

Technical Seminar for Cathodic Protection to GOGC Design Unit Specialists

*Dr. Nick Kioupis, Cathodic & Lightning Protection
Section Head, DESFA*



WITHIN THE JURISDICTION OF THE MINISTRY OF ENVIRONMENT, ENERGY & CLIMATE CHANGE



Source of Development, Supplier of Energy



CP Commissioning

- **Preliminary test (precommissioning)** to verify that the cathodic protection system is installed in accordance with the design requirements.
- **Start-up** of the cathodic protection system.
- **Verification of the cathodic protection effectiveness** in accordance with the CP criteria and to adjust it, if necessary.



CP Commissioning – Preliminary tests before energising the CP system

All temporary cathodic protection systems shall be disabled and the structure depolarized before commencement of preliminary testing.

- a) electrical integrity of the **cathodic protection circuit** (e.g. anode and cathode junction boxes, foreign structures);
- b) **transformer-rectifier stations:**
 - tightness of screws and nuts,
 - accessories are securely mounted,
 - correct denomination of pipeline and groundbed cables,
 - correct output polarity of the transformer rectifier;
- c) **oil-cooled transformer-rectifiers:**
 - required oil level;
- d) **electrical drainage stations:**
 - tightness of screws and nuts,
 - accessories are securely mounted,
 - correct polarity of pipeline and rail cables,
 - on pipeline potential for at least 24 h for later comparison;



CP Commissioning – Preliminary tests before energising the CP system

- e) functioning of **isolating joints**,
- f) electrical isolation of **earthing devices** and metallic **casings**;
- g) resistance measurements:
 - resistance against remote earth of the groundbed or the galvanic anode,
 - resistance between the structure to be protected and the groundbed;
- h) **test stations**:
 - correct marking of cables and terminals,
 - tightness of cable terminations;
- i) correct installation of **coupons** and working **electrodes**;
- j) **potential measurements at measuring points**:
 - corrosion potential, Ecor, of the structure on all test stations,
 - influence on the structure from a.c. or d.c. sources,
 - anode to electrolyte potential of galvanic anodes,
 - structure to electrolyte potential of neighbouring foreign structures.



CP Commissioning – Start-up

Impressed current stations

- a) Switch on the impressed current station and confirm that it is functioning correctly.
- b) Adjust station settings to conform to the potential requirements of the design. The causes of major deviations should be ascertained by measurements.

Typical measurements

- rectifier output voltage on impressed current station;
- protection current output;
- ON-potential at drain points



CP Commissioning – Start-up

Galvanic Anodes

- a) Check that they are functioning correctly. If major deviations occur, the causes should be ascertained by measurements and corrected.
- b) When necessary, connection of galvanic anodes may be carried out via variable resistors for current limitation.

Typical measurements

- protective current output of each galvanic anode;
- ON-potential of the pipeline at galvanic anodes locations.



CP Commissioning – Start-up

Drainage stations

- drainage current for at least 24 h;
- correct functioning of the unidirectional device (diode);
- ON-potential of the pipeline and potential of other foreign structures, such as railway, at the drainage station sites with the drainage connected and not connected for at least 24 h;
- direction and magnitude of currents on coupons, if any, for at least 24 h.



CP Commissioning – Start-up

Test stations

- ON-potential at the extremities of the protected structure;
- ON-potential at critical locations;
- ON-potential and current on coupons, if any;
- structure of electrolyte potentials of neighbouring foreign structures to verify any possible influence on them;
- ON-potential and current through the bond at bonded structures;
- ON-potentials to verify the electrical isolation of the structure at isolating joints, metal casings, reinforced concrete, earthing systems.



CP Commissioning – Verification of cathodic protection effectiveness

The pipeline to electrolyte potentials shall be measured once the pipeline to protect has sufficient contact with the electrolytic medium consecutive to trench backfill consolidation, is operating at its design condition (temperature, pressure) and after a suitable polarisation period (principally depending on the nature of the electrolyte and the protection current density through the coating defects).

The pipeline to electrolyte potentials shall meet the CP criteria.



CP Commissioning – Verification of cathodic protection effectiveness

Measurements of d.c. potential and a.c. voltage

d.c. ON-potentials and a.c. voltages at each test station: In areas where the potentials or voltage drops measured fluctuate (e.g. as a result of interference from a d.c. traction system), measurements should be made using a data logger, preferably during 24 h and simultaneously with adjacent test stations controlled;

OFF-potentials without d.c. stray currents at all selected test stations;

NOTE It is preferable to carry out these measurements at all test stations.

with d.c. stray currents, OFF-potential measurements, on external potential test probes or coupons at all equipped test stations, and preferably recorded over 24 h.



CP Commissioning – Verification of cathodic protection effectiveness

Current measurements

- d.c. protective current at each **impressed current station**, including the measurement of current in each negative cable;
- d.c. protective current at each **galvanic anode**;
- d.c. and a.c. currents flowing through **bonds** with the direction of d.c. currents, particularly in the presence of d.c. railways stray currents;
- d.c. current at d.c. **drainage** station, preferably recorded over 24 h;
- d.c. and a.c. currents through **d.c. decoupling devices**;
- d.c. and/or a.c. currents through external test **probe or coupon**, preferably recorded over 24 h in case of d.c. stray currents and/or a.c. interferences.



CP Commissioning – Verification of cathodic protection effectiveness

Adjustments

- adjustment of the protection current (increase or decrease);
- installation of new drainage station if necessary;
- adjustment of the circuit resistance of the drainage device (increase or decrease), if any;
- installation of d.c. decoupling devices;
- installation or disconnection of bonds



CP Commissioning – Verification of cathodic protection effectiveness

Adjustments

- adjustment of the protection current (increase or decrease);
- installation of new drainage station if necessary;
- adjustment of the circuit resistance of the drainage device (increase or decrease), if any;
- installation of d.c. decoupling devices;
- installation or disconnection of bonds