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FOCUSING ON FASTENERS:

KEY CONSIDERATIONS TO CHOOSING THE RIGHT FASTENERS

DANNY NG

–

Marketing Director of MKT Marketing

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HOW TO SELECT THE RIGHT FASTENER FOR LIGHTWEIGHT TRUSS & ROOFING.

Presented By : DANNY NG C.L.
Marketing Director, MKT Marketing

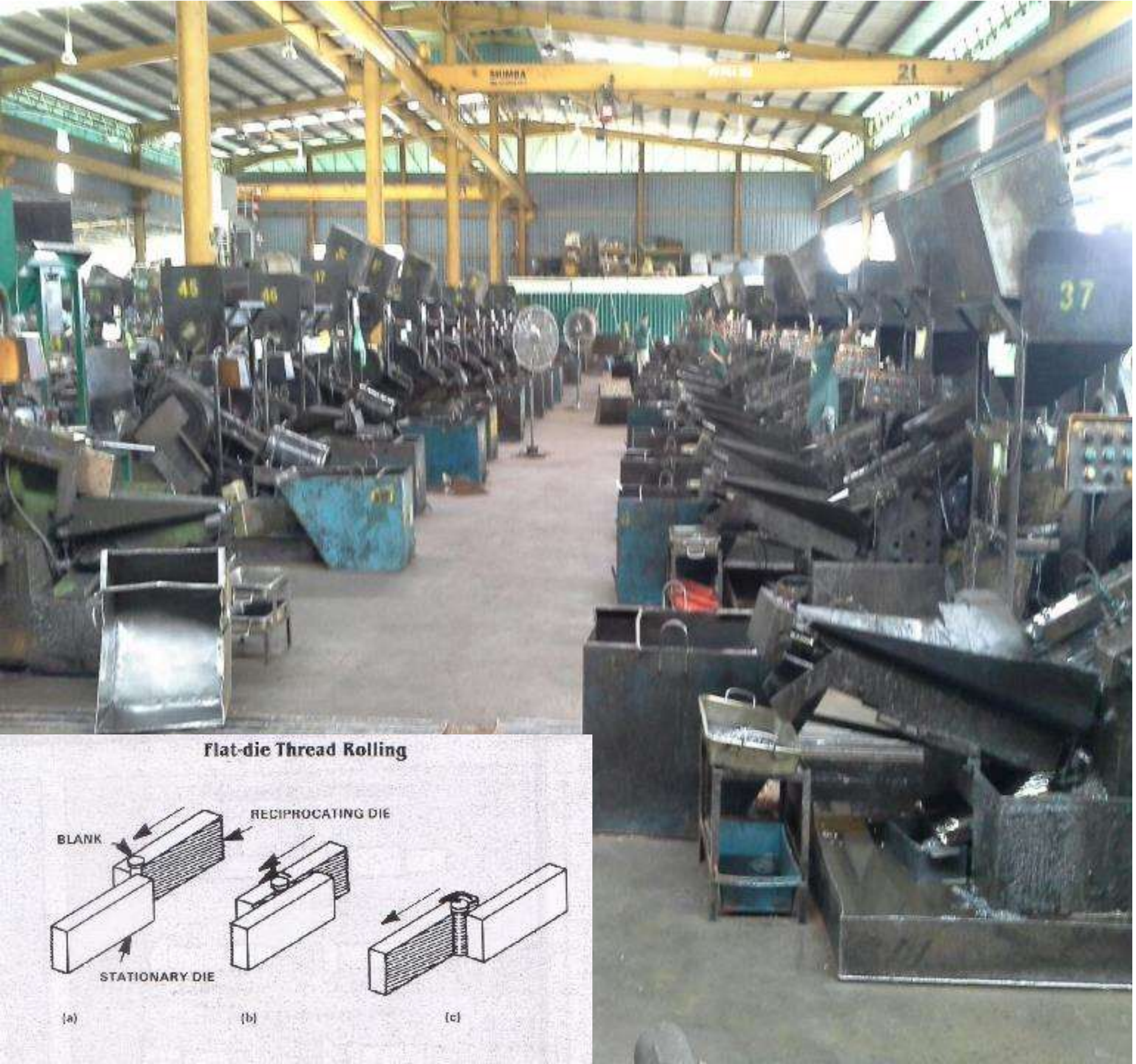
HOW TO PRODUCE FASTENER

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 1 Head Forming (Cold Forging)
- Speed : 200-350pcs/min

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 2   Knife Forming (Cold Form)
- Speed 250~400 pcs/min



HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 3   Thread Rolling (Cold Form)
- Speed : 200 – 400pcs/min

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 4 Hardening (Carburizing)

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 5 - Mechanical Zinc Coating

- Class 2
- Class 3
- Class 4

(In Room Temperature)

(Environment Friendly)

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 6 : Final Qc Inspection & Testing
  - Dimension Checking
  - Torsional Test
  - Bending Test
  - Drilling Speed Test
  - Cross Sectional Test
  - Salt Spray Test

HOW TO PRODUCE FASTENER (SELF DRILLING SCREW)

- Step 7 : Packing & Palletized
- Step 8 : Delivery / Shipping

COMMON SCREW TYPES FOR VARIOUS APPLICATIONS

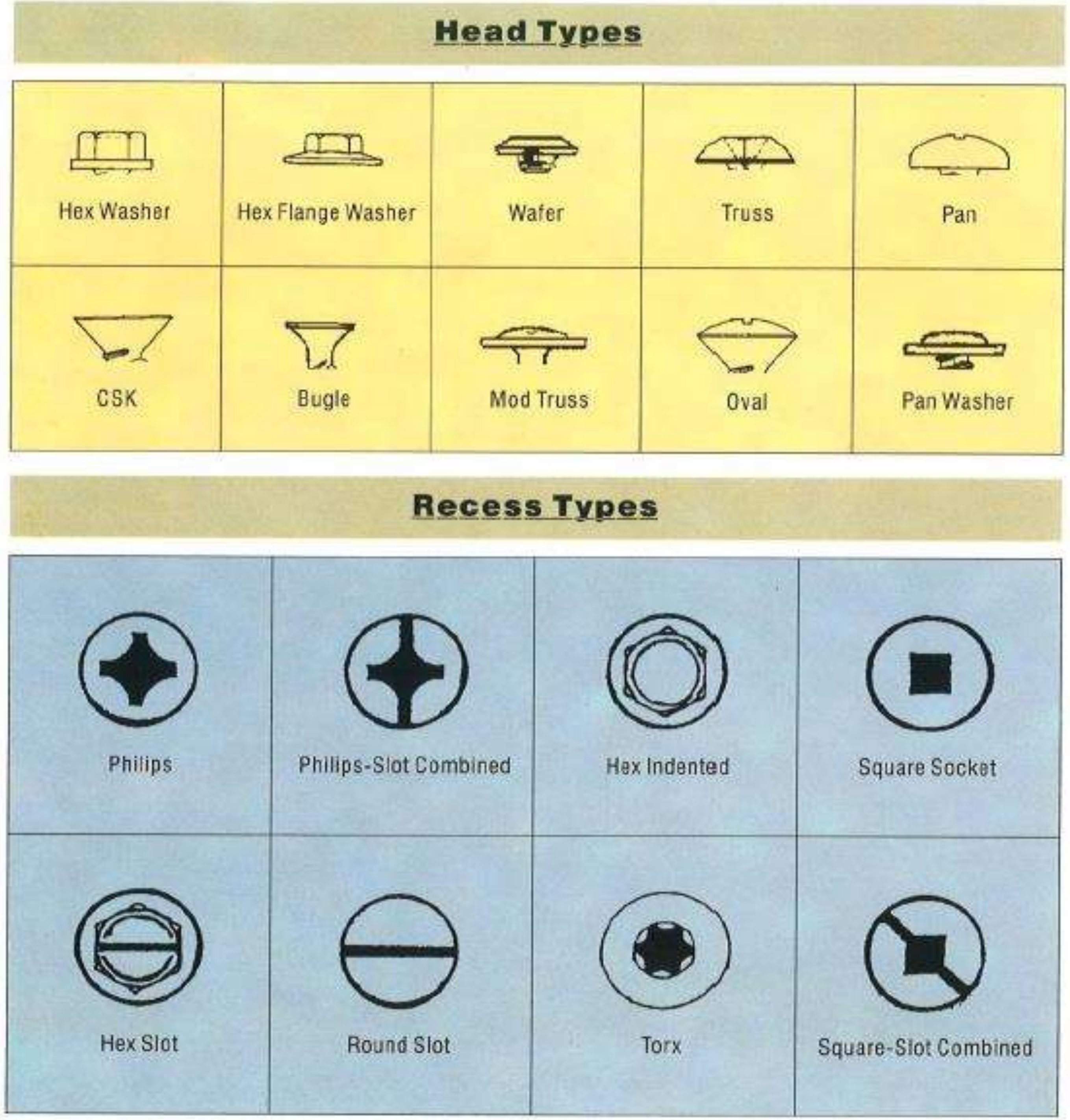
Fastener Types	Applications
Self Drilling Screw	Steel / Roofing / Wood
Self Tapping Screw	Steel / Aluminium / Furniture
Drywall Screw	Gypsum Board / Drywall
Chipboard Screw	Wood / Furniture
Machine Screw	Machine / Steel
Set Screw	Machine
Sems Screw	Electrical / Electronic Parts
Electronic Screw	Electronic Parts

SPECIFICATIONS/STANDARDS FOR SELF DRILLING SCREW

- USA – ASTM / AISI SAE J78
- UK – BS 7412
- Germany – DIN 7504
- * Australia – AS 3566 (JKR)
- Japan – JIS B1124
- International – ISO 15480

❑ **Body Diameter Comparison**

Imperial	Metric
#8	4.2 mm
#10	4.8 mm
#12	5.5 mm
#14	6.3 mm



STANDARDS/HEAD TYPES FOR SELF DRILLING SCREW

➢ **<u>Head Type</u>**

- * Hexagon Washer
- * Hexagon Flange
- Hexagon Slot
- Wafer
- Pan
- CSK Flat
- Truss
- Bugle
- Mushroom

HOW TO SELECT THE RIGHT SCREW

- Metal to Metal

(Self Drilling Screw)

- Metal to Timber

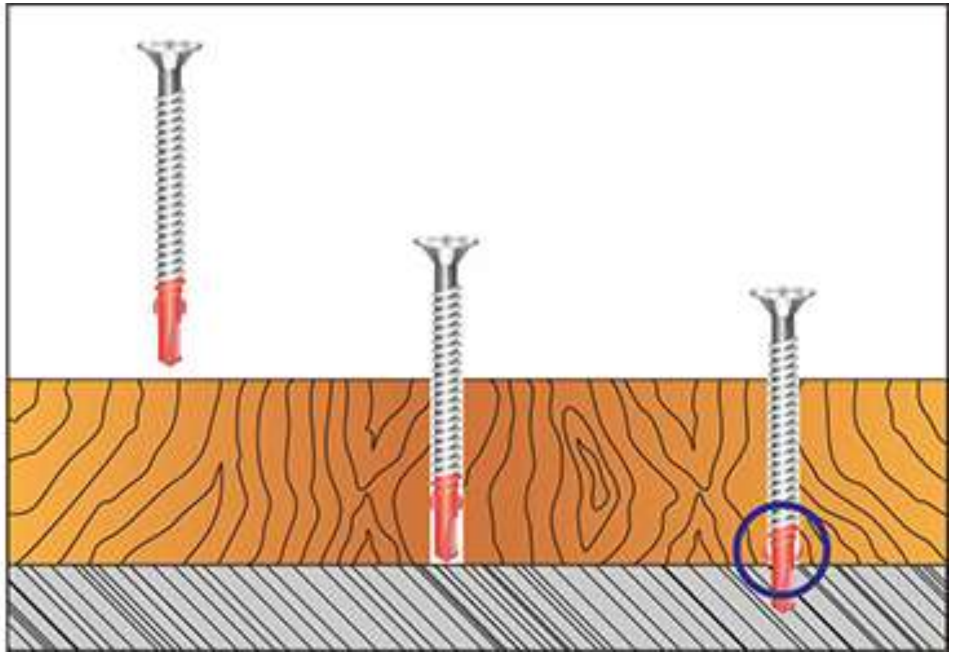
(TD Type 17 Thread Cutting End)

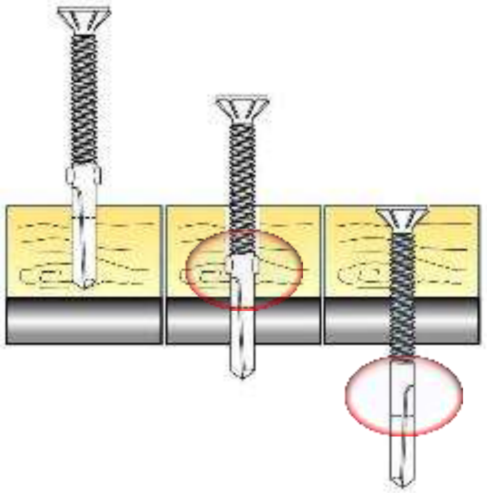
HOW TO SELECT THE RIGHT SCREW

- Timber to Metal
- Plasterboard to Metal

Application

- Wing screws for fastening timber to steel rails and purlins from 3-12mm. The screw wings ream a hole through the timber,and break away before drilling into steel.





(Self Drilling Wing Teks)

HOW TO SELECT THE RIGHT SCREW

- Plasterboard to Timber

(Drywall Screw Coarse Thread)

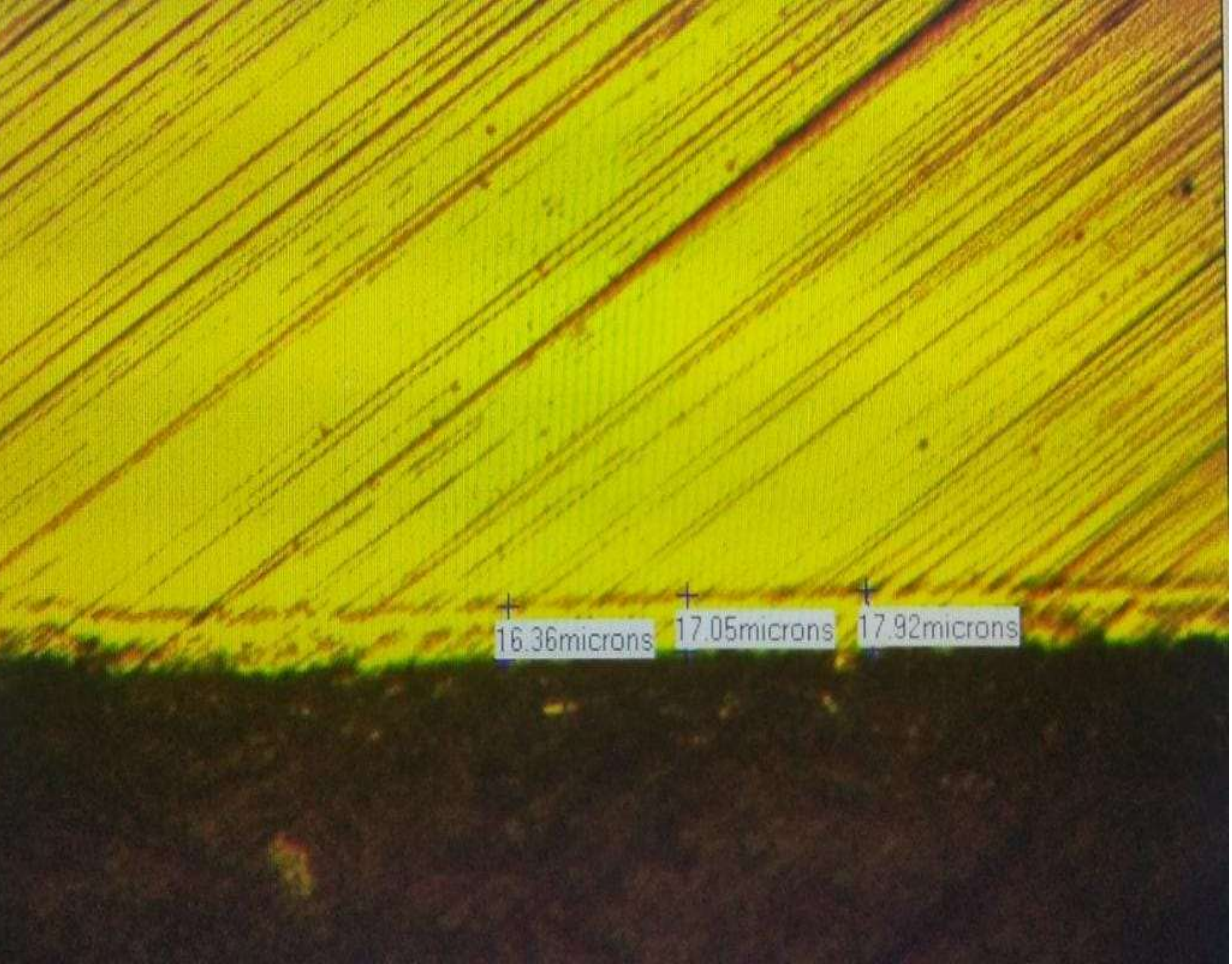
- Polycarbonate to Metal

(Self Drilling Screw with Ear Wings)

THE IMPORTANCE OF SURFACE COATING

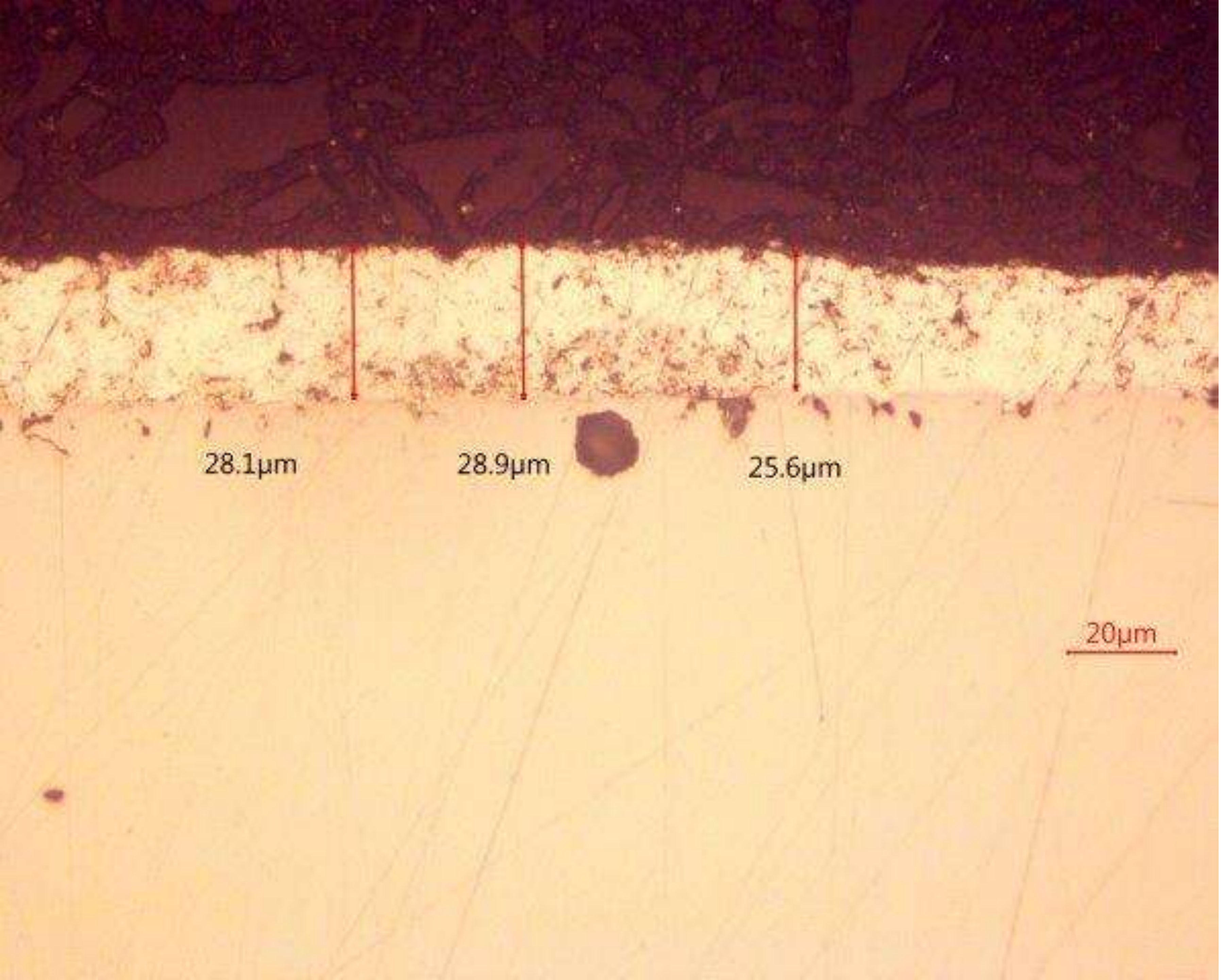
Why Mechanical Zinc Coating ?

- No Hydrogen Embrittlement
- No Detempering
- Excellent Thread Fit
- No Need to Chase Nuts After Plating
- No Galling
- No Stickers
- Excellent Adhesion



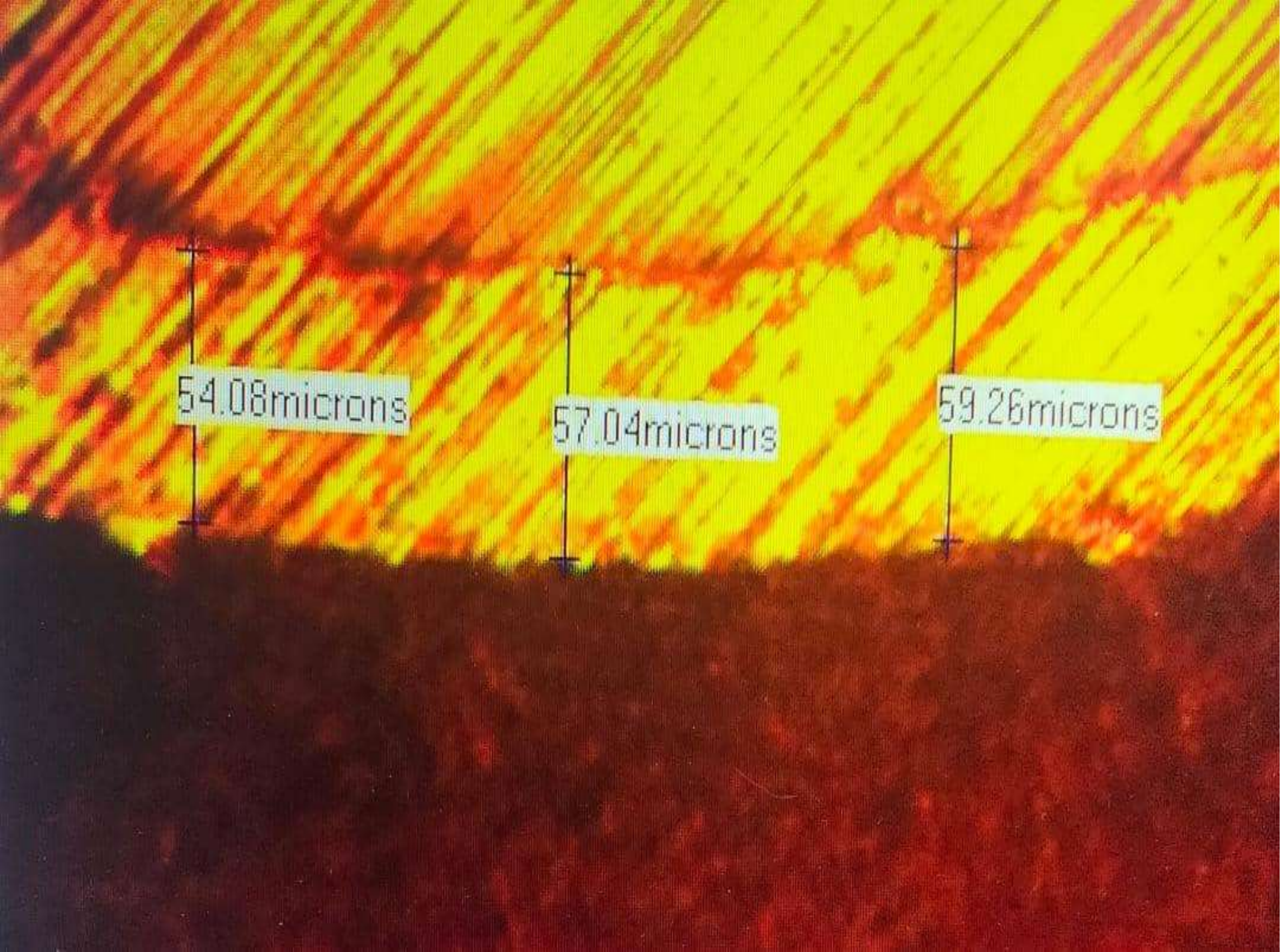
AS3566.2. TABLE 2

- Cross Section Test
  Class 2 Zinc/Tin
- Min 12 Microns
- Porosity Rating : 8+



AS3566.2. TABLE 2

- Cross Section Test Class 3 Zinc/Tin
- Min 25 Microns
- Porosity Rating : 9+



AS3566.2. TABLE 2

- Cross Section Test Class 4 Zinc/Tin
- Min 45 Microns
- Porosity Rating : 9+

SALT SPRAY TEST

(Salt Spray Test Machine)

REAL WORLD TEST

Table 1 — Categories of corrosivity of the atmosphere

Category	Corrosivity
C1	Very low
C2	Low
C3	Medium
C4	High
C5	Very high
CX	Extreme

ISO9223 CORROSIVITY CATEGORY

4th International Conference on Energy and Environment 2013 (ICEE 2013) IOP Publishing
IOP Conf. Series: Earth and Environmental Science 16 (2013) 012088 doi:10.1088/1755-1315/16/1/012088

Development of corrosion risk map for Peninsular Malaysia using climatic and air pollution data

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Abstract. Malaysia has catapulted to an era of major transition. This rapid transition has also cause impact to the environment. The human activities contribute to pollutions. Buildings and it component's performances are affected directly or indirectly by air pollutions and climate factors. It has triggering and accelerating degradation processes. When deterioration start, service life of the buildings and its components will decrease. This paper presents initial development of corrosion risk map for Peninsular Malaysia using Geographical Information System (GIS). The air pollution and climate data obtained from Malaysia Meteorology Department (MMD). The air pollution data was the salt ion deposition of nitrate, chloride and sulphate in a form of wet fall out (WFO). The corrosion risk map generated using geographical information system (GIS) using inverse distance weighing (IDW) and weighted overlay method. It found that the corrosion risk map can be generated with further site verification and it can be used by engineers for further prediction of service life of building components in achieving sustainable construction design.

1. Introduction

The surrounding environment condition has influenced the deterioration process of building materials. Corrosion is one of the common deterioration resulted by this complex interaction of metallic materials and the nature. The environmental load is described as the deterioration agent from and its local. Those agents will accelerate the deterioration process. Degradation can be subjected by behavior or dreadful conditions but the terminology of deterioration is more on worsening or weakening of particular object. In this study the work deterioration will be used as an expression of a process to decline the performance or the aging process that lower the quality and performance of particular building components.

Deposition of pollutants on the building surface generally depends on atmospheric concentrations of the pollutants and the local climate. Once the pollutants are on the surface, interactions will vary depending on the amount of exposure, the reactivity and the amount of moisture present. The transformation reactions may take place both in gas phase and in aerosol phase. For most of the materials, SO_2 is the main corrosive agent in the air [1]. Research has discovered that when NO_2 is presented with SO_2, increased corrosion rate occur. The NO_2 oxidizes the SO_2 to sulphate thereby promoting further SO_2 absorption. As a result, SO_2 is considered as a major contributor to deterioration of metallic materials [1, 2].

Moisture conditions are strongly correlated with relative humidity and temperature in absorption process deep in to the exposed building components. The moisture or wetness of surface did not

CORROSION RISK MAP FOR PENINSULAR MALAYSIA USING CLIMATIC AND AIR POLLUTION DATA

Done By : University Tenaga Malaysia

4th International Conference on Energy and Environment 2013 (ICEE 2013) IOP Publishing
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depend only on relative humidity but also on other parameters such as salt deposition, sunlight radiation, wind, and absorption of ambient heat [3]. With the relative humidity greater than 50% for all regions in Malaysia and average temperature of 27°C, average yearly time of wetness (TOW) in Peninsular Malaysia is equal to 0.783 fractional hours. It is classified by ISO 9223 the level of corrosion as class 5 where the layer on the surface of the building components can reside slightly longer and deterioration process will become more effective [4].

The most understandable influence of temperature is on the rate of the chemical reaction resulting in deterioration. If their surface temperature falls below the dew point, the surface becomes moist and in the presence of corrosive pollutants whose concentrations are increasing under the stable influence of the temperature inversion, conducive to certain types of deterioration to materials.

A research study on concrete deterioration in the Malaysian environmental conditions has been embarked by Malaysia Public Work Department (PWD) [5]. Ten locations in the Peninsular were chosen consisting major towns near the coastal area. A building was selected at each site for the study to be carried out with a ranging between 18 years and 50 years of age. The Corrosive Risk Rating (CRR) was a measurement of concrete corrosion risk represented by a range of 1 to 5 numerical scales. The CRR value was dependent towards the sulphate content, chloride content at a depth of 20 mm and the carbonation depth on a concrete building. From the study Climatic Corrosive Index (CCI) was formulated based on the monthly mean temperature and the monthly mean Relative Humidity (RH). A formula was proposed corresponds to the Scheffers's index format.

2. Methodology

In attempting to achieve the objective of this study, historical data have used. It consisted of air pollution data and climatic data. The data was recorded from 17 main measurement stations located in Peninsular Malaysia. The data from each measurement stations were recorded by Malaysia Meteorology Department (MMD). For the purpose of this study, data that extracted from the MMD data bank were the monthly weather report which record the received rainfall, temperature, humidity and air pollution data for 10 years from 1996 to 2005. The pollution data are in the form of wet fall out (WFO). Deposition of salt ion of chloride (Cl^-), sulphate (SO_4^{2-}) and nitrate (NO_3^-) were used. GIS maps have generated to determine data from the area which have no measurement stations. These maps are generated using inverse distance weighting (IDW) method. IDW method can efficiently apply and it has reliable computational process [6].

The process of development Corrosion Risk Map for Peninsular Malaysia was using ArcGIS 9.2. It was started with importing the data, generating the interpolation map using IDW method, reclassifying the IDW map into 5 levels scale and merge the generated map using weighted overlay method. Basically this study was producing initial map of corrosion risk map. The process of merging the generated IDW maps to produce the corrosion risk map was based on an assumption that the corrosion risk (CR) at a particular location is a function of environmental loads factors. It can be expressed in equation (1) where ion Chloride (C), ion Nitrate (N), ion Sulphate (S), received rainfall (Rain) and the time of wetness (TOW) are contributing to the level of corrosion risk.

$$CR = f(N, C, S, Rain, TOW) \quad (1)$$

3. Analysis and Discussion

The following Figures from Figure 1 to Figure 5 show the Chloride (C), Nitrate (N), Sulphate (S), received rainfall (Rain) and time of wetness (TOW) which has generated from respective average IDW map. The map also have classified to 5 different level from 1 to 5 where the class 1 represent lowest value and class 5 represent highest value of data.

It is very obvious for the area where it is more developed and have more industrial activities, these area is emitting high concentration of pollutant to the atmosphere. Those three areas are Klang Valley, southern part of Johor and Penang. The time of wetness for Peninsular Malaysia based on ISO 9223 is classified as class 5 but for the purpose of this study, it reclassified locally to a range of scale from 1 to

CORROSION RISK MAP FOR PENINSULAR MALAYSIA USING CLIMATIC AND AIR POLLUTION DATA

The Time Of Wetness for Peninsular Malaysia Based on ISO9223 is Classified as Class 5

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5. The purpose of reclassify the time of wetness IDW map is to distinguish locally which area having highest and lowest time of wetness as shown Figure 5.

Figure 1. Classified of IDW Chloride Map

Figure 2. Classified of IDW Nitrate Map

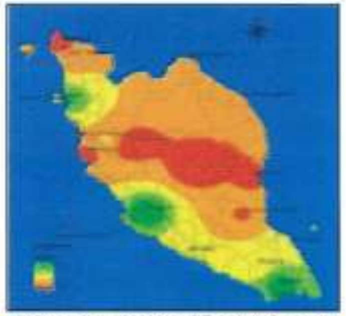

Figure 3. Classified of IDW Sulphate Map

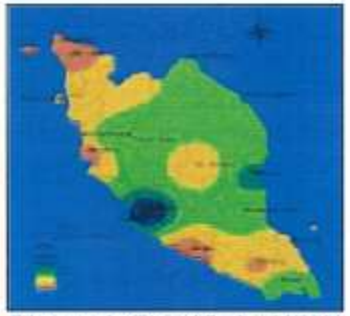

Figure 4. Classified of IDW Rainfall Map

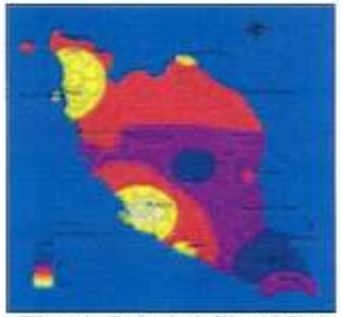

Figure 5. Local Classified IDW time of wetness map for Peninsular Malaysia

Figure 6 shows the corrosion risk map for Peninsular Malaysia. By merging the five layers of the environmental loads (i.e. N, C, S, Rain and TOW), a corrosion risk map generated. There are 5 different classes of corrosion risk that was represented in a scale from 1 to 5. Class 1 indicates the lowest corrosion risk and class 5 indicates the highest corrosion risk. From the generated corrosion risk map, Petaling Jaya has the highest rate of corrosion risk compared to other places. This is obvious, Petaling Jaya has the highest level of Nitrate and Sulphate. After Petaling Jaya, Kuantan and Kuala Terengganu are the area with level of corrosion risk 4. Although the concentration of Nitrate and Sulphate are low, the concentration of Chloride is very high compared to other areas. Kluang, Sitiawan and Alor Setar are the areas which have the lowest risk of corrosion. These areas are not much polluted by Chloride, Nitrate and Sulphate. The time of wetness at these areas are also low, therefore they fall under class 1, which is low corrosion risk. From this study, corrosion risk for Melaka is found slightly contradict with the ground condition. It was found from the previous study on building assessment, many building and infrastructure with metallic materials severely subjected to corrosion. Verification work is required to validate and improve the generated corrosion risk map [7].

CORROSION RISK MAP FOR PENINSULAR MALAYSIA USING CLIMATIC AND AIR POLLUTION DATA

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Figure 6. Corrosion Risk Map Peninsular Malaysia based on 10 Year of Data

4. Conclusion

Corrosion map have developed from this study. The result is based on the historical data from MMD for 10 years measured climatic and air pollution data from 17 measurement stations in Peninsular Malaysia. It shows that the generated corrosion map can be used for future study on corrosion cost to assist designer, engineer and maintenance officer also owner of building asset and infrastructure for estimating the maintenance cost. It also can be used in deciding alternative method of coating for corrosion prevention and using alternative technology and materials in construction. Site measurements are required to verify the result. So thus, its result can be reliable.

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[6] Cole, I S et. al. Mechanism of Atmospheric Corrosion in Tropical Environments 2000 *Marine Corrosion in Tropical Environments, ASTM STP 1399*, American Society for Testing and Materials, West Conshohocken, PA.
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CORROSION RISK MAP FOR PENINSULAR MALAYSIA USING CLIMATIC AND AIR POLLUTION DATA

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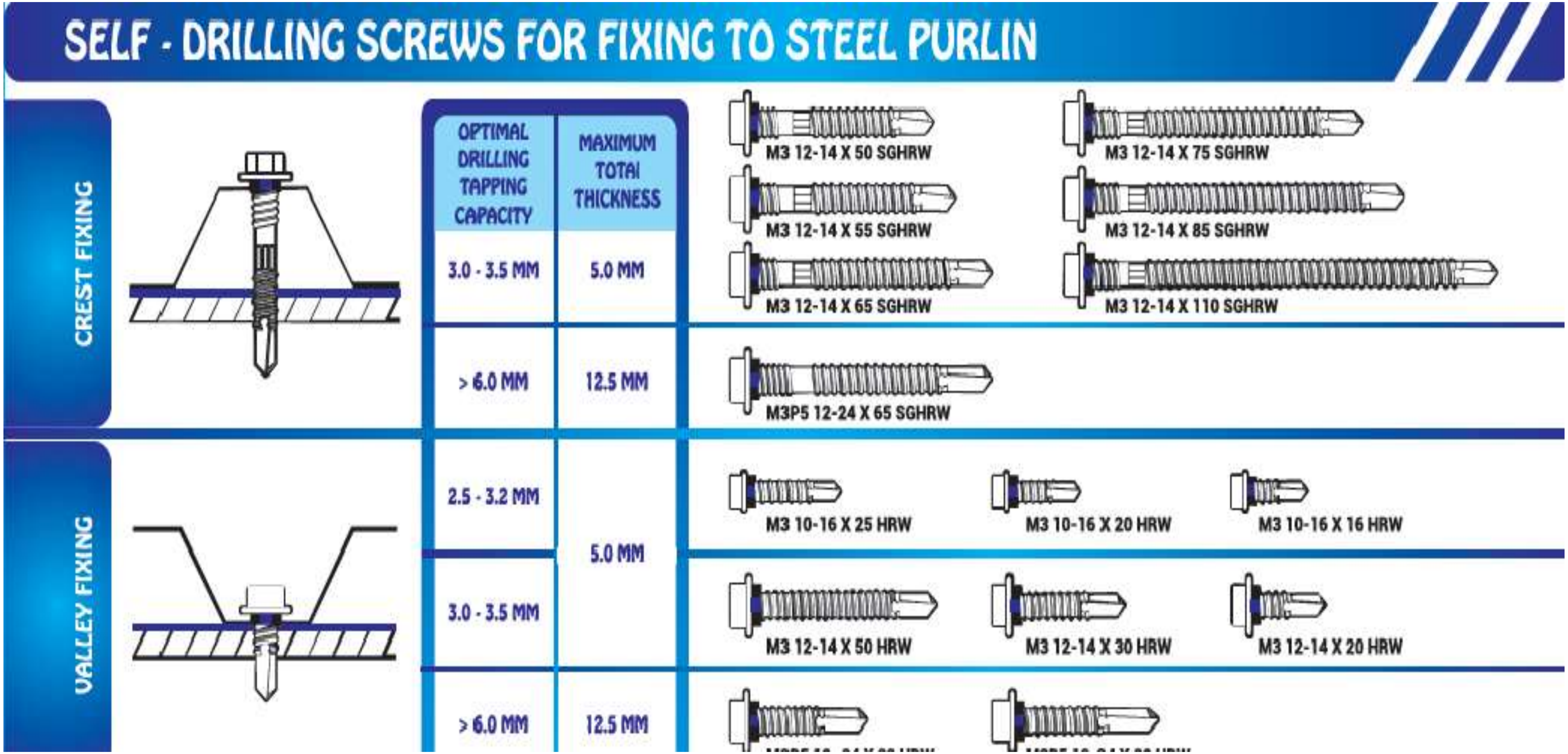
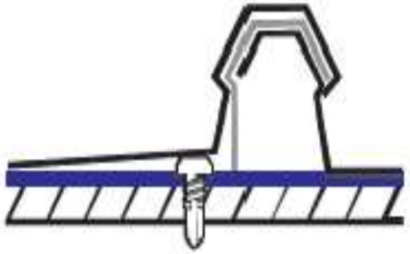
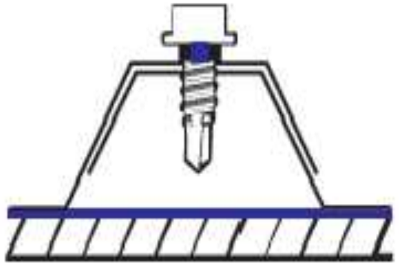
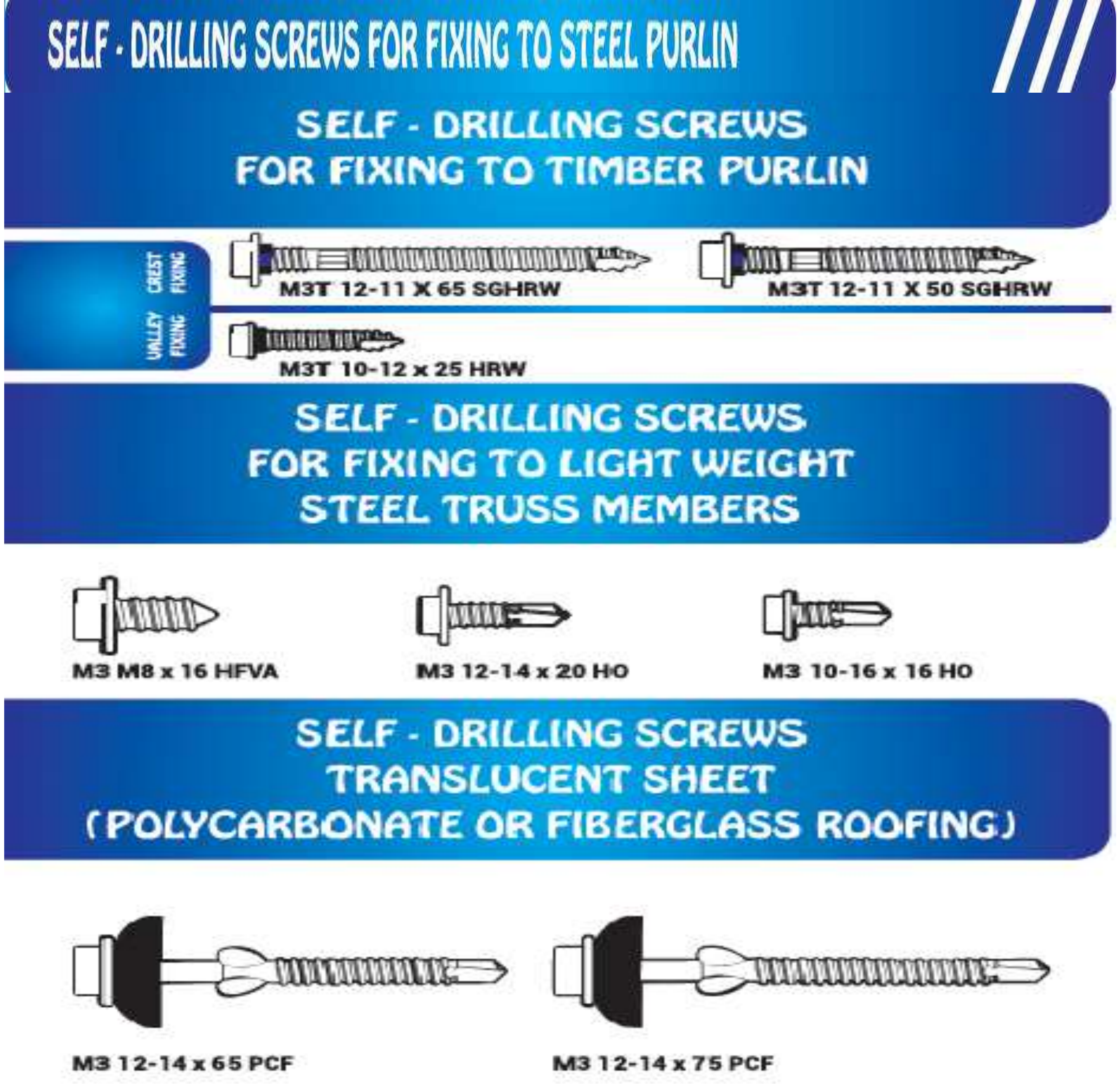
COMMOND TYPES OF SELF DRILLING ROOFING SCREW FOR LIGHT WEIGHT TRUSS AND ROOFING



COMMOND TYPES OF SELF DRILLING ROOFING SCREW FOR LIGHT WEIGHT TRUSS AND ROOFING

SELF - DRILLING SCREWS FOR FIXING TO STEEL PURLIN

CLIP FIXING		2.5 - 3.2 MM	5.0 MM	M3 10-16 X 32 WH; M3 10-16 X 22 WH; M3 10-16 X 16 WH
		4.0 - 4.5 MM		M3 10- 24 X 22 WH; M3 10-24 X 16 WH
		> 6.0 MM	12.5 MM	M3P5 12- 24 X 32 WH
OVERLAP FIXING		3.0 - 3.5 MM	5.0 MM	M3T 10-12 X 25 TDHRW; M3T 12-11 X 50 TDHRW
		1.5 MM	3.0 MM	M3S 12-15 x 20 HRW; M3S 10-16 x 16 HRW



COMMOND TYPES OF SELF DRILLING ROOFING SCREW FOR LIGHT WEIGHT TRUSS AND ROOFING

SELF - DRILLING SCREWS FOR FIXING TO STEEL PURLIN

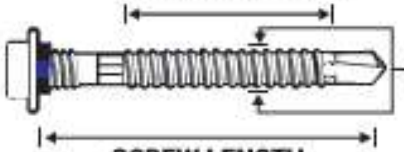
DESIGNATION

MECHANICAL ZINC CLASS   SCREW TYPE

M3 #12 - 14 X 55 SGHRW

SCREW GAUGE   SCREW LENGTH

THREADS PER INCH (TPI)



GAUGE	MAJOR DIAMETER
10	4.8 MM
12	5.5 MM

SCREW TYPE

- **SGHRW** - Hexagonal Head With Shank Guard And EPDM Washer
- **HRW** - Hexagonal Head With EDPM Washer
- **WH** - Wafer Head
- **HO** - Hexagonal Head Without Washer
- **PCF** - Hexagonal Head Wings With Dome Washer
- **HFVA** - TRUSS Fastener (Trusstite)
- **M3S** - Class 3 Reduce Knife

Class 2   Class 3   Class 4

Mechanically plated ZINC-TIN (20% - 30% TIN balance ZINC) minimum local metallic coating thickness 25 micron, surpassed AS3566.2:2002 class 3

DEKS
A Skellerup Industries Company

non-conductive black EPDM seals provide exceptional sealing of the roofing / cladding sheets for water tight protection. These engineer-designed seals assist in reducing corrosion from electro-galvanic reactions and remained unchanged in chemical properties even after long periods in extreme weather conditions.

TECHNICAL SPECIFICATIONS

PULLOUT PERFORMANCE (kN)

ULTIMATE AVERAGE PULLOUT LOADS

GAUGE / TPI	1.0MM	1.5MM	1.9MM	2.5MM
10G - 16TPI	2.1	4.2	5.5	7.2
12G - 14TPI	2.2	4.9	5.9	7.4

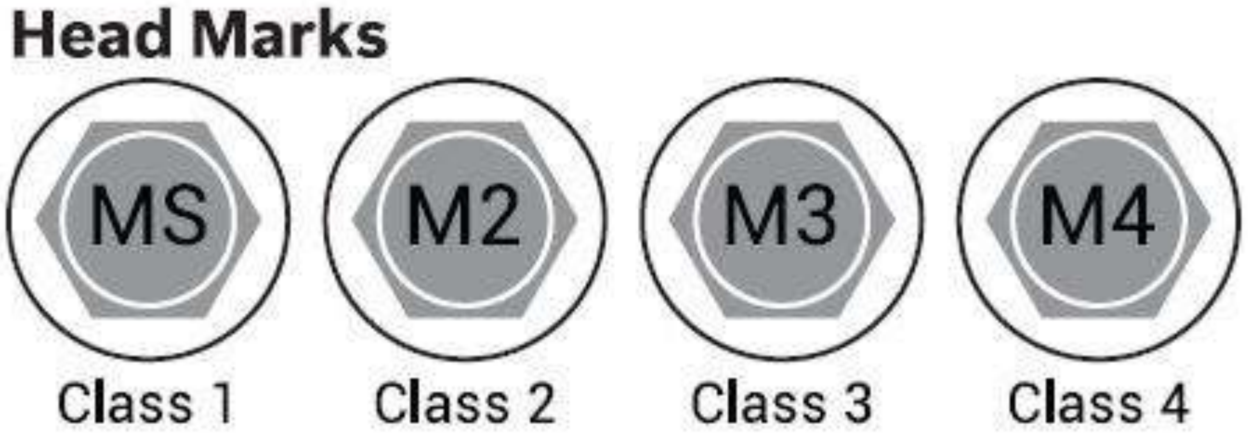
MECHANICAL PROPERTIES

	SINGLE SHEAR (kN)	AXIAL TENSILE (kN)	TORSIN (Nm)
10 G	6.0	2.5 Min	8.5
12 G	8.0	2.8 Min	10.9

INSTALLATION GUIDELINES

1. The correct socket should sit firmly and tightly to the electrical screwdriver. Set the screwdriver at 1800 - 2500 rpm.
2. Hold the electric power screwdriver perpendicularly to the work being drilled and give a sharp pressure downward (about 14kgs) to create a depressed mark on the work surface.
3. For wafer head fasteners ensure that Phillips #2 driver-bits are being used (NOT Pozi drive-bits).
4. At the same time, trigger the screwdriver slowly to assist it to 'dig in' as it starts to rotate.
5. Maintain firm end pressure and complete drilling in one operation.
6. Stop immediately when the screw is set so as to prevent overdriving.

COMMON TYPES OF SELF DRILLING ROOFING SCREW FOR LIGHT WEIGHT TRUSS AND ROOFING

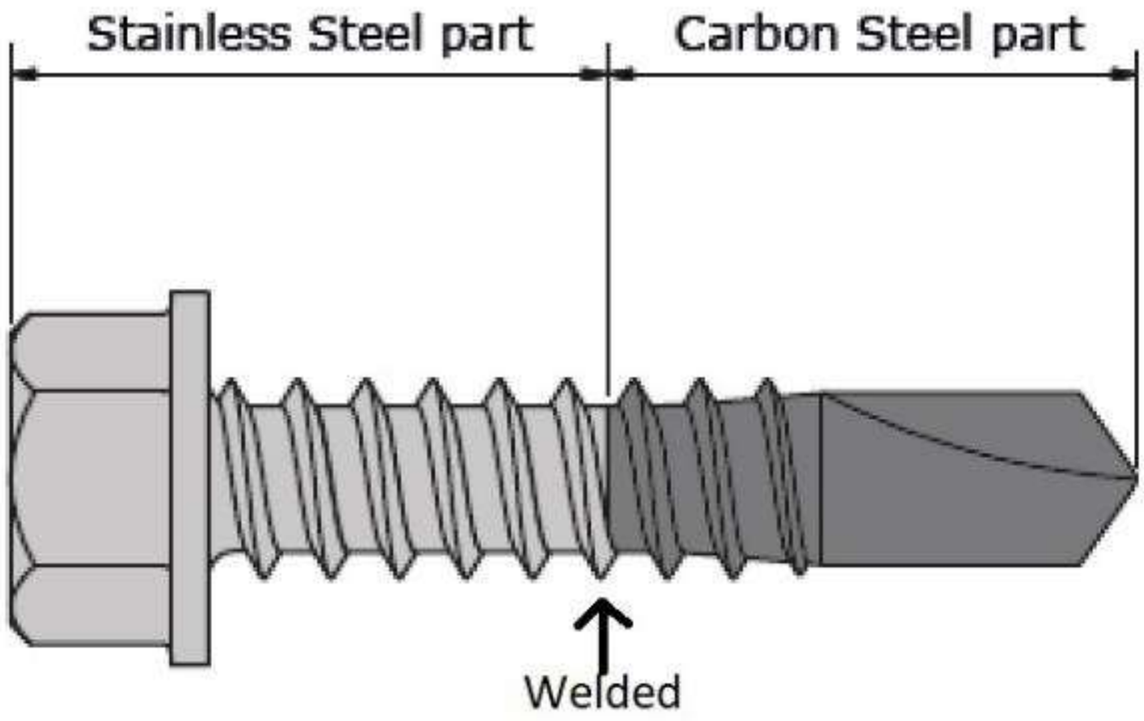


COATING CLASS IDENTIFICATION ON SCREW HEAD (FOR EASY IDENTIFICATION)

DRILLING SCREW FOR ROOFING

DRILLING SCREW FOR LIGHTWEIGHT STEEL STRUCTURE

DRILLING SCREW FOR IBS (ENDUROFRAME SYSTEM)



HIGH COST!

3-5 TIMES THAN CARBON STEEL SCREW

- Singapore Imposed Mandatory Regulation on Fasteners – Only Bi-metal Screws
- (Stainless Steel Body Welded With Carbon Steel Drill Point)

REAL WORLD TEST

Location : Kenting (South of Taiwan)

Corrosivity : Category 5

Testing Duration : 51 months

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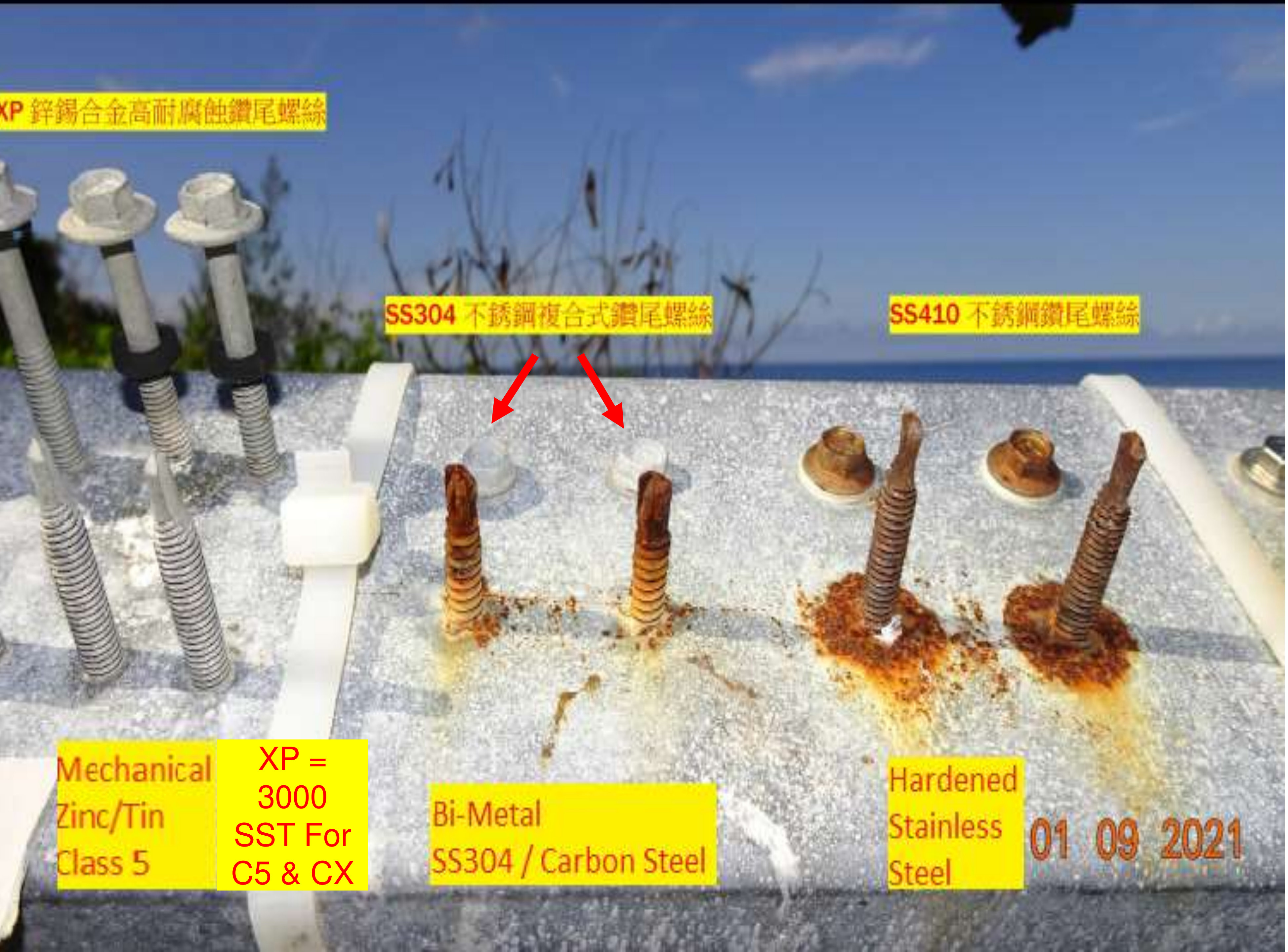
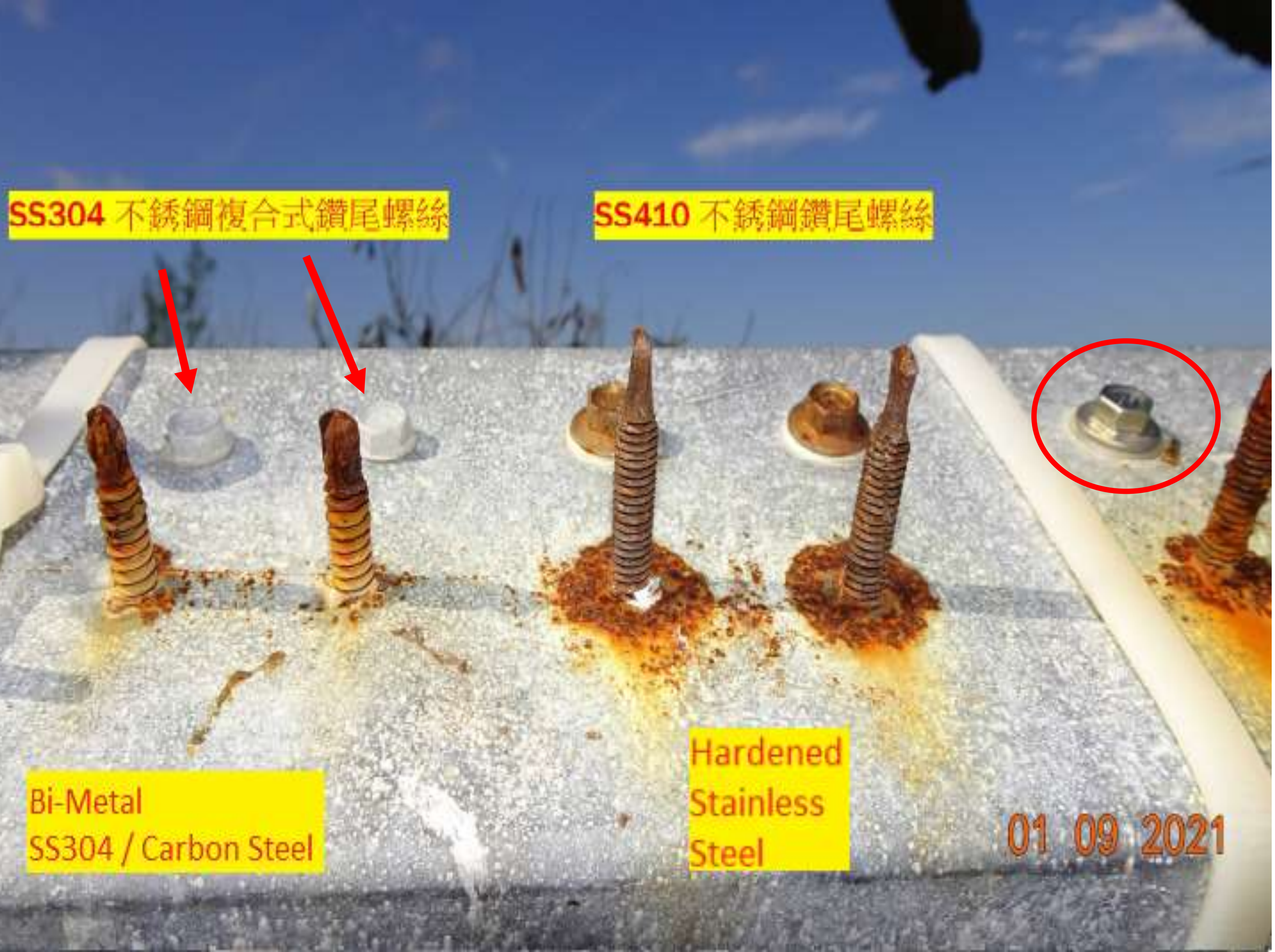


REAL WORLD TEST

Location : Kenting (South of Taiwan)

Corrosivity : Category 5

Testing Duration : 51 months



REAL WORLD TEST

Location : Kenting
(South of Taiwan)

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Category 5

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51 months

REAL WORLD TEST

Location : Kenting
(South of Taiwan)

Corrosivity :
Category 5

Testing Duration :
51 months

FUNCTIONS AND CORROSION RESISTANCE COMPARISON TABLE FOR ALL KIND OF SELF DRILLING SCREW

Types of Self-Drilling Screws / Items Compared	C5 High Corrosion Resistance	SS304 or SS316 Bi-Metal	410 Stainless Steel	SS Capped/Steel	Zinc-Plated
Size	#12-24	#12-24	#12-24	#12-24	#12-24
Material Weight	Export standard	Unknown	Insufficient	Insufficient	Insufficient
Antirust Capability	Excellent	Good	Ordinary	Ordinary	Poor
Suitable Environment	Unlimited	Ordinary	Ordinary	Ordinary	Ordinary
Service Life	Particularly Long	Long	Ordinary	Ordinary	Short
Use of Silicone Sealant	No Need	Needs	Needs	Needs	Needs
Drilling Speed	Excellent	Good	Fair	Fair	Good
Galvanic Corrosion Risk of Screw Decapitated	No	Yes	No	Yes	Yes
Potential Corrosion Risk of Steel Plate	No	High	Yes	Yes	No
Construction and Future Maintenance Costs	Low	Very High	High	High	High

DIALOGUE SESSION

Photo from MKT Marketing

FASTENER SUITABILITY

Photo from BlueScope

FASTENER SUITABILITY

TABLE 1

CLASSIFICATION AND DESIGNATION OF CORROSION RESISTANCE

Corrosion resistance class	Atmosphere of intended use
1	General use in internal application.
2	General use in other than external applications but where significant levels of condensation occurs.
3	External use in mild, moderate industrial or marine environments. Corrosivity categories C2 and C3 classified in accordance with ISO 9223.
4	External use in severe marine environment. Corrosivity category C4 classified in accordance with ISO 9223.

NOTE: The specification for self-drilling screws suitable for use in specific corrosive atmospheres are subject to agreement between manufacturer and consumer.

Source: AS 3566.2:2002

INCONSISTENT FASTENER PERFORMANCE

Photo from BlueScope

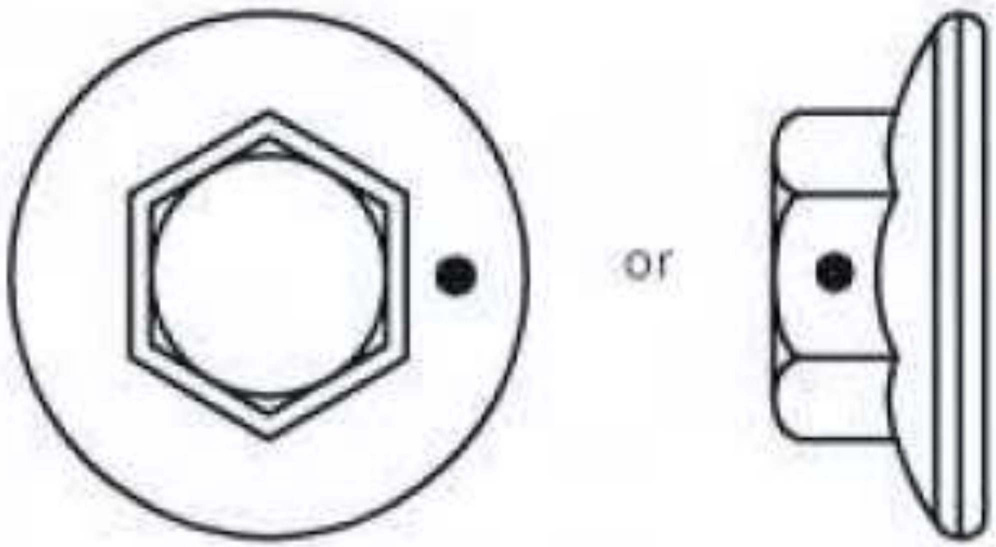
TABLE 2

REQUIREMENTS FOR ZINC AND TIN-ZINC COATED FASTENERS

Corrosion resistant class	Minimum porosity rating of mechanically plated coatings (see Clause 7)	Coating type	Coating composition (by mass)	Minimum local metallic coating thickness µm
1	—	Electro plated zinc	98 percent zinc	4
2	—	Electro plated zinc	98 percent zinc	12
2	6	Mechanically plated zinc	98 percent zinc	17
2	6	Mechanically plated zinc-tin	20-30 percent tin balance zinc	12
3	—	Electro plated zinc	98 percent zinc	30
3	—	Hot-dip galvanized	98 percent zinc	30
3	8	Mechanically plated zinc	98 percent zinc	40
3	8	Mechanically plated zinc-tin	20–30 percent tin balance zinc	25
4	—	Hot-dip galvanized	98 percent zinc	50
4	8	Mechanically plated zinc-tin	25-30 percent tin balance zinc	45

FASTENERS QUALITY CONTROL OF IN FACTORY

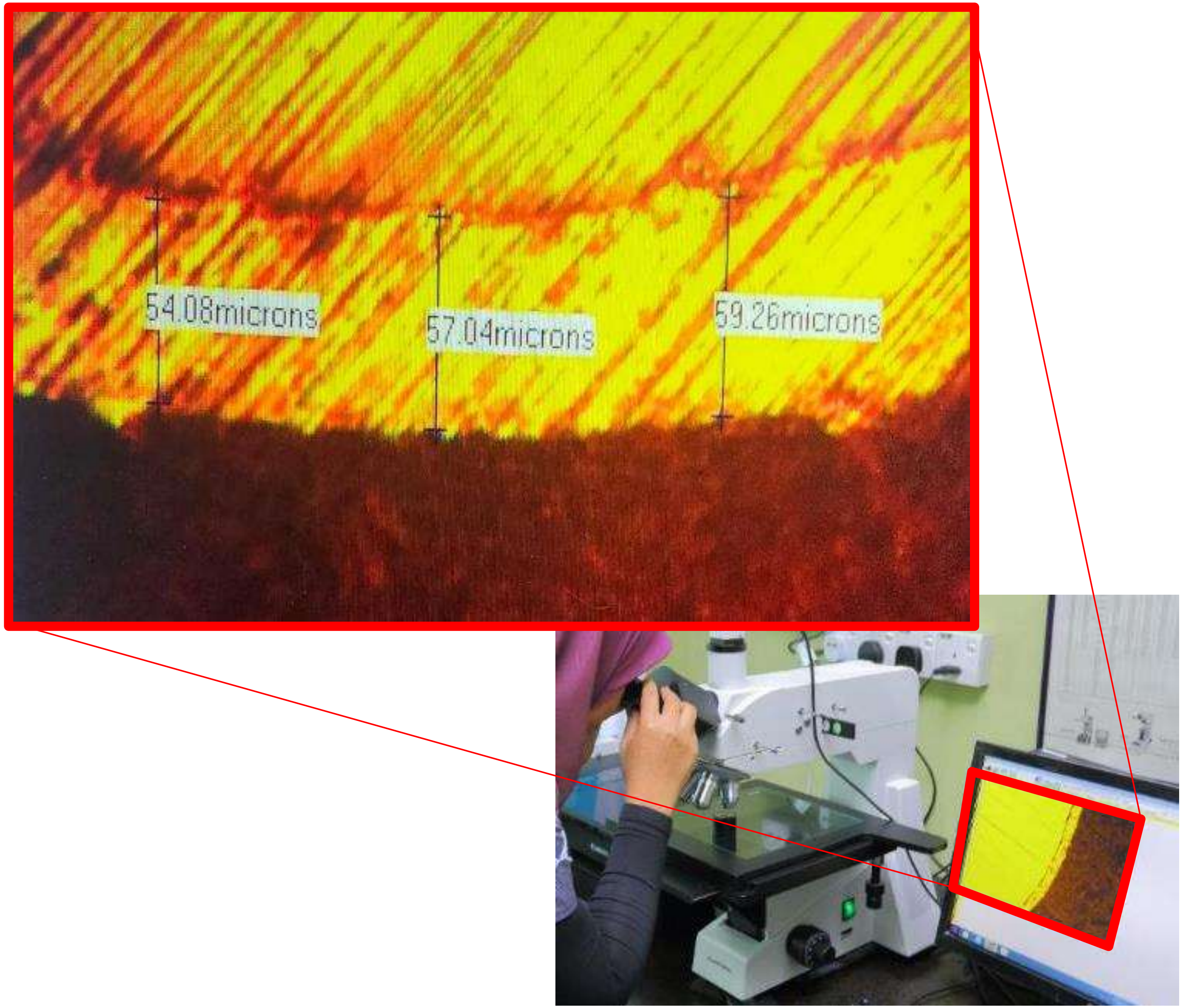
Source: AS 3566.2:2002



(a) Hexagon washer head

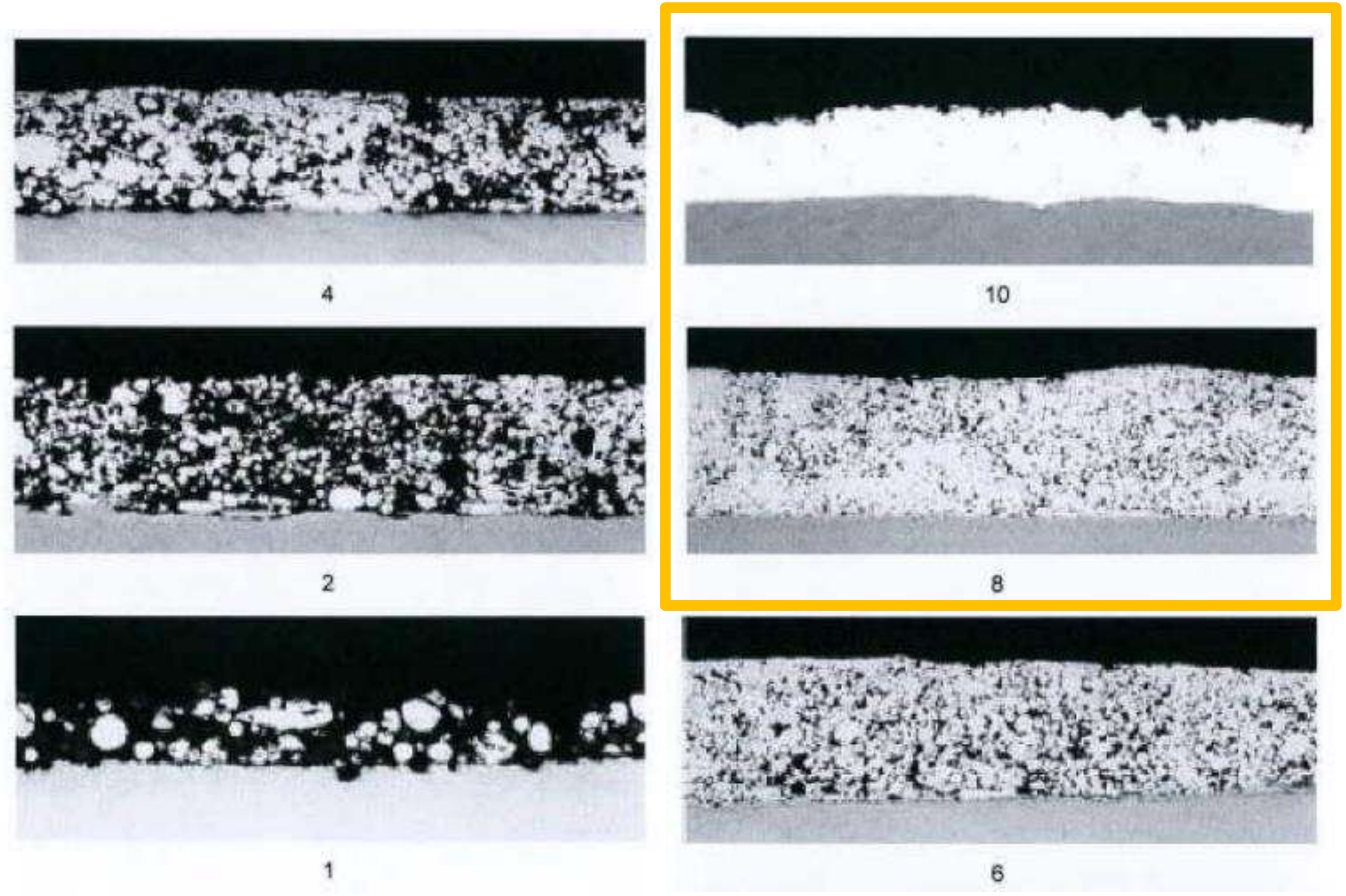
FASTENERS QUALITY CONTROL OF IN FACTORY

Source: AS 3566.2:2002



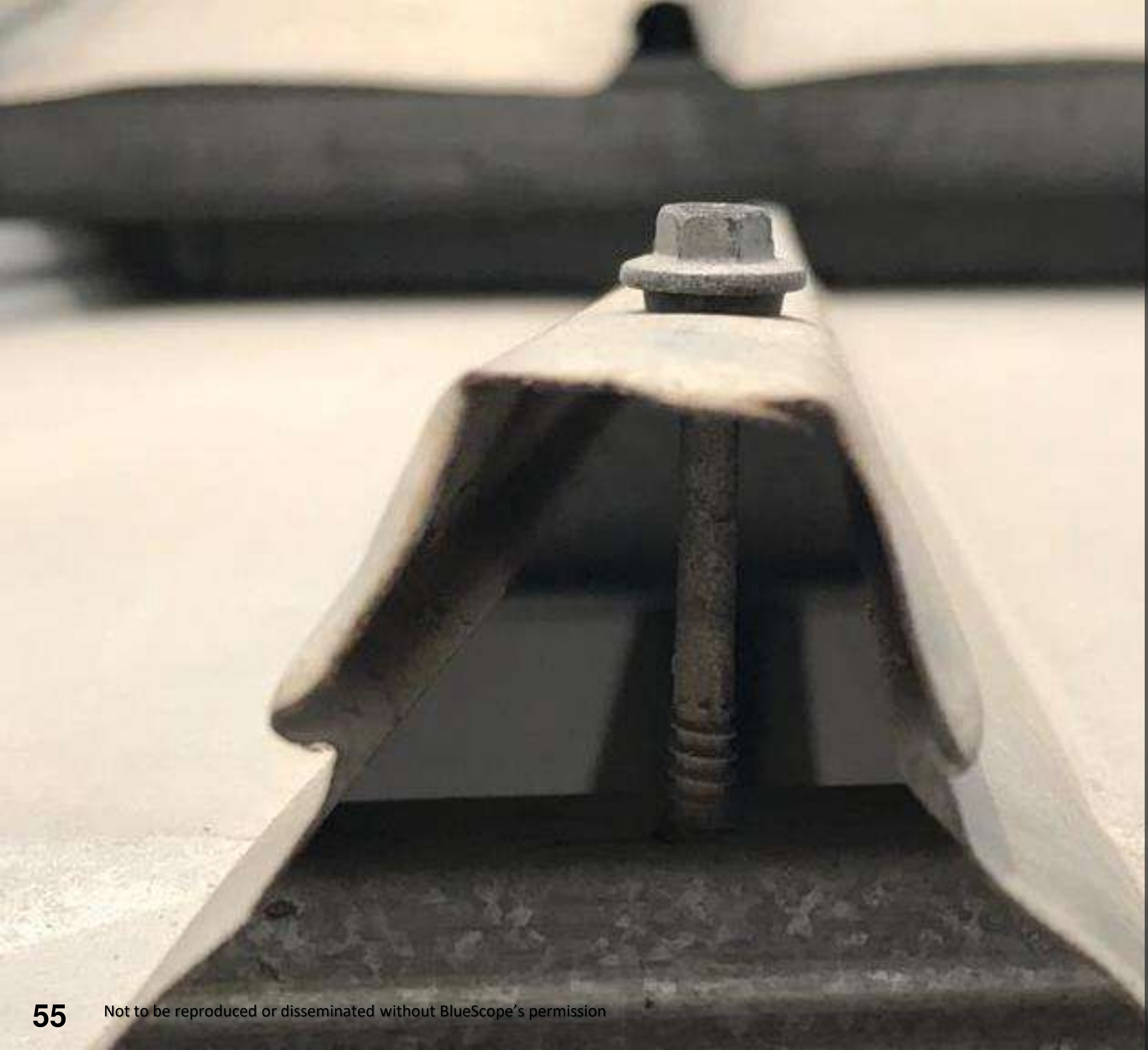
FASTENERS QUALITY CONTROL OF IN FACTORY

Photo from MKT Marketing



WHAT DOES COATING POROSITY AFFECT?

Source: AS 3566.2:2002



PERFORMANCE OF FASTENER SHANK

Photo from MKT Marketing

PERFORMANCE OF FASTENER SHANK

Photo from BlueScope

STAINLESS STEEL FASTENER WITH SLEVES TO ISOLATE DIRECT CONTACT

Photo from BlueScope

ASK US ANYTHING!

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SUMMARY

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THANK YOU

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