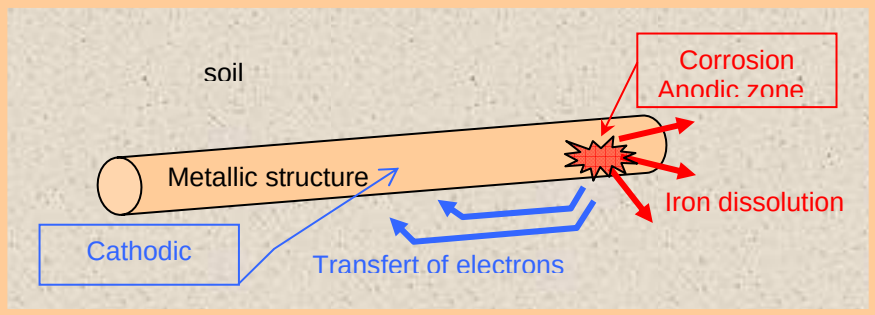
Corrosion process

The Corrosion is the result of a chemical or electrochemical reaction between a metal and it's environment, which produces a deterioration of the metal and it's properties. The identity of a metal is determined by its corrosion potential and is measured in millivolts. This measurement may vary from one zone to another depending on the surrounding medium.

The zone where the corrosion process may be initiated is known as the anodic zone. An anodic zone is defined by the most negative potential. The corrosion of a metal is an oxidization process called an anodic reaction. A cathodic zone creates a secondary process known as the cathodic reaction. This is a reduction process by which the electrons created by the anodic reaction is consumed, resulting in the two processes balancing their charges.

$$Fe \longrightarrow Fe^{2+} + 2e^{-}$$

In order for the corrosion process to occur, there must be an anodic zone and a cathodic zone. Depending on the circumstances, these two zones can be positioned close together on a metal's surface, or far apart. The two zones co-exist creating an electrochemical process in which the surrounding medium acts as a transport system for ions. This pathway is defined as the electrolyte.



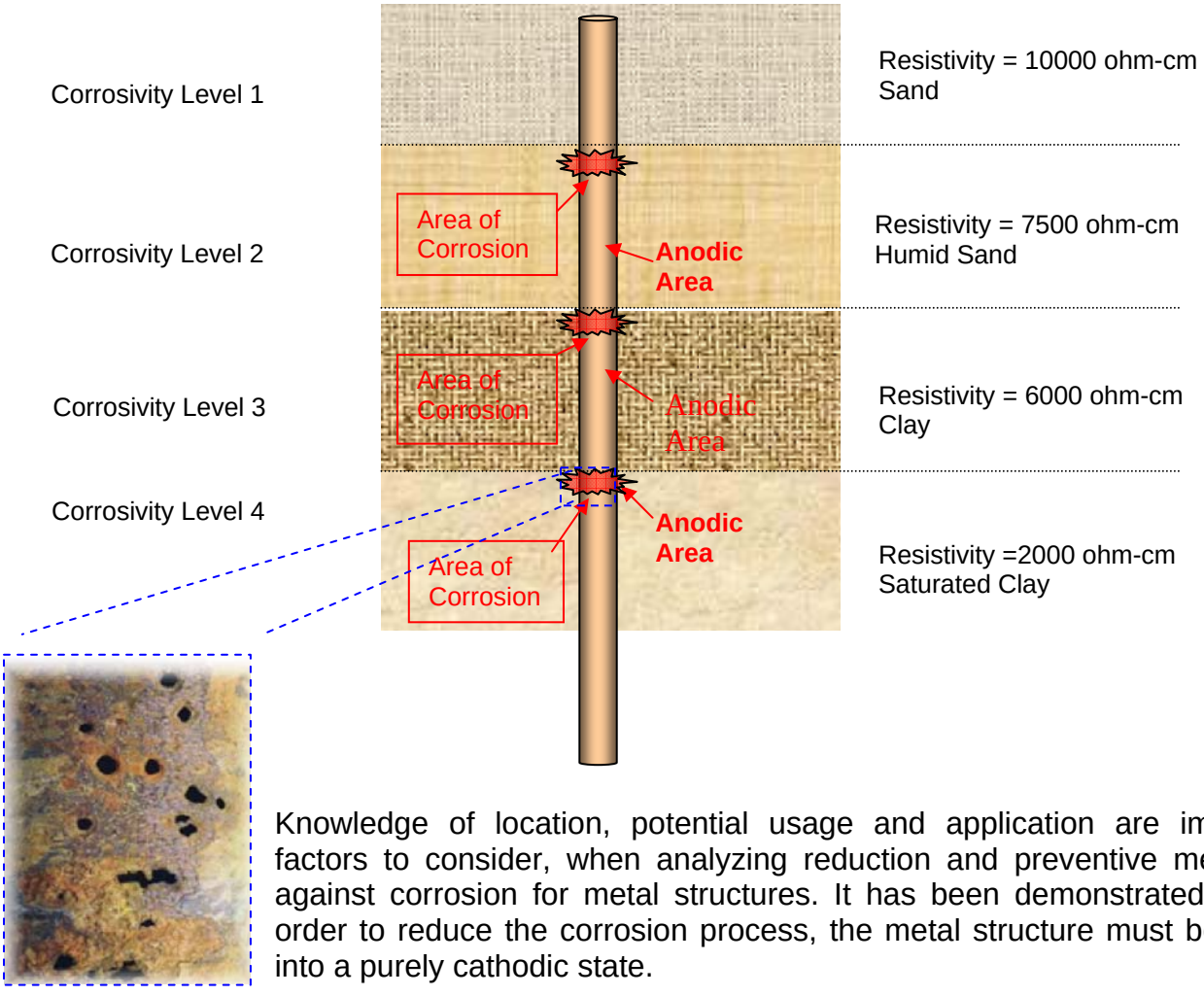
One of the key elements for the corrosion process is the soil surrounding the metal surface. In addition to the soil being an electrolyte, the properties of the soil may inhibit or enhance the corrosion. Such processes including soil resistivity (velocity of the current traveling through the ground), directly effect the formation, rate and placement of corrosion on the metal surface. A less resistive soil, results in an accelerated corrosion reaction.

Furthermore, soils with the following parameters may also influence the location and formation of the anodic zones.

- Low oxygenated soil
- Ground of low resistivity
- Presence of sulfato-reducing bacteria
- Soil saturated with water
- Organic contamination (compost, refuse, ...)
- Contact with highly conductive materials (ashes,coal,salts, ...)
- Dissimilar materials

On a metal structure placed in a soil environment, localized corrosion attacks are a particular concern. The metal structure may go through numerous layers of soil. With every layer there is a transition in soil composition, shifting aggressiveness with varying layers of resistivity. These resistive regions (both anodic and cathodic) typically decrease with incremental depth, however the corrosion process will be amplified on the metal structure where the various layers of soil intersect.

In understanding the corrosion process and the various elements involved that directly effect this electrochemical reaction, it is evident that the lifespan of a metal structure may be strongly influenced by one or several factors. The placement and rate of corrosion on a metal structure affects not only the metal internally but the lifespan structurally.



Knowledge of location, potential usage and application are important factors to consider, when analyzing reduction and preventive measures against corrosion for metal structures. It has been demonstrated that in order to reduce the corrosion process, the metal structure must be made into a purely cathodic state.

Techno Protection offers two corrosion protection applications, based on the cathodic protection principle. With the introduction of an external anodic area, the natural corrosion process can be manipulated to secure it efficiently against the degradation related to corrosion.

The solution against corrosion!

techno PROTECTION

INTRODUCTION

Techno protection is a well known electrochemical technique using the cathodic protection concept for stopping the corrosion process of underground metallic structures.

METHODOLOGY

The techno protection can be applied via two methods:

1)Techno protection impressed current (TPIM)
The TPIM works by using anodes composed of a noble metal that is fed by an external current source such as a rectifier. Through the rectifier, a voltage is applied to the structure that, in turn, generates a potential difference between the structure and the anodes. This difference protects the metal structure from corrosion.

2)Techno protection by sacrificial anode (TPSA)
The TPSA uses the intrinsic electrochemical property of metals. In this system, the anodes made with a less noble metal than the metal of the structure are used. These anodes are consumed by unloading a current and thus provide the cathodic protection of the structure or the metal structures.

APPLICATION

The choice of the right protection method, as well as the way to apply it, is based on the type of structure to be protected and it surrounding environment, then on a “case by case” approach. In any case, in order to apply the techno protection technology in an effective and durable way, three very important rules must be applied :

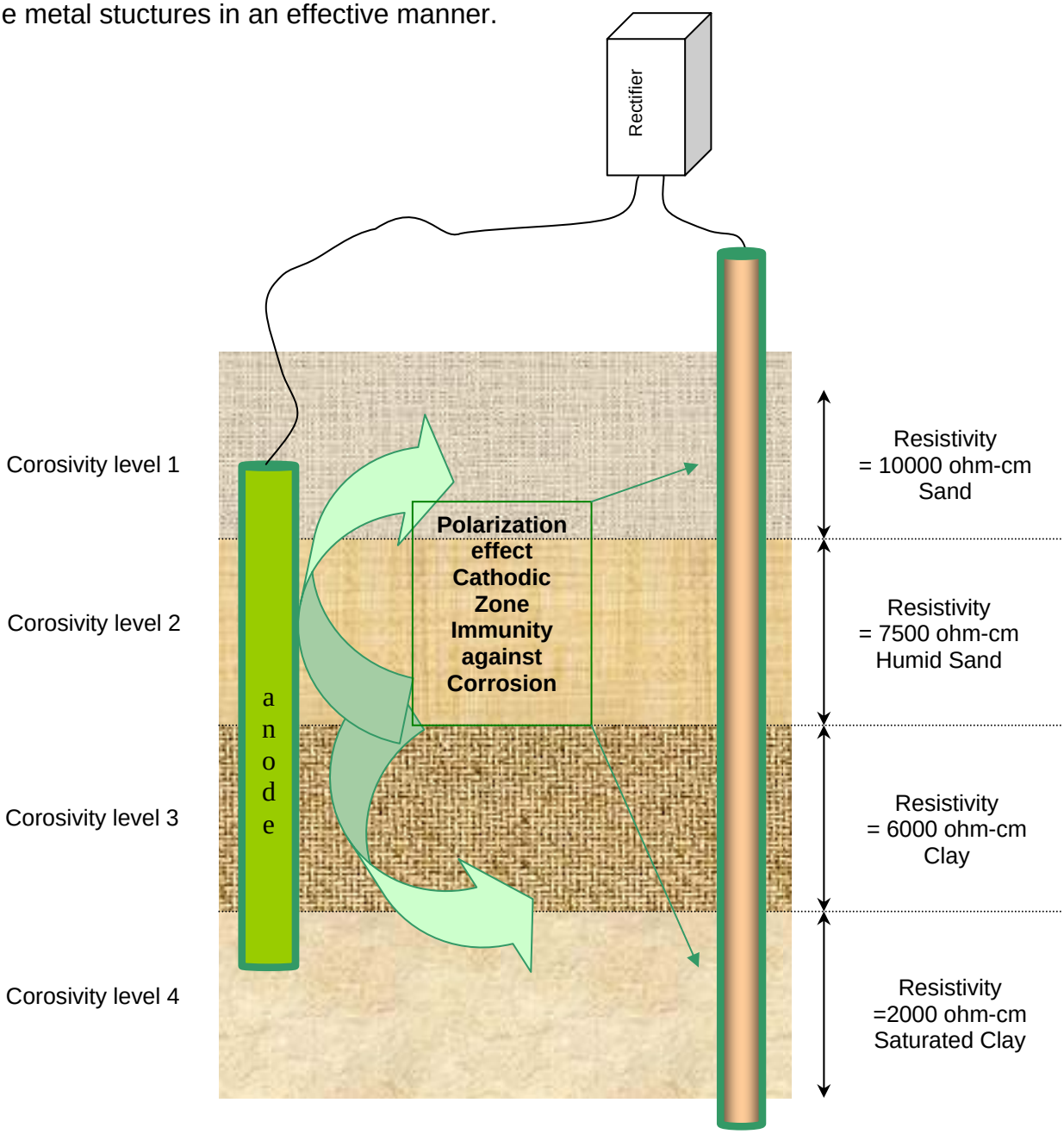
1. A specific design of the system according to the structure must be prepared by Techno protection' expert, including the choice of the type and method of the protection system to be installed.
2. All materials, installation and system used must be quality checked through the performance of anode efficiency test :
   • Certified materials
   • SA : ASTM G97 and B843
   • IM : ASTM B265 CP Titanium
3. Turnkey installation
4. The procedures to control and follow up the system must be implemented, through a periodic monitoring of its status and a follow up by certified technician of the Techno Protection network.

ADVANTAGES

Insure a substantial extension in the service life of the structure protecting the owners assets.

Techno protection imposed current (TPIM)

The Techno Protection Impressed Current application is an electrochemical technique, which inclusively transforms all of the metal stuctures in to a permanent cathodic state. By implementing an external source of current, the rectifier, controls and maintains polarization of the metal stuctures in an effective manner.

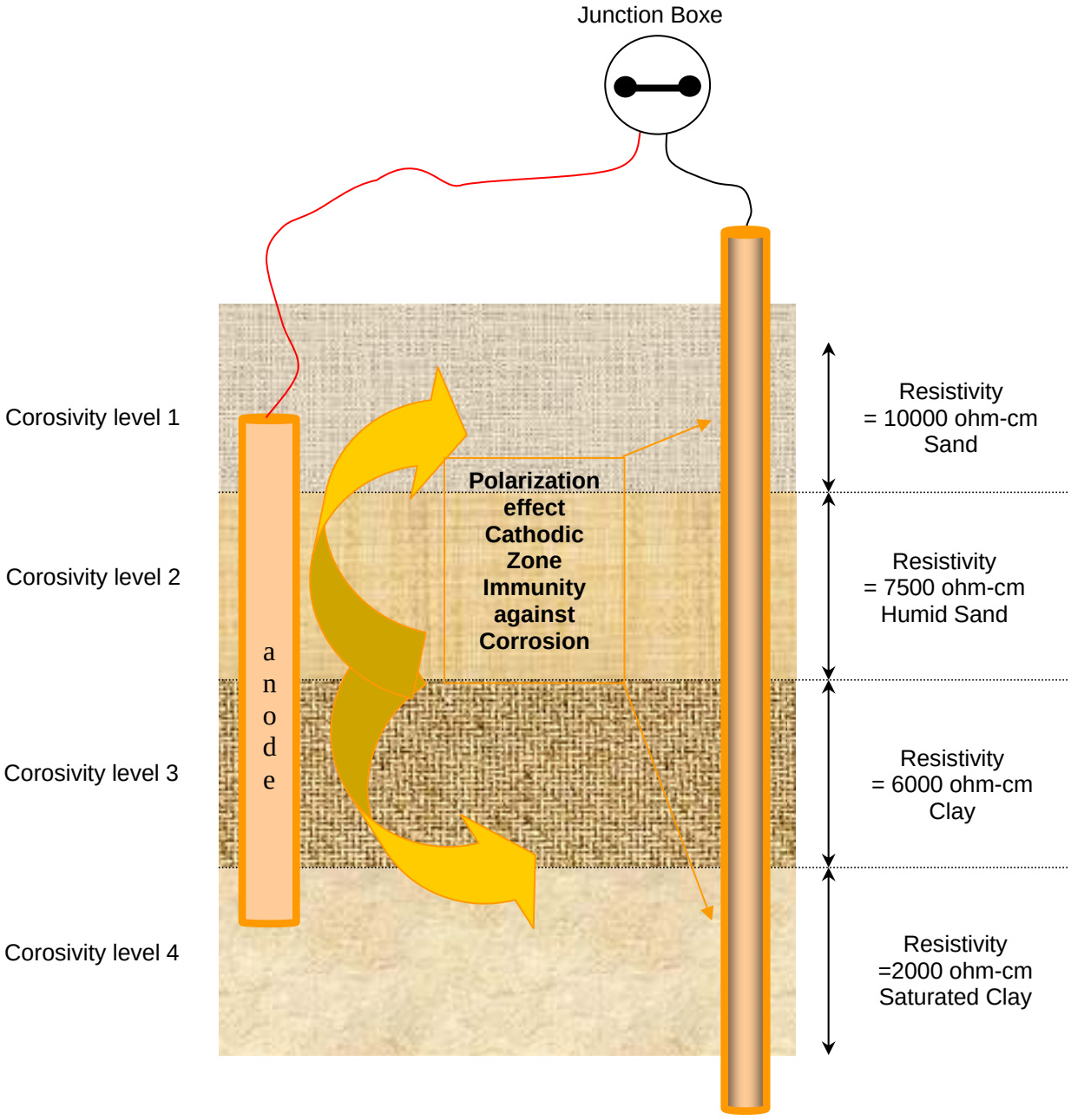


With the introduction of a foreign anodic zone, the anode, a cathodic zone is created on the metal stuctures surface, which provides a controlled immunity from natural corrosive influences.

This Techno Protection application ensures an unequalled extension of the service life expectancy of the metal stuctures.

Techno protection by sacrificial anodes (TPSA)

This Techno Protection by sacrificial anode application utilizes the intrinsic characteristics of the anode system to polarize the metal stuctures. By implementing this electrochemical technique the metal stuctures are brought completely to a cathodic state.



The introduction of a foreign anodic zone, the sacrificial anode, a cathodic zone is created on the metal stuctures surface that provides a controlled immunity from natural corrosive influences.

This Techno Protection application ensures a distinct extension of the service life expectancy of the metal stuctures, increasing estimates up to 2 times.