

German Cathodic Protection



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Competence in Cathodic Corrosion Protection

GCP German Cathodic Protection, a member of the GCP group, is an internationally operating company providing industrial services and systems for the world market. GCP German Cathodic Protection offers a wide range of technical services implementing tailored and customised solutions. GCP German Cathodic Protection's personnel know-how and more than 40 years of experience enables the company to respond flexibly to the needs of the markets.



Perfection in Manufacturing

GCP German Cathodic Protection is one of the leading international manufacturers and suppliers of mechanical and electrical components.

Components for cathodic protection systems are designed for a long operational lifetime. Therefore only the very best is good enough! Perfection is the basis of the development and manufacture of our cathodic protection materials.

Our own research and quality assurance system, combined with stringent control and test procedures, guarantee for this high quality level.

Only products which have passed these procedures will be released for shipment, ready to be installed and to work on site.

Our product components for cathodic corrosion protection systems include:

- Transformer rectifiers
- Alternative DC Power systems
- Sacrificial anodes
- Impressed current anodes
- Permanent test stations
- Reference electrodes
- Potential converters
- Current interrupters
- Cables
- Cable-to-pipe connections
- Flange insulating kits
- Dataloggers
- Measuring instruments and equipment
- Remote monitoring and control systems
- Data management systems
- Computer software



System Engineering Services

Our experienced team of engineers, project managers and technicians can design, manufacture, program and install systems that meet your specifications and requirements according to your budget and time frames. We believe in teamwork and long-lasting partnerships with customers, contractors and suppliers. This ensures that our products and systems offer the functionality and features necessary for continuous, uninterrupted operation.



Services

- Project consultancy
- Site surveys
- Basic design
- Detailed design and specifications
- Material procurement
- Construction and supervision
- Testing and commissioning
- Job training
- After sales service
- Monitoring and maintenance
- Remote monitoring and control services
- Stray current investigation
- Pearson survey
- Soil resistance measurement
- Fault location surveys
- Computerised close interval potential survey
- Computer based calculation of AC induced high voltage
- Training and development seminars

Application Technology



Our mission is to provide our customers with the best and most reliable cathodic protection systems based on our decades of experience and know-how.

We can supply complete packages from a single source – consultancy, site surveying, optimised engineering, material selection, material procurement, installation, testing, commissioning and after sales service.

Cathodic corrosion protection has proven its effectiveness worldwide over many decades in preventing the corrosion of buried or submersed steel structures.

Cathodic protection systems can be used for the following objects:

- Pipelines
- Harbours
- Jetties
- Oil and gas platforms
- Production wells for oil, gas and water
- Sheet piling
- Sluices
- Storage tanks
- Industrial plants
- Steel reinforcement in concrete



Corrosion and Cathodic Protection

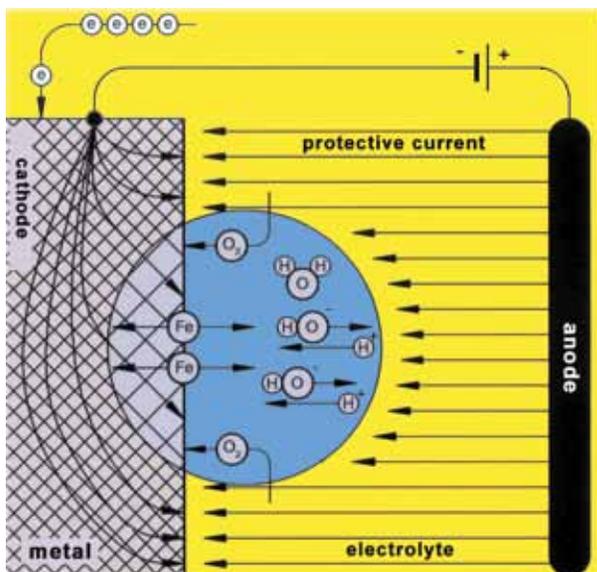
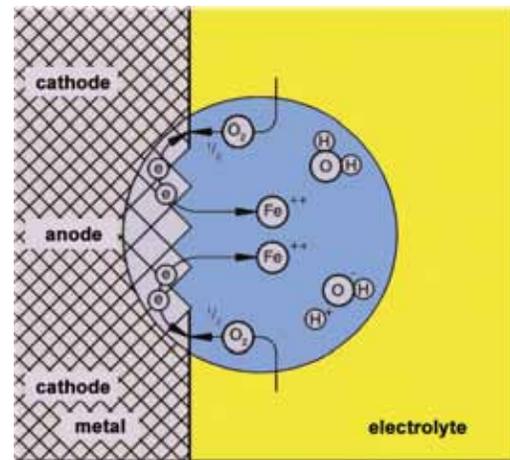
Corrosion

Corrosion is the destruction of a metallic material caused by chemical or electro-chemical reaction with its environment.

In all electrolytes, for example, in earth/ground, rivers or salt water, metal atoms go into solution as electrically charged ions. This corrosion reaction process produces a more or less rapid loss of the metal surfaces. The simultaneous movement of charged ions in the electrolyte and electrons in the metal causes a flow of current in the metal-electrolyte circuit.

The annual cost of loss caused by corrosion increases every year with the growing industrialisation of our society.

The efforts to counteract the destruction of technical or industrial installations valuable to our economy, for instance by the application of protective coatings, are increasing at the same rate. However, coating alone cannot provide complete corrosion protection since it is not possible to avoid minor defects such as pores or cracks in the coating.



The diagram shows how the protective current supplies electrons to the object being treated.

Cathodic Protection

Cathodic protection is a proven and reliable method and is effective even where there are undetected coating holidays. The protective current supplies electrons to the structure which is protected. These electrons cover the electron requirements for the reduction of oxygen which comes into contact with the metal surface. Without cathodic protection, these electrons would provide the decomposition of the metal. Thus, the potential of the metal surface is sufficiently reduced to prevent the disassociation of positive ions from the metal, where formerly an anodic reaction took place. The oxygen is reduced by cathodic reaction. The entire surface of the structure protected is thus transformed into a safe cathode, i.e. the metal is cathodically protected.

Objects

For many years, cathodic protection against corrosion has been successfully applied to a wide range of objects whose bare or coated surfaces are in underground, underwater or concrete-enclosed environments (locations). Illustration of such applications are shown below.

PIPELINES

- onshore pipelines
- offshore pipelines



PLANT AREAS

- industrial plants
- power plants
- underground metal installations
- petrochemical plants
- tank bottoms



OFFSHORE STRUCTURES

- platforms
- harbours
- jetties
- sluices
- oil rigs
- ports
- water intakes
- ships



PRODUCTION WELL CASINGS

- oil wells
- gas wells
- water wells



INTERNAL PROTECTION

- water tanks
- coolers
- turbines
- oil tanks
- condensers
- pipelines



STEEL REBARS IN CONCRETE

- marine structures
- dams
- offshore tunnels
- road bridges
- car parks
- cooling water towers

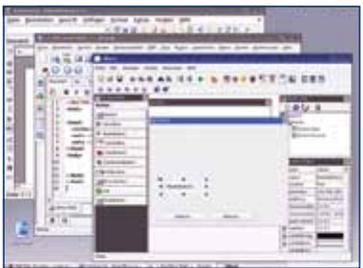


PRESTRESSED STEEL WIRES IN CONCRETE PIPES



Services

We have decades of experience in satisfying the requirements of domestic and international clients. We have a long and successful track record of providing first-class service and solutions to our domestic and international clients. We have the technical experience, resources and long-term business relationships needed to provide the complete range of services necessary for all types of cathodic protection activities, works and projects, regardless of their nature, size, complexity and location.

<ul style="list-style-type: none"> ■ SITE SURVEYS <ul style="list-style-type: none"> ■ data collection ■ soil resistivity measurements ■ current drain tests ■ location of groundbeds ■ location of AC power sources ■ location of CP stations ■ DC interference ■ AC interference ■ stray current 	
<ul style="list-style-type: none"> ■ DETAILED DESIGN <ul style="list-style-type: none"> ■ survey reports ■ protected objects ■ overall design criteria ■ scheme and calculations ■ DC/AC interference mitigations ■ material specifications ■ construction procedures ■ commissioning procedures ■ operating instructions ■ maintenance instructions 	
<ul style="list-style-type: none"> ■ MATERIAL <ul style="list-style-type: none"> ■ design and manufacture ■ procurement services ■ follow-up delivery schedule ■ factory inspection and testing ■ specialised packing ■ shipping, transport, delivery 	
<ul style="list-style-type: none"> ■ CONSTRUCTION AND SUPERVISION <ul style="list-style-type: none"> ■ project management ■ construction work ■ regular project review meetings ■ follow-up construction schedule ■ reporting system 	
<ul style="list-style-type: none"> ■ TESTING AND COMMISSIONING <ul style="list-style-type: none"> ■ equipment test ■ pre-commissioning ■ final commissioning ■ commissioning documentation 	
<ul style="list-style-type: none"> ■ JOB TRAINING AND QUALIFICATION <ul style="list-style-type: none"> ■ classroom training, seminars, courses and workshops ■ field training on-site 	
<ul style="list-style-type: none"> ■ AFTER SALES SERVICE <ul style="list-style-type: none"> ■ remote monitoring and control ■ spare part service ■ worldwide service and full-time support 	

Specialist services

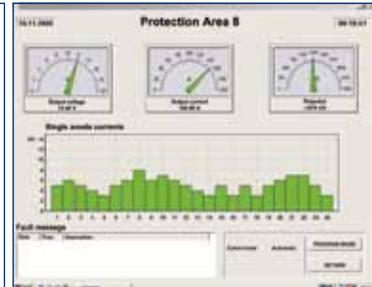
Regular monitoring and routine maintenance

GCP has been providing this service to a large number of clients in Germany for many years. The company always has the greatest concern for the functionality of systems and installations under its regular surveillance and maintenance. We consider this as a reservoir of knowledge and experience. Long-term relationships with our customers are cemented by mutual trust and understanding. We also provide this service to a large number of international customers on an „as needed“ basis. We can provide surveillance teams to operate worldwide, for example on annual contracts. Regular monitoring and maintenance services can be finalised in accordance with our practical experience, requirements of system functionality and enduser specifications.



Remote monitoring and control service

In addition to skilled engineers and maintenance technicians, we can also provide remote monitoring and control services for new or existing CP systems. We can design, install and maintain the highest quality systems using traditional or wireless communication systems. CORROCONTROL allows remote control and monitoring of CP system performance and functions for unattended CP stations meaning that only periodic on-site maintenance is required.



Intensive survey

Detailed intensive survey can pinpoint faults and limitations which are not always revealed by routine system monitoring surveys.



Stray current investigation

The effects of stray currents from DC systems (railways, tramways, mines, HVDC transmission, cathodic protection, etc.) are so well known that investigation and implementation of remedial measures is an integral part of CP projects. However, some CP systems may face unique problems which require more detailed and sophisticated investigation.

In most cases, it is not until some damage has already been caused that analysis is made of the effects of stray currents and the remedial measures needed to solve the problem.

We can also provide risk assessment and mitigation planning for proposed new CP systems so that any necessary remedial measures can be implemented in advance. This helps avoid delays which often arise when interfering systems are being operated by different owners.



Pearson survey

Using the method first introduced by Mr. J. M. Pearson, we can provide the skilled personnel and specialised equipment needed to carry out this survey which determines:

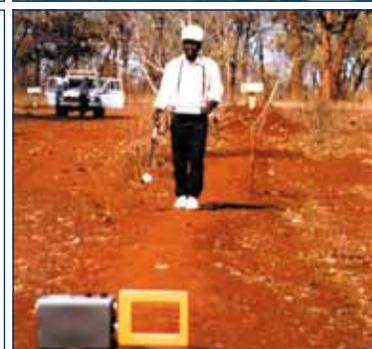
- location and depth of underground metallic pipelines, structures, cables, etc.
- location of defects in corrosion protective coating (so-called holidays)
- location of electrical contact between the injected test signal and nearby pipelines, etc.

Pearson survey was used extensively in the past. Although we can still offer such services, we recommend instead the use of a computerised Close Interval Potential Survey (CIPS) to determine the location and extend of defects in protective coatings and to assess any possible effects those may have on the functionality of cathodic protection systems for underground pipelines.



Fault location

Cathodic protection systems may have faults which only become apparent after system implementation. Such faults can substantially reduce the efficiency of a CP system. They may be caused by faulty insulating joints, contact with other metallic structures such as foreign pipelines, cables, sheet piling, reinforced concrete structures, casings, etc., or they may be the result of the presence of other insulating valves and expansion joints. It is not always easy to determine the location of such faults. However, our experienced personnel can offer a range of tried-and-tested methods to locate and eradicate such problems quickly and effectively.



Specialist services

Survey of subsea pipelines

We can provide services for the external survey of subsea pipelines in partnership with experienced, specialist marine survey companies. We are responsible for all matters concerning cathodic protection and the marine survey company determines the exact location and route of pipeline. Surveys use satellite positioning system and marine survey equipment such as echo sounders and side scan sonar to provide seabed data and sub-bottom profilers, related equipment to determine pipeline location and depth, towed and/or remote controlled vehicles for exact positioning of reference electrodes, as well as computers for on-line recording and processing of data.

All such survey projects can be carried out according to specific enduser specifications and requirements.



Close Interval Potential Survey (CIPS)

Analysis of the external corrosion of buried pipelines is made using pipe-to-soil potential measurements. Pipe-to-soil potentials are usually measured at fixed test points spaced between 1-5 km along a pipeline. However, since such measurements are only valid at the location of the reference electrodes, there is a lack of reliable information about the CP status elsewhere along the pipeline.

Considerable deviation in soil resistivity, interference and other factors can cause corrosion at intermediate locations even though the test points indicate favourable data. If the distance between the test points is decreased, the survey will provide more accurate data about CP conditions along the pipeline. This is why the Close Interval Potential Survey (CIPS) is developed, allowing intensive potential measurements to be taken at intervals of 5 metres or less.

Reasons to use Close Interval Potential Survey (CIPS)

It is obvious that a manual survey of pipe-to-soil potentials at such close intervals can be neither practical nor economical, especially if a long distance transmission pipeline is to be inspected. Even if stripchart recorders are available, such a survey would be extremely time consuming. Thus a faster and more reliable method is a better alternative.

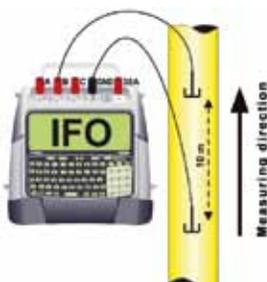
CIPS overcomes such problems by automatically recording, storing, calculating and displaying measurement data, which can be presented in tables or graphics.

The MoData2 Multifunction Instrument is used for field recording and display of pipe-to-soil potentials and voltage drops in a cathodic protection system. These are also stored in the MoData2's internal memory.



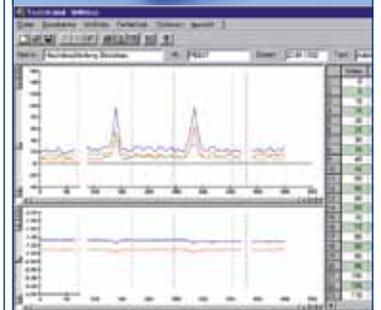
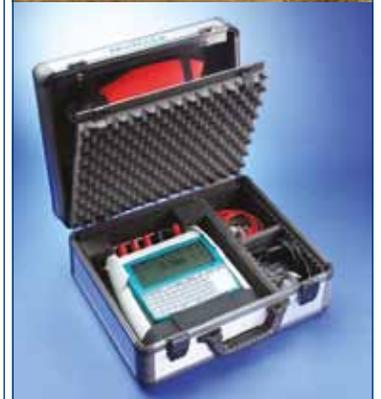
Our mobile software package integrates/offers 4 measuring methods:

- 2-electrode method
- 3-electrode method
- Addition method
- IFO method



Further technical details
can be found in:

Chapter 12, Document-No.: 12-310-R0



Specialist services

Computer based calculation of AC induced high voltage

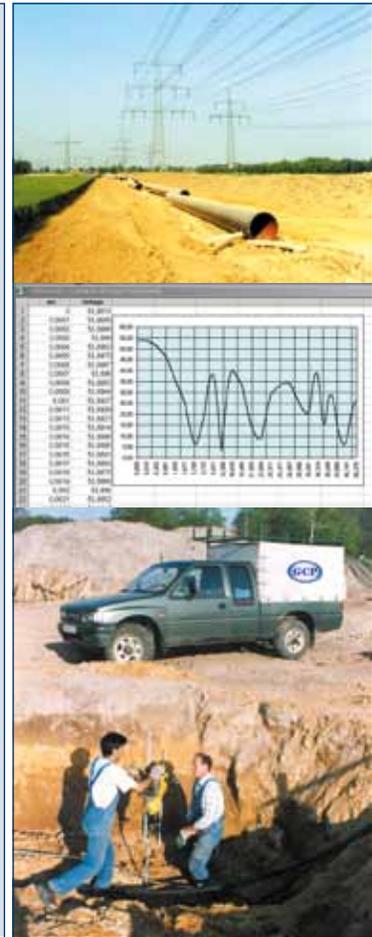
Effect of alternating current is a matter of serious concern for safety of pipeline, connected equipment and operating personnel. This problem has become more serious now than what it was in the past due to rapid increase in the number and voltage levels of AC transmission lines in the right of way of underground pipelines and improvement in the quality of pipeline coating.

Maximum permissible safe voltage up to which personnel and equipment may be exposed under various conditions are defined in safety codes and standards. It is obligatory for the owners to maintain voltage levels within safe limits. With increasing awareness of the public with regards to human and environmental safety, it is necessary to give due weightage to problems of AC interfered pipelines.

The magnitude of AC induced voltages can be measured in existing pipelines. But it is generally impossible to determine correct remedial measures to control the magnitude of permanently induced voltages. It is also impossible to determine the magnitude of voltages which would be induced when a pipeline is laid in the right of way of AC transmission lines. Because of these practical considerations, the company has developed a computer software and procedure to investigate and provide correct remedial measures for the safety of pipeline, connected equipment and operating personnel.

Our scope of services includes:

- collection of design and field data
- calculation of AC induced profiles along the pipeline
- calculation of AC voltage
- design of required earthing measures
- supply, installation and testing of recommended remedial devices
- field measurement of induced AC voltages
- preparation of reports



Computerised geophysical soil survey

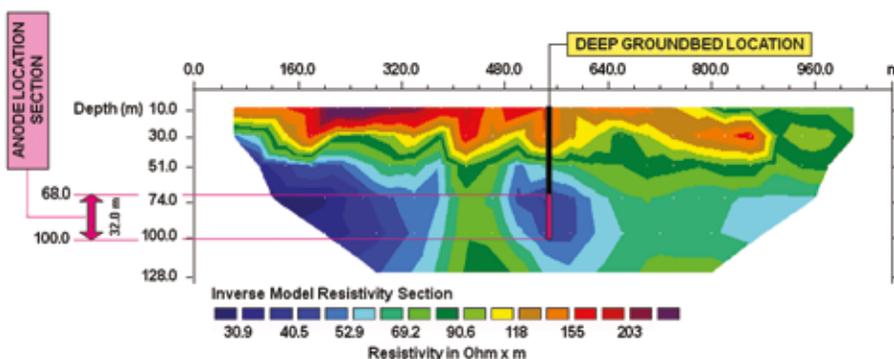
A very important part of our company's projects is the determination of electrical soil resistivity to assess the corrosiveness of soil and its effects on the working performance of groundbeds, especially on deep groundbed protection systems.

We carry out soil resistivity measurement surveys for cathodic protection systems and power distribution line projects and provide trained personnel with all equipment and accessories necessary to carry out such surveys in accordance with enduser requirements.

This measuring equipment has been developed and used successfully in the investigation of specific soil resistivity. Most of the commercially available earthing meters fail to provide correct measurements for soil resistivity at depths of more than 30 metres. Correct data on soil resistivity at greater depths is of special importance for the correct designing of deep anode groundbeds.

We use state-of-the-art portable soil resistivity meters which store readings conducted at user defined measurement cycles. This provides the highest accuracy and lowest noise levels in the industry.

The specialised survey for the determination of electrical resistivity and geographical profiling of the test area uses computerised measurements with test electrodes and custom made software for data processing and presentation of results.



Specialist services

Data management software

All GCP software packages are designed to enduser specific requirements and CP system structures. They substantially reduce the amount of paperwork and the cost for record storage management.

The data management system software allows users to import all relevant data and records either from hand-held dataloggers via interface or from computer network data files.

The data storage structure has been carefully refined and improved using years of experience in storing millions of records of site data.

Users can navigate through the various tasks of pipe sections, tank farms, pumping stations, etc. to view the required data.

They can create printed reports, save the data on a disk or into other applications, such as Excel™.

The software is fully compatible with all Microsoft™ applications and requires minimal training.



Training and qualification seminars

Depending upon enduser specific requirements, we can provide seminars for the training and qualification of personnel.

Our range of services includes:

- **management / executive appraisal programmes**
- **CP design and engineering courses for pipeline and plant engineers**
- **corrosion and cathodic protection basics**
- **system monitoring and maintenance**
- **CIPS, Pearson and other surveys**
- **office and field application of computers**

The training can be arranged at GCP offices, enduser offices or on-site depending upon enduser requirements and number of participants.

The program content is finalised in consultation with the client and includes tests, appraisals, assignments and field work for performance evaluation.

