

# PosMAC<sup>®</sup> 3.0

**POSCO Magnesium Aluminium  
alloy Coating product**

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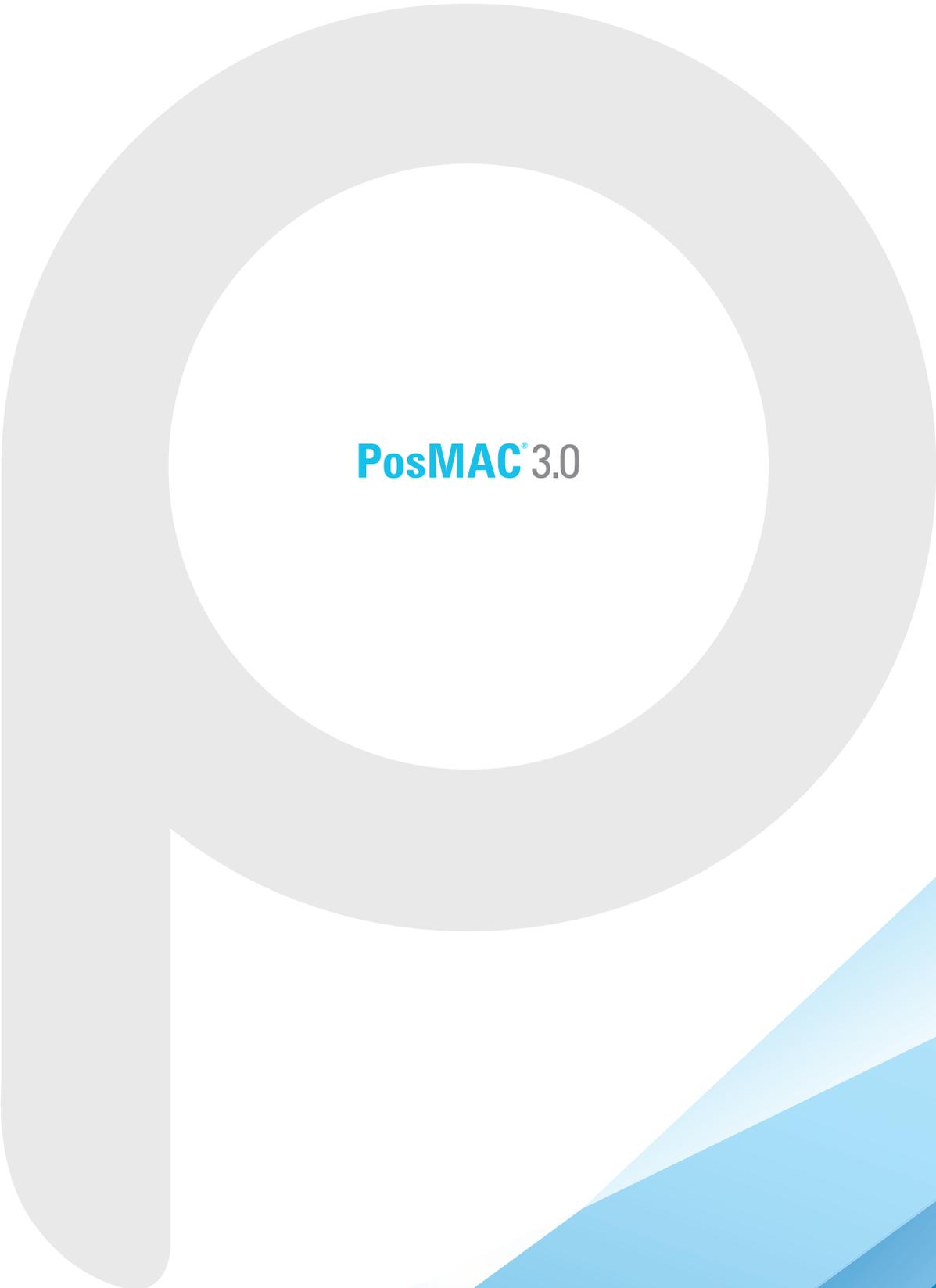




PosMAC<sup>®</sup>3.0 is a range of steel products that provide 5 to 10 times greater corrosion resistance compared with ordinary hot-dip galvanized steel sheet (GI, GI(H)) of the same coating weight. PosMAC<sup>®</sup>3.0 especially has an excellent cross section corrosion resistance. Ordinary products having thick plating can be replaced with it. The same processing, assembly and painting processes can be applied to PosMAC<sup>®</sup>3.0 as one would apply to GI steels.

## Contents

<b>What is PosMAC<sup>®</sup>3.0?</b>	<b>04</b>
<b>Equipment specifications</b>	<b>04</b>
<b>Manufacturing equipment</b>	<b>05</b>
<b>Corrosion resistance of PosMAC<sup>®</sup>3.0</b>	<b>06</b>
Why PosMAC <sup>®</sup> 3.0 has excellent corrosion resistance?	<b>06</b>
Comparison to galvanized (GI(H)) /	
Galvalume in corrosion resistance on flat surfaces(SST)	<b>07</b>
Comparison to galvanized (GI(H)) /	
Galvalume in corrosion resistance on flat surfaces(CCT)	<b>07</b>
PosMAC <sup>®</sup> 3.0's corrosion resistance on flat sheets compared to batch plated GI	<b>08</b>
PosMAC <sup>®</sup> 3.0's corrosion resistance on bent areas compared to that	
of hot dip galvanized steel (GI(H)) and galvalume	<b>08</b>
Corrosion resistance of cup drawing region	<b>08</b>
PosMAC <sup>®</sup> 3.0's corrosion resistance of processed product	<b>09</b>
Weathering test on cross sectional part(Korea Conformity Laboratories)	<b>10</b>
Estimation of PosMAC <sup>®</sup> 3.0's longevity(KOBELCO from Japan)	<b>10</b>
White rust occurrence of the PosMAC <sup>®</sup> 3.0	<b>11</b>
Galling & scratch resistance of PosMAC <sup>®</sup> 3.0	<b>11</b>
<b>Chemical resistance of PosMAC<sup>®</sup>3.0</b>	<b>12</b>
Chemical resistance to ammonia solutions	<b>14</b>
Acid rain simulation test results	<b>15</b>
<b>Phosphating property of PosMAC<sup>®</sup>3.0</b>	<b>16</b>
<b>Weldability of PosMAC<sup>®</sup>3.0</b>	<b>17</b>
Gas metal arc(GMA) welding	<b>17</b>
Spot welding	<b>20</b>
High frequency pipe-making welding	<b>20</b>
Laser beam welding	<b>21</b>
<b>Post-treatment for PosMAC<sup>®</sup>3.0 only</b>	<b>22</b>
<b>Bolt for PosMAC<sup>®</sup>3.0 only</b>	<b>23</b>
<b>Main usage</b>	<b>24</b>
<b>Post-treatment</b>	<b>28</b>
Organic ingredient Cr-free(NB)	<b>28</b>
Inorganic ingredient Cr-free(NT)	<b>28</b>
Cr <sup>3+</sup> +Eco chromate(CE)	<b>28</b>
<b>PosMAC<sup>®</sup>3.0(HR Base) specification</b>	<b>29</b>
<b>PosMAC<sup>®</sup>3.0(CR Base) specification</b>	<b>33</b>
<b>KS D 3030</b>	<b>37</b>
<b>Warranty</b>	<b>42</b>
<b>Patent / EPD</b>	<b>43</b>
<b>Order guide</b>	<b>44</b>
<b>Cautions on use</b>	<b>45</b>
<b>Packing</b>	<b>46</b>



**PosMAC®3.0**

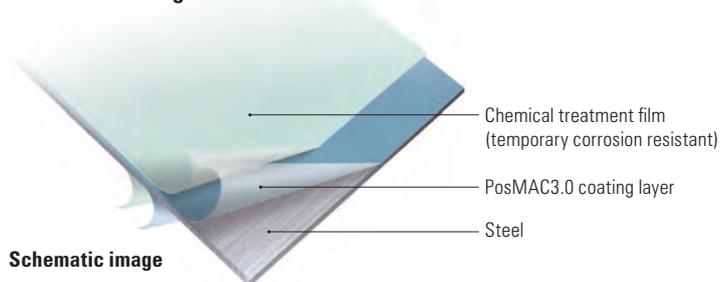
# What is PosMAC<sup>®</sup>3.0?

## What is PosMAC<sup>®</sup>3.0?

PosMAC3.0(POSCO Magnesium Aluminium alloy Coating product) is a ternary alloy coated steel(Zn- 3%Mg- 2.5%Al) with high corrosion resistance developed with POSCO's own technology.

\* **PosMAC<sup>®</sup>3.0** is the registered trademark of POSCO.

### Product configuration



### Product characteristics

- PosMAC3.0 is a corrosion resistant products that is 5 to 10 times stronger resistance than that of a normal hot-dip galvanized steel sheet(GI, GI(H)) with the same coating weight. PosMAC3.0 has an excellent cross-section corrosion resistance; normal thick plating products can be replaced with this product.
- The same processing, assembly and painting process can be applied to PosMAC3.0 as one would apply to GI.

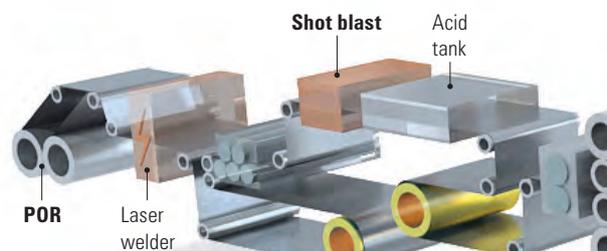
### Product characteristics comparison

- PosMAC3.0 is superior to GI in corrosion resistance on flat, machined, cross-section parts and is superior to galvalume in cross-section corrosion resistance.

Quality items		PosMAC3.0	GI	Galvalume
Hardness(Hv) of coating layer		110~130	60~80	80~100
Friction characteristics		◎	X	△
Corrosion resistance	Flat sheet	◎	△	◎
	Bending	◎	△	△
	Cup	◎	△	◎
	Cross-section	◎	△	X
Chemical resistance		◎	△	△
Weldability		◎	◎	◎

## Equipment specifications

Classification		Pohang #1CGL	Gwangyang #2CGL
Operation date		2012. 04	1992.6
Capacity		750 thousands ton/year	510 thousands ton/year
Product dimensions	Thickness	0.4~4.5mm	0.45~2.3mm
	Width	800~1650mm	720~1860mm
Coating weight		60~400 g/m <sup>2</sup>	80~350g/m <sup>2</sup>
Product grade		General, Structural	Automobile, General, Structural
Post treatment		Chromate(Cr <sup>6+</sup> , Cr <sup>3+</sup> ), Cr-free, Oiling	Chromate(Cr <sup>3+</sup> ), Oiling



# Manufacturing equipment

## Entry



The equipments at the entry section are composed of two pay off reels and a welder.

## Shot blast, Pickling



The scales from an HR coil can be removed completely by passing through the shot blast and pickling tank.

## Galvanizing



Zn-Mg-Al is coated onto the surface of the steel sheet after passing the annealing furnace in the pot reserved for PosMAC3.0, and then the targeted coating weight is achieved by spraying high pressurized air from the air knife.

## SPM & Post treatment

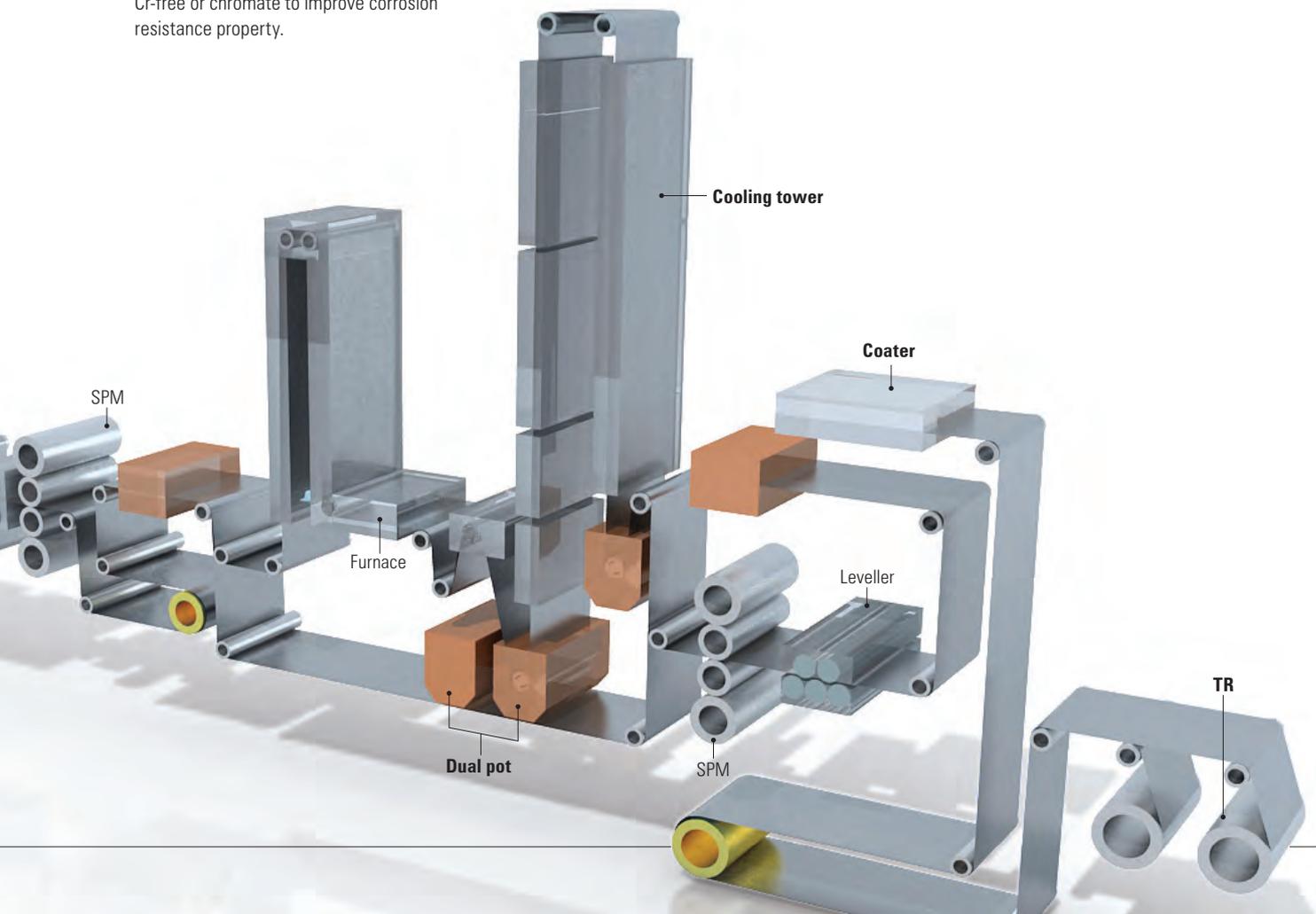


In order to obtain the flat shape and elegant surface, PosMAC3.0 product get passed through a skin pass mill. Also to prevent any white rust, product surface is coated with Cr-free or chromate to improve corrosion resistance property.

## Inspection & Coiling



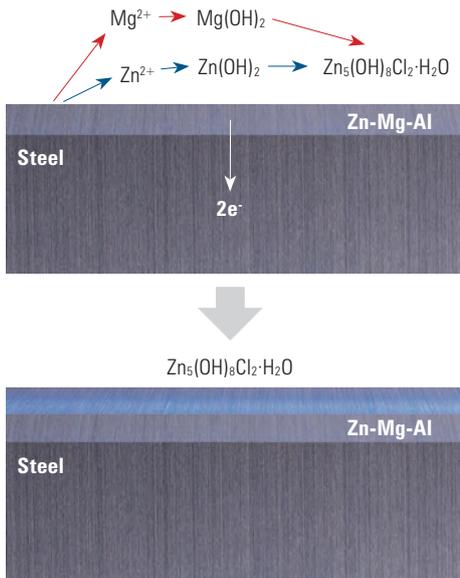
The equipment at the exit section are composed of an inspection table and an oiler equipment where the products are inspected synthetically and judged whether they are adequate for sale.



# Corrosion resistance of PosMAC®3.0

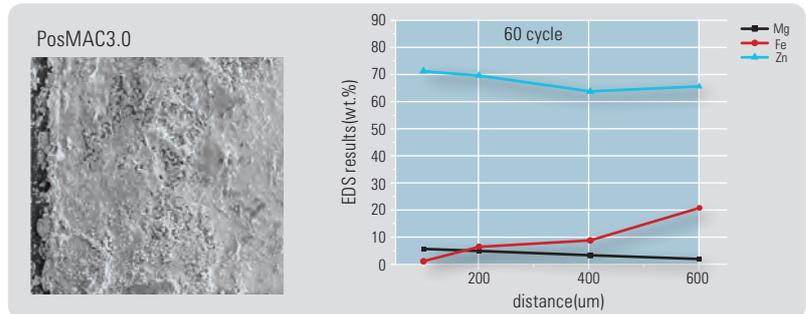
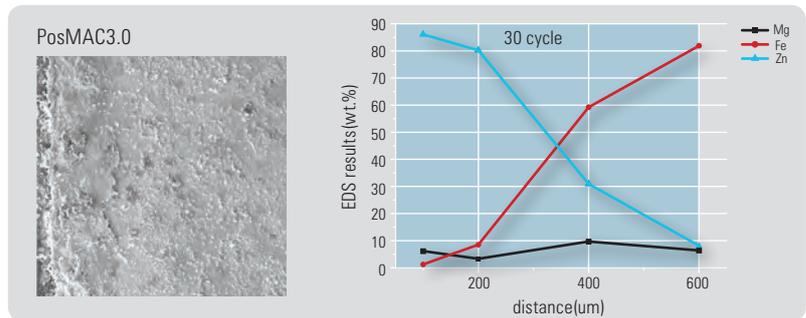
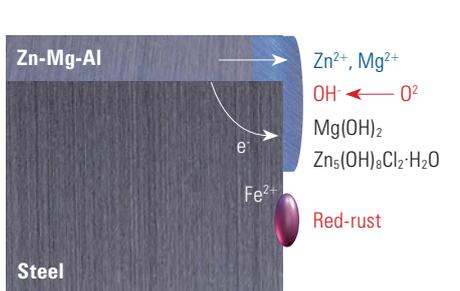
## Why PosMAC®3.0 has excellent corrosion resistance?

The magnesium(Mg) in PosMAC3.0's coating layer will accelerate the formation of a dense corrosion product called "Simonkollite ( $Zn_5(OH)_8Cl_2 \cdot H_2O$ )" which is extremely stable. When simonkollite is formed on the surface of the coating layer in a film-like-form, it plays a role as a corrosion inhibitor for the base metal.

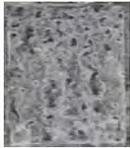


CCT	Surface	Cross-section
30 cycle		
60 cycle		

In addition, the upper coating layer can be dissolved to cover the cross-section and accelerate the growth of a stable corrosion product. However red-rust can be found in the already exposed steel plate, but fortunately, the film of the corrosion products covers the cross-section and serves to prevent corrosion.



### Comparison to galvanized(GI(H)) / Galvalume in corrosion resistance on flat surfaces(SST)

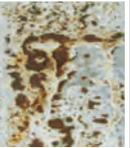
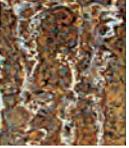
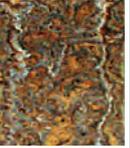
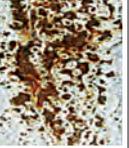
SST	PosMAC3.0			
	GI(H)	Galvalume	200g/m <sup>2</sup>	350g/m <sup>2</sup>
The coating weight on both sides	600g/m <sup>2</sup>	100g/m <sup>2</sup>	200g/m <sup>2</sup>	350g/m <sup>2</sup>
480Hr				
720Hr				
1440Hr				
2400Hr				

- PosMAC3.0 shows 5 to 10 times the corrosion resistance compared to galvanized steel sheet on flat surfaces.
- In addition, PosMAC3.0 shows equal or greater corrosion resistance than Galvalume on flat surfaces.

**Test method :**  
Salt Spray Test (SST),  
[ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

### Comparison to galvanized(GI(H)) / Galvalume in corrosion resistance on flat surfaces(CCT)

- PosMAC3.0 shows 5 to 10 times the corrosion resistance compared to galvanized steel sheet on flat surfaces.
- In addition, PosMAC3.0 shows equal or greater corrosion resistance than galvalume on flat surfaces.

CCT	GI(H)				Galvalume	PosMAC3.0		
	120g/m <sup>2</sup>	200g/m <sup>2</sup>	300g/m <sup>2</sup>	600g/m <sup>2</sup>		100g/m <sup>2</sup>	140g/m <sup>2</sup>	200g/m <sup>2</sup>
The coating weight on both sides	120g/m <sup>2</sup>	200g/m <sup>2</sup>	300g/m <sup>2</sup>	600g/m <sup>2</sup>	100g/m <sup>2</sup>	140g/m <sup>2</sup>	200g/m <sup>2</sup>	275g/m <sup>2</sup>
10 cycle (80Hr)								
70 cycle (560Hr)								
120 cycle (960Hr)								

**Test method :** Cyclic Corrosion Test (CCT),  
[ISO 14993] 1Cycle : Salt Spray 2Hr(5%NaCl, 35%) → Dry 4Hr(25%RH, 60°C) → Wet 2Hr(95%RH, 50°C)

# Corrosion resistance of PosMAC<sup>®</sup>3.0

Batch



## PosMAC<sup>®</sup>3.0's corrosion resistance on flat sheets compared to batch plated GI

(Korea Testing & Research Institute : Test No. TBO-000048)

PosMAC3.0 shows 5~10 times corrosion resistance to that of batch plated GI sheet.

SST	PosMAC3.0		Batch plated GI
	60g/m <sup>2</sup>	300g/m <sup>2</sup>	550g/m <sup>2</sup>
480 Hr			
720 Hr			

SST	PosMAC3.0		Batch plated GI
	60g/m <sup>2</sup>	300g/m <sup>2</sup>	550g/m <sup>2</sup>
1200 Hr			
2400 Hr			

**Test method** : Salt Spray Test (SST), [ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

## PosMAC<sup>®</sup>3.0's corrosion resistance on bent areas compared to that of hot dip galvanized steel(GI(H)) and galvalume

PosMAC3.0 shows 2~3 times corrosion resistance to that of GI(H) and Galvalume on bent areas.

Thickness/ Steel type	2.0 mmt CQ Grade		
	PosMAC3.0	GI(H)	Galvalume
SST	PosMAC3.0	GI(H)	Galvalume
Coating weight	140g/m <sup>2</sup>	140g/m <sup>2</sup>	140g/m <sup>2</sup>
800 Hr			
1200 Hr			

**Test method** : Salt Spray Test (SST), [ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

## Corrosion resistance of cup drawing region

Corrosion resistance of PosMAC3.0 is 2~3 times higher than that of GI(H) while equal to that of Galvalume.

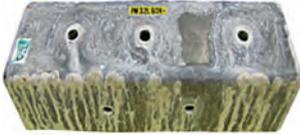
CCT	PosMAC3.0	GI(H)	Galvalume
Coating weight	275g/m <sup>2</sup>	350g/m <sup>2</sup>	200g/m <sup>2</sup>
60 cycle		 Red-rust happened after 35 cycle	
80 cycle			
100 cycle			

**Test method** : Cup Drawing → Cyclic Corrosion Test (CCT), [ISO 14993] 1Cycle : Salt Spray 2Hr(5%NaCl, 35%) → Dry 4Hr(25%RH, 60°C) → Wet 2Hr(95%RH, 50°C)

## PosMAC®3.0's corrosion resistance of processed product

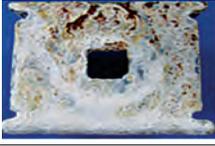
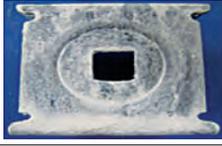
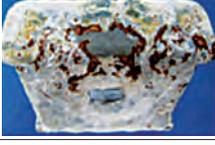
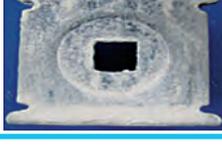
- **Processed product** : C-Type steel for solar photovoltaic power generator support structure.



Division		Coating weight	Processed area	Frontal cross-section
SST 500Hr	Batch-GI	370.3g/m <sup>2</sup> (One side)		
	PosMAC3.0	116.1g/m <sup>2</sup> (One side)		

**Test method** : Salt Spray Test (SST), [ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

- **Processed product** : Square type part for solar photovoltaic power generator support structure

Division	Batch-GI	PosMAC3.0
	432g/m <sup>2</sup> (One side)	195g/m <sup>2</sup> (One side)
SST 1000Hr		
		
SST 2000Hr		
		

**Test method** : Salt Spray Test (SST), [ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

# Corrosion resistance of PosMAC<sup>®</sup>3.0

## Weathering test on cross-section part (Korea conformity laboratories)

- Corrosion resistance in cross-section parts of PosMAC3.0, is superior to that of GI(H) and galvalume.
- PosMAC3.0 also gets red-rust in cross-section parts when initially exposed outdoors. However as the time goes by, the corrosion(red-rust) area of PosMAC3.0 tends to decrease through the formation of its distinctive oxide-based material(simonkolleite).
- If the thickness of PosMAC3.0 is more than 1.6t, we recommend post-treatment(catalog 19p, 22p), because it is not fully covered by simonkolleite after 1 year. And when the thickness of PosMAC3.0 is less than 1.6t and cross-section parts is clean without red-rust at initial construction, it is recommended to carry out post-treatment by the option of the customers.



Outdoor exposure test

Sample	Thickness	Coating weight (g/m <sup>2</sup> )	Cross-section image		
			After 6 months	After 1 year	After 2 years
PosMAC3.0	1.2	130			
	1.6	120			
	2.0	300			
Galvalume	1.6	120			
GI(H)	1.6	180			

Note. Outdoor exposure test at seosan chemical industrial complex(Oct. '12 ~ Oct. '14, Korea conformity laboratories)

## Estimation of PosMAC<sup>®</sup>3.0's longevity (KOBELCO from Japan)

Classification	Test sample	Thickness(mm)	Coating weight (Both sides, g/m <sup>2</sup> )	Post-treatment	Corrosion start time of Fe(CCT)	Estimate of longevity (Salt damage environment)
Ternary alloy coated steel	PosMAC3.0 (POSCO)	2.0	140	Cr	1,920Hr	50 years
		2.0	350	Cr-free(NB)	3,700Hr	100 years
	Competitor's high corrosion resistant Type 1	2.0	120	Cr-free	1,920Hr	50 years
		1.6	190	Cr	2,200Hr	60 years
	Type 2	0.27	120	Cr-free	2,200Hr	60 years
Galvanized steel	GI(H) (POSCO)	2.0	600	Cr	960Hr	25 years(Base)
	Batch GI (Domestic galvanizer)	2.0	1,000	-	960Hr	25 years

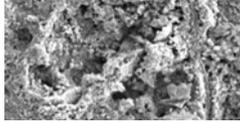
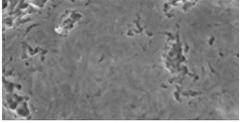
Test Method : Cyclic Corrosion Test (CCT), [ISO 14993] 1Cycle : Salt Spray 2Hr(5%NaCl, 35%) → Dry 4Hr(25%RH, 60°C) → Wet 2Hr(95%RH, 50°C)

Evaluation of longevity : Japan's bridge construction association stated that the longevity of a GI with K600 zinc coating has a corrosion resistance longevity of 25years. Based on this study the relative longevity of other comparable steel products was extracted.

### White rust occurrence of the PosMAC®3.0

- PosMAC3.0 is strong corrosion-resistant steel to protect the base metal by forming oxide of a dense structure called simonkolleite.
- Therefore, white rust also can occur as usual galvanized steel. To avoid white rust of PosMAC3.0 before the construction, the following should be noted.

### ■ FE-SEM image comparison of the corrosion product of the PosMAC3.0 & GI

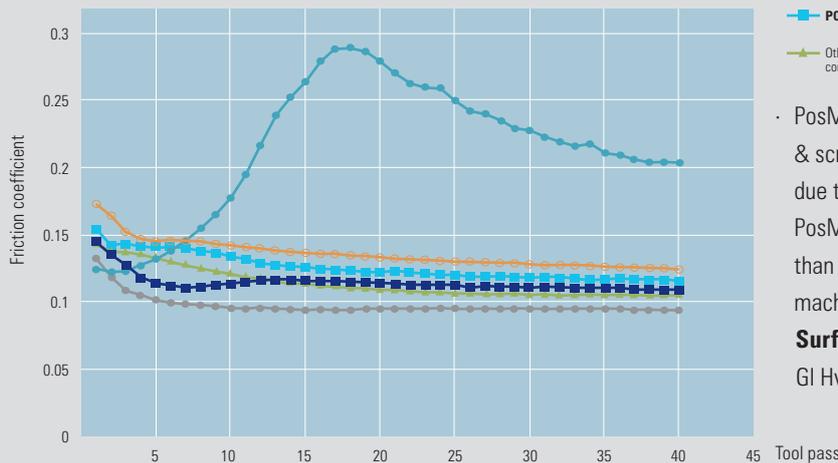
Division	GI	PosMAC3.0
Classification	ZnO	Zn <sub>5</sub> (OH) <sub>8</sub> Cl <sub>2</sub> , H <sub>2</sub> O, Zn <sub>4</sub> CO <sub>3</sub> (OH) <sub>6</sub> , H <sub>2</sub> O
Image	 Porous & incompact structure	 Stable & dense structure

### ■ Precautions when storing the PosMAC3.0 before the construction

- Coils, sheet, and processed products must be kept dry and smooth-ventilated place. White rust can be caused by water vapor on the ground floor when storing.
- Set vinyl and the thick pentagonal timber(thicker than 10mm recommended) on the ground first and stack the coils to ventilate ordinarily.
- The coil and sheet should be wrapped when raining and if the rain stops, the package should be removed so that the internal water could evaporate and get removed.
- To cover vinyl above the unpackaged coil where it has moisture in the air should not be kept for a long time as it might promote the reaction with coil and the moisture.
- When keeping the coil for a long time, it should be used quickly and in first-in-first-out manner since there is the possibility that white rust might occur.
- The unpackaged or package-separated coils have to be used quickly.

### Galling & scratch resistance of PosMAC®3.0

#### ■ Surface hardness vs. Tool pass for various plated steels

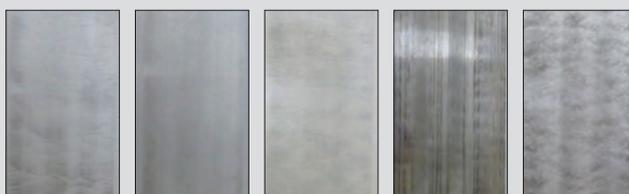


■ POSMAC3.0 1      ● Other company's high corrosion-resistant type 2  
■ POSMAC3.0 2      ● GI  
▲ Other company's high corrosion-resistant type 1      ○ Galvalume

- PosMAC3.0 has particularly excellent galling & scratch resistance compared to that of GI due to its high surface hardness. Consequently, PosMAC3.0 excretes less dust-like compound than a GI, so our customers can keep their press machines clean during the forming process.

**Surface hardness** : PosMAC3.0 Hv 110~130, GI Hv 60~80, Galvalume Hv 80~100

#### ■ Surface appearance after friction test



PosMAC3.0    Type 1    Type 2    GI    Galvalume

#### Test condition

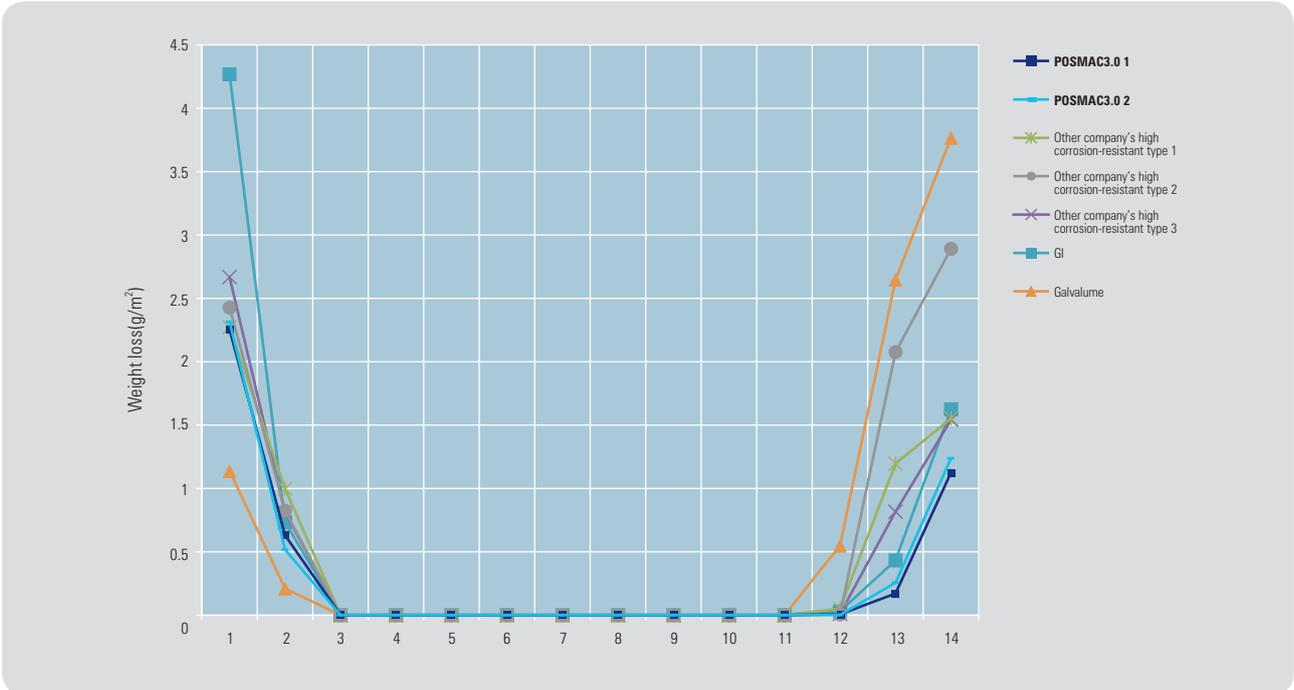
- Target force : 333.3 kgf, Pressure : 3.736 MPa
- Tip movement : 200 mm length, 20 mm/sec rate
- Avg. calculation region : 30mm ~ 170mm
- P-DBH(washing oil) oiled.

Type 1, 2 Other company's high corrosion-resistant

# Chemical resistance of PosMAC®3.0

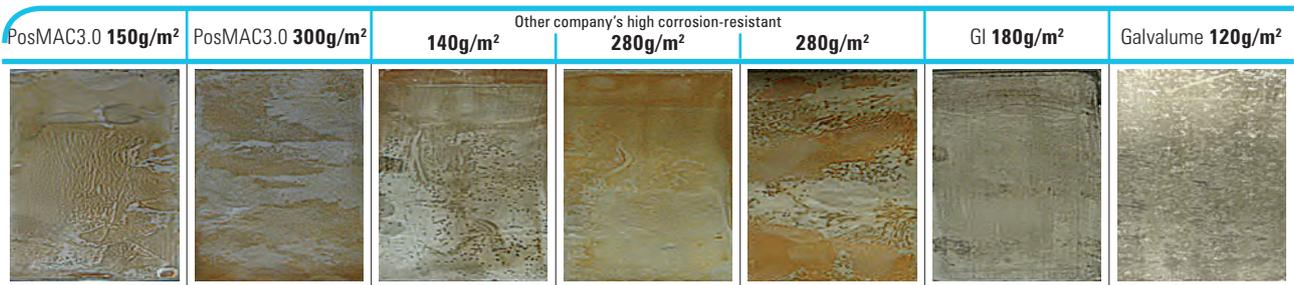
- PosMAC3.0 shows less weight loss of plating layer in comparison to GI and galvalume under either an acidic or an alkaline environment. This means that PosMAC3.0 is much more resistant to potent chemicals than other plated steels products.
- GI and galvalume are especially weak under the strong acidic condition (pH 1~2) and strong basic condition (pH 13~14), respectively.
- PosMAC3.0 is applicable for farm housing and building materials thanks to its excellent chemical resistance.

## Weight loss of plating layer vs. pH for various plated steels

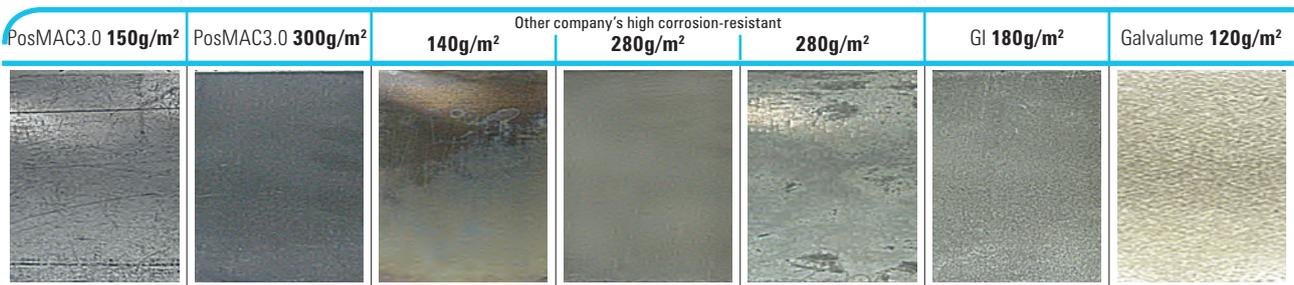


**Test method :** Weighing the loss of plated layer after dipping into various solutions (pH 1~14, H<sub>2</sub>SO<sub>4</sub>, NaOH and NH<sub>3</sub> single or mixed) for 24 hours.

## Chemical resistance against pH 1 solutions

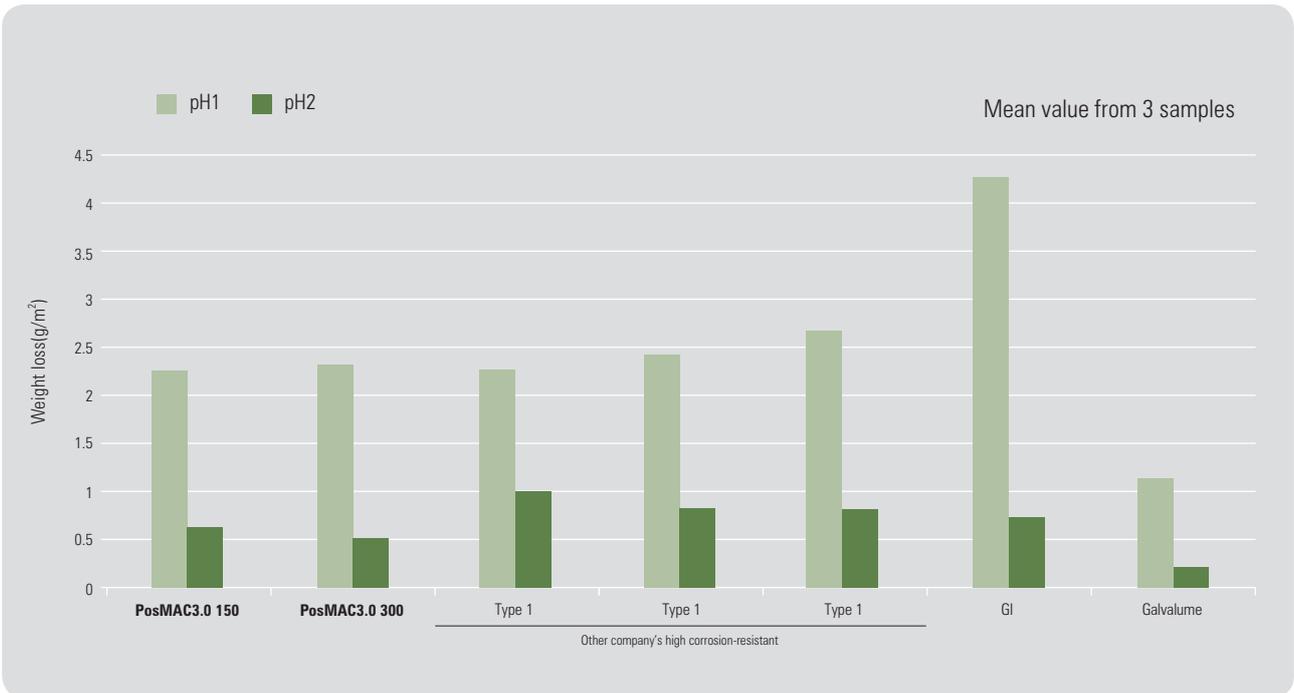


## Chemical resistance against pH 2 solutions

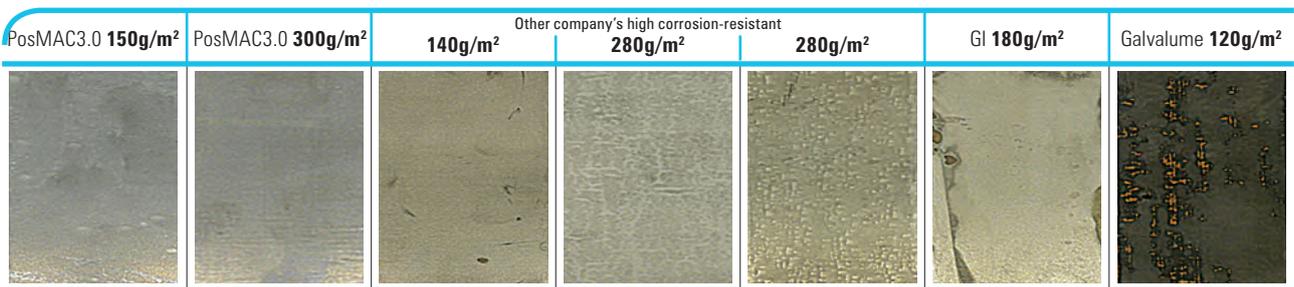


- All of the commercial alloy plated steels above shows similar chemical resistance under acidic conditions(pH 1~2).
- The galvalume which has the highest Al content shows the highest chemical resistance under acidic conditions(pH 1~2).

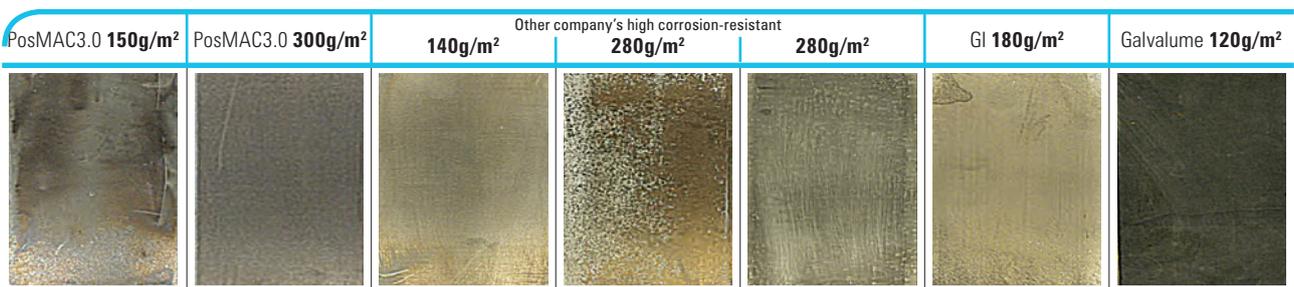
■ Weight loss from pH 1 and 2 solutions



■ Chemical resistance against pH 13 solutions

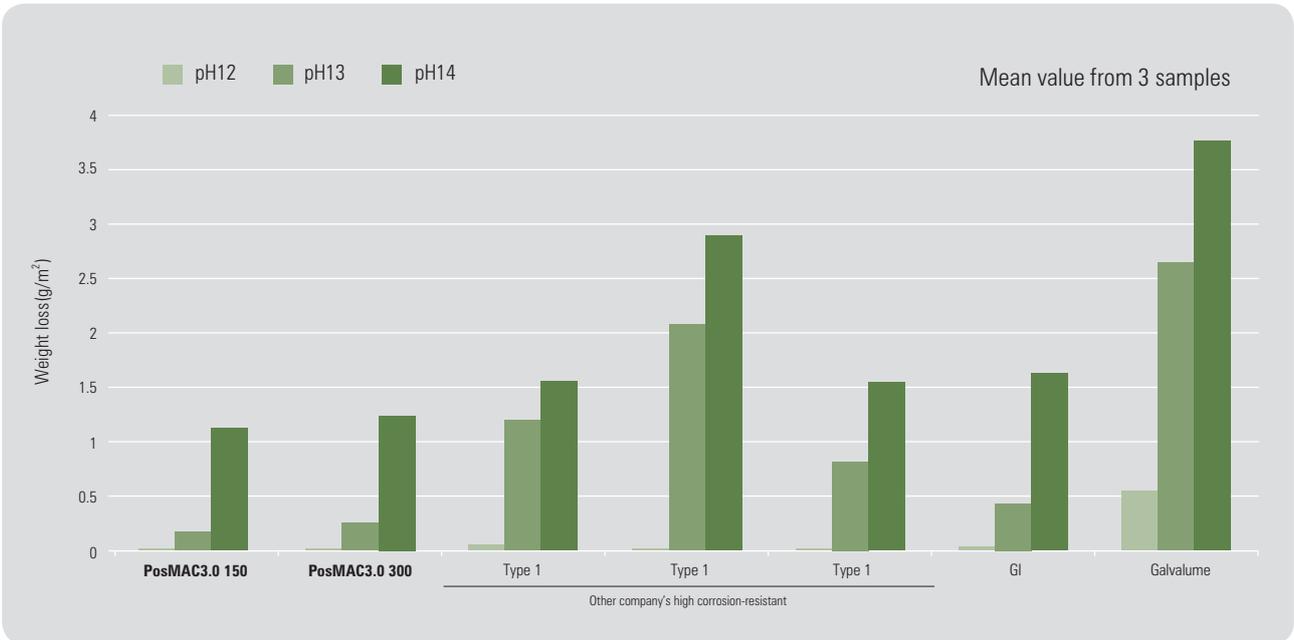


■ Chemical resistance against pH 14 solutions



# Chemical resistance of PosMAC<sup>®</sup>3.0

## Weight loss from pH 12, 13 and 14 solutions



- Galvalume's chemical resistance is the poorest under alkaline conditions (pH 12~14) although its chemical resistance was excellent under acidic conditions (pH 1~2).
- PosMAC3.0's chemical resistance is especially excellent under alkaline conditions (pH 12~14).

## Chemical resistance to ammonia solutions



### Evaluation method

- Dipping into a 10% ammonia solution (pH 12.5).
- Replace with fresh solution every 100 hours.
- Surface inspection after 1200 hours.

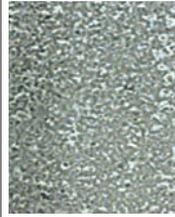
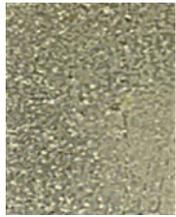
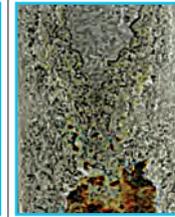
### Anti-corrosiveness after 1000, 1200 hours

Dipping Time	PosMAC3.0 120g/m <sup>2</sup>	GI 275g/m <sup>2</sup>	Galvalume 100g/m <sup>2</sup>	Dipping Time	PosMAC3.0 120g/m <sup>2</sup>	GI 275g/m <sup>2</sup>	Galvalume 100g/m <sup>2</sup>
	1000Hr					1200Hr	

- Galvalume displayed red-rust formation after 400 hours. / GI displayed rapid red-rust formation after 1000 hours.
- PosMAC3.0 did not display red-rust formation after 1200 hours.

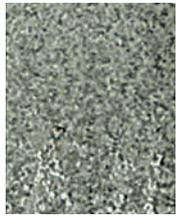
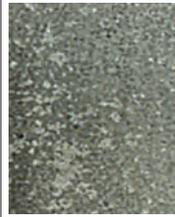
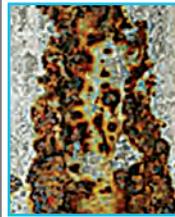
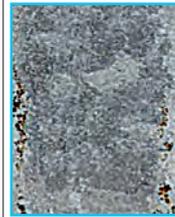
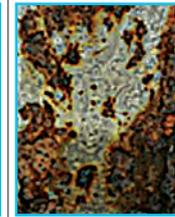
### Acid rain simulation test results

- Red-rust formed on the exposed edge of the galvalume after 30 cycles / similar symptoms became visible on the GI after 60 cycles.

Acid rain simulation	30 Cycle			60 Cycle		
	PosMAC3.0	GI	Galvalume	PosMAC3.0	GI	Galvalume
The coating weight on both sides	100g/m <sup>2</sup>	275g/m <sup>2</sup>	100g/m <sup>2</sup>	100g/m <sup>2</sup>	275g/m <sup>2</sup>	100g/m <sup>2</sup>
Cut surface edge taped						
Cut surface edge exposed						

**Test condition :** Artificial acid rain(0.1% NaCl solution+H<sub>2</sub>SO<sub>4</sub>, 35°C, 1Hr, pH4) → Drying(30%RH at 60°C, 4Hr) → Humid environment(95%RH at 50°C, 3Hr).

- Red-rust did not form on the exposed edge of the PosMAC3.0 after 90 cycles.

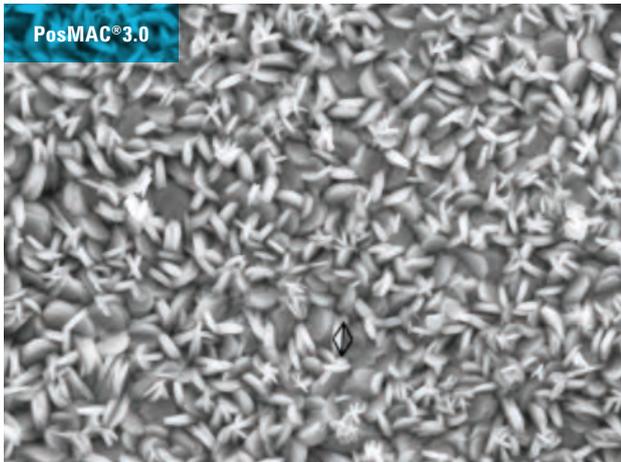
Acid rain simulation	90 Cycle			120 Cycle		
	PosMAC3.0	GI	Galvalume	PosMAC3.0	GI	Galvalume
The coating weight on both sides	100g/m <sup>2</sup>	275g/m <sup>2</sup>	100g/m <sup>2</sup>	100g/m <sup>2</sup>	275g/m <sup>2</sup>	100g/m <sup>2</sup>
Cut surface edge taped						
Cut surface edge exposed						

**Test condition :** Artificial acid rain(0.1% NaCl solution+H<sub>2</sub>SO<sub>4</sub>, 35°C, 1Hr, pH4) → Drying(30%RH at 60°C, 4Hr) → Humid environment(95%RH at 50°C, 3Hr).

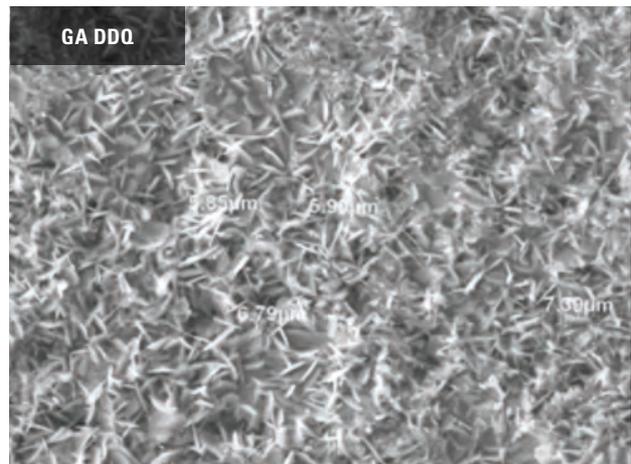
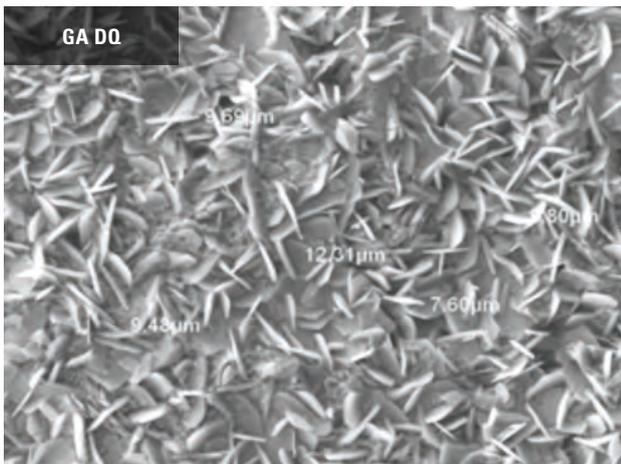
# Phosphating property of PosMAC®3.0

## Phosphating property

· Because phosphate crystallization is formed densely, phosphating property is advantageous.



Classification	Phosphate coating weight (g/m <sup>2</sup> )	Crystallization size (μm)
PosMAC3.0	3.75	4.6
GA-DQ	3.64	9~12
GA-DDQ	3.56	5~8



## Gas metal arc(GMA) welding

**Welding machine** Welding is achievable with general market-grade welding machine.

**Welding wire** It can apply general mild steel, structural wire. If you use KC28 of carbon steel, it is profitable in LME(Liquid Metal Embrittlement) prevention of weld zone more than SM309L, SM310. (stainless steel)

**Shield gas** It uses gas Ar+20% CO<sub>2</sub> for decreasing spatter.

**Welding current, voltage** When welding with the same speed of a general cold-rolled steel sheet, PosMAC3.0 is robbed of heat by the evaporation of its Zinc plating layer. So welding input heat must be established more than that of a general cold-rolled steel sheet. (About 5~10 % in electric current)

**Welding speed** To prevent defect occurrence like a blow hole or pit, welding speed must be set lower than that of a cold-rolled steel sheet.

**Repair spray coating** Damaged Zn-Mg-Al coating layer of weld zone, must execute repair spray coating for corrosion resistance security of weld zone. Execute Zn-Al alloy spray coating that is on common use according to specifications of makers.

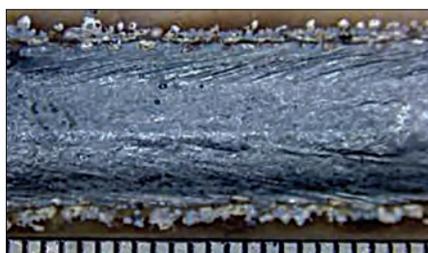
### LME(Liquid Metal Embrittlement) occurrence by welding material

Test information : PosMAC3.0-C, 1.2 mmt, Coating Weight M140g/m<sup>2</sup>, No oiled, No post treatment.

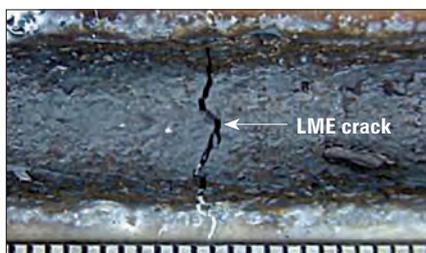
Welding material	Chemical composition	TS	EL	Note
KC28(1.2Φ)	0.07C-0.86Si-1.5Mn	580MPa	28%	YGW12, ER70S-6
SM309L(1.2Φ)	22Cr-12Ni-0.02C	563MPa	43%	STS Welding material
SM310(1.2Φ)	25Cr-20Ni-0.1C	610MPa	35%	

### LME crack observed on welding surface

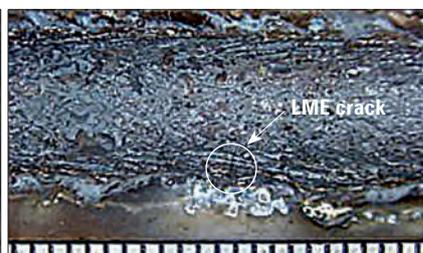
KC28(carbon steel) is good without LME, but STS welding material is sensitive in the LME.



KC28 : 150A-18V-1.0m/min



SM309L : 180A-18V-1.0m/min



SM310 : 180A-20V-1.1m/min

※ When welding under excessive stress condition, LME crack can happen. Before using the material, please contact our product technical part.

### PosMAC3.0 welding guideline

#### Circular fillet arc welding method between PosMAC3.0 panel and STS304 Pipe

In order to prevent LME crack when welding of the PosMAC3.0, (example of application: water tank), it has to be welded with both appropriate welding material and protection gas mixture ratio.

- 308L(100% CO<sub>2</sub>), 312(Ar+2% O<sub>2</sub>)

- The fillet arc welding part sectional picture between the PosMAC3.0 panel & the STS304 pipe



Classification	Maker	Diameter	Type	Shield gas	IASSI					
					C	Mn	Si	Cr	Ni	Mo
Shield-bright 308L Xtra	SeAH ESAB	φ1.2	Flux cored wire	100%CO <sub>2</sub>	0.03	1.3	0.6	19.2	9.6	0.2
SMP-M312			SolidWire	Ar+2%O <sub>2</sub>	0.1	1.9	0.33	29.9	9.79	-

\* If the shield gas mixture ratio change, LME crack could happen in PosMAC3.0 welding part.

# Weldability of PosMAC<sup>®</sup>3.0

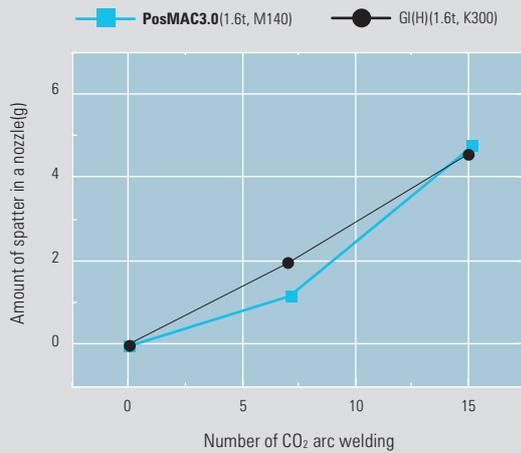
## Spatter occurrence when welding

Test information : PosMAC3.0-C, 1.6 mmt, Coating Weight M140g/m<sup>2</sup>, No oiled, No post treatment.

Welding condition : CO<sub>2</sub> welding, Welding material: KC28 solid wire(1.2Φ), Current 150A, Voltage 20V, Welding speed 0.6m/min

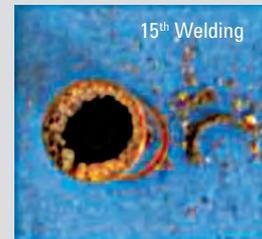
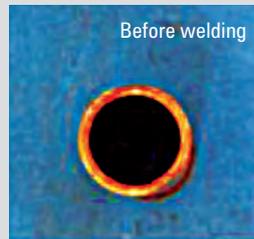
Test Result : As the number of arc welding increases, spatter weight of nozzle parts increases.

Therefore, nozzle cleaning is necessary after the 10th(Weld line 3,000mm) welding.



Weld line : 300mm

Welding condition : KC28, 150A-20V-0.6m/min



Spatter weight of nozzle of CO<sub>2</sub> arc welder

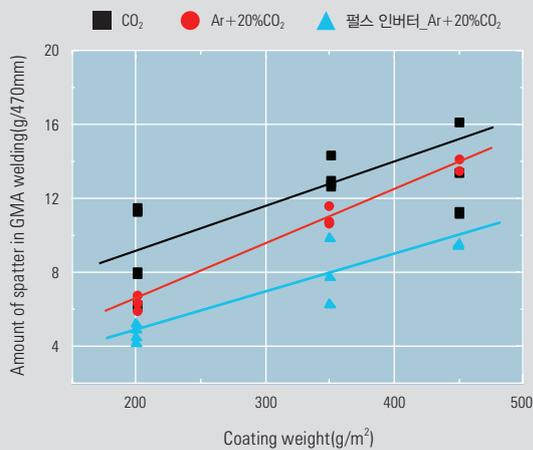
Nozzle condition after welding

## How to reduce spatter

During arc welding of coated materials, evaporating zinc pushes out molten metals, creating lots of spatter.

The amount of spatter increases dramatically with coating weight. Spatter also reacts sharply with CO<sub>2</sub> used in the welding of non-coated materials.

Spatter can be reduced by using pulse inverter electrical sources for arc generation and using Ar+20CO<sub>2</sub> as a shield gas.



· Target material : 1.9mmt PosMAC3.0-540

· CO<sub>2</sub>, Ar+20%CO<sub>2</sub> welding :  
KC25(1.2Φ solid wire), 180A-21V-0.6m/min

· Electrical source for pulse inverter\_Ar+20%CO<sub>2</sub> welding :  
KC25M(1.2Φ solid wire), 140A-23V-0.6m/min

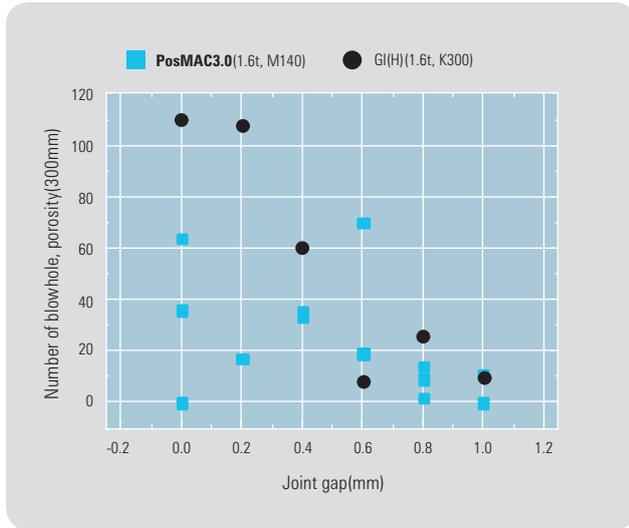
Properties relationship between amount of spatter, coating weight, and electrical source for arc welding

### Occurrence of porosity and blow hole reduction method

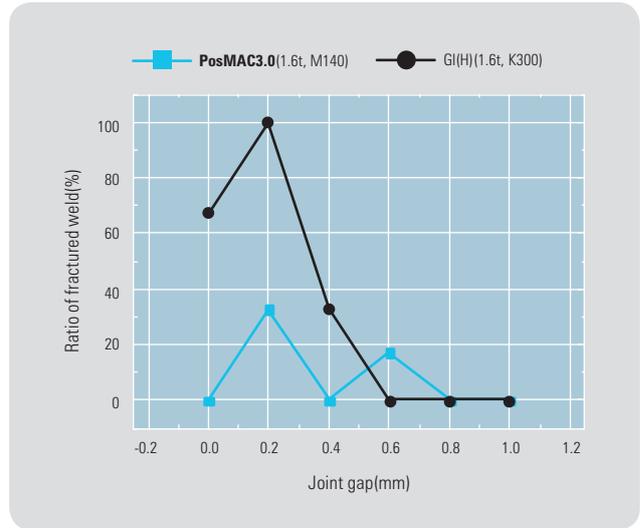
Test information : PosMAC3.0-C 1.6 mmt, coating weight M140g/m<sup>2</sup>, No oiled, No post treatment.

Welding condition : CO<sub>2</sub> welding, Welding material: KC28 solid wire, Current 150A, Voltage 20V, Welding speed 0.6m/min.

Test result : If it is set joint gap interval 0.6mm, because discharge of zinc stream is increased through joint, so strength of weld zone improves.



Relation of joint gap interval and porosity, blow hole



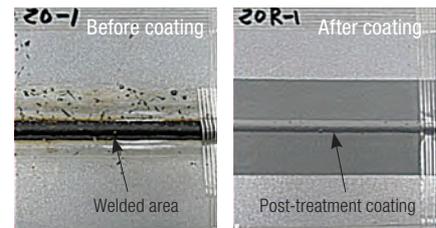
Relation of joint gap interval and weld zone fracture

### Post-treatment of arc-welded area

After arc-welding, post-treatment is necessary due to the loss of coated layers in the deposited metal zone as well as the heat affected zone. For PosMAC3.0, by spraying a layer (minimum 40μm per each side) of post-treatment solution containing commonly available Al-powder, galvanic corrosion-resistance appropriate to the material can be restored.

Material : 1.9mmt, 540MPa, Coating weight M450

Arc welding : KC25M(1.2Φ, solid wire), Ar+20%CO<sub>2</sub>, 160A-0.7m/min



### Result of SST per condition after post-treatment of arc-welded area of PosMAC3.0(after 960 hours)

Original material	Silver powder from A company(Paint)	Galvanic from A company (Paint)

Test method : Salt Spray Test (SST), [ISO 9227, JIS Z2371, ASTM B117] 5%NaCl, 35°C

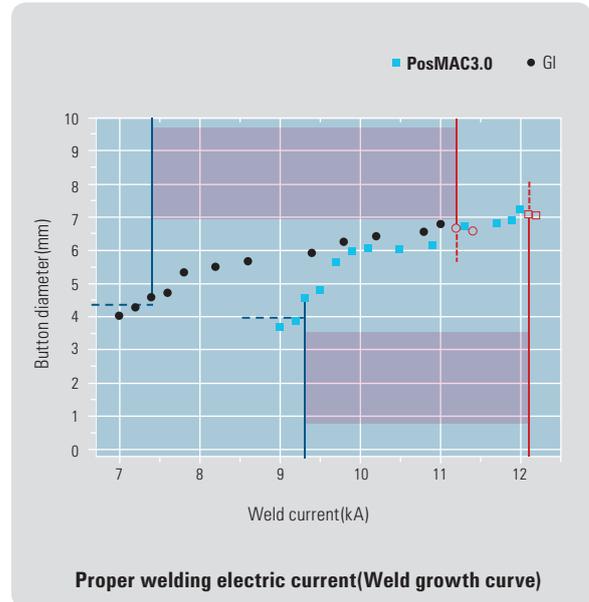
# Weldability of PosMAC<sup>®</sup>3.0

## Spot welding

- When PosMAC3.0 is welding (likely general Zn coating product) welding current must be enhanced compared to that of cold-rolled steel sheet. : When PosMAC3.0 is welding (likely general Zn coating product), current density falls and conduction path is expanded by the melting of the Zn layer.
- Electrode life-time is decreased due to the consumption of electrodes. As a reaction of the electrode and the Zn layer, figures out electrode life-time in advance and must carry out dressing, exchange regularly.

Spot weldability comparison of hot dip galvanized sheet and PosMAC3.0

Classification	Thickness (mm)	Coating weight of one side (g/m <sup>2</sup> )	Proper welding electric current (standard : more than 1.0kA)
PosMAC3.0	0.97	122	2.7
GI	1.2	72	3.8



## High frequency pipe-making welding

- High frequency pipe-making workability of PosMAC3.0 is similar to that of a general galvanized steel.
- Corrosion resistance of weld zone is superior to that of a general hot dip galvanized steel after spray coating processing.

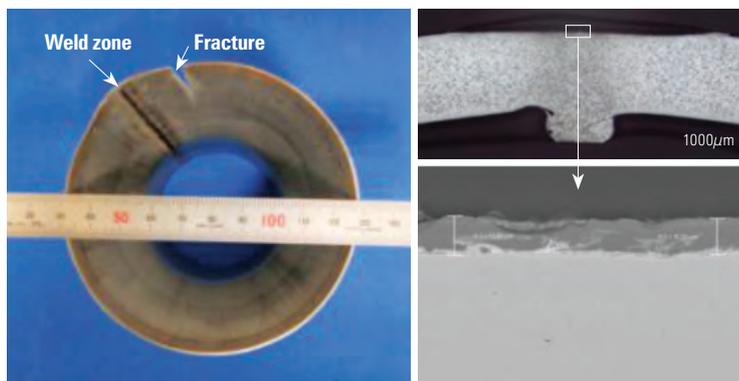
### Pipe-making and high frequency pipe-making weld of PosMAC3.0

Steel grade and steel pipe specification : PosMAC3.0 M200, Post-treatment : Chromate / Out dia 60.4mm, 48.9mm, Thickness 2.0mm

#### Test result :

Pipe-making property is good. Forming property of weld zone is excellent. Pipe extension ratio is more than 60% until base metal fracture occurs. Weld zone spray coating for repairing must be Al+Zn, Al-Zn alloy, Al and spray coating thickness is more than 7μm.

\* Base layer spray coating needs application of Al spray coating material for insurance of coating cohesiveness and thickness.



Pipe shape after pipe extension of high frequency pipe-making weld of PosMAC3.0.

Micro-structure of the spray coating layer in the high frequency welded pipe of PosMAC3.0.

Classification	High frequency welding		
	GI(H) 180g/m <sup>2</sup>	Batch-GI 600g/m <sup>2</sup>	PosMAC3.0 140g/m <sup>2</sup>
SST 300Hr			
600Hr			

Weld zone corrosion resistance of high frequency welded pipe of PosMAC3.0.

## Laser beam welding

Laser beam welding, in comparison to arc welding, generates a low heat point weld, which reduces spatter and defects, leading to improvements in quality and usability.

### Welding butt Joints

During laser beam welding of PosMAC3.0, heat input must be tightly controlled to retain desired physical properties. If heat input application is excessive during low-speed welding, coated layers will be vaporized and oxidized by welding heat, making it difficult for the welded part to retain corrosion resistance. On the other hand, if heat input is low madequately during high-speed welding, it is difficult to perform piercing welding.

The chart below shows the desirable welding speed range according to steel thickness and coating weight. For steel products other than those shown here, specific welding requirements can be derived.

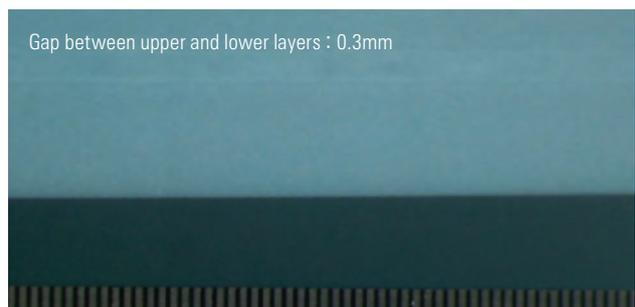
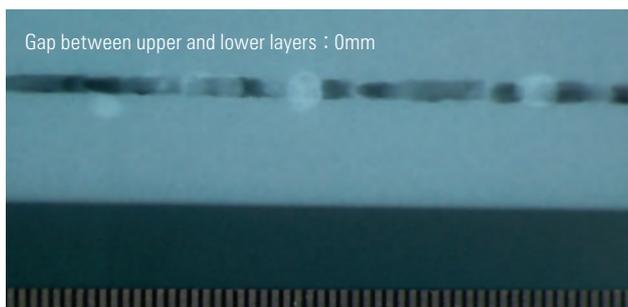
Division	Welding speed(m/min), Laser output 6kW					
	2	4	6	8	10	12
3.28t, M140, Chrome treatment	Coated layer elimination and oxidization	Proper welding condition	Partial penetration			
2.48t, M275, Chrome treatment						
2.47t, M275, Chrome treatment						
2.1t, M350, Chrome treatment						
2.34t, M140, No treatment						
2.33t, M140, NT treatment						
1.95t, M275, NT treatment						

**Laser beam welding requirements for PosMAC3.0 butt joints**

\* Penetration refers to the depth of the original material converted to welded metal after the melting process. The depth of this zone in the plate thickness direction is called penetration depth. If only part of a joint is penetrated, it is called partial penetration.

### Welding lap joints

When a lap joint is welded, the coated layer between the two plates vaporizes, and is absorbed into the molten metal, likely creating gas pockets. The faster the welding speed, the more gas pockets are formed. With reduced welding heat input, the number of gas pockets will decrease to a certain degree, but it is hard to completely prevent their occurrence. At the present time, the most effective way to minimize gas pockets is maintain a gap between the two plates of at least 0.3mm so that the vaporized coating layer can easily escape to the outside. However, though a bigger gap between upper and lower plates is favorable for preventing gas pockets, it must be heeded that too big a gap could hinder the creation of a sound joint.

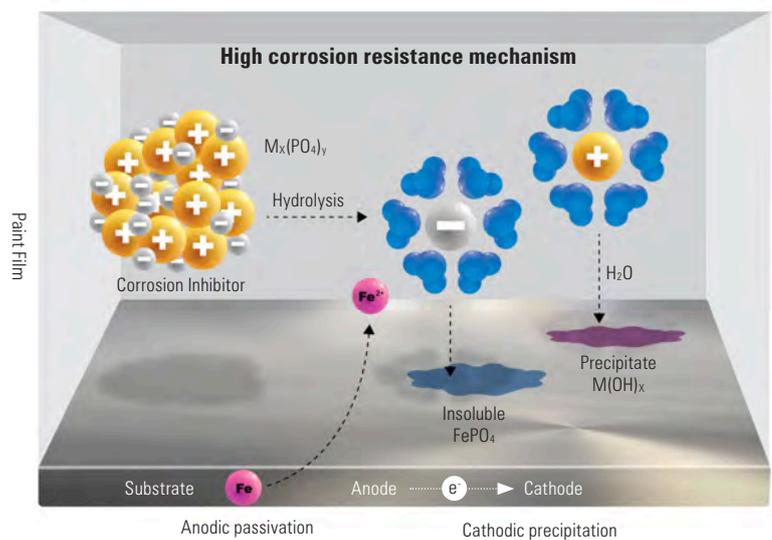
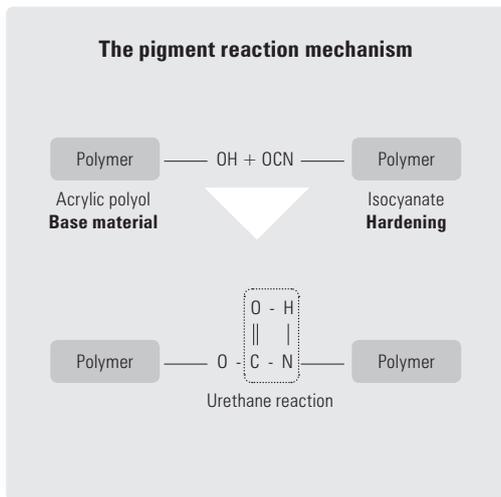


**X-ray analysis result of laser-beam-welded lap joint: 2.3t PosMAC3.0-C, M140, NT / 6kW-4m/min**

# Post-treatment for PosMAC<sup>®</sup>3.0 only

## The feature of MAC-GUARD

- The MAC-GUARD product is the repair solution developed by the PosMAC3.0 only.
- The MAC-GUARD product has excellent hardness, chemical resistance, water resistance due to the urethane(Urethane) coupling between polymers.
- The MAC-GUARD product contains two-component coating material with main component an acrylic polyol, a special anti-corrosive pigment [Mx (PO4) y]. It has excellent corrosion resistance by using zinc and aluminum flake.
- MAC-GUARD product has excellent weather resistance by using HDI(Hexamethylene diisocyanate) as a hardener instead of using MDI (Methylene Diphenyl Diisocyanate) or TDI(Toluene diisocyanate) to combine isocyanate to the benzene ring directly.
- 40 μm or more of the MAC-GUARD should be applied for one side with spray or paint to secure corrosion resistance.



## The results of corrosion resistant test

It is possible to ensure excellent corrosion resistance of welded parts by small amount of deposition(40μm) than commercial product(60μm)

### CCT Test result

CCT*	Commercialized product(60μm)	MAC-GUARD(40μm)
150 Cycle (1200Hr)	Red-rust happened	

\*CCT 1cycle(KS R 1127) : Salt spray 2Hr(5% NaCl, 35°C) → Dry 4Hr(25% RH, 60°C) → Wet 2Hr(95% RH, 50°C)



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Tel : +82-54-280-2127 / Fax : +82-54-278-6579

<http://www.akchemtech.co.kr>

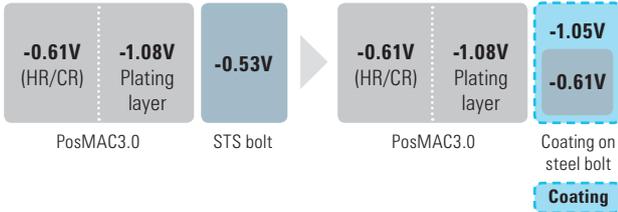
에이케이켄텍주식회사  
ChemTech CO.,LTD.

# Bolt for PosMAC<sup>®</sup> 3.0 only

## The feature of MAC-BOLT

By developing product which has similar self-potential of the PosMAC3.0, the galvanic corrosion due to potential difference get controlled. MAC-BOLT has excellent corrosion resistance, which is exclusively used with PosMAC3.0 through the sacrificial protection of the Zn & Al Flake.

### The self-potential among 5% the NaCl aqueous solution and corrosion-resistance



\* Galvanic Corrosion : The corrosion occurred by the electrochemical process when two mutually different kinds of metals get touched.

### The self-potential result of measurement for each material

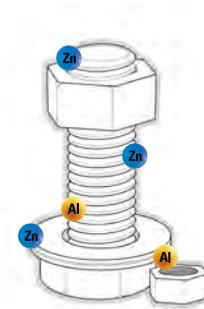
·5% NaCl(pH6.5, 35°C), PosMAC3.0 : -1041.6 mV/SCE

Material	Electric potential(mV)
Steel	-634.8
Zn plating	-1049.0
STS 304	-530.8
MAC-BOLT	-1054.7

## The surface treating material and method

### The ingredient of coating material

- Binder : Epoxy type
- Main ingredient : Zn & Al Flake + Nano Powder
- Feature : MAC-BOLT has the excellent corrosion resistance by combining Zn and Al Flake that is the sacrificial anode. The formation of the coating layer with the nano-powder in the space between flake
- Coating method : Dip & Spin → Heat Treatment(Dry)



### Coating process



### CCT test of Bolt

10~25 Cycle	30~50 Cycle	180~250 Cycle
Zn(Cr)*	STS 304	MAC-BOLT

\*m(Cr) : Chromate treatment on electro galvanized steel

### CCT test after bolting of PosMAC3.0 & PosMAC3.0

30 Cycle	100~300 Cycle

- MAC-BOLT : Red-rust did not occur over CCT 200 Cycle(1,600Hr)
- Zn(Cr) coated product : Red-rust happened in 30 cycle(240Hr), STS 304 : Red-rust happened in 50cycle(400Hr)
- **Test Method** : Cyclic Corrosion Test (CCT), [ISO 14993] 1Cycle : Salt Spray 2Hr(5%NaCl, 35%) → Dry 4Hr(25%RH, 60°C) → Wet 2Hr(95%RH, 50°C)



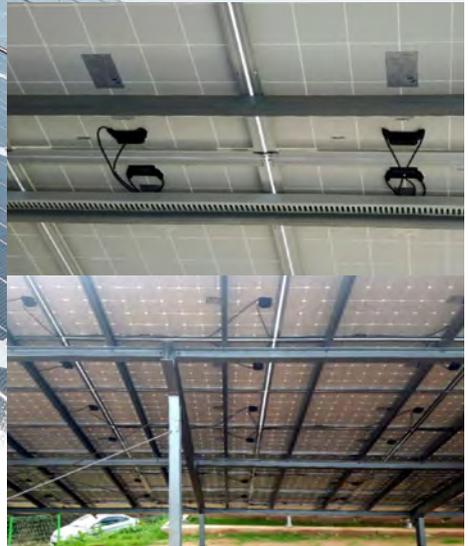
### Contact SAMIL CO.,LTD

(Sihwa Industrial Complex 5ra 409) 89, Jiwon-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Korea  
 Tel : +82-31-319-8137 / Fax: +82-31-319-8139 / E-mail : samil98@sifastener.com  
<http://www.sifastener.com>

# Main usage



Foundation structure supporting solar power panels



Foundation structure supporting solar power panels on the water



PEB(Pre-engineered metal building system)



Cooling tower



Silo



Distributing board



Pipe



Plant factory structure



Vinyl house pad



Vinyl house switch



Stock farm



Fish farms



Steel curtain wall



Cable tray

# Main usage



High corrosion resistance required part of an air conditioner



Motor case



Rock bolts



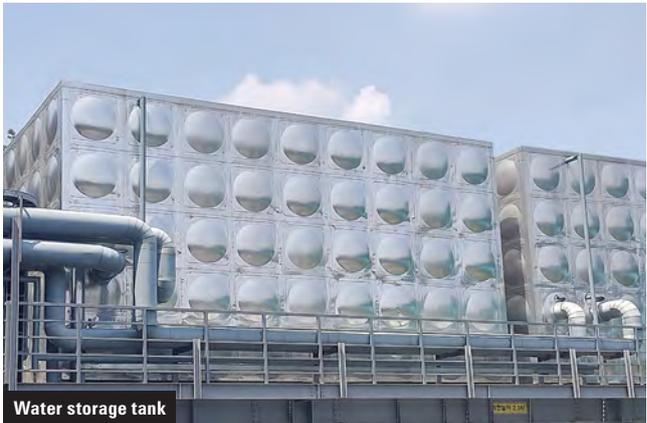
Corrugated steel



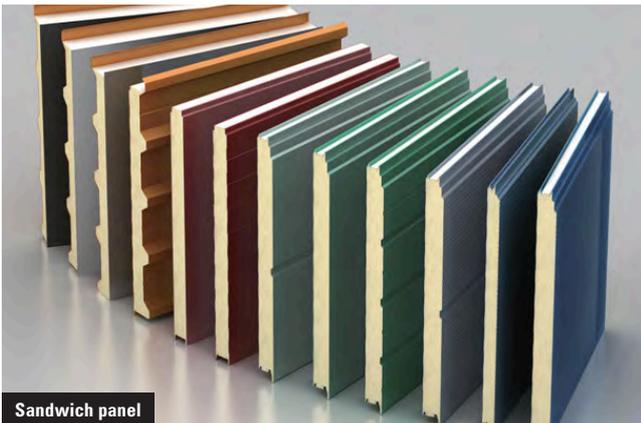
Back plate of noise barrier



Guard rail



Water storage tank



Sandwich panel



Roof, Wall



Resort building wall in coast(PosMAC3.0+PVDF treatment)



General house(PosMAC3.0+Polyester or PVDF treatment)



Apartment roof(PosMAC3.0+PVDF treatment)



PD panel

# Post-treatment

## Organic ingredient Cr-free(NB)

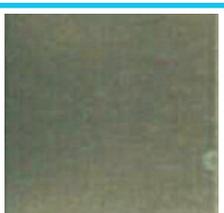
**Excellent corrosion resistance** It displays excellent white-rust resistance with its organic ingredient Cr-free membrane.  
**Environment friendly** Because it is a membrane that does not contain chromate, it is an environment-friendly material.

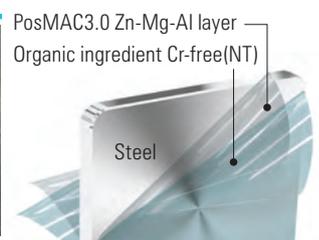
Post treatment	Corrosion resistance of flat sheet		Corrosion resistance of erichsen sheet	
	SST 72Hr	SST 96Hr	SST 24Hr	SST 48Hr
NB				



## Inorganic ingredient Cr-free(NT)

**Corrosion resistance** It has white-rust resistance similar to that of chromate.  
**Conductivity** Because it is an inorganic ingredient membrane, electric resistance is low while the conductivity of the surface is excellent.  
**Environment friendly** Because it is a membrane that does not contain chromate, it is an environment-friendly material.

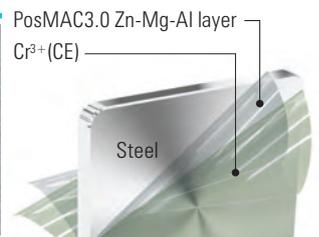
Post treatment	Corrosion resistance of flat sheet		Corrosion resistance of erichsen sheet	
	SST 72Hr	SST 96Hr	SST 24Hr	SST 48Hr
NT				



## Cr<sup>3+</sup> Eco chromate(CE)

**Excellent corrosion resistance** It displays excellent white-rust resistance by blocking corrosive factors with its chromium nitrate and chromium phosphate.  
**Environment Friendly** Because it does not contain Cr<sup>6+</sup>, it is an environment friendly material.

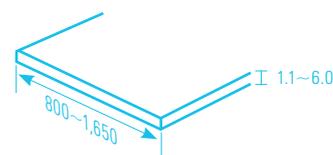
Post treatment	Corrosion resistance of flat sheet		Corrosion resistance of erichsen sheet	
	SST 120Hr	SST 168Hr	SST 24Hr	SST 48Hr
CE				



# PosMAC®3.0(HR Base) specification

## HR Base PosMAC®3.0

- Coating mass : 80~400g/m<sup>2</sup> (Both Sides)
- Post treatment : Cr-Free (NB, NT), Chromate(CL), Cr<sup>3+</sup> ECO Chromate(CE)
- Size in production(CQ) : Thickness 1.1~ 6.0mm / Width 800 ~ 1,650mm  
 ※ Width may vary depending on the thickness



Grade	POSCO	KS D 3030	JIS (Equivalents)	Mechanical properties(MPa,%)			
				YP	TS	EL	CMB
<b>CQ</b>	PM3HT270CQ (POSMAC-C)	KS-SGMHC	JIS-SGHC	170~400	270~450	30~	1T
<b>DQ</b>	PM3HT270DQ (POSMAC-D)	-	-	~280	270~450	36~	1T
<b>Structural</b>	PM3HT340R (POSMAC-340)	KS-SGMH245Y	JIS-SGH340	245~450	340~500	20~	1T
	PM3HT400R (POSMAC-400)	KS-SGMH295Y	JIS-SGH400	295~	400~	18~	2T
	PM3HT440C (POSMAC-440)	KS-SGMH335Y	JIS-SGH440	335~	440~	18~	2T
	PM3HY340C (POSMAC-Y340)	-	-	340~	410~	21~	2T
	PM3HT490C (POSMAC-490)	KS-SGMH365Y	JIS-SGH490	365~	490~	16~	3T
	PM3HT540C (POSMAC-540)	KS-SGMH400Y	JIS-SGH540	400~	540~	16~	3T

\*CMB : Coating Metal Bending test

Grade	DIN EN 10346	POSCO (Equivalents)	Mechanical properties(MPa,%)		
			YP	TS	EL
<b>CQ</b>	EN-DX51D	PM3HT270CQ	-	270~500	22~
<b>DQ</b>	EN-DX52D	PM3HT270DQ	140~300	270~420	26~
<b>Structural</b>	EN-S220GD	-	220~	300~	20~
	EN-S250GD	PM3HT340R	250~	330~	19~
	EN-S280GD	PM3HT400R	280~	360~	18~
	EN-S320GD	PM3HT440C	320~	390~	17~
	EN-S350GD	PM3HY340C	350~	420~	16~
	EN-S390GD	-	390~	460~	16~
	EN-S420GD	-	420~	480~	15~
	EN-S450GD	PM3HT540C	450~	510~	14~
	EN-S550GD	-	550~	560~	-

Grade	ASTM 1046M ( )* ksi unit	POSCO (Equivalents)	Mechanical properties(MPa,%)		
			YP	TS	EL
<b>CQ</b>	A1046-CSA	PM3HT270CQ	170~380	-	20~
	A1046-CSB	PM3HT270CQ	205~380	-	20~
<b>DQ</b>	A1046-FSA	PM3HT270DQ	170~310	-	26~
<b>Structural</b>	A1046-SS230(SS33)	-	230~	310~	20~
	A1046-SS255(SS37)*	PM3HT340R	255~	360~	18~
	A1046-SS275(SS40)	PM3HT400R	275~	380~	16~
	A1046-SS340(SS50)	-	340~	450~	12~
	A1046-HSLAS340(HSLAS50)*	PM3HT440C	340~	410~	20~
	A1046-HSLAS380(HSLAS55)*	PM3HT490C	380~	480~	16~
	A1046-HSLAS410(HSLAS60)*	PM3HT540C	410~	480~	12~

\* Please be sure to consult with our associates when making orders for that spec.

# PosMAC<sup>®</sup>3.0(HR Base) specification

\* The following manufacturing spec is the standard when the mill edge order.  
 In case of the slit edge order, possible width decrease with 20mm.

## PM3HT270CQ, PM3HT270DQ, PM3HT340R

■ Can be produced    ■ Require consultation

w \ t	1.05<	1.15<	1.25<	1.35<	1.45<	1.55<	1.65<	1.75<	1.85<	1.95<	2.05<	2.15<	2.25<	2.35<	2.45<	2.55<	2.65<	2.75<	2.85<	≤4.0	≤4.5	≤6.0	
800 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
850 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
900 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
950 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1000 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1050 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1100 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1150 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1200 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1250 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1300 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1350 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1400 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1450 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1500 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1550 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1600 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1650 ≤		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

## PM3HT400R

■ Can be produced    ■ Require consultation

w \ t	1.05<	1.15<	1.25<	1.35<	1.45<	1.55<	1.65<	1.75<	1.85<	1.95<	2.05<	2.15<	2.25<	2.35<	2.45<	2.55<	2.65<	2.75<	2.85<	≤4.0	≤4.5	≤6.0	
800 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
850 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
900 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
950 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1000 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1050 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1100 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1150 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1200 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1250 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1300 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1350 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1400 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1450 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1500 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1550 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1600 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1650 ≤			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

⚠ Please be sure to consult with our associates when making orders for specific usage.

**PM3HT440C, PM3HY340C**

■ Can be produced    ■ Require consultation

w \ t	1.05<	1.15<	1.25<	1.35<	1.45<	1.55<	1.65<	1.75<	1.85<	1.95<	2.05<	2.15<	2.25<	2.35<	2.45<	2.55<	2.65<	2.75<	2.85<	≤4.0	≤4.5	≤6.0	
800 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
850 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
900 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
950 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1000 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1050 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1100 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1150 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1200 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1250 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1300 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1350 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1400 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1450 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1500 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1550 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1600 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1650 ≤				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

**PM3HT490C**

■ Can be produced    ■ Require consultation

w \ t	1.05<	1.15<	1.25<	1.35<	1.45<	1.55<	1.65<	1.75<	1.85<	1.95<	2.05<	2.15<	2.25<	2.35<	2.45<	2.55<	2.65<	2.75<	2.85<	≤4.0	≤4.5	≤6.0	
800 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
850 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
900 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
950 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1000 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1050 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1100 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1150 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1200 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1250 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1300 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1350 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1400 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1450 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1500 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1550 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1600 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1650 ≤					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

# PosMAC®3.0(HR Base) specification

## PM3HT540C

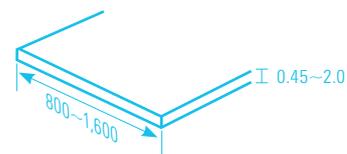
■ Can be produced    ■ Require consultation

w \ t	1.05<	1.15<	1.25<	1.35<	1.45<	1.55<	1.65<	1.75<	1.85<	1.95<	2.05<	2.15<	2.25<	2.35<	2.45<	2.55<	2.65<	2.75<	2.85<	≤4.0	≤4.5	≤6.0	
800 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
850 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
900 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
950 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1000 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1050 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1100 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1150 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1200 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1250 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1300 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1350 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1400 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1450 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1500 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1550 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1600 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
1650 ≤						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

# PosMAC®3.0(CR Base) specification

## CR Base PosMAC®3.0

- Coating mass : 80~350g/m<sup>2</sup> (Both sides)
  - Post treatment : ECO Chromate(CE)
  - Size in production(CQ) : Thickness 0.45~ 2.3mm / Width 720 ~ 1,860mm
- ※ Width may vary depending on the thickness



Grade	POSCO	KS D 3030	JIS ( 유사 규격 )	Mechanical properties(MPa,%)			
				YP	TS	EL	CMB
<b>CQ</b>	PM3CT270CQ (C-PosMAC-C)	KS-SGMCC	JIS-SGCC	170~400	270~450	30~	1T
<b>DQ</b>	PM3CT270DQ (C-PosMAC-D)	KS-SGMCD2	-	~280	270~450	36~	1T
<b>DDQ</b>	PM3CT270DD (C-PosMAC-N)	KS-SGMCD3	-	~280	270~450	43~	1T
<b>Structural</b>	PM3CT340R (C-PosMAC340)	KS-SGMC245Y	JIS-SGC340	245~450	340~500	20~	1T
	PM3CT400R (C-PosMAC400)	KS-SGMC295Y	JIS-SGC400	295~	400~	18~	2T
	PM3HT440C (C-PosMAC440)	KS-SGMC335Y	JIS-SGC440	335~	440~	18~	2T
	PM3HY340C (PosMACY340)	-	-	340~	410~	21~	2T
	PM3CT490C (C-PosMAC490)	KS-SGMC365Y	JIS-SGC490	365~	490~	16~	3T
	PM3CT570C (C-PosMAC570)	KS-SGMC560Y	JIS-SGC570	500~	570~	8~	3T

\*CMB : Coating Metal Bending test

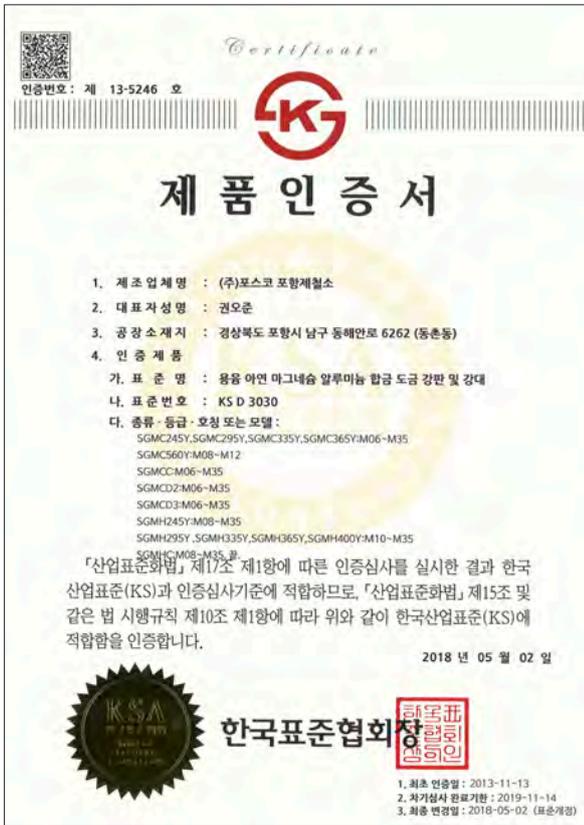
Grade	DIN EN 10346	POSCO (Equivalents)	Mechanical properties(MPa,%)		
			YP	TS	EL
<b>CQ</b>	EN-DX51D	PM3CT270CQ	-	270~500	22~
<b>DQ</b>	EN-DX52D	PM3CT270DQ	140~300	270~420	26~
<b>DDQ</b>	EN-DX53D	PM3CT270DD	140~260	270~380	30~
<b>Structural</b>	EN-S220GD	-	220~	300~	20~
	EN-S250GD	PM3CT340R	250~	330~	19~
	EN-S280GD	PM3CT400R	280~	360~	18~
	EN-S320GD	PM3CT440C	320~	390~	17~
	EN-HX340LAD	-	340~420	410~510	21~
	EN-S350GD	PM3CY340C	350~	420~	16~
	EN-S390GD	-	390~	460~	16~
	EN-S420GD*	-	420~	480~	15~
	EN-S450GD*	-	450~	510~	14~
	EN-S550GD*	PM3CT570C	550~	560~	-
Grade	ASTM 1046M ( )* ksi unit	POSCO (Equivalents)	YP	TS	EL
<b>CQ</b>	A1046-CSA	PM3CT270CQ	170~380	-	20~
	A1046-CSB	PM3CT270CQ	205~380	-	20~
<b>DQ</b>	A1046-FSA	PM3CT270DQ	170~310	-	26~
<b>DDQ</b>	A1046-DDS	PM3CT270DD	140~240	-	32~
<b>Structural</b>	A1046-SS230(SS33)	-	230~	310~	20~
	A1046-SS255(SS37)	PM3CT340R	255~	360~	18~
	A1046-SS275(SS40)	PM3CT400R	275~	380~	16~
	A1046-SS340(SS50)	-	340~	450~	12~
	A1046-HSLAS340(HSLAS50)*	PM3CT440C	340~	410~	20~
	A1046-HSLAS380(HSLAS55)*	PM3CT490C	380~	480~	16~
	A1046-HSLAS410(HSLAS60)*	PM3CT540C	410~	480~	12~
	A1046-HSLAS480(HSLAS70)*	PM3CT570C	480~	550~	12~

\* Please be sure to consult with our associates when making orders for that spec.









POSCO acquired the certification of KS D 3030(hot-dip zinc-magnesium-aluminum alloy coated steel sheet and strip) standard in May 2018.

**Cold-rolled products :**

SGMCC, SGMCD2, SGMCD3, SGMCC245Y, SGMCC295Y, SGMCC335Y, SGMCC365Y, SGMCC560Y

**Hot-rolled products :**

SGMHC, SGMH245Y, SGMH295Y, SGMH335Y, SGMH365Y, SGMH400Y

**Yield strength, Tensile strength, Elongation**

■ Hot-rolled products

Designation	YS Min, N/mm <sup>2</sup>	TS Min, N/mm <sup>2</sup>	EL Min, %	Test piece
SGMHC	(205)	(270)	-	No.5, Rolling direction
SGMH245Y	245	340	20	No.5 Rolling direction or Cross-section
SGMH295Y	295	400	18	
SGMH335Y	335	440	18	
SGMH365Y	365	490	16	
SGMH400Y	400	540	16	

Remark1) 1N/mm<sup>2</sup> =1MPa

Remark2) ( ) is only for reference

# KS D 3030

## Yield strength, Tensile strength, Elongation

### ■ Cold-rolled products

Designation	YS Min, N/mm <sup>2</sup>	TS Min, N/mm <sup>2</sup>	EL Min, %					Test piece
			Thickness(mm)					
			0.25≤t < 0.40	0.40≤t < 0.60	0.60≤t < 1.0	1.0≤t < 1.6	1.6 ≤ t < 2.3	
<b>SGMCC</b>	(250)	(270)	-	-	-	-	-	No.5, Rolling direction
<b>SGMCD1</b>	-	270	-	34	36	37	38	
<b>SGMCD2</b>	-	270	-	36	38	39	40	
<b>SGMCD3</b>	-	270	-	38	40	41	42	
<b>SGMC245Y</b>	245	340	20	20	20	20	20	No.5 Rolling direction or Cross-section
<b>SGMC295Y</b>	295	400	18	18	18	18	18	
<b>SGMC335Y</b>	335	440	18	18	18	18	18	
<b>SGMC365Y</b>	365	490	16	16	16	16	16	
<b>SGMC560Y</b>	560	570	-	-	-	-	-	

Remark1) When the anti-aging characteristics is featured in the SGMCD3 sheets and coils, the anti-aging characteristics is guaranteed for 6 months.  
Anti-aging refers to the characteristic preventing stretcher strains from occurring during manufacturing.

Remark2) In principle, tensile strength tests are not performed on plates with thickness under 0.25mm.

Remark3) ( ) is only for reference.

Remark4) 1N/mm<sup>2</sup> =1MPa

## Coating weight(Both sides)

Coating designation	Triple point test (g/m <sup>2</sup> , Average)	Single point test (g/m <sup>2</sup> , Min)
<b>(M06)<sup>a</sup></b>	60	51
<b>M08</b>	80	68
<b>M10</b>	100	85
<b>M12</b>	120	102
<b>M14</b>	140	119
<b>M18</b>	180	153
<b>M20</b>	200	170
<b>M22</b>	220	187
<b>M25</b>	250	213
<b>M27</b>	275	234
<b>(M35)<sup>a</sup></b>	350	298
<b>(M45)<sup>a</sup></b>	450	383

Remark1) For both sides, triple spots coating weight, the average value of the measurement of 3 test pieces is applied.

Remark2) For one side, single spot coating weight, the minimum value of the measurement of 3 test pieces is applied.

Remark3) Separate consultation is available for the maximum coating weight on both sides.

## Coating weight(Both sides)

### Hot-rolled products(CQ~DQ)

(Unit : mm)

Order thickness	Width		
	W < 1200	1200 ≤ W < 1500	1500 ≤ W < 1800
1.20 ≤ t < 1.60	±0.16	±0.17	±0.18
1.60 ≤ t < 2.00	±0.17	±0.18	±0.19
2.00 ≤ t < 2.50	±0.18	±0.20	±0.22
2.50 ≤ t < 3.15	±0.20	±0.22	±0.25
3.15 ≤ t < 4.00	±0.22	±0.24	±0.27
4.00 ≤ t < 5.00	±0.25	±0.27	-

### Hot-rolled products(Structural steel)

(Unit : mm)

Order thickness	Width	
	W < 1600	1600 ≤ W < 1800
1.20 ≤ t < 1.60	±0.19	-
1.60 ≤ t < 2.00	±0.20	±0.24
2.00 ≤ t < 2.50	±0.21	±0.26
2.50 ≤ t < 3.15	±0.23	±0.30
3.15 ≤ t < 4.00	±0.25	±0.35
4.00 ≤ t < 5.00	±0.46	-

### Cold-rolled products

(Unit : mm)

Order thickness	Width				
	W < 630	630 ≤ W < 1000	1000 ≤ W < 1250	1250 ≤ W < 1600	1600 ≤ W
t < 0.25	±0.04	±0.04	±0.04	-	-
0.25 ≤ t < 0.40	±0.04	±0.05	±0.05	±0.06	-
0.40 ≤ t < 0.60	±0.06	±0.06	±0.06	±0.07	±0.08
0.60 ≤ t < 0.80	±0.07	±0.07	±0.07	±0.07	±0.08
0.80 ≤ t < 1.00	±0.07	±0.07	±0.08	±0.09	±0.10
1.00 ≤ t < 1.25	±0.08	±0.08	±0.09	±0.10	±0.12
1.25 ≤ t < 1.60	±0.09	±0.10	±0.11	±0.12	±0.14
1.60 ≤ t < 2.00	±0.11	±0.12	±0.13	±0.14	±0.16
2.00 ≤ t < 2.30	±0.13	±0.14	±0.15	±0.16	±0.18
2.30 ≤ t	±0.15	±0.16	±0.17	±0.18	±0.21

Remark) ( ) is only for reference

# KS D 3030

## Tolerances on width

(Unit : mm)

Width	Hot-rolled products		Cold-rolled products
	Mill edge(A)	Cut edge(B)	
$W \leq 1500$	0~+25	0~+10	0~+7
$1500 < W$			0~+10

## Tolerances on length(for sheet)

(Unit : mm)

Hot-rolled products	Cold-rolled products
0~+15	0~+15

## Tolerances on camber

### Hot-rolled products

(Unit : mm)

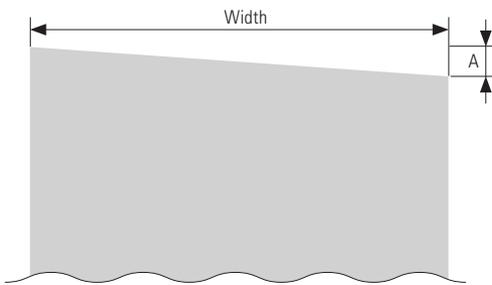
Width	Sheet			Coil
	Length			
	$L < 2500$	$2500 \leq L < 4000$	$4000 \leq L$	
$W < 630$	5	8	12	5mm/About an arbitrary length of 2000mm
$630 \leq W < 1000$	4	6	10	
$1000 \leq W$	3	5	8	

### Cold-rolled products

(Unit : mm)

Width	Sheet		Coil
	Length		
	$L < 2000$	$2000 \leq L$	
$W < 630$	4	4mm/About an arbitrary length of 2000mm	2mm/About an arbitrary length of 2000mm
$630 \leq W$	2		

## Tolerances on out-squareness



$$\triangle \text{ Out-of-squareness } \frac{A}{W} \times 100(\%)$$

Do not exceed 1%!

## Tolerance on flatness

### Hot-rolled products

(Unit : mm)

Thickness	Width				
	$W \leq 1250$	$1250 \leq W < 1600$	$1600 \leq W < 2000$	$2000 \leq W < 3000$	$W \geq 3000$
$1.20 \leq t < 1.60$	18	20	-	-	-
$1.60 \leq t < 3.15$	16	18	20	-	-
$3.15 \leq t < 4.00$	16		-	-	-
$4.00 \leq t < 6.00$	14		-	24	25

**Remark)** Unless otherwise specified, the maximum value of steel flatness shall be 1.5 times of the above table on the steels of the minimum tensile strength spec of over 570N/mm<sup>2</sup> or the minimum yield strength of over 430N/mm<sup>2</sup> or having equivalent chemical element or hardness.

### Cold-rolled products

(Unit : mm)

Width	Designation		
	Bow	Edge wave	Center wave
$w < 1000$	12	8	6
$1000 \leq w < 1250$	15	9	8
$1250 \leq w < 1600$	15	11	8
$1600 \leq w$	20	24	9

# Warranty

## PosMAC3.0 Durability Warranty

### Recipient of Warranty

The First Buyers purchasing POSCO products But, warranty can be issued on a (Solar Energy) Project Basis

### Warranty Period

20 years (for coating weight 250g/m<sup>2</sup> or more), 25 years (for coating weight 300g/m<sup>2</sup> or more)

- Type1. C1~C4 environments specified (ISO 12944-2 C1~C4)
- Type2. Solar Energy Project(Project name, Installed area(longitude, latitude))

### Warranty Contents

Durability Warranty (not disrupted by perforation or rupture)Guaranteed only when the structure is made of bare metal.

Exceptions include application environment, surface damage, corrosion factor contact, etc.

\*It is not about red or white rust

SAMPLE

## PosMAC 25 Years Warranty

**Client :**

**Project :**

**Coating Grade : ZM300**

**Date of Issue :**



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www.posco.co.kr

Client	POSCO
	Leader, Quality Design Group2 <i>Team Leader's sign</i>

Atmospheric-corrosivity categories and examples of typical environments

Mass loss per unit surface/thickness loss (after first year of exposure)				Examples of typical environments in a temperate climate(informative only)	
Low-carbon steel		Zinc		Exterior	Interior
Mass loss g/m <sup>2</sup>	Thickness loss µm	Mass loss g/m <sup>2</sup>	Thickness loss µm		
10or less	1.3 or less	0.7 or less	0.1 or less		Heated buildings with clean atmospheres, e.g. offices, shops, schools, hotels.
10-200	1.3-25	0.7-5	0.1-0.7	Atmospheres with low level of pollution. Mostly rural areas.	Unheated buildings where condensation may occur, e.g. depots, sports halls.
200-400	25-50	5-15	0.7-2.1	Urban and industrial atmospheres, moderate sulfur dioxide pollution. Coastal areas with low salinity.	Production rooms with high humidity and some air pollution, e.g. food-processing plants, laundries, breweries,dairies.
400~650	50~80	15~30	2.1~4.2	Industrial areas and costal areas with moderate salinity.	Chemical plants, swimming pools, coastal ship and boatyards.

2/9

### [Part of the original Warranty text]

The Client may not assign the warranties hereunder without POSCO's prior written approval, and even if with POSCO's prior written approval, the assigned warranty may not exceed the scope of this warranty provided herein.

# Patent / Environment Product Declaration

## PosMAC3.0 Patent

A total of 37 patents are registered for PosMAC technology.



No.	Patent No.	Title of invention
01	KR10-0498092	The zinc plating bath excellent in terms of corrosion resistance and galvanized alloy strip
02	KR10-1439693	Surface treatment composition for galvanized steel, surface treatment method for galvanized steel and galvanized steel sheet
03	KR10-1714935	Zn alloy plated steel sheet having excellent weldability and processed part corrosion resistance and method for manufacturing same
04	KR10-1665912	Hot dip zn alloy plated steel sheet having excellent anti-corrosion and method for manufacturing the steel sheet using the same
05	KR10-1819381	Zn alloy plated steel sheet having excellent bendability and method for manufacturing same



## EPD(Environment Product Declaration)

PosMAC is EPD certified, eco-friendly products.  
(ISO 14025, EN15804, ISO 21930:2017)





## Order guide

Please refer to the instructions mentioned below in order for you to select the products appropriate for your final usage when you place an order.



### Specifications

It is important for you to select a size appropriate for your final usage when you place an order for a product in a specific size.

In addition, since there are various grades of products which you can choose, even if the product is for general commercial use, please consult it with us before you place an order.



### Post-treatment

Please select a post-treatment method for the product following the surface treatment, and a surface treatment method appropriate for the conditions under which the final product is to be used. Please refer to the relevant catalog.

Cr-treated or Cr-free treated materials for post-treatment is effective in preventing white rust on the surface of galvanized steel sheet.



### Coating weight

Please select a proper coating weight according to the targeted durable life-span of the coating weight, the conditions of use, the method in which it will be processed and other various conditions where the final product will be used. A post-plating treated product is better under corrosive conditions, while on the other hand, a foil plating method is better for products requiring good formability and weldability.



### Oiling

Customer can choose the oiling volume according to the usage conditions. However, if you place an order for untreated and un-oiled product, white rust may formed on the surface of the product.



### Dimensions

The dimensions of a product greatly affects the actual yield ratio and the formability. If you need stricter dimensions within the available sizes in our catalogs, please consult with us when placing an order.



### Edge

Customer can select a product with mill edge or slit edge according to the usage of the product.

If the edge of our company's product is to be used as is for the final product, it is better to place an order with slit edge.



### Weld zone

In case of a coil product, a pickled weld zone and a plated weld zone could be mingled. Although such weld zones are relatively small parts of the product, their hardness is high and they are a little thick. Therefore, in case that it is hard for a customer to remove such parts, please select an option, 'No Mingle', then, we will take a measure for it.



### Packaging

An appropriate packaging type can be selected according to the conditions of the transportation and storage of a product, but if no packaging is selected, a warranty for white rust can not be issued.

**Since hot-dip galvanized steel sheets cannot exert its various characteristics when utilized inappropriately, please heed the following instructions concerning the care of the product.**



**Storage**

Do not keep the product in a place where excess moisture or water may permeate into the product's packaging. If excess moisture or water does come in contact with the product's surface, please dry it off right away. Keep the product indoors in a well ventilated facility, away from conditions where the daily temperature fluctuation is a norm. If the wrapping paper, etc., is damaged while it is being kept, please repair it right away, but keep in mind that even when the packaging is perfectly intact, white rust is known to formate when a galvanized product is kept in stock over a extended period of time. Lastly please take caution and be careful that the plated surface is not damaged during transportation or other operations.



**Processing**

Since certain lubricant products contains additives that causes zinc erosion, please use lubricants without corrosive properties, and in case the usage of such corrosive lubricant is inevitable, please remove it and treat the surface with an anti-corrosion agent after processing. If the product is to be processed, please select a size appropriate for the usage. Please avoid processing the product under highly moist, sulfurous conditions. Processing environments with either acid gas or sooty smoke should also be avoided.



**Welding**

In case of a resistance welding(RW), since zinc is attached to the electrode, it is necessary to clean it periodically. In case of a seam welding, the life span of the electrode can be extended by using the KNURL-GEAR DRIVE System. In case of a high-temperature brazing, especially, please avoid brazing with a GA material. Since some fumes are generated when welding, please weld a product at an airy place. Usually, a hot-dip galvanized product is not good for soldering with some general flux.



**Degreasing**

It is good to use a weak alkaline degreasing agent, either a natural degreasing agent or an organic solvent. Since strong alkaline degreasing agent corrodes zinc, please do not use such agents.



**Coating**

Since zinc is a highly active metal, it is difficult to attain the necessary adhesiveness when coated directly on to the surface of a hot-dip galvanized steel sheet without some additional treatments.



**Darkening**

As time progresses, the surface and its color may get less glossy and darkened.

Generally, high temperature and high humidity promote darkening.

Darkening is a natural process caused by the oxidation of the zinc plated layer and is irrelevant to the anti-corrosion performance.



**Usage**

Do not deviate from the original usage for which the product was intended for. If the usage of the product differs from the time it was ordered, it may face problems while being processed.



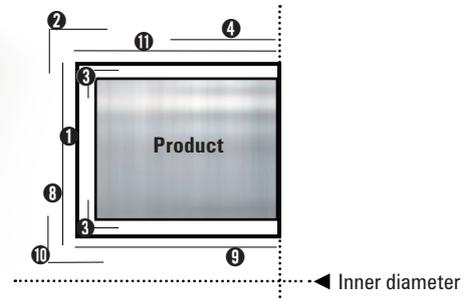
**Others**

When using a processed product, if certain treatments, such as coating, and etc., are not conducted on the plated surface, the effects of using a plated steel sheet decreases. (The corrosion levels of the products can vary depending on the conditions it is used.) So, please be noted.

# Packing



Name of outer pack



Name of cross-sectional pack

NO	Name	Material
1	PP VCI WRAP	VINYL
2	OUTER RING	STEEL
3	CORNER WRAP	ANTI-RUST BOARD
4	OUTER PROTECT BOARD	STEEL
5	HORIZONTAL BAND	STEEL
6	CENTER BAND	PET
7	VERTICAL BAND	STEEL
8	SIDE BOARD	PLASTIC
9	INNER PROTECT BOARD	PLASTIC
10	INNER RING	STEEL
11	OUTER PROTECT BOARD	ANTI-RUST BOARD

\* Packing type and materials are changeable.

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