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Casing measurements by coupons

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Tittle : Casing measurements by coupons

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ABSTRACT

Terega, which operates a 5000 km long gas network in southwest of France, uses permanents coupons on each test point (4000 TP) to asses the CP efficiency, by disconnecting pipe/coupons measurements.
On the old Terega network, the preferred corrosion control method was isolating and sealing the casing so there is no electrolyte in the space between the casing and the carrier pipe. However, since 2005, Terega fills that area with an improved bentonite. Casings are normally bare, while carrier pipelines are normally very well coated. Normally, on each system pipe/casing, a test point must be installed to check the insulation of the two structures This test station usually has wires, one or two to the casing and one or two to the carrier pipeline.

To control the insulation system, you have to take a potential measurement of the carrier pipeline and the casing by changing only the structure connection without moving the copper/copper sulfate reference electrode.

- If the two potential measurements are significantly different, the casing is not shorted to the pipeline. Under normal conditions, the carrier pipeline should be at a potential more negative than -0.85 volts DC, and the casing should be between approximately -0.35 and -0.65 volts DC (a difference of between 200 to 500 mV).
- If the two potential measurements are not significantly different (under 10 mV), the casing may be shorted to the pipeline and additional testing is required
- If the two potential measurements are different (under 100 mV), the casing may be shorted to the pipeline at the other end of the casing and additional testing is required

A very simple method can be applied with coupons to test the insulation system with a very good accuracy, by coupons…

François Castillon

PAPER

Generalities :

To control the insulation system, you have to take a potential measurement of the carrier pipeline and the casing by changing only the structure connection without moving the copper/copper sulfate reference electrode.

- If the two potential measurements are significantly different, the casing is not shortened to the pipeline. Under normal conditions, the carrier pipeline should be at a potential more negative than -0.85 volts DC, and the casing should be between approximately -0.35 and -0.65 volts DC (a difference of 200 to 500 mV or more between the two structures).
- If the two potential measurements are not significantly different (under 10 mV), the casing may be shortened to the pipeline and additional testing is required
- If the two potential measurements are different (under 100 mV), the casing may be shortened to the pipeline at the other end of the casing and additional testing is required.

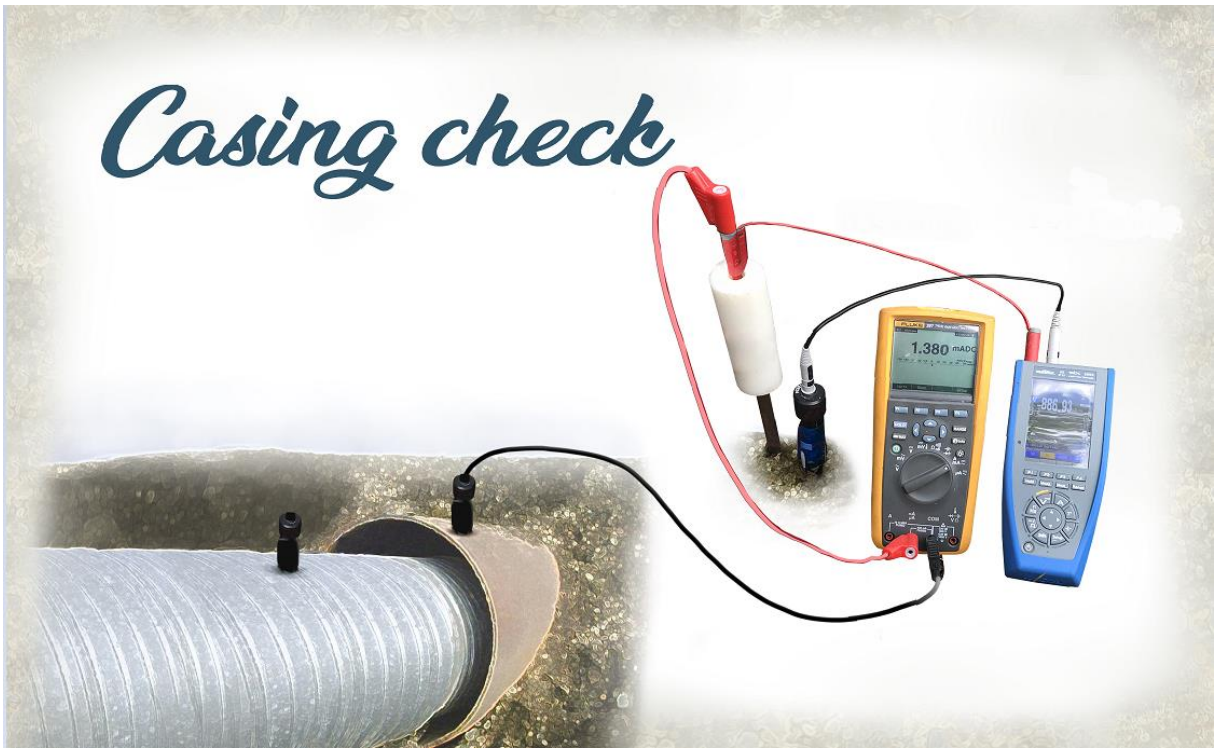
How to do additional testing :

Other measurements can be tried, but to verify if the link exists, the “battery test” is generally required, and clearly this test is not very secure and some problems can occur.

Nevertheless, It’s possible to analyse the two lasts cases, with a easy method of measurement, by coupons.

Accuracy measurements :

To do it, you must have a mobile coupon (annular, stake… whatever the shape), CSE electrode, wires, and measurement interface “Off on coupons” like Minilog, CPC, Correal, CouCou…. However, It’s possible to do it with 2 multimeters, but with less precision.



First, it's important to choose a placement for the coupon and electrode, and it's recommended to put the electrode against the coupon, near the steel in contact with the soil. These two elements must remain in the same place throughout the measurement.

Second, on the measurement interface "Off on coupons", it's time to connect the electrode and the coupon, in the designated entries. You can read the corrosion potential of the coupon.

For the third step, you must begin with the the less polarized structure, obviously the casing. Therefore, you plug the casing on the "pipe entry" on the measurement interface, and you watch the progression of polarization, until the Eoff potential has almost stabilized (after 5-10 minutes).

Obviously, it's required to write down the 3 stabilization values Eoff, Eon and Ic (current on the coupon) or to record the graphic polarization on a computer or tablet.

Fourthly, after disconnecting the casing by the measurement interface, it's better to connect the coupon with a grounding (big stake or other metallic structure independent with the CP system), to depolarize it quickly in order to try to get closer to the initial corrosion potential.

For the fifth step, all you have to do is repeat step 3, but now obviously with the pipe.

The last step, consist in comparing the measurements between the two structures, and understand the differences:

1. Eoff, Eon, Ic casing are equal, clearly the short circuit is demonstrated. This case is the easiest to conclude
2. Eoff pipe < Eoff casing and Ic pipe < Ic casing but these casing values are CP values. In this case an electrolytic contact is demonstrated.
3. Eoff pipe << Eoff casing and Ic pipe << Ic casing (Ic casing can be positive).
   In this last case, no contact exists.

Result analyses:

Results 1 and 3 are undoubtedly accepted and understood, we have to focus on the second…

I call this case an electrolytic contact, and in my opinion is not very worrisome. That is to say, this state notifies that the pipe has some coating defects in the casing annular space, and naturally, annular space contains electrolyte. This electrical phenomenon is caused by the CP currents entry on the casing to protect the pipe. This entry is near the casing measuring cable connection. These

currents, polarize the metallic structure on this part before going out, in other casing parts in the annular space, to go to the pipe. In this other casing location, clearly the potential is anodic.

(Explain Draw)

In spite of cathodic casing potentials, this case is not worrissome for the pipe, that is to say only the casing loses material, whereas the pipe contains coating defects which are protected by CP.

Nevertheless, we can't conclude on the pipe integrity, because if the pipe contains other coating defects, but located in the unfilled annular space (if it exists), the CP doesn't work…

However, this statement signifies an electrical insulation between the casing and the pipe.

Conclusion

This easy measurement method allows to analyze quickly the casing/pipe statement, doubtlessly.

This method can also be used, to determine the insulation of "insulation joint", aerial or buried, with the same accuracy.

Have a goods CP measurements.