A method of protecting steel from corrosion attack for sea water, soil, and concrete is described. A sacrificial anode is used as an additional battery in the sacrificial anode cathodic protection system. It connected in series or parallel depending on the need for protection and electrolyte resistivity. It produces a high negative potential if connected in series and generates a large current supply in parallel connection.

**PROBLEMS STATEMENT**

The most common failures of underground pipeline were prevalent mainly related to failures which it primarily caused by corrosion-induced leaks. The application of the sacrificial anode method as a corrosion protection is limited to high resistivity electrolytes such as dry soil, mud, and concrete. The limitations are mainly caused by its low negative potential and small current supply. The difficulty of producing anode materials with a high negative potential in the galvanic anode is also the main cause of its weaknesses.

**USEFULNESS**

The cathodic protection system shall electrically, physically connected to underground steel pipes and other metallic structures to protect from being corroded by the electrolytic forces occurring in moist soils. The use of sacrificial anodes is currently done to avoid the problem, the invention products acts as an external power source, it efficiently supply a protective current towards steel structures to protect corrosion problem in electrolyte environments.

**ENHANCEMENTS**

- Voltage and current supply can be designed according to electrolyte/medium resistivity.
- Anode material is limited to magnesium, aluminium or zinc only, any metal can be used as galvanic anode materials as long as it can provide a more negative potential than the metal to be protected.
- The periodic maintenance and inspection much easier and simpler than conventional cathodic protection system.

**NOVELTY & INVENTIVENESS**

- Acts as an additional battery to protect the steel structures in any corrosive environment.
- Combines the advantages features of cathodic protection (sacrificial anode and impressed current).
- Placed separately with electrolyte environment makes periodic maintenance and inspection to be easier.

**COMMERCIAL POTENTIALITIES**

A minimum 1 unit anode will be installed for each km depended on soil resistivity & anode design. Designing on domestic market, the pipelines which will be constructed as in Malaysia follows:

<table>
<thead>
<tr>
<th>Distance</th>
<th>Pipeline Design</th>
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</thead>
<tbody>
<tr>
<td>0-1000 km</td>
<td>Piercement Gas Unlitokun</td>
</tr>
<tr>
<td>0-1000 km</td>
<td>Duyatou-Sarawak Gas Pipeline</td>
</tr>
<tr>
<td>0-1000 km</td>
<td>Trans-Thailand Gas Pipeline (TIM)</td>
</tr>
</tbody>
</table>

If 50% of the corrosion protection come from our product, we are expected the income will be the recurring licence systems.