Silver180™ is highly Corrosion-Resistant hot dip coated steel sheet that has a coating layer of Zinc, Aluminum, and Magnesium.

Areas of salt damage
- Areas within 2 km of a coast line: Environments subject to flying particles of sea salt (seawater mist)
- Highways, bridges and surrounding areas in cold regions: Environments where temperature differences are large and condensation is likely to occur

Facilities and compost plants related to agriculture and dairy farming
- Environments subject to high humidity and temperature, where temperature differences are large and condensation is likely to occur
- Environments with a strong alkaline atmosphere and where gases are generated from livestock feed, manure, etc.

Areas within 2 km of a coast line: Environments subject to flying particles of sea salt (seawater mist)

Highways, bridges and surrounding areas in cold regions: Environments where temperature differences are large and condensation is likely to occur

Agricultural houses, cattle sheds (henhouse, cowhouse, pigsty), compost houses and plants

Light gauge sheet iron, strip, pipes, wire, sheet metal, etc.

AZ180 Coating Offers the most Severe Corrosion Resistance.

PVDF paint is the TOP Quality Paint; No color Change for 20 years.

Hyper180™ is AZ180 Coating with PVDF Paint.

Application Environments that Require Higher Corrosion Resistance

Target Applications
- Multi-storied parking garages, factory buildings, plants, warehouses, bridges, highway and railway-related facilities, other civil engineering/building steel structures

Steel Products for Applications
- Light gauge sheet iron, strip, pipes, wire, sheet metal, etc.
- AZ180 Coating
- PVDF Paint

The contents of this catalogue are provided for the sole purpose of supplying information about the products and are not intended as warranties or representations about the quality of the products. Furthermore, please note that the contents of this catalogue are subject to change without prior notice.
**Introduction & Features**

**Silver180™**

**Contents**
- Introduction & Features: 2
- Corrosion Resistance & Recommended End Use: 3
- Typical applications: 4
- Manufacturing processes: 5
- Quality characteristics: 6 - 11
- Standards: 12
- Hyper180™: 13 - 15

Silver180™ is a pre-coated steel sheet that can be used in a wide variety of fields and applications due to its following features.

1. **Superior corrosion resistance**
   - In corrosion resistance, Silver180™ is 10 to 20 times tougher than galvanized steel sheet and 5 to 8 times better than Zinc Aluminum alloy coated steel sheet when subjected to accelerated testing.

2. **Superior scratch resistance**
   - Silver180™ has better scratch resistance than ordinary hot dip galvanized steel sheet.

3. **Replacement for post hot dip galvanized products (surface-treated in their final shapes)**
   - With its attribute to withstand severely corrosive environments, Silver180™ can replace post hot dip galvanized products and thus enable customers to streamline manufacturing processes.

   - Silver180™ can be called a resource-saving product since it lasts long and provides excellent corrosion resistance with relatively light coating.
   - Silver180™ can also be called an environment-friendly product since it satisfies requirements of such environmental regulations as RoHS and ELV *.

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**Corrosion Resistance & Recommended End Use**

**Recommended End Use**
- Silver180™ application Environments that Require Higher Corrosion/Alkaline Resistance.
- Application for Rafter (PebHybrid), Purlins, Girls, Sag Arrestors, Flange Bracing, Roofing, Mezzanine Decking, Valley Gutter for Industrial & Commercial construction.
- It is especially "The Right Material" for Chicken/Cow Sheds/Animal Feed/Fertilizer/Garbage Treatment/Concrete contact & Close to Sea/Ocean projects.

**Product Description:**

<table>
<thead>
<tr>
<th>Base Metal Thickness (mm)</th>
<th>Total Coating Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>0.8</td>
</tr>
<tr>
<td>1.45</td>
<td>1.5</td>
</tr>
<tr>
<td>1.95</td>
<td>1.9</td>
</tr>
<tr>
<td>2.35</td>
<td>2.4</td>
</tr>
<tr>
<td>2.95</td>
<td>3.0</td>
</tr>
</tbody>
</table>

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**Corrosion Resistance Mechanism of Chromate-free Coating Film**

**Structure and Function of Coating Films**

- **Chromate-Free Coating Film**
  - Function of Chromate Coating Film
    - Barrier effect
    - Self restoration function
  - Corrosion Resistance Mechanism of Chromate Coating Film
    - Chromate-free coating film uses substances selected because they provide the characteristic features of chromate film such as its barrier effect, selfrestorative function and paint adhesiveness. Chromate-free coated steel has been realized by use of this special coating film.

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**Chromate-Free Coating Film**

- **Function of Chromate Coating Film**
  - Barrier effect
  - Self restoration function

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**Effects similar to those offered by special coating film containing corrosion-suppression agent**
Typical Applications

Using Silver180™ coating:

- Flange Bracing
- Flange Bracing
- Valley Gutter
- Galvanizing pot
- PebDeck (Mezzanine decking)
- Sag Arrestors
- Flange Bracing
- PebHybrid
- Roofing

PebHybrid

Manufacturing Processes

Silver180™ Production Line

- Chicken / Cow Sheds
- Animal Feed
- Fertilizer
- Close to Sea / Ocean / Acid Rain
Quality Characteristics

1. Corrosion Resistance Mechanism of Silver180™

Corrosion resistance mechanism
Mg and Al in the coating layer combine to form a fine, tightly adhered protective film. This thin surface structure suppresses corrosion of the Silver180™ coating, thus effectively enhancing overall corrosion resistance.

2. Comparison of Properties with Various Types of Coated Steel Sheets

(1) Durability of flat parts

Time to occurrence of red rust in salt spray test (SST : JIS Z2371):

Silver180™ has better resistance to red rust than hot dip galvanized steel sheet and zinc-5% aluminum alloy coated.

The level of its corrosion resistance rivals that of 55% aluminum zinc alloy coated.

(2) Appearances of processed parts in a salt spray test (SST)

The photos show the occurrence of red rust on 1-mm-thick processed parts in salt spray test (SST). Due to its excellent ability to prevent corrosion, Silver180™ has better resistance to red rust on processed parts than 55% aluminum-zinc alloy coated steel sheet.

(3) Appearances of processed parts after outdoor exposure test

Silver180™ shows excellent corrosion resistance even in processed parts.

Red rust occurrence after salt spray test

Lapse of time before occurrence of red rust (hours)

One-side coating weight (gr/m²)

Lapse of outdoor exposure

Appearances of specimens after salt spray test

Coating weight : 90gr/m² (one side), untreated

Appearances of 1-mm-thick processed part after 90-day exposure tests

Thickess 1mm, 180° bending, Thickness : 3.2mm, 120/120gr/m², untreated

Waste Treatment – Severe Corrosion (Urea, Ammonia, etc)
3. Anti-Chemical Performance

1) Ammonia resistance

Silver180™ resistance to ammonia is better than that of hot-dip 55% aluminum-zinc alloy coated steel sheet.

![Corrosion Loss of Three Types of Coated Steel Sheets in Ammonia Water](image)

- **Materials tested**
  - Silver180™ Zn-Al-Mg
  - Galvanized steel
  - 55%Al-Zn alloy coated steel

- **Post-treatment**
  - Untreated

- **Corrosion Loss (gr/m²/day)**
  - Silver180™: 2x
  - Galvanized steel: 2x
  - 55%Al-Zn alloy coated steel: 55%Al-2x

- **Testing conditions**
  After immersion for 24 hours in 5% ammonia water at 22°C, the corrosion loss was measured. The cut ends and the rear surfaces of the test piece were sealed.

2) Resistance to chemicals (corrosion in Acidic and Alkaline aqueous solutions)

In Acidic and Alkaline aqueous solutions, Silver180™ shows the same corrosion behavior as zinc-based coated steel sheet.

![Corrosion Loss of Four Coated Steel Sheets in Acidic and Alkaline Aqueous Solutions](image)

- **Materials tested**
  - Silver180™ Zn-Al-Mg
  - Galvanized steel
  - 55%Al-Zn alloy coated steel

- **Post-treatment**
  - Untreated

- **Corrosion Loss (gr/m²/day)**
  - Silver180™: 2x
  - Galvanized steel: 2x
  - 55%Al-Zn alloy coated steel: 55%Al-2x

- **Testing method**
  - **Solution**: Starting with an aqueous solution containing 1gr/liter Na₂SO₄ as the base mix, its pH was varied from 1 to 14 by adding H₂SO₄ on the acidic side and NaOH on the alkaline side.
  - **To measure corrosion loss** test pieces (n=3) were immersed for 24 hours in a solution adjusted to each pH at 30°C, and the corrosion loss was determined. Ends and bottom surface of the test pieces were sealed.

4. Outdoor Exposure Test Results

According to results of exposure tests conducted over a period of approximately seven years, Silver180™ is four times as corrosion resistant as galvanized steel sheet. Since corrosion mass loss of zinc-aluminum coated steel sheet tends to lessen over time, the superiority of Silver180™ in this respect is likely to become more pronounced in subsequent years.

![Exposure Test Site](image)

- **Outdoor exposure test site**
  - Coastal environment: Okinawa Prefecture
  - Rural environment: Gunma Prefecture

- **Testing conditions**
  - After immersion for 24 hours in 5% ammonia water at 22°C, the corrosion loss was measured. The cut ends and the rear surfaces of the test piece were sealed.

- **Materials tested**
  - Galvanized steel
  - 55%Al-Zn alloy coated steel

- **Post-treatment**
  - Untreated

- **Corrosion Loss (gr/m²/day)**
  - Galvanized steel: 90gr/m²
  - 55%Al-Zn alloy coated steel: 90gr/m²

5. Closed Compost House Test Result (5 years)

Silver180™ showed better corrosion resistance than hot-dip 55% Al-Zn alloy coated sheet.

![Exposure Test in a Compost House](image)

- **Testing method**
  - Solution: Starting with an aqueous solution containing 1gr/liter Na₂SO₄ as the base mix, its pH was varied from 1 to 14 by adding H₂SO₄ on the acidic side and NaOH on the alkaline side.
  - **To measure corrosion loss** test pieces (n=3) were immersed for 24 hours in a solution adjusted to each pH at 30°C, and the corrosion loss was determined. Ends and bottom surface of the test pieces were sealed.
6. Resistance to Acid & Acid - Rain

Silver180™ shows better corrosion resistance than post hot dip galvanized products in a sulfur dioxide (sulfurous acid gas) environment.

Silver180™
Post hot dip galvanized products

Corrosion loss (gr/m²) vs. Test duration (h)

- Silver180™
  (Thickness 2.3mm, 80g/m² (one side))
- Post hot dip galvanized product
  (Thickness 2.3mm, 50g/m² (one side))

Occurrence of red rust

Sulfur dioxide test conditions
- Sulfur dioxide concentration: 100 ppm
- Testing temperature: 40°C
- Relative humidity: 98% or more (conforms to JIS HB0500)

Silver180™ shows better corrosion resistance than post hot dip galvanized products in acid-rain environment.

- Acid rain simulated combined-cycle corrosion test conditions
  1: Spraying (0.1% NaCl + H₂SO₄), 1hr, 35°C, pH: 4
  2: Drying, 4hrs, 50°C, relative humidity 30%
  3: Moisture, 3hrs, 50°C, relative humidity 98%

- Corrosion rate of Silver180™ and post hot dip galvanized products in acid-rain simulated combined-cycle corrosion test

<table>
<thead>
<tr>
<th>Classification</th>
<th>Coating layer</th>
<th>Coating weight</th>
<th>Substrate</th>
<th>Post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver180™</td>
<td>Zn - Al - Mg</td>
<td>90g/m² (one side)</td>
<td>Soft Steel</td>
<td>Untreated</td>
</tr>
<tr>
<td>Post hot dip galvanized products</td>
<td>Zn</td>
<td>550g/m² (one side)</td>
<td>Soft Steel</td>
<td>Untreated</td>
</tr>
</tbody>
</table>

7. Scratch resistance of the coating layer

Silver180™ has harder coating layer than hot dip galvanized steel sheet or hot dip 55% aluminum-zinc alloy coated steel sheet, which gives it better scratch resistance and allows it to be used in applications that are subject to scratching and repeated friction during processing.

Silver180™
55% Al-Zn alloy coated steel
25% Al-Zn alloy coated steel
Galvanized steel

Symmetry of tip of test needle: 0.05mm

8. 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.

<table>
<thead>
<tr>
<th>Cut edge part</th>
<th>Initial exposure period (up to several weeks)</th>
<th>Intermediate exposure period (several years to several decades)</th>
<th>Long exposure period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate</td>
<td>Initial rust due to oxidation, condensation, etc.</td>
<td>The fine zinc-based protective film containing Mg covers the cut edge with leaching of Zn, Al, and Mg from the coating layers.</td>
<td>The exposed cut edge of substrate is oxidized due to rain, condensation, etc.</td>
</tr>
</tbody>
</table>

Silver180™ shows better red-rust resistance (durability) on cut edge than any other coated steel sheet.

<table>
<thead>
<tr>
<th>Exposure period</th>
<th>Photos of cut edges</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short exposure</td>
<td>Initial rust due to oxidation, condensation, etc.</td>
<td>Middle brown color turns to gray</td>
</tr>
<tr>
<td>Intermediate exposure</td>
<td>The fine zinc-based protective film containing Mg covers the cut edge with leaching of Zn, Al, and Mg from the coating layers.</td>
<td>Gradually darker - black</td>
</tr>
<tr>
<td>Long exposure</td>
<td>The exposed cut edge of substrate is oxidized due to rain, condensation, etc.</td>
<td>Eventually turns to gray</td>
</tr>
</tbody>
</table>

8. Materials tested

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type of coating</th>
<th>Coating weight</th>
<th>Substrate</th>
<th>Post-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver180™</td>
<td>Zn - Al - Mg</td>
<td>90g/m² (one side)</td>
<td>Soft Steel</td>
<td>Untreated</td>
</tr>
<tr>
<td>Post hot dip galvanized products</td>
<td>Zn</td>
<td>550g/m² (one side)</td>
<td>Soft Steel</td>
<td>Untreated</td>
</tr>
</tbody>
</table>
Coating Mass

Products can be manufactured with the coating mass listed in the following table.

- Minimum coating mass (total mass on both surfaces)

<table>
<thead>
<tr>
<th>Symbol of coating mass</th>
<th>Minimum average coating mass in triple-spot test (gr/m²)</th>
<th>Minimum coating mass at a single spot (gr/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K 12</td>
<td>130</td>
<td>102</td>
</tr>
<tr>
<td>K 14</td>
<td>140</td>
<td>119</td>
</tr>
<tr>
<td>K 18</td>
<td>180</td>
<td>155</td>
</tr>
<tr>
<td>K 20</td>
<td>200</td>
<td>170</td>
</tr>
<tr>
<td>K 22</td>
<td>220</td>
<td>187</td>
</tr>
<tr>
<td>K 25</td>
<td>250</td>
<td>215</td>
</tr>
<tr>
<td>K 27</td>
<td>275</td>
<td>234</td>
</tr>
</tbody>
</table>

Quality and Quantity Tables

- Silver180™ Mass table for coating weight symbol K18

<table>
<thead>
<tr>
<th>Coating weight symbol K18</th>
<th>Coating weight</th>
<th>Normal</th>
<th>346</th>
<th>446</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width (mm)</td>
<td>914</td>
<td>1,219</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Length (mm)</td>
<td>1,029</td>
<td>2,438</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Area (m²)</td>
<td>1.672</td>
<td>2.852</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coating weight symbol K18</th>
<th>Coating weight</th>
<th>Thickness (mm)</th>
<th>Unit mass (kg/m²)</th>
<th>One-sheet mass (kg)</th>
<th>One-sheet mass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.27</td>
<td>2.364</td>
<td>3.95</td>
<td>7.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>2.596</td>
<td>4.34</td>
<td>7.72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>3.384</td>
<td>5.66</td>
<td>10.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>4.169</td>
<td>6.97</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>4.954</td>
<td>8.28</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>6.254</td>
<td>10.9</td>
<td>19.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>8.094</td>
<td>13.5</td>
<td>24.1</td>
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<tr>
<td></td>
<td>1.2</td>
<td>9.864</td>
<td>16.2</td>
<td>28.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>12.80</td>
<td>21.4</td>
<td>36.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>15.94</td>
<td>26.6</td>
<td>47.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>18.30</td>
<td>30.6</td>
<td>54.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>25.36</td>
<td>42.4</td>
<td>75.4</td>
<td></td>
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<td></td>
<td>4.0</td>
<td>31.64</td>
<td>52.9</td>
<td>94.0</td>
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</tr>
<tr>
<td></td>
<td>4.5</td>
<td>35.57</td>
<td>59.5</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.0</td>
<td>47.34</td>
<td>79.1</td>
<td>141</td>
<td></td>
</tr>
</tbody>
</table>
Feature

Hyper180™ has the following features:
- Excellent corrosion resistance
- Substrate is extremely high corrosion resistance
- The surface of Hyper180™ is coated by PVDF paint that demonstrates excellent corrosion resistance and no color change.

Performance List

<table>
<thead>
<tr>
<th>Examination item</th>
<th>Test method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface hardness test</td>
<td>Pencil hardness</td>
<td>&quot;2H&quot;</td>
</tr>
<tr>
<td>Formability test</td>
<td>Extrusion cross-hatch</td>
<td>No stripping</td>
</tr>
<tr>
<td>Impact test</td>
<td>Ø 1/2in 1kg 500mm height</td>
<td>No crack &amp; stripping</td>
</tr>
<tr>
<td>Salt-spray test</td>
<td>5% salt solution, 500h</td>
<td>No blistering</td>
</tr>
<tr>
<td>Weathering test</td>
<td>Sunshine WOM 1,000h</td>
<td>No change in appearance</td>
</tr>
</tbody>
</table>

The following photomicrographs [1000x magnification] of test panels dramatically depict how Hyper180™ PVDF resin-based metal coatings resist degradation caused by photoinitiated oxidation and hydrolysis when exposed to a subtropical environment from 60 to 160 months.

Nothing works better longer.

In applications worldwide, Hyper180™ PVDF resin-based metal coatings have demonstrated superior performance and outstanding resistance to film degradation. These coatings will withstand extended exterior exposure to water, humidity, temperature, ultraviolet rays, oxygen and atmospheric pollutants.

The performance comparisons to the right were compiled by an independent, accredited testing laboratory and are based on actual exposure time.

Higher Performance of Hyper180™ PVDF Resin-Based Coatings.

In all critical measures of performance, Hyper180™ resin-based finishes deliver dramatically higher performance than other coating products. The charts below show relative performance based on published evaluations of generic coatings and the opinions of leading coating formulators.