Corrosion protection of the 21st century

ZAM® is a highly corrosion-resistant hot dip coated steel sheet that has a coating layer of zinc, 6% aluminum, and 3% magnesium.

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Superior corrosion resistance on surface

ZAM® has superior corrosion resistance as compared to galvanized steel, 55% Al-Zn alloy coated steel and Zn-5% Al alloy coated steel.

Appearance after salt spray test (SST: JIS Z2371)

(Coating weight on one side 0.30 oz/ft², no chem treat)

<table>
<thead>
<tr>
<th>Time</th>
<th>500h</th>
<th>1,200h</th>
<th>2,500h</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAM®</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>55% Al-Zn alloy coated steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Zn-5% Al alloy coated steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Galvanized steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Red rust occurrence after salt spray test

- ZAM®
- 55% Al-Zn alloy coated steel
- Zn-5% Al alloy coated steel
- Galvanized steel

ZAM® has superior corrosion resistance on bend processed parts

Appearance of 1.0t bend processed parts on salt spray test (180° 1.0t bend, thickness 0.126", coating weight on one side 0.40 oz/ft², no chem treat)

Outdoor exposure test

Coastal environment 100 ft from seashore (Okinawa Prefecture)

ZAM® has superior corrosion resistance in ammonia environment

Ammonia solution concentrate at 5% (pH 12.5)

Corrosion loss in coating layer by outdoor exposure test

*Patents have been registered for the product and its manufacturer. ZAM® is a registered trademark of Nisshin Steel Co., Ltd.*
**ZAM® produced to ASTM A1046 specifications**

**Superior corrosion resistance on cut edge**

Appearances of cut edge sections after salt spray test
(Thickness 0.126", coating weight 0.40/0.40 oz/ft², no chem treat)

<table>
<thead>
<tr>
<th>Time</th>
<th>100h</th>
<th>1,000h</th>
<th>5,000h</th>
</tr>
</thead>
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<tr>
<td>ZAM®</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>55% Al-Zn alloy coated steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Zn-5% Al alloy coated steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Galvanized steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

**Mechanism of corrosion resistance on cut edge**

Excellent corrosion resistance is achieved on cut edge parts by covering the ends with a fine zinc-based protective film that contains Al and Mg leaching from the coating layer.

![Diagram](image)

**ZAM® has superior corrosion resistance on drawing-processed parts**

Appearance after salt spray test on drawing-processed parts
(Drawing height 0.98", thickness 0.031", coating weight on one side 0.23 oz/ft², no chem treat)

<table>
<thead>
<tr>
<th>Time</th>
<th>0h</th>
<th>1,000h</th>
<th>2,000h</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAM®</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Zn-5% Al alloy coated steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

**ZAM® has superior corrosion resistance to post (batch) hot-dip galvanized**

Appearance after salt spray test of ZAM® vs batch galvanizing

<table>
<thead>
<tr>
<th>Time</th>
<th>500h</th>
<th>1,000h</th>
<th>2,000h</th>
<th>4,000h</th>
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<tbody>
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<td>ZAM®</td>
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<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Batch galvanized steel</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

**Zn-5% Al alloy coated steel**

- Thickness 0.091", coating weight on one side 0.30 oz/ft²
- Red rust occurs

**Galvanized steel**

- Thickness 0.091", coating weight on one side 1.87 oz/ft²
- Red rust occurs
Key attributes of ZAM®

- Significant cost savings due to longer service life, lower maintenance and elimination of need for other coatings or treatments
- Thinner coating than other metallic coatings, thus reducing cost and benefiting the environment
- Superior cut edge rust protection over other coated products
- Performs exceptionally well in animal confinement environments (high chloride and ammonia) as compared to any other coated products

Significantly lower total cost, higher corrosion resistance and shorter processing time than batch galvanizing
Available sizes

Available coating weights

<table>
<thead>
<tr>
<th>Inch-pound units coating designation</th>
<th>SI units coating designation</th>
<th>Standard coating weight</th>
<th>Minimum coating weight triple spot test both sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZM 30</td>
<td>ZMM 90</td>
<td></td>
<td>Inch-pound units (ounces / square foot)</td>
</tr>
<tr>
<td>ZM 40</td>
<td>ZMM 120</td>
<td>0.30</td>
<td>90</td>
</tr>
<tr>
<td>ZM 60</td>
<td>ZMM 180</td>
<td>0.40</td>
<td>120</td>
</tr>
<tr>
<td>ZM 75</td>
<td>ZMM 220</td>
<td>0.60</td>
<td>180</td>
</tr>
<tr>
<td>ZM 90</td>
<td>ZMM 275</td>
<td>0.75</td>
<td>220</td>
</tr>
<tr>
<td>ZM 115</td>
<td>ZMM 350</td>
<td>0.90</td>
<td>275</td>
</tr>
</tbody>
</table>

Available steel grades

ASTM specified properties

<table>
<thead>
<tr>
<th>Designation</th>
<th>Grade</th>
<th>YS(min.)</th>
<th>TS(min)</th>
<th>El(min.)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ksi</td>
<td>Mpa</td>
<td>Ksi</td>
</tr>
<tr>
<td>SS</td>
<td>33</td>
<td>33</td>
<td>230</td>
<td>45</td>
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<td></td>
<td>37</td>
<td>37</td>
<td>255</td>
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<td></td>
<td>40</td>
<td>40</td>
<td>275</td>
<td>55</td>
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<tr>
<td></td>
<td>50 Class 1</td>
<td>50</td>
<td>340</td>
<td>65</td>
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<tr>
<td></td>
<td>50 Class 2</td>
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<td>80</td>
<td>550</td>
<td>82</td>
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<tr>
<td>HSLAS</td>
<td>50</td>
<td>50</td>
<td>340</td>
<td>60</td>
</tr>
<tr>
<td>HSLAS-F</td>
<td>50</td>
<td>50</td>
<td>340</td>
<td>60</td>
</tr>
</tbody>
</table>

Typical mechanical properties for standard grades

<table>
<thead>
<tr>
<th>Designation</th>
<th>YS</th>
<th>TS</th>
<th>EI</th>
<th>n Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ksi</td>
<td>Mpa</td>
<td>Ksi</td>
<td>Mpa</td>
</tr>
<tr>
<td>CS typeB</td>
<td>30 - 55</td>
<td>205 - 380</td>
<td>50 - 60</td>
<td>345 - 415</td>
</tr>
<tr>
<td>FS</td>
<td>25 - 45</td>
<td>170 - 310</td>
<td>45 - 55</td>
<td>310 - 380</td>
</tr>
<tr>
<td>DDS</td>
<td>20 - 35</td>
<td>140 - 240</td>
<td>40 - 50</td>
<td>275 - 345</td>
</tr>
<tr>
<td>EDDS</td>
<td>15 - 25</td>
<td>105 - 170</td>
<td>35 - 45</td>
<td>240 - 310</td>
</tr>
</tbody>
</table>

Specifications

ZAM® (Zinc-Aluminum-Magnesium Alloy-Coated sheet) conforms to ASTM specification A1046. Please inquire other specifications to your Wheeling-Nisshin technical or sales representative.
### FAQ

**Q. What is the paintability of ZAM®?**

**A.** ZAM® has the same paintability as galvanized steel. Pre-paint testing is recommended because paintability is subject to the painting materials.

**Q. What is the weldability of ZAM®?**

**A.** ZAM® is weldable. It is recommended that the welded portion be touched up with metallic paint. The potential for thinner coating layers give ZAM® an advantage over welding other coated products.*

**Q. Why is ZAM® considered to be ‘a bridge’ between galvanized steel and stainless steel?**

**A.** ZAM® offers superior corrosion resistance to galvanized steel but at a fraction of the cost of stainless steel. Applications which require high levels of corrosion resistance and low cost may prove perfect for ZAM®.

**Q. Why is ZAM® environmentally friendly?**

**A.** ZAM®s superior corrosion resistance will allow customers to significantly reduce coating thickness which benefits the environment. Specifically, reducing coating thickness effectively decreases the amount of minerals mined from the earth, reduces harmful runoff dispersed into the soil and reduces coating residue at steel recycling plants.

**Q. Why is ZAM®s corrosion resistance superior to other coated products?**

**A.** ZAM®s unique chemical composition of Zn, Al and Mg combines to form a very tight and hard coating layer. This unique coating develops thin film byproducts that are remarkably corrosion resistant—even over cut edges.

**Q. How does the ZAM® coating layer migrate over cut edges?**

**A.** When the ZAM® coating layer corrodes in the rain, Zn and Mg flow over the cut edge. These elements form a fine zinc-based protective film.

*Technical information on welding and touch-up painting is available upon request.*

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**Corrosion mechanism of ZAM®**

- **ZAM® Coating Layer**
- **Steel Base**
- **GI Coating Layer**
- **Steel Base**

- zinc and zinc-aluminum based protective surface film containing magnesium
- white rust composed primarily of zinc
- Red rust

- Progress of corrosion

Wheeling-Nisshin is a certified ISO-9001:2008 company assuring continuous improvement, structured operating guidelines, superior quality control, and the highest possible level of customer service. Wheeling-Nisshin has also earned the “SHARP” certification from OSHA; this is an achievement of status that singles us out among our business peers as a model for worksite safety and health. Wheeling-Nisshin’s goal has always been to produce the best possible quality product while protecting the safety, health, and environment of our employees and the surrounding communities.