Animal barns and composting sheds
About ZAM®, which is suitable for animal barns and composting sheds

Because ZAM® has excellent resistance to ammonia and dampness, it is suitable for animal barns and composting sheds, which have a damp, harsh environment with the strong corrosiveness caused by livestock excreta and breath.

What the environment of animal barns and composting sheds is like

<table>
<thead>
<tr>
<th>Structure</th>
<th>Main type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow barn</td>
<td>open</td>
</tr>
<tr>
<td>Pigsty</td>
<td>enclosed</td>
</tr>
<tr>
<td>Chicken coop</td>
<td>enclosed</td>
</tr>
<tr>
<td>Composting shed</td>
<td>open</td>
</tr>
</tbody>
</table>

<Environment for raising livestock>
- Pigsty: Humidity regulation (under-floor watering, water spraying), temperature regulation (no greater than 10℃ difference between highest and lowest temperature of the day), ventilation, heat insulation.
- Chicken coop: Humidity regulation, temperature control (23-24℃), ventilation, heat insulation.
- Composting shed: Increase in temperature as compost is generated. Ammonia and water vapor are produced.

<Environmental factors>
- Ammonia
- Moisture

Resistance to ammonia

ZAM® has better resistance to ammonia than galvanized steel or 55%Al-Zn alloy coated steel.

<table>
<thead>
<tr>
<th>Our product name</th>
<th>Type of coating</th>
<th>Coating weight</th>
<th>Grade</th>
<th>Post treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZAM*</td>
<td>Zn+6%Al-3%Mg</td>
<td>90g/m² (one side)</td>
<td>mild steel</td>
<td>untreated</td>
</tr>
<tr>
<td>Galvanized steel</td>
<td>Zn</td>
<td>90g/m² (one side)</td>
<td>mild steel</td>
<td>untreated</td>
</tr>
<tr>
<td>55%Al-Zn alloy coated steel</td>
<td>55%Al-Zn</td>
<td>80g/m² (one side)</td>
<td>mild steel</td>
<td>untreated</td>
</tr>
</tbody>
</table>

• Samples

• Testing conditions
The corrosion weight loss was measured after immersion for 24 hours in 5% aqueous solution of ammonia at 22℃. Also, the end faces and rear surfaces of the test pieces are sealed.

Resistance to dampness

ZAM® has better resistance to humidity than Galvanized steel or 55%Al-Zn alloy coated steel.

Photo: 70℃ humidity test results

*ZAM is a coined name applied to hot-dipped zinc-alloy-coated steel sheets developed by Nisshin Steel Co., Ltd.
Results of exposure tests in enclosed composting sheds (in an ammonia atmosphere)

ZAM® showed better corrosion resistance than 55%Al-Zn alloy coated steel.

Available sizes

Cold-rolled substrate

Hot-rolled substrate

Examples of processed products

Processed Products

Light weight shaped steels

Round pipes

Applications

Heat insulation roof materials

Washer

Agricultural ventilation fan

* Consult us about the details because the manufactureable range varies depending on the specifications.

* Thicknesses other than the above can also be manufactured so please consult us.
Construction examples

Animal barns and composting sheds

- Chicken coop roof (corrugated)
- Cow barn roof (corrugated)
- Pigsty roof (corrugated)
- Composting shed roofs and walls (corrugated)

Composting sheds built with ZAM® structural material

- Interior of composting shed
- Composting shed structural material (shape steel, H-shaped steel)
- Outside appearance of composting shed
- Composting shed structural material (section steel, H-section steel)
Notice

■ Precautions in use

- Handling
  - In order not to damage the coating surface, handle the product carefully and do not put any sweat or finger smudges on the surface.
  - If the surface should become damaged, repair it.
  - Be careful when removing a coil band because the end of the coil could spring up as it unwinds.
  - Store products securely, so that coils do not tip over and stacked-up cut sheets do not topple.
  - Be careful of water or condensation on the products. If packaging paper is damaged, repair it.

- Processing
  - If the surface is damaged during processing, it could adversely affect corrosion resistance and paintability. In pressing in particular, some types of lubricating oil could corrode the coating layer, therefore check the compatibility before use. When lubricant is used, perform degreasing or other post-treatment after the processing.
  - Steel sheet tends to harden as time passes, which can degrade workability. To avoid this, use the steel sheet as soon as possible.

- Welding
  - Like other galvanized steel sheet, ZAM® is affected by the coating layer, which is of a low-melting-point metal.
  - In arc welding, there is an increase in spattering and blowholes as compared with hot- or cold-rolled steel sheet, and a reduction in strength due to cracking tends to occur. However if the conditions are properly selected, joints can be obtained that present no problems in junction strength.
  - Welding is also affected by such factors as the welding machine and the shape of the joint, hence welding tests are recommended.
  - In resistance welding, take care of the contamination that occurs on electrodes due to their picking up zinc.
  - Do welding in a well ventilated area, because fumes (white smoke) will occur whose main component is zinc oxide.

- Installation
  - To avoid electric corrosion when using stainless-steel bolts for attachment fixtures, use insulating packing.

■ White spots on hot-dip galvanized steel sheets
  - When hot-dip galvanized steel sheets are used outdoors, “white spots” develop on the surface in six months to two years, depending on the conditions of use.
  - The cause of such white spots is iron and copper present in airborne particles. As these elements adhere to the coated sheet surface, the surrounding coating layer reacts to form highly-adhering corrosive product in a pattern of white spots around them.
  - An effective approach to minimize the development of white spots is designing and building structures to have these airborne articles washed off easily—e.g. for example with steep roof pitches.

■ The phenomenon of blackening of hot dip zinc-based coating
  - It is known from experience that hot dip galvanized steel sheet (non-alloy type) is subject to blackening, which is peculiar to this material. This phenomenon occurs regardless of the manufacturer of the material. Discoloration similarly occurs also in hot dip zinc-based alloy coated steel sheet.
  - Blackening is a phenomenon in which the steel sheet appears black due to the presence of a very thin oxide film on the zinc surface layer. In hot dip galvanized steel sheet (non-alloy type), a very thin oxide film whose principal component is ZnO is formed on the zinc coating surface layer even immediately after manufacturing, but it has the property of changing and growing as time passes. From our experience thus far, we infer that this phenomenon of blackening occurs by the following mechanism.
    1. An oxide film grows
    2. The structure and thickness of the oxide film change
    3. The changes state of (2) causes a change in the optical absorption coefficient
    4. The surface takes on a black appearance

  - In hot dip zinc-based alloy coated steel sheet the zinc surface layer is covered with a very thin oxide film (mainly composed of ZnO). But the rate at which the oxide film changes and grows varies depending on such conditions as the structure and composition of the material as well as environmental factors, and the time until blackening becomes noticeable varies.
  - This blackening is unavoidable, but it is known to occur more readily under conditions of high temperature and high humidity.
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