



Exploration & Production

GENERAL SPECIFICATION

CORROSION

GS EP COR 111

External cathodic protection of onshore facilities

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1. Scope

This specification covers the rules applicable to cathodic protection projects for onshore facilities, such as pumping stations, compression stations, gas or oil treatment plants, storage tanks, etc.

This specification applies all buried piping, buried vessels, external side of tank bottoms and in general all metallic parts in contact with soil which are cathodically protected on purpose or DC consumers, such as earthing networks, concrete reinforcing steel bars, steel foundations, etc.

Cathodic protection of pipelines is not covered by this document but by [GS EP COR 110](#).

2. Reference documents

The reference documents listed below form an integral part of this General Specification and apply when they are not in conflict with those of the present document. Should some requirements of these documents differ, those from [EN 12954](#), [EN 13636](#) or [EN 14505](#) prevail. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
BS 7361 - Part 1	Cathodic protection - Part 1: code of Practice for land and marine applications
EN 12954	Cathodic protection of buried or immersed metallic structures - General principles for pipelines
EN 13636	Cathodic protection of buried metallic tanks and related piping
EN 14505	Cathodic protection of complex structures

Professional Documents

Reference	Title
API 651	Cathodic protection of aboveground petroleum storage tanks
API 653	Tank Inspection, Repair, Alteration and Reconstruction
NACE RP0193	External cathodic protection of on-grade metallic storage tank bottoms
NACE SP0169	Control of external corrosion on underground or submerged metallic piping systems
NACE SP0177	Mitigation of alternating current and lightning effects on metallic structures and corrosion control systems
NACE SP0286	The electrical isolation of cathodically protected pipelines

**Regulations**

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
ISBN 1-57590-092-0	Peabody's control of pipeline corrosion

Total General Specifications

Reference	Title
GS EP COR 101	Design of internal cathodic protection of equipment and storage tanks
GS EP COR 110	External cathodic protection of buried pipelines
GS EP COR 112	External cathodic protection of Onshore deep well casing
GS EP COR 201	Supply of sacrificial anodes
GS EP COR 210	Monolithic insulating joints
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP ELE 031	Design of earthing and bonding systems
GS EP ELE 051	Design and installation of lightning protection
GS EP ELE 079	Electrical apparatus for potentially explosive gas atmospheres
GS EP ELE 141	Power transformers
GS EP PLR 420	Site welding of carbon steel pipelines to API 1104 and DNV-OS-F101 (sweet service)
GS EP PLR 421	Site welding of carbon steel pipelines to API 1104 and DNV-OS-F101 (mild, intermediate and severe sour service)



3. General requirements

3.1 Qualification and Certification of Cathodic Protection specialists for design, installation Supervision, commissioning and routine inspection

Design, installation supervision, commissioning, and routine inspection of cathodic protection systems shall be carried out exclusively by competent and specialized personnel.

The qualification of each of the specialists shall be demonstrated by Contractor to Company before commencement of the work.

The verification of the formal Certification of the individuals shall be carried out as follows:

- Conventional design work, supervision of installation, pre-commissioning and routine monitoring works to be carried out by certified personnel at level 2 for all certification schemes except for NACE International where it shall be level 3.
- Complex design work, verification or commissioning to be carried out by certified personnel at level 3 for all certification schemes except for NACE International where it shall be level 4.

Accepted Certification schemes are AFAQ AFNOR Competence (Land Application Sector), APCE (Land Application Sector), Institute of Corrosion, NACE International. Any other certification scheme shall be approved by Company.

Any use of non certified personnel for cathodic protection design shall be subject to approval Company approval on a case by case basis (demonstration of competence through detailed curriculum vitae and description of experience).

3.2 Company involvement

Contractor shall involve Company's specialist or its appointed representative at each phase of the project, and more particularly during:

- Study
- Design
- Equipment selection and procurement (Factory Acceptance Tests)
- Installation
- Commissioning.

Company's specialist or its appointed representative shall have the right to attend the site/plant/factory and to review documents/reports/drawings when he considers appropriate. Approval from Company's specialist is mandatory at each phase of the project.

3.3 Sub-Contractors

When Contractor sub-contracts site surveys, studies (basic engineering and detailed engineering), works supervision, start-up and commissioning, including the preparation of the final report to a specialized Sub-Contractor, the choice of Sub-Contractor shall be submitted to Company for approval.



Notwithstanding the above provision, Contractor remains responsible to Company for the successful completion of the cathodic protection project and in no case he may use:

- Company approval for the choice of Sub-Contractor
- Company approval for the study report

to release him from his contractual liability.

In the case of complex installations or for any reason calling for the simultaneous intervention of several Contractors, special dispositions in the contract shall ensure coordination and compatibility of the various cathodic protection studies, the standardization and selection of equipment, checking of technical requirements at interfaces, preparation of an overall start-up and commissioning activity, and the issue of a common final report.

3.4 Definition of tasks

Unless the contract specifies otherwise, a cathodic protection project shall include all of the tasks listed below.

3.4.1 Study

The study shall include a site survey covering:

- The collection of all relevant information, the data required for the estimation of corrosion risks and the evaluation of coating materials
- The collection of all documents and information concerning the design of the structure to be protected, or taken as a DC consumer, its size, and those of its characteristics which are likely to influence the design of the cathodic protection system
- The collection of all documents and information pertaining to the environment of the work: the presence of nearby metallic structures whether cathodically protected or not, the presence of works likely to emit stray currents, the presence of high voltage cables or transmission lines, electric power stations, transformer stations, etc., which may damage cathodic protection installations, coatings, or the structures itself
- The collection of all information on availability of electrical power for the supply of cathodic protection installations.

The study shall also comprise the preparation of a detailed study report covering:

- An analysis of all information gathered and measurements taken, and an estimate of corrosion risks
- Justified design hypotheses, particularly for coatings damage and ageing
- The list, surface areas, and nature of the structures to be protected
- as the list, surface areas, and nature of DC consumers
- The technical requirements to be followed by other disciplines (civil works, piping, electricity) for electrical continuity and discontinuity of metallic structures
- A technico-economical discussion of the various schemes envisaged

- Design notes justifying the sizing and layout of equipment: anodes, transformers-rectifiers, cables, etc. Unless otherwise specified, the cathodic protection system shall be designed for a service life of minimum 20 years
- A list of materials, including assembly accessories, and the corresponding technical specifications
- A list of possible Suppliers
- Schematic diagrams
- Detailed equipment diagrams
- Detailed installation drawings, indicating:
 - The location of insulating joints
 - Electrical bonding to be installed
 - Special insulations to be installed
 - The layout of different types of equipment and their relevant installation procedure
 - Wiring diagram for electrical equipment.
- Installation instructions, indicating all precautions to be taken. Particular emphasis shall be given to the construction of:
 - Ground beds
 - Connections on anode circuits
 - Insulations between protected and non protected items
 - Insulations between items protected by different systems
 - Insulations between items protected by the same system, which must be separated temporarily for various operational reasons, such as routine checking of the quality of the coating, etc.
 - Influence correction with third parties
 - Reference electrode installation at fixed points.
- Instructions for checks to be carried out during the works, upon completion, and at start-up.

The location of DC power equipment (rectifier, drain point, current distribution, anodes, interconnection, and insulating joint boxes) shall be outside hazardous areas to allow permanent access on duty. If this is not possible, an enclosure corresponding to safety classification of the relevant area shall be used and the equipment fitted to allow energized readings from the outside.

The study shall be submitted to Company or its representative for approval.

3.4.2 Administrative formalities

If local legislation requires that an enquiry takes place before a cathodic protection system is installed, the preparation of the legal file is the responsibility of Contractor, and the study shall not receive definitive approval until the results of the official enquiry have been examined.



Company shall be responsible for transmitting the file to the competent administrative body. Company shall also receive the results of the enquiry.

Company shall be responsible for any questions of property which might be involved in the installation of the cathodic protection system.

Company shall likewise deal with the acquisition of land and rights of way and settle all additional costs and compensation for any loss of crops.

Contractor shall provide Company with all the information and documents required to deal with these property matters, including:

- Extracts of land survey maps
- Delimitation on the land survey maps of the land to be acquired and the temporary and/or permanent rights of way to be acquired.

If the installations require a power supply from the local distribution network, and unless otherwise specified, formalities with the local distribution company shall be carried out by Contractor. However, the network extension and connection costs shall be borne by Company.

3.4.3 Equipment supply

Unless otherwise specified, supply of all the equipment shall be the responsibility of Contractor.

Contractor shall also supply the spare parts recommended by Vendor for a two year operating period.

Contractor shall also supply all those spare parts which will be required during start-up of the installation.

Contractor shall make all necessary arrangements with Vendor to allow Company access at all times to the workshops during manufacturing to check:

- Manufacturing progress
- That the equipment conforms to the specifications
- And to be present during Factory Acceptance Testing.

A provisional manufacturing schedule shall be given to Company for planning inspections.

Vendor shall supply the factory test reports, the anode material chemical analysis, the certificates of approval for electrical equipment to be used in hazardous areas, etc., to Contractor who shall include them in the final report.

The final report shall consist of:

- A detailed description of the installation
- Vendor's drawings and operating and maintenance instructions
- As built drawings
- An equipment list with references and Vendor's addresses
- A list of spare parts for two years operation, with complete references
- Operating procedures
- A Complete list of measurements taken before and during the startup of the system

- Reports stating the agreements made with owners of neighbouring structures (duly signed by the various parties) on the corrective actions to be taken for any interference with these structures
- The results of the enquiry and the permission of local authorities if the installations are to be in countries where such installations are subject to special legislation.

4. Protection criteria

4.1 General

Unless otherwise indicated, all requirements of [EN 12954](#) shall apply. With zinc reference electrode (see § 7.10) the criteria shall be modified accordingly.

In addition, and unless otherwise indicated in this document, all the requirements of [NACE SP0169](#) and [BS 7361 - Part 1](#) shall apply.

4.2 Minimum negative polarization

Minimum polarization of carbon steel structures as measured with respect to the saturated Cu-CuSO₄ reference electrode shall be:

- -850 mV in general cases
- -950 mV for metallic structures buried in soils where sulphate reducing bacteria are likely to develop, such as in clay.

Less stringent potentials may be accepted in very highly resistive soils, in compliance with [EN 12954](#).

Important remark: Potential values shall be measured as close as possible to “true” values, correcting the error due to the ohmic drop in the soil. Since no reliable OFF potential can be measured directly on the steel structures, representative coupons for which OFF measurement is achievable shall be used (see § 7.10.3).

Note: More specific protection criteria may be used on a case per case basis with Company approval, depending on facilities and materials characteristics, coatings, and site.

4.3 Maximum negative polarization

The negative potential shall be limited to the most stringent of the requirements below:

- -1.2 V/Cu-CuSO₄ to prevent cathodic disbonding of coatings
- -1.1 V/Cu-CuSO₄ to avoid hydrogen induced stress cracking for high strength steels (SMYS > 700 N.mm²).