Theory of Rust

$4Fe(s) + 3O_2(g) + 3H_2O(l) \rightarrow 2Fe_2O_3(s) + 6H^+(aq)$
Type Of Corrosion Protections

- **Painting System**
  Polyurethane Base, Epoxy Base, Oil Paint, Fluorine Base

- **Insulation System**
  Fiberglass, Close cell PE
Type Of Corrosion Protections

- Blackening System
  Anti-corrosion by making the surface of iron become oxide, then the black film oxide will bonding on the surface iron

Type Of Corrosion Protections

- Cathodic Protection System
  The reaction of self-sacrificing from another material
  Will lose itself instead of the iron
  E.g. Hot-Dip Galvanized, Electrogalvanized,
The Origin of Hot-dip Galvanizing Process

1. The Hot-dip Galvanizing Process

Traditional hot-dip galvanization is the process where a protective film of zinc is formed by dipping steel structure into melted zinc as a high temperature.

2. The problem with Hot-dip Galvanizing

However, hot-dip galvanization can be processed only in certain-equipped factories, which makes onsite re-galvanization impossible if zinc film partially peels due to welding or cutting.
The Origin of Cold Galvanizing

- Cambridge doctors started working on solving these problems.
- Mixing a large amount of zinc powder with a resin
- A dry film containing more than 95% of zinc provides the same anti-corrosion affect as Hot-dip galvanizing.

ROVAL Cold Galvanizing Compound

ROVAL can be applied in standard temperatures.
The difference of anti-corrosion mechanisms

1. Difference of mechanisms

- Normal paints: Anti-corrosion by barrier protection
- ROVAL: Anti-corrosion by electrochemical reaction
The difference of anti-corrosion mechanisms

Cross-section of the ROVAL film

Paint film contains a large amount of zinc dusts.

Zinc dust

Steel
### Roval VS Other Anti-corrosion Paints

#### 1. Atmospheric Exposure Test

We have proven results from a 36-month atmospheric exposure test concluded at Japan Weathering Test Center in Miyako Island testing ROVAL and other companies' paints for anti-corrosion performance.

<table>
<thead>
<tr>
<th>ROVAL</th>
<th>Other Paint</th>
<th>Hot-dip Galvanizing</th>
<th>Other Galvanizing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Roval VS Hot-dip Galvanizing

#### 1. Detail of the test

- **Salt Spray Test**
- **Cyclic Corrosion Test**
- **CASS Test**
2. Salt Spray Test

Accelerated corrosion testing by spraying salt water.

ROVAL Specimen (DFT 80µm on blasted steel sheet)  
Hot-dip Galvanizing Specimen HDZ55

Before testing  
2256 hours later

3. Cyclic Corrosion Test

Accelerated corrosion testing involving cyclic exposure to salt fog, dry and wet conditions.

ROVAL Specimen (DFT 80µm on blasted steel sheet)  
Hot-dip Galvanizing Specimen HDZ55

Before testing  
3024 hours later
Copper Accelerated Acetic Salt Spray Test.

ROVAL Specimen (DFT 80µm on blasted steel sheet)

Hot-dip Galvanizing Specimen HDZ55

1008 hours later

Test Report

JASO Complex Cyclic Corrosion Test
ROVAL VS Fluorine VS Urethane
JASO Complex Cyclic Corrosion Test
ROVAL VS Fluorine VS Urethane

Urethane Paint System

<table>
<thead>
<tr>
<th>Paint System</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROVAL</td>
<td>85%</td>
</tr>
<tr>
<td>Fluorine</td>
<td>61%</td>
</tr>
<tr>
<td>Urethane</td>
<td>60%</td>
</tr>
</tbody>
</table>

ASTM B117 Salt spray test
Features

- Zinc Content in dry film: 96%
- Zinc purity: 99.995%
- Color: Gray
- Specific Gravity: 2.50 +/- 0.05
- Humidity: < 85%
- Temperature Resistance: -60 °C to 155 °C
- Flash Point: 39°C (Closed cup)
- Boiling Point: 137.7°C – 143.8°C
- Roughness degree: Rz 30 - 70 µm
- Sandblasting: Sa 2.5
## Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended dry film (thk.)</td>
<td>80 µm(40µm x 2)</td>
</tr>
<tr>
<td>Theoretical Coverage (40µm)</td>
<td>4 m²/kg µm</td>
</tr>
<tr>
<td>Surface drying</td>
<td>5-15 (min)</td>
</tr>
<tr>
<td>Recoat Time 2nd</td>
<td>after 1 hr</td>
</tr>
<tr>
<td>Optional Top coat</td>
<td>24 hr</td>
</tr>
<tr>
<td>Top Coat</td>
<td>unnecessary</td>
</tr>
<tr>
<td>Application Methods</td>
<td>brush, roller, airless spray</td>
</tr>
<tr>
<td>Used as primer</td>
<td>can be</td>
</tr>
<tr>
<td>Used as topcoat</td>
<td>can be</td>
</tr>
<tr>
<td>Topcoat with several types</td>
<td>can be</td>
</tr>
<tr>
<td>Shelf life</td>
<td>3 year</td>
</tr>
</tbody>
</table>

## Packaging

<table>
<thead>
<tr>
<th>Packaging</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5KG/can</td>
<td>5m²(two coats)</td>
</tr>
<tr>
<td>25KG/drum</td>
<td>50m²(two coats)</td>
</tr>
</tbody>
</table>
**User Guides**

**Application methods**

- **Brush**
  - E.g. Soft brush

- **Roller**
  - E.g. Long haired-roller

- **Conventional/air-less spray**

**Visual Model of Galvanized Surface**

**Level of Rust**

- **Lv0**
  - Newly galvanized surface.
  - Restoration is not required.
  - Recharging of zinc is effective even at this stage since anti-corrosion performance is proportional to total film thickness.

**Example of Treatment**

1. Scuff the surface with hand tool to remove white rust.
2. Apply ROVAL as much as you like.
## Visual Model of Galvanized Surface

### Level of Rust | Example of Treatment
--- | ---
Lv1 | • Slightly rusted but still zinc protects steel.  
    • Restoration is not required.  
    • Recharging of zinc is effective since anti-corrosion performance is proportional to total film thickness.  
1. Scuff the surface with hand tool to remove white rust.  
2. Apply ROVAL as much as you like.

Lv2 | • Rust starts developing on the surface.  
    Best for restoration.  
1. Scuff the surface strongly with hand tool to remove red rust and other contaminants.  
2. Apply ROVAL to obtain sufficient film thickness.
Visual Model of Galvanized Surface

<table>
<thead>
<tr>
<th>Level of Rust</th>
<th>Example of Treatment</th>
</tr>
</thead>
</table>
| **Lv3**       | • Rust develops and spreads all over the surface. *Immediate restoration is necessary.*  
  1. Scuff the surface with power tool to remove all red rust and other contaminants.  
  2. Apply ROVAL to obtain sufficient film thickness. |

<table>
<thead>
<tr>
<th>Level of Rust</th>
<th>Example of Treatment</th>
</tr>
</thead>
</table>
| **Lv4**       | • Rust totally covers the surface. *Elaborate treatment is necessary.*  
  *The strength of steel possibly deteriorates.*  
  1. Remove all of red rust by sandblasting, being careful not to lose strength of steel.  
  2. Apply ROVAL to obtain sufficient film thickness. |
Applications

Traffic sign gates  Sound block walls

Guard rails  Hot-dip galvanized surfaces
Applications

Buildings

Pedestrian bridges

Applications

Catwalks

Marine equipment
Applications

Power stations

Lighting towers

Applications

Steel frames

Pipes
Applications

Ducts

Gratings

Applications

Bolts

Pipelines
โรงแรมอัมมารี
## Projects Reference

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<th>Project Description</th>
<th>Location</th>
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<tr>
<td>Apr-93</td>
<td>Kyoto Garden of Fine Arts</td>
<td>JAPAN</td>
</tr>
<tr>
<td>Nov-93</td>
<td>Kansai International Airport</td>
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<tr>
<td>Oct-99</td>
<td>Tokyo Metropolitan Highway</td>
<td>JAPAN</td>
</tr>
<tr>
<td>Nov-99</td>
<td>Tokyo Disney Resort</td>
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<tr>
<td>Sep-01</td>
<td>Osaka Metropolitan Highway</td>
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<td>Nov-01</td>
<td>Osaka Prefectural Sayamake Museum</td>
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<td>May-03</td>
<td>Shinjuku Baseball Group</td>
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<td>Sep-03</td>
<td>Ohnaruto Bridge</td>
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<td>Jul-04</td>
<td>Xilong Super Large Bridge in Guangzhou</td>
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<td>Shanghai World Financial Center</td>
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<td>Beijing Airport Highway South Route</td>
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<td>Qinhuangdao Costal Highway</td>
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<td>Jinglong Power Station</td>
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<td>El Gaza Electric Towers</td>
<td>EGYPT</td>
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<td>Mar-09</td>
<td>Guangzhou Great Pedestrian Bridge</td>
<td>CHINA</td>
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## Letter of Distributorship

[Image of Letter of Distributorship]
Conclusion