# THE IMPORTANCE OF MAGNET PROTECTION WITHIN HARSH ENVIRONMENTS

## Background

The high sensitivity of Coto Technology's RedRock RRxxx series sensors enables them to be used reliably with very small magnets. However, should the magnets lose their strength, they may fail to trigger the sensor. Corrosion within the magnets is one major cause for loss of magnet strength. This application note describes the corrosion process and suggests methods with which to protect the magnet in order to maintain reliable operation of the RedRock RRxxx sensors.

## Corrosion Process

High strength magnet materials such as Neodymium Iron Boron (NdFeB), are easily corroded by oxidation and harsh chemicals. Corrosion causes a loss of magnet mass as well as volume expansion, with the corrosion products (rust) further accelerating the corrosion process, while also further reducing effective strength of the magnet. Proven methods are therefore needed to prevent – or at least retard – corrosion.

## Protection Methods

Environmental conditions should drive the level of protection used for the magnet. In benign conditions – such as when the magnet is in dry open air, or inside of an instrument that resides in a climate controlled room or on an industrial floor, conventional coatings like epoxy resin or nickel plating can sufficiently protect the magnet against corrosion. In general, these coatings are 0.02 to 0.08mm thick. It is recommended, however, that a magnet be placed in the actual application environment for a statistically representative period, and verified to operate without performance loss.

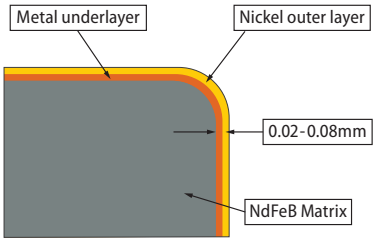


Figure 1. Nickel plating on Magnet

In applications where the magnet is immersed in, or exposed to high humidity or corrosive elements, these types of applied coatings eventually allow enough reactants to permeate through to the magnet and start the corrosion process. Once corrosion is initiated under the coating, volume increase resulting from the corrosion products eventually causes the coating to fail catastrophically, leading to rapid and complete destruction of the magnet, and a general failure of any product using the magnet to operate.

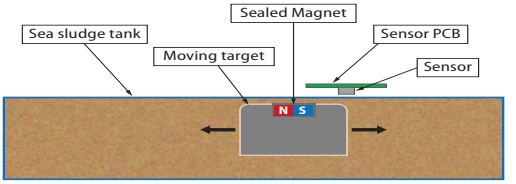


Figure 2. Stainless steel encasement for magnet used in marine applications.

In such heavy-exposure applications, the most successful methods fully encase the magnet inside of an impermeable structure. Applications in marine environments often seal the magnet inside a welded stainless steel containment case (Figure 2). Other applications may use plastic overmolding.

The cost for such a containment strategy is low when the magnet is holistically designed into the mechanics of the system. As an example, when the magnet is used in a liquid level detection/measurement application, the magnet is often incorporated into the float so that is completely encased in plastic (Figure 3). In such a design, there is only a marginal increase in float size to accommodate the weight of the magnet. Magnets thus deployed can perform indefinitely at design limits so long as the float is not damaged.

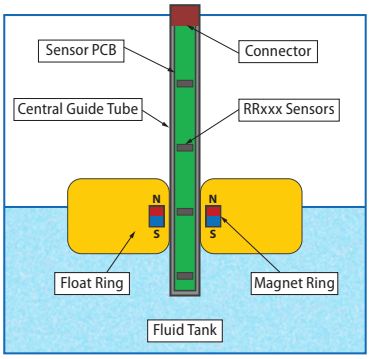


Figure 3. Magnet embedded in plastic float for use in fluid level sensing

## Conclusion

In order to extend useful life of an application using Coto's RRxxx sensors, the magnet must be protected against corrosion. The level of protection employed should be in proportion to the severity of the environment. The method chosen should be validated at prototype stage.

*For further application assistance, please contact Coto Technology's Sales and Applications Engineering team. (appsupport@cotorelay.com).*

 