Committee for Cathodic Protection and Associated Coatings

RECOMMENDATION PCRA 007

October 2010 – Rev.1

Assessment of the effect of mechanical protections of buried pipelines on the cathodic protection (compensatory measures according to the order of August 4th, 2006)

1 INTRODUCTION

The ministerial order of August 4th 2006, published in the « Journal Officiel » of September 15th 2006, regulates the safety of pipelines for the transportation of natural gas, liquid or liquefied hydrocarbons and chemical products.

Among others, it defines the new rules for the class location of pipeline sections depending on the environment that is being crossed (category A, B or C) and the new requirements to comply with for each of the three defined categories.

The articles 14 and 19 of the order of August 4th 2006 introduce the concept of « compensatory provisions which enable rendering the pipelines compliant with the new regulation, without the need for replacing them.

Reinforced concrete slabs, PE sheets, high tensile nettings, etc… are typical « constructive » protection measures which are presently approved by the authorities in the frame of the Professional Guidelines referred to in the order of August 4th 2006 (particularly the Guidelines GESIP *2008/01 « Performance of a safety study related to a transmission pipeline »* and *2008/02 «Transmission pipelines – Compensatory measures »*). The implementation of these constructive provisions may concern important lengths of the networks (several hundreds of kilometers).

It is therefore important to have knowledge of the effect of these "constructive protections" on the operation of the cathodic protection in order to adapt, if necessary, the specifications of these protections as well as the operating conditions of the new composite structure (pipeline with constructive protections).

The purpose of the present Recommendation is to synthesize the experience feedback shared by the members of the committee PCRA on this subject and limited to only concrete slabs and PE or PVC sheets. The present document does not address the issue of mechanical strength of these compensatory measures.

This Recommendation may be periodically revised according to newly acquired experience feedback.

The content of the present Recommendation may apply to any buried metallic pipeline under cathodic protection, whether it is for distribution or transportation of any fluids (natural gas, liquid or liquefied hydrocarbons, chemical products, water,…).

2 INITIATION OF THE PROCESS OF SHARING EXPERIENCE FEEDBACK

The compensatory provisions which ensure a mechanical protection may have an effect on the operation of the cathodic protection; possible effect which must be assessed in order to adapt, if necessary, the adjustment of the equipment and measuring devices as well as the interpretation of the newly obtained measurements.

In order to analyze the effect of these compensatory provisions on the effectiveness and the verification of the cathodic protection of a structure, the following have to be considered:

- The detection and localization of the pipeline,
- The coating fault detection,
- The cathodic protection measurements in order to assess its effectiveness.

The members of the PCRA committee, who have participated in preparing this Recommendation, have consensually implemented a process for the analysis of the effects of these compensatory provisions, in the respect of the specific good practices of each network operator. Based on this tool, two types of provisions (see § 3) have been the object of exchanges of results which have been synthesized in the following chapter.

It must be noted that tests are still being carried out by certain operators in order to progressively improve the common experience feedback.

3 RESULTS ACQUIRED AT MID 2010

Two types of compensatory provisions have been or are still being tested by certain network operators, members of the Committee:

- Concrete slabs with metallic or other reinforcements,
- Plastic sheets (of PE or PVC).
    - Jointed plain sheets
    - PE sheets with holes of 1 to several centimeters. These holes are uniformly distributed over the surface of the sheet and represent less than 1% of the total surface.

Conditions of the tests carried out

All the tests performed until now have been carried out with a minimum distance of 30 cm between the insulating sheets (PE or PVC type) or concrete slabs and the upper generatrix of the pipeline. The width of the employed PE sheets was between 1 and 1.5 m and that of the concrete slabs 1.4 m maximum.

Effect on the effectiveness of the cathodic protection

- The presence of concrete slabs or insulating sheets (PE or PVC type) may sometimes reduce the amount of current received by the pipe located beneath the shield that they compose. This impact is reduced for insulating sheets with holes compared to plain insulating sheets. Moreover, a test revealed that concrete slabs have an impact to a lesser extent compared to insulating sheets, these devices being placed at 40 cm above the pipeline.
- The insulating sheets do not impede from reaching the cathodic protection criteria.
- The presence of concrete slabs or insulating sheets (PE or PVC type)) increases the ohmic voltage drop during the E_{ON} potential measurement, especially just over the centerline of the pipeline.
- It is recommended to verify by means of suitable devices that the level of protection under the concrete slabs or insulating sheets (PE or PVC type) is in compliance with the applicable standards; eventually an adjustment of the cathodic protection installations may be required.

Effect on the detection of the pipeline and on the depth measurement

- The presence of concrete slabs or insulating sheets (PE or PVC type), with or without holes, has no or very little influence on the detection of a buried metallic pipeline, when implementing the electromagnetic detection method. The same is true for the measurement of the depth.

Effect on coating fault detection

- The presence of concrete slabs or insulating sheets (PE or PVC type) may cause localization errors in the range from several centimeters to several tens of centimeters.
- The presence of concrete slabs or insulating sheets (PE or PVC type) decreases the intensity of the potential gradients at grade during the search for insulation defects, especially right over the PE sheets. This effect has a lesser extent for insulating sheets with holes compared to plain insulating sheets. Coating fault detection shall therefore be carried out with the highest care.

General conclusion

Concrete slabs or insulating sheets laid above a buried pipeline have an effect on the cathodic protection. However this appears to be limited and not unacceptable impact on the operation of the cathodic protection of the structure and its verifications. As a result, the presence of these compensatory measures does neither impede achieving the protection criterion, nor the localization of the pipeline, nor the detection of coating faults,

In regions where constructive provisions such as mechanical protections are implemented, it is recommended to verify afterwards the effectiveness of the cathodic protection of the pipeline and to carry out coating fault detection with the highest care (e. g. low advance velocity during coating fault detection, enhancement of the strength of the emitted signal).