CEOCOR DRESDEN – SECTOR A

Paper n. 03

TRAINING CENTRE FOR CATHODIC PROTECTION

Osvaldo Fumei, Isproma KSA, Ryhad, Saudi Arabia
Ranieri Cigna, Isproma KSA, Ryhad, Saudi Arabia

Abstract
Within its activities in the Middle East Countries, Isproma has spread out some information and publications from the last Ceocor Congress, held in Giardini Naxos – Sicily in May, 2003. A great interest was manifested by some pipeline operators of these countries particularly on the subject of cathodic protection training. A paper presented by Camuzzi Gazometri dealing with training of cathodic protection specialised personnel and in particular the realisation of Cathodic Protection training and training centres in Italy was of great interest and reference. Isproma was then requested to design and realize a centre for training, examination, and assessment of cathodic protection personnel in Saudi Arabia. Besides the traditional electrical conditions normally found in the reality of cathodic protection of operating pipelines, the training field designed by Isproma also takes into account two peculiar sections, the first concerning the use of the technique of current attenuation measurements and the second the simulation of AC interference and its resolution. According to the willing of the client, training of the personnel is the primary goal and main scope for this realisation.
The paper describes the design of the Training Centre equipped with the most updated equipment, which also includes a teaching classroom, a workshop, and a warehouse for containing the equipment necessary for performing the tests and for the practical training of the personnel.

Foreword
Isproma KSA is a Company, established in Saudi Arabia, which offers professional services for a wide range of engineering applications, providing in particular expertise in all aspects of corrosion prevention and corrosion surveys.
Within its activities in the Middle East Countries, Isproma has spread out some information and publications from the last Ceocor Congress, held in Giardini Naxos – Sicily in May, 2003. A great interest was manifested by some pipeline operators of these countries particularly on the subject of cathodic protection training. A paper presented by Camuzzi Gazometri [1] dealing with training of cathodic protection specialised personnel and in particular the realisation of cathodic protection training and training centres in Italy was of great interest and reference.
This paper deals with the establishment of a Training Centre for training, examination and assessment of cathodic protection personnel. The centre is destined, in the near future, to be devoted also to other very important training activities, as for example the non destructive techniques (NDT), failure analysis, maintenance techniques, corrosion and protection of reinforced concrete structures, etc.

As far as cathodic protection techniques, methods, standards are involved, reference is made at international standards and text books [2-10].
The design of the Training Centre includes the following items:

- a network simulating real pipes (Training Field)
- a teaching classroom including its facilities
- a workshop for storage and calibration of the different kind of various equipment for performing tests and practical training of the personnel
- a warehouse for storing material and equipment.

Design of the Training Centre

Training field

The training field is realised such as to simulate and reproduce the plant and the electrical conditions which are normally found in the reality of cathodic protection of operating pipelines, including dc and ac interference.
The complete field lays on a square surface having approximately 6000 m^2 of extension, where also the building for the teaching classroom, the warehouse and the workshop will be placed.
Suitable paths will allow an easy access of the personnel to the installations during the training and the examination.
The pipeline network, whose layout is shown in Fig. 1 has an extension of approximately 400 m, and is arranged in 4 different sections:

- Section 1 contains a casing and seven simulated coating faults.
- Section 2 concerns a bituminous coated pipe with two large simulated coating faults for current attenuation measurements.
- Section 3 is devoted to AC interference, and incorporates an AC Transformer feeder, three AC Corrosion Coupons and one AC Discharge device.
- Section 4 contains 2 magnesium sacrificial anodes and is also devoted to dc interference tests. The section is fed by a Solar Power CP Station. This section crosses the pipe of Section 1 at 50 cm depth; two simulated coating faults will also be installed in order to produce d.c. interference between Section 4 and 2.

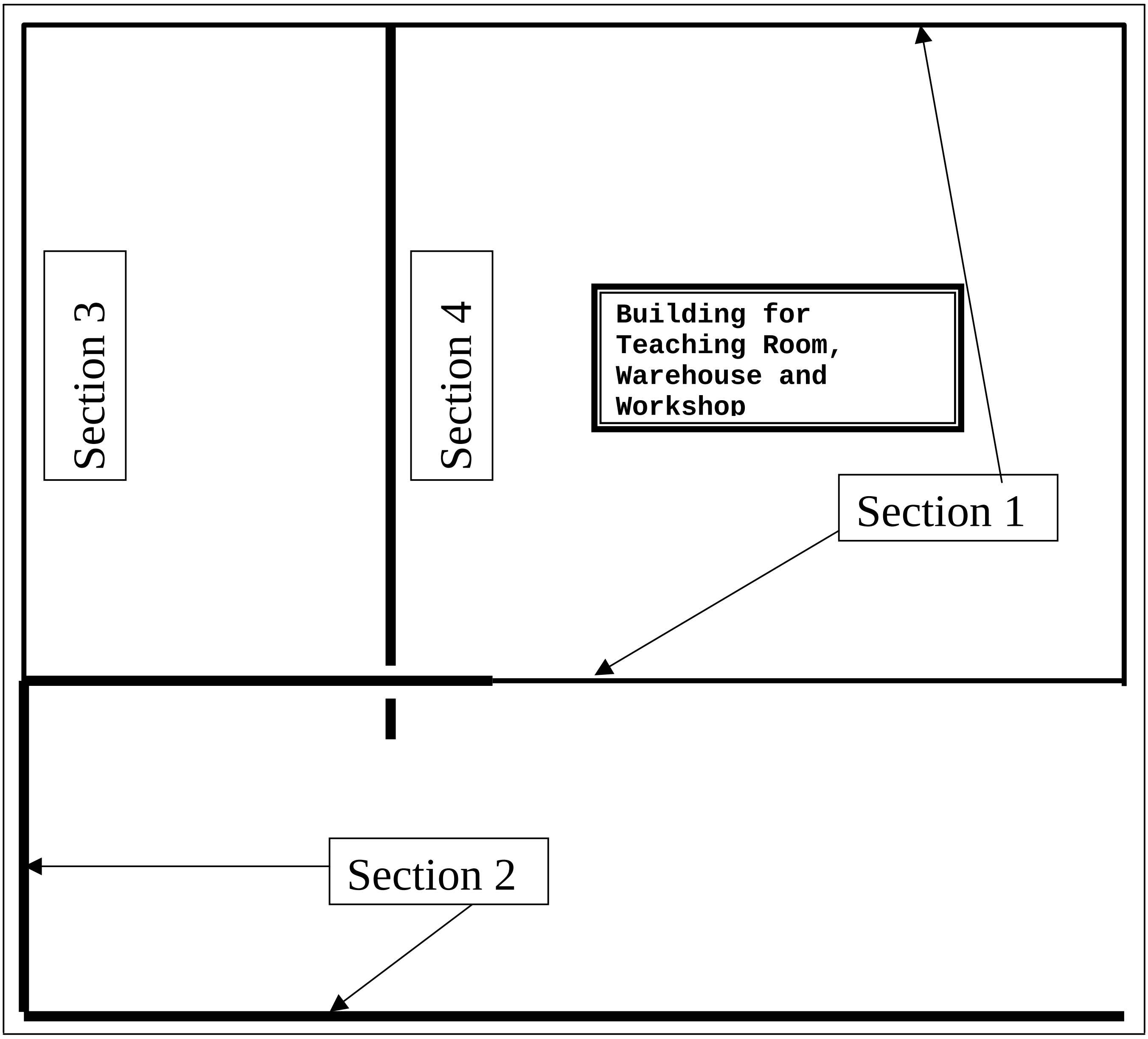

Fig. 1 – Layout of the training Field

Electrically welded pipes, 6” diameter, form a double ring with an off-take for the current attenuation measurements.
From a Configuration Terminal Box, (Fig. 2), which contains the electrical scheme of the pipeline network with the main elements constituting it, it will be possible for the trainers and for the students to arrange in different ways the electrical circuits of the network.

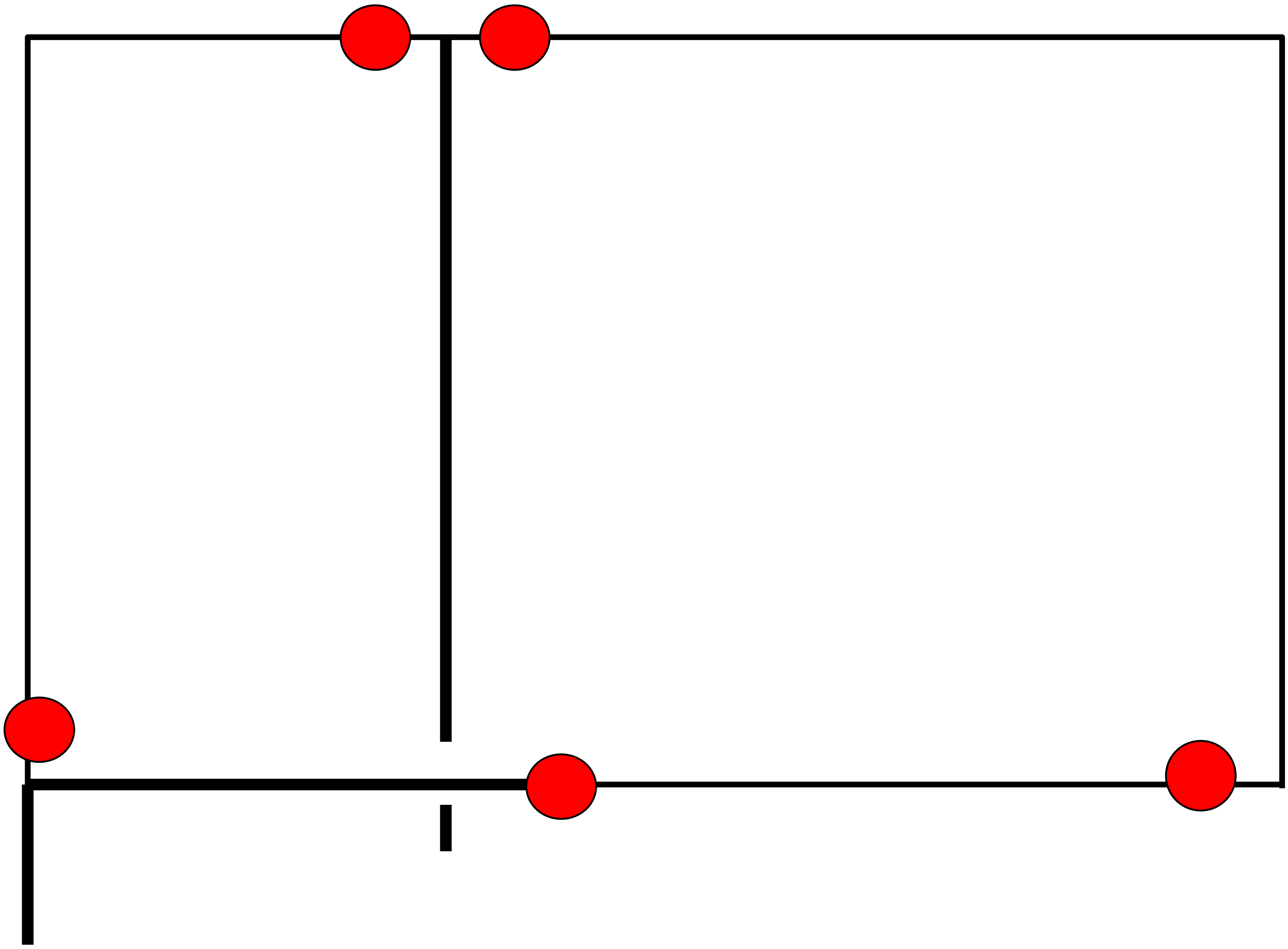

Fig. 2 – Configuration Terminal Box with isolating joints

The pipes are buried in a trench having a depth of about 1,2 m.
A specific section of pipes, in section 1, is devoted to measure different pipe depths.
The Sections 2 and 4 of the pipeline network are realised with pipes coated with bituminous coating (180 m). The remaining Sections 1 and 3 are made by pipes coated with three layers polyethylene (220 m).

The nine simulated coating faults, positioned along the pipeline, have a bare area comprised between 5 and 5000 cm^2
Each coating fault will be carefully calibrated when all of them will be connected to the network.
This calibration will be performed by using different survey techniques: longitudinal gradients, transverse gradients, attenuation.

The parameters to be calibrated will be for example the following:

- current requirement
- IR drop detected at the soil surface
- attenuation decay

A set of different mix of simulated coating faults will also be calibrated.

All these calibrations will be the base of the technical data of the CP Training field, to be used in the successive phases of training.

Each simulated coating fault will be inserted in the circuit by short circuiting the leads connecting the bare metal and the pipe. In Fig. 3 the board contained in the 9 stud terminal block is shown.

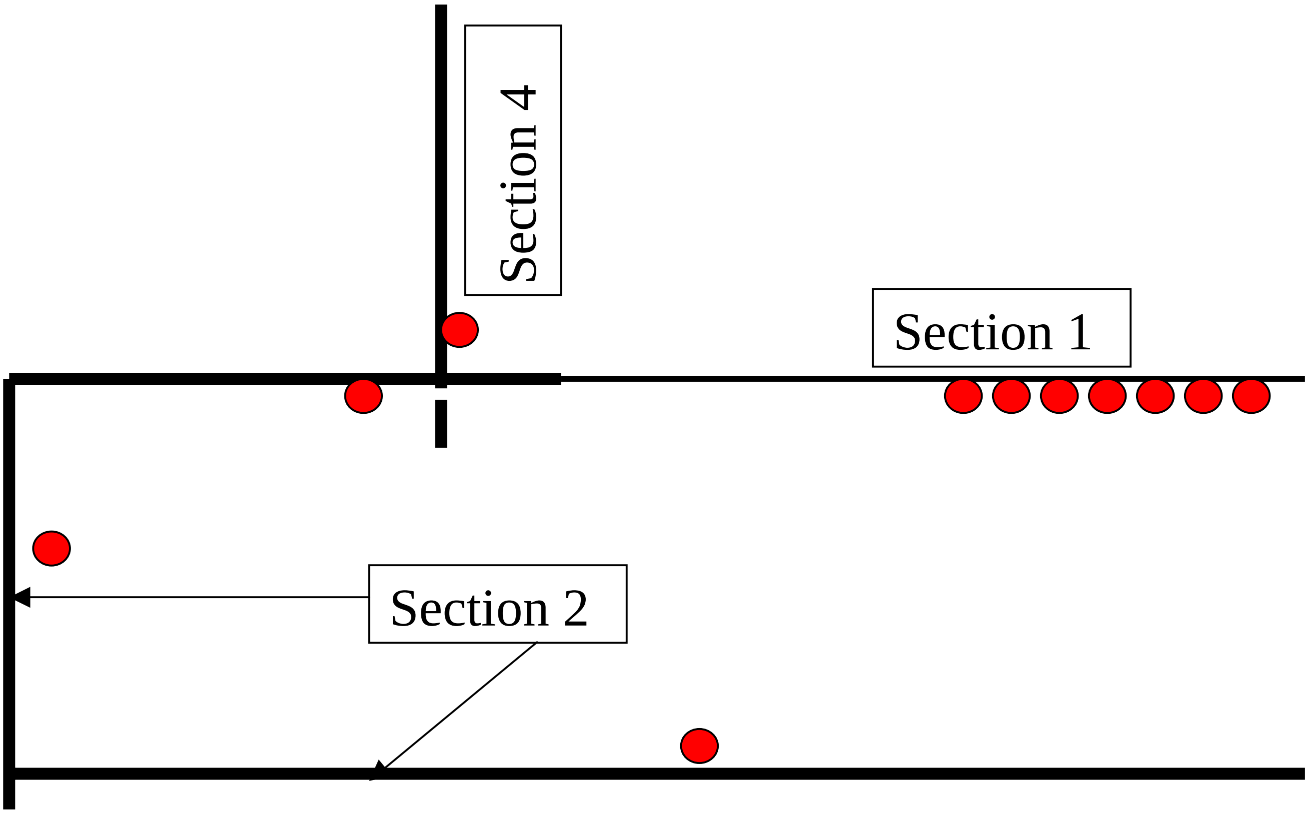

Fig. 3 – Board with the Simulating Coating Faults

Two supplementary coupons, having a bare surface of 80 cm^2 , are placed on each pipe at the crossing between the Section 2 and Section 4. These coupons will be used to simulate and settle the interferences by using an adjustable resistor.

Three corrosion coupons for AC influence are placed on the Section 3 of the circuit network; each coupon is equipped with a permanent reference electrode. This section is fed by a specially built transformer in order to produce an AC interference such as to measure AC Voltage on the pipe and AC Current on the Corrosion Coupons.

These special coupons, having a bare surface of 1 cm^2, are placed at a distance of 3 m from each other, and connected to a relevant branch box.
An AC discharge device will also be installed in this section in order to reduce AC voltage through an earthing plate.
In the Section 1 a casing will be realised by using a pipe 10” diameter coated with three layers polyethylene

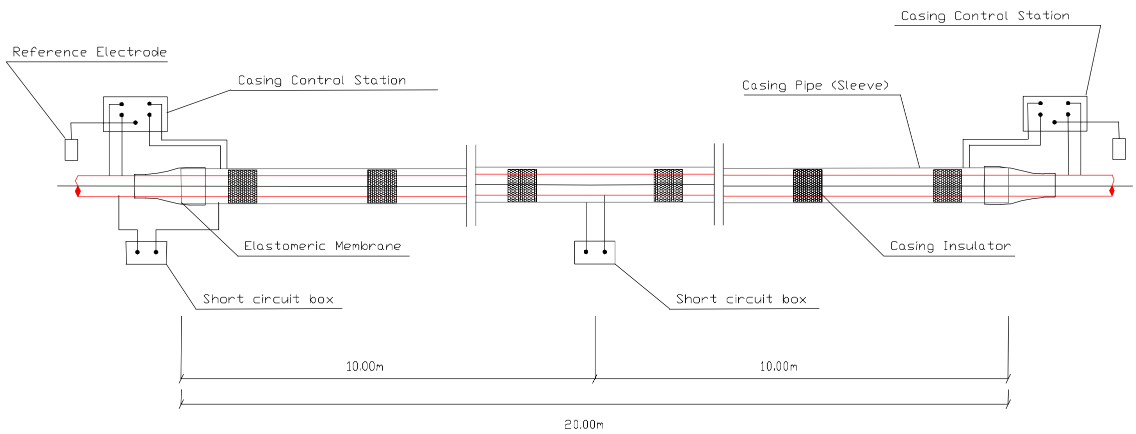

Fig. 4 - Casing

The casing is fixed to the pipe as shown in Fig. 4, where also the spacers/insulators every metre are indicated.
The casing is provided with two artificial contacts with the pipe, one in the middle and the other one at the end of the casing to simulate the pipe/casing short circuit conditions. The relevant two cables are ended at two specific short circuit boxes. The connection to the pipe in the centre is made with a cable out coming the casing through a hole.
These contacts simulate two typical short circuit different possibilities on operating pipelines between casing and carrier pipe.
The insulating joints are realised by a simple PVC insert.
Each insulating joint is provided with its test point with 2 cables welded on each side of the joint. The short circuiting of the insulating joints can also be made through the Configuration Terminal Box, located beside the CP Station.
This will allow the trainers and the students to connect the different sections to the cathodic protection circuit and arrange in different ways the electrical configuration of the network.

Permanent Cu-$CuSO_4$ (sat) reference electrodes are put beside the pipe at a distance of 50 cm from it, at the same depth burial of the pipe.
Two sets of six anodes (standard Si-Fe rod anodes) are fed by the two transformer rectifiers, one traditional oil cooled transformer rectifier connected to the Section 1 and one solar connected to the Section 4.
Two more anodes will be installed in Section 3 where the AC voltage transformer is connected.

Teaching classroom

The Teaching classroom has an extension of approximately 80 m^2, contains 25 armchairs with writing facilities, a teacher's post, and the didactic aids.

Workshop

The Workshop has an extension of approximately 60 m^2, contains the following items:

- Uncoated pipe coupons of different diameters
- Pipe coupons coated with bitumen, polyethylene, and cold taped
- Sandblasting unit
- Thermo shrinking bands and couplings
- Equipment for application of thermo shrinking bands and couplings
- Welding equipment (Cadweld, propane flame)
- Equipment and products for repair of leaks

Warehouse

The Warehouse has an extension of approximately 40 m^2, contains the equipment for performing tests and practical training of the personnel and spare parts.

The equipment for performing tests and practical training of the personnel to be stored in the warehouse includes millimetres, a current interrupter, a pipeline current mapper with fault finder, recorders, a ground resistance tester, an holyday detector, a Pearson-type detector, a Direct Voltage Gradient coating defect survey equipment, portable copper/copper sulphate reference electrodes.

References

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