RECOMMENDATION PCRA 006
November 2006 – Rev. 0

CEFRACOR
CENTRE FRANÇAIS DE L'ANTICORROSION

Committee for Cathodic Protection and Associated Coatings

Recommendations for the symbolism of cathodic protection equipment

Summary

1 SCOPE

The objective of this document is the recommendation of a list of symbols to be mentioned on the maps of the different operators of networks with regard to the elements comprising the cathodic protection system.

2 DEFINITIONS

A graphic symbol is defined as a visually noticeable figure used to transmit information independent of any language. It may be obtained by drawing, printing or any other means. The ISO 7000 standard defines the great majority of symbols in compliance with standards CEI 80416-1 and 80416-2.

The meaning of each graphic symbol may depend on its orientation in a given reference system. Therefore any ambiguity shall be avoided.

The symbolism shall be tailored to the scale of the maps.

According to the scale used, it is not necessary, neither technically possible to dispose of the same level of information indicated on the maps for all scales commonly used. It is therefore necessary to define a symbolism according to the scales of the maps used. Two levels of signalization are proposed:

- a definition of symbols for small and medium scales ($\leq$ 1 : 5000),
- a definition of symbols for large scales (> 1 : 5000).

Beyond the scale of 1 : 50 000, it is not necessary to portray the cathodic protection elements on the map.

The symbolized elements must be necessary and sufficient. They must be concise and relevant with regard to the information they provide. A text zone is associated with each symbol in which the operator may freely detail any information he deems useful.

When using a Geographic Information System (GIS) it is possible to localize the elements of the CP system by their GPS coordinates. In this case it is necessary to define the devices to be localized precisely (cabinet, test lead connection on the pipe…).

3 BASIC CATHODIC PROTECTION ELEMENTS TO BE SYMBOLIZED

For the symbolization of cathodic protection elements on maps the list of equipment below is to be considered:

- potential test point,
- anodic mass or impressed current ground bed,
- impressed current station,
- electric cell,
- galvanic anode,
- current drainage station,
- interconnection (direct, resistive, polarized, capacitive, inductive),
- insulating joint,
- casing,
- reference electrode,
- test coupon,
- grounding,
- spark-gap,
- nearby foreign structure,
- main characteristics of the pipeline,
- soil resistivity measurements.

4 CORROSION PROTECTION ELEMENTS TO BE SYMBOLIZED FOR SMALL AND MEDIUM SCALE MAPS (≤ 1 : 5000)

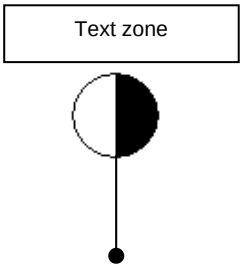
The principle for this type of equipment is the following:

- definition of a basic graphical symbol for each type of equipment,
- indication of data in a dedicated rectangular text zone of adaptable size. The indicated data are specific for each operator. The position of the text zone with regard to the symbol is free but shall remain at the periphery of the related symbol,
- the position of the connecting lines is free.

The defined symbols are given here below.

4.1 POTENTIAL TEST POINT

4.1.1 General principle



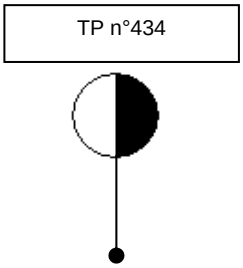
This element is recommended for the following equipment

- simple potential test point,
- potential test point associated with a test coupon and/or a measurement electrode,
- potential test point on several structures of the same or different operators,
- crossing of two structures of the same or different operators with possible interconnection.

4.1.2 Examples of application

4.1.2.1 Case n°1 : a single test point on the operated structure:

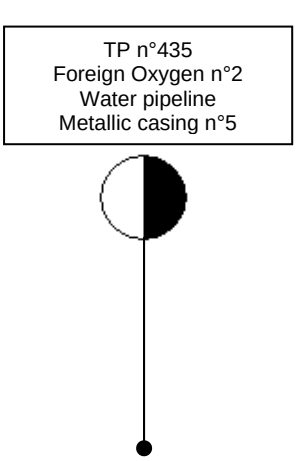
This involves a test lead connected to the operated pipeline.



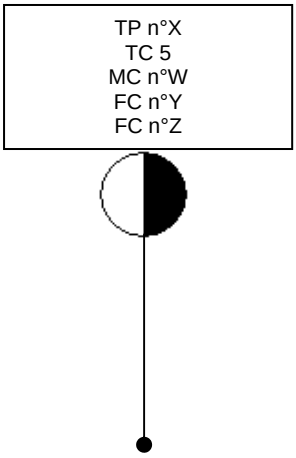
4.1.2.2 Case n°2 : a single test point on the operated structure associated with a metallic casing and two test points on nearby foreign structures:

This involves a test lead connected to the operated pipeline and one or several other test leads connected to the other nearby foreign structures.

→ a test point on the operated structure associated with a test point on the nearby foreign structure :



Example n°1



Example n°2
with an operator's specific codification:
- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm²,
- FC : foreign structure crossing,
- MC: metallic casing.

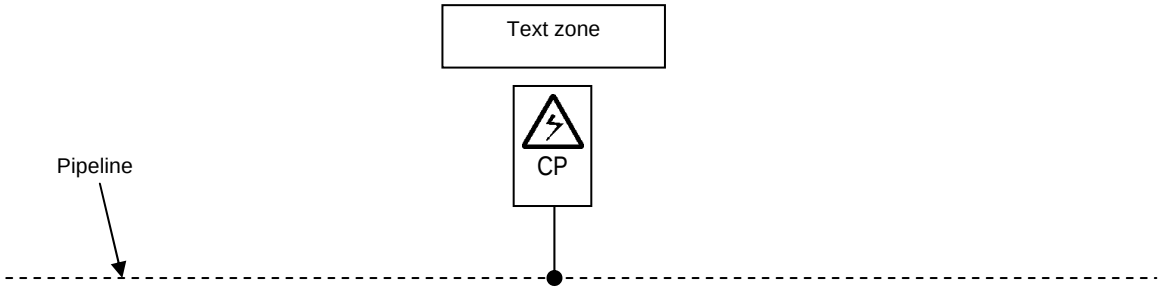
(no connection between the structures)

4.2 IMPRESSED CURRENT STATION

4.2.1 General principle:

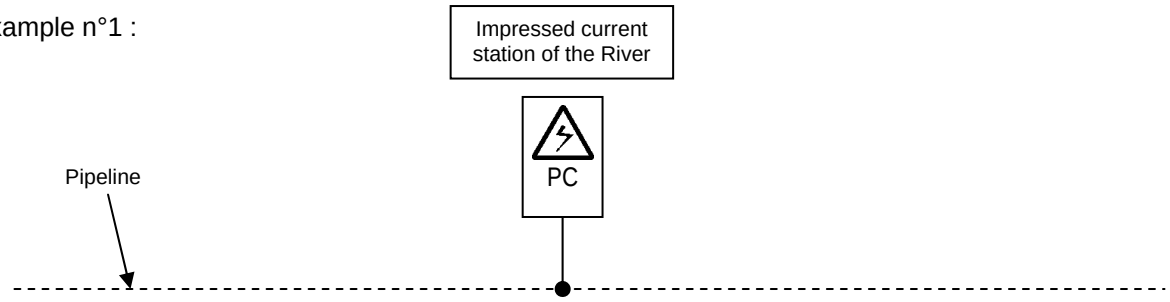
The electrical hazard symbol draws the attention on the presence of a low voltage power supply. The shape portrays an electrical cabinet capable of containing a current rectifier. The letters « CP », part of the symbol, signify: « cathodic protection ».

The electrical cell is part of this symbol. The text zone informs about its presence

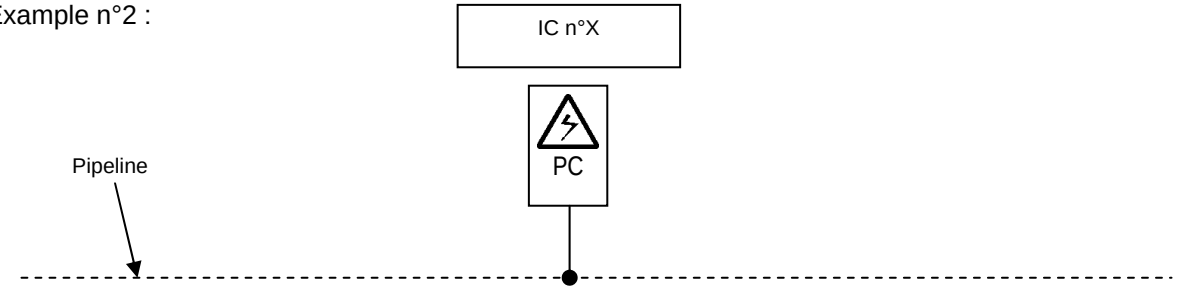


4.2.2 Examples of application:

Example n°1 :



Example n°2 :

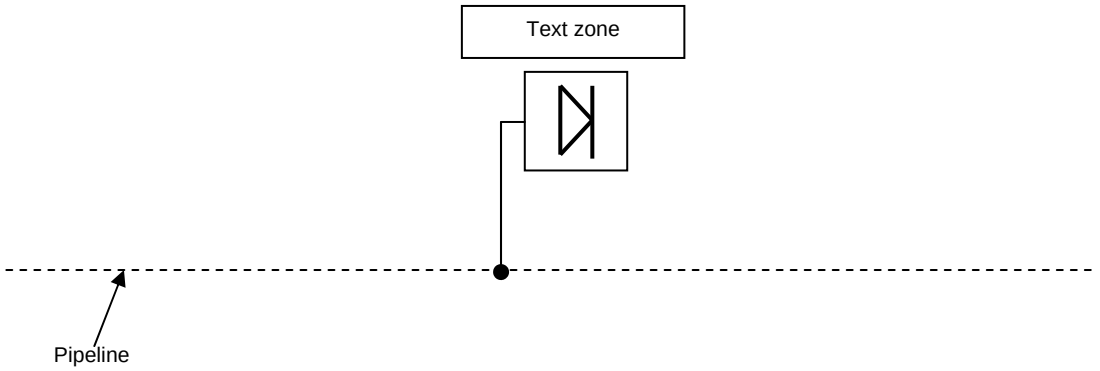


→ with an operator's specific codification::
- IC : impressed current station.

4.3 CURRENT DRAINAGE STATION

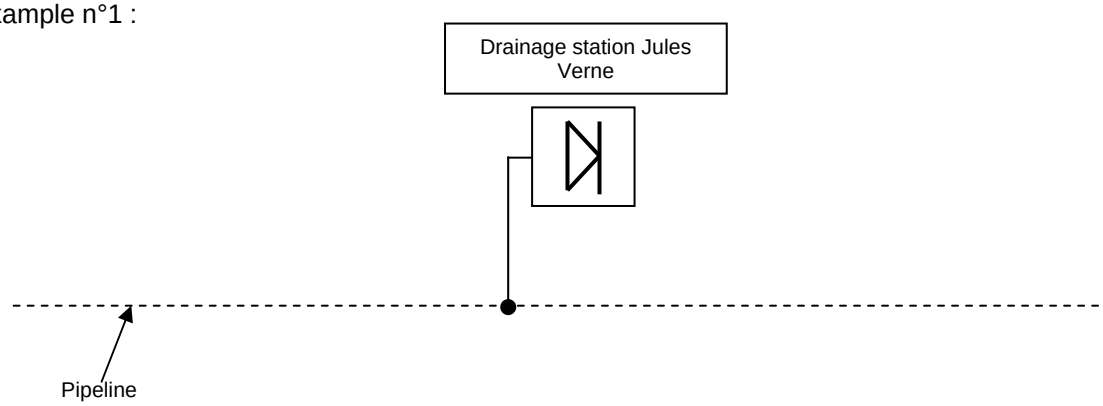
4.3.1 General principle

The symbol reminds that of a diode, without actually being one, and indicates the direction of the current. The square indicates the presence of a cabinet. The line coming from the left corresponds to the connection cable of the drainage station to the operated pipeline and reminds also of the flow direction of the current.

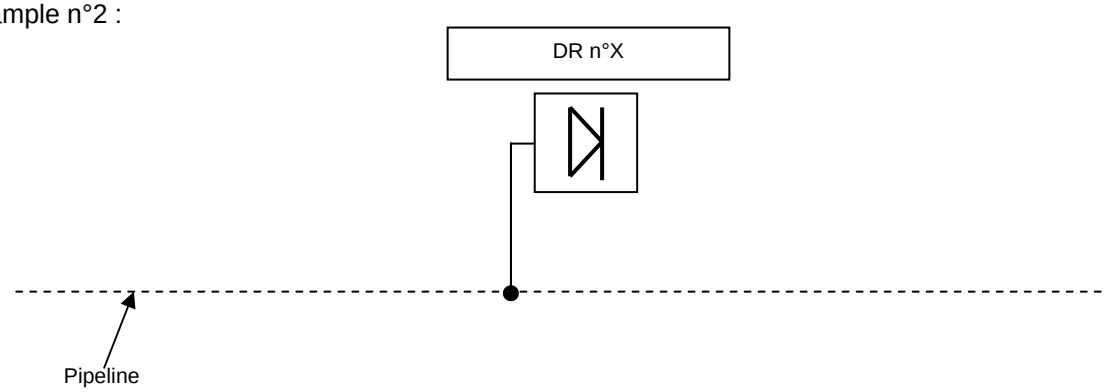


4.3.2 Examples of application:

Example n°1 :



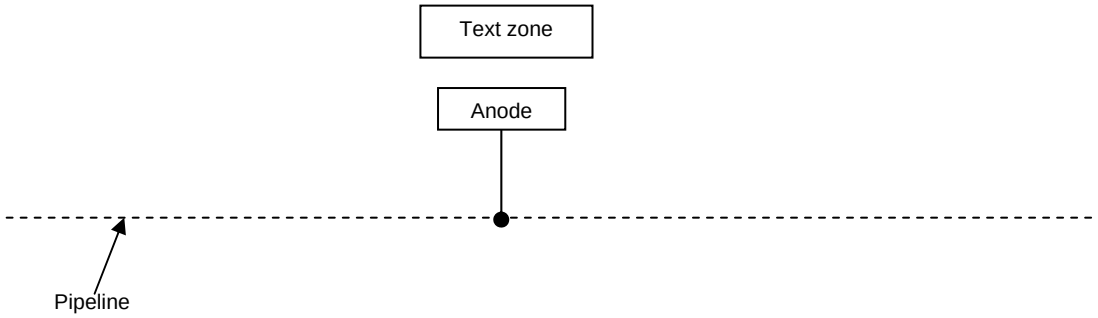
Example n°2 :



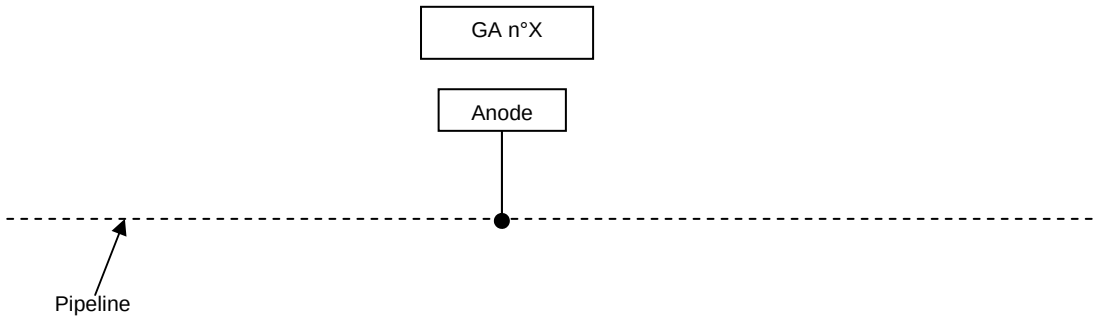
→ with an operator's specific codification:
- DR : drainage station.

4.4 GALVANIC ANODE

4.4.1 General principle



4.4.2 Example:

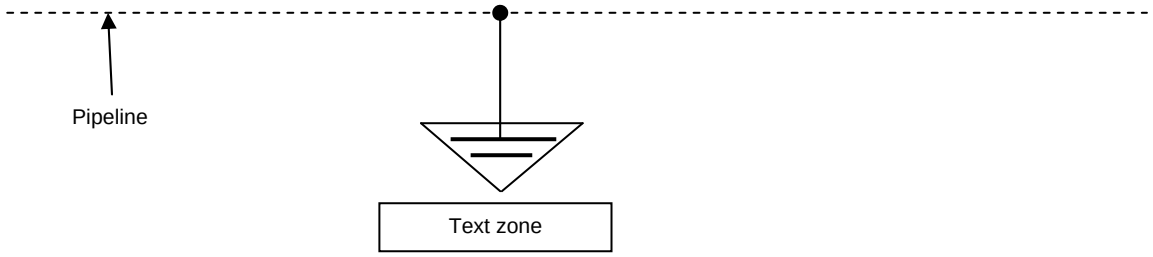


→ with an operator's specific codification:
- GA : galvanic anode.

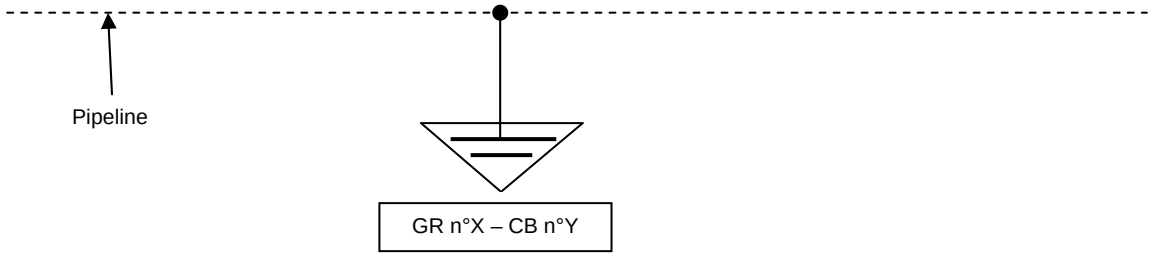
4.5 GROUNDING

4.5.1 General principle

This equipment allows grounding of currents (alternative or direct according to the needs) which affect the effectiveness of the cathodic protection. It includes all types of materials which may be utilized for such groundings (anode, grounding cable, galvanic mass, …). It also includes all types of equipment necessary (passive or active elements). It shall be distinguished from grounding systems used in the frame of electrical safety for the operators: with this goal, the triangular shape draws the attention on the hazard whilst making this difference. The nature of the material of the grounding system may be indicated in the text zone.



4.5.2 ***Example:***

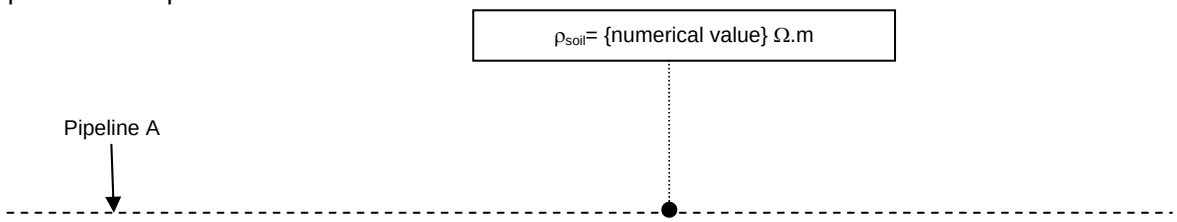


→ with an operator's specific codification:

- GR : grounding,
- CB : decoupling device

4.6 *SOIL RESISTIVITY MEASUREMENT*

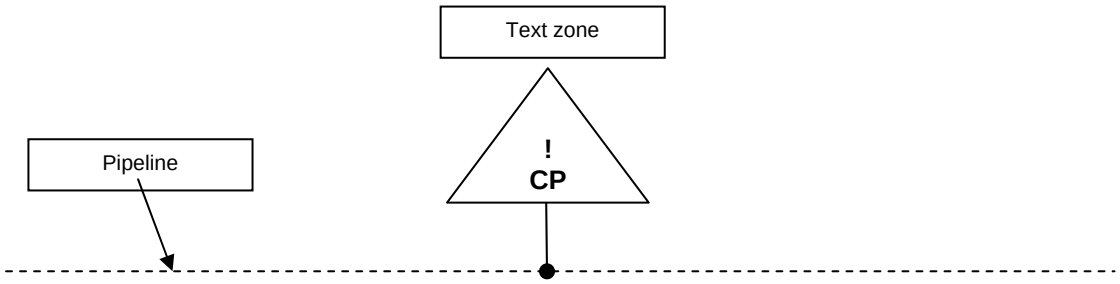
This measurement is generally carried out along the route of the pipeline. It is not necessarily performed at the level of the latter. The link between the measurement point and the rectangular box containing the measured value is a broken line in order to distinguish it from the measurement cables of a potential test point for instance.



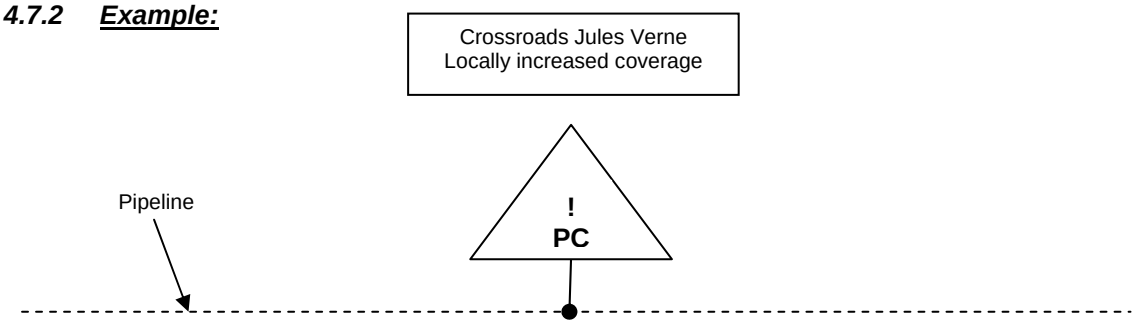
4.7 *SPECIAL POINTS*

4.7.1 ***General principle***

This symbol allows comprising all particular and rare cases, which do not justify a specific symbol for each case. It allows the operator drawing its attention on a particular point.



*4.7.2 **Example:***



4.8 PRINCIPLE CHARACTERISTICS OF THE PIPELINE

The following shall be mentioned: the nominal pipe size, the material of the line pipe, and the year of construction (with four digits). For steel pipelines, in addition, the type of coating and even the type of rock-shield could be indicated.

Example: NPS 150 PE 1988
NPS 300 CS 2001 PE3L
NPS 500 CS1998 PPRO CEM

Line pipe materials may include:

- steel	:	CS
- copper	:	Cu
- ductile cast iron	:	DUC CAST
- grey cast iron	:	GREY CAST
- polyethylene	:	PE
- PVC	:	PVC
- aluminum	:	Al
- lead	:	Pb

Types of coating for steel may include:

- coal tar enamels	:	C
- two layer polyethylene	:	PE2L
- three layer polyethylene	:	PE3L
- polypropylene	:	PPRO
- tapes	:	TAPE
- heat-shrink sleeves	:	THERM

Types of rock-shield may include:

- mortars	:	CEM
- baculas	:	BAC
- filts	:	FILT
- double coatings	:	2 x {coating type}

5 CORROSION PROTECTION ELEMENTS TO BE SYMBOLIZED FOR LARGE SCALE MAPS (> 1 : 5000)

The principle for this type of equipment is the following:

- definition of a basic graphical symbol for each type of equipment,
- indication of data in a dedicated rectangular text zone. The indicated data are specific for each operator.

The defined symbols are given here below.

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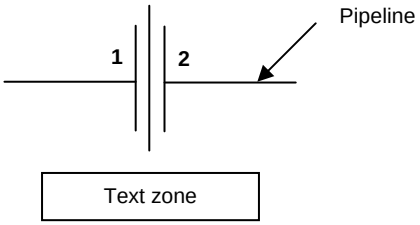
5.1 INSULATING JOINT

5.1.1 General principle

The basic symbol of an electrically open insulating joint is the following:

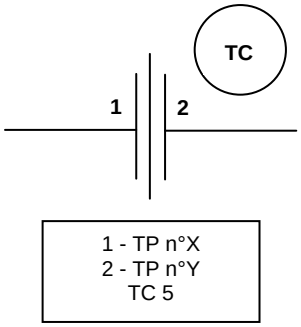


For more details, it may sometimes be necessary to add an arrow to clarify the link between the text zone and the related insulating joint. The digits “1” and “2” allow distinguishing the cables of the potential test points located at both sides. They may be used in order to distinguish them in the text zone.

5.1.2 Examples:

Example n°1:

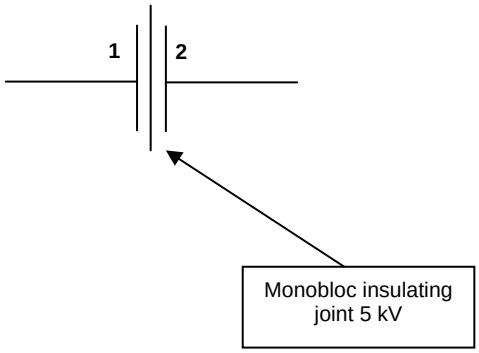
There is a potential test point at both sides of the insulating joint. A metallic test coupon is installed at one side.



→ with an operator’s specific codification:

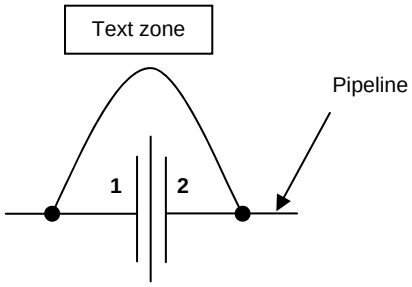
- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm²,

Example n°2:



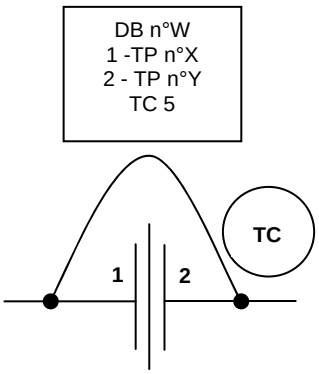
5.2 POSSIBLE COMPLEMENTARY EQUIPMENT AT AN INSULATING JOINT:

*5.2.1 **Insulating joint with direct bond***



*5.2.2 **Example:***

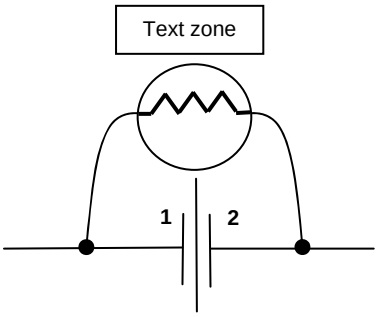
There is a potential test point at both sides of the insulating joint, with a direct electrical connection.



→ with an operator's specific codification:

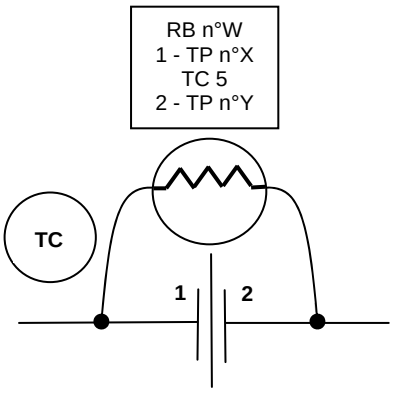
- DB : direct bond,
- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm²,

*5.2.3 **Insulating joint with resistive bond***



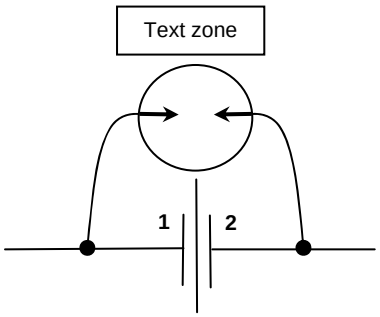
*5.2.4 **Example:***

There is a potential test point at both sides of the insulating joint, with a resistive electrical connection.



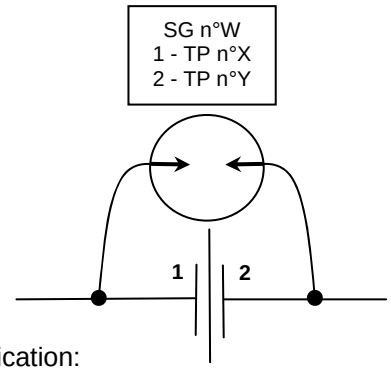
→ with an operator's specific codification:
- RB : resistive bond,
- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm²,

*5.2.5 **Insulating joint with spark-gap :***



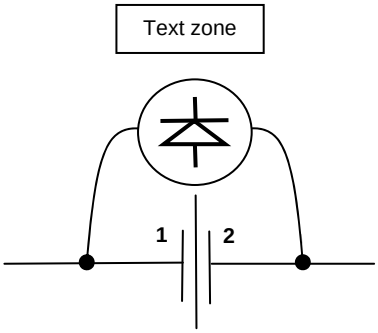
Note: the symbol of the spark-gap may also be connected to a grounding system. The two elements should then have a common text zone

*5.2.6 **Example:***

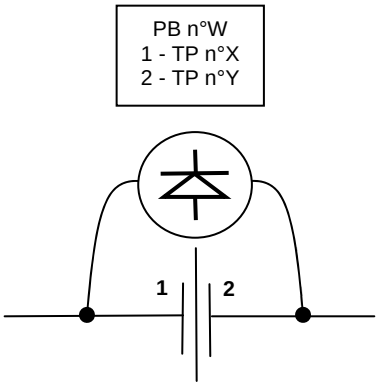


→ with an operator's specific codification:
- SG : Connection through spark-gap,
- TP : potential test point.

*5.2.7 **Insulating joint with polarized bond***



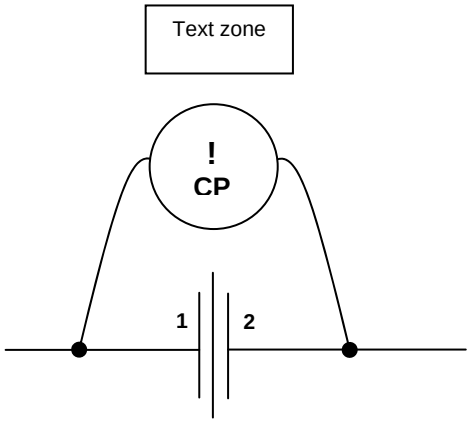
*5.2.8 **Example:***



→ with an operator's specific codification:
- PB : polarized bond,
- TP : potential test point.

5.2.9 Insulating joint with specific electrical bond:

All other types of electrical bonds over an insulating joint (which are les frequently used on the networks) should be symbolized in the following way :



This will be the case of:

- connection through a polarization cell,
- connection with an inductance,
- ….

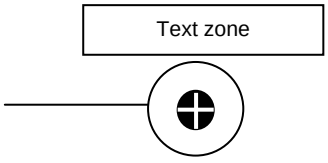
5.3 THE ANODE GROUND BEDS :

Four cases are to be distinguished. The ground bed must be connected to another cathodic protection equipment (impressed current station, cell, …).

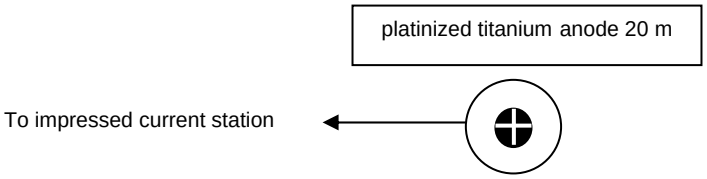
According to the type of the anode ground bed, a possible codification, to be indicated in the text zone, for the elements below could be as follows:

- rail	:	RA
- graphite anodes	:	GR
- high silicon cast iron anodes	:	FeSi
- magnesium anodes	:	Mg
- zinc anodes	:	Zn
- platinized titanium anodes	:	TiPl
- mixed metal oxide coated titanium anodes	:	MMO
- platinized niobium wire	:	NbPl
- aluminum anodes	:	Al

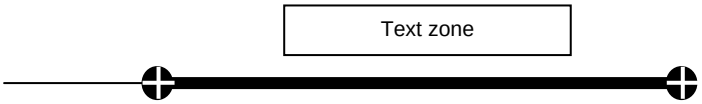
5.3.1 Vertical deep well ground bed :



Example :



5.3.2 Single horizontal ground bed:

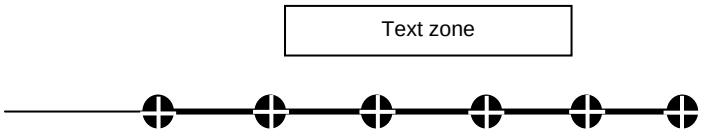


The length of the ground bed portrayed at scale should be consistent with its actual length.

Examples:

- rail,
- continuous piggy bag anode,
- mixed metal oxide wire,
- …

5.3.3 Horizontal ground bed with vertical anodes:

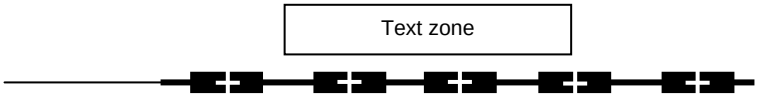


The number of symbolic elements comprising the ground bed should be equal to the actual number of anodes installed.

Examples:

- high silicon cast iron anodes,
- graphite anodes,
- …

5.3.4 Horizontal ground bed with horizontal anodes:



Examples:

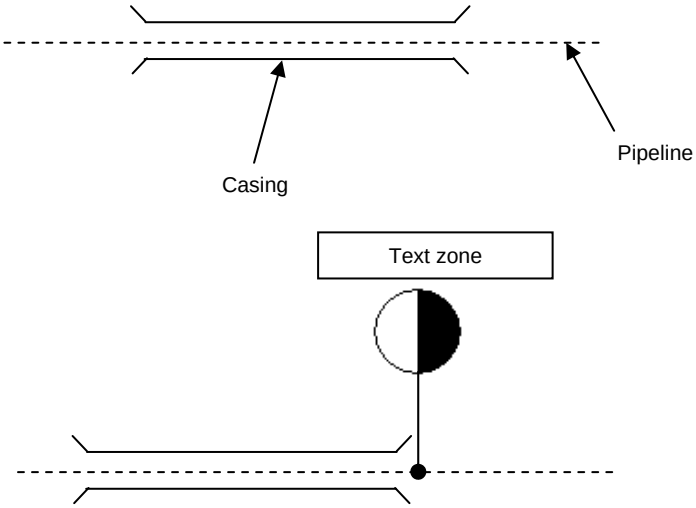
- high silicon cast iron anodes,
- graphite anodes,
- …

The number of symbolic elements comprising the ground bed should be equal to the actual number of anodes installed.

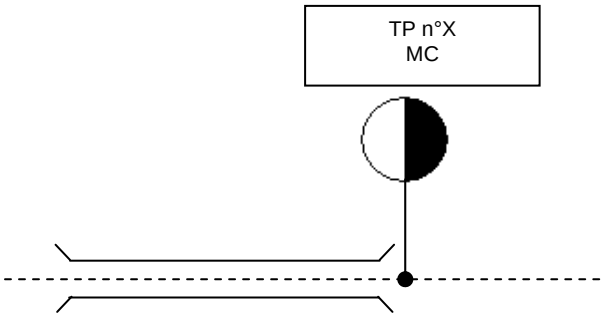
5.4 THE CASINGS :

5.4.1 General principle

The basic symbol for a casing is the following:



5.4.2 Example:



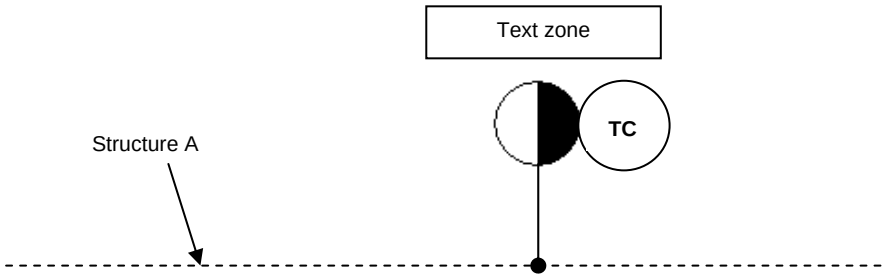
→ with an operator's specific codification:

- TP: potential test point,
- MC: metallic casing.

5.5 METALLIC TEST COUPON

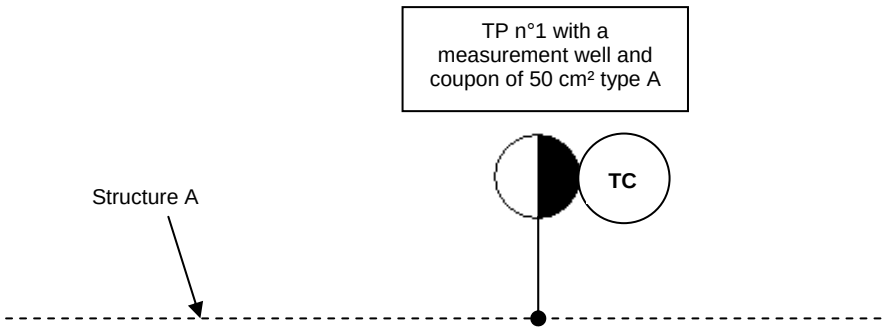
5.5.1 General principle

Whatever the position, the type or the surface of the coupon, it should be portrayed at the potential test point as follows:

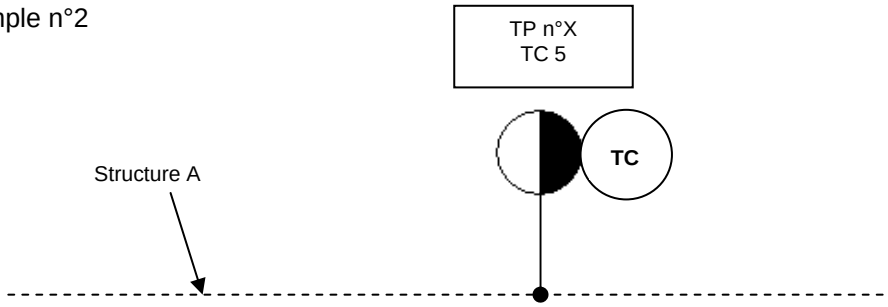


5.5.2 Examples:

Example n°1



Example n°2



→ with an operator's specific codification:

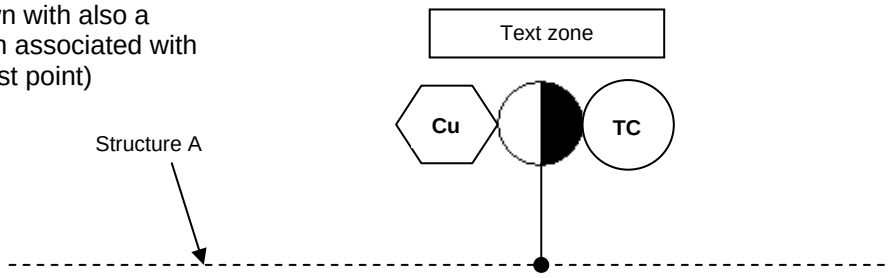
- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm².

5.6 REFERENCE ELECTRODE:

5.6.1 General principle

Whatever the position or the type of reference electrode, it is necessary to indicate the type of electrode used in an hexagon placed beside the symbol of the potential test point:

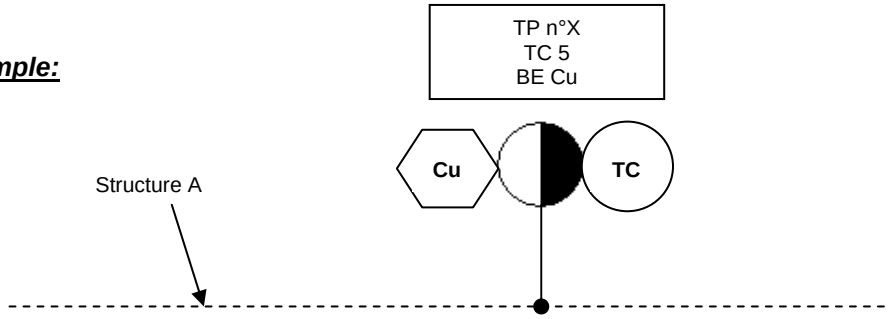
(example shown with also a metallic coupon associated with the potential test point)



The type of electrode is to be chosen from the following non exhaustive list :

- copper / copper sulfate	:	Cu
- zinc	:	Zn
- silver / silver chloride	:	Ag
- calomel	:	KCl

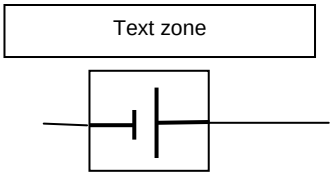
5.6.2 Example:



→ with an operator's specific codification:

- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm²
- BE Cu : buried electrode Copper / Copper sulfate.

5.7 THE ELECTRIC CELLS :

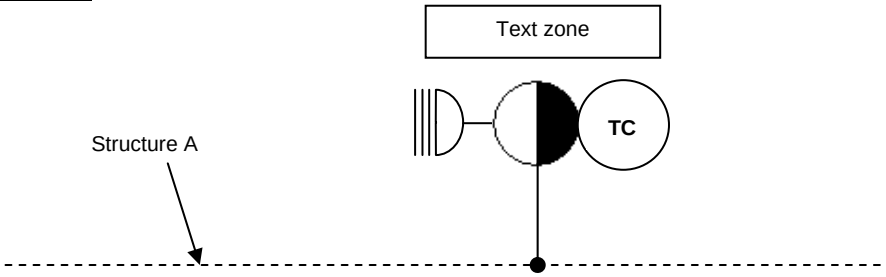


5.8 THE TELE TRANSMISSION – THE REMOTE MONITORING

5.8.1 General principle

The symbol is to be placed beside the equipment fitted out with tele transmission or remote monitoring

5.8.2 Example:

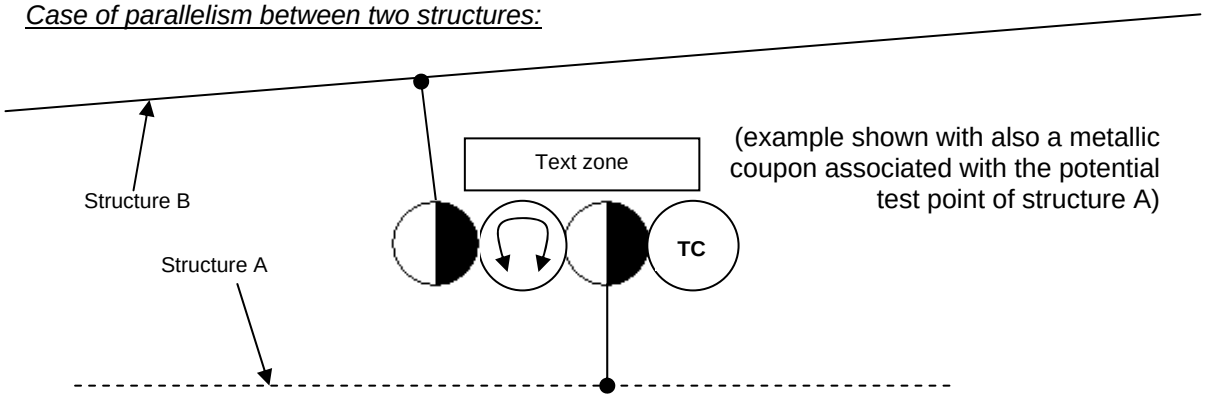


5.9 THE BONDS BETWEEN STRUCTURES

5.9.1 General principle

This bond is to be symbolized in the following manner whatever its type (direct, resistive, polarized, inductive or capacitive).

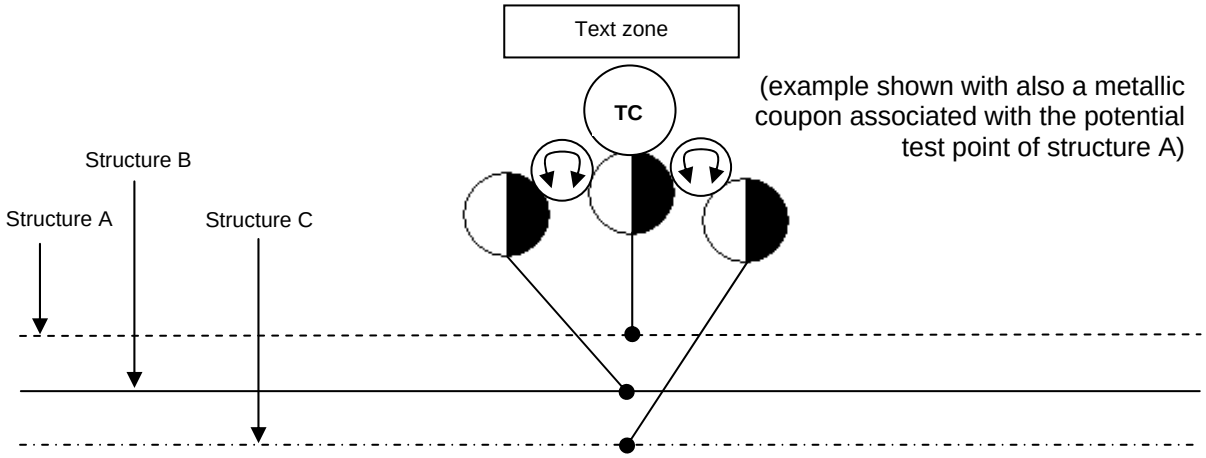
Case of parallelism between two structures:



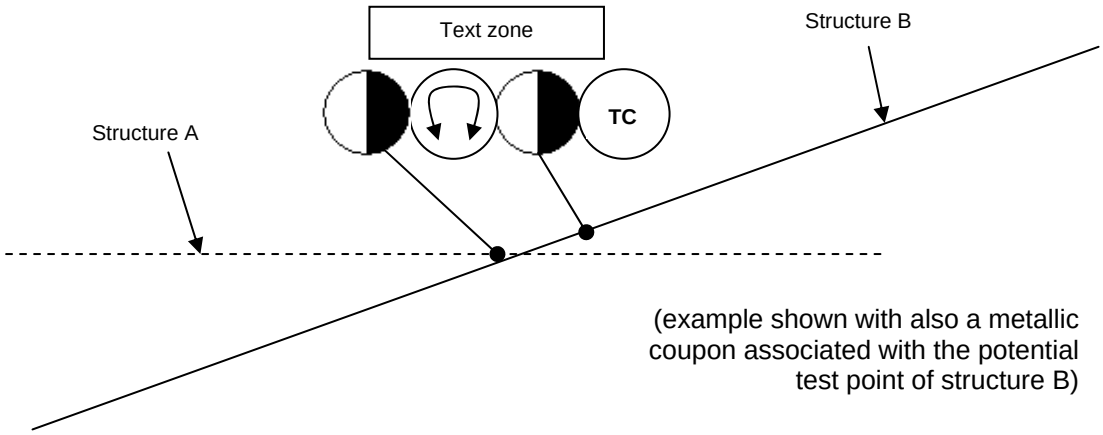
(example shown with also a metallic coupon associated with the potential test point of structure A)

When there are several structures bonded together at the same measurement point, only one single bond symbol («  ») is portrayed. But the number of symbols of test points will be equal to the actual number installed.

Case of parallelism between several structures:

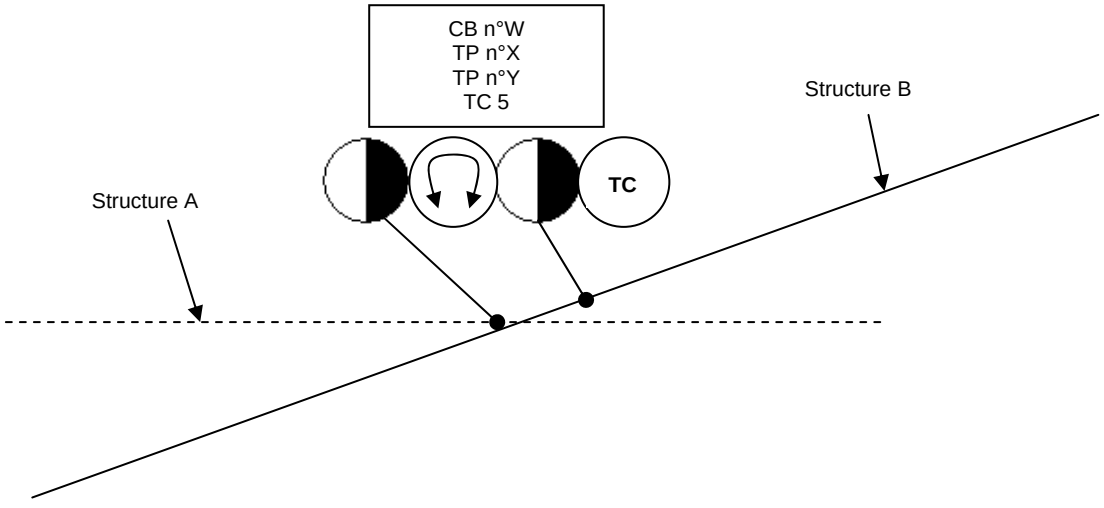


Case of crossing between two structures:



Note: when the junction box of a measurement point is remote from its connection point to the pipe, the cathodic protection cable can be represented running alongside the pipeline between the two locations (from the box to the connection point).

*5.9.2 **Example:***



→ with an operator's specific codification:

- TP : potential test point,
- TC 5 : metallic test coupon of 5 cm ²
- CB : capacitive bond (between structures of the same operator).

5.10 CONNECTION CABLE

The cross sectional area of all cables, whatever their nature, can be indicated on the drawings as the numerical value in square millimeters.

Example for a specific cathodic protection cable with a cross section of 50 mm² : 50^2