PRESENT AND FUTURE ROLE OF A.P.C.E. IN THE WORLD OF CATHODIC PROTECTION AND ANTICORROSION

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A.P.C.E. (Association for the Protection from Electrolytic Corrosions) is a free, non-profit Association founded on the total co-operation among its members.
A.P.C.E. was born in 1981: its goal is to constitute a forum of information and dialog among the Associates, also open towards the external world, through which the owners or the managers of buried metallic structures can face, localise and solve common problems for the protection of their structures from corrosion.

1 – Aims of A.P.C.E.

The main aim of A.P.C.E. is to promote and co-ordinate initiatives in order to help (and put into practice) the collaboration among those Associates who want to study and solve the electrolytic corrosion problems tied with the protection of buried metallic structures (art. 2 of the Statute). Two fundamental guidelines are evident:

- the promotion of mutual information in the field of cathodic protection and electrical interferences for all the users of the subsoil
- the promotion of initiatives for the solution of corrosion and electrical interference problems of buried structures.

In order to reach these goals, the development a culture in this field is essential.
Therefore its also necessary to develop the know-how in the specific fields of corrosion and cathodic protection of the personnel involved. This can be obtained through:

- the Qualification and certification of Cathodic Protection Personnel
- following of the works of Standardisation at a National and International level
- share and develop common experiences within similar bodies at a European level (e.g. CEOCOR, CEFRACOR etc.).

2 – Members of A.P.C.E.

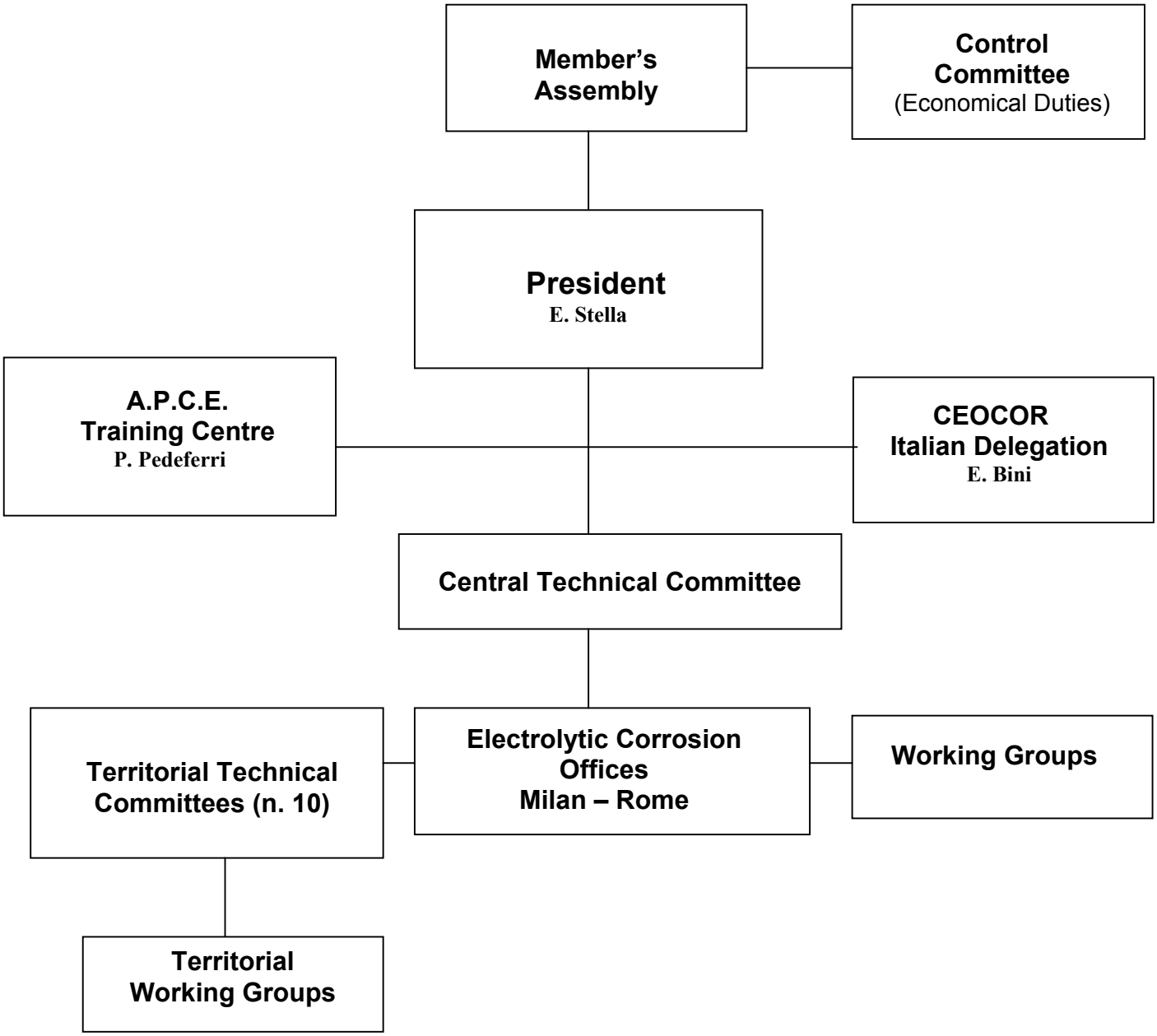
Members of A.P.C.E. can be companies, institutions/organisations or, in general, private or public subjects, having a local or national importance, that operate buried metallic structures or are anyhow interested in their protection from corrosion, or those companies that deliver direct currents in the ground, and the relevant Associations (art. 3 of the Statute).

The present members of A.P.C.E. are:
ANIGAS, Snam Rete Gas, Telecom Italia, Rete Ferroviaria Italiana (Public Railways), Italgas, Ministry of Transportation and Navigation, Ministry of Communication and other transport Institution, Municipalities, Companies dealing with Cathodic Protection and other numerous local companies; all of them are interested to the problem of electrolytic corrosions and cathodic protection aspects.

3 - Organisation

According to its statute, A.P.C.E. is active all over the national territory with its organisation based on 10 CTT (Territorial Technical Committees): CTT Torino, CTT Milano, CTT Venezia, CTT Genova, CTT Bologna, CTT Firenze, CTT Roma, CTT Napoli, CTT Bari and CTT Palermo.
These CTT operate through meetings among the Associates or Working Groups, composed by technicians and experts, assisting and co-ordinating each other in their activities and rules, related to the proximity or co-existence, in the same environment, of different structures and their cathodic protection systems.
On their side, CTT are co-ordinated, at national level, by a CTC (Central Technical Committee) which task is to guide, co-ordinate and control the scientific and technical activities as well as the rules and guidelines of the Association.
For this purpose, the CTC (Central Technical Committee) is supported by two main bodies (U.C.E. = Offices for Electrolytic Corrosions), placed respectively in Rome and Milan, having technical tasks for the assistance and co-ordination in the compilation and maintenance of a corporate member's Database, providing rules and recommendations, promoting the training and professional up-dating of the personnel employed in cathodic protection, by organising study meetings, conferences and similar initiatives in order to increase their level of know-how and conscientiousness.
At the top of A.P.C.E. there's a Members Assembly that has decisional and leading power for the whole activity.
A Control Committee has also been set up, with the task of verifying the economical balance of the Association; it only has economical duties.
In the last years A.P.C.E., continuing in the activity that traditionally gives it a distinctive character, has constituted the CFA (A.P.C.E. Training Centre), with the aim of planning, organising and leading the activities and relevant services in the fields of training, coaching, professional updating of the personnel in the field of cathodic protection against corrosion, with particular reference to training and qualification courses for cathodic protection personnel in the application Sectors foreseen in the National and European Standards. At present, Prof. Pietro Pedeferri, from the Department of Physical Engineering of the Politecnico of Milan, is the President of the A.P.C.E. Training Centre (CFA).
Since 1999, A.P.C.E. is a member and the national institution representing Italy in CEOCOR - "Comité d'Etude de la Corrosion et de la Protection des Canalisations", a Study Committee based in Brussels that studies the problems of corrosion and protection of pipelines and structures, metallic and not metallic, buried, immersed or aerial, for the transportation or the stocking of different fluids, in particular water and gas.

A.P.C.E. Organisation



4 - Activities of A.P.C.E.

In the last few years the main activities of A.P.C.E. have been devoted to:

- Training and Certification of Cathodic Protection Personnel
  Through its members and representatives, A.P.C.E. is presently supporting this activity in the field of Standardisation at a European level also through contacts and sharing of experiences with other European Countries.
  In particular, a strict co-operation with CEFRACOR/AFNOR is in progress, foreseeing a European common set of rules to establish mutual equivalence of Competence Levels and in the field of Cathodic Protection.

- Definition of Technical Rules to be adopted within the framework of the dispositions of the Italian Electricity and Gas Authority.

In this context, the Italian Electricity and Gas Authority has adopted, in Dec. 2000, the European Directive n. 98/30/CE, establishing common rules for the internal market of gas, in line with Art. 41 of Italian Law n. 144 dated 17th May, 1999.
This Law Decree imposes well-defined rules and introduces some important news.
According to this Decree, all the activities of import, export, transportation and dispatching, distribution and selling of natural gas have been declared free market.
On December the 28th , 2000 the Electricity and Gas Authority issued the deliberation 236/ 00 "Adoption of the directive concerning the discipline of safety and continuity of gas distribution service" - published in the Governmental Bulletin - ordinary supplement, general series n. 4, dated January 5th , 2001.
This deliberation applies to low, medium and high-pressure gas distribution pipelines up to the delivery points to final users, and indicates some indexes tied to safety and continuity of gas supply.
The Electricity and Gas Authority entrusted A.P.C.E. with the duty of defining guidelines concerning the sector of cathodic protection of buried metallic structures.
Aim of these guidelines is to provide criteria concerning cathodic protection of steel gas distribution pipeline networks and to deal with relevant aspects tied to it in order to implement the actions and fulfil the requirements of the deliberation 236/ 00.
The:

GUIDELINES ON CATHODIC PROTECTION FOR STEEL GAS PIPE DISTRIBUTION NETWORKS
A.P.C.E. – Code 4.20.01 – 29.11.2001
Edition 1 – Revision 0

have been issued by the Central Technical Committee of A.P.C.E. in Nov. 2001 and are included in this paper as Annex A.

A.P.C.E. has developed numerous services that are available for its Members and also for third parties. All services that A.P.C.E. offers to its Associates are granted by the Electrolytic Corrosion Offices and by the various Working Groups.
The services are bound towards different activities such as:

- subsoil interference information, and particularly to the structures that may determine electrical interferences;
- information on the CP stations of the members;
- reciprocal control of electrical interferences between metallic structures and relevant cathodic protection systems, keeping in mind the goals of quality and safety;
- the search for mitigation measures, among those possible, having the lowest cost for all the involved parties;
- technical assistance and consultation in the cathodic protection and corrosion fields;
- support the standardisation organisations by actively participating the works of commissions and technical committees at a national and European level;
- support the activities for the qualification and certification of cathodic protection personnel;
- training and technical updating of the personnel;
- promote innovation and researches in the relevant sector of interest by funding specific scholarships for it;
- definition and promotion of rules, standards, recommendations and certification to support the activities of the members;
- sensitisation of private or public institutions that operate in the subsoil and can influence or be influenced by the electric status of buried structures;
- cultural promotion in the sector of the protection of buried metallic structures from corrosion and of the personnel involved in this field.

Most of the above activities are performed at a local level in the framework of Territorial Technical Committees that are closer to the problems arising in the territory and consequently able to solve them rapidly.
A further tool for the continuous information both for the Associates and third parties, in the cultural field of the prevention of corrosion for buried metallic structures is the publication of the magazine “A.P.C.E. News” every four months.

5 - Qualification and Certification of Cathodic Protection Personnel

A.P.C.E., in order to ensure the quality of the activities carried out in Italy in the field of protection from corrosion, considered paramount to define and support a system to guarantee the professionalism of the personnel involved in these fields.

The Association promoted and supported the activities for achieving a Standard on the "Qualification and Certification of Cathodic Protection Personnel – General Principles" through agreements, rules, codes and other relevant documents that grant the personnel to be certificated, in co-operation with UNI (Institution of Italian Unification) and other industry and Universities experts.

For this goal A.P.C.E. set up an agreement with C.I.C.P.N.D. (Italian Co-ordination Centre for Non Destructive Tests) and the Certification Authority S.I.N.C.E.R.T. (National System for the Certification), in order to create and support, in the area and with the care and the competence of C.I.C.P.N.D., a specific activity for the "Qualification and certification of cathodic protection personnel" in the various sectors of application at different levels of competence of the technicians involved.

A.P.C.E. established a tailor-made structure, the C.F.A. (A.P.C.E. - Centre for Personnel Training) that employs teachers chosen among a number of experts in this field of activity, from Italian Universities or renowned experts from the industry.

A.P.C.E., as representative Authority for cathodic protection and interference problems among buried metallic structures at a national level, continues its engagements in promoting the culture of protection from corrosion through rules, conferences and the diffusion of technical information, always looking for new solutions to the problems related to the corrosion and cathodic protection fields.

The Association, within these targets, has defined and created many projects, fundamental in order to increase the efficiency of the global system according to the European rules, in line with other professional areas.

We believe that A.P.C.E. has achieved the goals of increasing the safety and quality thanks to its experts and each of the companies involved in the fields of cathodic protection and corrosion.

5.1. A.P.C.E.'s engagements in the field of Qualification and Certification of Cathodic Protection Personnel

In 1997 A.P.C.E. signed an agreement with C.I.C.P.N.D. (Italian Centre for Not Destructive Testing - accredited by S.I.N.C.E.R.T., the Italian Body for official accreditation), and jointly made a "Regulation for the Certification of Cathodic Protection Personnel".

Others rules and documents have been released by A.P.C.E. in order to put into practice the Qualification and Certification of personnel for different levels and fields of application such as:

- establishing the requirements for the training and examination Centres
- defining minimum required know-how levels
- preparing the Program of the courses
- preparing training tests and material
- appointment of a Director Responsible for the A.P.C.E. Training Centre and of a list of teachers

5.1.1. Personnel Qualified and Certificated in the field of Cathodic Protection 3rd Level

According to the "Regulation for the Certification of Cathodic Protection Personnel", the Qualification of 3rd level Experts for Cathodic Protection personnel has been carried out through the examination of Dossiers and CVs and through the assessment of previous experiences in the field of Corrosion and Cathodic Protection.

A total of 54 people (*) have been certificated since 1997 in the different Sectors of Application.

N. 54 people for the Sector of Buried or submerged structures (other than sea water)
N. 10 people for the Sector of Structures in sea water
N. 3 people for the Sector of Reinforcing steel in concrete
N. 4 people for the Sector of Internal surfaces of plants (pipes, reservoirs, pumps etc.).

(*) Some people are Certificated for more than one Sector of application

Since 1999 for Levels 1 and 2, a set of courses for the different fields of application have been supplied.

5.1.2. Training courses

Up to date (March, 2003), the following training courses have been organised and performed through A.P.C.E., with the participation of a total of 220 persons.

YEAR	N° COURSES	LEVEL	PLACE	Number of Participants
1999	2	2	ITALGAS Training Centre (Rome)	37
1999	1	1	ECU (Eni Corporate University) Training Centre – Credera (CR)	17
2000	1	2	ECU (Eni Corporate University) Training Centre – Credera (CR)	20
2000	1	1	ECU (Eni Corporate University) Training Centre – Credera (CR)	15
2000	1	2	NAPOLETANAGAS Training Centre-Naples	15
2001	1	1	ITALGAS Training Centre (Rome)	14
2001	1	2	ECU (Eni Corporate University) Training Centre – Credera (CR)	20
2001	1	2	ECU (Eni Corporate University) Training Centre – Credera (CR)	21
2001	1	2 (sea water)	POLITECNICO di Milano Dpt. Chemical-Physical Engineering	6
2001	1	2	CONSIAG Training Centre - Prato (Florence)	11
2002	1	1	CAMUZZI Training Centre Pescara (PE)	16
2002	1	2	CONSIAG Training Centre - Prato (Florence)	18

5.1.3. Personnel Qualified and Certificated in the field of Cathodic Protection 1st and 2nd Levels

Until March 2003, after training courses and examinations, the following number of people has been Qualified and Certificated:

	Total Participants		Total Certificated people
Buried or submerged structures	1st Level	62	37
Buried or submerged structures	2nd Level	152	65
Structures in sea water		6	No examinations until now
TOTAL PARTICIPANTS/ CERTIFICATED		**220**	**102**

These numbers demonstrate that the examination system is very selective and guarantees the high standard of the Certificated personnel.

5.1.4. Training courses foreseen during 2003

The following calendar has been set up for the courses for the year 2003:

DESTINATION	April, 2003	June, 2003	September, 2003
Buried or submerged structures (other than sea water) **LEVEL 2**			**22nd – 26th** CONSIAG Training Centre Prato (FI)
Buried or submerged structures (other than sea water) **LEVEL 1**	**7th – 11th** CAMUZZI Training Centre Pescara (PE)		
Buried or submerged structures (other than sea water) Refresher Courses **LEVEL 2** **LEVEL 1**		**10th – 11th** ECU (Eni Corporate University) Training Centre - Credera (CR)	
Structures in sea water **LEVEL 2**		**23rd - 27th** POLITECNICO di Milano - Dpt. Chemical-Physical Engineering	
Reinforced steel in concrete **LEVEL 2**		**23rd – 27th** POLITECNICO di Milano - Dpt. Chemical-Physical Engineering	

6. Conclusions

The general cost of corrosion in the U.S. is estimated to be around 4 % of the Gross National Product (GNP). In Europe an estimate has never been attempted with a scientific approach, but it is generally considered to be of the same order of magnitude.
The safety of the personnel is one of the most important aspects of corrosion, but the integrity of the equipment and the plants is sometimes of utmost interest, from an economical and strategic point of view.
The control of interferences among various systems delivering current in the subsoil is a complex task. This task cannot be achieved without a specialistic know-how and a wide culture in the specific fields of corrosion and cathodic protection.
Besides, the co-operation between the interfering and interfered systems involved is essential to achieve this control in a cost effective and efficient way.
Thanks to A.P.C.E. the following results have been achieved so far in Italy:

- more than 200 people attended the specialised courses on Cathodic Protection, Corrosion and other relevant aspects
- more than 140 specialists have been Certificated for the various Sectors of Application at different Levels
- 5 Training Centres have been founded all over Italy, covering the need for training the personnel in 4 Sectors of Application of Cathodic Protection
- a Permanent Centre for Training has been created with a high level structure.
- a permanent liaison between European organisations has been secured, through CEOCOR and other international standardisation bodies

The above said highly qualified personnel is presently fully operational in Italy and abroad in a wide range of industry fields, Laboratories, Universities, Standardisation bodies etc..
A.P.C.E. is very proud that the goals of improving the quality, the know-how and the general technical/specialistic culture of the Personnel involved in the fields of Cathodic Protection and Corrosion has been fully achieved.
The role of A.P.C.E. has been officially recognised by the Italian Authority for Electricity and Gas for defining Guidelines in its field of activity, in case of lack of applicable Standards.
We strongly hope and recommend that the same type of development is attained in other European Countries.
At present, a fruitful collaboration is being developed between A.P.C.E. and corresponding bodies such as CEFRACOR/AFNOR in France in the field of Qualification and Certification of Cathodic Protection Personnel.
A.P.C.E. is ready to develop further co-operation with similar organisations in Italy and in Europe and is willing to develop themes of common interest.

ANNEX A

GUIDELINES ON CATHODIC PROTECTION FOR STEEL GAS PIPE DISTRIBUTION NETWORKS

A.P.C.E. – Code 4.20.01 – 29.11.2001

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These Guidelines have been published in the Web Site UNI, the Official Body for Italian Standardisation www.uni.com with the agreement of:

Electricity & Gas Authority	***UNI Director***	***APCE President***	***A T I G Technical Director***
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1. INTRODUCTION

On December 28th 2000 the Electricity and Gas Authority issued the deliberation 236/ 00 "Adoption of directive concerning the discipline for the safety and the continuity of gas distribution service" - published in the Governmental Bulletin - ordinary supplement, general series n. 4 dated January 5th, 2001.
The deliberation, at article 28, recalls the Technical Standards relevant for the activities related to the safety and the continuity of the service.
Paragraph 1 quotes: in order to put the directive into practice, UNI – CIG ad CEI Technical Standards in force apply.
Paragraph 2 quotes: in case of lack of applicable Technical Standards, the Guidelines delivered by technical competent organisations such as ATIG and A.P.C.E. apply.

The Electricity and Gas Authority acknowledged A.P.C.E. (Association for the Protection from Electrolytic Corrosions) the assignment to define guidelines concerning the sector of cathodic protection of buried metallic structures.

Since its establishment, A.P.C.E. has pursued the objective of promoting and co-ordinate initiatives for the collaboration between the Associates for the study and the solution of problems tied to the cathodic protection of metallic structures from electrolytic corrosions, with regard also to electrical interferences that could arise among structures belonging to the users of the subsoil.

2. PURPOSE

Goal of these guidelines is to provide criteria concerning cathodic protection of steel gas distribution pipeline networks, or to deal with aspects connected to it, in order to implement the actions required by deliberation 236/ 00.

3. REFERENCES

3.1. Legislative

The application of Cathodic Protection to gas distribution networks is compulsory since 1968, by means of legislative dispositions.

Currently it is obligatory and regulated by:

- Ministerial Decree dated November 24th 1984 "Safety Rules against fire for the transport, the distribution, the accumulation and the use of the natural gas which density is not superior than 0,8" and following modifications dated 1989, 1991 and 1999

and

- Ministerial Decree dated February 23rd, 1971 n. 2445 "Technical Rules for the crossings and for the parallelisms of pipelines and channels carrying liquid and gas on railroad and other transportation means".

With respect to the legislative aspects, besides, it's wise to indicate that Law 6.12.1971, n. 1083, "Safety Rules for the use of combustible gas" establishes that all the materials, the equipments, the installations and the systems fed by combustible gas for domestic and similar uses must be built according to specific standards of good technique, for the safeguard of the safety.
A later article establishes that if the installations are implemented according to the rules established by National body of Unification (UNI-CIG), then it is considered correct according to the standards of good technique.

3.2 Normative

In the field of cathodic protection UNI (Italian Standardisation Body) has released the following technical standards that by now constitute a reference asset for buried metallic structures within which steel gas distribution networks are included.

UNI 9782
Cathodic Protection of metallic structures - General Criteria for the measurement, the planning and the realisation

UNI 9783
Cathodic protection of buried metallic structures - Electrical interferences among buried metallic structures

UNI 5
Cathodic protection of buried metallic structures – Current Measurements

UNI CEI 6
Cathodic protection of buried metallic structures – Potential measurements

UNI CEI 7
Cathodic protection of buried metallic structures – Electrical resistance measurements

UNI 10166
Cathodic protection of buried metallic structures – Test points

UNI 10167
Cathodic protection of buried metallic structures – Cabinets for devices and test points

UNI 10265
Cathodic protection of buried metallic structures - Graphic Symbols

UNI 10362
Cathodic protection of buried metallic structures - Verifications and controls

UNI 10428
Cathodic protection of buried metallic pipelines - Unidirectional drainages

UNI 10405
Cathodic protection of buried metallic structures - Localisation of the layout, coating faults and contacts with extraneous structures

UNI CEI 8
Cathodic Protection Devices - Cathodic protection feeders

UNI 10611
Insulating coatings for buried metallic structures associated to cathodic protection - Criteria for the design and the control

UNI 10835
Cathodic protection of buried metallic structures - Anodes and ground-beds for impressed current CP stations - Criteria for the design and the installation

UNI 10875
Qualification and certification of Cathodic Protection personnel - General principles

UNI 10950
Cathodic protection of buried metallic structures. Remote control of Cathodic Protection Systems

EN 12954
Cathodic protection of buried or immersed metallic structures - General principles and application for pipelines (January, 2001)

UNI EN ISO 8044
Corrosion of metals and alloys - Fundamental Terms and Definitions

SS UNI U68.00.003.0
Corrosion of buried metallic structures - Evaluation of soil corrosivity for alloyed and unalloyed ferrous materials

SS UNI U68.00.008.0
Cathodic Protection of complex structures - Planning, installation, testing, verifications and controls

Other standards released by UNI, by UNI's corporate bodies or by CEI (Italian Electrotechnical Committee), even if not specifically addressed to this field, give indications on the situations in which cathodic protection could be necessary, or other aspects tied with it are present.

4. TERMS AND DEFINITIONS

For the scopes of this Standard, the following definitions apply:

Cathodic protection feeder (UNI 9782)
Device able to furnish cathodic protection current to the metallic structures. The negative polarity of cathodic protection feeder is to be connected to the structure, the positive polarity to a proper ground-bed.

Galvanic Anode (UNI 9782)
Metallic material having a more negative electrochemical potential, that furnishes (by wearing out) electrical current to the metallic materials having a more positive electrochemical potential, when joined together through an electrolytic solution.

IR voltage drop (UNI 9782)
Difference of potential existing between two points of a metallic structure, or between two points of the electrolytic environment, due to a current flow.

Electrical connection between structures (UNI 9782)
Electrical connection between structures pertaining to the same cathodic protection system or between different systems, realised to obtain their equipotentiality, or a pre-set potential difference, for instance by connecting them through an electrical resistance.

Stray current (UNI 9782)
Current flowing in the electrolytic environment due to electric plants connected to earth during normal operating conditions (for example equipment of rail traction systems, cathodic protection stations), or due to equipments because of an insulation defect.

Planimetric Drawing (UNI 10265)
Sketch in opportune scale where the protected structure and fittings relevant to cathodic protection systems are shown, respecting their mutual position. Such sketches also represent the topographical characteristics.

Ground-bed (UNI 9782)
Element constituted by a conductive material dipped in the environment and used as an anode to furnish the current delivered through a Cathodic Protection Feeder.

Mixed drainage (UNI 9782)
Plant that includes a Cathodic Protection Feeder and a unidirectional drainage that works in an automatic and complementary way, according to the electrical characteristics of the circuit

Unidirectional drainage (UNI 9782)
Cathodic Protection plant through which an electrical unidirectional connection is realised between a structure to be protected and the rail of the transit system

Reference electrode (UNI 9782)
Electrode used to measure the potential of a material metallic immersed in an electrolytic environment (soil, water, etc.). It's electrochemical potential towards the standard hydrogen electrode (SHE) is known and constant in reproducible measuring conditions

Insulating joint (UNI 9782)
Component used for interrupting the electrical longitudinal continuity of a metallic structure

Cathodic Protection Station (UNI 9782)
Plant realised with cathodic protection feeders, with drainages or with galvanic anodes

Cathodic protection with impressed current
Plant that includes the cathodic protection feeder, the ground-bed, the permanent reference electrode and relevant cables, including the connection to the metallic structure to be protected

Drainage
Plant that includes the unidirectional drainage equipment, the permanent reference electrode and relevant cables, including the connection to the metallic structure to be protected

Galvanic anodes
Plant that includes galvanic anode/s, the relevant connecting cables and the measuring devices

Potential measurement performed continuously
Detection of potential or current values, performed with continuity through a remote control system and transmitted to a control and elaboration unit

Potential measurements non continuously performed
Detection of potential or current values performed by using indicating meters with duration of the registration in the order of minutes and/or by using recorders, with a given duration selected according to the variations of the interfering electric field during the 24 hours

Test Post (UNI 9782)
Device for the electrical measurements where an electrical connection to the metal is possible

Threshold Protective Potential (UNI 9782)
Pipe-to-soil potential value of a metallic material in contact with the environment, below which the corrosion rate is in practice negligible

Protection potential (EN 12954)
Structure-to-electrolyte potential for which the metal corrosion rate is negligible

Cathodic protection (UNI 9782)
Protection against corrosion realised by making cathodic the metallic surfaces of a structure towards the environment, giving to it a current able to reduce or hinder electrochemical reactions of oxidation of the metal

Characteristic test point (UNI 10362)
Measuring Point that allows ascertaining, with sufficient approximation and by a simple comparison between his electrical present parameters and those resulting from a previous reference electrical state, if a cathodic protection system has maintained its efficiency and effectiveness

Electrical Scheme (UNI 10265)
Sketch that represents, in an essential and schematic format, the protected structure, the various equipment and fittings relevant to cathodic protection, where the mutual graphical position of the components is maintained

Cathodic Protection System (UNI 10362)
Cathodic protection equipments, test points and of any other accessory, installed in one or more parts of the structure that can be electrically isolated from others

Note 1: The steel components of a gas distribution network shall be electrically divided by means of insulating joints, in sections of network electrically independent, whose totality constitutes the cathodic protection systems

Verification and control of a system of cathodic protection (UNI 10362)
All the actions undertaken to maintain the functionality of a cathodic protection system through periodical verifications and controls

5. CATHODIC PROTECTION OF STEEL PIPELINE GAS DISTRIBUTION NETWORKS

With reference to art. 29 and 31 of the deliberation 236/ 00, each distributor is bound to record the information and the data that will be delivered to the Energy and Gas Authority, according its instructions.

Below, only the data and information concerning cathodic protection and relevant aspects tied to it are given.

The obligation to record and communicate the data and information concerning the cathodic protection of each individual gas distribution network, at a territorial level concerns:

5.1 Number of Cathodic Protection Systems into which the network has been divided

The study of the electric fields existing in the soil and a correct design must allow the division of the steel gas network into parts, by installing insulating joints, that constitute the Cathodic Protection Systems.

Other insulating joints must be installed in particular points along the steel gas distribution network, in correspondence of all the final users (UNI 9783), in order to electrically separate it from any extraneous structure not interested by cathodic protection (for instance insulating joints at final users, insulating joints of separation of aerial parts, etc.).

From a practical point of view, it should be pointed out that the average dimension of each part of the network, belonging to a single cathodic protection system, should be approximately, with particular exceptions, of about twenty kilometres. This division of the gas distribution network into several Cathodic Protection Systems, controlled by one or more cathodic protection stations, assures an effective control on the currents circulating on the pipeline and limits the interference of stray currents on restricted parts of the network, allowing a remarkable benefit in case of possible anomalies that could arise during the operation of it and involving other structures buried in the surroundings.

According to this, the gas distributor must determine, for steel pipeline networks, the Cathodic Protection Systems into which the gas distribution network has been divided.

In case of a steel pipeline protected with galvanic anodes, it is necessary to determine the parts of the network to which this kind of cathodic protection is applied.

5.2 Number of Test Points on the pipeline for cathodic protection potential measurements

In order to verify the electrical protecting state of buried steel pipelines, the Standards UNI and EN prescribe the installation of test points. The same standard points out the criteria for their positioning and spacing and suggests that, in case of long pipelines it is sufficient to install test points at intervals of less than three kilometres while in urban areas, the spacing of test points must be lower than one kilometre.

The standard UNI 10166 prescribes that the test point must be essentially composed of a test box, connecting bolts, one or more cables for the connection to the structure/s and one or more cables for the connection to the reference electrodes, when scheduled.

The distributor will assign to these measuring test stations a univocal code, also taking into account that cathodic protection installations (cathodic protection feeders, unidirectional drainages, electric connections between structures) are considered as test points for measurements.

The test points should have a stable mechanical connection, must be electrically not resistive, should also allow the correct positioning of the portable reference electrode and, wherever necessary, the execution of recorded measurements for periods of more than twenty-four hours.

5.3 Total number of Test Points selected for cathodic protection potential measurements

In observance of Law Dispositions (DM 23.02.1971 n. 2445) and according to the standards UNI and EN, verifications and controls must be performed on the Cathodic Protection Systems in order to assure the correct and constant operation of the pipeline equipments and accessories and to maintain the correct level of cathodic protection during time.
The points selected for the measurement of the potential are the test points where the following operation are performed:

- the controls of the efficiency of Cathodic Protection Stations (cathodic protection feeders, unidirectional drainages, electric connections between structures, etc.);
- potential readings

The periodic potential readings must be performed not only in Cathodic Protection Stations but also in other points of the network cathodically protected by the same CP System, in order to verify if they, because of the change of electrical or environmental conditions, are still fit to allow the evaluation of the electric state of protection of the pipeline.
Therefore, on each Cathodic Protection System, one or more Characteristic Test Point must be chosen where the determination of the potential value is indicative of the effectiveness of the cathodic protection.
For ***not-continuous measurements*** the minimum number of Characteristic Test Points to be checked periodically for each Cathodic Protection System can vary from one to three, according to the level of variability (low, medium and high) of the electric state of the structure as defined in UNI 10950, and the plant situation. Besides, it should be noticed that UNI and EN Standards foresee, in the case of ***not-continuous measurements***, further periodic controls of the potential.

For ***continuous measurements***, the minimum number of Characteristic Test Points to plan in the remote control of the Cathodic Protection Systems, beyond to existing CP stations, can vary from one, for CP systems with low and medium variability of the electric field to two for systems where the variability of the electric field in the characteristic test point is high, provided that they do not coincide with the CP Stations.

Once determined, for each Cathodic Protection System, the total number of selected points for potential measurements, the must be divided between:
- test points where the not-continuous measurements are performed;
- test points where the continuous measurements are performed.

Cathodic Protection Station with impressed current, drainages, galvanic anodes and electrical connections between structures must also be included in the list above.

5.4. Total number of not-continuous potential measurements on steel pipelines

The frequencies prescribed by the standards must be regarded as maximum intervals for verifications and controls, since they refer to buried pipeline not interfered by stray currents. When stray currents are present, the standards establish that the frequency of controls must be increased according to their amplitude and variability.
In this case the distributors have the duty to establish the proper frequencies for the controls during operation, according to the specific factors of the protected network and other factors outside the cathodic protection system.
Each gas distributor must establish procedures for the operation and the maintenance of the Cathodic Protection Systems and verify their correct application.

In observance of Law Dispositions and technical standards, for each selected test point, the number of times in which the measurements have been performed locally during one year must be counted.

5.5. Cathodically protected and unprotected steel

The Ministerial Decree 24th November 1984 "Safety Rules against fire for the transport, the distribution, the accumulation and the use of the natural gas which density is not greater than to 0,8" at art. 2.6.1 prescribes that buried pipelines must be provided with coating and that cathodic protection must be applied.
A following paragraph quotes: cathodic protection doesn't have to be applied to pipes of limited length, provided with an efficient coating and electrically separated from the remaining part of network by means of insulating joints.
The meaning of "limited length" implies a value that reduces its extension within a well-defined position. With regard to this, a length of no more than one spool of pipe is recommended, corresponding to about 12 m.
Nevertheless, not only the length of the spool must be taken into account, but also the meaning of "efficient coating", in the sense that it should be regarded as fully responding to the protective functions, not only at the construction and laying stages, but also as time passes.
The steel parts of a gas distribution network cathodically protected must be divided between:
- pipelines cathodically protected with cathodic protection feeders and drainages;
- pipelines cathodically protected with galvanic anodes.

5.6. Conformity of the electrical measurements

With regard to the conformity of the potential protective values with the technical standards in use, the standard UNI and EN indicate the values that must be reached and maintained in time in order to make negligible or annul corrosion phenomena.
These potential values, called respectively Threshold Protective Potential and Protective Potential, are those existing in the metal-to-environment interface and therefore without the IR drop in the environment.
In the practical experience, since the saturated reference electrode Cu-CuSO4 is placed on the surface of the soil, the potential value includes the IR voltage drop between metal and environment and the reference electrode.
The IR voltage drop in the soil can have very different values, from a few millivolts up to some volts, depending on the current intensity and to the resistivity of the environment.
The IR drop deriving from currents circulating in the soil (protective currents and stray currents) could only be minimised when the reference electrode can be placed very close to the metal which contacts the soil.
The Standards UNI and EN suggest the procedures to measure the potential of steel pipelines and the performing methods in absence and in presence of external variable electric fields.
Each gas distributor, according to the type of measurement performed, will have to analyse the values measured (instant, recorded and remotely controlled) on each test point.
For continuous measurements transmitted by a remote control system, the values can be considered corresponding to the standards in use only if they keep an acceptable value for a duration of at least six months, even if not consecutive, provided that the period of absence of control doesn't overcome six months.
Besides, depending on the electrical status of each Cathodic Protection System, the potential values a single measurement or of more measurements (instant, recorded or remotely controlled) elaborated and correlated between them will allow the evaluation of the efficiency and the effectiveness of the cathodic protection.

5.7. Cartography of the various elements of the cathodic protection plant

Even if the Directive 236/ 00 doesn't make an explicit reference to the cartography of Cathodic Protection Systems, it is necessary to arrange planimetric sketches and possible electrical schemes of the steel gas pipeline distribution network, according to the Standard UNI 10265.

All the elements relevant to cathodic protection (insulating joints, test points, fittings, electrical connections with third party structures, etc.) must be identified with unique codes as required by recording and communication obligations for gas distributors.

The identifying codes assigned to all the elements regarding cathodic protection will allow, in particular, to link the position of the test points to the values of the electric measurements performed and to track down these measuring test points univocally within each Cathodic Protection System.