IRON PROBE DESERT: a new, patented probe for high-resistivity soils

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A new probe that operates with maximum effectiveness even in the most arid and resistant areas: IRON PROBE DESERT is the latest evolution of the IRON PROBE® family developed by SAIT Srl. Capable of absorbing even the smallest amounts of night-time humidity to ensure ion exchange, it is designed to meet the most demanding market requirements for corrosion monitoring.

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Soil is one of the most challenging corrosive agents because it is impossible to accurately predict its aggressive action on buried metals, such as those used in pipes and storage tanks. In fact, soil corrosion depends on numerous variables such as aeration, humidity, pH, the presence of microorganisms, climatic conditions, heterogeneity, sulphate-reducing bacteria, fertilisers, industrial waste, and various types of chemicals. To assess the potential risk of corrosion and select the most appropriate protection solution, it is essential to conduct an accurate analysis and evaluate parameters such as electrical resistivity, pH, the potential of buried structures, and their installation characteristics (coatings, lengths, and earthing systems). If there is a risk of corrosion, a cathodic protection system can prevent its development, and analysing the soil characteristics allows identifying the most suitable solution.

SAIT Srl, a company based in Umbertide (Perugia, Italy) specialising in the protection and maintenance of metal infrastructure and corrosion prevention through advanced cathodic protection technologies, patented the IRON PROBE® potential probe in 2022, marking a significant step forward in the field of cathodic potential measurement. Recently, in response to the need to operate on extremely dry and resistive soils, such as those found in the deserts of the United Arab Emirates or arid areas of Europe, this system has been further developed into its IRON PROBE DESERT version.

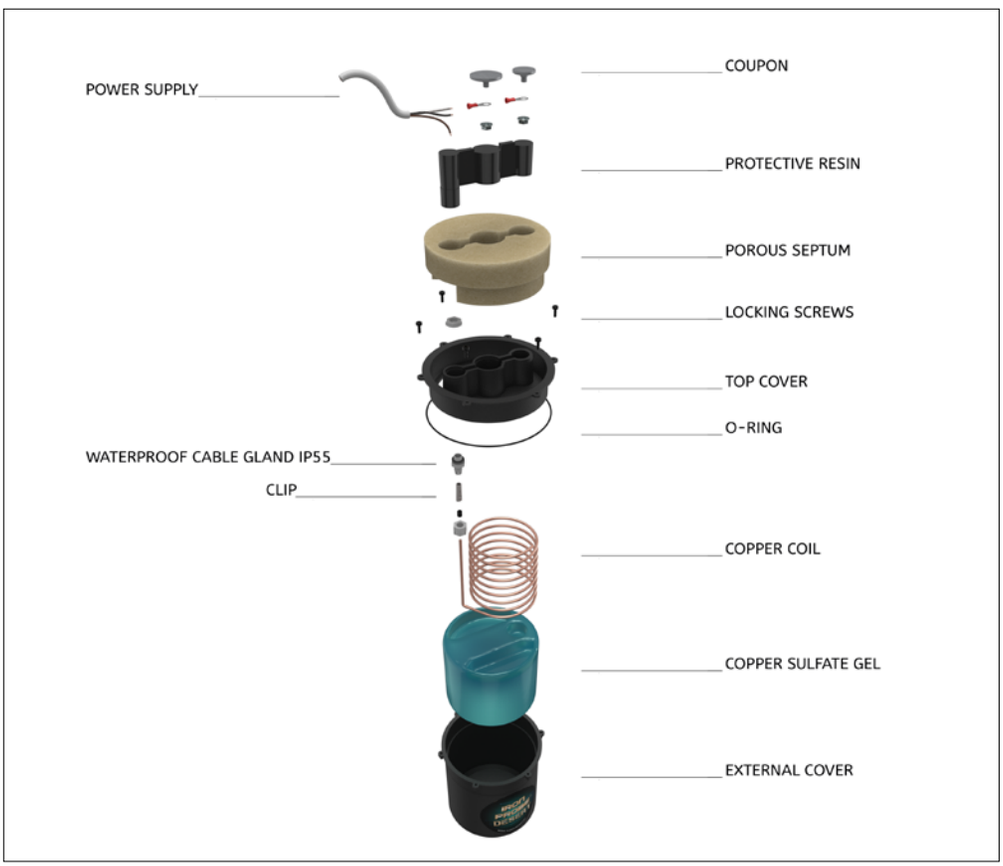

Figure 1 (top left) - IRON PROBE DESERT is designed to meet the most demanding market requirements for corrosion monitoring.

Figure 2 (top right) - In desert soils it can detect even the slightest amount of moisture present at night, thus enabling the ion exchange necessary for its proper functioning.

Figure 3 - Exploded diagram of IRON PROBE DESERT.

This new probe retains the main features of the original device[1], with high conductivity to ensure accurate measurements even on highly resistive soils by obtaining E_{on} potential values very close to the true $E_{on/off}$ potential. Such accuracy ensures a more realistic assessment of the cathodic protection status even in challenging environments. The new device features a porous septum specifically designed to absorb high levels of moisture. In desert soils, where hot conditions reduce the amount of moisture available, it can detect even the slightest amount of moisture present at night, thus enabling the ion exchange necessary for its proper functioning (**Figs 1 and 2)**. Thanks to this feature, IRON PROBE DESERT can operate effectively even in critical environments, ensuring reliable measurements in otherwise critical conditions.

IRON PROBE DESERT: effective corrosion monitoring

With over three decades of experience in the cathodic protection sector, SAIT has developed IRON PROBE DESERT as a new, efficient, reliable, and cost-effective reference electrode designed to provide a realistic assessment of a cathodic protection system's effectiveness. This probe, equipped with a single or double integrated coupon, is intended for E_{on} potential measurements and guarantees high stability and accuracy even in extreme environmental conditions. Its distinctive characteristic is the very high conductivity of its patented porous septum, which can retain soil moisture and ensure constant measurement over time, regardless of resistance variations due to very dry or arid periods. Adapting to any type of soil, it can also be installed far from the structure to be monitored, with considerable savings in terms of excavation and restoration.

[1] https://www.ipcm.it/en/open/corrosion-protection/2025/10/48-51.aspx

Key features of IRON PROBE DESERT

One of the main features of IRON PROBE DESERT is its ability to provide extremely accurate E_{on} potential measurements, which deviate by only 20-30 mV from the true $E_{on/off}$ potential even in high-impedance soils. This probe eliminates interference generated by stray currents, a problem that traditional reference electrodes cannot compensate for, and allows for cathodic potential measurements without voltage drops due to electrical resistance in the circuit (**Fig. 3**).

It also features as follows:

- an external cover in recycled polyoxyethylene;
- compact design (150 × 158 mm, H×Ø) for quick and easy installation;
- a patented ceramic septum with excellent conductivity and hygroscopic properties, with a 117.5-cm² contact surface specifically designed for high-resistivity soils;
- patented copper sulphate gel to avoid capillary leakage; stability tested on high-resistivity soils;
- steel coupons with a dimension of 10 cm² for DC measurements and 5 cm² for AC measurements;
- minimum distance between the porous septum and the coupons: 7 mm;
- registered trademark and European patent no. 202022000002267;
- compliance with ISO 15589-1.

Thanks to the extremely small distance between the coupons and the porous septum, IRON PROBE DESERT guarantees high-precision measurements with minimal deviations (**Table 1**) and no interference from external stray currents (**Figs. 4 and 5**).

In complex environments where stationary or transient interference can affect measurement accuracy, this probe offers more reliable potential detection by eliminating most interference and providing more realistic values related to the system's electrochemical behaviour.

Specific applications and benefits

IRON PROBE DESERT can be used to identify specific points along a pipe or structure where the potential indicates a risk of corrosion. In complex environments where stationary or transient interference can affect measurement accuracy, this probe offers more reliable potential detection by eliminating most interference and providing more realistic values related to the system's electrochemical behaviour. In addition to reducing measurement uncertainties, it ensures closer correlation between the measured potential and the actual behaviour of the metal, simplifying monitoring procedures and making traditional ON–OFF techniques unnecessary.

	Coupons	IRON PROBE	Reference Value	Max deviation
24h CSE-AAC stability	Not connected	min -120 mV max -115 mV,	- 120mV	+/- 5 mV
	Connected	min -130 mV max -110 mV	- 120 mV	+/- 20 mV
IR Drop	Measured Potential value Eon: -1,52 V		Real E irfree value: -1,04 V	-0,48 V
Ambient conditions	Sand grounds also with high resistivity with low chlorides content (<200 ppm)			
Temperature	-5°C ÷ +40°C			
Lifetime	>10 years			
Minimum input resistance of connected devices	10 Mega OHM			

Table 1: Features of the IRON PROBE DESERT.

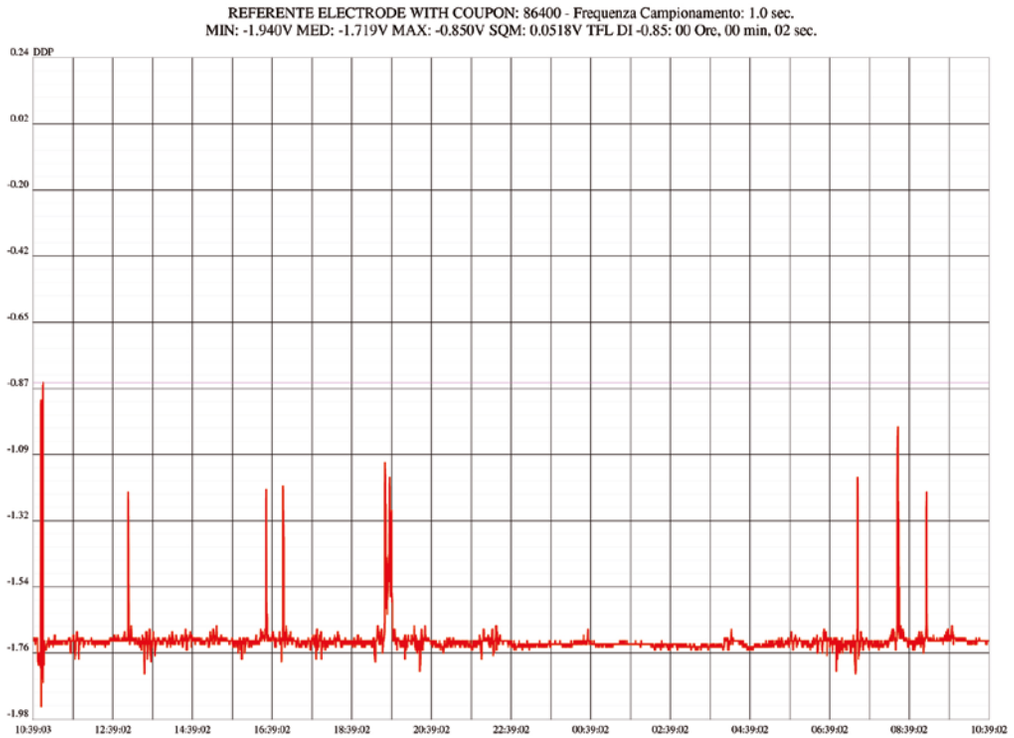

Figure 4 - Cathode potential measurement with a traditional electrode.

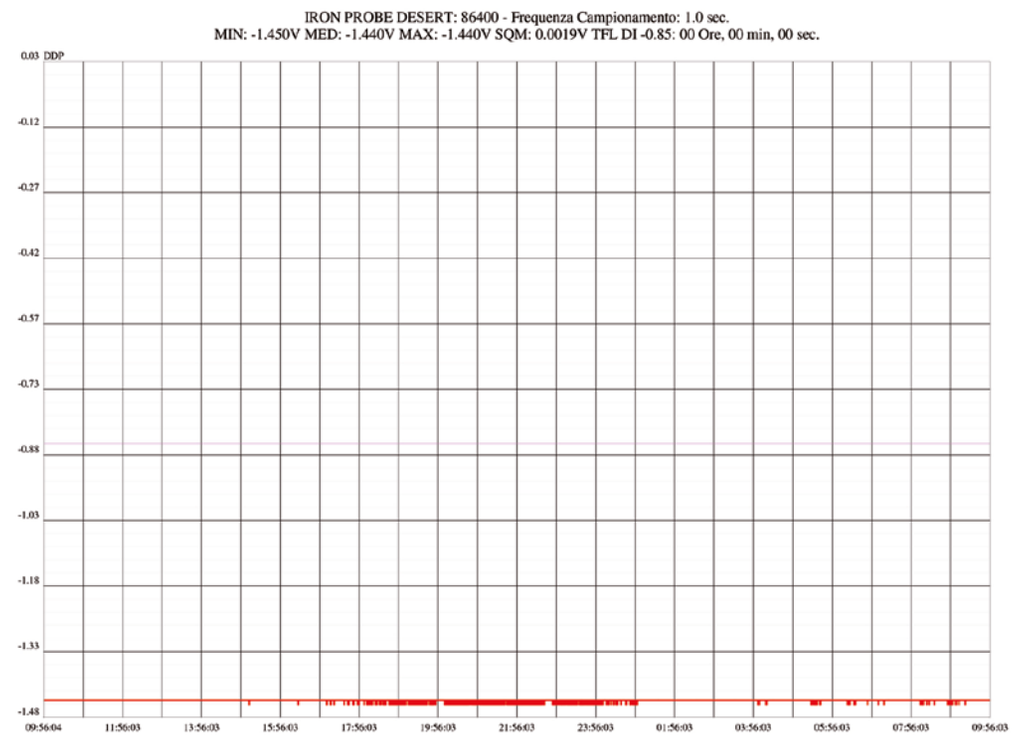

Figure 5 - Cathode potential measurement with IRON PROBE DESERT.

Conclusions

Validating the effectiveness of a corrosion protection system is a fundamental requirement for determining whether critical infrastructure is adequately protected from the risk of electrochemical degradation. IRON PROBE DESERT, in particular, was developed in response to the need for a probe capable of operating in arid and sandy soils, such as those found in the United Arab Emirates, where critical infrastructure such as oil and gas pipelines is located. Based on this specific requirement, SAIT designed an evolved version of its original IRON PROBE by modifying its upper part and optimising its structure to ensure excellent performance even in conditions of low humidity and high soil resistivity.

To date, over a hundred of these probes have been installed in various parts of the world, from Texas to Libya and Brazil. Further tests are also underway in the United Arab Emirates, where a supply of approximately 15,000 units is being explored, and in France, where, despite the absence of desert terrain, these devices are being successfully tested in environments characterised by high resistivity, such as sandy mountain areas or river banks with a strong presence of debris. Unlike desert terrain, which also has very high temperatures, these European soils are defined as resistive due to their granular composition and limited ability to retain moisture, making IRON PROBE DESERT an ideal solution for such contexts as well.