriate and current level of certification for the appropriate electrical test methods.

9. Design review and approval

- a. Before manufacture, the final design and associated technical requirements, inclusive of drawings and schedule, shall be agreed and approved by the responsible specifying engineer.
- b. The final design and technical requirements shall be accepted by BP (or nominated agent) before the review of the vendor's quality plan.

10. Manufacture and test (or service provision)

10.1. General

BP (or nominated agent) should request a monthly progress report from the vendor. If short delivery periods (typically less than 4 weeks) are expected, a weekly progress report should be negotiated with the vendor.

10.2. Material identification

10.2.1. General

Due consideration shall be made by the specifying engineer regarding any specific marking, nameplate or tagging requirements for the goods. If no specific requirements exist, the vendor may propose his own in-house standard by means of a nameplate drawing supplied to the purchasing representative for review and acceptance.

10.2.2. Concession requests

- a. Following commencement of manufacture, concession requests (see Definitions) may only be made in exceptional circumstances.
- b. The vendor shall discuss with the specifying engineer any proposal to submit a concession request. If the specifying engineer agrees that the request can be considered, the vendor shall submit the request using a standard BP concession request form; see Annex B.
- c. A concession request is not required for authorisation to perform normal in-process repairs or rework, providing that the agreed requirements permit such repairs or rework.
- d. Accepted concessions (deviations) shall be signed off by the specifying engineer or appointed technical authority.

